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Archeological and Bioarcheological Resources of the Northern Plains

edited by George C. Frison and Robert C. Mainfort, with contributions by George C. Frison, Dennis L. Toom, Michael L. Gregg, John Williams, Laura L. Scheiber, George W. Gill, James C. Miller, Julie E. Francis, Robert C. Mainfort, David Schwab, L. Adrien Hannus, Peter Winham, David Walter, David Meyer, Paul R. Picha, and David G. Stanley

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Abstract

The 12,000 years of human occupation in the Northwestern Great Plains states of Montana, Wyoming, North Dakota, and South Dakota is reviewed here. Syntheses of the archeological and bioarcheological resources under the guise of human adaptation types reveals significant gaps that future research should address.

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Foreword

This research was coordinated by the Arkansas Archeological Survey under the Department of Defense Legacy Resource Management Program. The contracts were administered by the Tri-Services Cultural Resources Research Center at the U.S. Army Construction Engineering Research Laboratories (USACERL), Champaign, IL. The contract manager and Principal Investigator was Dr. John S. Isaacson. Col. James T. Scott is Commander and Dr. Michael J. O'Connor is Director of USACERL. Mr. Larry Banks, formerly U.S. Army Corps of Engineers Southwestern Division archeologist, consulted extensively on the project.

The Central and Northern Plains Archeological Overview project includes four studies: the northern Great Plains (the Rockies east to the Minnesota River), the northwest woodlands (the Minnesota River east to the Great Lakes), the central Great Plains, and the central prairie-timberlands of Missouri. Using the concept of human adaptation, these overviews place cultural resources within cohesive environmental and cultural areas rather than arbitrary political boundaries such as states. These syntheses make clear why properties are significant, where there are gaps in archeological and bioarcheological knowledge, and what the future directions are for cultural resources planning by Department of Defense installations, the U.S. Army Corps of Engineers, and other federal agencies. In addition to the four archeological volumes, all citations are being entered in the National Archeological Citation Data Base. Other volumes included as part of this project are management guidelines, an executive summary, the bioarcheological sections of each area combined into a single volume, and a citations CD. Taken together with the volumes from the Southwestern Division of the U.S. Army Corps of Engineers Overviews (Arkansas Archeological Series Nos. 31-38), there are now syntheses of the current archeological record for almost one-half of the United States.

The Legacy Resource Management Program was established by the Congress of the United States in 1991 to provide the Department of Defense with an opportunity to enhance the management of stewardship resources on over 25 million acres of land under DoD jurisdiction.

Legacy allows DoD to determine how to better integrate the conservation of irreplaceable biological, cultural, and geophysical resources with the dynamic requirements of military missions. To achieve this goal, DoD gives high priority to inventorying, protecting, and restoring biological, cultural, and geophysical resources in a comprehensive, cost-effective manner, in partnership with Federal, State, and local agencies, and private groups.

Legacy activities help to ensure that DoD personnel better understand the need for protection and conservation of natural and cultural resources, and that the management of these resources will be fully integrated with, and support, DoD mission activities and the public interest. Through the combined efforts of the DoD components, Legacy seeks to achieve its legislative purposes with cooperation, industry, and creativity, to make the DoD the Federal environmental leader.

1 The Northern Great Plains Study Area, by George C. Frison and Robert C. Mainfort

The purpose of this volume is to summarize the important features and events of Northern Plains archeology and bioarcheology as part of the Central and Northern Plains Overview Project. This overview project, like the Southwest Division Overview of the south-central United States (Sabo et al. 1988; Hester et al. 1989; Hofman et al. 1989; Jeter et al. 1989; Story et al. 1990) is intended to be a synthesis that can be widely used by the U.S. Army Corps of Engineers land managers. Thus, it intentionally takes a broader view of an area by crossing political boundaries (Figure 1) and by using the concept of human adaptation types. Because modern political boundaries were of no relevance to prehistoric people and because much of the archeology conducted today is by state-bound archeologists, successful interpretation of prehistoric lifeways requires a larger panorama. The concept of human adaptation types has been adopted as a means by which the similarities and differences among and between prehistoric people can be emphasized without use of local, and often confusing, phases and named time periods used by archeologists.

This archeological overview of the Northern Plains was prepared under an Arkansas Archeological Survey contract with George C. Frison, who subcontracted much of the effort to other area specialists. These include David Schwab and David Walter (Montana Historical Society): Montana archeology and history; Dennis L. Toom (University of North Dakota): Middle Missouri archeology; Michael L. Gregg (New Jersey State Historic Preservation Office), David Meyer (University of Saskatchewan), Paul Picha (North Dakota Heritage Center), and David G. Stanley (Bear Creek Archeology, Inc.): northeastern periphery archeology; L. Adrien Hannus and R. Peter Winham (Augustana College): western South Dakota archeology; Julie Francis (Office of Wyoming State

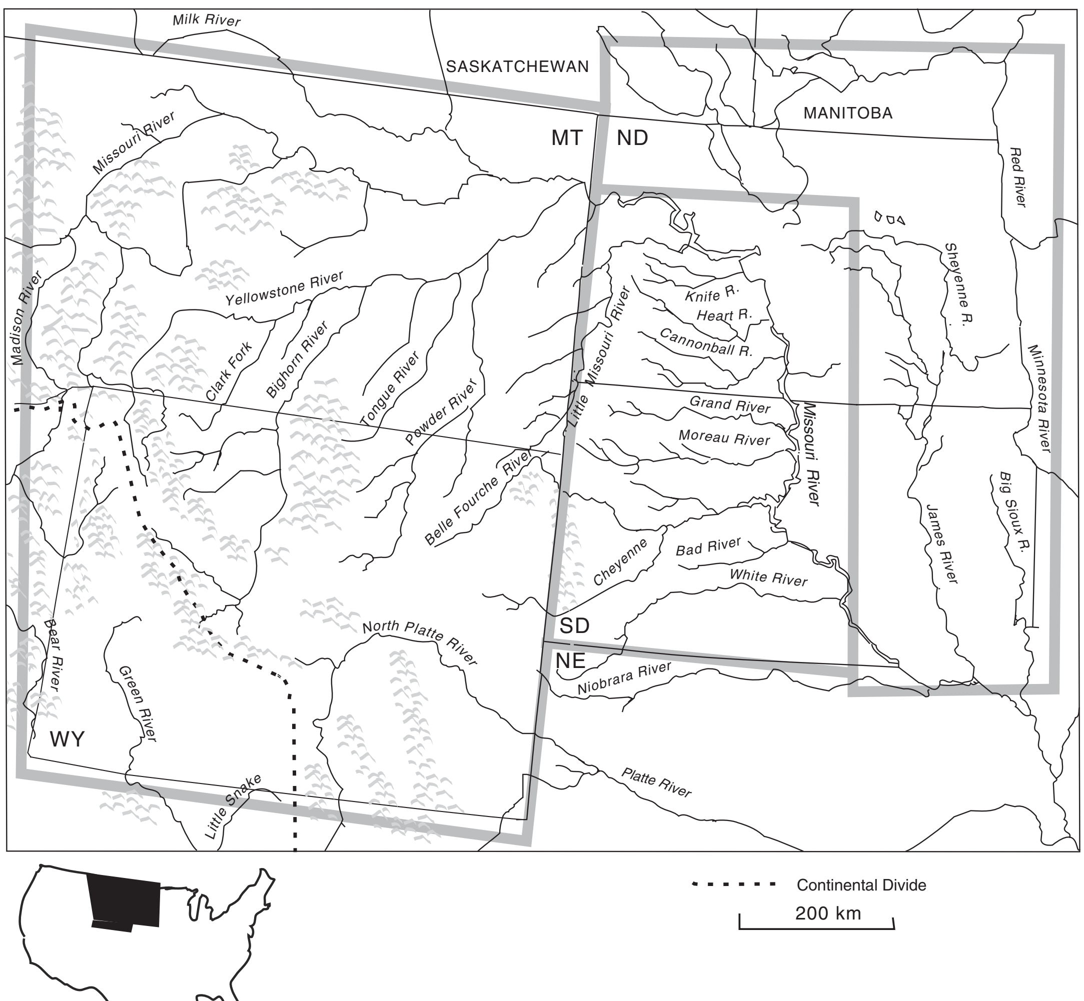

Figure 1. Subareas of the Northern Plains overview project: the Northwestern Plains, the Middle Missouri, and the Northeastern Periphery.

Archaeologist): rock art; and James Miller (University of Wyoming): lithic resources. Wyoming archeology, with some references to immediately adjacent areas (usually considered the Northwestern Plains), was compiled by George Frison.

The bioarcheology was funded by a separate grant. Laura Scheiber (University of Wyoming) completed the study of the Northwestern Plains and George Gill (University of Wyoming) wrote the historic part. The eastern half was done by John Williams, but he did not cover the distributions and characteristics of bioarcheological sites in South Dakota, which were summarized by Douglas Owsley as part of another overview (Owsley and Sandness 1996). With the assistance of Frison and Toom, Robert Mainfort wrote the chapter on the human adaptation types.

Land Ownership and Control

Approximately one-half of Wyoming is federally owned and managed. The Bureau of Land Management (BLM) is responsible for the bulk of federal holdings, followed by the U.S.D.A. Forest Service (USFS), the National Park Service (NPS), and the Bureau of Indian Affairs (BIA). Other federal agencies include the Fish and Wildlife Service (FWS), Bureau of Reclamation (BOR), U.S. Army Corps of Engineers (COE), and the Department of Defense (DoD). An unusual situation in southern Wyoming is the checkerboard area. In the midnineteenth century, the Union Pacific Railroad was granted every other section of land, 20 miles wide on both sides of the railroad right-of-way. This created a strip of land 40 miles wide and 400 miles long with alternating private-federal ownership. In Montana, federal agencies own and manage perhaps 25% of the land; in order of importance, the major agencies are the Forest Service, Bureau of Indian Affairs, and the Bureau of Land Management. Several large Indian reservations comprise most of the federal lands in South Dakota, while the Little Missouri National Grassland (USFS-managed) represents the largest federally owned tract in North Dakota. Most of the remaining lands in the study area are privately owned, although various state agencies have jurisdiction over a variety of lands, including state parks and forests, wildlife habitats, highway rights-of-way, and school grounds.

Management of Cultural Resources

The BLM is divided into districts, each with a district archeologist and staff. Staff size is dependent on the size of the district and the demands on the land, such as energy extraction, timber sales, and rangeland development. Each national forest has its own archeologist (or archeologists). The Park Service employs a staff of archeologists, as do the FWS, BIA, BOR, and COE. Cultural resource management philosophy on most federal lands is determined largely by the district archeologists. At one end of the spectrum are those who lean toward research; at the other are those who tend to be more concerned with surveys and inventories. Their activities are nearly always constrained by available funding.

The different states have their own sets of cultural resource management programs and policies. Energy companies, livestock operators, timber cutters, and other firms may contract with private consulting firms for archeological clearance on public and state lands. Private lands are mostly exempt from state and federal cultural resource management control.

Political Boundaries

Since most archeologists are constrained, to some extent, in their areal coverage by political and/or project boundaries, it is important to identify the individual or individuals who possess the necessary familiarity with a given area to enable preparation of an adequate overview. Most state educational institutions try to exert some measure of control over research efforts within their state boundaries, but this is not always possible. Federal and state agencies are usually cooperative and try to utilize in-state expertise for archeological surveys and mitigation projects whenever possible. Sometimes they are able to go to sole-source contracting with educational institutions. On the other hand, energy companies usually award their mitigation projects to the lowest bidder, which may or may not be one located in the particular state. By law, many projects are allocated to small business firms, thereby excluding institutionally based archeologists. Cultural resources may be only a small part of the operations of some large environmental assessment companies, and some of these operate nationwide.

Dissemination and Availability of Archeological Data

Competitive bidding for contract archeology has not encouraged the maximum extraction and dissemination of data. Energy companies seek only the minimum of mitigation efforts and rarely support extra efforts in the interests of pure research; these firms are rarely willing to underwrite the expenses outside the project area. In extreme cases, energy and similar interests may hesitate to make public their data recovered by contract.

The result is wide variation in the availability of archeological data. Much important data are buried in the so-called gray literature of contract archeology reports, too often spread only by word-of-mouth, since a formalized method of data distribution is lacking. Many institutionally based archeologists are at fault for failing to publish and adequately disseminate their research results.

Research Interests

The contributors to this overview are those believed to have the best overall knowledge of their particular area and/or topic of research. Most, but not all, are or have been affiliated with research institutions. In recent years, rock art has become a specialized study. Geoarcheology, which requires knowledge outside normal archeological studies, has witnessed phenomenal growth. Separate chapters are presented on both rock art and lithic resources. Certainly other special chapters could have been justified on topics, such as paleoclimates, palynology, and geomorphology as they pertain to interpretation of archeological assemblages.

All of these considerations were taken into account, along with that of making demands on a number of very busy persons to contribute what they believe constitutes an acceptable overview of Northern Plains archeology.

A General Description of the Present-Day Study Area

The Northern Plains, encompassing an area of 300,000 square miles, stretches from the Rocky Mountains east to the Red River of the North and from Canada south to the Central Plains of Colorado, Nebraska, Kansas, and Oklahoma. The study area lies almost wholly within the Great Plains physiographic province, but also includes a segment of the Central Lowland province along the northeast margin, and parts of the Middle Rocky Mountains, the Wyoming Basin, the extreme northern part of the Southern Rocky Mountains, and the South Dakota-Wyoming Black Hills. Four states are included in the study area: Montana, Wyoming, North Dakota, and South Dakota.

The major drainage basin is that of the Missouri River flowing first to the north, then to the east, and finally, southeast into the Mississippi. In the Missouri valley of the Dakotas, the river has cut a deep, trenchlike valley into the Missouri Plateau, often referred to as the "Missouri Trench." Its major tributaries include the Yellowstone, Bighorn, Musselshell, Cheyenne, Powder, and North Platte rivers originating to the west, the Milk and Marias rivers to the north, and the James River, originating to the east. In southwest Montana, the Madison, Gallatin, and Jefferson rivers join at Three Forks to form the Missouri River. The extreme southwestern part of the study area is drained by the Green River, which drains into the Colorado River in Utah. A small part of northwest Wyoming is drained by the Snake River, a major tributary of the Columbia River. The northeast corner of the study area in North Dakota is drained by the northward-flowing Souris and Red River of the North that eventually empty into Hudson Bay.

The topography of the study area is varied. Nearly flat but glaciated plains make up the northeast corner, with elevations ranging from about 1,500 feet along the river valleys to about 1,700-2,000 feet along the foot of the Missouri Escarpment (Coteau du Missouri). The Missouri Escarpment, extending northwest across the northeast part of the study area, marks the boundary between the Great Plains and Central Lowland physiographic provinces (Figure 2). The escarpment has east-

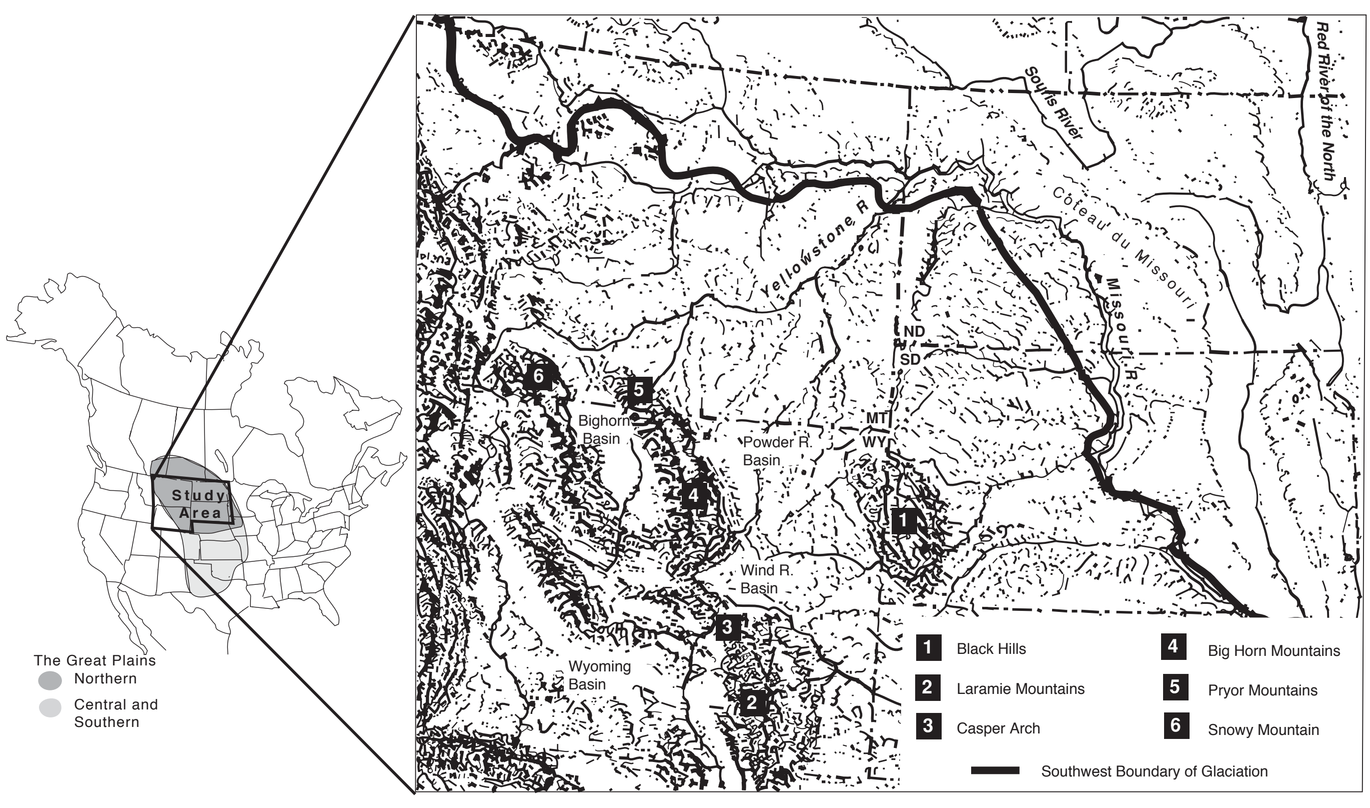

Figure 2. The Northern Plains study area in relation to the Great Plains physiograhic province of North America.

facing slopes rising from 1,700-2,000 feet above sea level (ASL) to 1900-2,000 feet at the top; to the west it levels off into the Missouri Plateau (sometimes called the Upper Missouri Basin).

The Missouri Plateau contains plains, low-lying hills, and tablelands that are interrupted by entrenched river valleys and isolated uplands. The plateau rises gradually from about 2,000 feet ASL in the east to 5,000-6,000 feet at the foot of the mountain ranges. Surface rocks are chiefly soft sandstones and shales except in the glaciated areas.

The Black Hills, an isolated mountain range in western South Dakota and northeast Wyoming, has elevations from 4,000 feet in the foothills to 7,000 feet along the crest. From the floor of the Powder River Basin and the North Platte River valley at 5,000 feet, the land is deeply faceted by tributaries and rises to nearly 9,000 feet along the crest of the Laramie Range. The north end of the latter, Casper Mountain, stands 2,000 feet above the basin floor and descends westward onto the plains of the Wyoming Basin.

A geologic structure called the Casper Arch separates the downfolded Powder River Basin on the east from the similar Wind River Basin to the west. The terrain across the Casper Arch is flat to gently rolling and is generally less than 6,000 feet. Locally it erodes into irregular breaks near the south Big Horn Mountains.

The Big Horn Mountains range from 4,500-6,000 feet in the foothills to more than 13,000 feet at the crest, forming a mountain barrier between the Powder River Basin on the east and the Bighorn Basin on the west. The east slope, facing the Powder River Basin, is steep and rugged and is cut by streams that flow out on to the plains. The Wind River originates in western Wyoming. It first flows east and then north into the Bighorn Basin where it becomes the Bighorn River, and farther on separates the Big Horn and Pryor Mountains; the latter is a northern extension of the former with elevations that range from 5,000 feet around the base to nearly 9,000 in higher parts.

The Yellowstone Plateau and adjacent mountain ranges formed the largest North American glaciated area south of the Cordilleran and Laurentide ice sheets. Contiguous mountain ranges include the Absaroka, Wind River, Gros Ventre, and Teton ranges in Wyoming and the Madison, Gallatin, and Bear Tooth ranges in Montana.

North of the Big Horn and Pryor Mountains, broad to sharply entrenched river valleys (Yellowstone, Musselshell, and Missouri rivers) and low dissected interstream divides dominate the landscape. The Big Belt, Little Belt, Big Snowy, and Bearpaw Mountains are the major uplands across this area.

The climate of the Northern Plains is wetter in the east than in the west, with the heaviest precipitation occurring in the growing season, though winter rain and snow are common. Moisture varies widely from year to year, and abnormally wet periods may be followed by abnormally dry ones, even within a year. Droughts of several years' duration sometimes occur over large parts and have had profound effects on the flora. Summers are hot to very hot, and winters are cold and somewhat dry. The growing season is short, averaging only

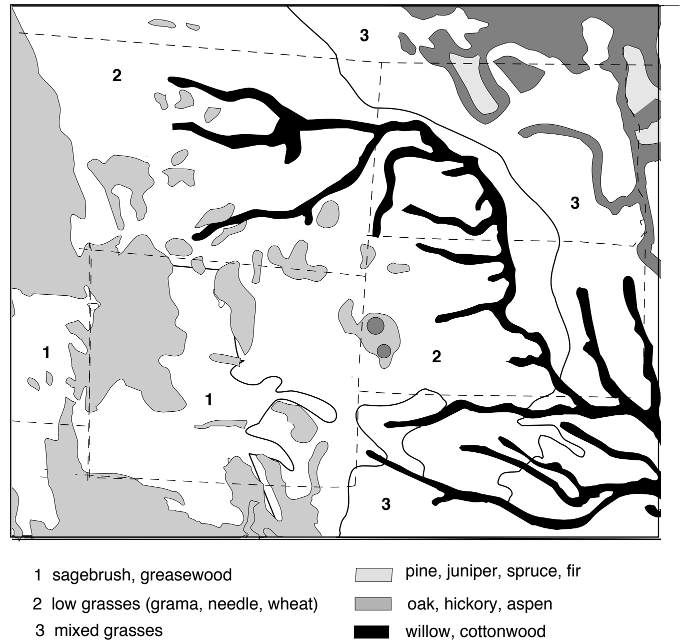

Figure 3. General vegetation patterns of the Northern Plains.

100 frost-free days in the study area, except for the Middle Missouri subarea which averages about 120 days frost free.

The vegetation history of the study area is not known in detail and the flora is thought to be recent and adventive in origin. Most species have extensive ranges beyond the study area and appear to have colonized the area from elsewhere, especially from the southeast and southwest. There are three zones of grassland vegetation: short grasses in the west, tall grasses in the east, and mixed short and tall grasses in the middle. These are bordered on the west by the coniferous, evergreen forests of the Rocky Mountains. Elements of these mountain forests extend halfway across the area on hills and escarpments. Along the eastern border and extending west along the rivers well into the grasslands are the deciduous hardwood forests of eastern North America, dominated by oaks, hickories, sugar maples, and basswoods (Figure 3). These forests become impoverished in species as they move west. The coniferous and deciduous forests meet only in the valley of the Niobrara River in north-central Nebraska but both types are found in the Black Hills of South Dakota. Throughout the area, the floodplains of rivers contain willow, cottonwood, elm, ash, and box elder.

Native fauna parallel the vegetational associations. Among the larger mammals, common grassland species include bison, deer, pronghorn, elk, badger, wolf, coyote, and jackrabbit. This list actually reflects habitat preference, as many species are classed as tolerant of both grassland and forest habitats, or occupying the grassland-forest ecotone (Chomko 1976:37). Mink, weasel, tree squirrel, ground squirrel, raccoon, muskrat, prairie dog, and a variety of rodents and insectivores are also found (Bailey 1926; Over and Churchill 1941).

Paleoclimates and Paleoenvironments

The grasslands of the Great Plains are located in an area dominated most of the year by Pacific air. Originating over the Pacific Ocean, this maritime polar air loses its moisture while crossing the Rocky Mountains, and arrives in the Great Plains as a dry air mass. Shifting patterns of air masses over time is the key factor influencing the distribution of the Plains grasslands (Wendland et al. 1987).

The postglacial history of the Northern Plains is among the least well known in North America. Several factors contribute to this situation. Foremost is the paucity of natural lakes and wetlands suitable for paleoecologic investigation. Many existing wetlands are large, shallow basins containing mineral sediments but little organic material. Intermittent desiccation and deflation have resulted in incomplete sedimentary records at many sites. Finally, fossil pollen grains from sites in the Northern Plains are often degraded and difficult to identify, and the most common species represented (e.g., grasses and sagebrush) have considerable ecological amplitude. Further complicating reconstructions are the time-transgressive nature of environmental and paleoecological changes across the study area and what appears to be considerable variability in climate between temporally equivalent localities.

Since the late Pleistocene, two major trends have dominated the environmental history of the Northern Plains. The first, from the Last Glacial Maximum at about 18,000 years ago to the waning years at about 10,000 years ago, witnessed the amelioration of climate that produced major changes in biota and landscapes. The retreat of the Cordilleran and Laurentide ice sheets opened vast areas for colonization by plants, animals, and people. Large herbivores thrived in this environment, but environmental changes, possibly coupled with human predation, quickly brought about their extinction.

A second paleoenvironmental trend was toward increased warmth and aridity during the mid-Holocene Altithermal, which was followed by greater effective moisture and cooling in the late Holocene. This is well documented in the Eastern Woodlands, Far West, and even the Northeastern Great Plains, but the timing and details of vegetational changes are poorly known throughout most of the study unit (Barnosky et al. 1987).

The varved sediment deposits of Elk Lake, in northwestern Minnesota (Bradbury and Dean 1993), provide an unparalleled record of climate and vegetation change spanning the entire Holocene. Although located near the northeastern margin of the study area, the Elk Lake data have broad relevance to much of the Northern Plains and are the principal source of the discussion that follows, with other data sets incorporated as appropriate.

During the late glacial period, much of the Northern Plains area apparently was an open environment dominated by grassland species. Appropriate microenvironments supported arctic mammalian species, suggesting a parkland. Late Pleistocene climates, characterized by lower summer temperatures and increased effective moisture, would have permitted animals limited by summer high temperatures to disperse to the south and those unsuited to more xeric conditions to extend their westward range. Disharmonious faunal associations, presumably reflecting reduced seasonal extremes in climate, typify local fauna. This suggests that there are no modern analogs for late Pleistocene climates or environments (Graham et al. 1987).

At Elk Lake, the late glacial period (11.6 to 11.0 ka) was characterized by a spruce forest and a climate that was much cooler and drier than present. The following 1000 years or so was a period of marked increases in both temperature and moisture. The Lange-Ferguson mammoth kill site in western South Dakota documents generally mesic conditions of the prairie/boreal forest ecotone around 10,500 years ago (Semken and Falk 1987).

Two localities in northwestern Montana, Guardipee Lake and Lost Lake, provide some of the available pollen records for the northwestern Great Plains. Other records include a high altitude lake core from the Big Horn Mountains (Burkhardt 1976); a deep core from Grays Lake in eastern Idaho, and another from the Ice Slough in western Wyoming (Beiswenger 1987); pollen samples from the Mill Iron site in southeast Montana (Scott-Cummings 1996); and others from the eastern Powder River Basin in Wyoming (Markgraf and Lennon 1986). At Guardipee Lake and Lost Lake, there is no evidence of a late glacial spruce forest that was replaced by pine or deciduous hardwoods. Rather, pollen data indicate the presence of temperate grassland, with shrubs occupying mesic habitats, by approximately 12,000 years ago. The nearby slopes, however, evidently supported pine, spruce, and fir; this would be consistent with findings in montane settings which indicate the presence of pine parklands. After 11,500 years ago, a trend toward increasingly dry climates is marked by the increased importance of sagebrush relative to grass (Barnosky 1989).

Pollen and phytolith studies (Scott-Cummings 1996) at Mill Iron site in southeast Montana (Frison 1996) indicate that by ca. 11,000 years ago, and for some time thereafter, local vegetation was dominated by sagebrush to a greater extent than at present, with almost equal parts of Festucoid (cold-season) and Chloridoid (warm-season) grasses. Chloridoid grasses later increased. Markgraf and Lennon (1986) suggest that in the Powder River Basin of eastern Wyoming, the Altithermal began about 5,000 years ago, although this seems too recent.

At Elk Lake, Minnesota, between 10.2 and 10.0 ka, the postglacial open spruce forest disappeared and was rapidly replaced by mixed pine forests (Bradbury et al. 1993). The spruce-pine transition documented at Elk Lake was time-transgressive from south to north (Whitlock et al. 1993). This vegetational change represents an increase in July temperatures of roughly 4°C and an increase in annual precipitation to approximately modern levels (Bradbury et al. 1993).

A similar pattern is well documented throughout the north-central United States. For example, in southern South Dakota, the spruce forest was replaced along its southern margin by prairie around 12,000 years ago. Various hardwoods, including oak, poplar, and ash, expanded into this area, mixing with spruce, by around 11,000 years ago. The westward limits of this parkland forest are unknown, but it extended at least into the central Dakotas. This was followed by the development of prairie about 1,000 years later (Barnosky et al. 1987).

A significant environmental change to a warmer, drier than modern climate is indicated at Elk Lake during the period 9.5 to 9.1 ka, followed by an eastward expansion of the prairie between 9.0 and 7.0 ka. Pine forests underwent major reductions between 9.0 and 8.0 ka, with sagebrush, and later grass, becoming dominant in the pollen record. Sagebrush first appears around 8.7 ka, marking the initial eastward expansion of prairie environments. Pollen evidence suggests that the transition into the prairie period was relatively gradual, but geochemical data indicate that the forest-prairie transition spanned only about 100 years (Bradbury et al. 1993).

At Guardipee Lake, Montana, the Altithermal began around 8,400 years ago (9400 RCYBP), an age intermediate between the Pacific Northwest and portions of the eastern Great Plains (Barnosky 1989).

The onset of the mid-Holocene arid prairie period (the Hypsithermal) occurs at 8.2 ka in the Elk Lake record. Between 8.0 and 7.0 ka, grass dominates the pollen assemblage, with a progressive influx of oak in the savannah vegetation. Various lines of evidence suggest that this period was generally dry, although spring precipitation was sufficient for abundant grass. Pollen assemblages from southern Saskatchewan, as well as certain data from Elk Lake, point to a cold, dry climate during the interval 7.8 to 6.6 ka (Whitlock et al. 1993; Bartlein and Whitlock 1993). Prairies along the United States-Canadian border near longitude 100°W provide a modern analog to this period. Bartlein and Whitlock (1993) estimate that between 7.8 and 4.5 ka, annual precipitation in northwestern Minnesota was about 100 mm less than present, and July temperatures were approximately 2°C warmer than present near the end of the period.

The dry westerly winds of the Pacific airstream became increasingly dominant between 7.0 and 4.0 ka, probably causing the water level in Elk Lake to drop to an all-time low. Maximum warmth was achieved around 6.7 ka, with an increase of about 1°C in both summer and winter temperature at that time. The severity of xeric conditions associated with the Hypsithermal are reflected in the depression of the water table in northwestern Iowa by 10 m between about 7,200 and 6,400 years ago (Bradbury et al. 1993). In the Midwest, Bartlein et al. (1984) concluded that the mid-Holocene temperature maximum was time transgressive, with maximum warmth occurring around 6.8 ka (6000 RCYBP) to the north and 4.4 ka (4000 RCYBP) in the south. In contrast, the onset of cooler and wetter conditions around 6000 years ago at Lost Lake, Montana, marks the end of the Altithermal, and gave rise to more diverse vegetation (Barnosky 1989). Bradbury et al. (1993) suggest that the main mid-Holocene period of dune activity in the Rocky Mountain basins and Nebraska Sand Hills equates with the main period of aridity and clastic influx at Elk Lake. The emerging picture is that the mid-Holocene was a dynamic period of climatic change, characterized by rapid transitions between dry and moist intervals.

Between 6.0 and 4.0 ka, the latter portion of the mid-Holocene, oak remains prominent in the Elk Lake pollen record, with decreases in grass and sagebrush. At 5.4 ka, the strong westerly winds seem to have dramatically subsided, a short-lived phenomenon that lasted until 4.8 ka, at which time strong winds returned, as documented by an increase in eolian clastic material (Bradbury et al. 1993). This previously undocumented interval serves to underscore the danger of characterizing long periods of time as “xeric” or “mesic,” as climatic conditions actually were rather dynamic. By about 3.8 ka clastic indicators fall to low levels, marking the onset of relatively calm climates and the end of the prairie period. Pollen from prairie plants, which had begun to decline by about 6.0 ka, were nearly at background levels two millennia later, as a mixed mesic pine-hardwood forest succeeded the oak savannah.

A variety of indicators suggests the establishment of modern climatic and environmental regimes by around 4.0 ka at Elk Lake, Minnesota. Pollen stratigraphy documents an interval of hardwood forest, dominated by oak, birch, and hophornbeam, during the period of 4.5 to 3.0 ka. Bartlein and Whitlock (1993) suggest that around 3.5 ka, mean temperatures were 1.5-2.0°C warmer than the present, with annual precipitation about 100 mm greater. A subsequent cooler interval produced mixed conifer-hardwood forests characterized by white pine, replacing the oak savannah around Elk Lake by about 2.7 ka. Temperatures may have decreased by as much as 6°C during this period, with white pine pollen peaking around 0.9 ka.

The Mondrian Tree site in west-central North Dakota has produced additional data on late Holocene mammalian species and environments. The lowest level of the site, dating to approximately 4,500 years ago, produced a steppe-like mammal assemblage reflective of drier conditions. A scrub gallery forest, including elm, box elder, and ash, is suggested by pollen data from the same level. By around 4,000 years ago, a more mesic climate is suggested by a sevenfold increase in boreomontane mammals. Boreal elements show a continuing increase between about 3,500 and 3,000 years ago. A cooler, more moist climate is implied. The site area probably consisted of an open grassland, with shrub gallery forest nearby. Continued increases in the number of boreoforest ecotypes suggest much the same climatic conditions between about 2,500 and 2,200 years ago.

A small mammal assemblage dated to around A.D. 150-550 from the Oakwood Lakes site in east-central South Dakota reflects the presence of a grassland and cooler, drier conditions than today. Faunal data from the Mitchell site, southeastern South Dakota, indicates the presence of a gallery forest with prairie uplands at ca. A.D. 1050. A climate virtually identical to that of today is implied. A fairly similar situation is documented at the Helb site in north-central South Dakota between about A.D. 1050 and 1100. Here, modern climate conditions supported an extensive upland prairie with meadows along the floodplain (Semken and Falk 1987).

By A.D. 1200, the Pacific airstream had moved southward into Minnesota and adjacent states, ushering in a period of drought (Bradbury et al. 1993). The Little Ice Age, or Neo-

Boreal (ca. A.D. 1450-1850), has frequently been invoked as a causal agent in observed archeological changes (see Bamforth 1990). Based largely on historical evidence from Europe, climates during this period are generally considered to have been cooler and wetter than present. An increasing body of data indicates that neither the Little Ice Age nor the preceding Medieval Warm Period can be characterized uniformly, and that considerable climatic variability (often localized) typifies these periods.

Around A.D. 1350, somewhat more arid conditions are implied by fauna from the Lower Grand (Davis) site. Evidence from the roughly contemporary (A.D. 1250-1400) Nailati phase occupation at the White Buffalo Robe site, west-central North Dakota, reflects a typical, modern prairie community. Warmer summers and increased aridity are implied during the succeeding Heart River occupation at the site (ca. A.D. 1450-1650), as grasslands were reduced in extent and partially replaced by herbaceous or shrub vegetation.

Faunal data from several of the Knife River villages (Lower Hidatsa, Big Hidatsa, and Sakakawea) in west-central North Dakota span the terminal prehistoric and historic periods, and are generally indicative of cooler temperatures and increased rainfall that generated a tall-grass prairie parkland over the Northern Plains (Semken and Falk 1987).

Dendroclimatic evidence for the Northern Plains is limited to the fairly recent past (post-A.D. 1600), but offers some insights that may have relevance to older climates. The discussion that follows is drawn from the recent synthesis by Fritts and Shao (1992).

During the interval A.D. 1600-1635, average temperature and precipitation throughout virtually all of the Northern Plains was within the modern range. An exception was southwestern Wyoming, which like the Southern Plains, was warmer and drier. A notable east-west dichotomy occurs between A.D. 1637 and 1666, with the western United States warmer and drier than areas to the east. Within the study area, Montana and Wyoming experienced higher temperatures, and drier conditions prevailed in western Wyoming, most of southern and eastern Montana, and most of North Dakota. Around A.D. 1717, warmer conditions existed throughout most of the United States, with decreased precipitation in portions of the west, including most of the Northern (but not Southern) Plains. By A.D. 1761, temperatures decreased somewhat across the United States. At this time, lower precipitation characterized much of the country, the Northern Plains being a notable exception (Fritts and Shao 1992).

Regional climatic variability is emphasized in virtually all recent paleoclimatic and paleoecological studies within and adjacent to the Northern Plains study unit. This point is underscored by dendroclimatic evidence for variations over the past 400 years. While past climates undoubtedly had significant impacts on prehistoric Native Americans, sweeping generalizations about climatic conditions at a specific time and across large areas are inappropriate, particularly when researchers closely link paleoclimates to prehistoric culture change. Not only are such deterministic arguments likely to be fraught with erroneous assumptions, but, in fact, statements such as "the return of mesic conditions around A.D. 1000 allowed the expansion of maize agriculture into portions of the Northern Plains" actually explain nothing.

Perhaps no archeologist viewed or understood the Great Plains in terms of prehistoric human occupations with the interest and perception of Waldo Wedel (1961:20-45). Year-to-year fluctuations in climate are unpredictable and of varying magnitude, and, without any doubt, strongly affected prehistoric human subsistence strategies. Historic events can be cited: for example, the hardships of the drought years of the 1930s still remain within the memories of many livestock operators on the Great Plains, and a half-century earlier, the terrible winter of 1886-1887 decimated the livestock and a small herd of nine buffalo still grazing free in the Bighorn Basin of Wyoming. As Wedel notes (1961:31), rainfall varies widely from year to year and these rapid fluctuations cannot yet be perceived in regional climatic studies. Archeologists working on the Great Plains and the Rocky Mountains depend largely on long-term climatic studies to formulate theories of past human lifeways; this has undoubtedly led to many erroneous interpretations.

2 Archeology of the Northwestern Plains, by George C. Frison, David Schwab, L. Adrien Hannus, Peter Winham, David Walter, and Robert C. Mainfort

History of Archeological Research

Since Wyoming, Montana, and the western Dakotas lack many of the visible archeological features like monumental earthworks, it is not surprising that these states received virtually no archeological attention until the 1930s. In assessing available data for the Northern Plains, Strong (1940) noted the paucity of archeological information (see also Wedel 1961). Certainly, Kroeber's (1939) and Wissler's (1906) rather bleak views of aboriginal occupations on the Plains prior to the arrival of horses and guns did little to inspire enthusiasm for prehistoric research in the area. While Paleoindian sites such as Lindenmeier (Roberts 1935), Finley, (Howard 1943), Agate Basin (Roberts 1943), and Horner (Jepsen 1953) have focused some archeological interest in the region and recent years have seen publication of many significant studies, knowledge of the area still lags behind that of more intensively studied regions such as the Eastern Woodlands.

In the 1930s, the Montana Archaeological Survey and the Works Projects Administration (WPA) sponsored excavations at Pictograph Cave, Hagen, and Ash Coulee, all in Montana, and a survey of part of the Yellowstone River valley was undertaken (see Mulloy 1958). Mulloy (1942, 1943, 1953) subsequently published descriptions of materials from the Hagen, Red Lodge, and Ash Coulee sites. The American Museum of Natural History sponsored investigations in several caves in the Pryor Mountains of Montana (Nelson 1942, 1943), but the recording techniques make the data of limited value.

Amateur archeologists made several important contributions in the 1930s. These include Brown's (1932) assessment of the Emigrant Bison Jump near the Three Forks of the Missouri River and H. P. Lewis' (1947) investigation of bison jumps in Montana. Also notable is Shumate's (1950) summary of archeology in the Great Falls area.

Early investigations in North Dakota are represented by the publications of Smith (1906), Libby (1910, 1913), and Grinnell (1918). George Will reported a visit to Ludlow Cave and a wickiup site in South Dakota (1909), but the earliest reported professional excavations in South Dakota were those of William H. Over (1936) at Ludlow and Pelham's Caves. Several years later, Over (1941) published an overview of South Dakota rock art. An early important rock art study in Montana is that of Mulloy (1958). More recent rock art studies in Montana include those of Secrist (1960), Shumate (1960), Malouf (1961a), Conner (1960, 1962), Conner and Conner (1971), Keyser (1977a, 1979), and Keyser and Knight (1976). A somewhat broader treatment of rock art is that of Francis (1991).

The Missouri River Basin Survey program was centered mainly in the Missouri River trench, but some significant work was accomplished in the smaller tributaries in Montana and Wyoming. This includes reports by Hughes (1949), Wheeler (1958), Fenenga and Cooper (1951), Miller (1963), Brown (1968), and Husted (1969).

Meleen and Pruitt (1941) examined rock shelters in South Dakota and conducted excavations at Stevens Ranch and Lords Ranch with support from the Works Project Administration. A number of surveys and testing projects in South Dakota were performed under the auspices of SIRBS (Smithsonian Institution River Basin Surveys) that includes reports by Wheeler (1958), Hughes and White (n.d.), and Mallory (1963, 1967).

Thomas Kehoe's (1960, 1967) publications on tipi rings and bison jumps on the Blackfeet Reservation in Montana are considered to be early classics, and Kehoe and McCorquodale (1961) published a detailed discussion of Avonlea points.

In the 1960s, the Milk River Archaeological Society made a number of useful contributions to Montana archeology, including work at the Keaster (Davis and Stallcop 1965) and Wahkpa Chu'gn sites (Davis and Stallcop 1966; Brumley 1971).

Kidwell (1968) conducted a detailed study of conical timbered lodges on the Northwestern Plains. A brief summary of the history and archeology of the upper Missouri River area was made by Sharrock and Keyser (1974). Davis (1976) and Davis and Aaberg (1978) made extensive site surveys of the same area and performed test excavations at a number of sites (Davis 1980).

In 1975 and 1976, excavations at Bootlegger Cave, near the Tiber Reservoir in Montana, produced important data on Late Prehistoric communal bison procurement (Roll and Deaver 1978). Keyser's (1979) doctoral dissertation summarizes the results of investigations in the Fresno Reservoir (Montana) including testing at a number of sites.

Long-term investigations in the Pryor Mountains of Montana were initiated by Loendorf (1969, 1971, 1973, 1974). This became what was perhaps the largest and most intensive archeological survey conducted in Montana. Loendorf performed the survey and testing for the Transpark Road in Bighorn Canyon National Recreation Area (Loendorf et al. 1981; Good and Loendorf 1974). Pryor Mountain investigations were continued by Bonnichsen, beginning in 1978 and lasting for a period of several years (see Bonnichsen and Will 1980; Bonnichsen and Young 1979), and included work at False Cougar Cave (Bonnichsen 1980).

Beginning in the 1970s, numerous relatively large-scale cultural resource management surveys have been undertaken, both to satisfy federal preservation and environmental requirements, as well as management mandates on federally owned lands. Presented by citation only, these include, but are not limited to, Artz and Root (1983), Deaver and Aaberg (1977), Gregg (1985a), Lahren et al. (1978), Lahren (1977, 1979), K. Deaver (1980a, 1980b, 1983), S. Deaver (1982, 1984), Grant (1981), Tratebas (1979), Wettstaed (1989), Reher (1979), Roll (1978), Ruebelmann (1983), and Davis (1975). A particularly useful overview is that of Beckes and Keyser (1983) for the Custer National Forest, and a more recent effort by Deaver and Deaver (1988) for southeast Montana reflects the maturity of contract-based archeology.

The Black Hills of South Dakota have been the focus of several overviews during the last 10 years (Cassells et al. 1984; Noisat et al. 1991; see also Sundstrom 1989 and Tratebas 1986). South Dakota's *State Plan for Archaeological Resources*, originally compiled by Buechler (1984), has undergone significant revision (Winham and Hannus 1990, 1991). Regional syntheses have been prepared for the White River Badlands (Winham et al. 1989) and Belle Fourche regions (Lippincott 1992).

Several organizational schemes for regional prehistory have been proposed, the earliest of which is that of Mulloy (1958), based on excavations at Pictograph Cave in southern Montana. Reeves (1970, 1973, 1983) offered refinements to Mulloy's pioneering efforts, drawing on data throughout the Northern and Central Plains, but dealing with only the period between 1000 B.C. and A.D. 1000. One aspect of Reeves' contribution is the proposed definition of several traditions and phases.

Frison (1978, 1991a) presented a cultural taxonomy that spans the entirety of Plains prehistory, but is limited to the Northwestern Plains, particularly Wyoming. Because there are quantifiable differences in prehistoric subsistence strategies as one progresses northward, Reeves' traditions and phases are not readily perceived south of the plains in Alberta and Montana. Similar problems are encountered in southeast Wyoming where intrusive elements from the Colorado Plateau and the Great Basin do not fit in the chronology (see Metcalf 1987). It is perhaps too much to expect that a single chronological system will prove adequate over a region as large as the study area.

The Northwestern Plains have contributed greatly to Paleoindian studies (Moss et al. 1951; Irwin-Williams et al. 1973; Frison 1974a; Frison and Bradley 1980; Frison and Stanford 1982; Hannus 1985, 1990; Frison and Todd 1986, 1987; Davis 1993; Forbis and Sperry 1952; Irwin-Williams et al. 1973; and Frison 1996). The Colby Mammoth Kill (Frison and Todd 1986) in the Bighorn Basin and the Lange Ferguson site in South Dakota (Hannus 1990) yielded information and ideas concerning Clovis mammoth procurement, butchering, and cold weather meat storage. The Hanson site (Frison and Bradley 1980), also in the Bighorn Basin, and McHaffie (Forbis and Sperry 1952) and Indian Creek (Davis 1993) near Helena, Montana are excavated Folsom sites. Another excavated Folsom component was present at the Agate Basin site in eastern Wyoming (Frison and Stanford 1982).

Perishable items from dry caves (Mulloy 1958; Frison 1962, 1965, 1968a; Frison and Huseas 1968; Frison, Adovasio, and Carlisle 1986; Frison, Andrews et al. 1986; Husted and Edgar n.d.) have greatly expanded the interpretive potential of archeological assemblages.

As will be seen in the culture history overview section, prehistoric bison procurement has traditionally been an important research topic (Frison 1978, 1991a). Already noted are Brown's (1932) observations on cursory studies of bison jumps along the Yellowstone River in Montana. An important landmark in bison procurement studies was a symposium and publication on bison jumps sponsored by the Montana Archaeological Society (Malouf and Conner 1962) that stimulated and focused interest on the problem.

Forbis (1962) published a lengthy account of excavations at the Old Woman's Bison Jump in Alberta. Sponsored by the National Park Service, Taylor (1971) made preliminary excavations at the Madison River Buffalo Jump. The Powers-Yonkee buffalo trap near Broadus, Montana was investigated in the early 1960s (Bentzen 1962a), with additional testing in 1986 (Bump 1987). Arthur (1962) described several jump sites in the upper Yellowstone drainage and Shumate (1967) reported on the Taft Hill Bison Jump, which has been largely destroyed. The Piney Creek Bison Jump in northern Wyoming was excavated in 1964 and 1965 (Frison 1967a), followed by work at the Kobold Buffalo Jump site in southern Montana in 1968 (Frison 1970a). Other Montana bison jumps include the Antonsen site (Davis and Zier 1978), Sam Lei Bison Kill (McLean 1976), and the Sly site (Steere 1980). Polk (1979) conducted a locational analysis of bison jumps in the Northwestern Plains.

Stone circles, or "tipi rings," ubiquitous across the Northern Plains landscape, have been the subject of considerable controversy over the years. Investigations of these features have produced relatively little cultural material, often leaving researchers feeling frustrated (Mulloy 1958). During an early archeological survey in eastern Wyoming, Renaud (1936) noted the abundance of stone circles and considered them worthy of study. Numerous subsequent publications have discussed stone circles, including those by Mulloy (1965), T. Kehoe (1960), Malouf (1961b), Hoffman (1953), Mulloy and Steege (1967), Brown (1968), and Aaberg (1975). A 1981 symposium focused on stone circles, resulting in a lengthy *Plains Anthropologist* Memoir (Davis 1983). Wilson (1995) has recently offered a postprocessual perspective on these features.

A. Kehoe (1958, 1959) discussed the ethnic affiliations of Northwestern Plains ceramics, postulating Blackfoot, Cree, and Mandan traditions in the region. This general theme received considerable attention during the 1970s and 1980s (Frison 1976a; A. Johnson 1977a, 1979a; Davis and Keyser 1982; Keyser and Davis 1981) and is touched on in the culture history section of this volume.

Reinvestigation of old Paleoindian site assemblages is part of present research efforts. Analysis of the material collected at the Hell Gap site in Wyoming during the 1960s by Harvard University (see Irwin-Williams et al. 1973) is ongoing. The stratified sequence at Mummy Cave in northwest Wyoming (McCracken 1978) produced a wealth of late Paleoindian and Archaic evidence that is also in the process of being reanalyzed. Excavation and analysis of the Mill Iron site in southeast Montana (Frison 1996) revived interest in the Goshen (now referred to as Goshen-Plainview) Paleoindian cultural complex first described at the Hell Gap site (Irwin-Williams et al. 1973).

An exhaustive review of contributions to Northern Plains archeology cannot be undertaken here, but several additional studies will be mentioned. Schwab (1987) completed a reanalysis of materials from Pictograph and Ghost Caves in Montana. Fredlund's (1981) dissertation reviews the Late Prehistoric period in southeast Montana. Greiser (1984) published a chronology of projectile points from southwestern

Montana. A useful overview of Middle Plains Archaic was published by Kornfeld and Todd (1985), and Davis (1988) assembled a synthesis on Avonlea. It should be noted that Steward's (1938) *Basin-Plateau Aboriginal Socio-Political Groups*, a landmark in American anthropology has been highly influential in later archeological studies in the Northern Plains and Rocky Mountains.

Culture History

Present cultural chronologies rely heavily (if not exclusively) on projectile point styles and certain tool types as diagnostic temporal and cultural markers. Assigning cultural affiliation to archeological sites is far from perfect and is often confused by variations within types and questions about the relevance of point morphology to prehistoric cultural groups (Stanfill 1988). However, these problems are being addressed with an increasing emphasis on improved methodology through better understanding of site formation processes and micro-stratigraphy; a greater concern with provenience, collection and preparation of radiocarbon and other dating samples; the advantages of accelerated mass spectometry (AMS) dating; and the development and use of better instruments in both field and laboratory.

Pre-Clovis or Ancestral Clovis

The beginning of human occupation in the Northern Plains and Central Rocky Mountains remains shrouded in uncertainty. Evidence of Clovis, characterized by distinctive weaponry, is found in all 48 contiguous states, but convincing evidence of pre-Clovis occupations, if present, still eludes us. Promising evidence of pre-Clovis has fallen apart under careful scientific scrutiny, and we are left with only the certainty that cultural groups as sophisticated as Clovis had to have arrived from some source and to have developed out of some preexisting cultural entity. Perhaps the most frustrating aspect of North American archeology is the relative ease with which Upper Paleolithic groups have been confirmed in the Old World versus our inability to either prove or disprove similar occupations in the New World, or trace the earliest known New World human groups directly into the Old World. Sediments of pre-Clovis age are known, but unequivocal cultural evidence within these deposits is lacking. Moreover, there are presently no known tool assemblages distinctive enough to be considered the product of a pre-Clovis cultural group.

Three decades ago, most New World archeologists concerned with this problem thought it would be resolved within a few years. Perhaps the next few years will produce definitive results.

The Paleoindian Period

Clovis

The southern terminus of the proposed "ice-free corridor" (Burns 1990; Catto and Mandryk 1990) is just to the north of the study area in Canada. Whether or not Clovis groups migrated south through the corridor is a moot point, but it is a distinct possibility and is perhaps the most logical of all proposed routes of entry. Assuming this to be the case, their first contact with the area south of the corridor would have been in the northwest corner of the study area. From here, these groups could have spread rapidly in all directions.

Clovis represents a terminal Pleistocene adaptation characterized by distinctive fluted spear points and carved bone and ivory shafts. Current radiocarbon dates suggest an age range of approximately 11,200 to 10,900 years ago for Clovis (Haynes 1993). Clovis peoples possessed highly developed lithic, bone, and ivory technologies, and produced what may have been the most effective flaked stone weaponry known in any part of the world at that time (Figure 4a-c). Experiments on modern elephants have demonstrated the effectiveness of Clovis points in hunting large game (Frison 1989). On the Northern Plains, archeological evidence demonstrates that Clovis hunters pursued mammoth, bison, and, to a lesser extent, horse, camel, pronghorn, and jackrabbit. However, continent-wide studies of Clovis indicate Clovis use of a wide array of small animal and plant species. Certain aspects of Clovis lithic technology are now sufficiently documented that Clovis identification can sometimes be determined without the diagnostic point. Examples include the Adams site, a large Clovis lithic reduction site in Kentucky (Sanders 1990), and the Yellow Hawk site in Texas (Mallouf 1989).

The Colby Mammoth Kill in northern Wyoming contained parts of at least eight mammoths, with evidence suggesting cold weather meat preservation through use of

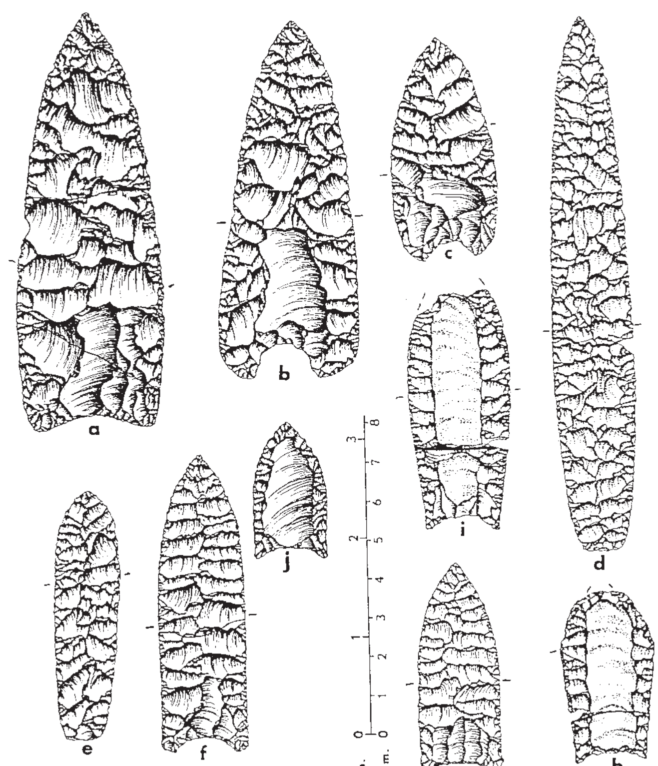

Figure 4. Paleoindian projectile points: a-c, Clovis; d, e, Agate Basin; f, g, Goshen; h-j, Folsom.

temporary frozen meat caches (Frison and Todd 1986). Bison, camel, horse, pronghorn, and jackrabbit remains also were recovered, but in very small numbers (Walker and Frison 1980). Evidence of a frozen meat cache consisted of long bones from at least three mammoths stacked around the articulated left front quarter of another mammoth, and the skull of a juvenile placed on top of the pile. This pile (Figure 5) had not been opened and was allowed to spoil, while a similar pile had been opened, the contents utilized, and the bones dispersed.

At the Lange-Ferguson site, in the western South Dakota badlands, parts of two mammoths were recovered in what was a wet location at the time of the kill. Two Clovis points were recovered there and another nearby in what is likely an associated camp. Mammoth bone flakes and cleavers evidently were utilized as butchering tools (Hannus 1985, 1989, 1990).

The Sheaman site, in the Agate Basin site locality in eastern Wyoming, yielded remains of bison and pronghorn. Associated artifacts include a carved cylindrical ivory shaft, a projectile point, and several flake and blade tools (Frison 1982a). A large assemblage of debitage was also recovered (Bradley 1982).

Caches of lithic and carved bone artifacts offer special insights into Clovis lifeways (see Frison 1991b). The Anzick site in south-central Montana produced over 100 lithic items, several objects of carved bone, and partial remains of two immature humans, all of which were covered with a heavy coating of red ochre (Lahren and Bonnichsen 1974). The points and bifaces were manufactured from high quality stone from multiple sources. Dates on the remains of one individual at the Anzick site are under 11,000 years, and are within the lower range of Clovis dates (Stafford et al. 1991), which are now proposed to range from ca. 9200 to 8900 B.C. (Haynes 1993).

The Fenn Clovis cache (of unknown provenience) contains 56 lithic specimens representing the entire sequence of Clovis point manufacture and dramatically demonstrating the techniques of Clovis biface reduction. One obsidian point exhibits a mastic on the hafting area believed to be amber. A crescent from the cache is identical to specimens from Nevada and Oregon, suggesting Clovis cultural ties from the Plains-Rocky Mountains to the far west. As at Anzick, all items were heavily coated with red ochre (Frison 1991b).

Lithic materials from the Fenn cache have been tentatively traced to several widespread sources. These include chert from the Green River formation in east-central Colorado, southern Wyoming, and into western Utah; chert from the Phosphoria and Amsden formations in northern Wyoming; and obsidian from extreme southeast Idaho. Other cherts probably derive from the Madison Formation in northern Wyoming or southern Montana. Also present were points made of quartz crystal, a material of unknown source.

Other notable Clovis caches are the Drake cache (Stanford 1991) in northeast Colorado; the Simon cache (Butler 1963) in southern Idaho; and the Richey cache (Mehringer 1988, 1989; Gramley 1993) in Washington.

Figure 5. Mammoth bone pile at the Colby site mammoth kill.

Goshen

Goshen points (Figure 4f, g) exhibit a pressure flaking technology that could be a direct precursor of Folsom, but it is difficult to conceive of Goshen lithic technology as being derived directly from Clovis. Goshen points are also very similar to the Plainview type, and mixing the type site Plainview specimens (Sellards et al. 1947) with points from the Mill Iron site in Montana gives the strong impression of a single assemblage. Some authors (Wheat 1972; Dibble and Lorrain 1968; Irwin-Williams et al. 1973), however, regard the Plainview point as marking the transition from Folsom into the long sequence of unfluted types that follows. Additionally, some points identified as Midland at the Hell Gap site (Irwin-Williams et al. 1973) are technologically inseparable from Goshen. Until the relationships among Goshen, Folsom, Midland, and Plainview are better understood, Goshen on the Northern Plains should be referred to as Goshen-Plainview (see Frison 1996).

Goshen was initially identified on the basis of a technologically and morphologically distinct point recovered below a Folsom level at the Hell Gap site in southeast Wyoming. Unfortunately, the Hell Gap materials were never completely analyzed, and a dissertation (Irwin 1967) and short summary article in *Plains Anthropologist* (Irwin-Williams et al. 1973) comprise the published information on the site.

Excavations at the Mill Iron site in southeast Montana (Frison 1996, 1991c) produced a much larger assemblage of Goshen materials than the Hell Gap site, and were instrumental in defining the Goshen complex. At Mill Iron, a bison bonebed containing partial remains of at least 30 animals was located next to a camp-processing area. Goshen points occurred within the bonebed and the campsite. Radiocarbon dates on Goshen at the Mill Iron site cluster into two groups: one at about 11,300 years ago and another at 11,000 years ago. If accurate, the earlier dates place Goshen contemporaneously with Clovis, while the later dates place it between Clovis and Folsom.

A small remnant of a Goshen component was present beneath a Folsom component at the Carter/Kerr-McGee site in eastern Wyoming, but was originally misidentified as Clovis (Frison 1984). Goshen has also been recognized at a small bison kill in the Middle Park area of northern Colorado (Kornfeld et al. n.d.). There remain unanswered questions about the age of the Goshen complex, but the stratigraphic position of Goshen below Folsom has now been documented at several sites.

No intact Goshen components were identified in South Dakota until recent excavations at the Jim Pitts site, a stratified, multicomponent locale in the Black Hills (Donohue and Hanenberger 1993). The site contains what appears to be a pure Goshen component at the base with a Folsom level stratigraphically above. Still higher, stratigraphically, is a mixed Paleoindian level with Agate Basin and Cody diagnostics.

Folsom

Folsom sites and components are found over the entire study area. Reported radiocarbon dates from Folsom components range from about 10,800 to 10,300 years ago, suggesting a relatively long duration for the complex (Haynes 1993). It appears that Folsom overlapped the Agate Basin complex in age, although stratigraphic evidence at the Agate Basin, Hell Gap, and Carter/Kerr-McGee sites gives the impression that Agate Basin always followed Folsom.

The Lindenmeier site (Wilmsen and Roberts 1978) in northern Colorado contains a well-known Folsom component. Components also occur at Locality 1 of the Hell Gap site (Irwin-Williams et al. 1973), Agate Basin (Frison and Stanford 1982), MacHaffie (Forbis and Sperry 1952), and the Carter/Kerr-McGee site (Frison 1984).

Major Folsom sites are situated in locations favorable for bison procurement, close to open grassland areas and at or very close to natural topographic traps into which animals were driven and killed. Examples include the Folsom type site in northern New Mexico (Figgins 1927) and Agate Basin site in eastern Wyoming (Frison and Stanford 1982).

Small communal kills, such as the Folsom component at the Agate Basin site, yielded remains of at least eight bison associated with antler, bone (Frison and Zeimens 1980), and stone projectile points. Remains of several pronghorn were present in the bison bonebed, but were not necessarily the result of a trapping operation. The faunal remains represent a cold weather occupation where hunters camped adjacent to the kill and utilized the meat products (Walker 1982). A canid from the component is the earliest known radiocarbon-dated evidence (10,780 ± 135 years B.P.; SI-3733) for a possibly domesticated wolf-dog hybrid in the study area.

The technological excellence involved in Folsom projectile point manufacture (Figure 4h-j) has received considerable attention. At the Agate Basin site, two punches (one of elk antler, the other made from the metatarsal of a bison) apparently were used to remove channel flakes through controlled pressure (Frison and Bradley 1981; Frison and Craig 1982). However, alternative methods can produce the same or similar results (Flenniken 1978; Sollberger 1985). Folsom lithic technology differs from that of Clovis, and many expert knappers question the technological derivation of Folsom from Clovis. Eyed bone needles from the Agate Basin site (Frison and Craig 1982) are similar in size and shape to modern metal counterparts.

The Indian Creek site, located about 30 km east of the MacHaffie site in the foothills of the Elkhorn Mountains, contains deeply stratified cultural deposits, the earliest of which is a Folsom component radiocarbon dated at 10,980 years ago (Davis 1993; Davis et al. 1987). Subsistence data from the site suggests broad-based resource utilization, rather than a focus on big game. Although bison is the most common mammal, deer, pronghorn, yellow-bellied marmot, rabbit species, black-tailed prairie dog, and vole are also present.

Midland

On the basis of the Hell Gap site data, Irwin-Williams et al. (1973) postulated a Midland complex dating from about 10,700 to 10,400 years ago, slightly overlapping Folsom and Agate Basin. However, identification of Midland as a distinct complex is questionable. Midland technology is very similar, if not almost identical, to both Folsom and Goshen; the only difference claimed is that Midland projectile points are not fluted. Projectile points claimed to be Midland from the Hell Gap site are also very similar morphologically and technologically to Goshen specimens. In addition, some Folsom assemblages include numerous unfluted points; only better data will resolve the Goshen-Folsom-Midland problem. The level designated as Midland at the Hell Gap site contained two postmold patterns that may represent living structures reminiscent of a plains tipi.

Agate Basin

Located in eastern Wyoming, the Agate Basin site is centered around an arroyo system (Albanese 1982) used in bison procurement. An Agate Basin component is situated between Folsom and Hell Gap levels. The site has been investigated by Roberts (1943; see also Bass 1970), Agogino (1972), and the University of Wyoming (Frison and Stanford 1982). The Agate Basin component at the Agate Basin site produced a radiocarbon age of just over 10,400 years ago, which compares favorably with the proposed age of the Agate Basin component at the Hell Gap site (Irwin-Williams et al. 1973). A mixed and undated Agate Basin-Hell Gap component was present at the Carter/Kerr-McGee site between a mixed Cody-Alberta component and a Folsom component. The Frazier site along the South Platte River in northeast Colorado produced unmistakable Agate Basin projectile points, although a date of about 9,600 years ago seems too recent (H. M. Wormington, personal communication 1976). The same is true of what is claimed to be a buried Agate Basin component at site 24MA778 on the upper Madison River in Montana, with a date of only 7,245 years ago (Brumley 1989).

Two separate Agate Basin bonebeds were present at Agate Basin site, although bone from the one dug by Roberts in 1943 was not saved. A nearly complete female bison skull from an Agate Basin component at Brewster site, now known to be part of Agate Basin site (Agogino 1972), correlates well in size with other bison of that time period (Wilson 1974). Bison bone from the bonebed at Agate Basin site, excavated by the University of Wyoming (Frison and Stanford 1982), includes a minimum of 75 animals, although this does not represent the entire bonebed. Some has been destroyed by looters and some has been lost by lateral arroyo cutting. However, dentition studies of the mandibles recovered in the bonebed indicates animals killed from early to late winter. One pile of bison carcass units appears to represent a frozen meat cache; unused carcass units apparently spoiled with the onset of warm weather (Frison and Stanford 1982).

Agate Basin seems to be a continuation of Goshen and Folsom lifeways. Bison were the mainstay of the economy, and Agate Basin hunters may have more effectively utilized arroyo traps. Experiments with various types of Paleoindian weaponry demonstrate that the Agate Basin point (Figure 4d, e) is probably the most lethal of all for killing bison.

Hell Gap

Hell Gap, as a point type and a cultural complex, was first recognized at the Hell Gap site (Irwin-Williams et al. 1973), and a short time later at the Sister's Hill site in northern Wyoming (Agogino and Galloway 1965). Hell Gap probably dates to about 10,000 years ago based on radiocarbon dates from the Casper site (Frison 1974a), Sister's Hill, and Hell Gap.

The bison bonebed at the Casper site (Figure 6) in southern Wyoming contained approximately 100 animals (a small part of the bonebed was destroyed by pipe line construction and the bone in this area was lost) trapped or impeded in a parabolic sand dune (Frison 1974a). Insight into Hell Gap projectile point manufacture technology at the Casper site (Bradley 1974) was provided by specimens collected from the Seminoe Beach site (Bradley 1991), not far upstream from the Casper site. The only modifications needed to transform the Agate Basin projectile into the Hell Gap point (Figure 7a, b) were to widen it slightly and add a shoulder.

Bone was unusually well preserved at Casper. Dental elements allowed inferences about animal population structures and seasonality (Reher 1974), and skeletal material provided baseline data for describing the subspecies *Bison antiquus* (Figure 8a, b) (Wilson 1974, 1975), although *B. occidentalis* characteristics were present on at least one male skull (see Wilson 1974: Figure 3.4b). Identification of a parabolic sand dune as a natural feature used to trap bison added a new dimension to Paleoindian bison procurement strategies. Camel bone in the bonebed exhibiting evidence of butchering suggests that *Camelops* may have survived until about 10,000 years ago.

Other Hell Gap components in the study area include the remnant of a bison bonebed in the uppermost component at the Agate Basin site and a mixed Hell Gap-Agate Basin component at Carter/Kerr-McGee (Frison 1984). These sites demonstrate the ability of Hell Gap cultural groups to utilize a wide variety of strategies to procure bison on a large scale.

A deeply buried Hell Gap component at Indian Creek site was dated to about 10,000 years ago (Davis 1984, 1993). Atomic absorption spectroscopy indicates the obsidian Hell Gap points were derived from Obsidian Cliff in Yellowstone National Park and the Camas-Dry Creek obsidian source in Idaho.

Alberta

Alberta projectile points were first recognized in southern Alberta, Canada (see Wormington 1957; Wormington and Forbis 1965). Alberta points (Figure 7c, d) exhibit broad stems and abrupt shoulders. Whether or not this represents a functional improvement is open to question, but it required changes in hafting the point to a wooden foreshaft. Instead of an expanding stem to absorb the shock of impact, this was now largely transmitted to the base and shoulders of the point.

An Alberta component was disclosed at the Hell Gap site, with a proposed time range of 9,000 to 9,500 years ago (Irwin-Williams et al. 1973). Radiocarbon dates from the Alberta-age Hudson-Meng Bison Kill in western Nebraska range from about 9,000 to 9,800 years ago (Agenbroad 1978).

Alberta-Cody

Excavations at the Horner site, near Cody, Wyoming (Frison and Todd 1987) revealed a bison bonebed radiocarbon dated to about 10,000 years ago. The diagnostic projectile points (Figure 7e, f) are morphologically and technologically

Figure 6. The Hell Gap age, Casper site bison bone bed.

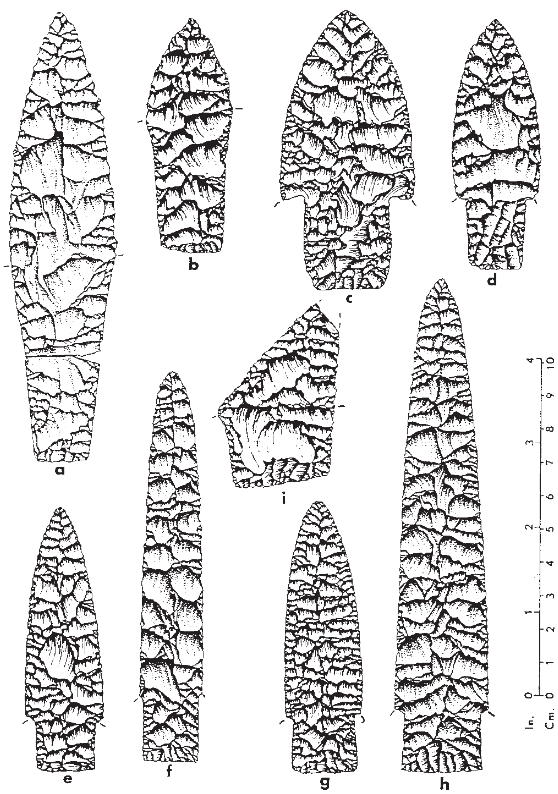

Figure 7. Paleoindian projectile points: a, b, Hell Gap; c, d, Alberta; e, f, Alberta-Cody; g, h, Scottsbluff; and i, Cody knife.

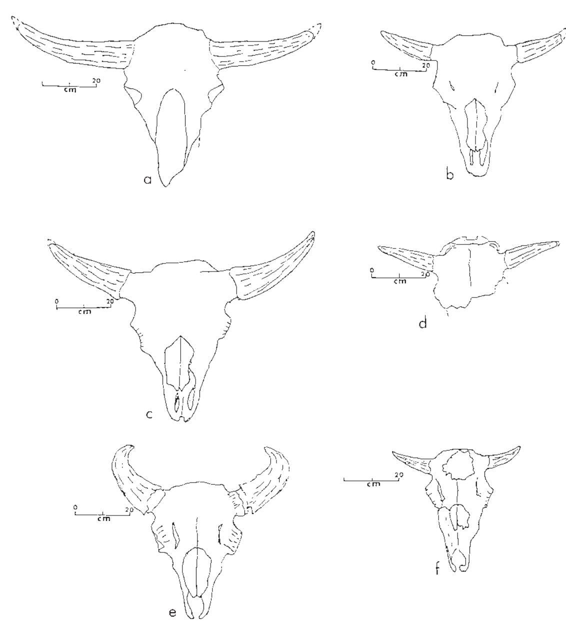

Figure 8. Bison types: a, male and b, female Bison antiquus *from the Casper site; c, male and d, female intermediate type from the Hawken site; e, modern male surface find; f, female* Bison bison *from the Glenrock Buffalo Jump.*

similar to those of the later Cody complex, but also exhibit similarities to Alberta points, so they were called Alberta-Cody (Bradley and Frison 1987).

Cody

Other than a refinement of the lithic technology, represented by Eden and Scottsbluff points, little separates points of the Cody complex from those of the preceding Alberta and Alberta-Cody complexes. Cody lithic technology has been thoroughly analyzed and described based on the large collection recovered at the Claypool site (Dick and Mountain 1960) in eastern Colorado (see Bradley and Stanford 1987). Based on several radiocarbon determinations, the Cody complex dates between about 8,800 to 9,300 years ago.

The Horner site is the type site of the Cody cultural complex (see Frison and Todd 1987), although part of the assemblage recovered by the Princeton-Smithsonian teams in the late 1940s and early 1950s included specimens now considered diagnostic of Alberta-Cody, indicating the first excavations were in mixed components.

The large Horner lithic assemblage included a Scottsbluff Type 3 point, which may be a knife rather than a projectile point. It is relatively short and broad, with straight to slightly convex blade edges and a square to slightly rectangular stem. Shoulders are prominent; one is usually straight, the other is often barbed (Bradley and Frison 1987:Figure 6.17a).

Two Cody components were found at Hell Gap site (Irwin-Williams et al. 1973), and a bison bonebed remnant of Cody age, containing animals killed in late fall/early winter, comprised the uppermost level at the Carter/Kerr-McGee site (Frison 1984). A Cody component at Medicine Lodge Creek site in northern Wyoming was dated at 8,800 years ago (Frison 1991a).

The Scottsbluff point (Figure 7g, h) received its name from Scottsbluff Bison Quarry in western Nebraska (Barbour and Schultz 1932), and the Eden point (Figure 9a, b) was named for the Finley site in the Eden Valley of western Wyoming (Howard 1943). Both sites contained extinct bison, and a radiocarbon date on bison bone from the latter site is about 9,000 years ago. Cody knives were present in the Horner site Cody assemblage, Finley site assemblage (Figure 7i), and Medicine Lodge Creek Cody assemblage (Figure 9g). Several Cody knife variations were recovered at Horner (Bradley and Frison 1987). The Larson cache, containing several complete and broken Scottsbluff Type 3 specimens (Figure 9e, f), was found a short distance from the Finley site (Ingbar and Frison 1987).

The MacHaffie site contained a Scottsbluff component dated at 8,100 years ago, which appears to be too late compared with other Cody complex dates. Faunal remains at MacHaffie include bison, deer, rabbit, and wolf. Lithic analysis (Knudson 1983) suggests that the site was inhabited by several extended families for a span of one to two weeks while processing local cherts.

Radiocarbon dates have been obtained on several other Cody components in Montana. A Scottsbluff component at the Myers-Hindman site (Lahren 1976) contained the butchered remains of bison, deer, elk, mountain sheep, and canids, and was dated to about 8,900 years ago. In the Bighorn Canyon area, level 1 at the Sorenson site was attributed to Scottsbluff and radiocarbon dated at approximately 8000 years ago (Husted 1969). At the Pretty Creek site in the Pryor Mountains, a Scottsbluff component was dated at about 7,700 years ago (Loendorf et al. 1981). The latter two dates appear somewhat recent for Scottsbluff. Stratigraphic Units II and III at the Mammoth Meadows I site contain hearths and discrete knapping stations (Bonnichsen, Douglas, Beatty et al. 1990; Bonnischen, Douglas, Stanyard et al. 1990). Radiocarbon dates obtained from the Cody complex levels ranged from nearly 9,400 to just over 8,200 years ago.

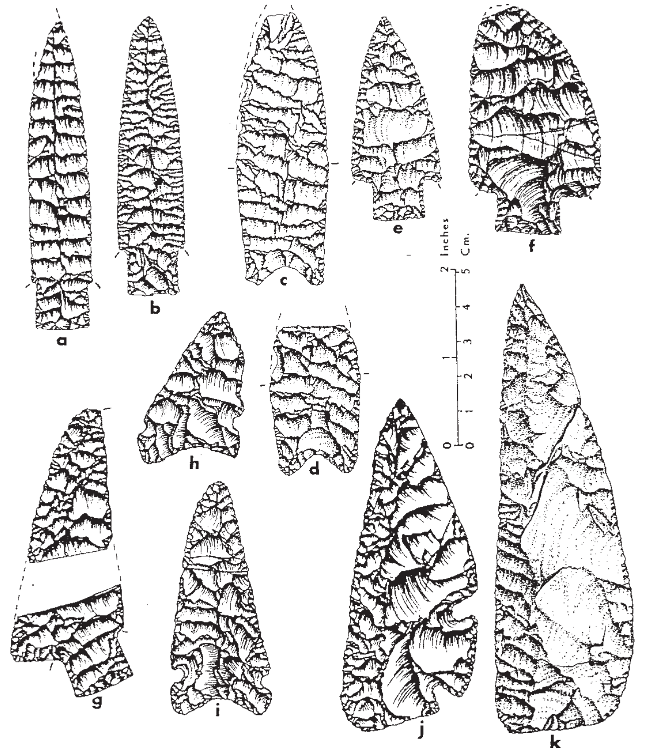

Figure 9. Paleoindian and Archaic projectile points and knives: a, b, Eden points; c, d, James Allen points; e, f, Scottsbluff knives; g, Cody knife; h, i, Middle Plains Archaic knives; j, k, Late Plains Archaic knives.

At the Olsen-Chubbuck site (Wheat 1972) in eastern Colorado, a large herd of bison was stampeded into a long, narrow, deep gully, crushing the lower animals and allowing the hunters to dispatch the upper animals. Wheat named the projectile points Firstview, but their relationship to the Cody complex is not clear. The same is true of the Jurgens site material (Wheat 1979) in northeast Colorado.

Eden and Scottsbluff points are found in a wide range of ecological settings, from the open plains to the high elevations. It appears that by Cody times, climatic conditions were deteriorating and caused bison populations to decrease and/or move to other areas, decreasing human reliance on these animals. This trend continued for nearly another thousand years until the end of the Paleoindian period at about 8,000 years ago.

Late Paleoindian Lanceolate Complex

The Late Paleoindian Lanceolate complex includes a series of potentially related point styles including Angostura, Lusk, James Allen, Frederick, Lovell Constricted, and Pryor Stemmed. Variation in these Late Paleoindian points is poorly understood, resulting in considerable typological confusion.

Excavations at the Barton Gulch site in the Ruby Valley, Montana, exposed two Late Paleoindian components. The Alder complex, dated at about 9,400 years ago, contains lanceolate Ruby Valley points, while the later Hardinger complex was dated at approximately 8,800 years ago (Davis et al. 1989). Large quantities of debitage, preforms, lanceolate points, knives, and scrapers were recovered, as well as the remains of cottontail rabbit, mink, and deer. Much of the faunal material had been processed, presumably from human activity.

The James Allen site is a small bison kill in the Laramie Basin of southern Wyoming (Mulloy 1959). A radiocarbon assay on bone produced an age of about 7,900 years ago. Projectile points in the bonebed were characterized by parallel oblique flaking (Figure 9c, d), typical of Late Paleoindian points, including James Allen, Frederick, Angostura, and Lusk.

The designation of Frederick derived from the Hell Gap site data (Irwin-Williams et al. 1973). In notes in the possession of one of the authors (G. Frison), Henry Irwin stated that he believed the Frederick designation was wrong and should have been called James Allen. The wisdom of this statement is evident because of the difficulty in separating James Allen and Frederick projectile points. The Frederick (James Allen) component at the Hell Gap site indicates a more widespread use of small animals and less emphasis on bison.

The nebulous Lusk complex may represent a continuation of James Allen (Frederick). The Betty Greene site near Lusk, Wyoming (Greene 1967, 1968), produced an assemblage including numerous broken and unfinished projectile points. A mano and two metates suggest subsistence shifted toward less dependence on large mammals and more on plant foods.

Hannus (1986) noted that Angostura as a “type” was never adequately defined. The Ray Long site in South Dakota produced Angostura points and hearth features. One component was dated at over 9,400 years ago while a more recent component yielded dates of about 7,100 and 7,800 years ago. As in the case of the not-too-distant Betty Green site, the latter also yielded grinding slabs and manos, which Wheeler (1958) interpreted to represent a campsite of hunters and gatherers.

Red Ochre

Red ochre is a common element in Paleoindian site components. Although ritual use seems implied for the red ochre associated with Clovis caches, it is an excellent preservative for wood and other perishable items. Moreover, red ochre is an abrasive and, in powdered form, can be applied to a strip of soft hide to obtain a polish on metal and stone.

A short distance south of the Hell Gap site is a source of red ochre (iron oxide) that has been mined commercially since the late nineteenth century. Excavations for a railroad track exposed a Paleoindian ochre mine that was not discovered until the late 1930s, and there was no systematic investigation of the site or the materials recovered until recently. Every Paleoindian projectile point type found at the Hell Gap site is represented in the tailings of this red ochre mine known as the Powars II site. Numerous bone and stone quarrying tools were also recovered (Stafford 1990).

Foothill-Mountain Paleoindian

More than two decades ago, significant differences were noted between Paleoindian points from the foothills and mountains and those on the open plains (Husted 1969). However, the stone tools from Foothill-Mountain Paleoindian sites retain a definite Plains Paleoindian character.

The most complete stratified sequence of Foothill-Mountain Paleoindian was recorded at Medicine Lodge Creek site, located at the juncture of the open plains and the mountain slope. It appears that the earliest known Foothill-Mountain groups (about 10,000 to 10,500 years ago) had cultural ties with the Goshen complex. Typical Goshen (or Goshen-Plainview) projectile points are found regularly on the surface at higher elevations and in the lowest level at Medicine Lodge Creek site (Figure 10a) (Frison 1976b). Younger Paleoindian levels at Medicine Lodge Creek produced lanceolate, stemmed, and fish-tailed projectile points dating between 9,000 and 10,000 years ago (Figure 10b, c, e). One of these, from a level radiocarbon dated at about 9,300 years ago (Figure 10c), and another from an undated level at nearby Southsider Cave (Frison 1991a:30) (Figure 10d) would be identified as Middle Plains Archaic points had they not been recovered in good context. Southsider Cave produced a long, lanceolate, parallel-oblique flaked point from another undated Paleoindian level (Figure 10f).

At Bush Shelter in the southern Big Horn Mountain foothills, the oldest cultural levels produced points very similar, if not identical, to Goshen, with dates of about 10,000 years ago (Miller 1988).

Lovell Constricted and Pryor Stemmed

In the Bighorn Canyon caves, Husted (1969) recorded several Foothill-Mountain Paleoindian levels. One produced points that he named Lovell Constricted. This point is short and stemmed, with an indented base and convex blade edges. Parallel diagonal flaking is nearly always present on finished specimens. Few specimens were found in the Bighorn Canyon caves, but others were recovered from a component at Medicine Lodge Creek (Figure 10h) dated at about 8,300 years ago.

Above the Lovell Constricted component in Bighorn Canyon Caves and at Medicine Lodge Creek are components containing what Husted (1969) named Pryor Stemmed. Pryor Stemmed dates range from about 7,800 to 8,300 years ago, and there are now sufficient data to elevate Pryor Stemmed to the status of a cultural complex (Frison and Grey 1980). The diagnostic point usually is stemmed, with an indented base (Figure 10i, j) and parallel oblique flaking; a lanceolate form (Figure 10g) has also been noted. Stages of alternate steep beveling were applied so that the points became progressively narrower, eventually weakening them until they broke. Broken Pryor Stemmed points often exhibit modification, with burinlike flakes removed from edges and faces, suggesting tool use while still hafted.

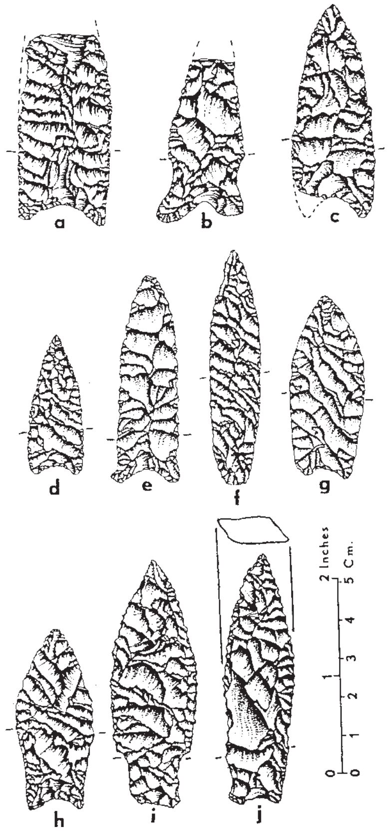

Figure 10. Foothill-Mountain Late Paleoindian points.

Other Big Horn Mountain foothill sites with Pryor Stemmed diagnostics include Paintrock V (Frison and Grey 1980), the Hanson Pryor site (Edgar 1966), and Schiffer Cave (Frison 1973a). The Big Horn and Pryor mountains appear to be the center of the Pryor Stemmed complex. However, numerous bibeveled points similar to Pryor Stemmed are found farther south in central Wyoming, but not in good context.

At Medicine Lodge Creek, a level dated at 8,000 years ago lay above a Pryor Stemmed component and contained what may represent an unbeveled Pryor Stemmed point. Immediately above this were Early Plains Archaic side-notched points. The same transition was recorded at the Paintrock V site.

A stratified sequence of Foothill-Mountain Paleoindian occupations has been recorded at the Lookingbill site in the southern Absaroka Mountains in western Wyoming. Radiocarbon dates indicate a number of cultural components from about 10,400 years ago until Late Prehistoric times (Frison 1983a). Few diagnostics were found in the lower levels, but one of the oldest may be an example of Haskett, as it is known farther west in Idaho (Butler 1965). Projectile points in a later component are similar to those dating to about 8,500 years ago at Mummy Cave and Medicine Lodge Creek. The terminal Foothill-Mountain Paleoindian component at the Lookingbill site produced many distinctive fish tail-shaped points of an as yet unnamed type and dated to about 8,000 years ago.

Since Foothill-Mountain Paleoindians and Plains Paleoindians occupied distinct ecosystems, subsistence strategies differed between the two groups (Frison 1992). For example, mountain sheep dominate the faunal remains at Mummy Cave, and a juniper bark cordage net nearly 9,000 years old, recovered in a dry cave in the northern Absaroka Mountains, indicates net trapping and a dependence on mountain sheep there in late Paleoindian times (Frison, Andrews et al. 1986). Foothill-Mountain Paleoindian groups evidently were more isolated than the open plains groups. Lithic materials were acquired locally, with none of the exotic materials from distant sources evident.

Pictograph Cave near Billings, Montana, provided the first systematic cultural chronology for the area at a time when little was known about the region (Mulloy 1958). Based on later discoveries at sites such as Mummy Cave and Medicine Lodge Creek, it is now apparent that some Pictograph Cave specimens are Foothill-Mountain Paleoindian artifacts (Frison 1992). Also found during the excavations at Pictograph Cave were two Eden points, thought to be the result of reuse by later groups.

A number of the major Paleoindian sites located on the Plains and in the mountains are shown in Figure 11.

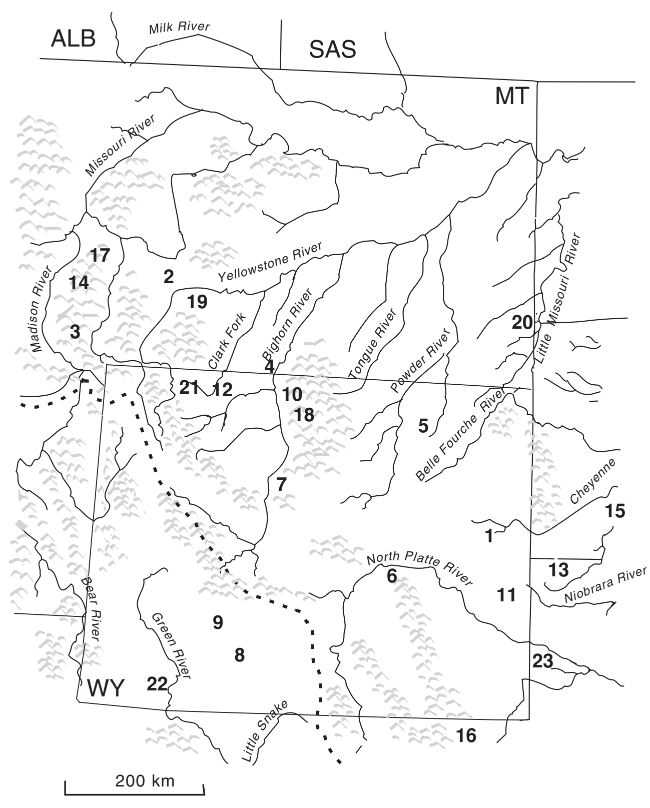

Figure 11. Paleoindian site locations: 1, Agate Basin 48NO201; 2, Anzick 24PA407; 3, Barton Gulch 24MA171; 4, Bighorn Canyon Caves, Sorenson 24CB202, Mangus 24CB221, Bottleneck 48BH206; 5, Carter/Kerr-McGee 48CA12; 6, Casper 48NA304; 7, Colby 48WA322; 8, Deadman Wash 48SW1455; 9, Finley 48SW5; 10, Hanson 48BH329; 11, Hell Gap 48GO305; 12, Horner 48PA29; 13, Hudson-Meng 25SX115; 14, Indian Creek 24BW626; 15, Lange-Ferguson 49SH33; 16, Lindenmeier 5LR13; 17, MacHaffie 24JF4; 18, Medicine Lodge Creek 48BH499; 19, Myers-Hindman 24PA504; 20, Mill Iron 24CT30; 21, Mummy Cave 48PA201; 22, Pine Spring 48SW101; 23, Scottsbluff Bison Quarry.

The Archaic Periods

Three divisions of the Archaic stage were proposed to encompass post-Paleoindian, preceramic cultures of the Northern Plains and Central Rocky Mountains (Frison 1978, 1991a). However, Reeves (1983) and Forbis (1992) do not like the Archaic concept and, along with several Northern Plains archeologists, prefer to use Mulloy's (1958) earlier terminology.

Early Plains Archaic

Recognized by the appearance of side-notched point types such as Bitterroot, Hawken, Pahaska Side-Notched, Blackwater Side-Notched, and other unnamed side-notched varieties of projectile points, Early Plains Archaic began about 8,000 years ago. It is not clear if this technological change represents a human migration into the area or an in situ development among resident human groups. Major elements of Early Plains Archaic, including grinding tools and stone-filled roasting pits, developed during the late Paleoindian period, and their use intensified during Early Plains Archaic. Unfortunately, attributes of Early Plains Archaic diagnostic projectile points are not clearly defined, leading to classificatory problems (Deaver and Deaver 1988). Misidentification of diagnostic Early Archaic points as Late Archaic (Buchner 1980; Gryba 1980; Reeves 1973) is a common problem unless recovery is in dated, stratigraphic contexts.

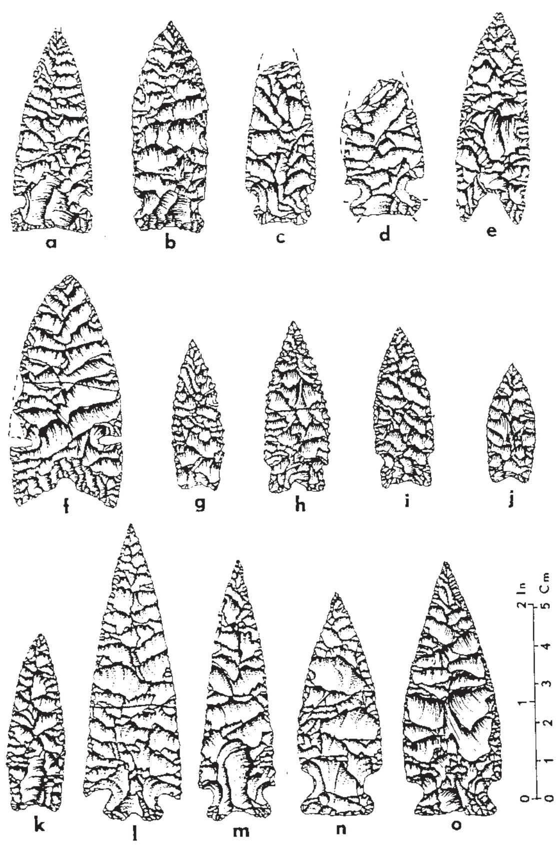

Figure 12. Archaic projectile points: a-d, Early Plains; e-k, Middle Plains; l-o, Late Plains.

Other than a more intensive use of plant products, there were no apparent major changes in subsistence strategies, and the side-notched projectile points (Figure 12a, d) may represent nothing more than the addition of side notches to a Late Paleoindian Lanceolate type. Although this may represent an improvement in hafting the point to a wooden foreshaft, the deep side-notches weakened the point, so breakage between the notches was common. Evidence at the Lookingbill site indicates a retention of some late Paleoindian tool types, including gravers and spurred end scrapers, into the Early Plains Archaic (see Frison 1983a). These tools soon disappeared, but the single-beveled knife (Figure 9k) made its appearance and lasted until the end of the Archaic, at which time notches were sometimes added (Figure 9j).

Diagnostic side-notched points occur in site components that directly overlie late Paleoindian levels at sites such as Mummy Cave (Wedel et al. 1968), Medicine Lodge Creek (Frison 1991a), and the Lookingbill site (Frison 1983a). At these sites, there are continuous stratigraphic accumulations from Foothill-Paleoindian into the Early Plains Archaic.

In his pioneering efforts to establish a Northwestern Plains prehistoric chronology, Mulloy (1958) was unaware of evidence for the Early Plains Archaic and suggested the possibility of abandonment of human populations during this time period. As mentioned earlier, better knowledge of Late Paleoindian and Early Plains Archaic projectile point types leaves little doubt of the presence of both in Pictograph Cave, from which Mulloy drew most of his data.

The first unequivocal evidence of Early Plains Archaic in the Northern Plains-Rocky Mountains area was from Mummy Cave in northwest Wyoming, where high integrity components with radiocarbon dates and diagnostic side-notched points lay directly above Foothill-Mountain Paleoindian components (see Wedel et al. 1968; Husted and Edgar n.d.; McCracken 1978). Early Plains Archaic projectile points are generally referred to as "early side-notched," although Husted and Edgar (n.d.) named two types: Blackwater Side-Notched and Pahaska Side-Notched.

Since the Early Plains Archaic period was one of weathering, caves and rockshelters contain the best data because deposition consists mostly of roof fall that formed stratified deposits largely independent of climatic conditions. Examples of early side-notched projectile points were found at Laddy Creek (Figure 12d), in the foothills of the western slopes of the Big Horn Mountains (Larson 1990), and at Lookingbill (Frison 1983b) (Figure 12a), where continuous deposition throughout the Early Plains Archaic was artificially controlled by flowing springs.

Pretty Creek, an open site in the Pryor Mountains of southern Montana (Loendorf et al. 1981), Southsider Cave in the northern Big Horn Mountains (Frison 1991a), and Mummy Cave in the northern Absaroka Mountains in northwest Wyoming yielded Early Plains Archaic radiocarbon dates of about 7,700 years ago, suggesting strongly that the proposed 8,000-year-ago beginning of the Early Plains Archaic is probably about right. There is also a noticeable increase in Early Plains Archaic radiocarbon dates beginning about 6,500 years ago until the end of the period at about 5,000 years ago.

At the Indian Creek site, a Mummy Cave/Bitterroot component produced radiocarbon and obsidian hydration dates that indicate an age of about 6,600 years ago. The associated faunal assemblage includes mountain sheep, indicative of an upland economy. An Early Archaic component at the Barton Gulch site (Davis et al. 1989) produced Bitterroot points dated between about 6,200 and 6,100 years ago. Nearby at the Mammoth Meadows site, two Bitterroot points were found in an undated zone above the Cody complex (Bonnichsen et al. 1992). In the Pryor Mountains, at False Cougar Cave, Early Archaic materials similar to those at the Pretty Creek site were dated between 6,000 and 6,200 years ago. Faunal remains suggest a focus on small game such as marmot, grouse, and rabbit (Bonnichsen and Oliver 1981a, 1981b, 1986).

Corner-notched projectile points reminiscent of the Late Plains Archaic occur occasionally in well-documented Early Plains Archaic components (see Frison 1991a:Figure 2.45c, g; McCracken 1978:Plate 59 e, g, h). There is a noticeable decline in the quality of lithic technology toward the end of the period, as documented at Mummy Cave (McCracken 1978:Plates 50, 51, 56) Lookingbill, and Wedding of the Waters Cave (Frison 1962) (Figure 12c).

Other sites with Early Plains Archaic components include Beaver Creek Shelter in the South Dakota Black Hills (Martin et al. 1988); Granite Creek Rockshelter, Paintrock V (Frison and Wilson 1975), and the Sorenson site in the northern Big Horn Mountains (Husted 1969); Little Canyon Creek Cave and Bush Shelter in the southern Big Horn Mountains (Miller 1988); and Wedding of the Waters Cave in the southern Bighorn Basin (Frison 1962, 1991a). The Deadman Wash site in the southern Green River Basin is a stratified open site with Early Plains Archaic radiocarbon dates between about 6,000 and 6,800 years ago (Armitage et al. 1982).

Evidence from open plains and interior intermontane basins suggests decreased human activity compared to late Paleoindian times, but this may partially reflect geologic activity during the dry Altithermal that caused some sites to erode and may have deeply buried others. For example, Sundstrom (1989) suggests that if Early Archaic sites were concentrated in the high meadows of the Black Hills, they may be deeply buried, and thus overlooked. Moreover, human presence in the foothills and mountains does not appear to be of greater intensity than in the preceding late Paleoindian period.

Semisubterranean pit houses, first noted at the Shoreline site (Walker and Ziemens 1976) along the North Platte River in south-central Wyoming, appear toward the end of the Early Plains Archaic. During the annual lowering of the reservoir, a circular depression about 1 m in depth was exposed. This proved to be a pithouse with a central hearth, a large side-notched projectile point, and some debitage at the bottom. The hearth produced a radiocarbon age of about 5,300 years ago.

The largest known pithouse site is at Split Rock, along the Sweetwater River in central Wyoming, which yielded several pit houses, side-notched projectile points, and radiocarbon dates from about 6,100 to 5,000 years ago (Eakin 1987). Pit houses were found at the Maxon Ranch (Harrell and McKern 1986) and Sweetwater Creek sites (Newberry and Harrison 1986) near the Green River in southwest Wyoming. Perhaps the best preserved pit house in the area is the Medicine House site (McGuire et al. 1984). It is clear that pit houses were a common and widespread feature, at least during the latter part of Early Archaic times, and they help to explain human survival in an area characterized by difficult winters.

Although the bison herds in the study area appear to have decreased significantly during Early Plains Archaic times, communal bison kills have been recorded in the Black Hills of northeast Wyoming. Two kills in the Hawken site locality (Frison et al. 1976) date to about 6,400 and 6,200 years ago respectively, and resemble Paleoindian arroyo kills. A gathering basin was located adjacent to steep-sided arroyos leading to perpendicular head cuts, which formed ideal bison trapping situations. At one of these, three layers of butchered bison bone yielded the remains of at least 100 animals and large numbers of side-notched projectile points (Figure 12b). Bison at the Hawken sites are an intermediate form between the earlier late Paleoindian forms and the modern form (Figure 8c, d) (see Wilson 1978). In addition, the Hawken sites suggest continuation of a procurement method developed and used for over two thousand years during Paleoindian times, rather than the recurrence of an old strategy after a long lapse of time.

Head-Smashed-In, perhaps the largest documented bison jump site in North America, is located in southern Alberta and produced evidence of bison jumping dating to nearly 5,700 years ago (Reeves 1978). Side-notched projectile points were associated with the bison bones in the deepest levels. No evidence of Early Plains Archaic bison jumping has as yet been recorded south of the Canadian border in the study area.

Dating to approximately 6,800 years ago, pronghorn remains and many side-notched Early Plains Archaic points were recovered at the multicomponent Trapper's Point site in the upper Green River Basin (Francis and Miller 1993). Of roughly the same age is a concentration of mule deer bones at the Lookingbill site. The full extent of the latter bonebed is not yet known, but it clearly contains several animals (Larson et al. 1995). Mountain sheep dominate the large fauna in all Early Plains Archaic levels at Mummy Cave (McCracken 1978), with few mule deer and bison represented.

Representing the most intensive use of the rockshelter, occupational level IV at the Sorenson site in Bighorn Canyon on the Wyoming-Montana state line was dated at about 5,500 years ago. Several fire pits were present, along with side-notched points and stone tools. The only identified bones were those of mule deer, but bison hair and egg shell were also recovered (Husted 1969).

Oxbow. The Oxbow complex was first recognized at the Oxbow Dam site in southern Saskatchewan (Nero and McCorquodale 1958), and is a Northern Plains manifestation characterized by side-notched points with deep basal concavities. Oxbow (or Mummy Cave) dates range from nearly 5,700 to over 4,000 years ago at Head-Smashed-In Buffalo Jump in Alberta (see Frison 1991a:Table 2.7). Deaver and Deaver (1988) believe that Oxbow diagnostics are more common on the open plains than in the foothills and intermontane valleys along the Rocky Mountain front. This may be the case in the northern part of the study area, but in cultural levels at Mummy Cave dated at about 5,000 years ago and at the nearby Dead Indian Creek site (Frison and Walker 1984) at about 4,600 years ago, Oxbow diagnostics are present well back into the mountains. At the latter site, the Oxbow points appear to be mixed with Middle Plains Archaic points. In addition, surface sites in the Absaroka and Big Horn Mountains south of the Montana line produce occasional Oxbow points.

Three Oxbow components at the Sun River site in Montana were dated from about 5,200 to 3,500 years ago, and faunal analysis suggests a shift from pronghorn in the earliest levels to bison during later times (Greiser et al. 1983). The present limited body of evidence suggests that Oxbow groups got as far south as southern Montana and northern Wyoming, and form a temporal bridge from the Early Plains Archaic to the Middle Plains Archaic.

The Middle Plains Archaic

As discussed earlier, the Altithermal period on the Northern Plains was a time of reduced moisture that affected both plant and animal life, including human groups. About 4,000 years ago, modern climates were established. By this time, the modern subspecies of bison had evolved (Figure 8e, f), becoming smaller and with shorter horn span and different shape than those at the Hawken site. A somewhat different set of diagnostic projectile points forms a convenient, if somewhat arbitrary, boundary between this time period and the preceding one.

Some projectile points in terminal Early Plains Archaic assemblages, particularly those from Mummy Cave, Southsider Cave, and Dead Indian Creek, all in Wyoming, are reminiscent of Oxbow and suggest continuity in projectile point styles from Early Plains Archaic into McKean/Middle Plains Archaic (Frison 1991a). Provided their dates are correct, Benedict and Olson (1973) have recognized point forms intermediate between James Allen and McKean lanceolate points in the Colorado Front Range. Reeves (1973) notes that components of the Mummy Cave complex contain Oxbow points in association with Bitterroot and Salmon River points, and suggests that Oxbow developed out of one of these earlier complexes.

McKean. The McKean complex, defined on the basis of McKean lanceolate points (with deep to shallow basal notching), as well as Duncan, Hanna types, and the Mallory side-notched variety (Frison 1991a), remains poorly understood. The McKean lanceolate projectile point (Figure 12e, j, k) was first identified and defined at the Mule Creek Rockshelter in northeast Wyoming (Wheeler 1952). Although similar in outline to some Late Paleoindian forms, McKean points lack blade edge grinding near the base and the carefully controlled parallel-diagonal pressure flaking of the latter. A tool type common to the Middle Plains Archaic is a side-notched knife that has the appearance of a large projectile point (Figure 9i) continually resharpened on one blade edge until worn out and discarded (Figure 9h).

Mulloy (1954a) conducted excavations at the McKean site, a short distance from the Mule Creek Rockshelter, and recovered a large assemblage of McKean points and several variants (including Wheeler's Duncan and Hanna types), which he interpreted as variants of a single type. Some confusion remains, since some sites produce only a single variant, while others (e.g., the Dead Indian Creek site, Frison and Walker 1984) produce all or part of the full range of variants.

At the Myers-Hindman site (Lahren 1976), a McKean component dated to between 3,100 and 3,500 years ago contained McKean lanceolate, Duncan, and Hanna points, along with bifaces, gravers, a shaft smoother, and abundant debitage. A wide variety of animal species was recovered, including pronghorn, beaver, bison, canid, rabbit, deer, elk, bighorn sheep, porcupine, and bear.

In the Bighorn Canyon, a McKean complex component was identified in levels IV and V at Bottleneck Cave. Remains of bison, deer, pronghorn, bighorn sheep, coyote, and rabbit were present, as well as bone needles, scrapers, knives, and groundstone tools (Husted 1969). In the nearby east Pryor Mountains, a McKean component with the full range of point styles was exposed in a thick deposit at False Cougar Cave, with associated radiocarbon dates about 3,700 years ago (Bonnichsen and Oliver 1986).

At the Dodge site in southeastern Montana, a cache of McKean complex tools was found. In addition to bifaces, unifaces, and scrapers, there were four McKean lanceolate points, two of porcellanite, and two of chalcedony (Davis 1976). One of the few McKean complex sites that has been intensely investigated and fully analyzed is site 24RB1164 (G. Munson 1990). Diagnostics from the site include Duncan, Hanna, and Mallory points. Bison and deer dominate in the faunal assemblage, and a radiocarbon date of about 3,300 years ago was obtained.

The Signal Butte site in western Nebraska (Strong 1935) produced a Middle Plains Archaic point variant called Mallory (Forbis et al. n.d.) that is wide, with a thin cross-section and deep side-notches placed well forward of the base. Bases may have a narrow, deep base notch, a deep indentation, or be straight. Mallory points (Figure 12f) occurred in association with McKean lanceolates (Figure 12e) at the Scoggin site, a bison kill in central Wyoming dated to about 4,400 years ago (Lobdell 1973; Miller 1976). The site consisted of a presumed reinforced wooden fence with postholes for support at the base of a steep talus slope, providing unequivocal evidence of communal bison kills during the Middle Plains Archaic.

At the 3500-year-old Cordero site in the central Powder River Basin, the partial remains of at least 13 bison were recovered during limited excavations (Reher et al. 1985). The site appears to have been an area where large bison were butchered and processed. Insufficient dental material was present to determine with certainty whether or not the site represents a large single event or procurement of animals over a period of time. The four projectile points recovered closely resemble Wheeler's (1954a, 1954b) Hanna type.

Mule deer dominate the faunal assemblage at the Dead Indian Creek site (Frison and Walker 1984), which produced an MNI of 60 animals based on dentition. An arrangement of several large male mule deer skulls with antlers attached suggests ritual activity. At least 16 bighorn sheep were recorded, as well as two elk. Many of the small mammal species present probably were used as food (Scott and Wilson 1984). Faunal evidence, as well as grinding tools and stone-filled roasting pits, suggests an adaptation to hunting and gathering subsistence strategies in an area with considerable numbers of large mammals. The large projectile point assemblage includes a number of McKean variants (Figure 12g-j).

A profile at Dead Indian Creek revealed a pit house nearly identical to those recorded for the Early Plains Archaic. Recent investigations at the McKean site revealed a similar pit house (Kornfeld and Todd 1985). The Sweetwater Creek (Newberry and Harrison 1986) and the Maxon Ranch sites (Harrell and McKern 1986) in the Green River Basin have also produced Middle Plains Archaic pit houses, as well as the Early Plains Archaic examples mentioned earlier. The occurrences of pit houses in widely dispersed locations indicate they were a common feature throughout the study area.

Stone circles or tipi rings (Figure 13), probably the remains of conical lodge structures, appear at least by Middle Plains Archaic times and proliferate in the Late Plains Archaic and Late Prehistoric periods. Grinding stones (manos and metates) and stone-filled fire or roasting pits (Figure 14) increase noticeably in the Middle Plains Archaic, indicating increased exploitation of plant food products. Many stone-filled preparation pits are lined with sandstone slabs.

Foothill-mountain rockshelters and caves were favorite locations for Middle Plains Archaic components. At Medicine Lodge Creek, there is a long, undisturbed sequence of Middle Plains Archaic levels (Frison 1991a). Comparable sites include Mummy Cave (McCracken 1978), the Sorenson and Bottleneck cave sites in Bighorn Canyon (Husted 1969), and Southsider Cave (Frison 1991a).

The dry deposits in Leigh Cave (Frison and Huseas 1968), in the foothills of the Big Horn Mountains, provide a rare look at Middle Plains Archaic perishable materials, including tanned hide sewed with vegetable (milkweed and juniper bark) fiber cordage. Food items include wild onion and sego lily bulbs, buffaloberry, prickly pear, chokecherry, limber pine nuts, and yucca seeds, pods, and leaves. Around a stone-filled roasting pit were several hundred roasted Mormon crickets (*Anabrus simplex*). Several square meters of the rockshelter floor were covered with a thin, packed layer of wild onion (*Allium* sp.) hulls. Faunal material included a mountain sheep ewe and lamb, and several small rodents. The plant foods and lamb suggest a spring and summer occupation. Manos and metates were present, and the projectile point assemblage included the McKean lanceolate, Duncan, and Hanna types.

Other Middle Plains Archaic sites and/or stratified sites with these components include Granite Creek Rockshelter (Frison and Wilson 1975), Wedding of the Waters Cave (Frison 1962), and Birdshead Cave (Bliss 1950). Benson's Butte in southern Montana, a stratified site on the top of an isolated erosional remnant, produced levels with McKean and Duncan projectile points (Fredlund 1979).

The McKean complex is well represented in South Dakota's Black Hills. Tratebas (1981) has noted that Kolterman, Harney, and Landers points, corresponding to sites of the same name in the Angostura Reservoir (Wheeler 1958), as well as component A points from the Ray Long site, can all be assigned to the McKean complex. Sundstrom (1989) observes that the various McKean complex point styles have considerable temporal/spatial overlap and suggests they represent a single complex. Black Hills Middle Plains Archaic sites have produced evidence of communal bison hunting, individual hunting of deer and other large game, and broad spectrum foraging (Keyser et al. 1984).

The Gant site in western South Dakota produced a radiocarbon assay of about 4,200 years ago on a component containing McKean lanceolate, Duncan, Hanna, and Oxbow points (Gant and Hurt 1965). The site was interpreted as a warm season plant processing and tool preparation site. Lightning Spring is a multicomponent McKean phase site in

Figure 13. Typical Archaic period tipi ring.

Figure 14. Typical Archaic period stone-filled roasting pit.

the North Cave Hills of Harding County, dated to about 3,900 years ago (Keyser and Davis 1985; Keyser et al. 1984; Keyser and Fagan 1993).

The Beaver Creek Rock Shelter provides the most complete Holocene geomorphic section yet identified in the Black Hills and documents the transition between the Early and Middle Plains Archaic periods, from approximately 6,700 to 3,800 years ago. Over 30 features (burned soil, hearths, roasting pits), debitage, and tools were recovered from strata dated between 4,700 and 4,000 years ago (Martin et al. 1993).

Late Plains Archaic

Beginning about 3,000 years ago, the Late Plains Archaic period represents a continuation of the lifeways of the preceding period, although there was a recognizable change in point types. There was extensive use of dry caves and rockshelters during the Late Plains Archaic, and caves in the Big Horn and Absaroka Mountains of Wyoming have produced a variety of perishable materials. Coiled baskets exhibit a technology identical to those of the same age from the Great Basin, and include bowl forms and parching trays (Frison, Adovasio, and Carlisle 1986). There is unequivocal evidence for the manufacture and use of the atlatl and dart at Spring Creek and Daugherty Caves (Frison 1965, 1968a). Wooden and elk antler digging tools suggest recovery of bulbs such as wild onion and sego lily and root crops such as bitterroot and biscuitroot. Bark, fiber, and sinew cordage were also preserved, as were decorative items, including feathers, animal hoofs (deer and/or pronghorn), and porcupine quills.

Red ochre was often used on perishable items, some of which may have been ritualistic, but some may have been used as a preservative. Other sites with Late Plains Archaic perishable materials include Mummy Cave (McCracken 1978), Birdshead Cave (Bliss 1950), Wedding of the Waters Cave (Frison 1962), and Bush Shelter (Miller 1988).

The corner-tang knife (Figure 9j) is a distinctive Late Plains Archaic tool type. Actually, this type without the tang is known from the Early Plains Archaic at the Lookingbill site (Frison 1983a), but it is found both with and without the tang in many Late Plains Archaic sites. The tool was made on a biface, but continual resharpening of one blade edge continually changed the shape (Figure 9k) until it either broke or became nonfunctional. Two tanged knives were found in direct association with corner-notched points, adjacent to a fire pit at the Garrett Allen site in southern Wyoming (Frison 1991a). Charcoal from the pits produced a radiocarbon age of about 1,700 years ago.

The number of radiocarbon dates increases significantly toward the end of the Late Plains Archaic (see Frison 1991a). This is believed to reflect a population increase in response to more favorable climatic conditions. There was a more intense use of interior areas of intermontane basins, as well as the foothills and higher elevations. Stone circles increased in number and size, and may have replaced, to some extent, the pits houses of the earlier Archaic periods. There apparently was increased demand for lithic materials, based on the numbers of stone circles associated with large stone quarries.

Yonkee. A number of arroyo bison traps and at least one bison jump located in the Powder River basin of northern Wyoming and southern Montana are included in the Yonkee complex. This complex derives its name from the Powers-Yonkee site, a bison trap at the end of a small gully, just west of the Powder River near Broadus, Montana (Bentzen 1962a). Other Yonkee sites include the Mavrakis-Bentzen-Roberts Bison Kill (Bentzen 1962b) and the Powder River site, both in Wyoming (Frison 1968b). Large, well-made Yonkee dart points are usually side or corner-notched with a basal indentation (Figure 12l, m), or basally notched, with long, straight to convex blade edges with needle-sharp points to achieve maximum penetration (see Frison 1991a). Unfortunately, these points are numerous in bison kill sites and are avidly sought by collectors.

The Yonkee complex has caused some confusion in High Plains archeology. Powers-Yonkee site produced a radiocarbon date of roughly 4,400 years ago, but the sample and date are now considered suspect. This date, coupled with the similarity of the projectile points to some of the McKean variants, caused Yonkee to be viewed as a seasonal aspect of the latter complex. Reinvestigation of Powers-Yonkee produced radiocarbon ages ranging from about 3,100 to 2,700 years ago (Roll 1988a), which fit well with other radiocarbon dates on Yonkee sites (see Frison 1991a). Yonkee is now considered part of Late Plains Archaic, rather than Middle Plains Archaic. Reassessment of the bison skull from Powers-Yonkee has revealed it to be representative of the modern subspecies (Figure 8e, f) rather than an earlier intermediate type (Figure 8c, d), as was first claimed.

The bonebed at the Mavrakis-Bentzen-Roberts site suggests that the trap was used repeatedly. Within the bonebed, points frequently were recovered in the animals' rib cages (Bentzen 1962b). The site is an arroyo trap, with remnants of posts suggesting some modification was needed. Intact skulls, bison rib cages, and other articulated carcass parts at this site and the Powder River arroyo kill (Frison 1968b) indicate meat stripping and limited utilization of carcasses.

Yonkee cultural groups may have developed directly out of the preceding McKean complex, as bison populations in the Powder River Basin reached numbers that would support communal procurement. Yonkee bison kills reflect the availability of large numbers of animals and a thorough knowledge of bison behavior.

An undated Yonkee level at Kobold site (Frison 1970a) in southern Montana provided evidence of bison jumping and numerous points similar to those from Yonkee arroyo kill sites (Figure 12l). A number of Yonkee bison kill sites have been recorded along dry tributaries of Powder River in south-central Montana. One Yonkee site in the Powder River Basin in eastern Wyoming, over 2,700 years old, produced mainly pronghorn bones (McKibbin et al. 1988). Laidlaw site in southern Alberta is a communal pronghorn trap about 3,000 years old, but with uncertain cultural affiliations (Brumley 1984).

Pelican Lake. The Late Plains Archaic on the Northern and Northwestern Plains is marked by gradual replacement of the McKean complex by the Pelican Lake complex (Hannus 1994). First identified by Wettlaufer (1955; see also Wettlaufer and Mayer-Oakes 1960) at Mortlach site in southern Saskatchewan, Pelican Lake is generally dated to about 3,000-2,000 years ago (Frison 1991a), but Gregg (1985a) and Reeves (1983) suggest a span of 3,500-1,600 years ago. The phase has a wide distribution, extending across portions of southern Alberta, Saskatchewan, and Manitoba, southward to Montana and Wyoming, and as far east as the Missouri River in the Dakotas. Reeves (1983) has proposed several "subphases" for Pelican Lake in the subarea, including Glendo (the southernmost), Upper Miles in northeastern Wyoming and southeastern Montana, Spring Creek in the Bighorn-Shoshone Basin in north-central Wyoming, and Blue Slate Canyon in the Rocky Mountains of northern Montana and southern Alberta.

Distinctive Pelican Lake corner-notched points (Figure 15b, c) occur in open, cave, and rockshelter sites, and in some areas, many Pelican Lake points were made of Knife River flint. Defining attributes of these points are corner notching and sharp points on the blade and base edges (Deaver and Deaver 1988). Unnotched points of several forms occur in relatively high frequencies at Pelican Lake sites (Reeves 1983); these may represent regional variants or, in some cases like Spring Creek Cave, unfinished specimens (Frison 1965).

Pelican Lake peoples utilized multiple habitat zones in the Northern and Northwestern Plains (Reeves 1983), with a concomitant set of expanded resource utilization schemes. Deaver and Deaver (1988), Frison (1991a), Gregg (1985a), and Reeves (1970, 1983) all note the broader spectrum of faunal utilization. Dyck (1983:107) observes that "although they were certainly not inventors of bison jumps and pounds, Pelican Lake peoples were the first to use some mass kill locations that were used repeatedly, in some cases, more intensively in later times." Recent field studies (Hannus 1994; Hannus et al. 1983, 1989; Clark and Wilson 1981; Lueck et al. 1990; Winham, Lippincott et al. 1988) suggest that the subtle refinement of techniques for utilizing diverse topographic features is a hallmark of Pelican Lake hunting adaptations.

Mulloy (1954b) excavated several sites in the Wind River Basin in Wyoming that yielded a number of stone circle concentrations, stone-filled fire pits, and grinding tools, as well as corner-notched projectile points. Two hearths produced radiocarbon assays between 3,300 and 3,500 years ago, but these early radiocarbon dates may be somewhat unreliable. The Late Plains Archaic occupations in the Wind River Basin were very likely part of a seasonal round of activities that included movements to other areas.

Two Pelican Lake levels at the Medicine Lodge Creek date to about 3,000 years ago. A date of over 3,500 years ago on charcoal from a Pelican Lake cremation burial in northern Wyoming (Frison and Van Norman 1985) may be too old, although, as mentioned earlier, both Gregg and Reeves suggest a span of 3,000-3,500 years ago for Pelican Lake. An initial Pelican Lake radiocarbon assay of about 3,000 years ago from Head-Smashed-In Buffalo Jump in Alberta (Reeves 1978) supports the beginning of Pelican Lake at about 3,000 years ago. Variants of corner-notched dart points are common (Deaver and Deaver 1988) (Figure 15d, e).

Bison kills in the Powder River Basin of Wyoming with Pelican Lake points include Lance Creek (Haynes 1968), Fulton, and Mooney (Frison 1991a). The Kobold Bison Jump (Frison 1970a) contained a bison bone level with Pelican Lake points, as did the upper level of the Billings Bison Trap (Mulloy 1958).

Along Powder River, north of Broadus, Montana, and separated by a short distance in a dry arroyo that drains into Powder River from the east, are the Upper and Lower Miles bison kills. The lower site is Yonkee; the upper is Pelican Lake. It is believed that both sites utilized headcuts in the arroyo as natural traps. If so, the site was first used by Yonkee hunters

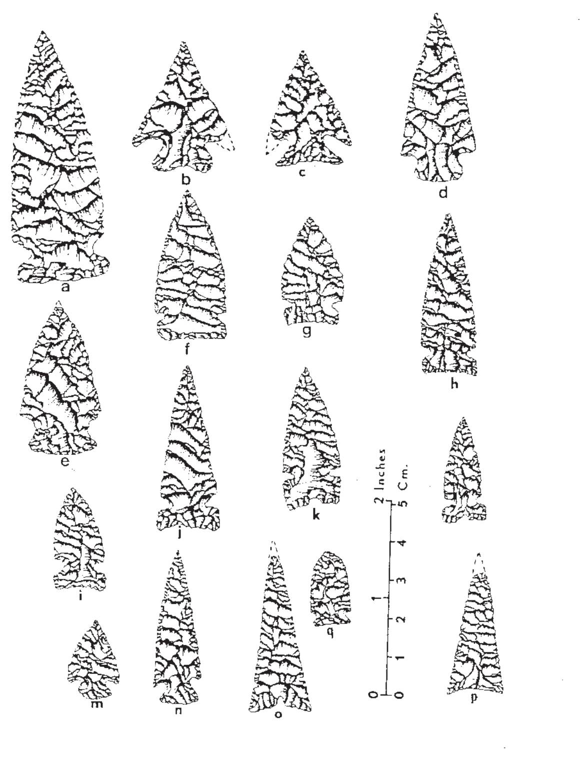

Figure 15. Projectile points: a-e, q, Late Plains Archaic; f-p, Late Prehistoric.

and, as the headcut moved upstream a short distance, it was used by Pelican Lake hunters. No dates were obtained and both sites were almost totally destroyed by artifact hunters.

A Pelican Lake component at the Sun River site, representing seasonal exploitation of bison, produced a radiocarbon age of about 3,600 years ago on charcoal from a feature in level I. Levels II and III were occupied between 2,800 and 3,500 years ago, and may be associated with a Pelican Lake or Hanna component (Greiser et al. 1983).

The Keaster site, located on Montana's northern High Line, included four Pelican Lake occupation levels (Davis and Stallcop 1965). The faunal assemblage contains abundant bison bone, as well as pronghorn and canid remains. Charcoal from the site returned as assay of about 1,940 years ago. At the Toston site in Montana, Pelican Lake tradition points were recovered from a component dated to about 3,430 years ago (Herbort 1988). Among the faunal remains were pronghorn, bison, mollusks, rabbit, and catfish.

A Pelican Lake component at Pilgrim site in the Limestone Hills of Montana contained 71 stone circles, some with associated hearths (Davis 1983; Davis et al. 1980, 1982). Deer were the dominant faunal species, followed by bison. Unburned bison bone returned a radiocarbon age of about 3,500 years ago. At the Schmitt Quarry site near the Three Forks of the Missouri, Pelican Lake peoples conducted extensive excavations into limestone deposits to procure silicified chert. Radiocarbon determinations from the site range from about 3,300 to over 1,600 years ago (Davis 1982).

As many as nine Pelican Lake components were discovered at the Hoffer site on Eagle Creek in Montana (Davis 1989). Radiocarbon assays average approximately 1,900 years ago. Bison dominate the faunal assemblage, with lesser amounts of pronghorn, deer, bird, fox, and canids. The Stark Lewis site is a stratified buffalo kill and tipi ring site located on the south flank of the Big Snowy Mountains of Montana (Feyhl 1972). Excavations revealed five occupations, the three lowest of which were attributed to the Pelican Lake phase. Radiocarbon dates suggest an age of about 1,720 years ago.

The Pelican Lake component at the Myers-Hindman site produced points, bifaces, bone awls, endscrapers, gravers, and grinding stones, as well as the remains of pronghorn, bison, beaver, canid, deer, elk, bighorn sheep, and various rodents. A radiocarbon date from this zone places occupation at about 2,300 years ago (Lahren 1976). On the Bighorn River in Montana, a Pelican Lake component at the Owl Creek site was dated between about 1,600 and 1,450 years ago. The site contained the heavily processed remains of deer, bison, and beaver.

Besant. The transition from Pelican Lake to Besant probably was gradual and may have begun as early as 2,500 years ago in North Dakota (Gregg 1985a, 1987), although perhaps not for another 500 years in areas to the west. Numerous sites with mixed Pelican Lake/Besant assemblages are known (e.g., Mondrian Tree, Naze, Keaster). Interestingly, Besant appears to persist in the Dakotas long after the appearance of smaller point forms in the west (Deaver and Deaver 1988).

Frison (1978:59) describes Besant points as "large, side-notched, dart-type projectile points, plus a few corner-notched points." Bases are usually straight, but some are convex or concave. Assemblages typically include a wide range of forms, including one that is relatively short and wide, with broad, shallow side notches (in many cases, the result of reworking broken specimens). A later, smaller variant of the Besant style, Samantha points are assumed to represent early arrowpoints; these eventually replace Besant points.

Ceramics are associated with Besant manifestations in northwestern North Dakota (Schneider and Kinney 1978) and on the Upper Missouri (Wood and Johnson 1973; A. Johnson 1977a, 1977b). In Alberta, ceramics were found in association with a buried component containing Besant and Samantha points at Wintering Hills site (Loveseth 1983; Vickers 1986:84).

According to Reeves (1983, 1990), Besant origins lie in the earlier Oxbow complex, while Pelican Lake derives from the McKean complex. He also suggests that the northern Besant peoples favored the Knife River flint quarries in North Dakota, while Pelican Lake period peoples preferred quarries in central and southern Montana, including the obsidian outcrops near Yellowstone National Park. Clearly Pelican Lake and Besant flintworkers consistently selected finer-grained, higher quality materials from diverse geographic locations.

Reeves (1970, 1983) describes the Besant phase as a nomadic hunting/gathering culture with a distinctive lithic artifact assemblage and regional manifestations to the east (i.e., the Dakotas) that include ceramics, burial mounds, and habitation structures. In considering a source for Besant, Reeves notes that "although origins are obscure, evidence suggests that it has been a resident Plains tradition on the Northeastern Periphery since possibly 500 B.C." (1983:185). The spread of Besant represents an important research topic. Reeves (1970, 1983) also presents an elaborate scenario of Besant as an egalitarian band society whose cultural system was significantly reworked as a result of participation in the Hopewell Interaction Sphere, but current interpretations of Hopewell make this scenario unlikely.

In reviewing Besant, Deaver and Deaver (1988:100) suggest a temporal span in the range of 1,200-2,500 years ago, thus overlapping with Avonlea and Pelican Lake. Moreover,

> the earliest dates are most common on the eastern edge of the Northern Plains, and the point types and adaptation developed somewhat later to the west. Interestingly, the dominance of Besant diagnostics persists in the Dakotas long after other point styles have appeared in the west. Transitional levels from Besant to Plains Village/Old Woman's/Late Woodland components tend to fall in the 650-1000 B.P. range in the Dakotas (Kropp and Sisseton Mounds, Dancing Grouse). Across the prairies of Montana and Alberta, Old Woman's arrowpoints replace Besant styles by 1000-1300 B.P. [Deaver and Deaver 1988:100]. The most appropriate range for the Besant Phase in southeast Montana is [sic] 1300-2000 B.P.

Besant peoples were without question the most sophisticated pedestrian bison hunters to occupy the Northwestern Plains, and their sites occur throughout the area. Evidence of their large, communal bison kills occurs in the Powder River, Wind River, and Shirley Basins of eastern and south-central Wyoming, and Besant sites are common in the southern Montana area. Deaver and Deaver (1988:100) characterize Besant as a highly specialized adaptation to the uplands, noting that the classic bison kills "are most common in the Northwestern Plains in open prairie settings," while sites in the foothills and forests represent more diverse economies. In the Northeastern Plains, groups with Besant material culture constructed burial mounds, a manifestation termed the Sonota complex by Neuman (1975). Greater quantities of ceramics, largely limited to burial mound contexts, are also characteristic of this subarea. Vessels appear to be utilitarian wares, with smoothed or cordmarked surfaces.

Although most information about Middle and Late Plains Archaic cultures comes from bison kill and/or processing sites, plant foods and small mammals, such as woodrat and cottontail rabbits, may have contributed as much or more to prehistoric diets than large mammal hunting. Even after the Wind River Shoshoni acquired horses in Protohistoric times and became bison hunters, they could only depend on bison meat for half of the year (Shimkin 1947). They hunted other game, including elk and deer, but also gathered a variety of plant foods, including roots, tubers, berries, greens, and seeds. Table 1 presents some of the more important food plants, but the list is by no means exhaustive (see Harrington 1967).

Besant hunters constructed large, sophisticated corral-like procurement complexes, one of which was preserved by the deposits of a dry arroyo in the Powder River Basin in eastern Wyoming. Construction of the Ruby Bison Pound (Frison 1971a) involved the use of large, paired posts placed in deep post holes, presumably with large logs stacked alternatively between the posts, to form an enclosure capable of holding as many as ten to twenty bison. A post and log fence also formed the drive lines leading into the corral. Numerous large side-notched and corner-notched projectile points (Figure 12n, o) were recovered within the corral and the immediately adjacent drive lane. The points exhibit excellent technology and were made of high quality materials; the needle-sharp points allowed easier penetration of bison hides.

Ruby also produced evidence of a large, bipointed structure approximately 6 m x 13 m that was apparently used for ritual purposes in conjunction with communal bison procurement. Apparently, the south half was roofed over and bison skulls were placed facing outward around the south half (Figure 16). Several holes or pits both within and adjacent to the structure contained bison vertebrae. This structure does not resemble any known prehistoric habitation structure on the High Plains.

The Muddy Creek Bison Corral (Hughes 1981; Frison 1991a) in the Shirley Basin of Wyoming produced the remains of a corral somewhat similar to that at Ruby, although no drive lines were found and a wooden ramp was used to dump the animals into the corral. As at Ruby, several hundred Besant points (Figure 15a) were recovered by artifact collectors inside the corral. At the top of a steep hill overlooking the site is a large boulder pile with several smaller piles nearby that may have been constructed for ritual purposes. Among the projectile points was an extremely small, well made specimen of doubtful functional use (Figure 15q). This could reflect shamanic activity similar to that proposed at the Jones-Miller Hell Gap Bison Kill in eastern Colorado (Stanford 1978). Several large, discrete

Table 1. Common Edible Plants Found on the Northern Plains and Rocky Mountains

Common Name	Genera and Species	Food Resource
Sego lily	*Calochortus nuttallii*	Bulb
Wild onion	*Allium textile*	Bulb
Biscuitroot	*Lomatium* Sp.	Root
Bitterroot	*Lewisia rediviva*	Root
Breadroot	*Psoralea esculenta*	Root
Yampa	*Perideridia gairdneri*	Root
Arrowleaf	*Balsamorhiza sagittata*	Early shoots
Cattail	*Typhus latifolia*	Early shoots, seeds
Saltbush	*Atriplex* spp.	Leaves, seeds
Yucca	*Yucca glauca*	Green pods, seeds
Prickly pear	*Opuntia polyacantha*	Fruit, leaves
Limber pine	*Pinus flexilis*	Seeds
Whitebark pine	*Pinus albicaulis*	Seeds
Goosefoot	*Chenopodium* sp.	Greens, seeds
Pig weed	*Amaranthus retroflexus*	Seeds
Indian ricegrass	*Oryzopsis hymenoides*	Seeds
Wild sunflower	*Helianthus annuus*	Seeds
Wild rye	*Elymus canadensis*	Seeds
Wild plum	*Prunus americana*	Fruit
Wild rose	*Rosa* spp.	Fruit
Chokecherry	*Prunus demissa*	Fruit
Serviceberry	*Amelanchier* sp.	Fruit
Buffaloberry	*Shepherdia argentea*	Fruit
Gooseberry	*Ribes inerme*	Berry
Currant	*Ribes* spp.	Berry

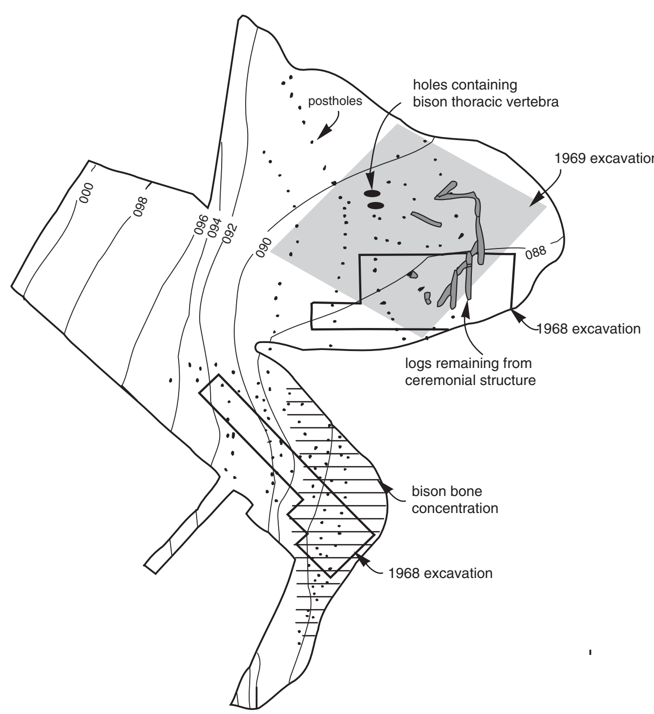

Figure 16. Plan view of the Besant Ruby site buffalo corral.

concentrations of tipi rings, unquestionably of Besant origin, in the site locality led one investigator (Reher 1983) to suggest the presence of tipi ring villages. They also suggest repeated use of the pound.

Another Besant bison procurement site, Cedar Gap, is located at a strategic position in Wind River Basin near the southern end of the Big Horn Mountains. Here animals were funneled down two arroyos into a corral. Recent excavations produced a large collection of Woodland ceramics (Frison 1991a). Butler-Rissler, a campsite on the banks of North Platte River near Casper, Wyoming, produced a large, partially reconstructed Woodland vessel and parts of another in direct association with Besant points, tools, and debitage. Two radiocarbon dates on the site range between 1,650 and 1,800 years ago (Miller and Waitkus 1989).

Half of the excavated tipi ring sites in the open prairies of Montana and North Dakota have produced diagnostics identified as Besant (Deaver and Deaver 1988; see also Schneider and Treat 1974), suggesting rapid expansion of Besant populations. Several Besant sites have been excavated in northern Montana along the Missouri and Milk River drainages (Ruebelmann 1983), including Milk River, Donavon, and Fresno. Most are buffalo pounds with associated occupation/processing areas. The multicomponent Fresno site includes a Besant bison processing area dated to about 1,700 years ago; the nearby Donavon site contained a Besant component dated to about 1,900 years ago. Multicomponent Wahkpa Chu'gn Buffalo Jump on Milk River (Davis and Stallcop 1966), produced several radiocarbon assays on Besant that average about 1,430 years ago.

At the Beaucoup site, near Malta, Montana, a Besant buffalo kill and processing site including nearly 100 cairns, 100 stone circles, and up to 20 stone alignments was recorded. Nearby at the Johnson Bison Kill, tipi ring excavations (Deaver 1983) yielded Besant points in association with Late Prehistoric side-notched varieties. The Keaster site is another communal buffalo kill with evidence of a pound structure. Bison, pronghorn, and canid remains were recovered from a component identified as a Besant/Pelican Lake transitional level (Davis and Stallcop 1965), dating to about 1,965 years ago.

A Besant component at the Ellison's Rock site, a rockshelter in the sandstone of the pine breaks region near Colstrip, Montana (Herbort and Munson 1984), yielded small amounts of bison, pronghorn, rabbit, and marmot. Radiocarbon dates from this horizon average about 1,000 years ago.

Terminal Late Plains Archaic

Between about 1,500 and 1,800 years ago, large atlatl and dart points were replaced by smaller points, although there is evidence of contemporaneity. It appears that peoples using the bow and arrow arrived while local groups were still using atlatl and dart. Thus, the Late Plains Archaic-Late Prehistoric boundary is not well defined and represents an overlap of two technological traditions over a period of several hundred years. Further complicating the issue, an Archaic hunting and gathering lifeway dictated by environmental conditions continued in some intermontane basin areas, such as Big Horn and Wind River basins in Wyoming, almost into Historic times. Temporal and cultural relationships between Besant and the subsequent Avonlea remain unclear because Avonlea and Besant sites often overlap in age. Several better known Archaic site locations in the area are shown in Figure 17.

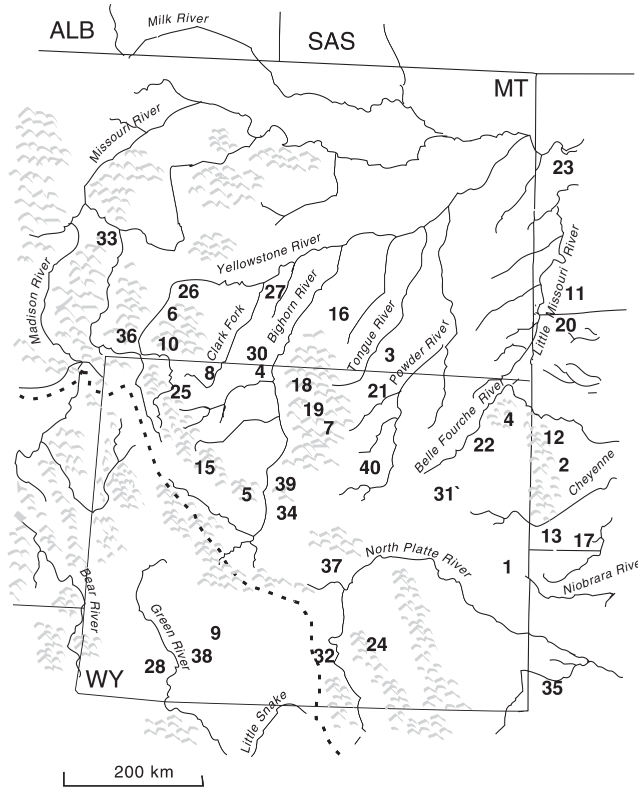

Figure 17. Archaic period site locations: 1, Bass Anderson Cave; 2, Beaver Creek Shelter 39CU799; 3, Benson's Butte 24BH1726; 4, Bighorn Canyon Caves (see Figure 11 for names); 5, Birdshead Cave 48FR54; 6, Carbella 24PA302; 7, Daugherty Cave 48WA302 and Spring Creek Cave 48WA1; 8, Dead Indian Creek 48PA551; 9, Deadman Wash 48SW1455; 10, Eagle Creek 24PA301; 11, Fisher 32BO207 and Red Fox 32BO213; 12, Gant 39ME9; 13, George Hay 39FA302; 14, Hawken 48CK303; 15, Helen Lookingbill 48FR308; 16, Kobold 24BH406; 17, Kolterman 39FA68; 18, Laddy Creek 48BH363, Medicine Lodge Creek 48BH499, and Southsider Cave 48BH363; 19, Leigh Cave 48WA304; 20, Lightning Spring 39HN204; 21, Mavrakis-Bentzen-Roberts 48SH311; 22, McKean 48CK7; 23, Mondrian Tree; 24, Muddy Creek 48CR324; 25, Mummy Cave 48PK201; 26, Myers-Hindman 24PA504; 27, Pictograph Cave 5YL1; 28, Pine Spring 48SW101; 29, Powers-Yonkee 24PR5; 30, Pretty Creek 24CB4; 31, Ruby 48CA302; 32, Scoggin 48CR304; 33, Schmitt 24BW559; 34, Shoshone Basin 48FR5, 48FR33, and 48FR34; 35, Signal Butte; 36, Sphinx 24PA508; 37, Split Rock Ranch 48FR1484; 38, Sweetwater Creek 48SW5175; 39, Wedding of the Waters 48HO301; 40, 48JO301.

Late Prehistoric Period

The beginning of the Late Prehistoric period on the Northern High Plains at about A.D. 500 or slightly earlier is marked primarily by the appearance of the bow and arrow. A transition from atlatl and dart to bow and arrow occurred between A.D. 420 and A.D. 750, with the Samantha side-notched point, the smaller corresponding arrow point of the

Besant complex, replacing the larger Besant side-notched dart points (Reeves 1970, 1983). Avonlea is generally limited to the Plains west of the Middle Missouri, east of the main Rocky Mountains, north of the Platte drainage and the Bighorn-Shoshone Basin, and south of the boreal forest in Alberta/Saskatchewan and the parkland in Manitoba (Reeves 1983).

Another diagnostic is pottery representing several traditions. The oldest ceramics are probably related to Plains Woodland, and evidently were brought to the area by Late Plains Archaic Besant groups and continued into the initial Late Prehistoric Avonlea. Parallel-grooved ceramics are associated with Avonlea at the Goheen site in east central Montana (A. Johnson 1988). Cordmarked (sometimes smoothed over) conoidal jars are known; fabric marked, bossed, and punctated sherds are infrequently reported. A wide assortment of nonlocal items suggests expanded interaction.

Reeves (1983) has proposed several Avonlea phases with the subarea, including Patten Creek, Keyhole, and Todd; data are very sparse for all but the latter.

The number of radiocarbon dates increases dramatically during the latter part of the Late Plains Archaic, reaching a peak around A.D. 1200-1300, and dropping off abruptly (Frison 1991a). This phenomenon is believed to reflect a sudden human population increase.

Stone circles proliferate in the Late Prehistoric period, as do stone-filled fire pits and grinding stones. Large-scale, communal bison hunting, usually represented by jumps, increased, especially north of the Montana-Wyoming border and into the plains and the Black Hills (Ruebelmann 1983; Tratebas and Johnson 1988). This practice lasted until the appearance of the horse in Protohistoric times, which fostered new bison procurement strategies, and eventually the near extinction of the species. Avonlea sites are relatively rare in southern Montana and exhibit distinct differences from sites to the north (Fraley 1988; Fredlund 1988). In areas such as the interior of the Bighorn Basin in northern Wyoming, where climatic conditions are more similar to those in the Great Basin than those in the High Plains, bison herd numbers were limited, and some Late Prehistoric groups continued Archaic lifeways into Protohistoric times.

Widespread adoption of the bow and arrow indicates the superiority of this weapon system over the atlatl and dart. Lithic material requirements also changed; a piece of flakeable stone will produce more small arrow points than larger dart points. Arrow shafts are shorter and easier to produce than dart shafts. In the study area, initial use of the bow and arrow is marked by the appearance of small, side-notched Avonlea projectile points that were fashioned primarily by pressure flaking. This technological innovation is widespread, and some researchers believe Avonlea lithic technology was adopted concurrently with bow and arrow technology by diverse prehistoric populations throughout the Northern Plains (Stanfill 1988).

Avonlea

The earliest small side-notched projectile point complex on the Northwestern Plains is Avonlea (Kehoe and McCorquodale 1961). As suggested by a date of about A.D. 110 from Head-Smashed-In Buffalo Jump in southern Alberta, Reeves (1970) recognized a transition from Pelican Lake to Avonlea at about A.D. 150-250 in Alberta and Saskatchewan, nearly 300 years earlier than dates from southern Montana and Wyoming. Terminal estimates range from A.D. 700 for the Saskatchewan Basin to about A.D. 900 or 1000 for the Upper Missouri. Slightly different age ranges may apply to specific subareas (Roll 1982). Most recorded Avonlea sites are located in the northern portion of the study unit, particularly in southern Alberta and southern Saskatchewan. The eastern extent of Avonlea appears to approximate the Middle Missouri. It has been suggested that Avonlea might represent occupation by Athabascans on their way to the Southwest (Frison 1973b). A comprehensive overview of Avonlea was published by Davis (1988).

Avonlea points are usually side-notched, with notches close to the base, and are typically made from high quality materials. Most points are very thin, with delicate, well-executed flaking; the lithic technology is excellent (Frison 1988a; Duguid 1968). A common variant exhibits upslanting side notches. Most Avonlea points are distinctive, but individual specimens are not readily separable from other Late Prehistoric side-notched points (Figure 15f-h). Another important aspect of Avonlea lithic technology is the production of bladelets from small conical and hemiconical cores (Reeves 1983). Ceramics are documented from a number of Avonlea sites in Montana (A. Johnson 1988), Wyoming (Frison 1973b); and Saskatchewan (Dyck 1983).

Several researchers, including Davis and Fisher (1988), Joyes (1988), Klimko and Hanna (1988), Reeves (1988), and Roll (1988b), recognize that Avonlea peoples employed a wide variety of adaptive strategies. Nonetheless, the general Avonlea lifeway appears to focus on communal hunting of upland herd animals, and most known Avonlea components are bison kills.

The Ulm Pishkun site, a large Avonlea buffalo jump on the dissected plains south of Great Falls, Montana, consists of a series of bonebeds extending for almost a mile along the base of Taft Hill. Recent excavations recovered Avonlea points, ceramics, and bison and canine bone (Roll 1992). Late Prehistoric side-notched points attributed to the Old Woman's phase have also been recovered from the site (Shumate 1967).

A bonebed and processing area at the Fantasy site yielded butchered bison bone, numerous lithic artifacts (including 350 Avonlea notched and unnotched points), groundstone, and bone tools. Parallel grooved ceramics were also recovered. Two hearths produced a radiocarbon determination of about A.D. 930. The site is located in a coulee, and a drive lane runs along the side of the main kill midden (Tratebas and Johnson 1988).

The Henry Smith site, an Avonlea phase bison pound along the Milk River near Malta, Montana, includes three bonebeds, six drive lanes, tipi rings, cairns, and two anthropomorphic petroform features attributed to ceremonial activity associated with communal hunting (Ruebelmann 1988). Two-hundred fifty Avonlea points were recovered from the site, as were scrapers, knives, bone choppers, fleshers, perforators, and plain and parallel grooved ceramics. A series of radiocarbon assays on bone and charcoal range from A.D. 770 to 1040.

The Herdegen's Birdtail Butte site, located along the east margin of the Bear Paw Mountains, has an Avonlea kill and processing component that has been radiocarbon dated to about 980 years ago. The Avonlea component overlies a Besant occupation, and based on differences in raw materials between the Avonlea and Besant components, Brumley (1990) suggests that the two cultural units represent distinct, unrelated human groups.

The Lost Terrace site, a campsite and butchering locality on the Missouri River, is the only known Avonlea site in Montana with evidence of heavy reliance on pronghorn. Two radiocarbon determinations place occupation sometime around A.D. 1050 (Davis and Fisher 1988). At Garfield Ranch, an Avonlea campsite on the Musselshell River in Montana, bison and deer dominated the faunal assemblage, with smaller amounts of pronghorn, rabbit, marmot, fish, and a mollusk. Excavations exposed a variety of hearths (G. Munson 1990). A wide array of macrofloral remains was recovered, and the site was dated to approximately A.D. 780.

In southern Montana and Wyoming, Avonlea sites often are located on top of and around buttes, some of which are relatively inaccessible. The defensible situation of these sites is interesting because there were other cultural groups present in the area and Avonlea appears to be intrusive. At Benson's Butte, Avonlea groups occupied a high butte top (Fredlund 1979, 1988). Bison was the primary food resource, with deer, pronghorn, rabbit, and prairie dogs supplementing the diet; domestic dogs may also have been eaten. The site assemblage includes numerous small side-notched and unnotched points, as well as sandstone and bone tools. Occupation was dated to approximately A.D. 500.

Radiocarbon-dated Avonlea sites in the Big Horn Mountains include Beehive (Frison 1988a); Shiprock, which is part of the Medicine Lodge Creek site (Frison 1988a); and Wortham Shelter (Greer 1978). To the south and east are Woodard in the Wind River Basin (Frison 1988a) and the Irvine site in central Wyoming (Duguid 1968). These sites represent adaptive strategies distinct from those in northern Montana, leading some researchers to recognize the Benson Butte-Beehive complex south of the Yellowstone River (Fredlund 1979, 1988).

The bottom level of Wardell, an Avonlea site on Green River in western Wyoming, produced a radiocarbon assay of about A.D. 370, and the youngest level was dated at about A.D. 960 (Frison 1973b). At the Pine Bluffs site in extreme southeast Wyoming, Early Plains Woodland ceramics occur in levels with Besant points, but a level dated at about A.D. 410 produced similar ceramics and Avonlea points. A later level dated to about A.D. 890 lacks both Woodland ceramics and Avonlea points, and is characterized by Upper Republican ceramics (see Frison 1991a). Dates from these two stratified sites are important for bracketing Avonlea occupation on the Northern High Plains.

In South Dakota until recently, Avonlea points had been identified only at Ludlow Cave (Over 1936), in the northwestern corner of the state. Research in the White River Badlands has produced Avonlea deposits in Pass Creek and Fog Creek drainages, with radiocarbon assays clustering around 1,500 years ago (Hannus and Nowak 1983, 1988; Nowak and Hannus 1983).

Contemporary non-Avonlea sites in the study area differ in settlement pattern and artifacts, and are recognized mainly by small, corner-notched projectile points. A level at Mummy Cave, dated to about A.D. 720, produced long, narrow points with relatively large corner notches (see McCracken 1978). A partially mummified human dressed in a tailored mountain sheep hide garment resembling a parka was found in the same level, as were many perishable items, including twisted vegetable fiber cordage, a mountain sheep hide boot, arrow shafts (one with a projectile secured to the shaft with a sinew binding), and several fragments of coiled basketry. Pictograph Cave, near Billings, Montana, has produced the largest known body of Late Prehistoric perishable materials (Mulloy 1958). The assemblage includes items of wood, bark, plant fiber, sinew, feather, and hide, as well as manufacturing debris.

Old Woman's Phase/Late Plains Side-Notched

This phase takes its name from Forbis' (1962) excavations at the Old Woman's Bison Jump in southern Alberta. Points typical of the phase occur across the entire study area, but the phase is restricted to Montana and northern Wyoming (as well as Alberta and Saskatchewan, which are not included in the study unit) where, in contrast to the Dakotas, the adaptation is not horticulturally based. Within the Northwestern Plains subarea, Old Woman's phase sites and artifacts are more common than those of any other phase.

The Old Woman's phase is generally dated between about 200 and 1,100 years ago. During this period, there is considerable evidence for movements of ethnic groups, although linking specific archeological remains with specific groups remains elusive. The end of the phase is marked by the influx of Euro-American goods and concurrent major adaptive changes.

Point styles of the Old Woman's phase are variable, but all are small to medium-sized arrowpoints. Most are side-notched, but corner-notched, tri-notched, and unnotched forms also occur. These points overlap stylistically with Avonlea and Samantha points. Unifacial "thumbnail" end scrapers are another phase diagnostic.

Like some earlier phases, Old Woman's is generally interpreted as a specialized adaptation to communal large game hunting (primarily bison) in the uplands (Ruebelmann 1983), although some faunal assemblages, especially from sites in forested areas, are relatively diverse. Most investigated Old Woman's phase sites in Montana are bison procurement or processing sites. Examples include the Wahkpa Chu'gn (Brumley 1976), Head-Smashed-In (Reeves 1978),the Sly Bison Kill (Steere 1980), and the Old Homestead Kill (Munson 1980). Both jumps and pounds are represented. Tipi rings (stone circles) are especially characteristic of the Old Woman's phase, with over half of the excavated examples in Montana producing diagnostics of the phase (Deaver and Deaver 1986, 1988).

At Bootlegger Trail, on Montana's Tiber Reservoir, bison populations were at sufficient levels year-round to allow communal hunts at almost any time of the year (Roll and Deaver 1978). The faunal assemblage contained abundant bison remains as well as deer, elk, pronghorn, grizzly bear, canids, fox, bobcat, beaver, porcupine, vole, ground squirrel, bird, fish, and river mussels. Faunal diversity was mirrored by an equally diverse artifact assemblage that included bone beads, ceramics, shell beads and pendants, and a copper fragment. Radiocarbon and obsidian hydration dates indicate occupation between A.D. 1280 and 1385.

In the Laramie Basin in southern Wyoming and northern Colorado, there are numerous Late Prehistoric period bison kills. The best known is the Willow Springs Buffalo Jump (Bupp 1981; Frison 1991a). Although lacking radiocarbon dates, the site is stratified, with Late Plains Archaic at the bottom and two Late Prehistoric components above. The oldest Late Prehistoric component consists of a bone level with associated small corner-notched points (Figure 15m, n).

The Willow Springs Bison Jump utilized a perpendicular sandstone ledge for the same purpose as the wooden ramp at the Muddy Creek Besant site. Here, animals were stampeded over the edge into a corral at the base. Post holes outlined the corral, which was reinforced with large stones. This type of bison procurement feature was widespread in Late Prehistoric times. The Foss-Thomas site in southeast Montana (Fry 1971; Frison 1991a), dated to about A.D. 1470, is operationally very similar to the Willow Springs jump, but is associated with Late Prehistoric period side-notched projectile points.

The Green River Basin produces numerous sites with small, corner-notched points. Some of these contain bison bone, but rarely do they suggest communal kills. These may be related to the Shoshonean occupation of that part of Wyoming and Utah. Some investigators have applied the name "Rose Spring" to these points after the type site in the Owens Valley in California (Lanning 1973), although definite relationships are lacking and only the similarity in point types between the two areas has been used to justify the application of the name.

More typical bison jumps involve stampeding animals over perpendicular bluffs high enough to kill and/or cripple. The Kobold site (Frison 1970a) (Figure 18) in central Wyoming and the Glenrock Bison Jump in south-central Wyoming (Frison 1970b) are good examples. Associated side-notched projectile points (Figure 15i, j) suggest killing crippled animals and/or possibly secondary use of the sites as an attraction for carnivores and scavengers.

Some sites in southeastern Montana, particularly along the Yellowstone and Missouri Rivers, have yielded ceramics with stylistic affiliations to the Middle Missouri area to the east. Examples include Kremlin (Keyser 1979), Nollmeyer (Krause 1995; Johnson and Kallevig n.d.), Ash Coulee (Mulloy 1953), and Hagen (Mulloy 1942). The latter two sites also produced bison scapula hoes, further strengthening the case for ties to

Figure 18. The Kobold Buffalo Jump in southeast Montana.

the east. A burial mound and earth lodge at Hagen are also characteristic of Plains Village groups. Hagen also yielded an unusually high density of bison remains.

At the Highwalker site in Montana, a Late Prehistoric period bison processing locus, side-notched arrow points, scrapers, knives, and utilized flakes were recovered, as were Powder River ceramics (Keyser and Davis 1981), which resemble variants of the Middle Missouri tradition. Radiocarbon dates place occupation between A.D. 1000 and A.D. 1100 (Beckes and Keyser 1983). It remains unclear if these sites represent local groups adopting elements of Plains Village culture, or if actual human migrations occurred.

Other sites yielding characteristic Old Woman's phase artifacts, as well as ceramics that may be Mandan-related, are linked to the Historic Crow Indians by some researchers. Most are located in northeastern Wyoming, southeast Montana, and northwest South Dakota. An early example is Mulloy's (1942) interpretation of the Hagen site in northeast Montana, which produced a large assemblage of Mandan Tradition pottery, as possibly being related to movements of the Crow on their way toward their traditional territory in the drainages of the Tongue, Powder, and Bighorn rivers.

The Piney Creek sites (Frison 1967a), Big Goose Creek (Frison et al. 1978) along the eastern edge of the Big Horn Mountains, and Ten Sleep Creek (Frison 1967b) and Medicine Lodge Creek (Frison 1976a) along the western edge of the same mountain range, may also represent Crow Indian occupations. All produced what some consider to be "degenerate" forms of Mandan tradition ceramics.

Big Goose Creek illustrates the principles of Late Prehistoric communal bison jumping. Opposing drive lines were utilized to funnel animals to the edge of a steep embankment. The drive line markers, consisting of stone piles, are visible for over 1 km. Drive lines leading to the edge of the embankment were preserved into the early part of the twentieth century, when they were destroyed by land leveling. Excavations revealed at least five separate periods of bison procurement. A corral structure probably was present, since the embankment slope was not steep enough to kill many of the stampeding animals outright. Radiocarbon ages of A.D. 1500 and 1420 were obtained on fire pits at the site (Frison et al. 1978).

Adjacent to the Big Goose Creek site kill area was a butchering-processing area with features for stone heating and stone boiling. The processing area produced a large bone, antler, and stone tool assemblage, including several decorative bone and antler items. Also present were white-tailed deer remains; it had been thought that white-tailed deer were introduced to the area in Historic times. Charred seeds of wild plum, another species thought to have been a Historic introduction, were recovered from a hearth.

The kill area represents a number of late summer to early fall events, but the hunting group continued to occupy the processing site during the winter, as indicated by the presence of fetal bones from female bison killed between late fall to early spring. Projectile points include small side-notched and side-notched/base-notched types. Ceramic vessel forms suggest Crow origins, since the decorative motifs suggest relationships to the Mandan Tradition (Frison et al. 1978).

The Piney Creek sites, a tipi ring area and a bison jump with a large processing area, also are of possible Crow origin (Frison 1967a) and postdate Big Goose Creek by about 100 years. The ceramics are similar to those from Big Goose Creek, but one partial vessel appears to be Intermountain (Shoshoni) rather than Crow (Frison 1967a), a situation usually attributed to Crow Indian males taking Shoshoni women. Numerous tri-notched points (Figure 15k, l) were found in the bonebed. The bison jump and processing area at the Piney Creek sites is typical of the Late Prehistoric bison subsistence strategy. Animals were stampeded over a steep bank, probably into a corral or pound where they were killed and butchered. The nearby processing area contained large anvil stones surrounded by hammerstones and numerous bone fragments. Also present were stone heating and stone boiling features surrounded by more bone fragments boiled for bone grease.

Similar processing area features were present at the Ten Sleep Creek site (Frison 1967b) on the western slopes of the Big Horn Mountains, which produced a nearly complete ceramic vessel (Figure 19c) believed to be of Crow origin (Frison 1991a). A buried component immediately adjacent to the Medicine Lodge Creek also produced possible Crow ceramics, as well as a large bone and stone tool assemblage. A radiocarbon age of about A.D. 1720 was obtained. Neither of the latter two sites was associated with buffalo jumps.

The Vore Buffalo Jump in northwest Wyoming is one of the larger and more unusual buffalo jumps on the Northwestern Plains. First use of the site occurred around A.D. 1500. The jump utilized a sink hole about 65 m in diameter at the top and 15 m deep. Apparently bison were driven into the site from several directions. Although most drive lines have been removed by farming activities, there are interrupted drive lines more than 1 km to the southwest.

Beneath just over 1 m of sterile soil is a deposit of bison bone over 4 m thick (Figure 20), representing 22 discrete jumping episodes over a 300-year time period. A variety of side-notched and tri-notched points is present; the uppermost levels yielded tri-notched and unnotched points (Figure 15o, p) that may be of Protohistoric age. The bison kills at Vore were early fall events, with one exception which occurred in late spring or early summer. Less than 10 percent of the site was excavated, and the entire site may contain as many as 20,000 animals (Reher and Frison 1980; Frison 1991a).

Plains Woodland

Several Woodland period sites have been recorded in the Black Hills of South Dakota and Wyoming. Wheeler (1958) found Woodland ceramics at Mule Creek Rockshelter in association with corner-notched points. Reeves (1970) believes these ceramics are comparable to Besant and Valley ceramics, and assigns the component to the Upper Miles subphase of Pelican Lake. The Berry Butte site, in the White River badlands, produced ceramics classified as Badlands Thick (Early Woodland) and Kadoka Cord-Impressed (Middle Woodland) (Lueck and Butterbrodt 1984).

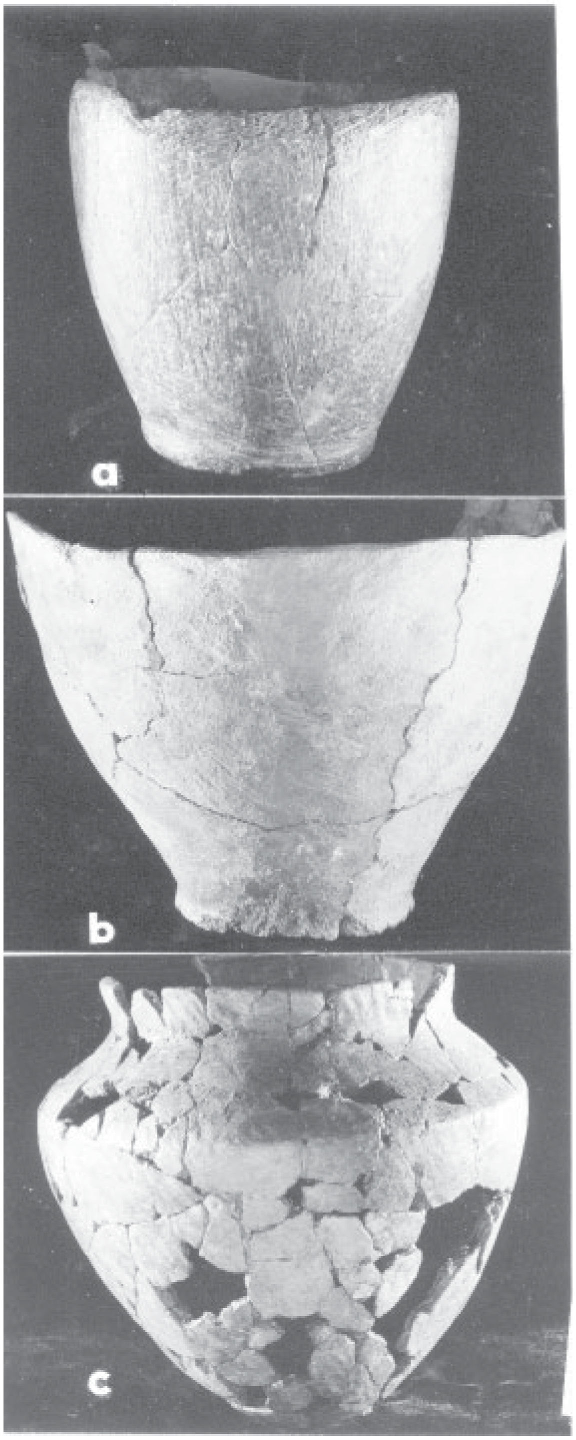

Figure 19. Vessels: a, carved steatite; b, Intermountain ceramic; c, probable Crow Indian ceramic.

Johnson (1993a) recently commented on the Late Plains Woodland in western South Dakota, drawing attention to the Long John site (Keller et al. 1984) and site 39SH133. The latter, radiocarbon dated to about A.D. 1200, yielded thin, cord-impressed sherds, while the Long John site produced fragments from two ceramic vessels (one egg-shaped with a smoothed surface, the other globular and cord roughened) in a hearth dated to about A.D. 750.

Figure 20. Bison bone levels at the Vore Buffalo Jump in northeast Wyoming.

Other Northern Plains Archeological Phenomena

Upper Republican

The area south of and along both sides of the North Platte River in Wyoming contains evidence of Upper Republican groups peripheral to those in Nebraska and Kansas (Reher 1971). Diagnostic ceramics occur stratigraphically above levels with Woodland ceramics at the Seven Mile Point site in southeast Wyoming, with radiocarbon assays of about A.D. 1150 and 1020. These dates are over 100 years later than any known dates on site components with Woodland ceramics (see Frison 1991a).

Initial Middle Missouri

Two groups of sites in western South Dakota are closely related to the village traditions of the Missouri River to the east. The first group apparently represents temporary encampments of Coalescent groups utilizing the badlands and Black Hills to extract lithic materials and food. Coalescent ceramics also occur in the White River badlands, the North

Cave Hills (Alex 1979), and at the Nollmeyer site in eastern Montana (Johnson and Kallevig n.d.; Krause 1995). The second group has produced cordmarked pottery similar to Middle Missouri and Central Plains Village types, dating between A.D. 1000 and 1300.

Johnson (1993b) recently presented a summary of Initial Middle Missouri (IMM) sites in western South Dakota, observing that in contrast to classic IMM sites to the east, those recorded in western South Dakota represent temporary camps and extractive sites. Among the sites with IMM ceramics is the Johnny site, overlooking the White River on the edge of the badlands, which has yielded examples of Anderson Decorated Lip, Anderson Plain Rim, and Stuart Collared Rim. Charcoal from a hearth produced an age of about A.D. 950, but multiple occupations are present. The Phelps site, near the edge of the Black Hills, yielded a large amount of Anderson ware and a Stuart Collared Rim vessel, as well as *Dentalium* shells and conch columella (see also Alex 1989; Alex and Martin 1993). Smiley-Evans, near the Wyoming border, yielded cord-roughened ceramics, a fortification, palisade, and possible houses (Alex 1979, 1989). A mean age of A.D. 1077 was obtained from 11 corrected radiocarbon dates (Alex and Martin 1993). The ceramics are similar to Anderson Low Rim, but are not up to IMM quality, and Johnson (1993b) postulates the site represents an unidentified Plains Woodland group.

The Huston-Fox site, on the Belle Fourche River, produced ceramics, stone tools, and fragmented bone; a radiocarbon age of about A.D. 1170 was obtained (Alex and Martin 1993; Kurtz and Keller 1986). Some of the ceramics are unlike any subarea types, while two rimsherds vaguely resemble Middle Missouri Riggs Ware (Lippincott 1992). The site also produced a number of ceramic beads, currently "the only known ceramic beads west of the Missouri in South Dakota" (Michael 1993:147).

Intermountain Pottery

Intermountain pottery, named and described by Mulloy (1958), is believed to be of Shoshonean origin. Although centered in western Wyoming and adjacent parts of Utah, Idaho, and Montana, Intermountain ceramics also occur in southern Wyoming and northern Colorado, and are considered indigenous to the Northwestern Plains and adjacent mountains.

Most Intermountain vessels exhibit a "flower pot" shape, with a flanged base and flat bottom (Figure 19b). Some examples have reinforced rims, sometimes combined with prominent shoulders (see Frison 1971b; Wedel 1954). Decoration is rare and is limited to fingernail impressions on shoulders. Vessels are thick, poorly fired, and contain tempering materials of unsorted sizes. Surfaces are usually roughly smoothed, and large pieces of temper are often visible. Broken vessels had apparently been repaired and then reused.

The oldest radiocarbon date for Intermountain pottery is about 740 years ago, at the Myers-Hindman site in southwest Montana (Lahren 1976). Dates from Mummy Cave (Wedel et al. 1968), the Shirley Basin site (Zeimens 1975), and Eagle Creek (Arthur 1966) are about 200 years later. The most extensive collection of Intermountain pottery from a single site is from the Eden-Farson site in west-central Wyoming, dated to less than 270 years ago. A wide variety of vessel forms was recorded (Frison 1971b), and an unfinished steatite elbow pipe may indicate a Protohistoric age. The numerous lodges at the Eden Farson site contained parts of over 200 pronghorn, all killed between late October and early November (Nimmo 1971), strongly suggesting communal procurement.

Steatite vessels that exhibit the same general shape as fired clay Intermountain vessels (Figure 19a) are also attributed to the Shoshonean occupation. However, steatite and ceramics have not been recovered together in the same context and it is not clear which came first. A number of steatite vessels and sources of steatite have been recorded (Frison 1982b).

Pronghorn and Sheep Trapping

Pronghorn could be taken in large numbers by traps, as documented by historic accounts of communal Shoshonean trapping in the Great Basin (Egan 1917; Regan 1934). Remains of a pronghorn procurement complex have been documented at the Late Prehistoric/Protohistoric Bridger Antelope Trap in southwest Wyoming, where the animals were funneled into an oval-shaped corral (Frison 1991a). Pronghorn would not jump or crawl through the brush corral so they were circled inside the corral until exhausted and probably killed with clubs.

Other Historic Plains Indian groups also hunted pronghorn communally. For example, Brule Sioux utilized a corral at the base of a cliff and, using horses, gathered herds of pronghorn and drove them over the edge into the trap (see Hyde 1974). At the headwaters of the Little Missouri River in northwest Wyoming, the Missouri Buttes Antelope Trap may be of Crow origin. Traces of juniper fences remain with V-shaped lines converging at a pit surrounded by juniper logs.

Bighorn sheep traps probably were designed more for taking nursery herds rather than mature rams. Ewes and lambs on a bedground will rapidly move downhill when disturbed, then abruptly change course and move uphill. Log and brush fences were placed in strategic positions to intercept animals and funnel them directly into a catch pen or a holding corral. The catch pen consisted of a narrow wooden ramp at the end of the converging drive fences that was camouflaged with a layer of dirt and rocks, and tall enough that the animals could not see the catch pen structure at the end of the ramp until it was too late to turn back. Once inside the log catch-pen structure, the animals were killed with wood and/or elk antler clubs, examples of which were recovered in the immediate vicinity of three traps. Bows made of mountain sheep horn with a heavy sinew backing were part of the Shoshonean material culture (Frison 1980).

Trapping complexes, such as the Dubois Animal Traps in the southern Absaroka Mountains in northwest Wyoming (Frison et al. 1990) and the La Marche Trap in southwest Montana (Keyser 1974), were carefully situated, and required the nearby presence of large amounts of dead timber. The construction effort involved required that large numbers of mountain sheep be taken. There is historic evidence for large mountain sheep populations during Protohistoric and early Historic times (Stuart 1935; Russell 1921; Fremont 1887).

Some traps have nearly disappeared, suggesting a terminal Late Prehistoric age, while two of the best preserved have been dendrochronologically dated to the end of the eighteenth century (Frison et al. 1990). Large ram skulls found in trees in the vicinity of these traps (see Frison 1991a) suggest ritual; small log and stone structures incorporated into the drive line fences were probably used by shamans.

The Bugas-Holding site (Rapson 1990), deep in the Absaroka Mountains, presents a likely subsistence strategy involved with Late Prehistoric mountain sheep trapping. Dated to about A.D. 1450, the site produced Intermountain ceramics and a faunal assemblage dominated by mountain sheep and bison. The former were taken in the fall, the latter throughout the winter. This suggests a settlement system with a base camp site in the river valley and temporary camps or even single day operations at nearby trapping locations. One recorded sheep trap (Figure 21) is located higher in the mountains at a favorable trapping location within a few kilometers of the site.

Figure 21. Catch-pen for a mountain sheep trap in the Absaroka Mountains in northwest Wyoming.

Bison Hunting

A number of the terminal Late Prehistoric period groups employed bison jumping, including the Crow, Blackfoot, and Plains Apache. At this time, the nonperishable material culture of Plains bison hunting groups was remarkably similar, and included grooved mauls, bison metatarsal and elk antler fleshers, and small side-notched, tri-notched, and unnotched arrow points.

The success of Late Prehistoric communal bison hunting is demonstrated by the quantities of bone that were mined for fertilizer in the twentieth century at several Northern Plains bison jumps. Only the larger and more accessible deposits were mined, and these represent only a fraction of the total number of animals killed (see Davis 1978).

Arroyo bison traps, some similar to and others significantly different than those of the Paleoindian and Archaic periods, also were used during Late Prehistoric times. One kind of trap was particularly well suited for relatively small numbers of animals. Four examples have been recorded, three in northeast Wyoming and one in southeast Montana, undoubtedly many others were used. The Cache Hill site (Miller 1984) in the Powder River Basin in eastern Wyoming is typical, and the proposed method of use is as follows. An arroyo with a continuous steep grade ending at a ridge-top was selected. The animals were gathered and driven up the steep arroyo for 1 km or more. Hunters at the rear kept continual pressure on the animals, while other hunters kept the animals within the confines of the arroyo. As the arroyo steepened, the animals, carrying large fat reserves at the end of summer and early fall, would have become tired, winded, and less aware of danger as they approached the actual kill location, just short of the ridge-top and the head of the arroyo. Hunters waiting just far enough over the ridge-top to be out of sight of the animals would have confronted the tired animals and they, along with the other trailing hunters, would have been able to kill at least part of the herd.

Cairns, Tipi Rings, and Medicine Wheels

Continuous and interrupted lines of stone piles and linear arrangements of stones have long been recognized as drive lines for animal procurement complexes (see Malouf 1962; Frison 1970b; Frison et al. 1990). The actual function of these features is conjectural and interpretations vary from pragmatic to ritualistic.

Other linear arrangements of cairns occur within southern Montana and much of Wyoming. The locations of these cairns, believed to be of Late Prehistoric to Historic age, make them unsuitable for drive lines. Some may represent trail markers, but many are in locations where the route is obvious. The size of the stones in a cairn may vary from pebbles to large boulders. The size of individual cairns and the distances between them also varies; some are contiguous and over 1 m in height while others exhibit multiple cairns at one or both ends of the line. The larger cairns represent a continuous accumulation over undetermined periods of time.

A preliminary study of six cairn lines was made in the Big Horn Mountains in northern Wyoming (Frison 1981). Similar cairn lines have been noted in the Laramie Range and the Ferris and Green Mountains, all in south-central Wyoming. A cairn line approximately 1.6 km long was described (Mulloy 1958) at Pryor Gap in south-central Montana, where ceramics and other Late Prehistoric artifacts were found in one of the more than 60 cairns in the alignment.

Loendorf and Brownell (1980) conducted a detailed study of the Bad Pass cairn line along the Bighorn River between the Pryor and Big Horn Mountains. Here, there is little doubt that the cairns represent trail markers, since the location is the only access through the extremely rough country. Excavation of several cairns produced diagnostic lithics of both Late Prehistoric and Archaic age. A radiocarbon assay of about 2,200 years ago was obtained from charcoal in one cairn. Protohistoric use of this pass by the Crow is documented by Native American informants, and journal accounts confirm later use by Euro-Americans.

Tipi rings (stone circles) are assumed to represent material used to hold down a lodge cover or strengthen the base of a structure (Figure 13). In his early discussions of stone circles in the Montana-Wyoming area, Mulloy stated "that the vast bulk of the stone circle complex has nothing whatever to do with tipis or any other kind of habitation site" (1958:212), but later took the more moderate position the use of stones to hold down tipi covers was considerably more frequent than he had suspected (1965:49). However, stone circles remain enigmatic and many apparently did not serve a structural purpose.

Stone circles too small to be the remains of structures are sometimes found near buffalo jumps such as the Glenrock site in central Wyoming (see Frison 1970b) and probably served a shamanic function. Two circles have large boulders in the center, similar to a feature at an Assiniboine bison drive described by Gilmore (1924), who suggested a religious function.

Plains tribes, especially the Crow, emphasized individual acquisition of supernatural power through ritual fasting in isolation, usually at a high, prominent location. The Pryor Mountains in southern Montana were often used for vision quests, as were other nearby regional mountain ranges. The remains of vision quest structures are oval or U-shaped single or multiple tiered rows of stone, usually about 2 m in width and designed to accommodate a single person (Fredlund 1969).

The Bighorn Medicine Wheel, located atop the Big Horn Mountains in north-central Wyoming, has generated much speculation since it was first reported in the literature by Simms (1903). Few subsequent reports are based on systematic investigations, but include Grey (1963a) and Wilson et al. (1981). Some believe the Medicine Wheel was a stellar observatory (Eddy 1974, 1977). Although it has undergone many disturbances, the Wheel probably is of Native American origin. It may have been built in several stages; artifacts recovered within and in the immediate vicinity are of Late Plains Archaic to Late Prehistoric age. The Fort Smith Medicine Wheel on the Crow Indian Reservation in southern Montana was not constructed in the shape of a wheel (Brown 1963), but consists of a central cairn with six radiating spokes.

Locations of several Late Prehistoric, Protohistoric, and Historic sites are shown in Figure 22.

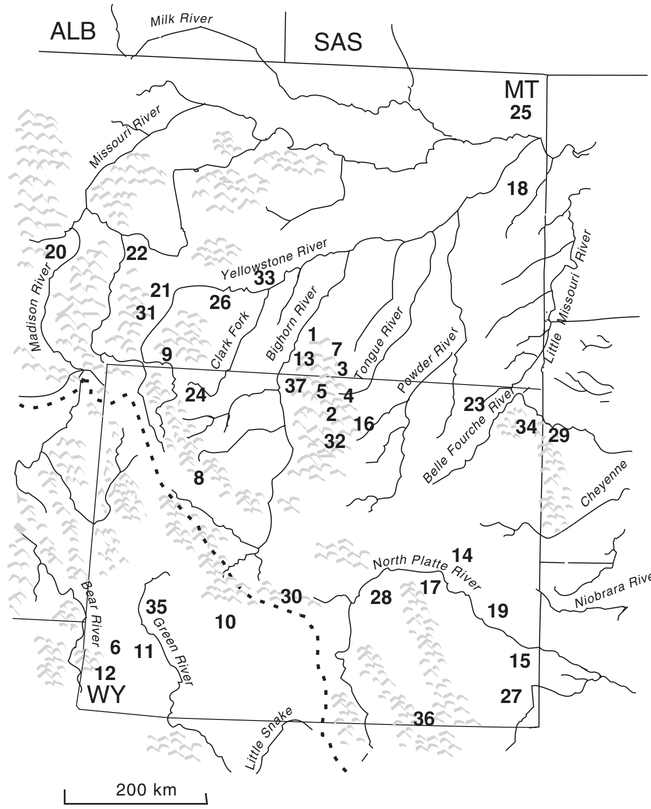

Figure 22. Late Prehistoric, Protohistoric, and Historic site locations: 1, Battle of the Little Bighorn; 2, Beehive 48BH346; 3, Benson's Butte 24BH1726; 4, Big Goose 48SH302; 5, Bighorn Medicine Wheel 48BH302; 6, Bridger Antelope Trap 28UT1; 7, Crook Battlefield and Kobold Buffalo Jump 24BH406; 8, Dubois Animal Traps 48FR307 and 48FR309; 9, Eagle Creek 24PA301; 10, Eden-Farson 48SW304; 11, Fort Bonneville and Green River Fur Trade Rendezvous; 12, Fort Bridger; 13, Fort C. F. Smith; 14, Fort Fetterman; 15, Fort Laramie; 16, Fort Phil Kearny and Piney Creek Buffalo Jump 48JO311; 17, Glenrock Buffalo Jump 48CO304; 18, Hagen 24DW2; 19, Irvine 48CO302; 20, La Marche Animal Trap 24BE1011; 21, Large Emigrant Buffalo Jump 24PA308; 22, Logan Buffalo Jump; 23, Missouri Buttes Antelope Trap 48CK49; 24, Mummy Cave 48PA201; 25, Nollmeyer 24RL1225; 26, Pictograph Cave 24YL1; 27, Pine Bluffs 48LA312; 28, River Bend 48NA202; 29, Smiley-Evans 39BU2; 30, South Pass; 31, Sphinx 24PA508; 32, Ten Sleep Creek 48WA305; 33, Thirty Mile Mesa; 34, Vore 48CK302; 35, Wardell 49SU301; 36, Willow Springs Buffalo Jump 48AB30; 37, Wortham Shelter 48BH730.

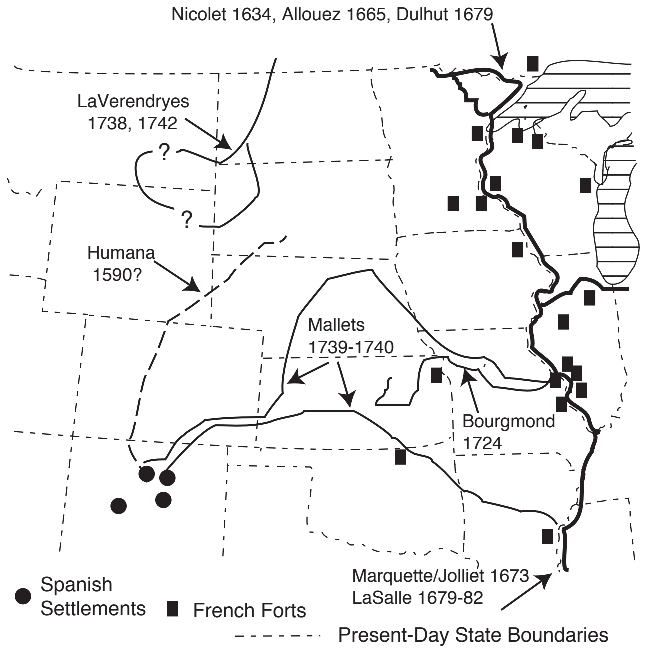

Figure 23. French and Spanish presence in the protohistoric period on the Great Plains and North-central Plains. The locations of these settlements, forts, and trails for the most part are approximate, but are presented to provide a general idea of the situation in the early protohistoric period.

The Protohistoric Period

The Early Europeans

The Protohistoric period in the Northwestern Plains began with the first contact, probably indirect, of Indians with Europeans. Both the French and the Spanish claimed the interior of the present-day United States in the sixteenth, seventeenth, and eighteenth centuries, and the English were contesting the northern boundary in the eighteenth century. In the sixteenth century, Spanish explorers from Mexico traveled farther and farther into the interior, perhaps even into the Northwestern Plains. In 1541 Coronado reached the northern Arkansas River, and Humana in 1590 may have reached the Northern Platte River (Figure 23). Spanish missionaries maintained successful settlements on the Rio Grande, and historical accounts verify that they traded corn and cloth for buffalo hides with Plains Indians. In 1720, the Spanish sent an expedition north under Pedro de Villasur to repel French intrusion, and they fought with Pawnee Indians along the North Platte River (Bourne 1922). The Taos Fair, which was established by the Spanish in 1723 and continued for another century, continued a tradition that reached far back in time.

French forts had been established to the east on the Minnesota and Mississippi rivers and around the Great Lakes in the late 1600s, and French traders from the north and southeast had penetrated the Northern Plains by this time. Etienne Veniard de Bourgmond and Claude Charles du Tisne traded with the Pawnee, Osage, and Arapaho tribes from a fort on the Missouri River, and both probably traveled westward as far as the North Platte in the period between 1712 and 1728. Pierre Gaultier de Varennes, Sieur de la Verendrye, obtained a monopoly of the northwestern fur trade to finance his search for the Northwest Passage. French authorities were alarmed not only by the activities of the English Hudson's Bay Company in Canada (which also was trading in the Northwestern Plains and Rocky Mountains), but also by the activities of the Spanish to the south. La Verendrye established a line of posts in present-day Canada and Minnesota. He proceeded from Fort La Reine on the Assiniboine River in Manitoba in 1738 to at least the Indians on the Missouri River. In 1742 he sent his sons Louis-Joseph and Francois from the Mandan headquarters, across the Dakota plains to the west. In company with "the Bow People" (probably Cheyenne or Crow bands), the brothers saw (in January, 1743) "the Shining Mountains." The Verendryes may have encountered the Black Hills, but more likely identified the Big Horn Mountains of Wyoming (Wood 1980a).

The earliest known archeological items of Euro-American origin included horses, trade beads, and small amounts of metal goods. Some of the latter were of Spanish origin, acquired indirectly, and so rare that they often were placed in Native American tree, platform, and crevice burials. These were so obvious that they were rapidly looted by the early Euro-

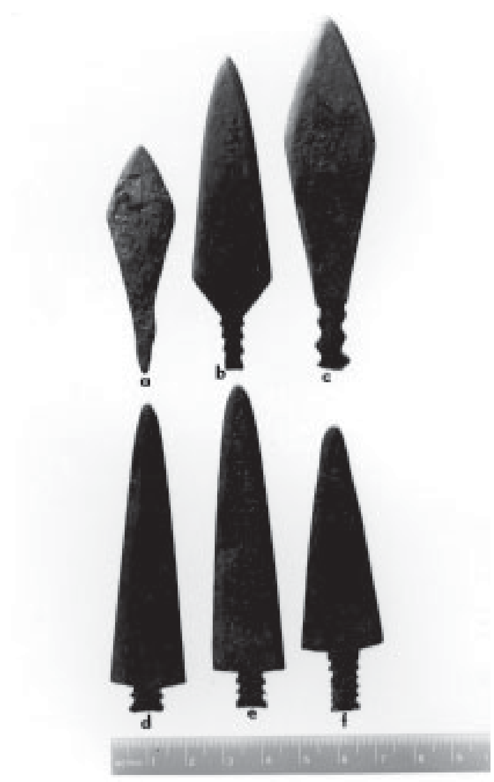

Figure 24. Protohistoric period metal projectile points: a-c, of Native American manufacture; d-f, of Euro-American manufacture.

Americans who saved only the artifacts as items of curiosity with no records of their provenience. The dates of manufacture and introduction of many items, such as glass trade beads and firearms, are known and allow at least earliest possible dates of their appearance in an archeological context (Devore 1992). Two distinct types of metal projectile points were used by Native Americans: one was manufactured by Euro-Americans (Figure 24d-f) and the other was made by Native Americans from pieces of metal that were heated and pounded into shape with stone tools (Figure 24a-c).

Problems of archeological and historic site interpretation are easily demonstrated. For example, in 1973, a livestock man, now deceased, took one of the authors (G. Frison) to a remote area of the southern Big Horn Mountains where there were over a dozen large piles of deteriorating bison long bones that had been deliberately broken, presumably for marrow recovery. The informant claimed that between 1915 and 1917, when he first happened on the location, there were a number of conical tipis still standing along with others that had collapsed. Pieces of bison hide were still present under some of the stone in the circles and horse travois poles were still leaning against some of the standing tipis (see Frison 1983b). He claimed the standing conical lodges were identical to some that are still standing in remote areas of the mountains (Figure 25).

By the late 1930s, collectors had removed nearly all of the lodge and travois poles; since the tipi rings were covered with bright orange lichen and easy to obtain, they were removed and used for fireplace construction just after World War II. A careful testing of the area in 1975 revealed no evidence of glass trade beads or other Euro-American items. However, the horse travois poles indicate the presence of the latter animals and at least a Protohistoric age. Two of the horse travois poles from the site were recently acquired from a collector. The general consensus among local inhabitants is that it was a site abandoned as the result of a smallpox epidemic. Accounts in similar vein would fill a large volume.

Figure 25. Conical pole lodge in the Absaroka Mountains in northwest Wyoming.

Other sites have been better investigated. For example, the River Bend site (48NA202) on the floodplain of the North Platte River within the city limits of Casper, Wyoming, was discovered when clearing brush and trees for a housing development. A large part of the site was destroyed before it was recognized but a portion was salvaged. Pieces of metal and a horse skull indicate a Protohistoric age, and the cultural content of the site suggests a large Shoshonean encampment (McKee 1988).

Undoubtedly, French and English trappers married Native American women and joined tribes in the Northern Plains as they did elsewhere in North America, but they have left little in the archeological record. Four burials of individuals of Indian/white ancestry have been found in the study area (see Chapter 7).

Plains Equestrians

The Spanish had only indirect contact with the Native Americans, but they changed the lives of the Indian irrevocably. Spanish settlements on the Rio Grande not only introduced horses to the Plains Indians, they also released horses, through stampedes, to roam free and increase across the Plains in the seventeenth century. By the mid-eighteenth century, Northern Plains Indians such as the Shoshones and the Crow were skilled horsemen (Ewers 1955:3-19; Haines 1938:430; Secoy 1953:33-38). The practice of working cattle from horseback was quickly adapted to bison hunting, which extended the hunting range of the Northern Plains tribes. The pressures of the Europeans and Americans from all directions forced changes in the way of life for many Indian tribes, and more and more tribes moved into the Northern Plains for subsistence. By the nineteenth century, the Kiowa, Kiowa-Apache, Arikara, Cheyenne, Arapaho, Teton Dakota (Lakota), Crow, Ponca, and Comanche were frequenting the Northern Plains (Cassells et al. 1984).

Although not precisely dated in the archeological record because of ambiguous radiocarbon dates for this period, Protohistoric sites with horse remains, shell and glass beads, metal points, and iron fragments have been found with Indian artifacts very often within Indian burials in the study area. These date from 1600 through the nineteenth century, but are considered Protohistoric, even though they overlap the Historic period (see Indian Tribes and Reservations, below). Many accounts were written about the Plains Equestrians from the end of the eighteenth century on; indeed, they were central to most historical events on the Northern Plains. Forty-nine Native American skeletons associated with European goods or horses have been recovered in the study area (see Chapter 7). Also, as discussed earlier, some of the Late Prehistoric bison, antelope, and sheep trap sites were used into the Protohistoric/Historic period.

Historic Period

Northern Plains history as part of western history is perhaps the richest of all the regional histories in the United States. Because of the romance of the cowboy and the Plains Indian, more scholarly and popular history books, more journals, more archival records, and even more movies are available about them than any other American regional group. Archeological studies have been conducted at only a few sites, but many sites are Historic monuments and are being preserved in local, state, and federal parks. Others, like the ubiquitous ghost towns, mining shafts, trading and military posts, and abandoned ranches, are left to the elements on large private and public lands. The preservation laws of the 1970s, considered those remains, historical or archeological, to be cultural resources. Since the documentation for these Historical remains is enormous, the purpose of this section is only to point out Historical cultural sites and give a few overview references for archeological studies.

The Traders

During the eighteenth century Canadian and American traders from the North West Fur Company and the Hudson's Bay Company left a number of manuscript journals with descriptions of the Northern Great Plains. After the Louisiana Purchase (1803) and the subsequent Lewis and Clark expedition (1804-1805), fur trappers and traders such as William H. Ashley (who received extensive press coverage by Missouri newspapers), Francis A. Chardon, Zenus Leonard, Osborne Russell, and Charles Larpenteur, and travelers with the traders, such as William Marshall Anderson, Rufus Sage, and Prince Maximilian, left valuable diaries (Missouri Historical Society Collections). The American fur trade, centered in St. Louis, included Manuel Lisa's Missouri Fur Company formed in 1808 with 150 men who were to trap the riches of Blackfoot and Crow country on the Missouri and Yellowstone rivers. Trading posts were established at the junction of the Yellowstone and Bighorn rivers for several years, but were abandoned as the War of 1812-1814 with Great Britain spilled over into the area. After 1819, a speculative boom in St. Louis helped the fur trade to expand over the entire Northern Great Plains. After 1827, the American Fur Company, run primarily by Pierre Chouteau, Jr. and Alexander Culbertson, established Forts Pierre, Union, Cass, Clark, and McKinsie (Figure 26). Because river access to St. Louis was essential, no successful fur posts operated either above the Fort Benton area on the Missouri or upriver from Fort Lisa on the Yellowstone—the effective heads-of-navigation for steamboats on those respective waterways. As the international beaver fur market faded in the 1850s, the American Fur Company refocused on the region's buffalo-robe trade, which had always been important on the Plains. This trade lasted until the early 1880s. See Wishart (1979), Phillips (1961), Chittenden (1902), Hafen and Hafen (1965), and Karamanski (1983) for overviews of the fur and hide trade.

The New Explorers

Scores of expeditions to the Northern Plains in the nineteenth century created reams of data, much of it stored in the National Archives (see U.S. National Archives and Records Administration 1989). From the Lewis and Clark expedition in 1805 to the 1870s, the U.S. government, under the auspices of the Topographic Bureau, the Corps of Topographical

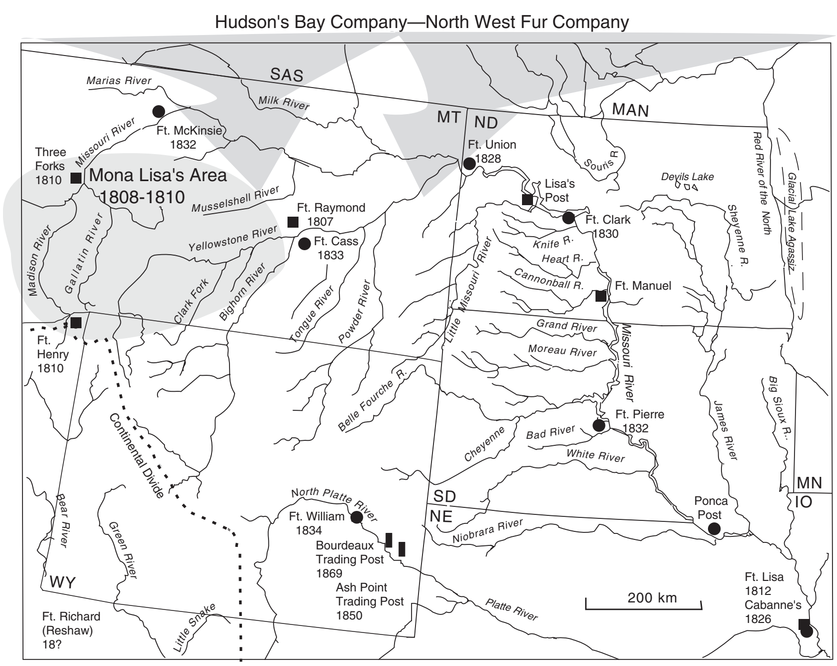

Figure 26. The fur trade frontier on the Northern Plains (early period before 1812 trading posts represented by squares, later period posts by circles). The entire area shown on the map became the hunting area of the Americans in the later period.

Engineers, the Office of Explorations and Surveys, and the U.S. Department of the Army (Friis 1975), sent numerous parties into the Northern Plains. Survey parties in the 1850s typically consisted of military and civilian botanists, topographers, geologists, civil engineers, surveyors, astronomers, naturalists, meteorologists, and artists. Missionaries like the Jesuit Father Pierre Jean DeSmet (1840-1868), artists like George Catlin (1832) and Bodmer (1833-1834), historians like Parkman (1846), scientists like ornithologist Elliott Coues (1873-1874) and William T. Hornaday (1886) who searched for bison specimens for the Smithsonian Institution, are just a few of the visitors to the Northern Plains. The transient nature of these many "explorers" left little, if any, archeological remains in the study area, but they made available much data for the examination of Historical archeological sites and reconstruction of the ecology of the area. See Bartlett (1962), Ewen and Ewen (1982), Goetzman (1967, 1987), and McFarling (1955) for overviews of these expeditions.

The Pioneer Travelers

With the news of the gold discoveries in California (1849) and the official cession of California following the Mexican War, masses of pioneers prepared to cross the continent. In this Great Migration, thousands of wagons followed the Oregon Trail through southern Wyoming (Figure 27). Winther (1964) and Mintz (1987) review the records and diaries of the people who made this trek. To these travelers, the Plains were considered worthless land that posed dangers from the weather and from the Indians. U.S. Army forts were established for protection. Probably the best organized pioneer travelers were the Mormons, 60,000 strong, who crossed Wyoming from Illinois to the Great Salt Lake in the years 1847 to 1863. Along their way, they blazed roads, constructed ferries, signposted exact distances, buried their dead, and set up storehouses of food and supplies for those who followed (Stegner 1964).

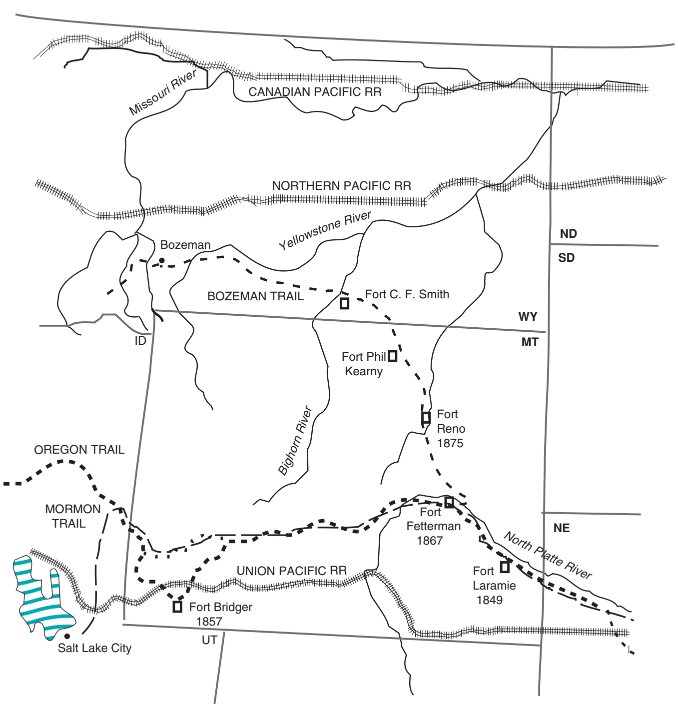

Figure 27. Nineteenth century trails and railroads in the Northwestern Plains.

The Miners

After gold was discovered in southwestern Montana, John Bozeman blazed a trail from Fort Fetterman to Bozeman, Montana, that was kept open by military forts. This trail is being marked and protected by the Bureau of Land Management, which owns parts of it. The first prospectors crossed the Continental Divide from the Idaho Country and worked the headwaters of the Missouri River. The initial strike on Grasshopper Creek (Bannack, 1862) was followed by discoveries on Alder Creek (Virginia City, 1863), Silver Bow Creek (Butte, 1864), Last Chance Gulch (Helena, 1864), and Confederate Gulch (Diamond City, 1864). Miners also ventured across the plains to prospect in such "island ranges" as the Sweetgrass Hills, the Bear Paws, the Little Rockies, the Highwoods, the Judiths, the Big Snowies, the Little Belts, the Castles, the Crazies, and even the Pryors and the Big Horns. An estimated 30,000 people had come to Montana by 1864, when the Territory of Montana was created. In 1867, prospectors rushed to the Sweetwater River region of Wyoming (South Pass City and Atlantic City), but this boom ended quickly. In 1874, silver was discovered at Butte and there was another flurry of prospectors, but the mines were scattered, transportation was poor, and many of the miners (as many as 15,000) joined the rush to the Black Hills, an area occupied by the Sioux Indians (see the Historic Indians section). Most of the miners were from the West, and it is estimated that up to a third of them were Chinese. See Storti (1991) for the story of the Rock Springs Chinese Massacre. Mining continued in Montana—quartz, coal, and other minerals. The greatest phase of Montana's mining history was the copper era of the 1880s and 1890s, led by Marcus Daly and his Anaconda Mine at Butte. Daly, as gold and silver kings elsewhere, found and built cities, mined coal for his furnaces, acquired huge tracts of timber to supply lumber for his mines, and established banks, power plants, and irrigation systems. He and the men who worked the mines became a major force in Montana politics. Greever (1963) and Paul (1963) present an overview of early mining.

The Cattlemen and the Sheepmen

Mining communities drew cattlemen and sheepmen to supply meat. These usually operated on a small scale, but large-scale freight companies and the Army also brought animals west and wintered them along the overland routes. Texas herds of longhorns arrived in Wyoming to feed the army of workers on the Union Pacific Railroad that was completed in 1868. In the 1870s, Texas cowboys pushed their cattle northward to winter on the grass ranges of Wyoming and Montana, and then shipped them to Chicago slaughterhouses. Between 1866 and 1885, millions of head of Texas cattle were moved into the open ranges of the Central and Northern Plains. Both cattle ranches and sheep ranches were established during the same period, and by the 1880s, these herds were vying with the buffalo and the Indians for the good grasses of the Plains.

Although popularly depicted as a romantic existence, open-range cowboy work proved tedious, exhausting, low-paying, and relatively short-term. A stockman could control thousands of acres of the public domain from a single 320-acre, titled home ranch and a few 160-acre claims to situate line camps and to secure water sources. Yet the entire industry depended on a precarious balance of grass, weather, outside capital, and Midwest markets. It became a speculator's dream—or his nightmare. The livestock industry was a prime incentive for transcontinental railroad construction through Montana. The Northern Pacific Railroad reached Miles City in 1881 and ran up the Yellowstone Valley, completing its transcontinental link in 1883 and opening strong markets for Montana stockmen.

The Canadian Pacific Railway crossed to the north of the Montana plains in 1885, and the Great Northern Railway followed the Missouri and the Milk Rivers along the Hi-Line to Great Falls in 1887. The creation of this transportation network forever would alter social, commercial, and political patterns on the Northern Plains (Riegel 1926; Grodinsky 1962; Lass 1962).

The transitory nature of the stockmen's frontier became evident with the "Hard Winter of 1886-1887." First the Northern Plains experienced several years of drought, overstocked ranges, and an exhausted grass resource. Then it suffered from a winter of deep snows, high winds, and ice storms that depleted the open-range herds by an estimated 40 percent. The boom had turned to bust.

This debacle signaled the withdrawal of most outside capital and the reconstitution of surviving ranches into fenced-range, winter-feeding, blooded-stock operations, many of which survive to the present day. For a history of the cattle and sheep frontier, see Atherton (1960), Pelzer (1936), Osgood (1970), Mercer (1954), Rollins (1979), Brisbin (1959), and Call (1942). The Nicolaysen Art Museum in Casper Wyoming presented an architectural exhibit of Historic ranches of Wyoming in 1986 (Sandoval 1986).

Historic Indian Tribes and Reservations

The threat to Oregon Trail travelers led to the Fort Laramie Council of 1851, which gathered an estimated 10,000 representatives of the Sioux, Cheyenne, Arapaho, Snake, and Crow tribes. The subsequent treaty allocated specific lands to the Indians and allowed the government to make roads and establish military posts. Treaties were made in 1855 with the Flathead, Pend d'Oreille, Kootenay, Blackfeet, Blood, Piegan, Gros Ventre, River Crow, and Assiniboine. The invasion of gold miners in Montana touched off the Sioux War of 1865-67, which flared more intensely when the federal government announced plans to connect mining towns with the Bozeman Trail. Captain William J. Fetterman and 82 soldiers under his command were ambushed and killed by the Sioux in 1866. In 1868, further treaties with the Shoshones, Bannocks, Teton, Santee, Yanktonnais Sioux, and Mountain Crow ceded most of Wyoming and half of Montana to the U.S. government (Cohen 1942) (Figure 28). Indians were assigned to specific reservations where government agents could supervise them. The depression following the military defeat of the Plains tribes caused many of them to seek supernatural help. The Ghost Dance religion originated among the Paiute about 1870 and promised that supernatural power would prevail and reunite all Native Americans, dead and alive, in a new land free from hunger and misery. Few Indians settled peacefully into reservation life, and young warriors drifted back into the open countryside. Fighting continued.

When prospectors crossed Indian hunting grounds in the Black Hills Gold Rush, the Sioux fought back. An army column under Lieutenant Colonel George A. Custer chased the Sioux to the banks of the Little Bighorn River in Montana on June 25, 1876, where he and his contingent were destroyed. "Custer's Last Stand" received extensive newspaper coverage and a nationwide demand for revenge. The Sioux were surrounded and beaten within a few months. This marked the end of major Indian warfare, but occasional outbreaks occurred. In 1877, the Nez Perce rebelled and were defeated at Bear Paw Mountain.

The final blow to Plains Indian tribes was the extermination of the buffalo in the 1880s (see Lepley and Lepley 1992 and Barness 1985 for overviews of the buffalo and their demise). Beginning with the winter of 1880-1881, starvation beset the Plains natives. In 1883 and 1884, an estimated 30 percent of the Blackfeet starved to death.

Sitting Bull, the main protagonist at the Battle of the Little Bighorn, returned from Canada and was pardoned by the U.S. government. His hatred of the whites never ceased and he was killed in 1890 during an attempt to arrest and remove him from the Standing Rock Reservation because of his continual troublemaking. After several other incidents, the Seventh Cavalry intercepted a group of Sioux, led by Chief Big Foot, that had left the reservation and were on the way to the South Dakota Badlands. The army forced unconditional surrender and marched them to a camp on Wounded Knee Creek. On

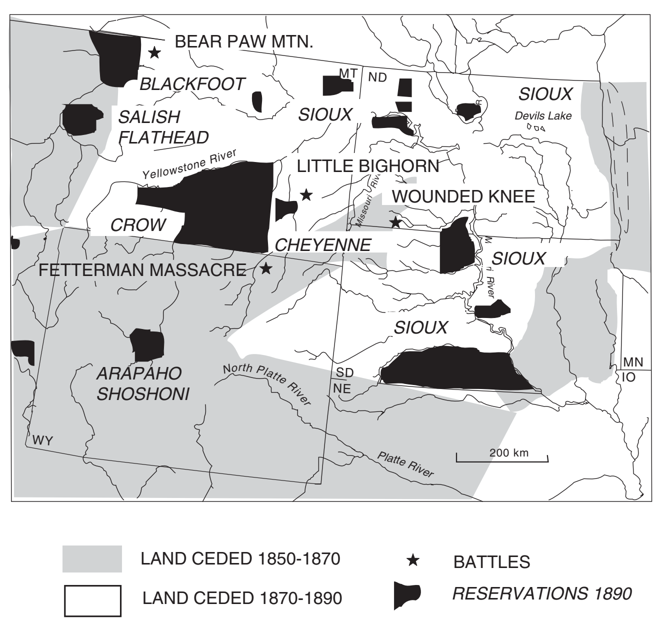

Figure 28. Indian reservations and major battles on the Northwestern Plains.

the morning of December 29, 1890, the soldiers attempted to disarm the Sioux. A Sioux medicine man, Yellow Bird, was blowing an eagle bone whistle and calling for resistance, claiming the soldiers would be powerless and their bullets would not penetrate the "ghost shirts" worn by the Sioux. Fighting erupted, and in the immediately ensuing events, 300 Sioux men, women, and children, and 60 soldiers died. By January 16, 1891, all the Sioux surrendered and were returned to their reservations.

Defeated, diseased, and demoralized, these Native Americans stood little chance of deterring white stockmen, farmers, and land speculators. The newcomers gained some of the remaining reservation lands—either by further reducing the boundaries or by legislating the "allotment" of that land. Nevertheless, the Indian tribes of Wyoming and Montana reservations have survived another century and continue to make history on the Northern Plains. For an overview of Historic Indian tribes on the Northern Plains, see Utley (1984), Kappler (1971), U.S. Department of the Interior (1975), McDonnell (1991), and Hoxie (1984).

The Farmers

The removal of the buffalo and the Indians, free land under the Homestead Act, increased immigration, and the construction of the railroads hastened the number of farming settlements in the Northern Plains. The farmers achieved some early success along the eastern border of the Big Horn Mountains, where water could be diverted for irrigation. Between 1880 and 1890, they constructed about 5,000 miles of ditches to irrigate approximately 2 million acres of land. The population of Wyoming and Montana, however, grew slowly and only the scientific developments in crop seeds, dry farming, and farm equipment of the twentieth century allowed further growth. For a history of agriculture on the Northern Plains, see Hargreaves (1957) and Wessel (1977).

The Military

The story of the U.S. government and the role of military forces on the Northern Plains is woven throughout the history

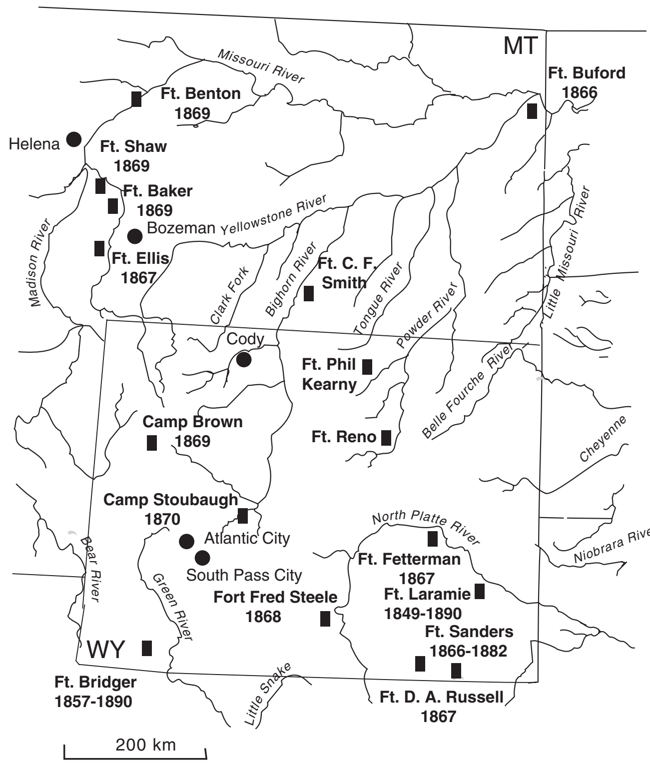

Figure 29. Some military camps and forts on the Northwestern Plains.

of the Indians, miners, ranchers, and farmers, and archeological and historical remains of their forts and battles exist across the study area (Figure 29). See Wooster (1988) and Utley (1973), for overviews of the military in the area, and Sheridan (1972) for outlines of Forts Buford, Shaw, Ellis, Benton, Baker, D. A. Russell, Fred Steele, Bridger, Laramie, and Fetterman. For archeological work at the Little Bighorn Battlefield site, see Scott and Fox (1987), Scott (1989), and Fox (1993).

3 Lithic Sources in the Northwestern Plains, by James C. Miller

Rocky Mountain and the western Plains physiographic provinces are plentifully supplied with lithic materials exposed in primary outcrop or in Cenozoic-aged secondary deposits (e.g., coarse alluvium and diamictites). Lithic materials were an important economic resource for the prehistoric people that used them in tool manufacture, production of utilitarian wares, and production of ceremonial or art objects or materials.

Lithic materials are classified by formation processes and lithologic character. Formation processes in sedimentary environments are classed as penecontemporaneous, authigenic or diagenetic, replacement, and epigenetic. Penecontemporaneous materials form concurrently with the host formation. Authigenic materials form after deposition of the host unit through chemical unmixing in subsurface environments. Replacement type materials are a subcategory of authigenic materials most commonly formed by amorphous silica replacement of organic materials and are fossiliferous. Epigenetic materials are postdepositional as well, but form exclusively in subaerial weathering environments.

Lithic resources fall in more or less lithologically distinct environments identified as sedimentary, metamorphic, and igneous. Major sedimentary material classifications for lithics include amorphous silica (opal, chert), cryptocrystaline silica (chalcedony, agate, quartz), and silica-cemented clastic sediments (orthoquartzites and porcellanites). Ferruginous and calcareous sandstones used as groundstone implements, clay minerals used in ceramic manufacture, and some mineral derived pigments are included here. Metamorphic materials include metaquartzite, steatite and other talclike rocks, catlinite (a metamorphosed claystone), and melted clastic rocks related to spontaneously combusted coal seams (clinker and nonvolcanic glass). Igneous rock types employed as lithic materials include extrusives such as obsidian, ignimbrite, basalt, and occasionally rhyolite. Intrusive igneous types are less commonly used as chipped lithics, but were used as groundstone implements.

Prehistorically utilized lithic materials occur in either primary or secondary depositional contexts. Primary context defines exposures in outcrops of the host stratigraphic unit. Secondary context defines redeposition of resistant clasts in alluvial and glaciofluvial systems, and glacial ice. These deposits occur as diamictites (stratigraphically bound conglomerates), pediments (cobble armored surfaces), alluvial gravel related to Quaternary alluvial systems, or as a component of glacial till or drift.

Definitions

The major sedimentary lithologies utilized prehistorically include chert, opal, agate, chalcedony, flint, porcellanite, and orthoquartzite. Chert and opal are defined by a random arrangement of individually precipitated, minute silica masses visible with a cross polarizing microscope. Opal is different from chert due to water in the lattice. Both agate and chalcedony differ from chert and opal because they are cryptocrystalline, and under a cross polarizing microscope display a regular, lathelike pattern resulting from intergrown quartz crystals. All four species are translucent or clear in thin sections but differ in density and hardness. Cryptocrystalline varieties are harder and denser. Flint is a related species, but remains more or less unique, formed by partial dissolution and precipitation of biogenic opal derived from diatoms, radiolarians, and silica sponge spicules. Any of these materials can display a dull to waxy luster, or less commonly a vitreous luster, and occur in a range of colors due to elemental impurities.

Porcellanites and orthoquartzites are silica-cemented clastic rocks. Orthoquartzites are silica-cemented sandstones (Krynine 1948), and porcellanites are finer clastic rock with silica cement or "impure cherts" (Jackson 1970:406). Porcellanites most commonly derive from weathered tephra. Orthoquartzites, also termed silcretes, are commonly associated with fossil soils formed in tropical climates.

Metamorphic lithologies are defined by temperature and pressure of formation, and elemental composition. Steatite and other talclike rocks (e.g., minnesotaite, pyrophyllite, and possibly stilpnomelane species) are hydrous magnesium or iron magnesium silicates and are best identified by softness, greasy feel, and a range of colors from almost black to light green, and brown to red. They are formed in low pressure, low temperature metamorphic facies from dolomitic rock. Massive exposures are termed soapstone. Catlinite is a low temperature metamorphosed claystone (Berg 1938) and similarly soft, but red in color and contains white mineral inclusions.

Metaquartzites are a high temperature, generally high pressure, near pure, variegated silica metamorphic rock. It is easily separated from orthoquartzite by the lack of distinct grain boundaries and small, assessory fractures that form subparallel to main fracture planes. Metaquartzites were frequently employed as boiling stones where available, and were probably less important as a lithic material if other materials were available.

Clinker is a class of low temperature, near surface pressure metamorphic product related to spontaneously combusted coal seams. Low grade varieties are black, gray, or red, and were generally not an important material if other materials were available. Medium and high grade clinker are best identified by the presence of bubbles formed by the separation of volatile gasses during combustion. The medium grade varieties have been labeled porcellanites in the northern Plains by Fredlund (1976). High grade varieties are called nonvolcanic glass (e.g., Frison 1974b). Clinkers "clink" if tapped on a hard surface and this is perhaps one of the best identifying traits for the low grade species.

Igneous lithologies commonly employed as tool stone include only extrusives, i.e., obsidian, ignimbrite, and a few aphanitic species such as basalt and trachyte. Obsidian and ignimbrite are similar. Obsidian forms through rapid cooling and solidification of superheated extrusive flows. Ignimbrites are the result of remelting due to subsequent superheated flows. Ignimbrite contains ash and rock fragments while obsidian does not. The difference may not seem important due to the co-occurrence of the two materials in the geologic record, but is useful in detailing more specific procurement behaviors close to the sources.

Basalt is a dark aphanitic extrusive, and commonly contains green, glassy phenocrysts of olivine. Its utility as a lithic material is measured by texture. Trachyte is generally light in color and its use has been reported by Blasing and Pawlikowski (1990). Neither lithology is particularly good as a tool stone, and their use may reflect resource poverty as much as anything else.

Lithic Sources

Rock units are defined both by lithology and age. The majority of good quality primary lithic source locations is found in Paleozoic and later sedimentary rocks simply because most lithic materials form in sedimentary depositional environments. In the Rocky Mountain and western Plains provinces, primary source locations can also be defined physiographically by age. Precambrian sources are generally exposed in rugged uplift cores and Paleozoic materials in rugged, high relief, cuesta form topography surrounding cores or exposed in overthrust belts. Mesozoic sources are commonly exposed in low to moderate relief cuesta form topography surrounding uplifts. Cenozoic sources are commonly exposed on low to moderate relief table form (e.g., butte and mesa) features in the Rocky Mountain basins and on the western Plains.

The more resistant lithologies are common components of secondary deposits. Diamictites in Tertiary deposits, and Quaternary pediment and alluvial gravel deposits contain a variety of lithic materials. Diamictites are similar to other primary context materials in sedimentary deposits and have limited, predictable exposures, although the materials they contain are less diverse than Quaternary pediment and alluvial gravel. The restricted diversity is a result of provenance during the age of deposition. Quaternary deposits generally contain the full array of resistant lithic materials. Diamictite and pediment secondary sources are generally confined physiographically to Tertiary deposits and table form features in the Rocky Mountain basins and western Plains. Quaternary alluvial gravel secondary sources are related to active or recently active alluvial systems. On the northern Plains, glacial drift or till was an important source of some materials.

Precambrian Lithic Materials

Uplift core lithic materials include all sources of Precambrian age. The four most important materials are steatite and catlinite, used to manufacture bowls, pipes, bannerstones, and other carved artifacts, and metaquartzite and banded iron formation (BIF) cherts used in stone tool production. Steatite is commonly a dark or green colored, soft, piebald magnesium oxide (i.e., talc) and has several known primary exposures in Archean rocks of the Middle Rocky Mountain province (Frison 1982b; Adams 1992); however, locations of additional sources defy prediction. Archean rocks have been severely altered through the course of geologic time by metamorphism and faulting, and do not occur in predictable patterns on the surface. Nothing short of an intensive pedestrian survey of Archean belt rocks will define all available steatite sources. Steatite and related rocks are too soft to survive long in alluvial transport, and secondary deposits of the material are near the primary source locations.

Catlinite has a more restricted source location in southwestern Minnesota. Catlinite was formed by heat metamorphism in a claystone facies of the Early Proterozoic Sioux quartzite (Morey 1984). Generally red in color and containing light colored mineral inclusions (sericite, hematite, and diaspore, and lesser quantities of kaolinite, chlorite, and pyrophyllite) (Morey 1984:62-63), catlinite is harder than steatite and other talclike rocks.

Metaquartzite is a high temperature modified quartz or silica rock which exhibits patterns of assessory fractures on flaked surfaces subparallel to the major fracture planes. It is variegated and piebald, and displays a range of quality with respect to knappability. Few primary sources of metaquartzite materials are known. Metaquartzite is resistant to most physical and chemical weathering processes and as a consequence, metaquartzites were more easily procured from secondary source locations (i.e., diamictites or pediment and alluvial gravel).

BIF cherts are common constituents of most nonglacial secondary deposits and have a few exposures in uplift cores. The material is commonly red, orange, or yellow, and characteristically brittle. Tools manufactured from the material are rare, probably owing to its brittle nature. The material is most commonly noted in casual lithic procurement sites and represented by tested pieces and initial production stage waste flakes.

Paleozoic Lithic Materials

Paleozoic source formations include stratigraphic units of Cambrian, Ordovician, Devonian, Mississippian, Pennsylvanian, and Permian age. Most are cherts and most are variegated, dense, sometimes brittle, and generally opaque, even in thin sections. A quick and easy method of defining

Paleozoic materials in an assemblage employs the use of short and long wave ultraviolet (UV) light. Most Paleozoic source materials do not fluoresce (with the exception of the Phosphoria cherts which weakly fluoresce green), while the late Cretaceous and Cenozoic sources do. Most of the Paleozoic materials are devoid of fossil inclusions, although brachiopods, trilobites, and graptolites are sometimes present. Most Paleozoic primary sources are bedded (penecontemporaneous) or unbedded (authigenic) nodular cherts. The Phosphoria Formation cherts occur as nodules on the eastern areas of the Rocky Mountains, but as medium or massive beds in the overthrust area on the western margin of the Rocky Mountains. The single most important epigenetic variety occurs at the upper contact of Mississippian-age strata.

Paleozoic materials are the most common materials available in the eastern and southern Plains and in the Central Lowland provinces (e.g., Meyers 1970; Butler and May 1984; Vehik 1985; Banks 1990). Primary exposures nearer the Rocky Mountains are restricted to Rocky Mountain outliers such as the Black Hills, and in the Rockies the materials are restricted to uplift core areas.

Cambrian Sources

Cambrian materials used prehistorically are from the Flathead and Gallatin formations. The Flathead Formation arkosic orthoquartzite is most commonly a coarse grained sandstone or granule-pebble conglomerate used as groundstone implements. The Gallatin Formation contains orange and black, brittle, brachiopod/trilobite bearing cherts in its upper or Open Door Member in the northern Wind River basin in Wyoming (Martin et al. 1980). The chert from this formation is a common component of diamictites and pediment gravel in northwestern and north central Wyoming and southwestern Montana, and in alluvial gravel deposits far out in the Plains.

Ordovician Sources

Ordovician sources include variegated orthoquartzites, possibly including the Big Springs quartzite reported by Loendorf (1973; see Craig 1983:34-35), nodular cherts in the Bighorn dolomite in the Big Horn Mountains in north central Wyoming (Loendorf 1973; Francis 1979, 1983; Craig 1983), and in the Pryor Mountains extending into south central Montana (Loendorf 1973). The Black Hills time-stratigraphic equivalent is the Whitewood Formation, which is considered a questionable source (Craig 1983:34), and the overthrust belt equivalent is the Fishhaven. The Bighorn dolomite has nodular cherts in the lower part and a brecciated, cherty dolomite in the upper or Leigh Member (Cygan and Koucky 1963:30). The brecciated zone is present in the Fishhaven as well, although little nodular chert is associated with the zone (Baer et al. 1980:185). A fossil soil, possibly related to the quartzite, has been noted in Lincoln County, Wyoming (Boeckerman and Eardley 1956:180).

Devonian Sources

Devonian Jefferson, Three Forks, and Darby formations are exposed in the Big Horn Mountains and to the west in northwest Wyoming and southwest Montana. The Jefferson and Three Forks formations are exposed in the more northerly areas and grade southward into the upper and lower Darby, respectively, in Wyoming, and the Jefferson has been mapped in the Crawford Mountains in Utah and Idaho (e.g., Andrichuk 1956). Brittle, bedded, graptolite bearing, pebble-sized, gray and black nodular cherts are present in the Jefferson Formation in the Belt Mountains and the Limestone Hills in west central Montana (Nelson 1963:36; Mertie et al. 1951:25). The Jefferson is brecciated on its upper contact and cherts are present in the zone. The brecciation extends into the middle Darby to the southwest, south, and southeast, but the cherts diminish in those directions.

Mississippian Sources

Variegated epigenetic and penecontemporaneous Mississippian cherts are some of the most abundant, good quality lithic resources available from primary sources in the Rocky Mountains and secondary sources on the Plains. Chert bearing Mississippian-age formations include the Mission Canyon (Madison Group) in Montana; Madison in most of Wyoming; Guernsey in the Hartville Uplift in eastern Wyoming; Brazer in the Wyoming overthrust belt; and Pahapsa in the Black Hills. Most of the Mississippian cherts are epigenetic types formed by uplift, subaerial erosion, and karst formation at the end of the Mississippian (Henbest 1956:37-38; Lageson 1980:57). The epigenetic types are mottled, variegated cherts, most commonly red, orange, purple, and clear; opalitic chert (clear or milky) generally combines with other colors only in the epigenetic type. Penecontemporaneous types are commonly an even orange or yellow to red or purple color and occur in beds rather than ancient karst features. Pyrolucite or birnessite (manganese oxide) dendrites are common in Mississippian cherts.

The Mississippian cherts were an important economic resource prehistorically and considerable effort was expended to procure it. Quarry and other procurement sites are known in southwest Montana (Davis 1982); the Big Horn Mountains (Francis 1979, 1983); Hartville Uplift (Craig 1983); Wind River Mountains, and overthrust belt of Wyoming (Miller 1991a); at Cross Mountain in northwest Colorado (Gardner et al. 1983); and in the Black Hills of Wyoming and South Dakota (Tratebas 1978).

Pennsylvanian Sources

The Pennsylvanian Amsden Formation contains commonly light colored opaque cherts and porcellanites that exhibit a dull luster on fresh breaks. The Amsden has wide exposures in northwest and north central Wyoming (Bachrach 1956; Boeckerman and Eardley 1956; Fisher 1963; Gorman

1963; Soister 1967), and cherts from the formation are epigenetic or penecontemporaneous in origin. Morgan and Round Valley formations in the Wyoming overthrust belt contain similar cherts (Randall 1960). Amsden materials were used prehistorically in the Big Horn Mountains (Francis 1983), and Round Valley materials were probably used at Cross Mountain in northwestern Colorado (Gardner et al. 1983).

The Pennsylvanian Hartville, Wells, Tensleep, Quadrant, and Minnelusa formations are superadjacent to the Amsden, Morgan, and Round Valley formations, and all are generally related to a broad, shallow sea that inundated the western continent after Mississippian-aged karst formation. The Hartville Formation is sedimentologically similar to the Wells, Tensleep, Quadrant, and Minnelusa limy or dolomitic sandstones and orthoquartzites, but includes some limestones at its base that may be late Mississippian in age. The Quadrant is locally cherty in west central Montana (Freeman et al.1958:449) and is the source of a poor quality gray chert. The Tensleep is rarely cherty on the eastern flank of the Big Horn Mountains (Fisher 1963:54), but solution breccias in the upper part of the formation contain gray and black cherts (Fisher 1963); orthoquartzites are present in some parts of the breccia. In northwest Wyoming, the Tensleep Formation contain a number of cherty zones containing variegated cherts (Bachrach 1956:64). Orthoquartzite is more obvious in the Wells Formation exposed in the overthrust belt (e.g., Baer et al. 1980). The Minnelusa Formation in the Black Hills has a "blue chert limestone member" identified by Brady (1958:45), and the chert nodules are present on contacts where the limestone has been removed. Fisher (1963) has traced exposures of the brecciated zone as far west as the Big Horn Mountains in Wyoming.

Permian Sources

The Phosphoria Formation has wide exposures in Wyoming, southwestern Montana, Colorado, and in the overthrust area of Idaho and Utah. The formation thickens to the south and west, being thickest is the overthrust where it is the source of significant phosphate deposits. In the western area of exposure, the formation contains three massive chert beds (Sheldon 1955, 1956). Only one of these is present in southwestern Montana and about 20 to 30 ft of chert exposed in the east flank of the Elkhorn Mountains south of Helena, Montana, represents the entire formation there. In Montana, the chert is yellowish brown or gray. In the overthrust belt and western areas of the Middle Rocky Mountains farther south, the cherts are commonly gray or black and sometimes contain spirifer brachiopods and fusilinids (Baer et al. 1980:187; Boeckerman and Eardley 1956:180; Conner and Hatch 1980; Sheldon 1955, 1956). Most commonly, the material is opaque, exhibits a dull luster on fresh breaks, and is frequently porcellanitic. The Phosphoria was apparently a more important lithic resource in the eastern areas of the Rocky Mountains and Rocky Mountain outliers on the Plains. Phosphoria cherts from the Big Horn and Pryor mountains varies in color from maroon, red, or purple to green, black or white (Frison and Bradley 1980; Francis 1979, 1983; Peebles 1981; Loendorf 1973; Craig 1983). Cherts from the Minnekahta Limestone Member of the Goose Egg Formation, exposed in the Black Hills, share many traits with the Phosphoria cherts exposed farther west.

Mesozoic Lithic Materials

Mesozoic source formations include stratigraphic units of Jurassic and Cretaceous age. Jurassic-age orthoquartzites and porcellanites come from the Cloverly and Morrison formations and are best identified and separated from similar Tertiary materials by a mineral assemblage consisting primarily (i.e., apx. 98%) of quartz and Paleozoic chert clasts. Cherts from Mesozoic rocks are opalitic, predominantly authigenic or epigenetic, and fluoresce green under long and short wave UV light.

Porcellanites and orthoquartzites in the Morrison and Cloverly formations are some of the most important sources where these formations are exposed. The Morrison is a chert rich, salt and pepper sandstone, and is a few meters thick in southwest Montana (e.g., Freeman et al. 1958). The formation thickens southward in Wyoming. The Cloverly Formation overlies the Morrison. In eastern Wyoming, the contact is the Lakota Conglomerate, but the Lakota is limited in westward extent, and there is no reliable contact between the units in areas farther west (Love 1956).

Lithic materials from these units have been extensively utilized throughout the area of exposure (Frison and Bradley 1980; Francis 1979, 1983; Craig 1983; Peebles 1981; Tratebas 1978). The Cloverly porcellanites and orthoquartzites are generally recognized by their even colors (purple, gray, and tan most commonly) from the Spanish Diggings in the Hartville Uplift (Saul 1969). The Morrison materials are red, yellow, and gray and exhibit linear features relic of fucoids (fossil worm burrows) and roots. The time equivalent Fall River sandstone in the Black Hills is the source of Black Hills quartzite. Prehistoric quarries at Flint Hill, Parker Peak, and Butte Mountain have been documented by Tratebas (1978).

Polished chert pebbles (i.e., gastroliths; Dondanville 1963) derived from the Morrison (Francis 1979, 1983) and permineralized wood from Dakota Formation in the Black Hills (Tratebas 1978) were occasionally utilized. A banded and mottled brown, gray, and cream colored chert and porcellanite exposed in the vicinity of Cody, Wyoming, and in northwestern Colorado may be related to the Morrison, or to an as yet unidentified Cretaceous unit.

A series of porcellanites of late Cretaceous age occur in western Wyoming. The Aspen (Entzminger 1980:167; Love 1956), Bacon Ridge (Love 1956), and Harebell (Love 1956) formations in northwest Wyoming contain pink and white, pearl gray, and green porcellanites, respectively. The Hilliard Formation exposures near Kemmerer, Wyoming, contain a series of thin bedded or platy tan to dark brown porcellanites, and similar materials are available from the Baxter Formation, the Hilliard equivalent exposed in the Baxter Basin east of Rock Springs, Wyoming. Localized brown, marine gastropod bearing porcellanite nodules are present along the east flank of the Rock Springs Uplift, generally associated with dolomitic concretions ranging up to 0.5 m in diameter. All these materials are commonly opaque in thin sections and exhibit a dull luster on fresh breaks.

A platy, purple orthoquartzite outcrops near the upper contact of the Almond Formation (Mesa Verde Group), and a similar material has been found in archaeological assemblages in the western foothills of the Black Hills, probably sourced from equivalent-aged strata exposed there. Low grade clinker deposits are present in most late Cretaceous units.

Cenozoic Lithic Materials

Cenozoic source formations include various stratigraphic units of Tertiary and Quaternary age, although the latter consists primarily of igneous extrusives and related weathering alteration products. Cherts are penecontemporaneous types for the most part, generally opalitic, and contain invertebrate fossils. The most common fossils are ostracods and ostracods are present in nearly every Tertiary source material. The second most common variety of Tertiary cherts is authigenic replacement types (i.e., fossiliferous types) formed by silicification of stromatolites, algal logs, wood, and invertebrate "death" beds or coquinas. Tertiary-age orthoquartzites and porcellanites, like similar Mesozoic lithologies, are best identified by mineral assemblages. Tertiary materials contain significant quantities of feldspar minerals which appear as light colored, opaque clasts, or intersticial material.

It is appropriate to discuss Tertiary materials by epochs, rather than periods as done for the Precambrian, Paleozoic, and Mesozoic sources above. The Tertiary strata are generally flat lying, and as such have much broader exposures in the Rocky Mountain Basins and on the Plains. Also, the Tertiary Period coincides with the Laramide orogeny and related, massive volcanic activity. The vulcanism distributed volcanic glass over the region, which was a significant source of soluble silica and resulted in the formation of numerous and varied material types.

Paleocene Sources

The Fort Union and its equivalents are the first Tertiary units and are exposed from the western Plains of Canada south to the High Plains, and in most basins in the Rocky Mountain system. In northeastern Wyoming and eastern Montana, the Fort Union is divided into the Tullock, Lebo, and Tongue River members (oldest to youngest) (Brown 1958). The Tullock and Lebo members are combined in the Ludlow Member in North Dakota; the equivalent member of the Tongue River is the Sentinel Butte. In Wyoming's Windriver Basin, the Fort Union members are named (in ascending order) the "lower," Waltman Shale, and the Shotgun members (Keefer 1969).

The dominant Fort Union Formation lithic sources are orthoquartzites or porcellanites (silcretes) formed in fossil soils. An extensively exposed fossil soil in the Rock Springs uplift, (Ritzma 1965) on Black Buttes, Aspen Mountain, and to a lesser extent on the northeast flank of the uplift is called Black Buttes quartzite. Tongue River silicified sediment is the equivalent lithology in the northern Plains. However, the so-called Tongue River materials are also present in the lower Wasatch Formation (Eocene) in the Powder River Basin, and the appellation of Tongue River is somewhat inaccurate. Keefer notes abundant chert, orthoquartzites, porcellanites, and siliceous shales in the lower member of the Fort Union in the Windriver Basin (1969:21).

The silcrete deposits in the Fort Union (and Wasatch) are typically gray, yellow, or red porcellanites. Similar to the Morrison (Jurassic) porcellanites, they display root bioturbation and fucoid features. Mineral composition is strikingly different and the Fort Union materials have a considerable feldspar content.

Fort Union Formation and equivalent-aged strata also contain some of the best permineralized wood lithic sources. Permineralized wood from Paleocene units is present in quantity in the western Powder River Basin (Reher 1979), the eastern Powder River Basin (Craig 1983:45), on the western flank of Rock Springs Uplift along the course of Killpecker Creek, and in the Middle Park (from Coalmont Formation) (Miller 1991a). Fort Union permineralized wood is translucent, brown to clear, opaline chert and exhibits wood grain textures and tree rings.

Variable grades of clinker are abundant in southeast Montana and northeast Wyoming. As noted, however, the medium grade varieties have been unfortunately labelled porcellanite (Fredlund 1976). High and low grade species are also present in the area. Low grade clinkers are present in the Wasatch Formation in western North Dakota.

Eocene Sources

The Wasatch Formation contains the same type of porcellanites as the Fort Union in the Powder River Basin. Another important source from the Wasatch is present in the western Wyoming Basin and related to the large lakes that formed in the area during the Eocene. Three thin ostracod coquinas in the upper part of the Wasatch were partially silicified and formed a light colored ostracod chert. Exposures of the material occur along the base of White Mountain immediately west of Rock Springs, Wyoming, and near Sage Junction by the Wyoming-Utah-Idaho border.

The Green River Formation contains sediments deposited in a series of fossil lakes in southwestern Wyoming, northwestern Colorado, and northeastern Utah (see Grande 1984). The units are widely exposed, and contain a rich variety of lithic sources. Penecontemporaneous cherts are present in the Parachute Creek Member, in the Piceance Creek (Lundell and Surdam 1975) and Sand Wash basins (Kornegay and Surdam 1980). Penecontemporaneous cherts in the southern Green River or Bridger basin are black and brown, and termed "tiger" chert because of distinctive varvelike banding (Love 1977) composed alternately of chert (or opal) and light colored porcellanites. The bands are commonly subparallel and were disturbed by soft sediment deformation concurrent with deposition. The best known sources are in the vicinity of Pine, Cedar, and Sage Mountains northeast of Lone Tree, Wyoming. A similar suite of materials is recorded by Stucky (1977) in the Sand Wash Basin, Colorado, and in the central Green River Basin at Opal Bench east of Kemmerer, Wyoming, and Wildcat Butte, west of Little America, Wyoming.

The more northern sources in the Green River basin have higher clastic contents and are better defined as porcellanites. They formed in shallower water and display a wider variety of soft sediment deformation features, and on the northern border of the ancient lake, silicified dolomitic concretions which exhibit concentric banding subperpendicular to the bedding planes and rip-up clasts are common features. Light blue opalitic chert inclusions (replaced ostracod carapaces) are a common trait of these cherts. Still farther north in the basin, a series of thin, platy, dolomitic gray and medium brown porcellanites formed in the mudflats north of the ancient lake. Similar porcellanites, but green and gray in color, formed in deltaic facies rock of the lower Bridger formation where the latter formation interbeds with the Laney (upper) Member of the Green River Formation near Granger, Wyoming, and also near Baggs, Wyoming, in the Washakie Basin. The Green River Formation materials, and most other opalitic cherts from Eocene sources, fluoresce orange or brown under long and short wave UV light.

The Bridger Formation interbeds with the Laney (upper) Member of the Green River Formation and overlies it. Brown opalitic cherts formed in playa lakes (identified as white layers) in the Jack Morrow Hills and in the upper Bridger Formation sub units (C, D, and E beds) in the southern Green River (or Bridger) Basin. Commonly thin bedded cherts in the Jack Morrow Hills and bedded nodular cherts in the southern basin (called Lone Tree chert), these cherts have light gray and white porcellanite exteriors, and in the south, the porcellanites contain planispiral gastropods.

Fossiliferous or replacement cherts are present in the Green River and Washakie formations in the Green River and Washakie basins. The quality is better in the Washakie Basin. The Great Divide Basin sources from Eocene rocks are in general restricted to the northwestern basin margin. A silicified gastropod (*Goniobasis tenera*) coquina at the base of the Tipton Member of the Green River Formation is an obvious marker bed whereever the formation is exposed, and was used to some extent prehistorically, but the gastropods impart an unpredictable flaking habit and limited the chert's utility. Silicified ostracod coquinas are much more common (commonly identified as ooids or oolids) in the Tipton and Laney members of the Green River Formation, and in the Washakie Formation. The best sources of are in the Washakie Basin where they are commonly brown, translucent cherts with lighter colored ostracods. Some exposed on Mexican Flats at the base of Delaney Rim south of Creston Junction, Wyoming, are variegated and porcellanitic. Green River and Fossil basin varieties are more commonly opaque and porcellanitic.

Algal logs and stromatolites are ubiquitous in the Green River Formation and in many cases have been silicified. Algal log cherts exhibit imperfect laminae, and for the most part the best quality materials are restricted in exposure to Whiskey Basin and north to the Blue Forest east of Fontenelle, Wyoming. These materials were an important local source and are identified in the literature as Whiskey Buttes chert. Commonly opaque and porcellanitic, it ranges from black and dark brown to tan in color and displays light blue opal inclusions (ostracod carapaces). Opalized wood is associated with algal logs, but is poor lithic material, generally brittle. In the Fossil Basin in the Wyoming overthrust belt, an algal chert displaying widely spaced, dark, bifurcated laminae in a cream color chert and porcellanite is present in the Fowkes Formation.

Stromatolites or algal reefs are widespread in the Green River Formation (Bradley 1929), exposed throughout western Wyoming and northwestern Colorado. Different degrees of silicification along the course of the outcrops is apparent and several areas contain knappable quality cherts. The better materials are brown and translucent to opaque. The prehistoric use of these various materials is reported in the Sand Wash Basin (Stucky 1977), Washakie Basin (Michaelson 1983), and Green River Basin (Love 1977).

The Wagon Bed and Tepee Trail formations exposed in the Windriver Basin represent less certain sources of lithic material. Van Houten (1964:36) documents a limestone containing siliceous zones three to five feet thick with wide exposure in the upper part of the Wagon Bed Formation. Chalcedony and probably silicified stromatolites are present in the Hendry Ranch Member of the Tepee Trail (Reidel 1969:39).

A late Eocene source of considerable interest is a bedded chert in the Golden Valley Formation in western North Dakota, the primary source of the Knife River "flint." The material is a brown, translucent, opalitic chert. The chert was originally precipitated in the base of channel deposits (Hickey 1972:116) and in ponds bordering established drainage systems during the Eocene of western North Dakota (Miller and Larson 1990). Knife River chert has a complicated formational history. Mostly formed through penecontemporaneous processes, it displays the effects of authigenic and epigenetic processes as well. Once identified as silicified lignite (Clayton et al. 1970), the chert contains vegetal fossils, predominantly palm leaf fragments, and few ostracod molds. The organic materials were encased in silica gel and later replaced with chalcedony (Miller and Larson 1990:86-87). Hickey (1972) reports two porcellanites in Golden Valley Formation rocks, one identified as the Hard Siliceous or HS bed, and the other as the Taylor chert bed which marks the contact between the upper and lower members of the Golden Valley Formation. The porcellanites are poor quality materials, but used to some extent. The HS bed has been related by Hickey (1972) as a probable relic of a fossil soil mapped by Pettyjohn (1966).

Oligocene Sources

The White River Group or Formation has broad exposures on the Plains of South Dakota, Wyoming, Nebraska, and Colorado, and in some intermontane basins in the Rocky Mountains. Singler and Picard (1979) report a chalcedony and opal bearing limestone at the top of the Chadron Formation or Member in western Nebraska and eastern Wyoming. Called Flattop chalcedony, the material is an opalitic chert (e.g., Ahler 1977a). The appellation of Flattop is also used to define materials from Kimbal Formation (Pliocene) in northwest Colorado (Craig 1983:46). Plate chalcedony is another material from the Chadron Formation or Member rocks (Carlson and Peacock 1975), but possibly the Brule Formation or Member (Ahler 1977a:136), and was reportedly precipitated in vertical fissures or fractures (Ahler 1977a:136). Some specimens exhibit algal produced laminae and other bedding features which are inconsistent with the interpretation. Plate chalcedony is a true chalcedony, and in some cases intergrowths of minute quartz crystals are visually apparent. The various materials from Oligocene rocks vary from clear or milky opal to white, gray, pink, or purple opaque cherts and porcellanites. Translucent varieties are commonly gray, pink, or purple, display mottling, and contain globular inclusions. Most, if not all, have an epigenetic origin. Carlson and Peacock's (1975) "purple and white chalcedony" in the Brule Formation in the South Dakota Badlands is related to these sources. "Scenic chalcedony" (Nowak and Hannus 1985) is a brown, translucent, opaline chert from southwest South Dakota and is another Oligocene White River Group material.

Miocene Sources

The Arikaree and Ogallala formations have wide exposures on the central Plains and in some intermontane basins in the Rocky Mountains. Arikaree opalitic cherts contain manganese dendrites and are present at Oregon Buttes in the Jack Morrow Hills at the northern end of the Rock Springs Uplift (Zeller and Stephens 1969). Francis (1988:9) describes a tan to white, banded chert with round, white inclusions from the Arikaree Formation. Opaline and white opaque cherts are available from Arikaree and Ogallala formation rocks on the Plains in eastern Wyoming and Colorado, and western Nebraska and South Dakota. Many of the small, opaque chert nodules have an epigenetic origin. An orthoquartzite and porcellanite relic of a fossil soil from the Ogallala in central South Dakota and Nebraska is called Bijou Hills silicified sandstone (Carlson and Peacock 1975; Ahler 1977a).

The Browns Park Formation has exposures west of the Gore Range in north central Colorado and southwest Wyoming. The Troublesome Formation is exposed in the Middle Park, east of the Gore Range in north central Colorado. The opaline and opaque, porcellanitic cherts from the formations are similar (Miller 1990). The materials occur in thin beds related to playa lake deposits and are penecontemporaneous, although some are modified by subsequent epigenetic processes. The better materials are opaline, milky, translucent cherts that display aglal or stromatolitic banding. The epigenetic cherts are mottled and contain globular inclusions.

The Teewinot Formation contains a welded rhyolite tuff and is diatomaceous in parts (Love 1956:89-91). The Camp Davis Formation contains a diatomite (Love 1956:89-91). These materials may represent locally used lithic sources.

Pliocene Sources

The Bivouac Formation contains another welded rhyolitic tuff (Love 1956:90-91), but like the Teewinot, may represent no more than a locally used source, if used at all. The Kimbal Formation is the source of the Kimbal "chalcedony" (Carlson and Peacock 1975), or the Kimbal-Flattop "chalcedony" (Craig 1983:46), in northeast Colorado, and is a translucent, tan, brown, gray, and purple opaline chert with globular inclusions. Materials from Grouse Mountain on the eastern fringe of the Middle Park, north central Colorado, are a product of epigenetically weathered tuff, and is characteristically opaque and variegated (commonly red, orange, yellow, brown, and occasionally purple). It is best identified by dark crystal lathe inclusions and small cubic or rhombohedral voids filled with secondary mineral matter. A similar material is found at Table Mountain northeast of Grouse Mountain near the Colorado River and Willow Creek confluence which is called Table Mountain jasper.

Pliocene and Pleistocene Igneous Extrusives Sources

Extensive igneous extrusives in western North America occur in the Rocky Mountains, Interior Plateaus, and the Pacific Coastal Ranges. Unquestionably the most important source for the northern Plains is the Yellowstone Plateau area in northwest Wyoming, eastern Idaho, and southwest Montana. Other sources perhaps include the Idaho Batholith and Snake River Plains. Obsidian, ignimbrite, basalt, crystal quartz, and some workable rhyolites come from the Yellowstone Plateau.

Important Secondary Sources

Secondary sources of prehistoric lithic materials are, by definition, coarse clastic deposits resulting from geomorphic processes. Lithic materials are for the most part resistates, and survive long distant transport in fluvial/alluvial, glaciofluvial, and glacial systems. Till or drift, glaciofluvial runoff channels, and modern alluvial systems are important secondary sources in the northern Plains. South of the limit of continental ice advance, river channels, terraces, pediments, and stratigraphically confined diamictites, are the important secondary sources. Diamictites are different from other secondary deposits. They are more widely separated in geologic time and are exposed in outcrop, stratigraphically bound by other lithologies.

Examples of utilized diamictites locations in Tertiary deposits include those in the Cathedral Bluffs Tongue of the Wasatch Formation (Eocene) in the northern Great Divide Basin; the Bridger Formation (Eocene) in the western Green River Basin; the Wasatch Formation (Eocene) in the Powder River Basin of Wyoming; and the Lysite Member of the Wind River Formation in the northern Wind River Basin. All of these sources contain a range of materials originally derived from Precambrian, Paleozoic, Mesozoic, and early Tertiary sources. Pebble obsidian (Love 1977) in Pliocene(?) and Pleistocene gravel deposited by the ancestral Green River was an important secondary source in the Green River Basin.

The Chadron chert from the Chadron Formation (White River Group, Oligocene) (Ahler 1977a:134) includes a number of Paleozoic materials available in the Badlands of South Dakota. An atypical secondary source is found in the Beaver Divide Conglomerate of the White River Formation (Oligicene); Lohman and Andrews (1968:39) describe the presence of cherty limestone slide blocks from Wagon Bed Formation (Eocene) incorporated in the conglomerate.

"Sweetwater agates" (Love 1961), probably an erosional relic of the Arikaree Formation (Miocene) (Zeller and Stephens 1969:22), are available in the basins of the Wyoming Basin Province. "Moss agates" noted by Craig (1983:44-45) in the eastern Powder River Basin have an uncertain provenance, but may also derive from the Arikaree Formation.

Ahler's (1986) "primary" source area of Knife River "flint" is one of the best known secondary sources on the northern Plains. Quarry pits were excavated in Quaternary glaciofluvial and alluvial gravels to procure the material and the Knife River chert was clearly an important local resource. Scenarios envisioning the transport of Knife River chert into the southern Plains may be exaggerated because similar materials are available in abundance throughout the region. However, Knife River chert is present in river channels farther east and south along the course of the Missouri River.

Rainy Buttes "silicified" wood (Loendorf, Kuehn et al. 1984) from southwestern North Dakota is implied to be a secondary source, but the description of its occurrence (1984:335) is inadequate to determine the true nature of the deposit. Loendorf, Kuehn et al. (1984) indicate the size of the pieces grades up to small boulders (>25cm), but make no mention of other lithologies, if present. The material apparently occurs in terrigenous deposits forming the Rainy Butte feature and the material may not represent redeposited materials. From the available description, it probably should be defined as a primary source locale.

Formational Processes

Igneous and metamorphic formational processes are controlled by heat and pressure of formation, cooling rates, and source rock composition. They occur in landscapes that are relic of the processes involved, displayed as either a constructed geological terrane or an erosional remnant that is characteristic of lithologies present and processes involved in formation. Sedimentary lithic sources share much the same character in outcrop, within a range of variation, and similarly share geochemical environments of formation regardless of time of formation related to the host rock units.

Sedimentary silica deposition is controlled by alkalinity in aqueous environments, and in most cases, alkalinity is controlled by carbonate and bicarbonate in solution (e.g., Drever 1988:99-122), which in turn is affected by atmospheric CO_2 in near surface environments or by ground water with either atmospheric or an auxiliary source of CO_2. SiO_2, as quartz or amorphous silica, is relatively insoluble in low pH conditions, but solubility increases exponentially around pH 9 and above independent of solution Eh or pe. The solubility of amorphous silica and volcanic glass are somewhat elevated compared to crystalline quartz. It is not by accident that most near pure silica sedimentary lithologies occur in association with calcareous rocks or that most near pure silica lithologies used prehistorically are found in Tertiary stratum with volcanic provenance.

The formation of cherts, porcellanites, and orthoquartzites are classified as penecontemporaneous, authigenic (or diagenetic), and epigenetic. Penecontemporaneous cherts form at or near the time of deposition of the host rock, outcrop in beds or bedded nodules, and occupy more or less specific strata within a stratigraphic sequence. Authigenic (or diagenetic) cherts are nodular and form after deposition of the host rock through chemical unmixing, stratigraphically confined in zones. Epigenetic cherts form during subaerial weathering of silica bearing rocks, generally forming small nodules in open terrain, or more massive deposits in brecciated zones or karst features. Epigenetic silica rocks are always associated with and below a stratigraphic contact. Replacement cherts are most commonly fossiliferous (the single exception is true oolitic cherts) and formed through either authigenic or, less commonly, epigenetic processes. Porcellanites and orthoquartzites can form penecontemporaneously, authigenically, or epigenetically, although the latter types are most common.

Penecontemporaneous or Magadi type cherts (after Surdam and Eugster 1976), most commonly begin formation as silica gel in hypersaline, hyperalkaline bodies of water, playa lakes or shallow, stratified lakes, for example, and are precipitated by fresh water input. Hypersaline, hyperalkaline waters increase silica solubility. Fresh water input from surface drainage, or from less alkaline ground water, affects pH and silica solubility. These cherts are variegated, depending on impurities and Eh conditions, and form in stratified beds or as bedded nodules. The quantity of soluble silica in solution controls whether beds or nodules will form. Banding is common in these cherts, and relic of clastic deposition (porcellanite after solidification) in varves, concretion formation (dolomite and dolomitic concretions are preferentially silicified; Leeder 1982:307), or biologically produced in the case of algal or stromatolitic banding. These types of cherts display mottling relic of wave action and bioturbation, soft sediment deformation features, and cracks relic of subaerial exposure. Rip-up clasts (e.g., mud chips) from drying mud flats are sometimes apparent.

Nodules form in periodically silica deficient waters, and are near pure silica in the interior and porcellanitic on the exterior. Nodules are most common in marine and lacustrine limestones, dolomites, and marlstones where they form either penecontemporaneously or authigenically. Flint is not stratigraphically bounded, and true flints are authigenic rather than penecontemporaneous, forming exclusively in chalk cliffs from biogenic opal (Deer et al. 1966:351).

Penecontemporaneous porcellanites and orthoquartzites form in marine or lacustrine littoral, sublittoral, and mudflat facies rocks and are produced by changing pH conditions initiated by migration of fresh water through sediment saturated with hypersaline, hyperalkaline pore waters (Knauth 1979). Silicification occurs along the migration front. Banding or other features in these deposits are preserved sedimentary features rather than produced. Migration is affected by sedimentological character and bedding, and porcellanites and orthoquartzites formed through this process are commonly platy in exposure.

Authigenic (diagenetic) cherts, porcellanites, and orthoquartzites form after deposition of the host unit. The process involves advection or diffusion transport of dissolved silica to precipitation sites or chemical unmixing (Jackson 1970:173), some possibly due to moderate pressures (near surface) and geothermal gradients. Flint describes dark nodular, biogenic cherts derived from organic silica tests in chalk cliffs (Deer et al. 1966:351).

Epigenetic cherts, porcellanites, and orthoquartzites originate via subaerial weathering of silica bearing calcareous sediment or rock, characteristically contained in brecciated or karst zones. Nodules form in brecciated zones (Krumbein and Sloss 1963:184). The presence of diffuse mottling, sharply defined globules, manganese dendrites, and clastic inclusions identify cherts and opals formed in this environment. Weakly developed epigenetic zones produce small, opaque cherts and porcellanitic cherts. Epigenetic porcellanites and orthoquartzites, called silcretes, are associated with fossil soils formed in tropical climates (Leeder 1982:308), more commonly in quartz clastic sediments subjacent to coal or lignite beds (Goldschmidt 1958:367). Root casts and worm burrows (fucoids) are common features of these materials.

Replacement cherts represent silica deposition in void spaces vacated by other materials (organic compounds and $CaCO_3$ polymorphs most commonly), and most are fossiliferous. Permineralized wood (petrified wood is an inaccurate definition), algae, stromatolites (colonial algae), and coquinas (rocks composed of invertebrate hard parts) are examples. Silica permineralized wood is easily recognized by relic wood features. Algal cherts exhibit bifurcated banding or diffuse concentric laminae (on logs) in short lived environments. Stromatolitic cherts are silicified algal colonies or stromatolites in reefs. Silicified coquinas are composed of invertebrate hard parts, most commonly gastropods or ostracods in Tertiary deposits, and brachiopods, graptolites, and corals in pre-Tertiary deposits.

The only nonorganic replacement chert regularly used as lithic material is oolitic chert. Most Paleozoic cherts in the eastern Plains and the adjoining areas of the Central Lowlands are oolitic replacement cherts. Oolids (also ooids or oolites) are $CaCO_3$ concretionary spheres produced by gentle, multidirectional water motion. Calcium carbonate gradually accretes around a particle of organic or inorganic origin. Ostracod cherts are frequently misidentified as oolitic, however, some of the ostracod cherts from the Tipton Member of the Green River Formation exhibit oolitic accretions surrounding ostracod carapaces.

Conclusion

The recognition and identification of lithic materials in archaeological site assemblages has always been a vital aspect of archaeological research. In an obtuse way, lithic materials loosely indicate population ranges or exchange networks. Procurement sites and activities at procurement sites provide clues to prehistoric behavior, and perhaps indicate levels of economic importance of some resources.

Identification of lithic resources in assemblages remains a problem. Yet, lithic materials from the various source strata have explicit characteristics that identify them to a specific source rock. While color remains the least useful criteria for identification for most materials, formational processes remain the most important. Features displayed in specimens identify the process of formation, and other clearly identifiable traits—mineral content, UV fluorescence, and fossils—confine materials to a geologic period. It is entirely possible to assign chipped lithics and debitage to specific sources, but other difficulties are apparent.

There are limits to the complete understanding of prehistoric lithic procurement behaviors. While it is possible to state firmly that such a material was ultimately derived from such a source, it remains a matter of conjecture in areas away from procurement sites exactly how the materials came to the sites. Primary deposits are restricted to physiographic areas, such as the mountain cores, outer and inner cuestas, or tablelands discussed above. Almost without exception, however, all the sedimentary and Precambrian materials are present in secondary deposits that extend far out into the Rocky Mountain Basin interiors and far out into the Plains.

4 Rock Art of the Northwestern Plains, by Julie E. Francis

The Northwestern Plains, extending along the eastern slopes of the Rocky Mountain cordillera into the shortgrass plains from Alberta to northern Colorado, contains a bewildering array of aboriginal rock art. Prehistoric and historic Native Americans executed human, animal, and abstract forms utilizing all known techniques, including pecking, engraving, abrading, and painting. Human forms range from small, simple stick figures to near life-size figures with elaborate headdresses, details of heads, hands, feet, and genitalia, clothing, and weaponry. Numerous animal species, ranging from reptiles to grizzly bear, have been depicted. Abstract forms include geometrics, circles, spirals, dots, lines, and other widely recognized symbols such as shields, tipis, and spears.

Recent research in the Northwestern Plains has been on the forefront at rock art research in North America, with the utilization of new advances in dating techniques. These studies have provided strong evidence for a much greater antiquity of rock art than previously suspected, extending perhaps to Paleoindian times. In addition, reexamination of the ethnographic literature has provided new insights into the interpretation, use, and function of rock art sites by Native Americans in the Northwestern Plains.

Location and Distribution

Rock art sites, ranging from single figures or panels to complexes of sites several kilometers long, are known throughout the Northwestern Plains. As noted by Francis (1991), rock art sites tend to be located in and around major uplifts, primarily where streams issue forth from the mountains, as these areas afford suitable exposures of rock surfaces on canyon walls and in caves. Some rock art sites are located in the open plains in situations where geologic factors, such as incision by stream courses into underlying bedrock or erosion of less resistant layers, have created exposures of suitable sandstones and limestones. Rock art also occurs on boulders strewn along talus slopes and hogbacks in the open plains.

Major rock art complexes occur throughout the entire study area (Figure 30). Most notable among these are the Black Hills in eastern Wyoming and western South Dakota (Keyser 1984; Sundstrom 1984); at Castle Gardens in central Wyoming (Renaud 1936); the eastern slopes of the Wind River Mountains extending along the Wind River and into the southwestern Bighorn Basin (Francis et al. 1993; Gebhard 1969); the eastern and western slopes of the Big Horn

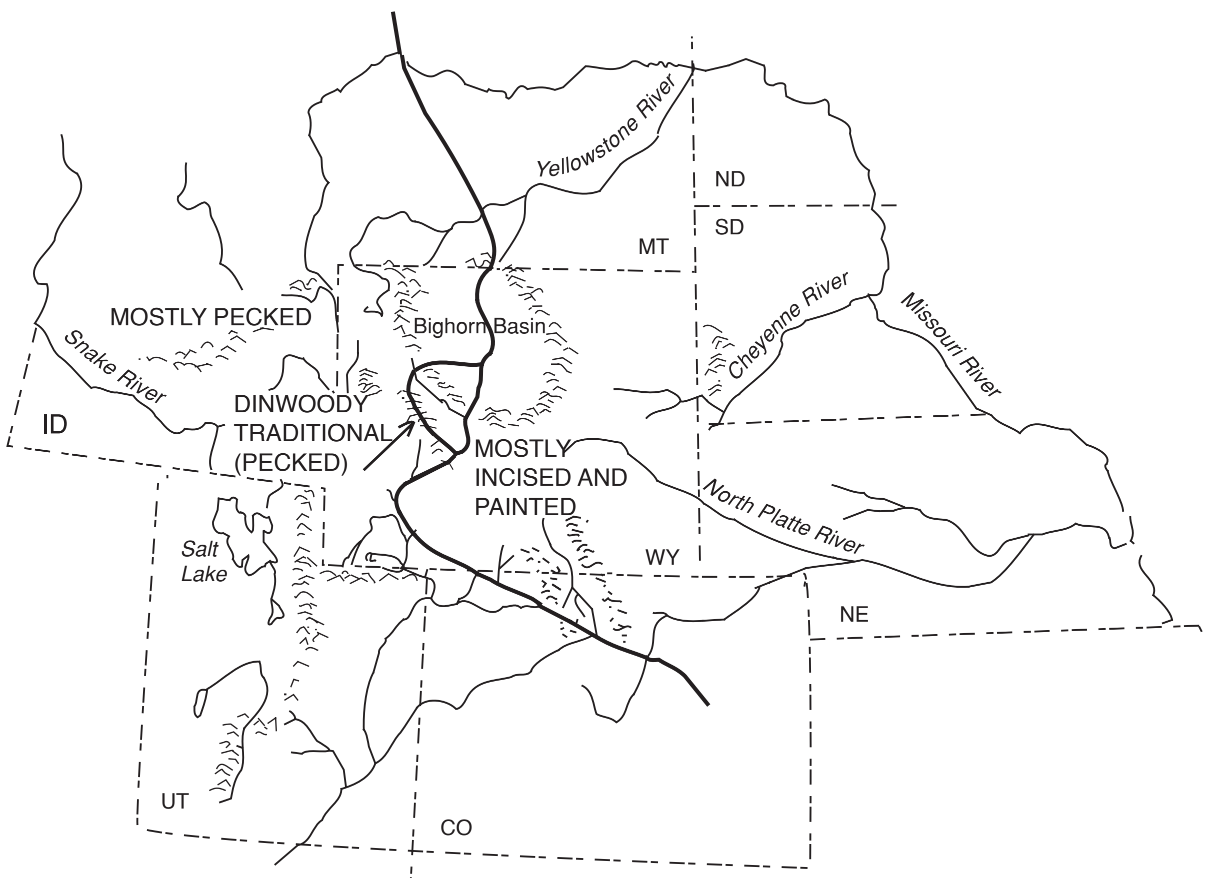

Figure 30. Distribution of major rock art traditions in the Northwestern Plains.

Mountains (Bies 1993; Loendorf and Francis 1987); throughout the Pryor Mountains in southern Montana (Loendorf 1991; Loendorf and Porsche 1985; Loendorf et al. 1990); along the Yellowstone River and Missouri River in central Montana (Conner 1984; Mulloy 1958); and into southern Alberta along the Milk River (Keyser 1977b; Magne and Klassen 1991).

As noted by Frison (1978), the location of rock art sites is neither random nor predictable, except in a very general sense. Although Francis (1991) suggested that some of the variation in density of rock art sites may be due to the intensity of investigations, there clearly are areas where the density of rock art sites is much higher than surrounding areas. Such is the case along Wind River valley and in the southwestern quarter of the Bighorn Basin, which has been long recognized for its unusual and spectacular rock art, generally termed Dinwoody tradition or style (Francis 1994; Grant 1967; Wellmann 1979). However, even within a given area, the location of rock art cannot readily be predicted. That is, rock art sites cannot be found simply by identifying the appropriate geologic exposures. One drainage valley may contain hundreds of figures and panels, while the next valley, with identical exposures of sandstone, may contain none. There also are large areas with major rock exposures that do not contain rock art, e.g.,Yellowstone Park and Jackson Hole. The western slopes of the Wind River Mountains also appear to be devoid of aboriginal rock drawings.

Factors affecting the location of rock art sites may have as much to do with aboriginal spiritual beliefs and practices, such as vision questing, as with factors which have been traditionally identified in archeological models (e.g. type of bedrock, exposure or aspect, vegetation, water sources, etc.). It may be that in order to model rock art site locations, it will become necessary to examine ethnographic and ethnohistoric accounts of Native American groups, in addition to natural environmental variables.

Motif, Style, and Spatial Distributions

Traditionally, rock art studies have been plagued by a plethora of terms relating to design elements, motifs, and styles, largely in the realm of art history. The result has been total confusion, such that comparative studies between sites have been nearly impossible, and it has been difficult to determine whether any two investigators are even discussing the same phenomenon. However, when one examines rock art in the Northwestern Plains from the perspective of technique of manufacture, along with the occurrence of several widely recognized types of figures or motifs, a relatively simple but important pattern of spatial distributions becomes apparent.

Rock art can be made by several techniques: pecking, incising, abrading, painting, and combinations of these techniques. All types of rock art manufacture occurred in the Northwestern Plains. From southern Alberta at Writing-on-Stone (Keyser 1977b; Magne and Klassen 1991), into central Montana, in Wyoming east and south of the Bighorn River, and continuing south into Colorado and extending east throughout the shortgrass prairies, incising and painting are the most common modes of manufacture. Pecking is relatively uncommon. Rock art in this portion of the study area was made both by deeply incising lines into the rock and by fine scratching. In some cases, the rock surface was abraded or smoothed prior to producing specific figures. Sometimes paint was applied to incised figures. This combination of techniques occurs in Montana at sites such as Bear Gulch and Valley of the Shields, and at Castle Gardens in central Wyoming (Loendorf 1990:50).

Pictographs are also fairly common in central Montana and southern Montana, the eastern slopes of the Big Horn Mountains, and in the Black Hills. Among the most well known examples are Pictograph Cave (Mulloy 1958), several sites along the Middle Fork of the Powder River (Loendorf and Francis 1987), and in Craven Canyon in the Black Hills (Sundstrom 1987) (Figure 31).

Coinciding with the distribution of incised and painted rock art are two well-known types of human figures: shield-bearing warriors and V-necked figures (see also Schuster 1987:31). Both are among the hallmarks of Plains rock art. Shields and shield-bearing warriors were first described by Mulloy (1958) based on work at Pictograph Cave. They are among the most common rock art motifs in Montana (Loendorf and Porsche 1985).

Shield-bearing warriors are highly variable, but they usually consist of a human figure with a circular shield that covers the torso from the knees to shoulders (Figure 32). Sometimes hands and arms protrude from behind the shield; these occasionally hold a spear or bows and arrows. Legs can be decorated with fringe, and heads often show details of eyes, nose, and mouth, and headgear. The shields themselves are often decorated (Loendorf and Porsche 1985).

V-necked figures are closely associated with shield-bearing warriors, and are an important variant of the rectangular-bodied human. They exhibit a V-shaped or pointed shoulder line (Figure 33). There are many types of V-necked figures, and Magne and Klassen (1991) suggest that evolutionary trends relating to changes in Plains Indian culture during the Late Prehistoric and Historic periods can be discerned.

Other common design elements associated with shield-bearing warriors and V-necked figures include numerous abstract designs, circles, ovoids, hatching, spears, arrows,

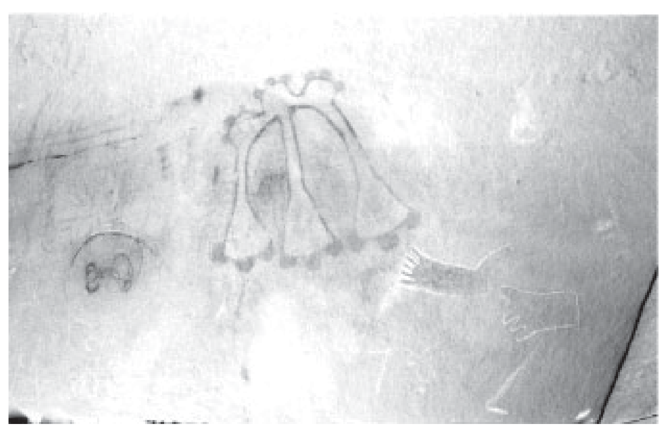

Figure 31. Pictographs from Craven Canyon, South Dakota.

Figure 32. Incised shield-bearing warrior and other designs from Trapper Canyon, Big Horn Mountains, Wyoming.

Figure 33. Incised V-neck figures from the Big Horn Mountains, Wyoming (Jameson 1977).

animal tracks, and several types of animals. Among the most common type of animal found with these figures are bears and bear claws (see Loendorf and Porsche 1985). There is also a clear association of these types of figures with the horse (Conner 1984), and Loendorf and Porsche (1985) note that historic items such as horses and guns are exclusively made by fine line incising.

Pecked rock art has a much more restricted spatial distribution and is most common in the western portion of the study area. In general, pecked rock art occurs on the east slopes of the Wind River Mountains, along the Wind River valley, and extending north into the Bighorn Basin and southern Montana. The exception to this is Whoop-Up Canyon and a few other sites in the Black Hills (Sundstrom 1984). Although pecked rock art is not common in the Black Hills, Whoop-Up Canyon is an extremely large complex of petroglyphs, dominated by pecked human and animal figures very similar to pecked figures in the Big Horn and Pryor Mountains. It may be that Whoop-Up Canyon is the easternmost outlier of pecked rock art in the Northwestern Plains.

Two distinct styles of pecked rock art can be distinguished. The first has been termed the Dinwoody style or tradition (Francis 1994; Wellmann 1979). Dinwoody rock art is well-known for the large, sometimes near-life size, elaborate human figures (Figure 34). Nearly all Dinwoody human figures exhibit headdresses; multiple sets of limbs may be represented often with bizarre orientations. Secondary human figures can be incorporated into the body of a larger human figure, and many human glyphs exhibit intricate lines pecked within the torso. Animals are closely associated with human figures. These are often large artiodactyls, mountain sheep, antelope, and canines (Francis 1989, 1994).

Gebhard (1969) originally noted the limited spatial extent of Dinwoody rock art. Major Dinwoody sites are located along the creek valleys north and south of Dinwoody Canyon in the Wind River Mountains, extending down the Wind River to what is now Boysen Reservoir (Stewart 1989; Tipps and Schroedl 1985; Wheeler 1958), and north into the southwestern quarter of the Bighorn Basin. Dinwoody rock art does not occur east of the Bighorn River. In essence, it encompasses the valley system of the Wind River and the western portion of the upper Bighorn River (Gebhard 1969). It is also notable that within this circumscribed area, incised rock art containing shield-bearing warriors and V-necked figures is almost nonexistent (Francis et al. 1993).

The other distinctive variety of pecked rock art has been termed the *en toto* pecked style (Loendorf and Porsche 1985:69-70). *En toto* pecked rock art includes smaller, much simpler human and animal figures which have been made by completely pecking the entire figure (Figure 35). This type of rock art occurs in the Bighorn Basin and extends into the southern portion of Montana. It is not found north of the

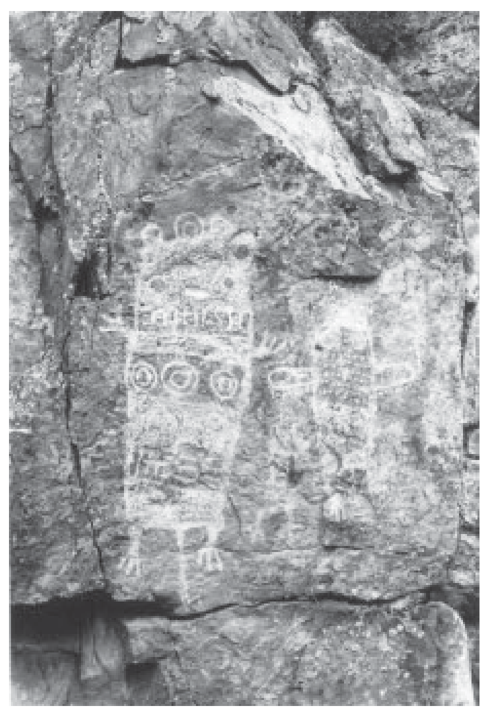

Figure 34. Dinwoody tradition petroglyphs from the Ring Lake area, Wind River Mountains, Wyoming.

Figure 35. En toto *pecked figures from Petroglyph Canyon, Pryor Mountains, Montana.*

Pryor Mountains in Carbon County, Montana (Loendorf and Porsche 1985). Many figures that could be classified as *en toto* pecked occur at Dinwoody sites, perhaps suggesting a close relationship between the two varieties of rock art. *En toto* pecked figures also occasionally occur at incised and painted sites east of the Bighorn River. However, they are relatively rare at these sites, generally appear older, and are often superimposed by incised figures.

New Advances in Rock Art Dating

Prior to the mid-1980s, most rock art in the Northwestern Plains was presumed to date to the protohistoric and historic periods (Gebhard and Cahn 1950; Hendry 1983). However, investigations by Loendorf at several sites in southern Montana provided the initial data indicating that some rock art was much older than previously suspected. First, dates of around 1,200 to 850 years ago were suggested for the *en toto* pecked style, based on cultural remains found near rock art panels at the Petroglyph Canyon site (Loendorf 1984). Cultural debris at the base of a panel of incised and painted shield-bearing warriors at the Valley of the Shields site yielded radiocarbon dates of 950 ± 80 and 870 ± 80 B.P. (Loendorf 1990). Abrading tools found in the dated cultural level had the same red paint used in the petroglyphs adhering to the use surfaces, thus positively associating them with the manufacture of the rock art.

In addition, investigations at the Legend Rock site in the southwestern Bighorn Basin provided the first chronological information for Dinwoody rock art. At this site, charcoal from cultural levels partially burying and well below a common type of anthropomorphic figure was radiocarbon dated to 1920 ± 140 B.P. and 2180 ± 130 B.P., indicating that the figure was manufactured around 2,000 years ago (Francis 1989).

This chronological information, along with refinements in accelerator mass spectrometry (AMS) radiocarbon and rock varnish or cation ratio (CR) dating developed by Ronald I. Dorn, provided the impetus to develop a CR dating curve for the Bighorn area in Wyoming and southern Montana (see Francis et al. 1993 for a description of these techniques). Although CR dating is not without controversy (see Francis et al. 1993), results are extremely promising. Multiple samples of organic material from the same petroglyph have yielded overlapping ^{14}C determinations. Different samples taken from the same figure have yielded contemporaneous dates, and samples taken from superimposed figures provide ages consistent with the superimposition (Francis et al. 1993).

A total of 19 Dinwoody petroglyphs, seven *en toto* pecked figures, and two outline pecked or incised figures have now been dated by AMS and CR techniques (Francis et al. 1993; Francis 1994). Dates for Dinwoody petroglyphs range from over 6,000 to 200 years B.P., spanning the Early Archaic and Historic periods. *En toto* pecked figures appear to primarily date to the Late Archaic and Late Prehistoric periods, with dates ranging from 2,600 to less than 1,000 years ago. The only dated fine line incised figure is less than 1,000 years old and may, in fact, be Historic period, consistent with dates suggesting for this manufacturing technique (Loendorf and Porsche 1985).

A CR dating curve has also been developed for the Black Hills based upon data from the Whoop-Up Canyon site. Although results have not been formally published, over 50 dates from a variety of fully pecked animal, human, and abstract figures have been obtained (Tratebas 1993). These dates span over 9,000 years, beginning in Clovis times, and suggest that pecked rock art in the Northwestern Plains may be extremely ancient. This long span of dates is also consistent with that from the Bighorn area.

Techniques for direct ^{14}C dating of rock paintings are also being developed (Chaffee et al. 1994a; Russ et al. 1990, 1991). Briefly, the ability to date pictographs requires that organic materials were incorporated into the paints, that it has not exchanged with either older or younger carbon, and that it can be extracted without contamination. Low temperature, low pressure plasma extraction systems have been used to successfully date pictographs in Texas, Utah, Brazil, and Montana (Chaffee et al. 1994a). One Montana rock painting has now been dated. This date was from a fully painted (i.e. the entire body was painted and not illustrated in outline form) human form from Elk Creek Cave in the Pryor Mountains. The sample yielded a date of around 840 ± 50 B.P. (Chaffee et al. 1994b).

New Avenues for Interpretation and Research

Rock art has traditionally been viewed as having limited interpretive value, largely because of a lack of chronological control and due to problems with classification and comparability of studies. However, recent investigations hold much promise for increased interpretive and explanatory studies. Several of these utilize time-honored techniques of archeological inquiry, including excavation, classification, seriation, multi-disciplinary approaches (Loendorf 1994), and ethnographic analogy (Loendorf 1993; Whitley 1994).

Rock art sites are commonly perceived as having little excavation potential, and the association of cultural materials found at the base of rock art panels has always been questioned. However, it has been excavation which provided the initial chronological data for Northwestern Plains rock art and has recovered tools and items that can be directly associated with rock art manufacture (Francis 1989; Loendorf 1990). Excavation at the base of a Dinwoody panel in the Bighorn Basin yielded several broken steatite sucking tubes thought to be part of a shaman's tool kit (Frison and Van Norman 1993). While direct association of the rock art and the artifacts cannot be demonstrated, the occurrence of these items at a rock art site is not likely coincidental, and offers valuable clues about the context in which the site might have been used.

Pollen sampling at rock art sites has also yielded intriguing results. In the Pinon Canyon area of southeastern Colorado, cattail pollen (*Typha latifolia*) has been recovered from features in rock art sites thought to be associated with Apache rituals, which extensively used cattail pollen (Loendorf 1994). No other samples from the same area showed any cattail pollen. Furthermore, within the Pinon Canyon region, cattail pollen only occurs in areas where it is currently growing. Thus, the likelihood that the pollen was introduced by human means is great.

In addition, a wide variety of pollen from medicinal plants, including tobacco (*Nicotiana* sp.), has been found from soil samples at the base of a rock art panel in Frozen Leg Cave overlooking Bighorn Canyon in Montana. The rock art panels in this cave contain plant figures strongly reminiscent of Crow icons of tobacco found on medicine bags (Loendorf 1994). Pollen samples from caves in similar elevations and settings in Bighorn Canyon did not produce the same types of pollen, and the analyst concluded that wind transport of these species into Frozen Leg Cave was not likely (Loendorf 1994).

Improved classification and typological studies can also yield insight into the use of rock art. Loendorf and Porsche (1985) suggest the use of descriptive types to designate a group of glyphs exhibiting similar explicitly defined attributes, and reserve the term, style, for a descriptive type or series of descriptive types that can be placed into specific temporal and spatial frameworks. Using this approach, they defined two specific styles in the Pryor Mountain area, *en toto* pecked and the fine line incised style. Using this same basic approach, Francis (1994) defined several types of Dinwoody human and animal figures and used AMS and CR dates to seriate petroglyph types. This analysis revealed changes in the types of Dinwoody figures manufactured over time and led Francis (1994) to suggest an evolutionary sequence in which relationships between humans and animals changed, possibly indicative of changes in shamanistic and ritual practices.

Ethnographic analogy has rarely been used to interpret rock art in the Northwestern Plains, largely because many of the Historic period tribes are presumed to be recent migrants to the area, and thus did not make or use rock art. As we see below, reexaminations of the ethnographic literature in both the Northwestern Plains and in California call into question these notions, and are providing rich avenues for the interpretation of prehistoric rock art. Furthermore, such studies may offer valuable information regarding prehistoric migrations into the Northwestern Plains and the antiquity of some Historic period tribes, specifically the Shoshone.

Research by Whitley (1992) indicates that there are numerous ethnographic accounts of rock art production continuing into the Historic period by the Shoshone. Furthermore, a number of ethnographers recorded the use of rock art sites for vision quests, which were known as *poha kahni* or house of power (Whitley 1992). Whitley (1992) also notes that the Numic vision quest was not a generalized puberty rite or life crisis ritual, but rather was undertaken by shamans and shaman-initiates to acquire supernatural power.

Whitley (1994) reviews numerous ethnographic accounts in which informants mentioned that rock art was made by "rock babies," "water babies," "mountain dwarves," or "little people" known as the *nynymbi* among the Wind River Shoshone. He further argues that ethnography indicates that these beings were very powerful spirit helpers that a shaman obtained in an altered state of consciousness. Informants stated that the art was made by a rock baby because no semantic, linguistic, or epistemological distinction was made between the actions of a shaman and his dream helper. In other words, to say that a rock baby made rock art was to affirm that it was engraved by a shaman (Whitley 1994).

Loendorf (1993) discusses a strong connection between Dinwoody rock art sites and shaman's vision quests among the Wind River Shoshone and recounts the tale of a specific vision quest involving a *nynymbi* known as Seven Arrows which occurred in the Dinwoody vicinity. Other creatures, sometimes classified with rock or water babies and known as *pandzoavits*, apparently were dangerous and mysterious ogres, described as giants who live in water and sleep on rocks (Loendorf 1993). Hultkrantz (1987:50) illustrates a petroglyph identified as a *pandzoavits* which Loendorf (1993) considers to be an excellent example of Dinwoody rock art, and has been dated as old as 3000 years (Francis et al. 1993). Using this line of evidence, Loendorf (1993) concludes that Dinwoody rock art is the product of the Eastern Shoshone, and that these people have a much greater antiquity in the Northwestern Plains than suggested by other investigators who feel that Numic speakers migrated out of eastern California across the Great Basin sometime after A.D. 1000 (Butler 1981; Madsen 1975; Wright 1978).

Also, by implication, these lines of evidence give considerably greater confidence for the use of the ethnography of the Wind River Shoshone to interpret Dinwoody rock art, and Loendorf (1993) suggests that a particular figure found at one and possibly two sites in the Bighorn Basin may be representations of a particularly powerful *pandzoavits* known as Water Ghost Woman (Figure 36). Loendorf (1993) also interprets several other features of Dinwoody sites in terms of ethnographic information about the habits of *nynymbi* and *pandzoavits*.

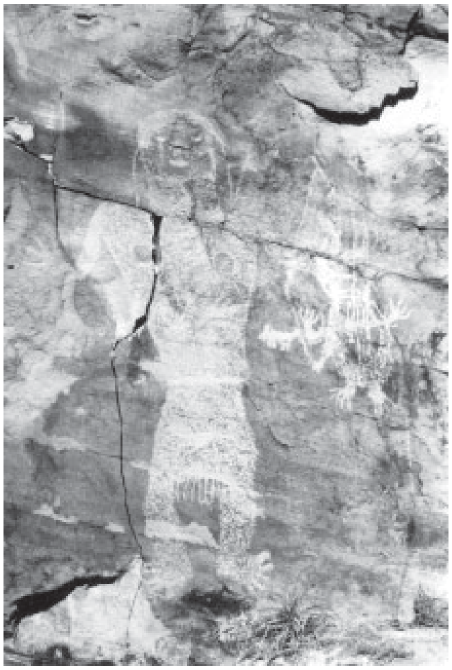

Figure 36. Dinwoody petroglyph inferred to be the supernatural Shoshonean being, Water Ghost Woman, southwestern Bighorn Basin, Wyoming.

Summary

Present data suggest that two major groupings of rock art can be identified within the Northwestern Plains: pecked and incised/painted. The incised/painted tradition occurs predominantly east of the Big Horn Mountains and contains symbols such as shield-bearing warriors and V-necked human figures. Pecked rock art most often occurs in the western portion of the Northwestern Plains, predominantly on the eastern slopes of the Wind River Mountains, the southwestern portion of the Bighorn Basin, the extreme southern portion of Montana, with occasional outliers as far east as the Black Hills.

Symbols within pecked rock art are much different than those occurring with incised and painted styles. Shields do not occur, and humans are often depicted as elaborate, supernatural-appearing beings within the circumscribed area of Dinwoody rock art. The types of animals depicted also differ between pecked and incised/painted rock art. Pecked rock art appears to have a much greater time depth than incised/painted types, extending perhaps to the Paleoindian period. The best available evidence for incised and painted shield-bearing warriors thus far indicates that these types of figures are no older than 1,000 years. Within the Bighorn Basin, these two major rock art groupings overlap, with a complex pattern of concurrent rock art traditions in different portions of the area.

Other archeological investigations, along with reviews of the ethnographic literature, strongly indicate that much rock art in the Northwestern Plains may be associated with shamanistic and ceremonial practices, and that these practices may well have changed through time. There is a clear association of Dinwoody rock art with shamanistic practices, both through direct archeological evidence and ethnographically. There are strong spiritual connections between pecked rock art in California and several Shoshonean tribes, and Dinwoody rock art and the Wind River Shoshone. Rock art studies may provide the most convincing evidence to date for the antiquity of specific cultural groups in the Northwestern Plains. Use and cultural affiliations of incised/painted rock has not been as thoroughly researched through the ethnographic literature. However, spatial distributions suggest that this rock art is the indigenous rock art of the Plains area.

The Northwestern Plains is at a crossroads of the North American continent and encompasses portions of both the Great Plains and Great Basin culture areas. It should not be unexpected that rock art exhibits a similar degree of diversity as the prehistoric and historic cultures of these areas. Both new and old analytical techniques are opening new lines of inquiry into significant questions which have not been readily addressed solely through projectile point or ceramic types. As analytical techniques improve, future studies, grounded firmly in anthropological and archeological method and theory, should continue to provide new information into the prehistory and history of the Northwestern Plains.

5 Archeology of the Middle Missouri, by Dennis L. Toom

If the Great Plains of North America can be described as a "land of sun and wind and grass" (Wedel 1961), then the Middle Missouri subarea is best characterized as a land of sun and wind and grass and water and trees (Figure 1). The Middle Missouri subarea consists of the Missouri River Valley and immediately adjacent areas of the upland plains running through the central parts of North Dakota and South Dakota. Environmentally, the Middle Missouri is essentially an extension of the Temperate Deciduous Forest biome (the Eastern Woodlands), providing habitat for woodland communities in the midst of the Northern Temperate Grassland biome (the Great Plains) (Shelford 1963). It is this "eastern flavor" of the Middle Missouri that sets it apart from other subareas of the Plains and, in large part, accounts for its distinctive cultural developments during late prehistoric times. For purposes of archeological study, the Middle Missouri is divided into six regions (Figure 37).

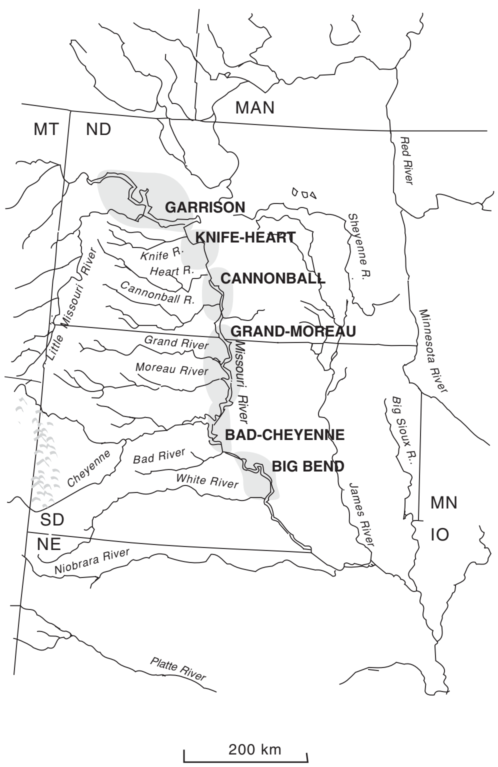

Figure 37. Archeological regions of the Middle Missouri subarea of the Plains (from Lehmer 1971:Figure 21).

Physical Environment

The physiography of the Middle Missouri subarea is dominated by the valley of the Missouri River. The present course of the Missouri represents the integration of three former drainage basins as a result of glacial diversion during the Pleistocene (Thornbury 1965). In the Dakotas, the Missouri River has cut a deep, trenchlike valley into the Missouri Plateau, a major feature of the Great Plains physiographic province (Fenneman 1931; Hunt 1974; Thornbury 1965). Thus, the Missouri Valley of the Dakotas is often referred to as the Missouri Trench (Flint 1955:14-15; Thornbury 1965:290-291).

Throughout much of the Dakotas, the Missouri Trench lies at the interface of two divisions of the Missouri Plateau—the Glaciated Missouri Plateau section to the north and east and the Unglaciated Missouri Plateau section to the south and west. More specifically, to the north and east of the trench are the Missouri Coteau and the Missouri Escarpment (Bluemle 1977; SDGS 1971a). In the eastern Dakotas, the Missouri Escarpment separates the Great Plains proper from the Central Lowlands province. The gently rolling hills of the Missouri Coteau border the eastern side of the Missouri Trench, and are mantled with Wisconsinan glacial drift. The numerous streams that dissect the region often cut deeply enough to expose the underlying Cretaceous bedrock.

To the south and west of the Missouri River trench is a landscape of smooth, rounded hills and occasional high, flattopped buttes that is part of the Unglaciated Missouri Plateau. In South Dakota, this area is referred to as the Pierre Hills (SDGS 1971a); in North Dakota it is known as the Coteau Slope (Bluemle 1977). The area west of the trench was unglaciated, except for a narrow band immediately adjacent to the trench where scattered glacial boulders and isolated pockets of glacial till (Crandell 1953; Flint 1955).

Geologically, the Missouri Trench is a fairly young feature, having formed during the Illinoian stage of the Pleistocene epoch (Crandell 1953; Flint 1955). As the Illinoian ice mass advanced south and west across the Dakotas, it blocked the predominantly eastward-flowing streams of the region. These streams, along with meltwater from the ice, were diverted southeastward along the ice margin. This event, which Flint (1955) has termed the "great diversion," established the present-day course of the Missouri River.

Wisconsinan glaciers, although largely failing to cross the trench, contributed meltwater and outwash sediment to the Missouri River (Clayton and Moran 1982; SDGS 1971b). Extensive runoff from glacial meltwater and lower sea levels at the time resulted in downcutting that went through and exposed glacial outwash deposits and underlying bedrock of the Cretaceous period. Glacial outwash deposits can be seen today in the walls of the valley, particularly on the east side of the river. The Cretaceous bedrock exposed in the valley is composed of the Pierre Shale Formation, a highly fossiliferous stratum containing marine fossils.

In the years following World War II, a series of dams and reservoirs was constructed by the U.S. Army Corps of Engineers along the Missouri River in the Dakotas (Lehmer 1971). In South Dakota, these are, in ascending order, Fort Randall Dam and Lake Francis Case, Big Bend Dam and Lake

Sharpe, and Oahe Dam and Lake Oahe. Garrison Dam and Lake Sakakawea are located in North Dakota, as is the upper portion of Lake Oahe. These dams and their reservoirs have significantly altered the physiography of the Middle Missouri subarea, especially the low-lying features of the Missouri Trench. Lake Francis Case and Lake Sharpe have inundated substantial portions of the Big Bend region; Lake Oahe covers large areas of the Bad-Cheyenne, Grand-Moreau, and Cannonball regions; and Lake Sakakawea has inundated much of the Garrison region. Only the Knife-Heart region in North Dakota remains largely unaffected by dam and reservoir construction (Figure 37).

Physiographic Zones

Following Ahler et al. (1991) and Lehmer (1971), the Middle Missouri subarea, as it existed prior to dam construction, can be subdivided into four physiographic zones: (1) the river and floodplain zone; (2) the terrace zone; (3) the breaks zone; and (4) the upland zone. Tributary streams and their valleys comprise a fifth zone combining elements of the other four. This physiographic variability undoubtedly was of significance to past human inhabitants. In this regard, Ahler et al. (1991:11) write that:

> The zoned environment in the Missouri River valley provides a rich composite of habitats and resources which has supported development of complex human cultures. The timbered floodplain provided winter shelter, wood supplies, and relatively well-watered soils suitable for agriculture practiced with stone and bone technology. The terraces above the floodplain, free from flooding, provided suitable locations for permanent settlements. Such settlements were juxtaposed between the riverine/floodplain resources, on the one hand, and the vast animal resources in the nearby and more distant upland prairies. The breaks zone provided small niches with important tree and animal species and sheltered locations for animal traps, hunting camps, and temporary settlements. In addition to being a huge hunting arena, the uplands provided promontories and locations with grand vistas suitable for religious and ceremonial observances.

Each of the four primary physiographic zones of the Middle Missouri subarea is briefly described in the following paragraphs. Flora and fauna are considered in a subsequent section.

The River and Floodplain Zone

The Missouri River itself is central to the physiographic zones of the Missouri Valley. Not only did the river shape zones, but it supplied or supported many important resources not available in abundance elsewhere in the region. Of paramount importance was a nearly inexhaustible supply of water, but the river also supported aquatic life and abundant timber resources.

The Middle Missouri floodplain was covered by a dense gallery (stream-skirting) forest that supported several species of trees and shrubs (Burgess et al. 1973). The gallery forest contrasted with the adjacent terrace surfaces which are predominantly covered by mixed grass grassland vegetation in the absence of cultivation. Tributary stream valleys of the Missouri are also wooded, and wooded draws, mainly supporting juniper, are present in the more rugged terrain bordering the river.

Today, more than 80% of the Middle Missouri floodplain has been inundated. The only substantial stretch of relatively intact channel and floodplain is in the Knife-Heart region of North Dakota, between the upper end of Lake Oahe near Bismarck and Garrison Dam. All other regions in the Missouri Valley of the Dakotas have been substantially modified in recent times, particularly by reservoir projects.

The Terrace Zone

Terraces of the Missouri River comprise a complex and variable series of Late Pleistocene and Holocene age erosional and depositional terraces. As many as four prominent terraces above the floodplain have been recorded in South Dakota (Coogan 1987); six have been identified in North Dakota (Reiten 1983), here considering Reiten's "B terrace" in North Dakota as the floodplain. Erosional terraces occur at higher elevations in the valley, while the lower-lying terraces are depositional. The highest elevation erosional terraces are actually benches bordering on the upland plains. The structure of the depositional terraces consists of alluvial sands and gravels, mainly of Pleistocene age, capped by Holocene windblown silts (Clayton et al. 1976). Extensive areas of low-lying river terrace have been inundated.

The terrace zone is critical archeologically because it is here that most recorded sites have been found, particularly on and in the low-lying depositional terraces on which the earthlodge village sites of the Plains Village tradition were constructed.

The Breaks Zone

Surface erosion and the rapid downcutting of the Missouri and its tributary streams have created, in places, steep and heavily dissected slopes rising hundreds of feet above the level of the river, a physiographic feature referred to as the "Missouri Breaks" (Rothrock 1943:34-41). The breaks zone comprises the walls of the river valley, between the floodplain and the upland zones, in the absence of well-defined terraces. Where the slopes are the steepest, the breaks are largely devoid of vegetation, consisting principally of deep gullies and erosional channels separated by high, knife-edged ridges. Where the slopes are less steep, the breaks take on a more inviting appearance as a complex of grassy coulees and wooded draws, supporting a variety of vegetation. The hills and ridges of the more rugged breaks terrain are carved out of bedrock, and often have thin caps of glacial till and/or loess. In some places, the river has cut its channel up against these hills, creating high, vertical bluffs. In other places, the breaks slope less steeply and are abutted by low-lying depositional terraces.

The Upland Zone

Those portions of the Missouri Plateau bordering on the Missouri River trench are referred to as the upland plains, which join the margins of the breaks at the lip of the Missouri

Valley. They consist of relatively flat to rolling table lands, forming the plains beyond the valley proper. The juncture of the breaks and uplands often is very abrupt, with the breaks forming a steep, high escarpment at its interface with the uplands. The uplands are located well above the level of the river, offering spectacular panoramic views of the Missouri Valley in many places. The uplands support a mixed grass prairie ecosystem.

The grassland fauna supported by the upland plains were important resources to the Amerindian peoples of the Middle Missouri. Bison were a key resource, providing native peoples with most of their animal protein and fat needs, in addition to supplying a variety of raw materials used in the manufacture of clothing, shelters (skin tents), tools, and ornaments.

Flora and Fauna

The distribution of the native flora and fauna of the Middle Missouri subarea closely corresponds to the four main physiographic zones. As mentioned above, the Missouri Valley of the Dakotas is an extension of the Temperate Deciduous Forest biome into the Northern Temperate Grassland biome. The interface of these two biomes in the subarea represents an important ecotone, offering ecological diversity not to be found elsewhere in the region. The grassland biome corresponds to the mixed grass grassland, or prairie, that covered the upland plains and river terraces. This association was dominated by various short to medium tall grasses, including western wheatgrass, blue grama, needle-and-thread, green needlegrass, sand dropseed, side-oats grama, and buffalograss. Other plants of the grassland biome are prickly pear, yucca, sage, prairie turnip, and various forbs (Johnson and Nichols 1970; Kuchler 1964; Over 1932; Weaver 1968). Mixed grass prairie interspersed with wooded draws also flourished in the less steeply sloping portions of the Missouri Breaks, but where steep slopes preclude soil formation, the breaks zone is essentially devoid of vegetation.

The forest biome corresponds to the extensive gallery (floodplain) forest once found along the Missouri Valley in the Dakotas. The floor and sheltered slopes of the valley supported stands of timber, including eastern red cedar, juniper, cottonwood, willow, elm, ash, bur oak, and box elder. Other woody plants found in the valley include common rose, fringed sage, silver sage, gooseberry, serviceberry, buffaloberry, wild plum, and chokecherry (Burgess et al. 1973). Although these species were numerous in the valley, mixed grass prairie was the dominant vegetation association in the Middle Missouri subarea.

Changes in the composition, abundance, and distribution of native flora in the Middle Missouri subarea during the past 10,000 years are poorly understood. Paleobiotic studies from nearby areas, including northeastern South Dakota (Watts and Bright 1968) and southeastern North Dakota (Cvancara et al. 1971), indicate that grassland was established as the dominant floral community at ca. 10,000 B.P., replacing boreal and mixed conifer-hardwood forests (Bernabo and Webb 1977; Webb et al. 1983; Wendland 1978; Wright 1970). Since that time, there have been fluctuations in the composition and relative abundance of species, largely in response to climatic change.

Prehistoric people influenced the natural flora. By A.D. 1000, Plains Village groups had introduced corn, beans, squash, sunflower, and tobacco into the Trench (Benn 1974; Haberman 1984; Nickel 1974, 1977). Timber stands along the Missouri River were of primary importance to the villagers, not only as construction materials for the building of earthlodge villages, but also as fuel and raw materials for tools (Griffin 1977; Zalucha 1982, 1983). Consequently, Plains Village populations may have severely impacted the gallery forest, perhaps affecting the density and distribution of certain trees (Weakly 1971). Moreover, establishment of garden plots on the floodplain required clearing of wooded areas (Will and Hyde 1917; Wilson 1917).

The native fauna of the area once included both grassland and forest species, paralleling the vegetational associations. Among the larger mammalian fauna, common grassland species included bison, pronghorn antelope, wapiti (elk), badger, coyote, swift fox, and jackrabbit. Common forest species included whitetail deer, mule deer, bear, wolf, beaver, red fox, kit fox, porcupine, striped skunk, and cottontail rabbit. These listings actually reflect habitat preference, as many species are classed as “widespread,” ones tolerant of both grassland and forest habitats or occupying the grassland-forest ecotone (Chomko 1976:37). Mink, weasel, tree squirrel, ground squirrel, raccoon, muskrat, prairie dog, and a variety of rodents and insectivores also are found in the study area (Bailey 1926; Over and Churchill 1941).

Throughout the prehistoric and early historic periods on the Plains, bison was far and away the most economically important species to native peoples (Bamforth 1988; Davis and Wilson 1978). Weighing 2,000 pounds or more, a mature bison provided a wealth of food and raw materials, including red meat, fat from marrow bones, skins for clothing and shelter, sinews for string and for sewing, and bone for tools and ornaments. Because they traveled in herds and followed predictable migratory patterns, bison could be taken in large numbers through the use of communal hunting techniques, such as drives and traps (Verbicky-Todd 1984). The economic importance of bison to native peoples of the Plains, including late prehistoric village horticulturists, cannot be overemphasized.

Numerous species of waterfowl currently live in the Middle Missouri subarea, including geese, mallards, pintails, teal, canvasbacks, redheads, white pelican, sandhill crane, and great blue heron. Other large birds found in the area are eagles, owls, and hawks. Songbirds such as warblers, swallows, sparrows, thrushes, and western meadowlarks are abundant. Native game birds include grouse, prairie chicken, and bobwhite quail.

Reptiles and amphibians are represented by numerous species of lizards and snakes, most notably the bull snake and prairie rattlesnake, and various turtles, frogs, and toads.

Channel catfish, white bass, suckers, and paddlefish are native to the Missouri River, and mussels also were present in the Missouri and its tributary streams (Over 1915).

No regional reconstructions of prehistoric faunal distributions over time have been undertaken. Excavation reports provide only compilations of species taken by prehistoric occupants (Falk 1977; Parmalee 1977; Semken and Falk 1987). Human predation has had significant impacts on certain species, particularly larger game animals such as bison and wapiti (elk), which are no longer found in the wild.

Soils

The soils of the Middle Missouri subarea are generally classified as Mollisols at the order level. At the suborder level, soils in the northern part of the subarea (North Dakota and extreme north-central South Dakota) are grouped with the Borolls, and soils in the southern part of the subarea, in central and southern South Dakota, are grouped with the Ustolls (Birkeland 1984:Fig. 2-4; see Soil Survey Staff 1975).

Mollisols are the organic-rich, dark-colored, alkaline soils typical of the steppes and prairies of the world (Soil Survey Staff 1975). Borolls are the cool to cold Mollisols of the higher latitudes and mountains, and Ustolls are the warmer Mollisols of the middle to low latitudes that are intermittently dry for long periods during the summer.

Climate

Seasonal patterns in the movements of three continental-scale air masses largely determine the climate of the Plains and the Middle Missouri subarea. In winter, air masses originating in the northern polar regions bring cold arctic air into the region. In summer, warm air flows northward from the Gulf of Mexico. Throughout the year, dry westerly air masses can sweep eastward, blocking flows of moisture-laden air from the Gulf and the Arctic. If persistent, the westerly air flows can induce drought (Borchert 1950).

The present climate of the Middle Missouri ranges from dry subhumid in the southeast to semiarid in the northwest. Most of the subarea in central North and South Dakota is at the western margin of the dry subhumid zone, with a semiarid climate immediately to the west (Thornthwaite 1941; Ruhe 1970:38). Therefore, for the majority of the area, changes in climate would oscillate between subhumid (relatively mesic) and semiarid (relatively xeric) conditions.

The modern climate is characterized by drastic seasonal and year-to-year fluctuations in temperature and precipitation. At Pierre, South Dakota, the mean annual temperature is 46.3°F (8°C), and mean annual precipitation is 17.9 inches (455 mm). The first and last frosts usually occur before May 8 and after October 6, respectively, defining an average annual growing season of about 151 days (Borchers 1980). The climate in the northern part of the subarea is somewhat harsher. The mean annual temperature at Bismarck, North Dakota, is 42°F, and mean annual precipitation is 15.15 inches. The frost-free period extends from about May 11 to September 22, for an average annual growing season of about 135 days (Stout et al. 1974).

The specifics of past climatic fluctuations in the Middle Missouri subarea are poorly known. A model of climatic change proposed by Bryson and colleagues (Baerreis and Bryson 1965; Bryson 1987; Bryson and Baerreis 1968; Bryson and Padoch 1980; Bryson and Wendland 1967; Bryson et al. 1970; Wendland 1978; Wendland and Bryson 1974) has gained some currency in the archeological literature of the Plains and adjacent regions (Anfinson and Wright 1990; Ehrenhard 1972; Lehmer 1970, 1971; Toom 1992a; Wedel 1986; Wood 1974) (Table 2). The chronology of the Bryson model is founded on statistical analyses of a global sample of radiocarbon dates (Bryson et al. 1970; Wendland and Bryson 1974). These analyses identify several relatively brief intervals during which significant changes occurred throughout the northern hemisphere in a number of climatically sensitive indicators, including vegetation, sea levels, glaciers, and archeological cultures. Building largely from a meteorological model proposed by Bryson (1966), Bryson and colleagues suggest that the episodes of climatic change reflect transitions in upper atmospheric circulation patterns, affecting the movement of air masses on a global scale.

The Bryson model, supplemented by palynological evidence from the upper Midwest, provides general insights into Holocene (post-10,000 B.P.) paleoclimates of the Middle Missouri subarea. Around 12,000 B.P., during the Late Glacial episode, the spruce forests of the Late Pleistocene extended at least as far west as the Nebraska Sandhills (Watts and Wright 1966) and as far south as northeastern Kansas (Gruger 1973). From ca. 11,500-10,500 B.P., the Middle Missouri is mapped as mixed conifer-hardwood forest (Wendland 1978). By about 10,000 B.P., during the Pre-Boreal episode, these forests had retreated from all but the extreme eastern portions of the Dakotas, and a grassland flora, similar to that of today, was established over the rest of the subarea (Watts and Bright 1968). Replacement of the conifer-hardwood forests by grassland was complete by the beginning of the Boreal episode at ca. 9500 B.P.

Between ca. 7900 and 5000 B.P., a period of much warmer and drier conditions prevailed, marking the Atlantic episode, also known as the Altithermal (Antevs 1955). A substantial decrease in human occupation of the Plains during the Atlantic interval has been hypothesized (Frison 1975), but the data are inconclusive (Benedict 1979; Reeves 1973).

Following the Atlantic episode, an essentially modern climate was established. Weather patterns and vegetation communities probably achieved stability in their present configurations by about 4000 B.P. (Wendland 1978), but there have been fluctuations above and below present-day averages. The Sub-Boreal episode (ca. 5000-2900 B.P.), which succeeds the Atlantic, was typified by cooler, moister conditions in the northern Plains. Climatic deterioration set in once again

Table 2. Postulated Climatic Episodes and Events of the Holocene and Late Pleistocene in the Great Plains Based on the Bryson Model (adapted from Wedel 1986:Table 3.1; Wendland 1978)

Episodes	Estimated Dates[1]	Events
Recent	post-100 B.P. (A.D. 1883-present)	Stronger westerlies beginning about 1883; drier and warmer in the Plains. End of the Little Ice Age, beginning of present-day climate.
Neo-Boreal	ca. 400-100 B.P. (A.D. 1550-1883)	The Little Ice Age. Colder and moister, cool summers, cold autumns; glaciers reform in the Rockies.
Pacific	ca. 800-400 B.P. (A.D. 1150-1550)	Stronger westerlies, increased Pacific airflow, return to drier conditions. Cooler and drier in the central and northern plains; steppe conditions move eastward, prairie retreats. Withdrawal of native horticultural peoples from the western central Plains.
Neo-Atlantic	ca. 1225-800 B.P. (A.D. 725-1150)	Increased moisture, warming trend peaks; more Gulf (tropical) airflow, increased summer rain in central and Northern Plains. Prairies move westward at expense of steppe. Increase in tree pollen, western Nebraska, ca. 1,000 B.P. Maximum westward expansion of native maize cultivation west of the Missouri River.
Scandic	ca. 1600-1225 B.P. (A.D. 350-725)	Warming trend, transition period. Return toward Atlantic conditions; warmer, drier in the Northern Plains.
Sub-Atlantic	ca. 2900-1600 B.P. (950 B.C.-A.D. 350)	General climatic deterioration. Summers wetter, winters stormier.
Sub-Boreal	ca. 5000-2900 B.P. (3050-950 B.C.)	Cooler, more precipitation in the Northern Plains; increased Arctic airflow.
Atlantic	ca. 7900-5000 B.P. (5950-3050 B.C.)	The Altithermal interval. Stronger westerlies, more Pacific and less Arctic airflow; climate substantially warmer and drier than present, extensive desiccation of the Plains. Maximum expansion of grasslands.
Boreal	ca. 9530-7900 B.P. (7580-5950 B.C.)	Change in atmospheric circulation patterns, rapid wasting of continental ice sheet. Climate increasingly continental; warmer summers and colder winters. Grassland predominates by ca. 9,500 B.P.
Pre-Boreal	ca. 10,800-9530 B.P. (8850-7580 B.C.)	Warming trend, grassland expansion continues. Holocene begins at ca. 10,870 B.P.
Late Glacial	ca. 13,000-10,800 B.P. (11,050-8850 B.C.)	Summers cooler, winters warmer and less severe than present; boreal forest retreats northeast, grasslands expand; mean temperatures a few degrees Celsius cooler than present.
Full Glacial	to ca. 13,000 B.P. (11,050 B.C.)	Cooler summers, milder winters than at present; boreal forest widespread in Northern Plains and south to Kansas.

[1]The date ranges assigned to each episode vary somewhat from one publication to the next (e.g., Bryson and Padoch 1980; Wendland and Bryson 1974; Wendland 1978); the dates expressed here are those used by Wedel (1986:Table 3.1).

during the Sub-Atlantic episode at ca. 2900 B.P. and persisted until about 1600 B.P. The succeeding Scandic episode (ca. 1600-1225 B.P.) is characterized as a warming trend.

The Neo-Atlantic episode (ca. 1225-800 B.P.) witnessed a peak in the warming trend and the establishment of conditions that apparently were somewhat moister than later episodes. During the comparatively warm and moist Neo-Atlantic episode, Plains Village peoples first appeared in the Middle Missouri subarea (Ehrenhard 1972; Lehmer 1970, 1971; Toom 1992a; Wood 1974). In Europe, the Neo-Atlantic episode is called the "Medieval warm period," or "Little Climatic Optimum" (Anfinson and Wright 1990:215). A return to generally drier conditions is proposed for the succeeding Pacific episode (ca. 800-400 B.P.), which is sometimes divided into the Pacific I and the Pacific II (Bryson and Wendland 1967:Table 23). The earlier Pacific I episode (ca. 800-550 B.P.) is characterized as a dry interval, whereas the later Pacific II episode (ca. 550-400 B.P.) is described as a brief return to Neo-Atlantic conditions (Lehmer 1970:121). The Neo-Boreal episode (ca. 400-100 B.P.), also known as the "Little Ice Age," witnessed a shift to a cooler and wetter climate. The Recent episode (ca. post-100 B.P.) refers to the establishment of the somewhat warmer and drier climatic conditions of the present day. Descriptions of the various climatic episodes are, at best, broad characterizations, and considerable variations undoubtedly occurred within each period (Bamforth 1990).

The temporal limits of the climatic episodes of the Bryson model vary somewhat from one region to another, as well as from one study to the next. Recent geoarcheological analysis of the Late Holocene period in the Lake Sharpe area in central South Dakota, aimed at testing the correlation of the Neo-Atlantic episode with the development of Plains Village culture, demonstrated that the Neo-Atlantic probably dates from about 950 to 700 B.P. (ca. A.D. 1000-1250) (Toom 1992a). Some regional temporal refinements to other Late Holocene episodes of the Bryson model for the Middle Missouri are also indicated by the findings of this study.

Bartlein and Webb (1982) analyzed modern and fossil palynological data to estimate annual precipitation patterns over the upper Midwest at 9000 B.P. (Early Holocene), 6000 B.P. (Middle Holocene), and 3000 B.P. (beginning of the Late Holocene). Their estimates for northeastern South Dakota, based on the pollen record from Pickerel Lake (Watts and Bright 1968), provide an impression of the relative magnitude of Holocene climatic changes in the region and are probably generally relevant to the Middle Missouri. At 9000 B.P., annual precipitation at Pickerel Lake was about 22.7 inches, near the present-day average of 21.2 inches. At 6000 B.P., during the warm, dry Atlantic episode, annual precipitation was around 17.2 inches, 19% less than present. By 3000 B.P., during the cool, moist Sub-Boreal episode, annual precipitation had risen to about 21.0 inches, again near the present average (Bartlein and Webb 1982). While the Pickerel Lake data reflect major climatic changes during Holocene, they provide no insights about smaller changes in climate that may have occurred during the Late Holocene.

History of Archeological Research

The Middle Missouri subarea has seen a long and productive history of archeological research, and in fact, is one of the most intensively studied regions in North America.

Past research has been uneven, however, in both the particular archeological entities subjected to study and the time of those studies. For example, archeological research was most active in the 1950s and 1960s, during the Interagency Archeological Salvage Program, which concentrated on excavation of earthlodge village sites. Thus, while we know a great deal about village archeology based on 1950s and 1960s method and theory, we know comparatively little about other kinds of archeological sites, and village archeology itself has lagged behind in most regions in terms of current research.

Following the structure of Willey and Sabloff's (1980) history of American archeology, the history of Middle Missouri archeology can be divided into four periods: (1) Exploration and Speculation (1738-1883); (2) Description and Early Classification (1883-1945); (3) Salvage Archeology and Culture History (1945-1970); and (4) Contract Archeology and Cultural Ecology (1970-present).

Exploration and Speculation Period (1738-1883)

The Exploration and Speculation period refers to the time when Euro-American explorers and traders began to recognize archeological sites and to speculate on their origin. The first documented awareness of archeological sites in the Middle Missouri comes with the Lewis and Clark expedition of 1804-1806, although native peoples undoubtedly had an awareness of their heritage. In portions of the Lewis and Clark journals pertaining to the Missouri River Valley of the Dakotas, recently abandoned village sites are mentioned, including identification of tribes said to have occupied the villages (Thwaites 1969; see also Moulton 1983). The locational information provided by Lewis and Clark is precise enough that many localities can be linked to recorded archeological sites (Lehmer 1966).

The major importance of the Exploration and Speculation period stems not from archeology, but from the wealth of information to be found on traditional native lifeways in early historical journals and accounts that came out of the Middle Missouri, beginning in the mid-1700s (1738-1743) with the explorations of the La Verendryes (Smith 1980), and ending by the late 1800s when Euro-American settlement of the region began in earnest. In addition to the Lewis and Clark journals and La Verendrye letters, other significant historical documents, particularly those describing native lifeways and providing ethnographic analogies for archeological interpretation, are the journal of Trudeau (or Truteau) (Abel 1921); Chardon's journal (Abel 1932); Tabeau's narrative (Abel 1939); the journals of Larocque, Henry, and Thompson, and McKenzie's narratives (Coues 1965a; Wood and Thiessen 1985), Catlin's accounts and drawings (Catlin 1973), Bradbury's travels (Thwaites 1966a), Brackenridge's journal (Thwaites 1966b), Maximilian's journal and Bodmer's drawings (Thwaites 1966c; Thomas and Ronnefeldt 1976), and Denig's accounts (Ewers 1961).

Description and Early Classification Period (1883-1945)

During this time, early avocational and professional archeologists began to provide detailed descriptions of archeological sites, including mapping, and to classify sites to place their findings within a regional context.

The first professional archeology in the Middle Missouri was conducted by Theodore H. Lewis in the late 1800s. Lewis, a surveyor and archeologist, conducted the Northwestern Archaeological Survey (NWAS) from 1881-1895 under the sponsorship of Alfred J. Hill of St. Paul, Minnesota. The goal of the NWAS was to record prehistoric earthworks sites found in the upper Mississippi Valley and adjacent areas, including parts of the Middle Missouri subarea in North Dakota and South Dakota (Haury 1990). The findings of the NWAS were never published, but the notebooks, maps, and other documents, which contain a wealth of archeological information, are curated by the Minnesota Historical Society (MHS Hill-Lewis Collection, 1891-1895).

In 1883, Lewis was in the upper Knife-Heart region of the Middle Missouri, in North Dakota, where he recorded and mapped prominent mound and village sites (Ahler 1993a; SHSND 1990). The following year, he recorded sites in the Bad-Cheyenne and upper Big Bend regions of South Dakota (site records, South Dakota Archaeological Research Center, Rapid City). Additional work was done by Lewis in the Knife-Heart region of North Dakota in 1890.

Following Lewis, a number of avocational and professional archeologists worked to build a comprehensive picture of Middle Missouri sites, focusing almost exclusively on earthlodge village sites. The first truly systematic excavations were done in 1905 by George F. Will and Herbert J. Spinden, at Double Ditch site north of Bismarck, North Dakota (Will and Spinden 1906). They concluded that Double Ditch had been occupied by the prehistoric Mandan. They also recorded and mapped a number of sites in North Dakota, in addition to collecting artifact samples (Will 1924). Other projects of the early 1900s were concerned principally with recording and mapping village sites, leading Ahler (1993a) to refer to the early 1900s as the "Mapping Period" of upper Knife-Heart region archeology.

Following Will and Spinden's work at Double Ditch, most initial excavations took place in North Dakota during the late 1920s and early 1930s under the direction of Alfred W. Bowers of the Beloit College Logan Museum (Bowers 1948). Bowers extended his investigations into South Dakota, overlapping with one of the pioneering archeologists of that state, W. H. Over. It was Over who first recorded many of the village sites in the Middle Missouri subarea of South Dakota (Sigstad and Sigstad 1973).

Bowers also conducted ethnographic work among the Mandan and Hidatsa (Bowers 1950, 1965), and Gilbert L. Wilson (1917, 1924, 1928, 1934, 1971; Gilman and Schneider 1987) produced a wealth of ethnographic information on the Hidatsa. Melvin R. Gilmore (1919, 1926, 1927, 1930, 1931; Rogers 1990) mainly studied the Arikaras, as did Preston Holder (1958, 1970). The study of the agricultural practices of the village Indians of the Middle Missouri by Will and Hyde (1917) is considered to be a classic ethnography.

In the 1930s and 1940s, George F. Will and Thad C. Hecker tested village sites in North Dakota, and developed the first comprehensive cultural-historical framework for village culture in the northern Middle Missouri (Will and Hecker 1944). This was followed by Bowers' (1948) more comprehensive village taxonomy and included sites in South Dakota. Thus, from the outset of systematic research in the subarea, there were competing taxonomies, and the situation has not improved.

In 1932, W. Duncan Strong (1933), of the Smithsonian Institution, investigated village sites in the vicinity of Mobridge, South Dakota, including the Leavenworth and Anton Rygh sites. In 1938, Columbia University graduate students under Strong's direction excavated a number of sites in North Dakota, including Slant Village (Strong 1940). The following year, Columbia University field parties turned attention to sites near Pierre, South Dakota, notably the Arzberger site (Spaulding 1956).

Investigations during the Description and Early Classification period established the Middle Missouri subarea as one of the major archeological regions of North America. This played a major role in the following period, when a massive research effort was initiated in the subarea to salvage archeological information and materials in advance of public works projects.

Salvage Archeology and Culture History Period (1945-1970)

The watchwords of post-World War II archeology in the Middle Missouri, from 1945 to 1970, were salvage excavation and culture history. Plans to construct dams and reservoirs along the Missouri River in the Dakotas threatened thousands of archeological sites. The Interagency Archeological Salvage Program (IASP), administered and conducted jointly by the National Park Service (NPS) and Smithsonian Institution River Basin Surveys (SIRBS), was established in response to a need for major archeological research in advance of dam construction.

The Missouri Basin Project of SIRBS became the lead agency conducting archeological work in the Middle Missouri, although NPS also contracted with other institutions, mainly state universities and historical societies, for archeological services. The IASP for the Middle Missouri represents one of the major archeological undertakings of the twentieth century in North America. As summarized by Lehmer (1971), this program operated most actively in the Dakotas during the 1950s and the 1960s, particularly in South Dakota where three of the four main stem Missouri River dams were to be constructed.

Under the IASP, excavations were undertaken at 74 village sites (often with multiple components), 11 historic military and trading posts, nine Woodland mound and occupation sites, five Foraging (Archaic) sites, and two other historic sites (Lehmer 1971:Appendix 1). Clearly, villages received by far the most attention, and preceramic sites received the least. This listing does not reflect the extensive survey work that also was conducted and which often included test excavations. Primary inventory projects for each of the four reservoirs in the Dakotas are listed in Table 3. The number of reports that came out of the Middle Missouri IASP is impressive (Lehmer 1971), but reports on some of the major site excavations have yet to be completed.

The principal goal of the Middle Missouri IASP was the development of a comprehensive culture history for northern Plains Village culture. This goal was met, as eloquently presented by Lehmer (1971) in his *Introduction to Middle Missouri Archeology*, which for many has been the "bible" of Plains Village archeology for the subarea. Other cultural traditions are given only cursory treatment in this overview, which is understandable, given the emphasis of the program and the history of archeology. Probably the most significant development to come out of the Middle Missouri IASP was the Lehmer/Caldwell taxonomic system, essentially an adaptation of organizing principles suggested by Willey and Phillips (1958) to the Middle Missouri. As first promulgated (Lehmer and Caldwell 1966) and later reformulated (Lehmer 1971), this taxonomy, which basically applies only to the northern Plains Village tradition, has become the framework for most subsequent village archeological work in the region. Development of the Lehmer/Caldwell taxonomy was a response to the perceived limitations of the Midwestern Taxonomic System used to organize village research for the Middle Missouri IASP (Stephenson 1954). Dissatisfaction with the Lehmer/Caldwell taxonomy has surfaced in recent years, particularly in the northern regions of the subarea.

Reports on major IASP excavations have trickled out in the years since the publication of Lehmer's synthesis which marks the end of this significant period in Middle Missouri archeology. Some of the post-1970 reports have been produced through the continued efforts of the sponsoring institutions and/or the sustained interest of principal investigators (Bass et al. 1971; Kivett and Jensen 1976; Krause 1972; Smith 1972; Smith 1977; Sperry 1982; Wood 1976),

Table 3. Primary Archeological Site Inventory Reports Produced by the Interagency Archeological Salvage Program in the Middle Missouri

Reservoir	Abbreviated Title	Citation
Garrison (Lake Sakakawea)	Archeological and Paleontological Resources of Garrison Reservoir	Kivett 1948
	Historical Aspects of Garrison Reservoir	Mattison 1951
	Archeological and Paleontological Resources of Garrison Reservoir: Suppl.	Metcalf and White 1953
Oahe (Lake Oahe)	Archeological Resources of Oahe Reservoir	Cooper and Stephenson 1953
	Archeological Survey of Oahe Reservoir	Jensen 1965
	Historic Sites in Oahe Reservoir	Mattison 1954
Big Bend (Lake Sharpe)	Archeological Resources of Big Bend Reservoir	Huscher and McNutt 1958
	Historic Sites in Big Bend Reservoir	Mattison 1962
Ft. Randall (Lake Francis Case)	Archeological and Paleontological Resources of Ft. Randall Reservoir	Cooper 1947
	Archeological and Paleontological Resources of Ft. Randall Reservoir: Suppl.	Cumming 1953
	Archeological Sites in Ft. Randall Reservoir: Supplement	Mallory 1965
	Historic Sites in Ft. Randall Reservoir	Mattes 1949

or through the continued efforts of the National Park Service, especially through the Backlog Analysis Program of Interagency Archeological Services (Ahler and Toom 1989; Griffin 1984; Knudson et al. 1983; Lehmer et al. 1978).

Contract Archeology and Cultural Ecology Period (1970-present)

The transition from "salvage archeology" to what has come to be known as "contract archeology" occurred between 1965 and 1970. Lehmer's synthesis, although not published until 1971, was essentially completed by 1965 and mainly reflects information current as of that time.

The period from 1965-1970 witnessed a slowing of the Middle Missouri IASP as it moved toward its end. The last major IASP salvage project was conducted in 1969 and 1970 at the Lower Grand (Davis), Walth Bay, and Helb sites (Falk and Ahler 1988). This work is significant in that it not only closed the Middle Missouri IASP, but also ushered in the Contract Archeology and Cultural Ecology period, which is characterized by use of modern sampling, recovery, and analytical techniques, as well as a greater concern with cultural ecology as a theoretical orientation. In the Middle Missouri, this change was spearheaded by a number of graduate students from the University of Missouri, Columbia, under the advisory of W. Raymond Wood. Prominent among these were Carl R. Falk, F. A. (Cal) Calabrese, and Stanley A. Ahler, who have guided Middle Missouri archeology, particularly Plains Village studies, into the contemporary era.

This period of Middle Missouri archeology is basically a continuation of the former IASP, but without the administrative and coordinating functions performed by SIRBS and NPS. Responsibility for archeological sites was transferred to federal land-managing agencies under environmental legislation, especially the National Environmental Policy Act. In the subarea, the key agency was the U.S. Army Corps of Engineers (COE), Omaha District, which was and is responsible for the operation and maintenance of the main stem Missouri River dams and reservoirs and adjacent project areas in the Dakotas.

Federal land-managing agencies have met their cultural resources responsibilities largely by contracting for archeological services with research institutions and private consultants on an as needed basis, rather than sponsoring integrated research programs like the IASP. The Phase I research program of the NPS for the Knife River Indian Villages National Historic Site (KNRI) near Stanton, North Dakota, is an exception to the typical approach to contract archeology (Thiessen 1993).

While archeological research in the Middle Missouri has slowed appreciably since the heyday of the IASP, there has been activity, mostly in the form of mandated cultural resources management (CRM) projects. Much of the research sponsored by the COE has involved comprehensive cultural resources inventories for federal lands. The COE has funded several reservoir project surveys, sometimes including follow-up testing (Table 4) to assess National Register of Historic Places eligibility.

Recent CRM surveys clearly are not redundant with the IASP surveys, which were neither systematic nor comprehensive. Their primary purpose was to locate and identify village sites for salvage excavation; recording other kinds of sites was a secondary concern. In short, the IASP surveys were not done to current standards. An additional goal of many recent COE surveys has been to assess the condition of previously recorded sites within the reservoirs.

Other major survey and testing projects include KNRI and Cross Ranch, both in the upper Knife-Heart region in North Dakota, neither of which are within reservoir areas. The KNRI project was funded by NPS to assist the development of a park and to enhance the public interpretation of archeological sites. This ambitious and highly successful research program is summarized in four volumes published by the NPS Midwest Archeological Center (Thiessen 1993). The Cross Ranch survey and testing project, funded by the State Historical Society of North Dakota, also was spurred by planned park development (Ahler, Lee, and Falk 1981; Ahler et al. 1982; Weston et al. 1980), although plans to convert the entire Cross Ranch area into a state park never materialized.

The KNRI and Cross Ranch research programs are of particular importance because the Knife-Heart region represents a unique setting within the Middle Missouri, one that has not been substantially altered by dam and reservoir construction. Situated between the headwaters of Oahe Reservoir to the south and Garrison Dam to the north, the Knife-Heart region is the only remaining stretch of Missouri River bottomland in the Dakotas that has not been inundated. Without exception, the other portions of the Middle Missouri have been flooded and extensively modified to the extent that virtually no bottomlands remain intact.

Recent archeological research in the Middle Missouri has not attained the scope or intensity of that conducted under the IASP. A notable exception is the 1968 Wood/Lehmer testing program. Although not a part of the Middle Missouri IASP, it is considered here because it represents a logical continuation of the program, and because it stimulated later research of more contemporary design.

In 1968, W. Raymond Wood and Donald J. Lehmer collaborated on an ambitious testing program to collect excavated samples from village sites in the upper Knife-Heart region. These results remained largely unreported until recently, when the materials were incorporated into the KNRI Phase I research program (Thiessen 1993). More importantly, this work provided impetus for subsequent, larger scale projects at sites such as Ice Glider, Cross Ranch, Upper Sanger, and Bagnell, all located on the Cross Ranch (Ahler 1993a). Being outside the reservoir areas, village sites like these received little attention under the Middle Missouri IASP, and Wood and Lehmer initiated their post-IASP research program here to help bridge this information gap.

Two post-1970 mitigation projects were done at a scale comparable to IASP salvage excavations. These were conducted at the Mondrian Tree site, in the upper Garrison region, and the White Buffalo Robe site, in the upper Knife-

Table 4. Primary Archeological Site Survey and Testing Projects Conducted within U.S. Army Corps of Engineers Project Areas in the Middle Missouri since 1970

Reservoir/Project	Abbreviated Title	Citation
Garrison	Cultural Resources Survey Along Parts of Lake Sakakawea[a]	Floodman 1989a
(Lake Sakakawea)	Archeological Survey of Portions of Garrison Reservoir Shoreline[b]	Haberman and Schneider 1975
	Test Excavations at Midipadi Butte (32DU2)[a]	Kuehn et al. 1982; Kuehn et al. 1984
	Archeological Shoreline Survey of Parts of Lake Sakakawea[b]	Leaf 1976
	Reconnaissance Along Parts of Lake Sakakawea and Lake Audubon[a]	Lueck et al. 1992
	Cultural Resources Survey Along Parts of Lake Sakakawea[a]	Noisat et al. 1986
	Test Excavations at the Moe Site (32MN101)[b]	Schneider 1975
	Cultural Resources Inventory Along Parts of Lake Sakakawea[a]	Science App.&Overland Archeology 1982
	Cultural Resources Inventory Along Parts of Lake Sakakawea[a]	Van Hoy and Nathan 1983
	Cultural Resources Inventory Along Parts of Lake Sakakawea[a]	Winham, Lippincott, and Lueck 1987
	Cultural Resources Inventory Along Parts of Lake Sakakawea[a]	Winham, Lippincott et al. 1987
Oahe (Lake Oahe)	Test Excavations at the Jake White Bull Site (39CO6)[a]	Ahler 1977b
	Test Excavations at the Travis 2 Site (39WW15)[a]	Ahler et al. 1977
	Cultural Resources Survey Along Parts of Lake Oahe (Test Excavations)[a]	Falk and Pepperl 1986
	Cultural Resources Inventory Along Parts of Lake Oahe[a]	Larson et al. 1983
	Cultural Resources Inventory Along Parts of Lake Oahe[a]	Larson , Schweigert et al. 1986
	Cultural Resources Reconnaissance Along Parts of Lake Oahe[a]	Lueck et al. 1989
	Cultural Resources Inventory Along Parts of Lake Oahe[a]	Penny et al. 1987
	Test Excavations at the Wounded Knee Site (32EM21)[c]	Root 1983
	Cultural Resources Inventory Along Parts of Lake Oahe[a]	Sanders et al. 1987
	Cultural Resources Inventory Along Parts of Lake Oahe[a]	Sanders, Penny et al. 1988
	Test Excavations at the Travis 2 Site (39WW15)[a]	Sanders, Larson et al. 1988
	Final (Test) Excavations at the Travis 2 Site (39WW15)[a]	Toom 1991
	Archeological Survey Along Parts of Lake Oahe[a]	Toom and Artz 1985
	Monitoring and Reconnaissance at the Travis 2 Site (39WW15)[a]	Weston et al. 1979
	Test Excavations at Sites Along Lake Oahe[a]	Winham and Lueck 1983
	Cultural Resources Reconnaissance Along Parts of Lake Oahe[a]	Winham and Lueck 1987
	Cultural Resources Reconnaissance Along Parts of Lake Oahe[a]	Winham, Lippincott, and Lueck 1988
Big Bend	Archeological Investigations Along Parts of Lake Sharpe (Survey and Testing)[a]	Falk 1984
(Lake Sharpe)	Test Excavations at the Little Cherry Site (39HU126)[a]	Kapler 1991
	Test Excavations at the Lower Antelope Creek Site (39ST106)[a]	Nowak 1983
	Test Excavations at Ft. Sully I (39HU52)[a]	Ruple 1984
	Archeological Investigations Along Parts of Lake Sharpe (Survey and Testing)[a]	Steinacher 1981
	Test Excavations at Three Sites Along Lake Sharpe[a]	Toom 1989
	Test Excavations at Eight Sites Along Lake Sharpe[a]	Toom 1990a
	Test Excavations at the Little Pumpkin Site (39HU97)[a]	Toom 1992b
	Archeological Survey Along Parts of Lake Sharpe[a]	Toom and Picha 1984
Ft. Randall	Archeological Reconnaissance Along Parts of Ft. Randall Reservoir Shoreline[b]	Kay 1973
(Lake Francis Case)	Cultural Resources Reconnaissance Along Parts of Lake Francis Case[a]	Lees et al. 1985
	Cultural Resources Reconnaissance Along Parts of Lake Francis Case[a]	Olson and Zimmerman 1979
	Test Excavations at Four Sites Along Lake Francis Case[a]	Penny et al. 1991
	Test Excavations at Sites Along Lake Francis Case[a]	Tibesar et al. 1986
	Cultural Resources Reconnaissance Along Parts of Lake Francis Case[a]	Winham and Lueck 1984
Multiple Reservoirs	Archeological Inventory, Missouri River, Ft. Benton, Montana, to Sioux City, Iowa[a]	Adamczyk 1975

[a]Funded by the U.S. Army Corps of Engineers, Omaha District.
[b]Funded by the National Park Service (essentially holdover projects from the Interagency Archeological Salvage Program).
[c]Funded by other sources.

Heart region. The Mondrian Tree site contains occupation horizons of the Plains Archaic, Plains Village, and Historic periods (Toom and Gregg 1983). Extensive excavations were conducted in 1980, as the site lay in the path of the upper Missouri River crossing of the Northern Border Pipeline. A substantial portion of the Mondrian Tree site has been preserved for future research. Additional survey and testing for the pipeline, which transected North Dakota from northwest to southeast, generated useful data. The CRM work along the North Dakota segment was massive (Root and Gregg 1983a, 1983b), but work within the Middle Missouri subarea proper, aside from the Mondrian Tree site, was comparatively minor. Excavations at site 32EM21 (Root 1983), a Sonota occupation, and site 32EM61 (Gregg et al. 1983), a Plains Village burial cairn, at the southern Missouri River crossing are noteworthy, however.

The White Buffalo Robe site was a multicomponent earthlodge village site that contained three separate occupations, including components of the Nailati, Heart River, and Knife River phases (Lee 1980). A remnant of the site, most of which had been previously destroyed, was completely excavated in 1978. Although not widely distributed, the White Buffalo Robe report is one of the comprehensive works on earthlodge village archeology. Another significant recent contribution on village archeology, although more modest in scale, is the report on the Travis 1 site, located in the Grand-Moreau region of South Dakota (Haberman 1982).

A number of additional Middle Missouri research projects have been completed in recent years. Innovative ceramic studies have been done by Calabrese (1972) and C. Johnson (1977a, 1977b), and Johnson's (1980) overview of ceramic classification provides information on virtually all of the traditional types. Ahler's lithic tool (1975, 1979) and raw material (1977a) studies have set new analytical standards, and provide analytical models that are applicable beyond the Middle Missouri. Thiessen's (1976, 1977) work with radiocarbon dates has aided chronological studies. Semken and Falk (1987) have investigated past climates using faunal data, and Nickel (1974, 1977) has published useful paleobotanical studies. Weston's (1986, 1993) research on bone tools, and the work of Goulding (1980) and Toom (1979) with stone tools, have documented post-contact technological change. Subsistence studies by Richtsmeier (1980) have contributed new information on environment and native agricultural practices in the subarea. Continued work with the Crow Creek massacre data has yielded new information on the Initial Coalescent variant (Willey and Emerson 1993; Zimmerman and Bradley 1993). Toom has provided insights into the operation of the early fur trade and its archeological implications (1979), early village formation as it relates to climatic factors (1992a), and early village formation and subsistence practices (1992c).

The foregoing discussion on post-IASP archeology has been focused largely on the Missouri River Valley proper. Unfortunately, the surrounding upland plains have been virtually ignored, with the exception of mound sites. In South Dakota, little is known about sites beyond the river valley itself. A Plains Woodland site (39ST80) just to the west of the river in Stanley County was excavated by Haberman (1979). On the west side of the river in Hughes County, the Bull site (39HU191), a stone circle (tipi ring) site was excavated by Hovde (1982).

Mike Fosha of the South Dakota Archaeological Research Center (SDARC), Rapid City, recently completed excavation work at the South Whitlock site (39PO61), a multicomponent site in the Missouri River uplands containing stone circles, a cairn, and buried deposits. The surface component, including the stone circles and the cairn, is attributed to a late prehistoric or protohistoric occupation based on the presence of two metal beads. The buried site components are extremely interesting and include two Late Plains Archaic horizons, two Middle Plains Archaic horizons, and one Late Paleoindian horizon. The Late Archaic horizons yielded the remains of at least one "pit house" structure, potentially representing the oldest domestic structural remains recorded in the subarea.

Stone circle sites are also the most common site recorded along the Middle Missouri uplands in North Dakota. Rock cairns, another common feature in the uplands, tend to co-occur with stone circles. Since the late 1970s in North Dakota, a number of stone circle and cairn sites have been investigated. The largest and most significant is the Anderson Tipi Ring site, excavated and reported by Ken Deaver (1985) and colleagues. Deaver and other private contractors have been very active in the investigation of stone circle, cairn, and other Middle Missouri upland sites in North Dakota (Deaver 1990, 1991; Deaver and Deaver 1987; Deaver et al. 1989; Fredlund et al. 1984; Good 1981; Greiser and Greiser 1984; Larson 1992; Larson and Penny 1994; Olson 1992; Tucker and Olson 1992). The University of North Dakota also has conducted research at some sites in the uplands zone (Ahler et al. 1979; Ahler, Mehrer, and Picha 1981; Artz et al. 1991; Good and Hauff 1979; Kuehn and Hodny 1984; Kuehn and Perry 1986).

Culture History

The Middle Missouri subarea has been a focal point of human occupation because of its importance as a diverse resource area and natural transportation route. Area prehistory is generally divided into five primary cultural periods: (1) Paleoindian (ca. 9500-5500 B.C.); (2) Plains Archaic (ca. 5500-1 B.C.); (3) Plains Woodland (ca. A.D. 1-1000); (4) Plains Village (ca. A.D. 1000-1780); and (5) Historic (ca. A.D. 1780-present) (Figure 38). These periods are, for the most part, named for the cultural traditions that dominated during

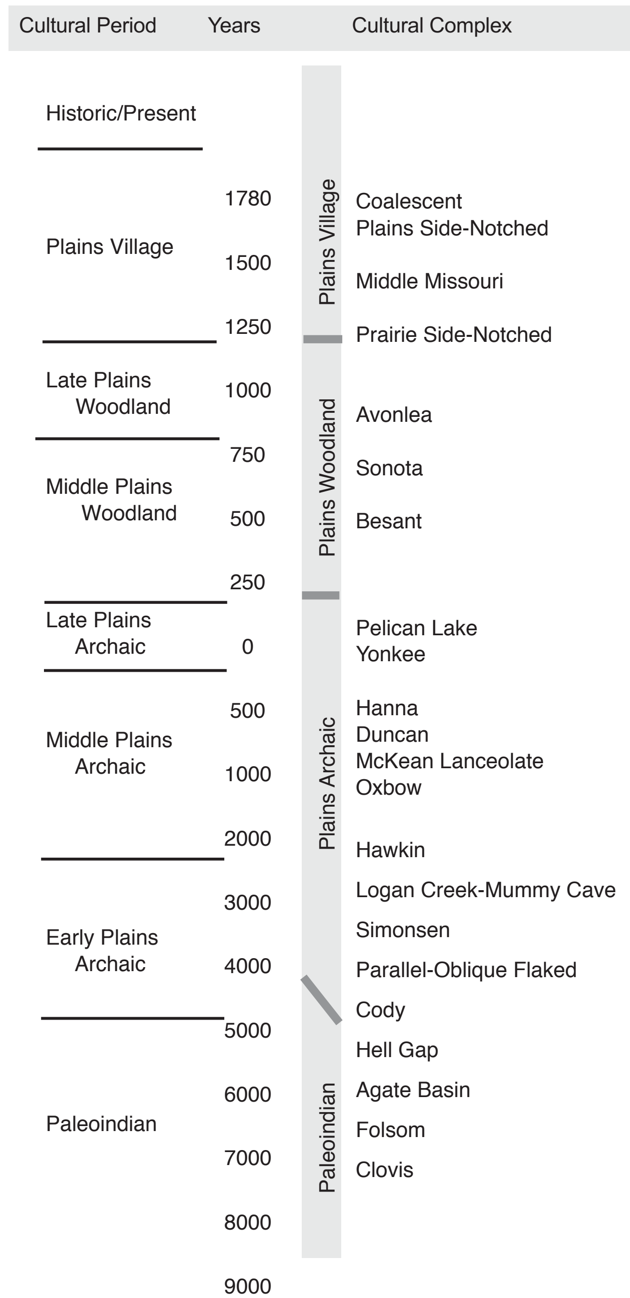

Figure 38. General taxonomic model of Middle Missouri culture history (adapted from SHSND 1990).

those times, and, hence, also connote differences in material culture, particularly basic technology.

The Paleoindian, Plains Archaic, Plains Woodland, and Plains Village traditions represent aspects of four of Willey's (1966) sixteen principal cultural traditions of North America. The "Plains" qualifier used in conjunction with the Archaic and Woodland traditions indicates that these regional taxa exhibit characteristics distinct from their eastern counterparts; the Plains Village tradition is unique and has no obvious counterpart in the east. The fifth and final period, the Historic, encompasses the time following the decline of the Plains Village tradition, the rise and decline of the Plains Equestrian tradition, and the eventual domination of the Middle Missouri by the Euro-American tradition.

Other temporal referents used in conjunction with native Middle Missouri archeology include the preceramic, ceramic, and late prehistoric periods. The ceramic period includes the Plains Woodland and the Plains Village traditions, during which native produced ceramics were in general use. The late prehistoric period generally is coeval with the ceramic period, but some reserve use of the term for the time following the introduction and widespread use of the bow and arrow in Late Plains Woodland times.

Paleoindian Period (ca. 9500-5500 B.C.)

The first documented human inhabitants of the Middle Missouri subarea were nomadic hunters and gatherers known as Paleoindians. The Paleoindian tradition, also referred to as the Big Game Hunting tradition, is traditionally viewed as an adaptation to hunting late Pleistocene megafauna (Frison 1991a; Willey 1966). In the Plains, the primary quarry were now-extinct species of mammoth and bison. Sites of this tradition consist mainly of animal kill sites, processing locations, and camps. Technologically, the tradition is recognized by fluted and unfluted lanceolate projectile points. Various types of these artifacts are found over much of the Plains, and suggest to some a highly mobile lifeway (Bamforth 1988; Frison 1991a; Irwin-Williams et al. 1973; Irwin and Wormington 1970).

The Paleoindian tradition is divided into a number of complexes, mainly based on differences in age and projectile point styles. The three primary complexes are Clovis (ca. 9500-9000 B.C.), Folsom (ca. 9000-8000 B.C.), and Plano (8500-5500 B.C.). The Clovis and Folsom complexes are distinguished by the lanceolate, fluted point types of the same names. The term Plano often refers to any later Paleoindian complex exhibiting unfluted lanceolate points, and includes a number of complexes. Among the more widely recognized Plano complexes in the subarea are Midland/Plainview; Agate Basin/Hell Gap; Alberta/Cody (Scottsbluff/Eden); and Angostura/Frederick/Lusk. The less well-known Goshen complex (ca. 9000-8500 B.C.) appears to fall in between Clovis and Folsom (Irwin-Williams et al. 1973; Frison 1988b, 1991a).

Data on Paleoindian in the subarea are scant, as only a few sites have been recorded (Table 5), in part because most earlier investigations focused on village sites (Lehmer 1971).

Table 5. Selected Paleoindian Sites and Primary References for the Middle Missouri Subarea of the Northern Plains

Site Name (Number)	Identified Components	References
Moe Site (32MN101)	Folsom, Agate Basin, various other Plano	Haberman and Schneider 1975; Schneider 1975
Travis 2 (39WW15)	Plano (Angostura) Weston et al. 1979;	Ahler et al. 1977; Ahler 1980; Toom 1991; Sanders, Larson et al. 1988
Mud Flat (39WW49)	Plano (unspecified)	Weston et al. 1979
Walth Bay (39WW203)	Plano (Frederick)	Ahler et al. 1974; Falk and Ahler 1988

Sampling problems aside, the scarcity of such sites suggests limited utilization of the subarea by Paleoindian groups. Late Paleoindian (Plano) components presently far outnumber Clovis and Folsom components. The apparent paucity of earlier Clovis and Folsom components may in part reflect the location of the Middle Missouri at the edge of a vast, glaciated landscape during terminal Pleistocene times.

Plains Archaic Period (ca. 5500-1 B.C.)

The Plains Archaic tradition encompasses a variety of foraging adaptations to the Plains. These adaptations are interpreted as a readjustment of Paleoindian lifeways to a changing Plains environment beginning with the onset of the Holocene (Frison 1975). The extinction of Pleistocene megafauna was of particular significance, apparently requiring radical changes in subsistence practices. In essence, the Plains Archaic tradition is seen as a shift away from the specialized megafauna hunting economies of the Paleoindians toward the hunting of essentially modern species of both large and small game. There also was an apparent increased reliance on wild plants, although Paleoindian peoples also made extensive use of plant foods. Nonetheless, Plains Archaic subsistence practices appear to have been more generalized, and typically are viewed as nomadic foraging; the tradition sometimes has been called the "Foraging" tradition (Lehmer 1971:30).

Although considerable regional diversity in subsistence practices existed during Plains Archaic times, depending on local circumstances, bison were the primary quarry of northern Plains Archaic groups. Technologically, more diverse and regionally restricted lithic tool types appeared, notably notched and stemmed projectile points and hafted cutting tools (Frison 1991a; Mulloy 1958; Reeves 1973). The earliest recorded domestic structural remains (pit house floors) attributable to this period (Late Plains Archaic) were recently found at the South Whitlock site (39PO61) in the extreme southern Grand-Moreau region of South Dakota (Michael Fosha, personal communication January, 1994).

In the Northern Plains, Plains Archaic is usually divided into Early, Middle, and Late periods. Early Plains Archaic (ca. 5500-3000 B.C.) is represented by such complexes as Logan Creek and Simonson in the east, and Mummy Cave and Hawkin in the west, all of which are characterized by similar forms of early side-notched projectile points. The Early Plains Archaic period is coeval with the Atlantic, or Altithermal, climatic episode, and typified by hot and dry conditions. During this period, the population of the Northern Plains may have declined substantially. McKean, best known of the Middle Plains Archaic (ca. 3000-1000 B.C.) complexes, is characterized by McKean Lanceolate and Duncan/Hanna points. A somewhat earlier Middle Plains Archaic Oxbow complex is recognized on the basis of Oxbow points. McKean complex sites are widespread and far more common than Early Archaic sites, suggesting an increase in human populations during the Sub-Boreal climatic episode.

The most widespread Late Archaic complex is Pelican Lake, identified on the basis of Pelican Lake corner-notched points; the Yonkee complex appears to be contemporary. In the west, Besant side-notched points and the Besant complex are usually associated with Late Plains Archaic, and Pelican Lake and Besant points co-occur in some sites. However, in eastern parts of the Northern Plains, such as the Middle Missouri, Besant points are considered diagnostic of Plains Woodland complexes like Sonota. In extreme eastern portions of the Northern Plains, diminutive Pelican Lake points are found in Early Plains Woodland contexts (Gregg 1987; Toom n.d.).

Plains Archaic sites are also comparatively rare in the subarea. This is partially a reflection of bias from a previous lack of systematic investigation, but Plains Archaic sites are often deeply buried in the terraces of the Missouri Valley and difficult to find by conventional surface survey techniques. Nevertheless, the relative scarcity of sites suggests a comparatively small population for the subarea at this time.

Several well-documented Plains Archaic sites are present in the subarea, most of which seem to represent transient campsites (Table 6). Such sites are usually found eroding from low-lying terrace scarps or cutbanks, especially near small tributary streams and in association with buried soil A horizons. These buried A horizons mark the surfaces of paleosols in the loess cap that overlies the terrace fill, which is typically alluvium.

Table 6. Selected Plains Archaic Sites and Primary References for the Middle Missouri Subarea of the Northern Plains

Site Name (Number)	Identified Components	References
Tysver-Olson (32DU593)	Early Archaic	Kuehn 1984
Mondrian Tree (32MZ58)	Middle and Late Archaic	Toom and Gregg 1983
Sugarloaf Butte (32MO17)	Late Archaic (Pelican Lake)	Johnson et al. 1990
Unnamed (32MN395)	Middle and Late Archaic	Larson and Penny 1994
Medicine Crow (39BF2)	Early, Middle, and Late Archaic	Ahler and Toom 1989
South Whitlock (39PO61)	Middle and Late Archaic (Late Archaic Structures)	Report in Preparation, M. Fosha, SDARC
Walth Bay (39WW203)	Middle and Late Archaic	Ahler et al. 1974; Falk and Ahler 1988
Travis 2 (39WW15)	Early, Middle, and Late Archaic	Ahler et al. 1977; Weston et al. 1979
Mud Flat (39WW49)	Middle and Late Archaic	Weston et al. 1979
Indian Creek Sites	General Archaic	Winham and Lueck 1983
Ft. Thompson Sites	Early, Middle, and Late Archaic	Neuman 1964a
Diamond-J (39HU89)	Early and Late Archaic	Steinacher 1984a
Rousseau (39HU102)	Middle and Late Archaic	Steinacher 1984b; Toom 1992a

Plains Woodland Period (A.D. 1-1000)

Sites of the Plains Woodland tradition are common in the subarea relative to those of preceding periods (Table 7). Burial mounds first appeared during Plains Woodland times. Linear mounds are most common in the northern part of the subarea (Chomko and Wood 1973), while conical are more frequent in the central and southern parts (Neuman 1975). Mound sites appear to be more numerous than habitation sites, probably because they are more conspicuous. Habitation sites are typically deeply buried in the loess caps covering depositional terraces and less readily visible than mounds or later Plains Village sites. The house remains recorded at the La Roche site are suggestive of semipermanent campsites or even small villages (Hoffman 1968; Neuman 1975).

Information about the Plains Woodland tradition lacks detail, especially in the Middle Missouri subarea where past research focused on mound sites rather than habitation sites. In the subarea, Middle and Late subperiods are recognized, based on differences in projectile point and pottery styles. The designations Middle and Late Plains Woodland, rather than early and late, recognize relationships to the Middle and Late Woodland periods in the Eastern Woodlands. An Early Woodland period is represented in the Northeastern Plains subarea, (the Naze site in North Dakota [Gregg 1987]), but in the Middle Missouri subarea no comparable taxon is known. Further, there seems to be an abrupt transition from Late Archaic to Middle Woodland artifact styles, often with considerable overlap in what are essentially the same assemblages, with no Early Woodland stage recognizable.

The Sonota complex is presently the best-defined Middle Plains Woodland manifestation in the subarea, and takes its name from sites located near the South/North Dakota state line. The geographical range continues to expand as additional sites are identified. Assemblages typically contain side-notched dart points (Besant Side-Notched) like those associated with the Sonota complex (Neuman 1975). Sonota pottery resembles other Middle Plains Woodland ceramics and includes conoidal vessels with cordmarked surfaces and rims decorated with bosses or punctates (Neuman 1975). Dentate stamping is a minor decorative technique, and some vessel surfaces are smoothed or plain. Sonota is estimated to date between A.D. 1 and 600 (Neuman 1975). Relationships with Middle Woodland cultures of the Eastern Woodlands are suggested by burial mounds and pottery (Benn 1990; Neuman 1975).

Late Plains Woodland assemblages are characterized by small, notched arrow points similar to Avonlea, Prairie Side-Notched, and Samantha Side-Notched of the northern Plains (Kehoe 1966a, 1973; Kehoe and McCorquodale 1961; Reeves 1983; Davis 1988). Little is known about Late Plains Woodland pottery in the Middle Missouri, but ceramics in the Big Bend region of South Dakota may be most similar to early Plains Village (Initial Middle Missouri) wares (Toom 1990a). The Truman Mound site in the Big Bend region produced simple stamped pottery that Neuman (1960) interpreted as indicative of Late Plains Woodland. A. Johnson

Table 7. Selected Plains Woodland Sites and Primary References for the Middle Missouri Subarea of the Northern Plains

Site Name (Number)	Identified Components	References
Cross Ranch Sites (various)	Middle and Late Woodland	Ahler, Lee, and Falk 1981; Ahler et al. 1982
Linear Mound Sites (various)	Middle Woodland?	Chomko and Wood 1973
Midipati Butte (32DU2)	Middle Woodland (Besant)	Kuehn et al. 1982; Kuehn et al. 1984
Wounded Knee (32EM21)	Middle Woodland (Sonota)	Root 1983
High Butte (32ME13)	Middle Woodland	Wood and Johnson 1973
Boeckel-Renner (32ME799)	Late Woodland (Avonlea)	Larson 1992; Artz et al. 1991
Yellowbird (32ME847)	Late Woodland (Avonlea)	Larson 1992; Artz et al. 1991
Onion Ring (32ME166)	Middle Woodland (Besant)	Deaver et al. 1989
Anderson Tipi Ring (32ML111)	Middle Woodland (Besant)	Deaver 1985; Good and Hauf 1979
Dancing Grouse (32ML107)	Middle Woodland (Besant)	Deaver and Deaver 1987
Evans (32MN301)	Late Woodland (Avonlea)	Schneider and Kinney 1978
Unnamed (32MN395)	Middle and Late Woodland (Besant and Avonlea)	Larson and Penny 1994; Christensen 1992
Sugarloaf Butte (32MO17)	Middle Woodland (Besant)	Johnson et al. 1990
Unnamed (32OL270)	Middle Woodland (Besant)	Fredlund et al. 1984
Boundary Mound (32SI1)	Middle Woodland (Sonota)	Neuman 1975; Wood 1960
Porcupine Creek (32SI6)	Middle Woodland (Sonota)	Scheans 1957
Alkire Mound (32SI200)	Middle Woodland (Sonota)	Henning 1965
Ft. Thompson Mound Sites	Middle Woodland?	Toom 1984a (see also Neuman [various] 1960, 1961a, 1964a)
Olson Mound (39BF223)	Middle Woodland?	Neuman 1961b
Truman Mound (39BF224)	Middle Woodland?	Neuman 1960
Sitting Crow (39BF225)	Middle Woodland?	Unreported (see Neuman 1964a)
Side Hill (39BF233)	Middle Woodland?	Unreported (see Neuman 1964a)
McBride Mounds (39BF270)	Middle Woodland?	Unreported (see Neuman 1960, 1964a)
Arp (39BR101)	Middle Woodland?	Gant 1967
Stelzer (39DW242)	Middle Woodland (Sonota)	Neuman 1975
Swift Bird Mound (39DW233)	Middle Woodland (Sonota)	Neuman 1975
Grover Hand (39DW240)	Middle Woodland (Sonota)	Neuman 1975
Arpan Mound (39DW252)	Middle Woodland (Sonota)	Neuman 1975
Scalp Creek (39GR1)	Middle and Late Woodland?	Hurt 1952
Ellis Creek (39GR2)	Middle Woodland	Hurt 1952
Rousseau (39HU102)	Middle Woodland (Sonota)	Steinacher 1984b; Toom 1992a
Little Elk (39HU221)	Middle Woodland (Sonota?)	Toom 1984b
Site Name (Number)	Identified Components	References
Windy Mounds (39LM149)	Late Woodland	Toom 1990a
Lost Nation (39LM161)	Middle Woodland (Sonota)	Toom 1989, 1992a
Stricker Mounds (39LM227)	Woodland?	Smith 1975
Good Soldier (39LM238)	Middle Woodland?	Neuman 1964b
La Roche (39ST9)	Middle Woodland (Sonota)	Hoffman 1968; Neuman 1975
Unnamed (39ST80)	Middle Woodland (Sonota)	Haberman 1979
Sitting Buzzard (39ST122)	Late Woodland	Toom 1990a, 1992a

(1988:139) has characterized the Truman Mound pottery as "parallel grooved," which she differentiates from the simple stamping associated with the Avonlea complex.

A convergence of Plains Woodland and later Plains Village traits is evident in diagnostic artifacts recovered from sites on the Cross Ranch in the Knife-Heart region of North Dakota (Ahler, Lee, and Falk 1981; Ahler et al. 1982). At these sites, ceramics exhibiting a unique constellation of attributes are associated with early arrow point forms similar to the Prairie Side-Notched type (Ahler et al. 1982). However, the pottery vessels at Cross Ranch appear to be conoidal or subconoidal, a form typical of Middle Plains Woodland. Further north, at sites in the Garrison region of North Dakota, Late Woodland period components produce points and ceramics of the Avonlea complex (Larson 1992; Larson and Penny 1994; Schneider and Kinney 1978), which was widespread in the Northern Plains (Davis 1988). Based on limited evidence, changes in material culture in Late Plains Woodland point toward subsequent developments in the Plains Village tradition. The Late Plains Woodland period is dated at ca. A.D. 600-1000 in the subarea.

The Plains Woodland tradition is viewed as a time of innovation during which many new technological, economic, and social elements made their appearance in the subarea. Subsistence was reminiscent of the broad-spectrum foraging of the Plains Archaic, with the same emphasis on bison. Incipient horticulture may have been practiced, but direct evidence is lacking or inconclusive, particularly in the Northern Plains where Archaic subsistence patterns were carried over into the Woodland tradition (Hoffman 1968; Neuman 1975). Nevertheless, the notion that horticulture was practiced in Woodland times, particularly late in the period, persists (Benn 1990; Wedel 1961). Other innovations of importance include ceramics, semipermanent dwellings (and by inference semipermanent camps), the bow and arrow, and mortuary ceremonialism.

Most Plains Woodland innovations are thought to have diffused into the subarea from the Eastern Woodlands (Benn 1990; Caldwell and Henning 1978; Willey 1966). Population appears to have increased during this period, as suggested by the greater number of sites. However, Late Plains Woodland sites are less common than Middle Plains Woodland sites, particularly in the southern portions of the subarea, possibly indicating a population reduction prior to the advent of the Plains Village period.

Plains Village Period (A.D. 1000-1780)

Semisedentary farmers who lived in permanent villages for at least part of the year appeared in the eastern Plains around A.D. 1000 (Wedel 1961, 1983). These village horticulturists are collectively referred to as the Plains Village tradition (Willey 1966). The principal subdivisions, the Middle Missouri tradition, the Central Plains tradition, and the Coalescent tradition (Lehmer 1971; Lehmer and Caldwell 1966), are designated here as subtraditions because they are subareal manifestations of the encompassing Plains Village tradition.

In the Middle Missouri subarea, sites of the Plains Village tradition far outnumber those of earlier periods. Plains Village spans the late prehistoric and early historic periods, and represents a regional florescence in native lifeways. Extensive earthlodge villages, some of which were fortified (Lehmer 1971), are characteristic of the subarea. In the Central Plains area, prehistoric villages tend to be dispersed hamlets (Wedel 1986). Other site types include winter villages, isolated earthlodges, semipermanent hunting camps, short-term campsites, cemeteries, and various specialized activity sites.

The outstanding features of Plains Village culture are a semisedentary settlement pattern centered on seasonally occupied, permanently fixed earthlodge villages and a mixed subsistence strategy with three main elements: (1) garden agriculture, (2) bison hunting, and (3) generalized foraging (Toom 1992a, 1992c). The garden produce of the villagers included corn, beans, squash, sunflower, and tobacco. The innovations during the Plains Woodland period (increased sedentism, ceramic manufacture, the bow and arrow, and domestic architecture) all manifest themselves in more complex forms in Plains Village culture, although there is not a clear, direct linkage or continuum between Plains Woodland and Plains Village populations.

While Plains Village culture in the Northern Plains has been described as essentially homogeneous in terms of settlement-subsistence patterns and technology (Wood 1974), on a more specific level there is considerable variability across space and time. For example, there is notable variation in specific settlement-subsistence patterns proposed for certain Middle Missouri and Central Plains subtradition archeological taxa (Lehmer 1971; Wedel 1986). Such variation reflects time depth, cultural-geographical diversity, and accelerated cultural dynamics during late prehistoric and early historic times. The diversity within Plains Village tradition largely accounts for the complex taxonomic system that has developed around it.

Plains Village Taxonomy

The current Plains Village taxonomic system was developed by Lehmer and Caldwell (1966), and later refined by Lehmer (1971). The cornerstones of the basic Lehmer/Caldwell taxonomy, are the Middle Missouri, Central Plains, and Coalescent subtraditions (Table 8). The Middle Missouri and Central Plains subtraditions present a conceptually neat package, in that they are both late prehistoric in age and areally restricted; in this latter sense, they are subareal traditions. In contrast, the Coalescent subtradition spans the terminal late prehistoric and early historic periods, representing the eventual amalgamation or "coalescence" of the other two traditions, as currently defined. It lacks a specific areal extent and it relates to a perceived cultural process, rather than a taxonomic unit.

Table 8. Adaptation of the Lehmer/Caldwell Taxonomic Model for the Plains Village Tradition in the Middle Missouri and Central Plains Subareas (adapted from Lehmer 1971, based on information in Blakeslee 1978; Krause 1969; Thiessen 1977; Toom 1992d; Wedel 1986)

Subtradition	Variant	Est. Date Range
Coalescent	Post-Contact	A.D. 1650-1886
	Extended	A.D. 1500-1650
	Initial	A.D. 1300-1500
Middle Missouri	Initial	A.D. 1000-1300
	Extended	A.D. 1100-1500
	Terminal	A.D. 1500-1650
Central Plains	Upper Republican	A.D. 1000-1300
	Nebraska	A.D. 1000-1400

The three subtraditions of the Lehmer/Caldwell taxonomy are divided into as many as eight variants (Table 8). Variants are similar to the cultural horizons of Willey and Phillips (1958), but with the addition of time. Variants incorporate significant regional variation in material content and spatial distribution, so variants are perhaps best conceived of as "megaphases" (Krause 1977 and Lehmer 1971 for discussion). Several phases have also been named as subdivisions of the variants, but comprehensive phase definition is still in its infancy, and the variant persists as the primary analytic unit around which most Plains Village research is organized. An exception is the Post-Contact Coalescent variant, which has a number of relatively well defined phases, including Felicia, Talking Crow, Bad River, Le Beau, Heart River, and Knife River (Lehmer 1971). Other identified phases include Ft. Yates (Lehmer 1966), the Nailati and Clark's Creek phases (Calabrese 1972) of the Extended Middle Missouri variant, and the Grand Detour phase of the Initial Middle Missouri variant (Caldwell and Jensen 1969).

The Disorganized Coalescent variant (A.D. 1780-1862), used in the Lehmer/Caldwell taxonomy to group sites occupied after the 1780 smallpox epidemic, has been dropped here in favor of an expanded definition of the Post-Contact Coalescent variant. In addition, the variants identified for the Central Plains subtradition in Table 8 do not adequately account for all the variability within the subtradition, particularly in the southern portion of the Central Plains. It would be appropriate to define a Southern Plains subtradition to round out the model and account for Plains Village manifestations in this subarea.

The upper Knife-Heart region of North Dakota, recently redefined by Ahler (1993b) as the Knife region, is another exception to the generally underdeveloped state of Plains Village phase definition. Substantive research into Plains Village culture has been sponsored by the National Park Service in conjunction with the development of the Knife River Indian Villages National Historic Site (Thiessen 1993). A major objective of the research program has been phase definition and redefinition of Plains Village taxonomy in general. Ahler (1993b) has concluded that it would be premature to extend his Knife River taxonomic system much beyond the Knife region in the absence of comparable studies for other regions.

The Ahler taxonomy, which has been extended to the Garrison region, and to a lesser extent the Heart and Cannonball regions, is based on a number of interrelated and cross-cutting cultural complexes, indicating general trends or orientations in material culture (Figure 39). These complexes are overlain by a series of cultural phases, which are only defined for the Knife and the Garrison regions (Figure 39). Both the complexes and the phases are regionally restricted, but not exclusively so. Another unit defined by Ahler (1993b), the ethnic tradition, refers to the prehistoric trajectories believed to relate to the development of the historically known Mandan, Hidatsa, and Arikara, who are often referred to collectively as the Middle Missouri Villagers. A more traditional Plains Village taxonomic overview of the upper Knife-Heart region is provided by Wood (1986a).

Reconciling the Lehmer/Caldwell taxonomy with the Ahler taxonomy is not easy because they employ conceptually different units and also are scaled differently in terms of space and time. This problem reflects fundamental differences between Plains Village culture history in the northern and the southern regions of the subarea, as well as different histories of archeological research. Most of the SIRBS research, upon which the Lehmer/Caldwell taxonomy is based, was done in the southern regions of the subarea in South Dakota (Lehmer 1971); therefore, the Lehmer/Caldwell taxonomy has a definite southern bias. The Lehmer/Caldwell taxonomy relates best to Ahler's Mandan and Arikara ethnic traditions, but fares poorly for the Hidatsa ethnic tradition, which is a northern subarea phenomenon that was not intensively investigated until some years after the Lehmer/Caldwell taxonomy had been formulated.

Perhaps the clearest way to present this problem is to view the Middle Missouri subtradition as the oldest resident Plains Village cultural phenomenon, one that is closely associated with the Mandan ethnic tradition. Later, the Central Plains subtradition, taking the initial form of the Coalescent subtradition (Initial and Extended variants), impinged on the southern homeland of the Middle Missouri subtradition, forcing these peoples to move upriver into the Garrison region, where the subtradition took its final form as the Terminal Middle Missouri variant. At this stage, then, the Coalescent tradition is entirely within the Arikara ethnic tradition. It is only later, following the end of the Terminal Middle Missouri variant, during Post-Contact Coalescent times, that the Mandan ethnic tradition coincides with the Coalescent subtradition.

At about the same time that the early Coalescent subtradition was pressuring the Middle Missouri subtradition in the south, other village peoples were impinging on it in the north. In the Lehmer/Caldwell taxonomy there is no archeological unit that can accommodate these intruders, who represent a part of the Hidatsa ethnic tradition. Some of the Hidatsa ethnic tradition (Charred Body complex) may be an outgrowth of the Middle Missouri subtradition (Middle Missouri complex), but much of it derives from a separate, unidentified subtradition-level unit from the Northeastern Plains. This unidentified subtradition causes a breakdown of the Lehmer/Caldwell taxonomy in the northernmost regions of the subarea. During the early stages of the Knife River

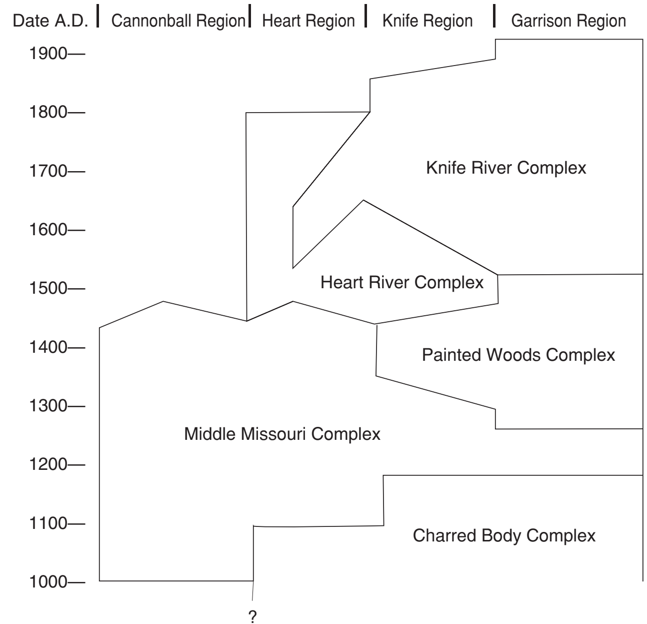

Figure 39. Cultural complexes of the Ahler taxonomy for the Plains Village tradition in the northern Middle Missouri subarea (from Ahler 1993b:Figure 25.1).

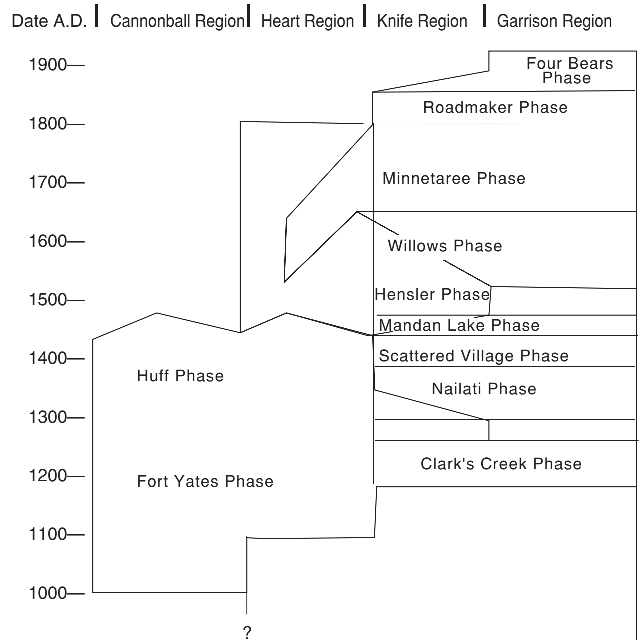

Figure 40. Cultural phases overlaid on the cultural complexes of the Ahler taxonomy for the Plains Village tradition in the northern Middle Missouri subarea (from Ahler 1993b:Figure 25.2).

research, the Scattered Village complex was defined to at least temporarily account for such archeological components (Lovick and Ahler 1982). The Scattered Village complex was later abandoned in favor of the system discussed here (Ahler 1993b; Figures 39 and 40). It is not until the Post-Contact Coalescent variant that many of the archeological components of the Hidatsa ethnic tradition can be properly accounted for within the Lehmer/Caldwell taxonomy. Thus, it is apparent that the Coalescent tradition is best conceived of as a cultural process, and a largely historic one at that, rather than as a useful archeological unit.

It should be noted that the Lehmer/Caldwell taxonomy and the Ahler taxonomy can best be compared with respect to time. Early, middle, and late units of the Lehmer/Caldwell scheme can be compared to equivalent temporal units of the Ahler scheme until enough additional research has been done in Plains Village taxonomy to permit a better reconciliation of the two taxonomic models, and ultimately complete revision of the existing systems.

Conventional Culture History

Although the Knife River research and revised taxonomy for the region is an important advance, the majority of the Plains Village sites and components in the Middle Missouri subarea are still classified according to the Lehmer/Caldwell taxonomy. Consequently, it is best to discuss Middle Missouri Village culture history in terms of these conventional units.

For the Middle Missouri subarea, the origins of the Plains Village tradition are diverse and poorly known. Village origins are tenuously linked to developments in the Eastern Woodlands and the expansion of sedentism and agriculture to the margins of the Northern Plains at about A.D. 900, ostensibly under the distant impetus of Mississippian cultures and the rise of Cahokia (Anderson 1987; Lehmer 1971; Tiffany 1983, 1991a; Toom 1992a, 1992c; Wood 1967, 1974). Fully developed village culture is first seen in the subarea with the emergence of the Initial Middle Missouri variant (IMM) in the Big Bend region of South Dakota. Recent studies places the beginning of IMM at ca. A.D. 950-1000 (Thiessen 1977; Toom 1992d), probably the latter date. According to traditional interpretation, the Extended Middle Missouri variant (EMM) was established shortly after IMM in both North and South Dakota.

Both migration and in situ development have been invoked to explain the onset of Plains Village culture (Alex 1981a; Anderson 1987; A. Johnson 1977c; Lehmer 1971; Tiffany 1983; Wood 1974). Whatever the case, the appearance of Plains Village culture in the Middle Missouri subarea was both sudden and seemingly without archeological precedent. In this sense, the Middle Missouri tradition (IMM and EMM) is seen as a revolutionary, not evolutionary, development within the Middle Missouri subarea, lending credence to the migration argument (Toom 1992a, 1992c).

Following the establishment of IMM and EMM in the Middle Missouri subarea, the Initial variant of the Coalescent subtradition appeared at ca. A.D. 1300 (Blakeslee 1993; Toom 1992d). The Initial Coalescent variant (IC) is closely related to the Upper Republican variant of west-central Kansas and Nebraska (Wedel 1986). The movement of IC peoples into the Middle Missouri from the Central Plains has been linked to a prolonged period of drought (Lehmer 1970, 1971), for which there is some supporting evidence at sites in the Middle Missouri (Toom 1992a). Blakeslee (1993) disagrees with this position, but his interpretation is based on an uncritical acceptance of the dating of the Pacific climatic episode.

The establishment of the IC in the Big Bend region of South Dakota largely coincides with the decline of IMM and the withdrawal of EMM northward, upriver. The original IMM population appears to have been absorbed by the more vigorous EMM peoples at this time. The Extended Coalescent variant (EC), the successor to the IC in South Dakota, is interpreted as a direct outgrowth of the IC, just as the Terminal Middle Missouri variant (TMM) is viewed as the direct successor of the EMM and remnants of the original IMM population (Table 8). EC villagers continued to expand upriver to the present-day North Dakota-South Dakota state line, at the expense of TMM peoples, until by the end of the Middle Missouri tradition, TMM villages are found only in a restricted portion of the Missouri Valley in south-central North Dakota.

Lehmer (1971) and others believe that these population movements produced culture contacts and exchanges that resulted in a general leveling of differences in material culture. This process of "coalescence" produced the Post-Contact Coalescent variant (PCC) (ca. A.D. 1650-1886), which is found throughout the subarea. Contacts were not always peaceful, however, as indicated by the presence of heavily fortified villages (Caldwell 1964; Lehmer 1971). That these fortifications were defensive is dramatically demonstrated by the discovery of the massacre of the majority of an entire IC village population at the Crow Creek site (39BF11), consisting of the remains of nearly 500 men, women, and children (Willey and Emerson 1993; Zimmerman et al. 1981; Zimmerman and Bradley 1993). The coalescence process in the Middle Missouri subarea becomes fully manifest in the historically known Arikara, Mandan, and Hidatsa village tribes (Meyer 1977), who are often referred to collectively as the Middle Missouri Villagers.

Arikaras belong to the Caddoan language family, while Mandans and Hidatsas are Siouan speakers. Arikaras, most closely related to Skiri (or Skidi) Pawnee of the Central Plains, are generally equated with the IC and EC of the Coalescent tradition, and are widely recognized as occupants of the Middle Missouri subarea in South Dakota during protohistoric and early historic times (Lehmer 1971). However, after the widespread and devastating smallpox epidemic of A.D. 1780-1781, they abandoned the southern part of the subarea and moved farther upriver (Krause 1972; Lehmer 1971). Depredations by nomadic Plains Equestrian tradition tribes, particularly the Sioux, are also believed to be responsible for this abandonment.

The Mandans, a historic North Dakota tribe, are generally equated with the IMM, EMM, and TMM of the Middle Missouri tradition (Wood 1967), while the majority of the Hidatsas have a more obscure culture history that is difficult to infer from the existing taxonomic framework (Ahler et al. 1991; Ahler 1993b). The Mandans and the Hidatsas also suffered greatly from epidemic diseases and attacks by the Sioux.

During protohistoric and early historic times, the development of the Euro-American fur trade caused fundamental changes in the lifeways of Plains Villagers and all other Amerindian groups on the Plains. The acquisition and trade of European manufactured goods and horses became a major aspect of village economies, causing significant alterations throughout the entire social fabric (Ahler et al. 1991; Berry 1978; Deetz 1965; Ewers 1954, 1968; Goulding 1980; Rogers 1990; Toom 1979; Wood 1974, 1980b).

European epidemic diseases were first documented in the subarea at this time, although earlier epidemics are likely (Dobyns 1983; Ramenofsky 1987). These had a particularly disastrous impact on village culture, especially the 1780-1781 smallpox epidemic that caused severe population loss and extreme cultural disruption, reducing Plains Village peoples to a mere shadow of what they had once been (Lehmer 1971; Meyer 1977). Village sites occupied after the widespread 1780 epidemic were assigned to the Disorganized Coalescent variant (A.D. 1780-1862) (Lehmer 1971), but this taxonomic unit is subsumed here under an expanded definition of the Post-Contact Coalescent variant.

As a result of these historical processes, the Plains Village tradition is brought to a close in the Middle Missouri in A.D. 1886 with the final abandonment of Like-a-Fishhook Village in North Dakota, the last traditional earthlodge settlement of the surviving Mandans, Hidatsas, and Arikaras (Smith 1972). Like-a-Fishhook Village was established by the Hidatsas and the Mandans around A.D. 1845. The Arikaras did not join them at Like-a-Fishhook until A.D. 1862, following the abandonment of Star Village, their last independent village site (Metcalf 1963a). Lehmer (1971) marks the terminus of the Plains Village tradition at A.D. 1862, which saw the merger of the surviving Arikaras, Hidatsas, and Mandans into a single village. Ahler (1993b) uses the abandonment of Like-a-Fishhook to mark the end of the tradition, the date that is also used here. However, the Plains Village period is ended at A.D. 1780, following the historically documented smallpox epidemic, because after this event domination of the Middle Missouri subarea shifted from the Plains Village tradition to the Plains Equestrian tradition. For these reasons, A.D. 1780 is used here to mark the advent of the Historic period, which saw the presence of three competing cultural traditions in the subarea—Plains Village, Plains Equestrian, and Euro-American.

Some Plains Village Sites

Past excavation work in the Middle Missouri centered on village sites. The listing of village site excavations in Table 9 is not exhaustive, but is an attempt to identify most sites that have seen extensive excavation work, or that offer unique insights into some aspect of Plains Village culture. Most of the sites listed are earthlodge villages, but a few other site types of the tradition are also represented.

It is evident from Table 9 that all the regions of the Middle Missouri have had substantial excavation work done in them, with the exception of the Heart region (Lower Knife-Heart). Only one site in the Heart region, Slant Village, has seen appreciable excavation work since the 1940s, and the published results are not definitive because of incomplete analysis (Ahler, Schneider, and Lee 1981). Clearly, much additional research is needed at sites of the Heart River complex not only to supplement current data, but also because these sites are key to identifying and understanding the later phases of the Mandan ethnic tradition, which were centered in the region.

Historic Period (A.D. 1780-present)

With the advent of the fur trade and the introduction of European manufactured goods and the horse, a new Amerindian force arose in the Northern Plains—the Plains Equestrian tradition (Hanson 1975; Jablow 1950; Robinson 1974; Secoy 1953). These relative newcomers began to compete with the Plains Villagers for dominance in the subarea. During the early 1700s, various tribes began moving into the Northern Plains from the east under the pressures of the expanding Euro-American frontier and intertribal warfare. Some of these became the historically known Plains Equestrian groups, such as the Sioux (Dakota), Cheyenne, Crow, and Assiniboine. After the A.D. 1780 smallpox epidemic had devastated the villagers, mounted nomads, especially the Sioux, who were less affected by the epidemic, were able to dominate the Middle Missouri well into the historic period. However, sites relating to these groups often leave few traces and are rarely identified. Large Sioux campsites are historically documented in the subarea (Mattison 1954; Smith 1960a), but few have been positively identified archeologically. Such sites have not been a focus of major research efforts. The most extensively investigated and reported Plains Equestrian site in the subarea is Ice Glider (32OL110), located on the Cross Ranch in the upper Knife-Heart region of North Dakota, which probably was occupied by the Yanktonai Sioux in the mid-1800s (Wood 1986b).

The rise of Plains Equestrian tradition was coeval with the development of the fur trade, which was most active in the Middle Missouri during the nineteenth century (Chittenden 1954; Sunder 1965; Wishart 1979; Wood and Thiessen 1985). In addition to its impact on native cultures, the fur trade also stimulated Euro-American exploration of the subarea. The first documented Europeans to penetrate to the Middle Missouri were the La Verendryes, who made trips from Canada during the mid-1700s into what was to become the Dakotas (Smith 1980). Others soon followed, but it was the Lewis and Clark expedition of 1804-1806 that was the best known and also collected the most information on the area during early historic times (Thwaites 1969; also Moulton 1983).

The fur trade era represents the initial exploration and exploitation of the Middle Missouri by Euro-Americans, but was not a time of settlement. The subarea was dominated by Plains Equestrian tribes, and fur trading enterprises were only concerned with exploiting furs and hides for commercial gain. Initially, these resources were primarily supplied by native hunters and trappers; when the resource base was exhausted, trading concerns abandoned their posts, often selling them to the U.S. Army. Therefore, the fur trade is best viewed as a temporary occupation of the subarea by Euro-Americans for a specialized purpose, not as a permanent settlement of the region.

Table 9. Selected Plains Village Sites and Primary References for the Middle Missouri Subarea of the Northern Plains

Region	Site Name (Number)	Primary Component(s)[a]	References
Garrison	Midipadi Butte (32DU2)	Knife River/Unassigned	Kuehn et al. 1982; Kuehn et al. 1984
	Bear Den (32DU175)	Knife River/Unassigned	Kuehn and Perry 1986
	Rock Village (32ME15)	Knife River/Four Bears, Roadmaker	Lehmer et al. 1978
	Grandmother's Lodge (32ME59)	Middle Missouri/Clark's Creek	Woolworth 1956
	Nightwalker's Butte (32ML39)	Knife River/Minnataree	Lehmer et al. 1978
	Mondrian Tree (32MZ58)	Painted Woods?/Unassigned	Toom and Gregg 1983
Upper Knife-Heart	Clark's Creek (32ME1)	Middle Missouri/Clark's Creek	Calabrese 1972
(Knife Region)	White Buffalo Robe (32ME7)	Knife River/Roadmaker, Heart River/Hensler, Painted Woods/Nailati	Lee 1980
	Amahami (32ME8)	Knife River/Four Bears, Roadmaker, Painted Woods/Nailati	Lehmer et al. 1978
	Lower Hidatsa (32ME10)	Knife River/Minnetaree. Heart River/Willows, Hensler	Ahler and Weston 1981
	Sakakawea (32ME11)	Knife River/Four Bears, Roadmaker	Ahler et al. 1980
	Big Hidatsa (32ME12)	Knife River/Four Bears, Roadmaker Minnetaree, Willows, Painted Woods, Scattered Village	Ahler and Swenson 1985
	Star Village (32ME16)	Knife River/Four Bears	Metcalf 1963a
	Taylor Bluff (32ME366)	Knife River/Four Bears	Ahler 1988
	Elbee (32ME408)	Painted Woods/Unassigned, (Extended Coalescent?)	Ahler 1984
	Like-a-Fishhook (32ML2)	Knife River/Four Bears	Smith 1972
	Flaming Arrow (32ML4)	Charred Body/Unassigned	Toom 1988
	Upper Sanger (32OL12)	Painted Woods/Scattered Village, Nailati	Stoutamire 1973
	Cross Ranch (32OL14)	Painted Woods/Nailati	Calabrese 1972
	Bagnell (32OL16)	Painted Woods/Mandan Lake?, Scattered Village?	Unreported (but see Lehmer et al. 1973)
	Greenshields (32OL17)	Knife River/Roadmaker	Nicholas and Johnson 1986
Lower Knife-Heart	Slant (32MO26)	Post-Contact Coalescent	Ahler, Schneider, and Lee 1981
(Heart Region)	Havens (32EM1)	Extended Middle Missouri	Sperry 1982
Cannonball	Tony Glas (32EM3)	Terminal Middle Missouri	Howard 1962a
	Unnamed (32EM61)	Unspecified Plains Village	Gregg et al. 1983
	Shermer (32EM10)	Terminal Middle Missouri	Sperry 1968
	Bendish (32MO2)	Extended Middle Missouri	Thiessen 1975
	Huff (32MO11)	Terminal Middle Missouri	Howard 1962b; Wood 1967
	Fire Heart Creek (32SI2)	Post-Contact Coalescent, Extended Missouri	Lehmer 1966
	Paul Brave (32SI4)	Extended Middle Missouri	Wood and Woolworth 1964
	Ben Standing Soldier (32SI17)	Extended Middle Missouri	Unreported
	South Cannonball (32SI19)	Extended Middle Missouri	Griffin 1984
Grand-Moreau	Anton Rygh (39CA4)	Post-Contact Coalescent, Extended Coalescent	Knudson et al. 1983
	Bamble (39CA6)	Post-Contact Coalescent	Baerreis and Dallman 1961
	Helb (39CA208)	Extended Middle Missouri	Falk and Ahler 1988
	Demery (39CO1)	Extended Coalescent	Woolworth and Wood 1964
	Jake White Bull (39CO6)	Extended Middle Missouri	Ahler 1977b
	Leavenworth (39CO9)	Post-Contact Coalescent	Krause 1972; Bass et al. 1971
	Lower Grand (Davis) (39CO14)	Extended Coalescent	Ahler 1975; Falk and Ahler 1988
	Potts (39CO19)	Extended Coalescent	Stephenson 1971
	Red Horse Hawk (39CO34)	Post-Contact Coalescent	Hoffman 1970
	Travis I (39CO213)	Extended Middle Missouri	Haberman 1982
	Four Bear (39DW2)	Post-Contact Coalescent	Hurt et al. 1962
	Calamity (39DW231)	Extended Middle Missouri	Unreported
	Swift Bird (39DW233)	Extended Coalescent	Hoffman 1963
	Molstad (39DW234)	Extended Coalescent	Hoffman 1967
	Hosterman (39PO7)	Extended Coalescent	Miller 1964
	Larson (39WW2)	Post-Contact Coalescent	Falk and Johnson n.d.
	Spiry-Eklo (39WW3)	Post-Contact Coalescent	Baerreis and Dallman 1961
	Swan Creek (39WW7)	Post-Contact Coalescent	Hurt 1957
	Blue Blanket Island (39WW9)	Post-Contact Coalescent	Stephenson 1969
	Spiry (39WW10)	Extended Coalescent	Baerreis and Dallman 1961
	Walth Bay (39WW203)	Extended Coalescent	Ahler 1975; Falk and Ahler 1988
	Payne (39WW302)	Extended Coalescent	Wilmeth 1958
Bad-Cheyenne	No Heart Creek (39AR2)	Extended Coalescent	Hurt 1970
	Thomas Riggs (39HU1)	Extended Middle Missouri	Hurt 1953; Johnston 1967
	Spotted Bear (39HU26)	Post-Contact Coalescent	Hurt 1954
	Rosa (39PO3)	Post-Contact Coalescent	Hurt 1959, 1974
	Sully (32SL4)	Post-Contact Coalescent, Extended	Unreported
	Cheyenne River (39ST1)	Post-Contact Coales., Extended Coales., Extended Mid. Miss.	Unreported
	Black Widow (39ST3)	Extended Coalescent	Unreported
	Buffalo Pasture (39ST6)	Post-Contact Coalescent	Lehmer and Jones 1968
	Fay Tolton (39ST11)	Initial Middle Missouri	Wood 1976
	H. P. Thomas (39ST12)	Post-Contact Coales. Extended Coales. Initial Middle Missouri	Falk, Johnson, and Richtsmeier n.d.
	Phillips Ranch (39ST14)	Post-Contact Coalescent	Lehmer 1954
	Indian Creek (39ST15)	Post-Contact Coalescent, Extended Middle Missouri	Lehmer and Jones 1968
	Breeden (39ST16)	Extended Coalescent, Initial Middle Missouri	Brown 1974; Toom and Artz 1985
	Dodd (39ST30)	Post-Contact Coalescent, Initial Middle Missouri	Lehmer 1954
	Leavitt (39ST215)	Extended Coalescent, Post-Contact Coalescent	Lehmer and Jones 1968
	Black Widow Ridge (39ST203)	Post-Contact Coalescent, Extended Middle Missouri	Unreported
Big Bend	Medicine Crow (39BF2)	Post-Contact Coalescent	Ahler and Toom 1989; Deetz 1965
	Talking Crow (39BF3)	Post-Contact Coalescent, Initial Coalescent	Smith 1977
	Crow Creek (39BF11)	Initial Coalescent, Initial Middle Missouri	Kivett & Jensen 1976; Zimmerman et al. 1981; Haug 1986; Willey & Emerson 1993
	Pretty Bull (39BF12)	Post-Contact Coalescent, Initial Middle Missouri	Unreported

Table 9, continued

Region	Site Name (Number)	Primary Component(s)[a]	References
Big Bend	Two Teeth (39BF204)	Post-Contact Coalescent	Smith and Johnson 1968
	Swanson (39BR16)	Initial Middle Missouri	Hurt 1951
	Arzberger (39HU6)	Initial Coalescent	Spaulding 1956
	McClure (39HU7)	Post-Contract Coalescent	Johnston 1982
	Chapelle Creek (39HU60)	Post-Contact Coalescent, Initial Middle Missouri	Brown 1967
	Little Pumpkin (39HU97)	Extended Coalescent	Toom 1992b
	Whistling Elk (39HU242)	Initial Coalescent	Steinacher 1984c; Toom 1992a
	Stricker (39LM1)	Extended Coalescent	Smith 1975
	Medicine Creek (39LM2)	Extended Coalescent, Initial Coalescent, Initial Middle Missouri	Unreported
	Hickey Brothers (39LM4)	Extended Middle Missouri	Caldwell et al. 1964
	Oacoma (39LM26 & 27)	Post-Contact Coalescent	Kivett 1958
	Dinehart (39LM33)	Initial Middle Missouri	Unreported
	Clarkstown (39LM47)	Extended Coalescent	Unreported
	King (39LM55)	Extended Middle Missouri, Initial Middle Missouri	Johnson 1979b
	Antelope Dreamer (39LM146)	Initial Middle Missouri	Toom 1990a
	Rattlesnake Keeper (39LM160)	Post-Contact Coalescent	Toom 1989, 1990b
	Buzzing Yucca (39LM166)	Extended Coalescent	Toom 1990a
	Jiggs Thompson (39LM208)	Initial Middle Missouri	Caldwell and Jensen 1969
	Langdeau (39LM209)	Initial Middle Missouri	Caldwell and Jensen 1969
	Black Partisan (39LM218)	Initial Coalescent	Caldwell 1966
	Jandreau (39LM225)	Initial Middle Missouri	Jones n.d.
	Pretty Head (39LM232)	Initial Middle Missouri	Caldwell and Jensen 1969
	Spain (39LM301)	Extended Coalescent	Smith and Grange 1958
	Over's La Roche (39ST9)	Extended Coalescent	Hoffman 1968
	Fort George Village (39ST17)	Post-Contact Coalescent	Hoffman 1970
	Sommers (39ST56)	Initial Middle Missouri	Falk, Steinacher, and Johnson n.d.; Steinacher 1990
	Red Fire (39ST88)	Initial Middle Missouri	Steinacher 1981
	Ghost Lodge (39ST120)	Post-Contact Coalescent	Toom 1990a
	Ketchen (39ST223)	Extended Coalescent, Extended Middle Missouri	Moerman and Jones 1966a; Johnson 1979b
	Cattle Oiler (39ST224)	Extended Coalescent, Initial Middle Missouri	Moerman and Jones 1966b; Johnson 1979b
	Eagle Feather (39ST228)	Extended Coalescent, Initial Middle Missouri	Toom 1992a
	Stony Point (39ST235)	Post-Contact Coalescent, Initial Middle Missouri	Steinacher 1981; Toom 1992a
	Bowers' La Roche (39ST232)	Extended Coalescent	Hoffman 1968
	Durkin (39ST238)	Extended Middle Missouri	Johnson 1979b

[a]Sites in the Garrison and the Upper Knife-Heart (Knife) regions are classified according to the Ahler taxonomy (see Ahler 1993b; Figures 4 and 5). Sites in all other regions are classified according to a modified version of the Lehmer/Caldwell taxonomy (see Lehmer 1971; Table 7). Under the Ahler taxonomy, the first name is that of the complex, and the names following the slash (/) are those of the phases.

At one time, Euro-American fur trading posts were a fairly common type of archeological site in the subarea (Mattes 1949, 1960; Mattison 1951, 1954, 1962; Miller 1960; Mills 1960; Smith 1960a, 1968, 1972), and some were excavated by the SIRBS (Table 10). Like all other types of sites, these have suffered from the inroads of modern development, particularly dam and reservoir construction, and comparatively few intact examples remain in the subarea today.

U.S. military occupation of the Middle Missouri began near the close of the fur trade era. Numerous Indian agency posts and forts were established along the Missouri in the Dakota Territory (Athearn 1967; Mattes 1949, 1960; Mattison 1951, 1954, 1962; Mills 1960; Ruple 1984; Sheridan 1972; Smith 1960b, 1968, 1972). The purpose of the military presence was to subjugate and pacify the native population in order to secure the region for permanent Euro-American settlement (Smith 1984). Like fur trading posts, U.S. military posts were once rather common archeological entities, but they, too, have suffered some destruction from modern development; a number were excavated by the SIRBS (Table 10).

In concert with the military occupation of the region, several reservations were formed to hold subjugated Amerindian groups. Reservation archeological sites consist of remnants of Indian agency buildings and structural remains such as "dugouts" and cabins occupied by the Native American reservation population. The latter, usually representing native homestead allotments (Smith 1984), have not been extensively documented by past archeological surveys, but more recent survey work within the Lower Brule, Crow Creek, and other reservations in the Dakotas has found them to be quite numerous (Falk 1984; Steinacher 1981; Toom and Picha 1984). Native cemeteries, ranging in size up to a few acres, tend to cluster around Indian population centers on the reservations.

Once the Middle Missouri had been secured by the military, Euro-American settlers began occupying the region during the late 1880s (Robinson 1966; Schell 1975). Early Euro-American tradition settlement sites include the remains of small communities, post offices, homesteads, and farm/ranch yards. Again, such sites were poorly documented by early archeological surveys, but more recent work has found them to be very common (Table 10). Within the bounds of the reservations, it is frequently difficult to distinguish Euro-American and Amerindian sites of this period because many native homesteads on the reservation were eventually taken over by whites (Smith 1984). Cemeteries of this period are also present, usually as small community or family plots. Euro-American settlement of the subarea was essentially complete by the early 1900s, and land use and settlement patterns had become more or less fixed, continuing up to the present day.

Table 10. List of Selected Historic Archeological Sites and Primary References for the Middle Missouri Subarea of the Northern Plains

Site Name (Number)	Identified Components	References
Ft. Stevenson (32ML1)	Euro-American military post	Smith 1960b
Ft. Berthold I and II (32ML2)	Euro-American military post	Smith 1972
Kipp's Post (32MN1)	Euro-American trading post	Woolworth and Wood 1960
Ft. Lincoln (32MO141)	Euro-American military post	Good 1988, 1989; Fox 1990; Emerson and Fox 1991; Fox and Emerson 1991; Penny and Larson 1992
Crow-Flies-High (32MZ1)	Amerindian settlement (Hidatsa village)	Malouf 1963
Ice Glider (32OL110)	Amerindian campsite (Yanktonai Sioux)	Wood 1986b
Garden Coulee (32WI18)	Amerindian settlement (Hidatsa village)	G. Fox 1982a
Ft. Manuel (39CO5)	Euro-American trading post	Smith and Ludwickson 1981
Ft. Randall (39GR15)	Euro-American military post	Mainly unreported; Hannus et al. 1986
Ft. Sully I (39HU52)	Euro-American military post	Ruple 1984
Ft. Lookout (39LM57)	Euro-American trading post	Miller 1960
Medicine Creek (39LM241)	Euro-American homestead site	Smith 1968
Red Cloud Agency III (39LM247)	Euro-American Indian agency	Smith 1968
Ft. Sully II (39SL45)	Euro-American military post	Unreported
Ft. Bennett Agency (39ST26)	Euro-American military post and Indian agency	Unreported
Ft. George (39ST202)	Euro-American trading post	Smith 1968
Ft. Pierre II (39ST217)	Euro-American trading post	Smith 1960a
Ft. Pierre Chouteau (39ST237)	Euro-American trading post	Unreported

The Disappeared and the Disappearing

No overview of Middle Missouri archeology would be complete without mention of the unprecedented level of site destruction that has occurred in this portion of the Great Plains. The construction and operation of four main stem Missouri River dams and their reservoirs within the Dakotas has inundated and severely eroded most of the original bottomland areas and much of the original low-lying terrace areas along the Missouri, locations where the greatest number of archeological sites would be expected. Untold thousands of sites have undoubtedly been destroyed or severely damaged as a direct result of these public water projects. The Middle Missouri IASP did what it could to mitigate the impacts, but these efforts, while substantial, were far from adequate by modern standards.

In the South Dakota portion of the subarea alone, past and present surveys have identified and recorded some 360 earthlodge village sites. Of this number, only about 120 or 33% are above the reservoir levels, and many have suffered greatly from shoreline erosion and other impacts of modern development. Realistically, the present best estimate is that only approximately 25% of the village sites that were once known in the Middle Missouri subarea of South Dakota remain more or less intact today (Steinacher and Toom 1985). Comparable figures are not available for the North Dakota portion of the subarea, but village destruction was far less severe because of the preservation of the Knife-Heart region and the smaller number of village sites that were once present in the Garrison region (Lehmer 1971). In the Cannonball region of North Dakota, however, many village sites were inundated or have suffered extensive damage from erosion. A conservative estimate of overall village site destruction in the Middle Missouri would fall somewhere between 50 and 75% of the once existing resource base.

These figures do not even begin to cover the sites that were not as well documented by the SIRBS IASP surveys, particularly those of the preceramic period, which must have been destroyed by the hundreds, with little or no archeological investigation. Surely the Paleoindian, Plains Archaic, and Plains Woodland sites have suffered rates of destruction comparable to those estimated for the better documented village sites.

The destruction of such a substantial portion of the archeological record in the region is a major loss. It clearly underscores the fact that what remains of Middle Missouri archeology, no matter what its age, is all the more significant and precious. Unfortunately, the destruction of significant archeological sites by reservoir erosion and other means continues largely unabated in the Middle Missouri today. A graphic example was the nearly total destruction of the Boley village site, a large Heart River phase village situated on the north side of Mandan, North Dakota, for a housing development. In addition, promises of site stabilization and preservation within federal project areas have gone virtually unfulfilled in the face of dwindling federal dollars and unsympathetic project managers. The deplorable state of Middle Missouri archeology has reached crisis proportions, and unless something is done soon, little will survive into the twenty-first century outside of preserves such as the Knife River Indian Villages National Historic site and Cross Ranch Nature Preserve.

On the positive side, the state of North Dakota has been farsighted in the preservation and protection of some major village sites, including five state-owned State Historic Sites (Ft. Clark, Double Ditch, Huff, Menoken, and Molander), the Ward village site which is a Bismarck city park, and Slant Village within Ft. Lincoln State Park. Ft. Clark State Historic Site also contains the remains of important fur trade posts. Sadly, the state of South Dakota has not made a similar effort.

Another issue that deserves consideration is the fate of the inundated sites. The recent drought years of 1988-1992 exposed a number of long inundated village and other sites as levels in three of the four main stem reservoirs (Garrison, Oahe, and Ft. Randall) were allowed to fall. The exposed village sites, particularly those in the upper portion of Lake Oahe, near Mobridge, appeared quite literally as a carpet of artifact debris of all kinds that had been eroded from the original site matrix. A question about these sites remains unanswered, however. Do primary archeological deposits and features remain intact in these sites, or have they been reduced to heaps of secondary context material? Unfortunately, the opportunity to study this question has passed due to lack of financial support for the necessary research and the refilling of the reservoirs by the heavy rains of 1993. Nevertheless, limited observations made by some suggest that intact deposits and features do still exist at some of the inundated sites, especially those that were covered quickly and, thus, not subjected to extensive lateral cutting. We therefore should not readily dismiss inundated sites as completely destroyed and no longer of any scientific research interest, and these sites should be given consideration in long-term cultural resource management plans.

6 Archeology of the Northeastern Plains, by Michael L. Gregg, David Meyer, Paul R. Picha, and David G. Stanley

The Northeastern Plains is a subarea of the Northern Plains archeological culture area (Anfinson 1982; Gregg 1994a; Wood 1971) (Figure 1) and was referred to as the Northeastern Periphery by Wedel (1961). Recent research has demonstrated that the Northeastern Plains is a subarea with unique cultural developments. The subarea includes several ecologically distinct areas that are posited to be archeological regions. Paleoecology is an important factor in the Northeastern Plains, where the presence of glacial ice, glacial meltwater rivers, and glacial lakes rendered vast territories uninhabitable during portions of the Paleoindian period.

The Northeastern Plains is largely the western portion of the Young Glacial Drift Section of the Central Lowland physiographic province (Fenneman 1938). The western boundary is the Missouri Escarpment, west of which lies the Missouri Plateau of the Great Plains province. To the south and southeast in Iowa and Minnesota are the Dissected Till Plains with their more mature drainage systems. The forested Superior Upland lies to the east and north in Minnesota and Manitoba.

Alternatively, the eastern margin of the subarea has been viewed as the prairie-woodland ecotone (Kucera 1991). As discussed earlier in this volume, this boundary shifted throughout the Holocene in response to climate change. Similarly, the northern boundary of the subarea may be viewed as the northern margin of the parklands of southern Manitoba and Saskatchewan. The northern margin of the grasslands advanced to its maximum northward extent during the arid mid-Holocene, and retreated southward during the late Holocene.

Surface sediments of the Northeastern Plains are generally glacial drift, sometimes up to 500 ft thick. The drift is underlain by Cretaceous shale throughout much of the subarea, a prominent exception being Niobrara limestone in southeastern South Dakota, southwestern Minnesota, and northwestern Iowa (Fenneman 1938). The Turtle Mountains, straddling the North Dakota-Manitoba border, are a remnant of Fort Union formation sandstones overlying the Cretaceous beds. The Pembina Escarpment, Riding Mountains, and Duck Mountains are elevated areas of Cretaceous bedrock west of the Red River valley in northeastern North Dakota and southern Manitoba, with Niobrara chalk sometimes exposed beneath Pierre shale (Fenneman 1938).

The Coteau des Prairies (or Prairie Coteau) is a linear upland extending from northeastern South Dakota southward across southwestern Minnesota into northwestern Iowa, and rising 700 to 800 ft above the surrounding drift plains (Gilbertson 1989). Knobs of Sioux quartzite rise above the general surface in southern portions of the Prairie Coteau and eastward from there to the Minnesota River valley in southern Minnesota (Fenneman 1938). Sioux quartzite, and beds of catlinite layered within it, are two bedrock stone materials that were utilized in precontact times.

The Northeastern Plains is part of the Northern Temperate Grassland (Kucera 1991; Shelford 1963). Moving from southwest to northeast across the subarea, the predominantly mixed grass prairie gives way to tall grass prairie increasingly dotted with lakes, marshes, and patches of deciduous forest. On the northern margins of the subarea in Saskatchewan and Manitoba, the prairie merges with aspen parkland. To the east, there is a transition to the northern coniferous forest and the southern deciduous forest. As illustrated in Figure 41, several archeological regions can be defined within the Northeastern Plains based on natural features and resources (AHPD, SHSND 1990; Winham and Hannus 1990). These regions are posited to provide a geographical scale to enable drawing meaningful conclusions in comparative studies of their respective archeological records.

The northernmost portion of the subarea encompasses the Souris River basin and portions of the Assiniboine River basin

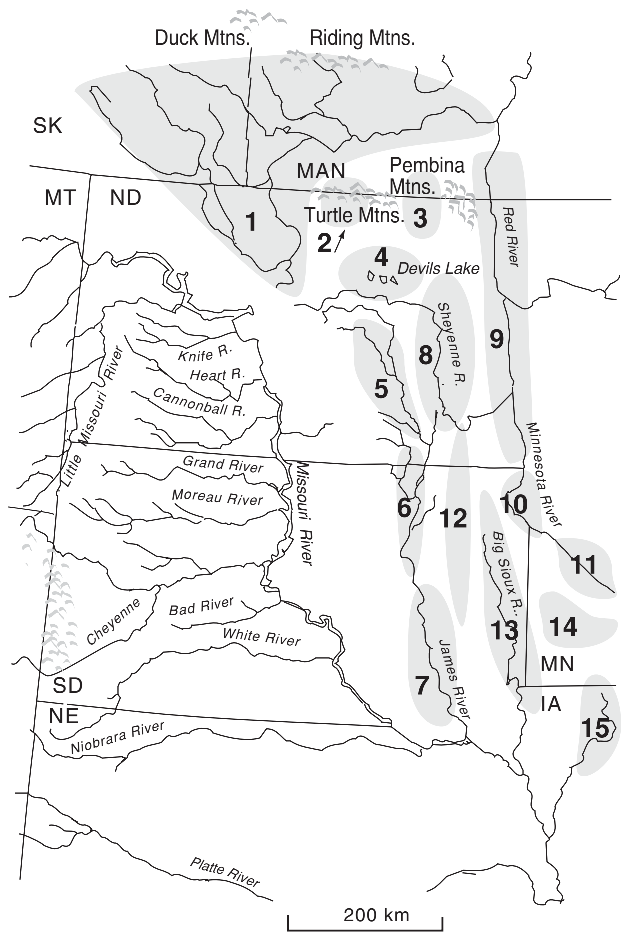

Figure 41. Archeological regions of the Northeastern Plains archeological subarea: 1, Souris Basin; 2, Turtle Mountains; 3, Pembina Mountains/Manitoba Escarpment; 4, Devils Lake; 5, Upper James River Valley; 6, Middle James River Valley; 7, Lower James River Valley; 8, Sheyenne River; 9, Red River Valley; 10, Lake Traverse/Big Stone Lake; 11, Upper Minnesota River Valley; 12, Prairie Coteau; 13, Big Sioux River; 14, Prairie Lakes; and 15, Little Sioux River.

in northern North Dakota and southern Manitoba. This was principally the territory of the Assiniboine at the time of Euro-American contact (Dahlberg and Whitehurst 1990).

To the south is the hilly, wooded terrain of the relatively small Turtle and Pembina "mountains." Species composition of the woodlands here is unique in all of North America, and includes large stands of dwarf bur oak (Stevens 1963). The distinctive habitats of the Turtle Mountains were sometimes frequented by animal species not usually associated with the plains, such as moose and caribou (Bailey 1926).

The Devils Lake basin is a closed drainage that is mainly prairie, with a few areas of mixed hardwoods around the major lakes in the center of the basin. Like elsewhere in the subarea (Radle 1981), surface water in the Devils Lake region dries up during extended droughts (Gregg 1994b).

The upper James River Valley, south of Devils Lake, is narrow, deep, and heavily wooded relative to the middle and lower portions (Artz 1995; Picha and Gregg 1993). Hardwood gallery forests line the riverbanks and hardwood draws extend up the tributary drainages to the level of the surrounding plains. The woodland habitats that developed in the shelter of the deep valley offered a range of biotic resources matched in few other places in the subarea, such as the Sheyenne River and Big Sioux River regions. At the beginning of the Holocene, the middle portion of the James River Valley was occupied by glacial Lake Dakota. After the lake drained, ecological succession on the old lake bed culminated in mid-grass prairie. This low-lying region is known as the James River Lowland (Flint 1955). The Lake Dakota Plain extends from just northeast of Huron, South Dakota, some 130 miles northward into North Dakota. The lower James River Valley figured prominently in the origin and development of Plains Village cultures in both the Northeastern Plains and Middle Missouri subareas and was part of Dakota-Sioux territory at contact time. The Sheyenne River drainage is a west to east trending basin that heads on the face of the Missouri Escarpment and flows eastward, discharging into the Red River in southeastern North Dakota (Running 1995).

The Red River Valley includes the expansive bed of glacial Lake Agassiz, the array of shorelines that developed when the lake stood at various stages, and the Holocene Red River itself, which flows northward through the approximate center of the lake plain. Most of the Red River Valley is a relatively featureless plain, except where Holocene drainages have downcut and levees have formed along some of the larger watercourses (Foss et al. 1995). Gallery forests stand along the meandering Red River. Lake Traverse and Big Stone Lake lie at the divide between the drainages of the Red and Minnesota rivers.

Lying east of the Big Sioux River in southwestern Minnesota and northwestern Iowa, the Prairie Coteau is a north-south trending region of higher land that was not glaciated during the last major advance. This is prairie lakes country, and is divided by the Big Sioux River (Anfinson 1987). The southeastern portion of the Northeastern Plains subarea includes the Big and Little Sioux rivers, which drain southward to the Missouri River out of the Prairie Coteau. In late prehistory, the lower reaches of these drainages exhibited strong ties to the Central Plains culture area.

Cultural developments in the Northeastern Plains were often influenced by in-movements of people and ideas from adjacent subareas. The Minnesota River provided a direct connection to the Upper Mississippi Valley. The Big Sioux and James rivers accessed the Lower Missouri Valley. The plains bison herds attracted frequent visitation from the Northeastern Woodlands across the prairie-woodland ecotone (Wedel 1974). The Red River-Lake Winnipeg waterway facilitated interaction with Boreal Forest peoples. The transition zone between the Northeastern Plains and Northwestern Plains is as difficult to map as the mid-grass to short-grass ecotone. Finally, the longest border of all is with the Middle Missouri subarea, and Middle Missouri influences were persistently a factor in Northeastern Plains cultural development.

Geoarcheological investigations demonstrate that it is important to incorporate landform evolution into discussions of settlement practices (Bettis and Benn 1984). It is imperative to recognize the ages of various landforms and to determine the ages of the sediments that comprise them. Figure 42 is a model depicting buried soils and their associations with prominent archeological cultures during the Holocene in the Northeastern Plains. In settings where sediments eroded from uplands accumulated during dry episodes of the Holocene, topsoils that developed under mesic conditions were buried.

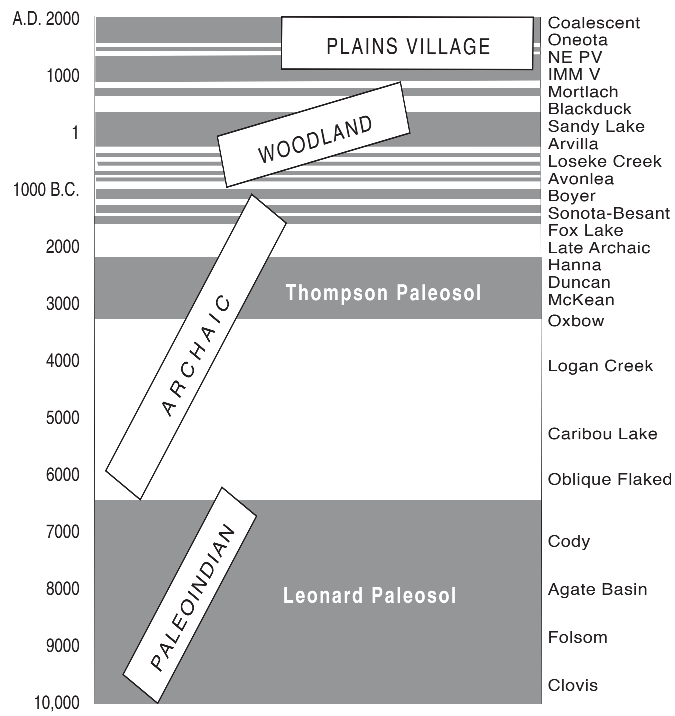

Figure 42. Idealized profile depicting prominent buried soils of the Holocene age Oahe Formation along with other buried soils identified at archeological sites in alluvial settings in the Upper James River region. Prominent archeological complexes are placed in time to show their correlations with mesic climatic regimes under which landforms were stable and soils developed.

Archeological deposits attributable to the prominent prehistoric cultures are typically associated with these buried topsoils (Artz 1995; Foss et al. 1995).

In North Dakota, the typical stratigraphic profile of Holocene sedimentation has been termed the Oahe Formation (Clayton et al. 1976). The deepest and earliest buried soils are the Leonard paleosols of the Oahe Formation. These paleosols are generally the darkest and thickest of all the buried topsoils, and represent the time when mesic conditions prevailed the longest. Capping the early Holocene paleosols are poorly developed sediments of the mid-Holocene. Developed mid-Holocene soils have been identified, but they have not yet been stratigraphically correlated in a sufficient number of localities to be formally described and named (Running 1995). For example, alluvial-colluvial fan deposits in the Souris Valley that have been tested indicate periods of rapid mid-Holocene infilling, with the late Holocene artifact deposits in overlying late Holocene soils (Robert Christensen, North Dakota Department of Transportation, personal communication to Paul Picha, April 1996).

History of Archeological Research

The earliest archeological investigations were avocational throughout much of the subarea. In 1871, A. J. Comfort, an army surgeon stationed at Fort Wadsworth, Dakota Territory, described Indian mounds of the northern Prairie Coteau and along the James River in the Middle and Upper James River regions (Comfort 1873). Early U.S. land surveyors sometimes recorded site information, including plotting site legal locations and sketching site layouts. An example is an early notation of the Anderson Earthworks, an interconnected set of conical and linear earthen mounds in the Upper James River region (Beardsley 1875).

Alfred J. Hill, of St. Paul, Minnesota, initiated and sponsored the Northwestern Archaeological Surveys program from 1881 until his death in 1895. The goal of the NWAS was to record prehistoric earthworks in the Upper Mississippi Valley and adjacent areas, including parts of the Middle Missouri (see Haury 1990). Hill's principal fieldworker, T. H. Lewis, recorded thousands of burial mounds, earthworks, boulder petroglyphs, and petroforms throughout the Northeastern Plains in the U.S. and Canada (Haury 1990; Lewis n.d., 1886a, 1886b, 1890a, 1890b). The findings of the NWAS were never published, but notebooks, maps, and other documents, which contain a wealth of archeological information, are curated by the Minnesota Historical Society (MHS Hill-Lewis Collection, 1891-1895).

Cyrus Thomas, affiliated with U.S. Geological and Geographical Survey, excavated mounds and other sites in portions of the subarea. Many of these locations are mentioned in his "Ancient Mounds of Dakota" (Thomas 1873) and *Catalogue of Prehistoric Earthworks East of the Rockies* (Thomas 1891).

Warren Upham (1896) identified earthworks during a geological survey of glacial Lake Agassiz. Henry Montgomery, an avocational archeologist, targeted several of the mounds reported by Upham in the Devils Lake and Red River Valley regions (Montgomery 1906); unfortunately, there is very little documentation from his work.

W. H. Over, affiliated with the University of South Dakota Museum (now the W. H. Over Museum), conducted research throughout eastern South Dakota from the 1910s through the 1930s (Sigstad and Sigstad 1973), recording mounds and earthlodge villages. In the 1930s, the WPA sponsored avocational and aspiring professional historians and archeologists to compile oral histories and archeological site information on a county-by-county basis throughout North Dakota (Floodman 1989b). Thad C. Hecker's work in the Souris Basin region resulted in stimulating visionary insights during a period when little attention was devoted to locations other than the Missouri Valley (Gregg and Picha 1990). Hecker also investigated sites on the Red River in southern Manitoba, such as Lockport (MacNeish 1958:15). Much of this valuable information remains unpublished, but it is curated at the State Historical Society of North Dakota in Bismarck.

The Arvilla gravel pit burial site was investigated by Jenks (1932), who also reported on Browns Valley Man, now confirmed as Paleoindian in age (Jenks 1937). William Duncan Strong excavated at the Biesterfeldt site in the Sheyenne River region in 1938 (Strong 1941; Wood 1971), demonstrating that fortified earthlodge villages were present well north in the Northeastern Plains.

Several regional overviews and summaries of prehistory appeared late in this period. Wilford (1941) published the first synthesis of Minnesota prehistory, which he updated several times (Wilford 1945, 1955, 1970). Inspired by Wilford, amateur archeologist Chris Vickers published summaries of his Manitoba findings (Vickers 1945, 1948). MacNeish (1958) wrote the initial synthesis of southern Manitoba prehistoric archeology.

Outside the Missouri River Valley, surveys were performed in the Souris Basin by Bauxar (1947a); in the Middle (Howard and Black n.d.) and Upper James River regions by Bauxar (1947b), Mallory (1966), and Wheeler (1963); and in the Devils Lake basin by Cooper (1947). Excavations at the Hintz site provided evidence of earthlodge villagers occupying the James River valley (Wheeler 1963).

In southeastern Saskatchewan, the construction of a dam and reservoir on a tributary of the Souris River necessitated a survey of the area in 1957. As a result, the Long Creek site was excavated by W. J. Mayer-Oakes and Boyd Wettlaufer in 1958. This deeply stratified site was extremely important in clarifying the culture history of a large section of the Northern Plains (Wettlaufer and Mayer-Oakes 1960).

Several important non-SIRBS projects were undertaken during the late 1950s through the 1970s. These include Johnson's (1962:160-161) survey of relict beaches of glacial Lake Agassiz and Nelson's (1973) survey of boulder features and petroglyphs in western Minnesota and the eastern Dakotas. As part of glacial Lake Agassiz beach surveys in southwestern Manitoba, Morgan Tamplin, of the University of Manitoba, excavated the Avery site in 1966 (Joyes 1970).

Since 1974, the tempo of archeological and historical investigations has increased as a result of the National Historic Preservation Act and the National Environmental Policy Act, coupled with planning by the U.S. Bureau of Reclamation (BOR) and Army Corps of Engineers for their water management projects. Numerous locations and sites in eastern North Dakota have been surveyed and tested (Good 1977; Good et al. 1976; Good, Dahlberg et al. 1977; Good, Kinney et al. 1977; Schneider 1976, 1982a; Vehik 1976).

One of the major sites to be excavated in southwestern Manitoba was Stott, a Blackduck site on the Assiniboine River. Work was conducted there by L. Syms in 1975, 1976, 1977, and 1979 (Hamilton et al. 1981; Tisdale 1978). Some excavations had been conducted at this important site as early as the 1940s by R. S. MacNeish (1954).

Investigations in the Middle and Lower James River regions in the late 1970s and early 1980s were directed mostly toward site inventory work. South Dakota Archaeological Research Center personnel surveyed large blocks within the valley (Haberman 1983a; Keller and Keller 1982, 1983). Artifact scatters, stone circle sites, and mounds were the most common resource types identified.

A three-year investigation along the Upper James from 1984 to 1986 included site survey, test excavations, and block excavations at the Naze site (Gregg et al. 1985; Kordecki and Gregg 1985, 1986; Gregg et al. 1986; Gregg 1987; Gregg and Picha 1989; Gregg et al. 1987).

In 1979, the Soil Conservation Service funded archeological excavations at Sully's Hill Game Preserve in the Devils Lake region, during which the Irvin Nelson site was identified. Block excavations at the site subsequently were conducted by North Dakota State University (S. Fox 1982a, b). Additional fieldwork followed in this region (Floodman 1989b, 1989c; Gregg 1994b; Picha and Gregg 1991).

In 1982, SHSND conducted salvage excavations at the Jamestown Mounds site (Snortland-Coles 1985), one of the most striking mound groups that T. H. Lewis encountered in North Dakota during his fieldwork in the late 1800s. Excavations focused on remnants of two mounds partially destroyed by a housing development. SHSND archeologists also directed salvage excavations at the Devils Lake Burial site, a Late Woodland mortuary site on a hill overlooking Sweetwater Lake (Snortland and Good 1987). Salvage at site 32SN102 along Pipestem Creek recorded the remains of an Archaic burial (Fox and Williams 1982).

A UND archeological field school tested the Sharbono site on Grahams Island in 1986 (Schneider 1988). In the 1980s and 1990s, the State Historic Preservation Offices of Minnesota, South Dakota, North Dakota, and Iowa have channeled federal funding into previously unsurveyed areas with high archeological site potential. Topical studies include Haury's investigation of mound sites in the Devils Lake, Sheyenne, and Upper James River regions (Haury 1990), and drift prairie lake studies in the Upper James and Sheyenne regions (Kordecki and Toom 1996).

In the late 1980s and through the 1990s, Bev Nicholson of Brandon University has conducted extensive surveys of the Tiger Hills-Pembina Trench locality in the Pembina Mountains/Manitoba Escarpment region. His most extensive excavations have been at the Lovstrom site (Nicholson 1990, 1991a, 1991b), but subsequently he has focused on the Duthie and Jackson sites (Nicholson 1994).

In the late 1980s and early 1990s, the largest project ever conducted in southern Saskatchewan was centered on the Souris River just upstream from Estevan. Directed by James Finnigan of the Saskatchewan Research Council, this CRM work involved survey and large-scale excavation in the Rafferty Reservoir (Finnigan et al. 1990).

Culture History

Paleoindian

At the end of the Pleistocene, many portions of the subarea were uninhabitable due to the presence of wasting glacial ice, glacial lakes, meltwater channels, and other periglacial environmental constraints (Hallberg and Kemmis 1986). By 5500 B.C., essentially modern environmental conditions prevailed throughout all but the northernmost portions of the subarea.

The first documented human inhabitants of the subarea were nomadic hunters and gatherers known as Paleoindians. The Paleoindian, or Big Game Hunting, tradition is traditionally viewed as an adaptation to hunting late Pleistocene megafauna (Frison 1991a; Willey 1966). In the Plains, the primary quarry were now-extinct species of mammoth and bison. Recorded site types include animal kill sites, processing locations, and camps. Technologically, Paleoindian is recognized by fluted and unfluted lanceolate projectile points. Various types of these artifacts are found over much of the Plains, and they suggest to some a highly mobile lifeway (Bamforth 1988; Frison 1991a; Irwin-Williams et al. 1973; Irwin and Wormington 1970).

The major difficulty in locating Paleoindian sites is finding intact remnants of early Holocene landscape, and then determining if they were places that would have attracted early Holocene hunter-gatherers (Bettis and Benn 1984; Foss et al. 1995). A great deal of the land surface from 10,000 years ago has been eroded away or deeply buried by sedimentation. In the river valleys that carried glacial meltwaters, early Holocene surfaces that hold Paleoindian cultural deposits are tens to scores of meters below present-day floodplain surfaces and water tables. For example, a stable land surface of Paleoindian age is documented 30 m below the surface of the present Souris River floodplain in North Dakota (Boettger 1986).

Paleoindian is divided into a number of complexes, mainly based on differences in age and projectile point styles. For the most part, Paleoindian studies have been limited to identifying and describing components representative of complexes defined elsewhere in the Plains. These include Clovis (ca. 9500-9000 B.C.), Folsom (ca. 9000-8000 B.C.), and Plano (8500-5500 B.C.), used here to encompass Agate Basin-Hell Gap, Cody, Parallel-Oblique Flaked, and Pryor Stemmed. An exception is the terminal Paleoindian Caribou Lake complex defined by Manitoba archeologists working along waterways in today's Plains-Parkland ecotone. Goshen has not been identified in the subarea. Most Paleoindian sites are known only from surface collections; few intact components have been excavated. Figure 43 depicts the locations of some of the sites mentioned.

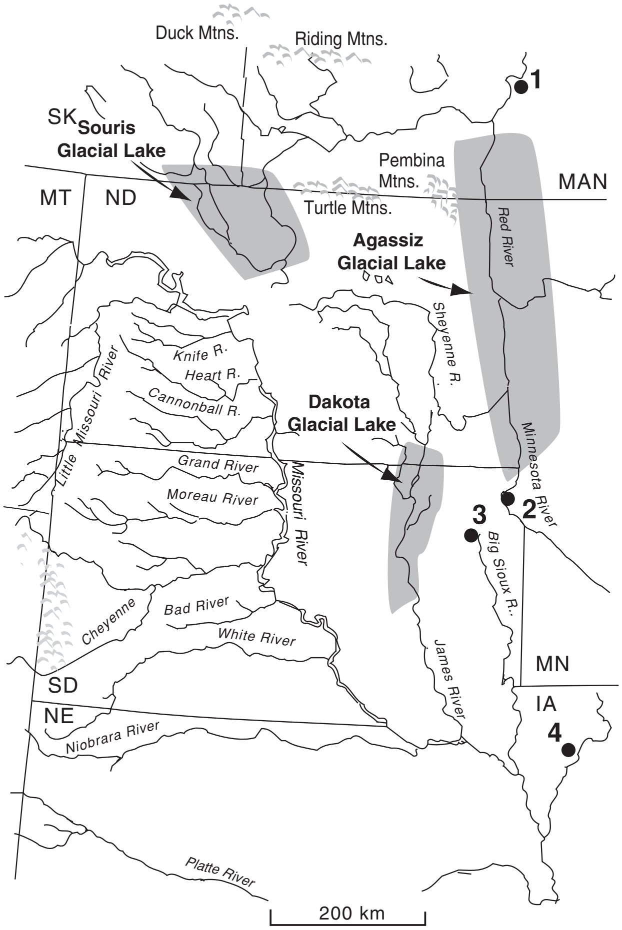

Figure 43. Locations of some Paleoindian sites in the Northeastern Plains: 1, Sinnock; 2, Browns Valley; 3, Winter; and 4, Cherokee.

The earliest documented cultural complex in the subarea is represented by surface finds of Clovis fluted points. In southern Manitoba and northeastern North Dakota, Clovis artifacts occur at and above the elevations of the Manitoba and Pembina Escarpments, representing the highest levels and maximum extent of glacial Lake Agassiz (Figure 43). Clovis material has also been reported from the Souris Basin region (Miller 1992). In the Lower James River region, Clovis artifacts have been found on Pleistocene terraces within the valley north of Mitchell, and at the Bliss Hill site near Vermillion (Fosha 1994).

Folsom finds are reported from southern Manitoba (Buchner and Pettipas 1990); the Sheyenne River region (Haury and Schneider 1986; Schneider 1982b); the Souris Basin region, including southeastern Saskatchewan (Hecker, unpublished reports on file in the SHSND archives; Kehoe 1966b); and the Lake Traverse-Big Stone Lake region (P. Munson 1990). Haug (1982) reported a possible intact component at the Winter site in the Big Sioux River region.

Hell Gap-Agate Basin has been recorded in southern Manitoba (Buchner and Pettipas 1990; Steinbring 1974); the Red River Valley region (E. Johnson 1988; Michlovic 1988); the Sheyenne River region (Haury and Schneider 1986); and the Upper and Middle James River regions (Gregg et al. 1987; Keller and Keller 1983).

Some Manitoba archeologists suggest that the early Agate Basin-Hell Gap complex (8000 to 7000 B.C.), referred to as Early Sisters Hill, evolved into a late Agate Basin complex (Late Sisters Hill) that persisted from 7000 to 5500 B.C. in southern portions of the prairie provinces (Buchner et al. 1983). They further suggest that people with Late Sisters Hill material culture occupied an area adjacent and to the east of contemporary people with Cody material culture.

Cody is distinguished by Alberta, Scottsbluff, and Eden points, and Cody knives. Most sites are known from along the margins of early Holocene glacial lakes and playa lakes, and from the rims of major river valleys. Cody is documented in the Red River Valley (Larson et al. 1986), Upper James (Gregg et al. 1987), Middle James (Hannus 1982), Souris Basin (Miller 1992), and Prairie Coteau (Lass 1980).

Late Paleoindian components with parallel-oblique flaked points, such as Browns Valley, Lusk, and Frederick, date from around 7000 to 5500 B.C. Browns Valley points were first described from the Browns Valley site in the Lake Traverse-Big Stone Lake region (Jenks 1937), where they were associated with 9000 year old human skeletal remains. Browns Valley points are also reported from the Sheyenne River region (Haury and Schneider 1986).

Pryor Stemmed is best known from the Wyoming-Montana border country in the Northwestern Plains, but Pryor Stemmed points have been recorded in the Turtle Mountains and Souris Basin regions (Borchert 1995; Carmichael 1986). The points range from lanceolate to stemmed.

Caribou Lake Complex

This complex was identified in southeastern Manitoba by Buchner (1979, 1981), and the investigated sites are located at places that are thought to have been bison crossings along the Assiniboine and Winnipeg rivers. The inferred date range of ca. 5500 to 4500 B.C. is late for Paleoindian, but the lanceolate points are reminiscent of Paleo forms and unlike Early Archaic side-notched forms. Percussion flaked trihedral adzes are also distinctive of the complex. Caribou Lake appears to represent the material culture of people with plains-boreal forest ecotonal adaptations and subsistence focus on bison (Buchner 1981). Sites are often located in settings that are below today's lake levels and water tables. Settlements were adjacent to permanent water, but water levels were low due to mid-Holocene drought.

Paleoenvironmental Considerations

Large expanses of the subarea were under the influence of glacial lakes, glacial meltwater rivers, and wasting remnant blocks of glacial ice through the initial several thousand years of the Paleoindian period (Schneider 1982b). The last major continental glaciers receded from the subarea by 11,500 years ago. The James Lobe of the Laurentide ice sheet, approximately centered on the James River valley, extended into South Dakota as far south as Huron (Flint 1955; Hallberg and Kemmis 1986), and the Red River lobe extended to the

Lake Traverse-Big Stone Lake region (Brophy and Bluemle 1983). The extent of the Souris lobe is approximated by the modern Souris River basin in North Dakota.

The maximal glacial lobe advances produced large terminal and lateral moraines that served as natural dams. As the glaciers wasted, these dams held back meltwaters, forming vast lakes that are important considerations in Paleoindian settlement and land use studies (Figure 43). Glacial Lake Agassiz was filled to overflowing and drained through its southern outlet between 11,500 and 11,000 years ago. Around 10,900 years ago, the glacial ice front had receded sufficiently northward that the lake could drain across northern Minnesota, reducing the level and extent of the lake. Readvance of the Red River Lobe around 9900 years ago increased lake levels, and the lake again discharged through its southern outlet. Thereafter, the glacial front retreated rapidly, and lake levels lowered. Lake Agassiz was mostly drained back to the extent of modern-day Lake Winnipeg by about 7500 years ago (Teller and Clayton 1983). Several studies have attempted to correlate Paleoindian sites of different ages with glacial lake stages (e.g., Pettipas 1982; Pettipas and Buchner 1983).

Plains Archaic

The Plains Archaic tradition subsumes a variety of foraging adaptations during the changing environmental conditions of the Holocene (see Frison 1975). This tradition dominated the Middle Missouri and Northeastern Plains from about 5500 to 400 B.C. At 5500 B.C., Paleoindian adaptations persisted in some northerly portions of the subarea. Persistence of this sort was repeated 5000 years later when some Plains Archaic adaptations lasted well beyond 400 B.C. in the north, while Plains Woodland lifeways began to take hold in the south. Key sites are shown in Figure 44.

The extinction of Pleistocene megafauna, possibly hastened by Paleoindian hunters, coupled with rapidly changing landscapes and dynamic climate regimes of early postglacial times undoubtedly presented major subsistence challenges to humans. In essence, the Plains Archaic tradition is generally seen as a shift from specialized megafauna hunting economies toward the hunting of essentially modern species of both large and small game. There also was an apparent increased reliance on wild plants, although Paleoindian peoples undoubtedly made extensive use of plant foods. Plains Archaic subsistence practices appear to have been more generalized and typically are viewed as nomadic foraging (see Lehmer 1971:30).

Although considerable regional diversity in subsistence practices existed during Plains Archaic times, bison were the primary quarry of northern Plains Archaic groups. More diverse and regionally restricted lithic tools appeared, notably notched and stemmed projectile points and hafted cutting tools (Frison 1991a).

Early Plains Archaic

Early Plains Archaic was largely coeval with the Altithermal climatic episode, which was typified by warmer and drier conditions (Buchner 1980). During this period, the population of the Northern Plains may have declined substantially. Most of the prominent Early Archaic sites are bison kills and bison processing stations, including Smilden-Rostberg (Larson and Penny 1991) and 32RI775 (Michlovic 1995; Running 1995) in eastern North Dakota, the Granite Falls site in southwestern Minnesota (Dobbs and Christianson 1991), the Itasca site in western Minnesota (Shay 1978), and the Cherokee site in northwestern Iowa (Anderson and Semken 1980).

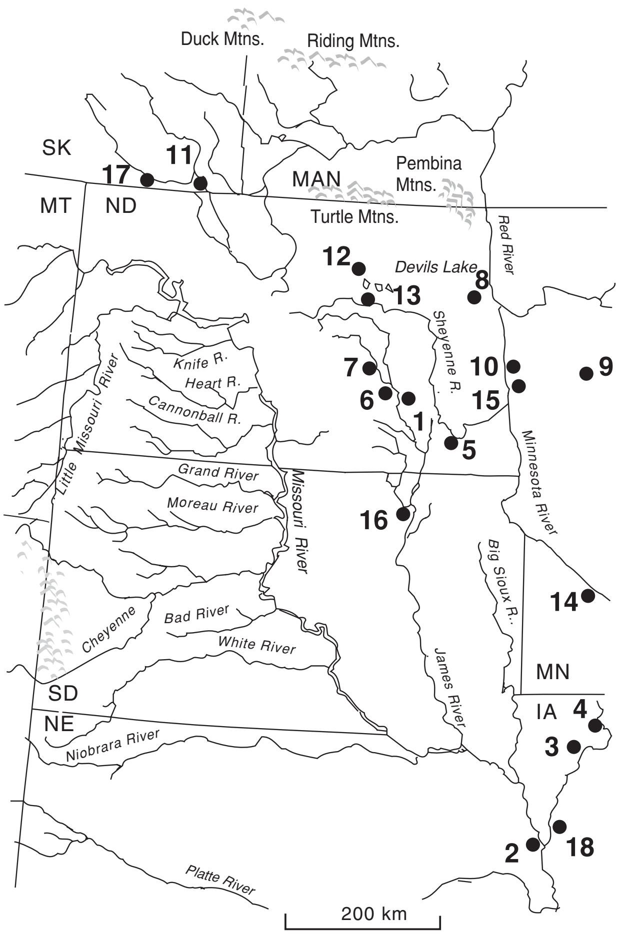

Figure 44. Locations of Archaic sites mentioned in the text: 1, Nelson; 2, Logan Creek; 3, Simonsen; 4, Cherokee; 5, 32RI775; 6, Naze; 7, Pipestem Burial; 8, Smilden-Rostberg; 9, Itasca; 10, Mooney; 11, Oxbow Dam; 12, Horner-Kane; 13, Irwin Nelson; 14, Granite Falls Bison Kill; 15, Canning; 16, 39SP202; 17, Long Creek; and 18, Turin.

In the Souris Basin, Nero and McCorquodale (1958) tested the Oxbow Dam site in 1956. Components here yielded eared points dating to just over 5000 B.P. and became the type site of the Oxbow complex. This complex became better known with the excavation of two Oxbow levels at the nearby Long Creek site (Wettlaufer and Mayer-Oakes 1960).

Point style diversity, focus on use of local tool stones, and infrequent use of exotic stone in Early Archaic components may indicate reduced interaction between human groups (Michlovic 1995). It seems likely that the mid-Holocene droughts caused reduced biomass, reduced human carrying capacity, and thus a decline in human populations. Population reduction may have been sufficient to disrupt alliance and exchange relations.

Middle Plains Archaic

Middle Plains Archaic sites have not been the focus of major research efforts in the subarea. In 1986, the SHSND salvaged an Archaic flexed burial exposed in a wall of a gravel pit. The skeleton was resting in a bed of red ochre, and a catlinite bannerstone was found in association (AHPD, SHSND 1990). The Turin site burials in western Iowa were originally thought to be Paleoindian, but have been dated to 2770 B.C. ± 250. Accompanying the interments were *Anculosa* beads and a Knife River flint (KRF) side-notched point. Bioanthropological study suggests that the population (physical type) that inhabited the eastern Plains north of Kansas during the Middle and Late Archaic period "was fairly stable" (Fisher et al. 1985:217).

Few other Middle Archaic sites have been sampled by excavation. One is the Canning site along the Red River, dated between 4000 and 3000 B.C.; bison processing was a prominent activity (Michlovic 1986). The stemmed bifaces that characterize this assemblage exhibit affinities to Midwestern regional variants. Other Middle Archaic manifestations are likely present on alluvial and colluvial fans and terraces along major waterways including the Souris, James, Sheyenne, Big Sioux, and Minnesota rivers.

At the Middle-Late Plains Archaic transition, Duncan and Hanna variants are relatively common. Surface finds of Duncan points along the Red River drainage evince continued Archaic occupation of the valley. Further south, Hanna and Duncan have been reported from the Upper and Middle James River valley (39SP202) and Sheyenne River regions (Gregg and Picha 1991; Haury and Schneider 1986). Archaic populations exploited plains and forest-edge resources throughout the subarea by Late Archaic times.

Late Plains Archaic

Late Plains Archaic (1500-400 B.C.) is the earliest period commonly represented by near-surface sites in valley bottom settings. The Upper James River floodplain contains alluvial sediments that have aggraded 3 to 6 m above present river level during the past several thousand years. The total accumulation of floodplain sediments from the entire Holocene may be 20 to 30 m in places.

Old Copper artifacts, including socketed points and cutting tools, have been recorded as surface finds in and around the Red River Valley region (Johnson 1962, 1964; Spiss 1968; Steinbring 1970), and are documented westward in the Devils Lake and Upper James River Valley regions. Deeply corner-notched Pelican Lake points have been collected from sites on terraces, valley wall foot slopes, and alluvial fans (Gregg et al. 1986, 1987; Kordecki and Gregg 1986).

A preceramic component at the Nelson site in the Upper James River region produced small corner notched points and radiocarbon ages of 430 B.C. ± 70 and 973 B.C. ± 40; the latter date is on bone (Gregg et al. 1986). At the Akata site, two stratified Late Plains Archaic components have been dated to the first millennium B.C. (Gregg et al. 1987). Subsistence seems to have focused on bison. The recovery of both large and small points, some the size of arrowheads, suggests that both large, slow, heavy-impact projectiles and smaller, faster atlatl darts were used from at least Late Archaic through Middle Woodland (Gregg 1987).

By Late Archaic times, domestic dogs are postulated to have been an important "storable food surplus" for Northeastern Plains peoples (Gregg et al. 1987). Burned canid remains were recovered from a Late Plains Archaic component at 32SN111 (Gregg et al. 1986). At the Long Creek site, a Hanna component is dated to 1413 B.C. ± 115 (Wettlaufer and Mayer-Oakes 1960:50). This component yielded a decorated, coyote-sized canine tooth, along with canid bones identified as domestic dog, as well as the expected bison bone. Overlying this was a Pelican Lake component dated to 293 ± 100 B.C. It produced several corner-notched Pelican Lake dart points. Again, the faunal sample was dominated by bison, with canid well represented (Wettlaufer and Mayer-Oakes 1960:47, 49).

Ahler (1986) suggests that KRF quarrying peaked during the Late Plains Archaic, a span of time that temporally overlaps Early Woodland in the Upper James region and southeastward (e.g., Farnsworth and Emerson 1986). This peak intensity of KRF surface mining correlates with a period of increased population density. Portions of the subarea that had not previously witnessed very much human use became regularly utilized. One example is the drift prairie landscape of eastern portions of the subarea. This landscape, dotted with pothole lakes, abounds with Late Archaic and subsequent Woodland campsites. It appears that mesic conditions kept the pothole lakes full of potable water, sustained healthy grasslands, supported increased biomass, and thus facilitated increased human population.

Plains Woodland Tradition

Efforts have been made to link historically recognized tribal or ethnic groups to some Woodland archeological cultures. Historically recorded residents of the Northeastern Plains include Arapahos, Assiniboines, Atsinas, Cheyennes, Crows, Dakotas, Hidatsas, Mandans, and Plains Ojibwas (Hanson 1979; Howard 1965, 1966, 1976; Wood 1971, 1986c).

The Plains Woodland period is divided into Early, Middle, and Late subperiods. Early Woodland (400 to 100 B.C.) in the subarea is represented by Fox Lake, while Middle Woodland (100 B.C. to A.D. 600) complexes include Sonota-Besant and Laurel. Avonlea, Blackduck, Sandy Lake, and Mortlach are Late Woodland (A.D. 450 to 1750). Site locations are shown in Figure 45. Plains Archaic lifeways persisted into Woodland times in northern regions of the subarea, and Woodland adaptations endured into historic times along the prairie-woodland ecotone from Minnesota through southern Manitoba into Saskatchewan.

The Plains Woodland period is viewed as a time of innovation during which many new technological, economic, and social elements appeared in the subarea. Subsistence was reminiscent of the broad-spectrum foraging of the Plains Archaic, with the same emphasis on bison. Some researchers feel that horticulture was practiced in Woodland times, particularly late in the period (Benn 1990; Wedel 1961), but direct evidence is often lacking or inconclusive, particularly in the northernmost portions of the subarea where Archaic

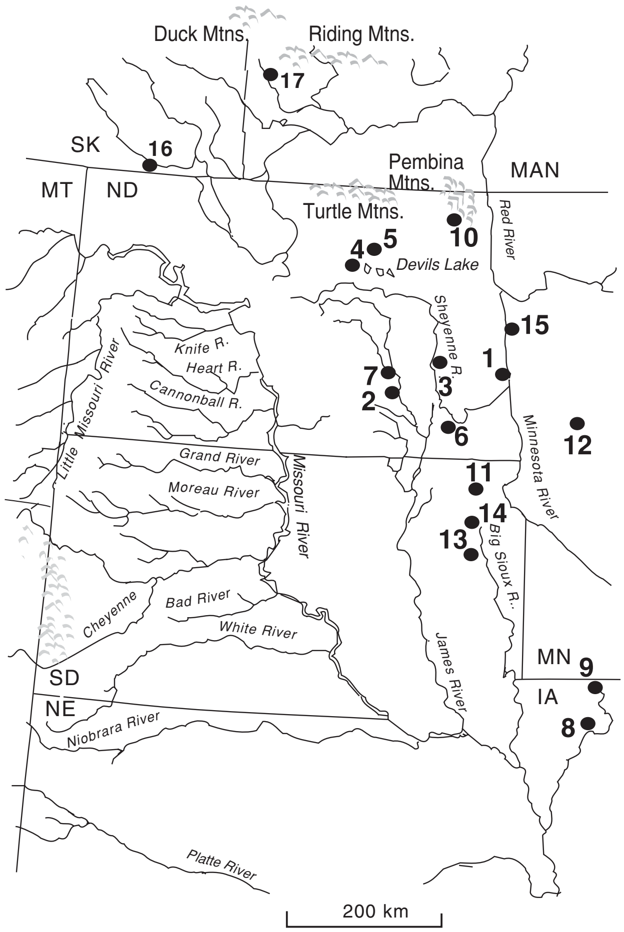

Figure 45. Woodland sites mentioned in the text: 1, Dahnke-Reinke; 2, Naze; 3, Baldhill Mounds; 4, Horner-Kane; 5, Devils Lake Burial; 6, Lisbon Burial; 7, Jamestown Mounds; 8, Rainbow; 9, MAD sites; 10, Blasky; 11, Sisseton Mound; 12, Dead River; 13, Oakwood Lakes; 14, Winter; 15, Canning; 16, Long Creek; and 17, Miniota.

subsistence patterns carried over into Woodland times (see Hoffman 1968; Neuman 1975). Other innovations include improved ceramics, semipermanent dwellings (and by inference semipermanent camps), and the bow and arrow.

Most Plains Woodland innovations are thought to have diffused into the subarea from the Eastern Woodlands (Benn 1990; Caldwell and Henning 1978; Willey 1966). Population appears to have increased, as suggested by the greater number of sites. However, Late Plains Woodland sites are less common than Middle Plains Woodland sites, particularly in the southern portions of the subarea.

Early Woodland

In the Northeastern Plains, ceramics first appeared during the Early Woodland period. At the Naze site in the Upper James River Valley region, a Middle Woodland occupation is underlain by an Early Woodland zone dating to about 2400 years ago, based on five radiocarbon assays on oak charcoal from the burned central support posts of a residential lodge (Gregg 1989). This component contains points and ceramics that could be reasonably viewed as antecedent to Besant (Gregg 1987). The sherds exhibit similarities to Midwestern variants such as Black Sand, and generally are tempered with coarsely crushed granite. Pastes are soft and friable (Swenson 1987). Exteriors, and occasionally interiors, are often cordmarked. The only identified vessel form is a conoidal jar with a straight rim. Decorative modes include cordmarking, embossing, and trailing over cordmarking. Sand/grit temper, as well as the thick walled conoidal vessel form, are characteristic of early ceramics throughout the midcontinent (Farnsworth and Emerson 1986).

Middle Woodland

Middle Woodland complexes named for ceramic styles and other diagnostic artifacts include Boyer, Arthur, and Fox Lake in the south (Benn 1981, 1982, 1983, 1986; Bonney 1970); Sonota in the central and northern regions (Gregg 1987, 1994a; Neuman 1975; Syms 1977); Besant and Avonlea in the west (Reeves 1983; Schneider and Kinney 1978); Laurel in the prairie-woodland ecotone to the northeast (Stoltman 1973); and St. Croix in the east (Gibbon and Caine 1980). If all of these were contemporary and represent ethnic and social diversity, then maintenance of group territories probably was a persistent concern. Mortuary mounds probably served as territorial markers as well as cemeteries (Lofstrom 1987), a practice that originated in Archaic times (e.g., Charles and Buikstra 1983).

Sonota-Besant

Sonota-Besant refers to related contemporary Middle Woodland complexes dating from about 50 B.C. to A.D. 600 that occur from the eastern Dakotas and Manitoba to the Rocky Mountains in Wyoming, Montana, and Alberta (Neuman 1975; Reeves 1970; Wettlaufer and Mayer-Oakes 1960). Relationships with Middle Woodland cultures to the east are suggested by burial mounds and pottery (Benn 1990; Neuman 1975). Material culture traits greatly overlap between Besant and Sonota. The origins of Besant and Sonota remain unknown (Davis and Stallcop 1965; Reeves 1983; Beckes and Keyser 1983), but data from the Naze site suggest that the complexes derive from Early Woodland cultures of the Northeastern Plains (Gregg 1987:443).

Besant refers both to a distinctive, widespread, side-notched point type, as well as to a phase. In the subarea, Sonota is characterized by Besant material culture, with the addition of conical mounds and ceramics (Neuman 1975; Snortland 1994). An example is the Baldhill Mounds site along the rim of the Sheyenne River Valley. Both excavated mounds at the site capped central mortuary crypts covered with oak logs. Besant Side Notched points were found in association (Hewes 1949). Neuman (1967) reports an uncorrected age of 1860 ± 150 B.P. from the site. Outside the Sonota core area, people with Besant material culture did not routinely make ceramics and build mounds (Reeves 1970, 1983).

Sonota-Besant point types include Besant Side Notched, Samantha Side Notched, and large, corner-notched forms identified as Pelican Lake and Archaic Barbed (A. Johnson 1977b; Kehoe 1974; Reeves 1983; Syms 1980).

At the Naze site, the Sonota-Besant component yielded both large Besant and small Samantha points (Gregg 1987) and dates between about 40 B.C. and A.D. 70. The small

Samantha points are interpreted as high speed, low impact dart points, rather than arrowpoints, based on the age of the component, which is 400 to 500 years earlier than the generally accepted date for the appearance of the bow and arrow in the subarea.

Sonota pottery resembles other Middle Plains Woodland ceramics, and includes conoidal vessels with cordmarked exterior surfaces and rims decorated with bosses or punctates. Dentate stamping occurs infrequently, and some vessel surfaces are smoothed or plain.

During the Middle Woodland period, interregional exchange appears to have increased, coincident with increased population density, as indicated by the numbers of base camps, temporary camps, and burial mounds attributable to Sonota-Besant (Gregg and Picha 1989). Artifacts and raw materials characteristic of the Hopewellian horizon in the Eastern Woodlands (Struever and Houart 1972) have been recovered from Sonota-Besant mortuary and occupation sites. Various exotica has been found in the Missouri River Valley near the North and South Dakota border (Neuman 1975); the upper James River Valley of eastern North Dakota (Gregg 1987; Snortland-Coles 1985); the Sheyenne River Valley in eastern North Dakota (Hewes 1949); and along the Red River of the North near the North Dakota-Minnesota border (Thompson 1990).

High quality lithics were an important component of Hopewellian exchange (Winters 1984); exchange of obsidian and KRF predates Middle Woodland, although greater quantities appear during the period (Baugh and Nelson 1988; Clark 1984; Loendorf, Ahler et al. 1984; Syms 1977). Other nonlocal materials found in subarea sites include copper and *Anculosa*, *Busycon*, and *Marginella* shells (Gregg and Picha 1989). Apparently long-distance exchange was substantially curtailed by around A.D. 500.

Sonota-Besant tipi encampments, some with associated mounds, were established in the vicinity of prairie lakes and seasonal drainages (Deaver 1985; Schneider 1982a). At the Sprenger site, in the headwaters of the Sheyenne River, nearly 100 stone rings and stone-lined depressions were recorded (Schneider 1982a); associated artifacts are typical of Sonota-Besant. The Ratigan site in the Rafferty Reservoir locality of the Souris Basin is a Besant tipi ring site (Rollans et al. 1992), while the Crane site, a few kilometers away, is a deeply stratified site on the Souris floodplain with several superimposed Besant components (Gibson and McKeand 1992). These components yielded large amounts of KRF as well as pottery, and one occupation contained a well-formed copper awl.

During late Middle Woodland times, people in the subarea continued to hunt big game and gather wild plant foods, including tuberous roots (Deaver 1985). Bison not only were a major subsistence focus, but also figured prominently in ideological traditions, as suggested by the interment of bison and human remains together in Sonota mortuaries (Neuman 1975; Schlesier 1987).

Late Plains Woodland

By the Late Plains Woodland period (A.D. 600-1000), the bow and arrow had replaced the atlatl and dart. With this change in weaponry were parallel changes in lithic technology and point styles. Lithic reduction strategies shifted from the production of large, percussion flaked bifaces to the manufacture of small, thin bifaces using pressure flaking (Ahler and VanNest 1985). Bipolar core technology, which was rarely employed in the subarea prior to the Late Plains Woodland period, became commonly employed to generate small flake blanks from pebble-sized pieces of high quality stone. Late Plains Woodland assemblages are characterized by small, notched arrow points such as Avonlea, Prairie Side-notched, and Plains Side-notched (Kehoe 1966a; Kehoe and McCorquodale 1961; Reeves 1983).

As with Besant, Avonlea (Kehoe and McCorquodale 1961) refers both to a distinctive point type and to a phase which is distributed across the Canadian plains and into Montana and the Dakotas. Avonlea assemblages are characterized by small, thin, finely crafted arrowpoints. In campsites in the Aspen Parklands, sherds of conical vessels are often present. As at the Miniota site, on the Assiniboine River floodplain in western Manitoba, these vessels are usually net impressed (Landals 1994, 1995). A radiocarbon assay of 1340 ± 90 B.P. has been obtained at this site. Avonlea faunal assemblages are dominated by bison, especially on the grasslands. Avonlea is well represented in the upper Souris Basin, as at the Long Creek site (Wettlaufer and Mayer-Oakes 1960:37-40). However, farther east in the Manitoba plains, the complex is uncommon (Joyes 1988). Here, a complex with both net-impressed and cord-roughened pottery appears to be present, termed Rock Lake (MacNeish and Capes 1958).

Semipermanent base camps characterized by larger and more numerous storage pits appeared in western Iowa around A.D. 700 (Benn 1982). Although nonhorticulturists also aggregated into relatively large groups for extended periods, fixed residential settlements are characteristic only of certain later Plains Villagers.

Linear mounds, most of which overlook major river valleys, represent a later development and are believed to date between A.D. 1000 and 1500. These earthworks may have ties to the Effigy Mound tradition of the upper Midwest (Chomko and Wood 1973). Some mounds constructed during Sonota-Besant times continued to be used for mortuary purposes into the Late Woodland and Plains Village periods. For example, the Jamestown Mounds were used for a period of more than 1000 years (Snortland 1994; Snortland-Coles 1985).

The Blasky or Fordville mound group, located along the Forest River in eastern North Dakota in the Red River Valley region, originally included at least 35 conical mounds and four linear mounds ranging in length from 74 to 820 m (Larson, Penny et al. 1986; Wilford 1970). It seems likely that this and other large mound groups have long histories of use (Lewis 1886b; Montgomery 1889, 1906). Recurrent use of mortuary sites suggests ethnic continuity within a region.

Sites of the Blackduck complex are found from southern Manitoba to west-central Minnesota and northeastward into the Woodlands (Hamilton et al. 1981; Joyes 1970; MacNeish 1954, 1958; Steinbring 1980; Tisdale 1978). Blackduck ceramics are recorded in the Devils Lake and Upper James River regions (Schneider 1982c), and similar Late Plains Woodland wares have been found beyond the Northeastern Plains to the west (e.g., Ahler et al. 1981). The earliest Blackduck sites date to around A.D. 800 (Evans 1961; Syms 1977), and sites with this ceramic tradition dominated the prairie-woodland ecotone in subsequent centuries (Carmichael 1981). European trade items have been recovered from protohistoric Blackduck sites in Ontario.

The Mortlach complex is the major Late Plains Woodland culture of southern Saskatchewan (Malainey 1991; Walde 1994). It was first described at the Long Creek site (Wettlaufer and Mayer-Oakes 1960:21-37), but it is also known from the Evans site (Schneider and Kinney 1978) and 32WI12 (Metcalf 1963b) in northwestern North Dakota both located in areas straddling the boundary between the Souris Basin region and the Middle Missouri subarea. The well made, thin Mortlach pottery occurs in several forms, including S-rim, angled rim, and wedge-shaped profiles. Exterior surface treatments include check stamped, simple stamped, cord roughened, and fabric impressed. Exterior rims and necks may be elaborately decorated with dentate stamps or cord-wrapped tool impressions, as well as pinches and punctates. Mortlach ceramics are found eastward into southern Manitoba where they appear to "grade" into other pottery types. This bison-hunting culture endured into protohistoric or early historic times, as several components contain European trade goods. Walde (1994) and Malainey (n.d.) strongly argue that this complex was produced by the western Assiniboine.

The "Arvilla complex" is represented at many late Plains Woodland mortuary sites in the eastern portion of the subarea (Snortland 1994). Conical and linear burial mounds were constructed. Both St. Croix and Blackduck ceramics occur in mortuary contexts at Arvilla sites (Johnson 1973; Syms 1979, 1982). The diversity of ceramics and other artifacts suggests that several different ethnic groups used Arvilla mortuary sites.

Sites of the Sandy Lake complex straddle the prairie-woodland ecotone in central and western Minnesota, southern Manitoba, and eastern North Dakota, and date between approximately A.D. 1000 and 1700 (Anfinson 1979; Cooper and Johnson 1964; Michlovic 1985). Like some other Late Woodland complexes, Sandy Lake is defined primarily on the basis of ceramics. Ancestral Dakota people are thought to have made Sandy Lake ceramics (Michlovic and Schneider 1988).

Plains Village

Semisedentary hunter-gatherer-gardeners who lived in permanent villages for at least part of the year appeared in the eastern Plains around A.D. 1000 (Wedel 1961, 1983). These village horticulturists represent the Plains Village tradition (Willey 1966).

Around A.D. 1100, Plains Village lifeways developed among Woodland populations in southwestern Minnesota (Tiffany 1983); northeastern South Dakota (Haug 1995); western Iowa (Anderson 1987); and portions of the James River Valley (Alex 1981b; Haberman 1983b, 1993; Haug et al. 1994). Clear and direct linkages or continuums have not been identified between regional Plains Woodland and succeeding Plains Village populations.

Historically, groups such as the Awaxawi Hidatsa, Ioway, and Cheyenne had Plains Village adaptations, while others such as the Middle Dakota, Assiniboine, and Plains Ojibwa had Plains Woodland adaptations. Different groups within one society or of one ethnic affiliation sometimes employed different adaptive strategies. There was a time, for example, when some Cheyenne lived as Plains Villagers, while others were equestrian nomads (Wood 1971).

Plains Village cultures are characterized by semisedentary settlement featuring seasonally occupied, permanently situated earthlodge villages and mixed subsistence strategies that usually included gardening, bison hunting, and generalized foraging (Toom 1992a, 1992c). Garden crops included maize, sunflowers, and tobacco (e.g., Haberman 1983b). Prevailing climatic conditions limited this adaptation to the southern half of the study area for the most part, but during warm mesic intervals, it appears to have expanded northward. For example, in recent years, it has become apparent that this economic system was taken north along the Red River where it has been shown to be present at the Lockport site, near Winnipeg (Buchner 1986, 1988). It has also been identified in the Souris Basin of southwestern Manitoba (Nicholson 1990, 1991a). Thus, Plains Village groups had diverse subsistence and settlement practices at different times and places, ranging from reliance upon gardening and construction of permanent villages to reliance on hunting and gathering and moving settlements seasonally.

In the central portions of the Northeastern Plains, Early Plains Village subsistence involved hunting, gathering, and gardening, but there is no evidence for substantial reliance on horticulture (Haug 1995; Schneider 1988). Bison remained the mainstay of the diet, supplemented with elk, deer, dogs, and smaller mammals (Haury 1987; Wood 1971). Wild plant foods (greens, fruits, seeds, and tuberous roots) continued to be important, as they had been for thousands of years (Benz 1987).

An important facet of bison processing was rendering grease from the bones, manifested archeologically by concentrations of broken bone and fire-cracked rock around hearths and shallow pits. Bone grease is a necessary ingredient to pemmican, and it was used as a condiment to flavor boiled dishes and dried foods (Leechman 1951; Speth 1983; Vehik 1977). About 2.3 kg (5 pounds) of grease could be rendered from the bones of one bison (Wilson 1934).

Corn has been identified at seven Plains Village components in the Upper James River Valley region (Gregg et al. 1987). Scapula hoes have been reported from Hendrickson III, Larson, and Hintz (Wheeler 1963).

During the Pacific episode (A.D. 1250-1550), environmental conditions across the Northern Plains became warmer and dryer (Anderson 1987). Droughts during the Pacific episode apparently reduced the extent of already limited amounts of arable land, resulting in food shortages, malnutrition, and internecine warfare (Gregg and Zimmerman 1986). Plains Village settlements in northwestern Iowa and southeastern South Dakota were abandoned (Alex 1981b; Benn 1986). Social upheavals are indicated by the appearance of fortified villages. Fortification walls and defensive ditches were constructed around smaller villages such as Hendrickson III, the Shea site along the Maple River (Michlovic 1988; Michlovic and Schneider 1988), and Linden Village on the shore of Big Stone Lake (Haug 1983). The Crow Creek massacre dates to this period (A.D. 1325) (Willey 1990).

Lithic assemblages include finely flaked bifaces and unifaces, groundstone axes, tablets, and pipes. Most early arrowpoints are classified as Prairie Side-notched; the more uniformly made and straight-sided Plains Side-notched forms are found at later sites (Kehoe 1966a). Bison scapula hoes are a hallmark trait of most native Plains horticulturists. Bone spatulates often were used as pressure flakers to make and refurbish stone tools.

The bifacially prepared end scraper (Gregg 1987) may be a Plains Village diagnostic. Unilateral, heavy duty bifacial cutting tools, often made of KRF or Tongue River silicified sediment, are diagnostic. One lateral edge was hafted in a bone or wooden handle, and the other was used for cutting (Ahler et al. 1991; Lehmer 1971).

The intensity of catlinite quarrying in southwestern Minnesota seems to have peaked during late prehistoric times (Sigstad 1973, 1983). Elbow pipes are perhaps the best known artifacts, but Plains Village assemblages in the subarea include tubular smoking pipes, rectangular tablets (often with incised markings), and arrowpoints.

Burial practices were variable, perhaps even within individual communities (Snortland 1994). At the Dirt Lodge Village site in the Middle James River region, initial burial may have been on scaffolds, with subsequent differential treatment of the cranial and postcranial remains (Haberman 1983b, 1993). Mortuary mounds were often located atop prominences such as the edges of upland plains overlooking river bottomlands (Alex 1981b; Swenson and Gregg 1988). Northeastern Plains Village mortuary mounds are classified as Devils Lake-Sourisford (Snortland 1994; Snortland and Swenson 1992; Swenson and Gregg 1988; Syms 1979).

Late Plains Village sites provide evidence of regional interaction and exchange in the form of nonlocal materials. Catlinite from southwestern Minnesota, obsidian from the Rockies, and marine shells from the Gulf and Pacific coasts indicate a revitalization of long-distance trade relations that had been in place for centuries (Wood 1972, 1980b). Decreased use of KRF in favor of locally available lithics such as Swan River chert suggests that access to the western North Dakota source area may have been curtailed (Gregg et al. 1987; Picha and Gregg 1987; Schneider 1982c) and/or KRF decreased in importance in long distance exchange relations.

Plains Village Ceramics in the Northeastern Plains

The vast majority of reported Plains Village ceramic vessels from the Northeastern Plains are globular jars; rim forms include straight, outcurved, and braced. Grit, sand, and shell were used as tempering materials. Vessel exteriors were malleated with cord-wrapped or carved wooden paddles. Surfaces of some vessels were smoothed, while others were left partially or entirely cord roughened or stamped.

Northeastern Plains Village ceramic assemblages often exhibit a mix of Plains Village and Woodland traits. The two most prominent wares are Sandy Lake, which is usually considered to be Woodland, and Buchanan Flared Rim ware, commonly associated with Village cultures. Globular jars with smoothed or simple stamped exterior surface treatment, an outcurved rim, a well defined neck area, and rounded shoulder are the most common vessel form associated with the latter ware. Decorative elements include tool impressions, trailed lines, and cord-wrapped tool impressions.

Buchanan Flared Rim jars with tool impressions and trailed lines are of special interest because they represent a widespread ceramic trait complex that extends throughout much of the Northeastern Plains. Its origins can be traced eastward from the Devils Lake and Upper James River regions, and linked with Linden Everted Rim ware as defined at the Cambria site in southern Minnesota (Knudson 1967).

Archeologists in the Northeastern Plains have begun to standardize classification of ceramics representing this trait complex (e.g., Benn 1992). Michlovic and Swenson (1993) defined the Northeastern Plains Village ware group that includes three wares, each with a characteristic surface treatment. Owego Flared Rim ware is check stamped (Wood 1963). Buchanan Flared Rim ware is smoothed or simple stamped (Wheeler 1963), while Lisbon Flared Rim ware is cord-roughened or smoothed over cord-roughened (Wood 1963).

Some decorative motifs on the shoulders of Buchanan Incised-Trailed appear to represent peregrine falcons. This motif, which appears prominently on Oneota ceramics, has been interpreted by Benn (1989) as a representation of power and aggression. Benn suggests that this symbolism on the Village pottery of the Northeastern Plains represents dominance and unity of the various interacting tribal groups that lived Plains Village lifeways in this formerly Woodland territory (Benn 1992). Raptorial bird motifs are present on some miniature mortuary vessels interred with Devils Lake-Sourisford burials (Swenson and Gregg 1988).

Northeastern Plains Village Complex

This complex is characterized by the ceramics described above, high frequencies of KRF, regular occurrence of catlinite artifacts, semisedentary villages, earthen mounds, and Devils Lake-Sourisford mortuary goods. Subsistence seems to have been primarily intensive foraging, supplemented by limited gardening (AHPD, SHSND 1990:B36-37). Some site locations are shown in Figure 46. This complex developed around A.D. 1000 and persisted into the protohistoric era.

Hidatsa oral traditions hold that their Awaxawi subgroup occupied a territory that included the Sheyenne River Valley and the headwaters of the Red River in late prehistoric times (Bowers 1965). If so, they probably shared this territory with the Cheyenne and some of the Teton or Middle Dakota. The Hintz site, in the Upper James River Valley, is an earthlodge village interpreted by Wheeler (1963) and Wood (1986c) as a protohistoric Hidatsa settlement (Dill 1975). The Schultz site on the Sheyenne River (Bowers 1948), the Sharbono site on Graham's Island at Devils Lake (Schneider 1983), and the Irvin Nelson site on the Devils Lake shoreline (S. Fox 1982a) are other late prehistoric sites posited to have been used by Hidatsas. All of these sites represent the Northeastern Plains Village complex.

Cambria Complex

This complex occurs in southern Minnesota along the Minnesota River (Johnson 1961; Knudson 1967; Ready

1979). Obsidian and KRF from western sources at the Cambria site indicate exchange across the study area between A.D. 1100 and 1300 (Wattrall 1974). Cambria ceramics exhibit technological and stylistic influences from surrounding Middle Missouri, Middle Mississippian, and Woodland populations (Knudson 1967). The occurrence of KRF in Early Plains Village sites throughout the central and northern portions of the subarea, plus the broad distributions of ceramic stylistic traits, suggest widespread interactions between different cultural groups.

Cambria potters were influenced by Middle Mississippian potters from the American Bottom. Cambria influence, in turn, is readily apparent in contemporary Northeastern Plains Village ceramics. Elden Johnson (1991) suggests that people with Cambria material culture procured bison products for the Cahokia trade system.

Great Oasis

Like Cambria, Great Oasis has been viewed either as a terminal Late Woodland or incipient Plains Village complex. The Great Oasis complex occurs in southwestern Minnesota, northern Iowa, and eastern South Dakota and dates around A.D. 1100 (Alex 1980; Anfinson 1979; Haberman 1983b, 1993; Henning and Henning 1978; Johnson 1969; Keller and Keller 1983; Zimmerman 1985). A variety of adaptations are associated with Great Oasis, ranging from principally hunting and gathering in the prairie lakes regions to possibly horticultural in northeastern Iowa-southeastern South Dakota riverine environments (Henning and Henning 1982). In its horticultural aspect, it is akin to Cambria and Initial Middle Missouri cultures.

The Hartford Beach Village in the Lake Traverse/Big Stone Lake region is surrounded by a defensive ditch and bastioned palisade (Haug 1983, 1995). Ceramics display traits identifiable as Late Woodland, Cambrian, and Northeastern Plains Village. Botanical remains from cache pit fill include corn. Residential architectural features within the site have been difficult to identify, as they have been at other small fortified "village" sites in this central portion of the Northeastern Plains.

Oneota

By A.D. 1300, Oneota cultures dominated the southern third of the subarea, with expansion northward by around A.D. 1500. Protohistoric and historic occupants of the Oneota settlements in the Blood Run locality, straddling the border of Iowa and South Dakota may have included the Ioway, Oto, and Omaha (Alex 1981b; Stanley 1989). Oneota complexes include Blood Run, Olivet, and Correctionville-Blue Earth-Orr (Alex 1981b; Stanley 1989). Oneota ceramic technological and stylistic influences (shell tempering and broad trailed-line decorations) have been identified as far north as the upper James River and Red River headwaters areas of North Dakota and Minnesota (Gregg et al. 1987; Michlovic 1983). Oneota peoples made extensive use of catlinite pipestone from southwestern Minnesota (Sigstad 1973, 1983), and may have been the principal point-of-contact distributors in late prehistoric times when long-distance exchange of catlinite was most extensive (Brown 1989).

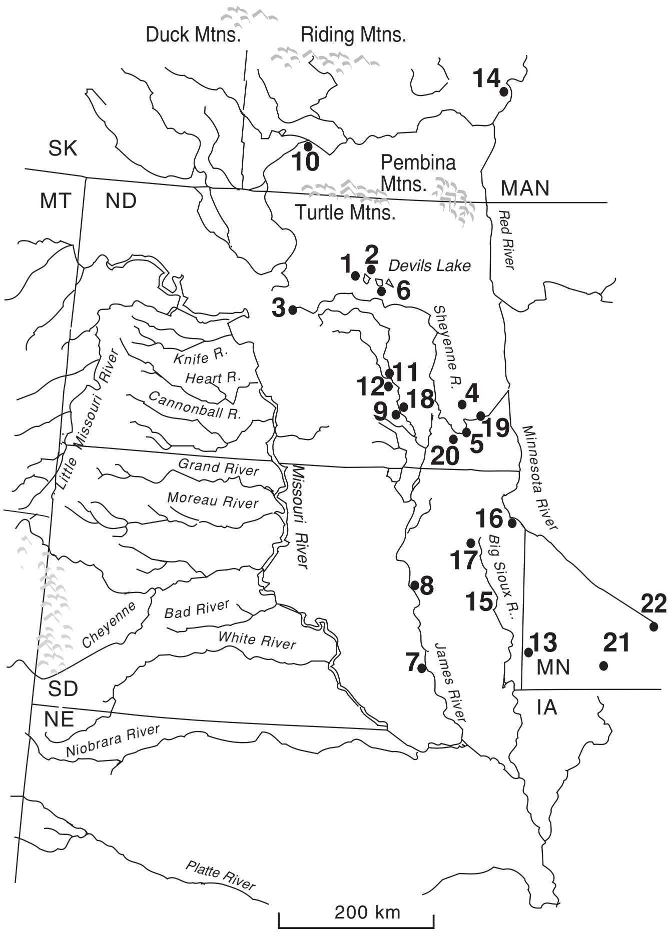

Figure 46. Locations of some reported Plains Village sites: 1, Sharbono; 2, Horner-Kane; 3, 32SH7; 4, Shea; 5, Biesterfeldt; 6, Irvin Nelson; 7, Mitchell; 8, Dirt Lodge Village; 9, Naze; 10, Lovstrom; 11, Hintz; 12, Jamestown Mounds; 13, Catlinite National Monument; 14, Lockport; 15, Oakwood Lakes; 16, Hartford Beach Village; 17, Winter; 18, Hendrickson III; 19, Schultz; 20, Lucas; 21, Great Oasis; and 22, Cambria.

Oneota settlements appear to have been larger than the more northerly villages, and they may have depended on stored surpluses of maize for their perpetuation, as indicated by remains from cache pits in sampled sites.

Protohistoric and Historic Periods

Many protohistoric Plains Village and Woodland assemblages include both traditional and Euro-American artifacts. During the mid to late 1600s, metal tools such as axes and knives were available only in limited quantities. Limited availability of trade goods as well as preferences for using traditional tools for some tasks meant that both traditional and Euro-American tools were in use at the same time. The period of transition from use of exclusively Native American to exclusively Euro-American technologies lasted for more than two centuries.

Many aspects of native technologies reached their highest levels of development just before the influx of European goods. Technological change is perhaps the most evident sort of culture change identifiable in the archeological record of the Fur Trade period. Euro-American artifacts, including knives, kettles, and glass beads are hallmarks of this period. At protohistoric sites, particular artifact styles or types can sometimes be associated with historically recognized tribal or ethnic groups.

Archeological research, oral histories, and historic documentation indicate the presence of the Dakota (Yankton and Yanktonai) (Haberman 1981), Ojibwa, Cheyenne, Plains Cree, Assiniboine, Ioway, Mandan, Arapaho, Atsina, Oto, Missouri, and Hidatsa in the Northeastern Plains during protohistoric and historic times (Bowers 1965; Bray and Bray 1976; DeMallie 1975; Howard 1972, 1976; Michlovic 1983; Syms 1985; Wood 1971). Ancestors of all of these peoples may have utilized parts of the Northeastern Plains around A.D. 1500, and group territories overlapped (Syms 1985).

The Biesterfeldt site in southeastern North Dakota, a protohistoric fortified village that included about 60 earthlodges, has been interpreted as a residential settlement of Cheyenne peoples living a Plains Village lifeway around A.D. 1750 (Wood 1971). Strong (1941) suggested that the Cheyennes may have dwelled in the Sheyenne valley by A.D. 1600 or earlier. Oral histories of the Dakota state that at one time the Cheyennes also lived in the Devils Lake region (Grinnell 1923). Thus, archeological and ethnographic evidence indicates that the Algonkian-speaking Cheyenne, equestrian nomads of historic times, lived a Plains Village lifeway in the central part of the study area around A.D. 1500.

During the 1600s, European goods were exchanged for furs and other Native American products by French traders who worked the western end of Lake Superior, the Upper Mississippi River country, and the Minnesota River Valley (Birk 1984; Birk and Johnson 1992; Tanner 1987:Map 6). A Northeastern Plains Village component dating to the mid-1600s was tested at the Horner-Kane site at Devils Lake (Gregg 1994b). The Horner-Kane excavations indicate that by the 1600s, Native American technologies and material culture in the Devils Lake region (and beyond) were being reshaped under influence of the Fur Trade. Ethnic/tribal affiliation could not be established for this component, given the sketchy knowledge of culturally diagnostic artifacts of this time period in the region.

Ethnographic accounts of tribal migrations indicate that the Devils Lake area was utilized by numerous groups. George Will (1924) reported that an Awaxawi Hidatsa village was located at Grahams Island. Bowers (1948, 1965) noted Hidatsa use of the Devils Lake region and east-central North Dakota in general, and reported that at least one subgroup of the Mandans dwelled at “High White Butte” north of Devils Lake after residing in the Red River and Sheyenne River valleys. Grinnell (1923) stated that the Cheyennes occupied the Devils Lake region; this is partially substantiated by a Chippewa account of a Cheyenne presence (Coues 1965b). The Crows, Arapahos, and Atsinas also may have resided here (Hewes 1948). In protohistoric times, equestrian groups reported to have utilized this area include the Assiniboines, various Dakota bands, and the Chippewas (Howard 1972, 1976).

The first fur trade posts in southern Manitoba were established by La Verendrye and sons in the 1730s and 1740s. One was near the mouth of the Red River, one at the mouth of the Assiniboine River on the Red River, and two on the Assiniboine River directly south of Lake Manitoba (Champagne 1968, 1971). It was from one of the latter posts that La Verendrye set out to visit the Mandans in 1738. In the latter 1700s, a number of North-West Company posts were built on the Red and Assiniboine rivers, eventually to be countered by Hudson’s Bay Company posts. This trade led to the formation of the Metis as a distinct ethnic group, a people who became a major element in the fur trade and the buffalo hunt through the early and mid 1800s. The amalgamation of the North-West Company with the Hudson’s Bay Company in 1821 led to the establishment of a major depot, Upper Ft. Garry, at the mouth of the Assiniboine. Settlement began to grow around this center, foreshadowing the development of the city of Winnipeg at this location and the initiation of extensive Euro-American agricultural settlement in the late 1800s.

Many other locations within the Northeastern Plains were important as sources of furs and hides exchanged among Native Americans and Euro-Americans during the eighteenth and nineteenth centuries. The Minnesota River Valley, extending northwest to Lake Traverse-Big Stone Lake, was frequented by early traders, including Jonathan Carver, Charles Patterson, and Murdoch Cameron (Nute 1930). Pierre Dorion, interpreter for the Lewis and Clark expedition, was a resident trader in the Lower James Valley during the late 1780s. His progeny remained active in the regional fur trade until the early 1800s. Later, in the nineteenth century, American Fur Company interests were represented by individuals such as Robert Dickson and his son, William. Joseph N. Nicollet’s 1838-1839 expedition through the Northeastern Plains recorded the last vestiges of once-prominent native lifeways (Bray and Bray 1976; DeMallie 1975; Wood 1993). The Red River Valley in today’s North Dakota-Minnesota border country served as a focal point in fur trade operations, being situated equidistant between the Red Lake region of Minnesota and the Devils Lake basin to the west (Nute 1930; Ritterbush 1991). Early fur trading establishments (posts and wintering houses) were situated on main stem waterways and their tributaries, some taking advantage of traditional rendezvous locations (Meyer and Thistle 1995; Picha 1996).

Conclusion

Prehistoric land use throughout the Northeastern Plains was influenced by climatic change as reflected in biomass adjustments of local and regional scale. Figure 47 is a schematic representation of changes in the water level of Devils Lake through the mid and late Holocene in response to variation in annual precipitation. During xeric periods, the lake dried up, and potable water may have been

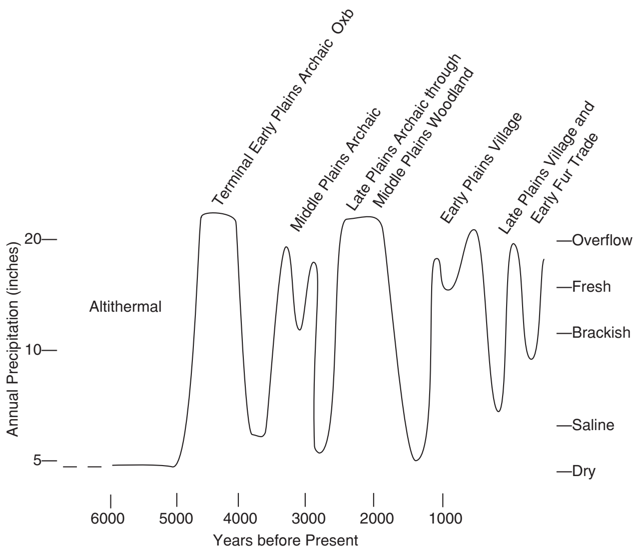

Figure 47. The fluctuating levels of Devils Lake through the middle and late Holocene in response to variation in annual precipitation (adapted from Hobbs and Bluemle [1987:60] and Callender [1968:248]) and correlations of periods of prominent archeological cultures with periods of high precipitation and concomitantly high biotic resource potential.

nonexistent during many periods throughout the Devils Lake region. There are no prominent archeological cultures that correlate with any of these xeric periods. On the other hand, lakes in the basin were full of fresh water a good deal of the time during mesic periods. These mesic periods match with the eras of the subarea's most prominent archeological cultures. The hydrologico-cultural model for the Devils Lake region is but one example of how changes in air-mass patterns, available precipitation, and potable water impact human decision making and settlement practices in time and space (Anfinson and Wright 1990).

7 Bioarcheology in the Northwestern Plains, by Laura L. Scheiber and George W. Gill

Bioarcheology in the Northwestern Plains, Wyoming and Montana, has some distinctive features. Burials seldom contain more than one individual, and there are fewer burials overall due to high mobility and low population density of the hunter-gatherer prehistoric populations. However, the drier climate permits excellent preservation of skeletal remains, especially those buried in dry rockshelters. The burials were typically excavated under accidental or salvage conditions; some sites especially in Montana have been recorded without disturbing or studying the skeletal remains. The history of bioarcheology in this area is also shorter than most—spanning only the past 60 years.

History of Bioarcheology in Wyoming

Works Project Administration (WPA)

The WPA employed a number of people to conduct a series of projects during the late 1930s in the West. Archeological projects in Wyoming focused on the conduct of field surveys—the first systematic study of Wyoming prehistory (Sowers 1941). These surveys did not result in the discovery of any burials. However, at least four human skeletons were found during 1935 in explosion rubble while a WPA road crew was working near Torrington in Goshen County. These individuals had apparently been placed in a crevice in the cliffs. The associated artifacts were dispersed among the workers who even returned to the site after work with lights in order to find more. The skeletons were eventually brought to the attention of S. H. Knight, geology professor at the University of Wyoming. He in turn sent the remains to W. W. Howells at the American Museum of Natural History. Howells believed them to be morphologically similar to "Minnesota Man," retaining features that Howells termed "proto-Indian Mongoloid" (Howells 1938:320). Because archeological research at the time focused largely upon chronology building, the search for the oldest artifacts and sites was very important. Although the Torrington individuals were not as old as was previously thought (Agogino and Galloway 1963), the skeletal remains from the site were well described, and information was presented and available in the literature (Gill 1974; Howells 1938).

River Basin Surveys

The first systematic excavation of human burials occurred during the River Basin Surveys of the Missouri Basin Project. At least 17 reservoirs and dams were planned for the Missouri River drainage in Wyoming. Archeologists surveyed and tested sites in the north and central part of the state during the late 1940s and early 1950s. The project goals were to document the area prehistory as much as possible before water from the reservoirs covered a large number of sites. The predominant theme was the construction of regional chronologies. "The flood control and reclamation program of the federal government will bring complete destruction to hundreds of archeological sites of varied nature and antiquity. Only prompt action, carefully planned, will enable us to salvage the information needed to reconstruct the prehistory of the region" (Wedel 1947b:1).

The Survey documented five burial sites near the Boysen Reservoir along the Bighorn River in Fremont County, one site near Yellowtail Reservoir along the Bighorn River in Big Horn County, another in the Oregon Basin in Park County along a tributary of the Shoshone River, and one at Big Sandy Reservoir in Sweetwater County. Four of these sites were excavated; however, only few remains were actually recovered for study. Some skeletons were not collected; others had been previously taken away by local residents. The predominant pattern was one or two individuals buried in small rock crevices. Four of the seven burials were Protohistoric in age while the other three were of unknown affiliation.

Unfortunately, beyond basic laboratory analysis available in limited printed distribution, these individuals were not further analyzed or used to help explain more of the regional prehistory. Only one site from Boysen Reservoir (48FR63) received even a brief mention in a summary of the work (Wedel 1948:29). Because the remains were not (and still are not) available for further research, little can be said about these sites from a research perspective.

Another human skeleton recovered under the auspices of the River Basin Surveys was found during the 1951 excavations at the McKean site (48CK7), the Middle Archaic type site located in Crook County in northern Wyoming along the Belle Fourche River. William Mulloy, anthropology professor at the University of Wyoming, excavated the site under contract with the National Park Service. T. D. Stewart of the United States National Museum examined the adult female cranium from the site. He thought the individual looked similar to Neumann's Deneid types in terms of the diagnostic features of her low vault height (Stewart 1954).

Wyoming Archaelogical Society

The history of bioarcheology in any state has its good and bad efforts by amateur collectors. Some cases in Wyoming over the years have been actual looting operations, usually for the associated grave goods such as glass trade beads, buttons, and old weaponry. In more recent years, looting has been successfully prosecuted on grave desecration charges. Other efforts by conscientious collectors with a true interest in Plains prehistory have also occurred, sometimes in cooperation with professional archeologists.

One such group of amateurs has recorded site and burial information and managed to attain a "step above" the work of many other amateurs. This group is the Wyoming Archaeological Society (WAS) with numerous individual chapters around the state. From its beginning in the late 1950s, members have been reporting their findings in *The Wyoming Archaeologist* (Buff 1990; Galloway 1963; Korell 1981; Scoggin 1978) and occasionally in *Plains Anthropologist* (Grey 1963b; Steege 1960) . They and other amateurs also have been important in bringing burials to the attention of professionals without disturbing the graves.

The WAS has excavated or been involved with at least 12 burial sites, especially in the late 1950s and early 1960s when little bioarcheology was being conducted in the state. In a number of instances they also documented burials that had already been removed from their original contexts.

Two examples of conscientious amateur involvement with especially productive results are the investigation of the Turk and PK Burial sites in northern Wyoming. The Turk site (48WA301) was excavated during the summer of 1961 by Don Grey and Glen Sweem of Sheridan. It was a multiple burial that had already periodically been disturbed for years when the two men salvaged the remains (Grey 1961, 1963b). The skeletal remains were later analyzed by Walter Birkby and William Bass (1963) who thought that the burials were probably Shoshonean. The PK Burial (48SH308) was also investigated by Grey who was notified when a skull was removed from a grave in 1959. Grey excavated another multiple interment of three adult males who showed evidence of prehistoric warfare. Grey also sent these remains to William Bass. During analysis, Bass and Lacy (1963) proposed that these individuals were Siouan.

The importance of these early burials lies in their irregularities; multiple interments with evidence of Late Prehistoric warfare are relatively rare. Although a responsible effort was made to salvage and publish information pertaining to these sites, more intensive excavation procedures would have undoubtedly helped to understand the different patterns that were represented. The concern with establishing tribal affinity in bioarcheology during the early periods is exemplified by the bioarcheological reports.

Academic Archeology

Most of the systematic bioarcheology in Wyoming since the 1960s has been conducted by archeologists and physical anthropologists at the University of Wyoming in Laramie, who have used human skeletal remains to generate research hypotheses for the area. What little analysis of human remains recovered before that time was usually conducted by people outside the state and their reports often were not distributed or incorporated into regional studies.

The close relationship between archeologists and physical anthropologists is an important one. Archeologists have excavated many of the human remains. William Mulloy, who established the first basic chronology for the Northwestern Plains (Mulloy 1958), documented an occasional burial in the 1960s. Most notable is the Huntley/Table Mountain Burial, a probable Woodland interment that was intensely looted during the late 1960s (Eisenbarth and Earl 1989).

As the head of the Department of Anthropology at the University of Wyoming and Wyoming State Archeologist, George Frison has provided revisions and further framework to the cultural prehistory and was involved in a number of burial excavations. For instance, in 1969 Frison excavated a burial that was eroding from a badger hole behind one of the car dealerships in Laramie. Investigation at this City Springs site revealed a primary extended Protohistoric burial of an adult female.

George Gill joined the faculty of the University of Wyoming in 1971 as its first physical anthropologist with a primary interest in bioarcheology, and since then burials have been scientifically excavated when necessary. His research interests have focused on Historic populations (Gill 1994), microevolution, biological distance, pathology, diet, demography, intergroup relationships and conflict, and assemblage differences (Gill 1981,1991). New methods of determining sex, age, and race from various skeletal elements have been developed and tested using Wyoming skeletal data (Gill and Rhine 1990).

In many instances, local residents have called Frison or Gill with information on burials they have found which have allowed the anthropologists to conduct scientific recoveries. In some cases even looted burials have been salvaged.

Twenty-nine burials have been salvaged by trained professionals in Wyoming in a systematic manner since the 1970s. A good example of a coordinated effort between the University and the WAS is the excavation of the Glendo burial. A partial frontal bone of a human skull was first noted eroding from the middle of a gravel road by individuals from the Cheyenne chapter of the Wyoming Archaeological Society. They communicated this information to the University and excavations followed. The adult female that was recovered had been buried in the ground during the mid-1800s with planks placed over her, resembling a coffin. Osteological analysis revealed that this woman possessed American Indian and Caucasoid traits, indicating that she had mixed ancestry (Gill 1976b).

Skeletal data have also been obtained during forensic cases. Working with the Wyoming State Crime Lab and local county coroners, Gill has analyzed at least 24 prehistoric and early Historic burials that were brought in by law enforcement personnel.

Cultural Resource Management

Cultural resource management has always been a key aspect of Wyoming archeology since the River Basin Surveys. However, cultural resource management as understood today began in earnest in the 1970s and 1980s with the increased development of minerals such as coal, oil, and uranium. Fortunately, the University of Wyoming has a strong presence in the state, and most burials recovered through such projects have been excavated by Gill or analyzed by him at a later date. Thus, files have been kept for many burials that otherwise may have become part of the gray literature and less accessible for research.

The group most responsible for contributions to bioarcheology is the Office of the Wyoming State Archaeologist in Laramie. Since the leadership of Frison during the late 1960s, the State Office has been involved in the recovery of skeletal remains and has provided the University with virtually its only funding to salvage human burials in the field.

The State Archaeologist's Office has investigated eight burial sites alone, with at least another 15 in combination with other agencies such as the University. The Bridger Gap Burial was salvaged during mitigation of highway construction (Truesdale and Gill 1987). This elderly female was buried between two sandstone rocks in southwestern Wyoming sometime during the last 250 years. Evidence of slight arthritis, trauma to the distal right tibia and fibula causing double fracture and ankylosis, and two small fractures in the back of her head were noted. Certain biological traits correspond with other individuals found in the same Wyoming Basin area. "She is representative of a population of long standing from the southwestern area of Wyoming and this population element would seem to have been of basic Shoshonean stock" (Truesdale and Gill 1987:26). Shoshonean as used here implies groups that migrated from the Great Basin and historically may include various groups of Shoshoni as well as the Utes, Paiutes, and Gosiutes.

Additionally, six sites have been investigated either alone or jointly with the State Archaeologist by the federal Bureau of Land Management. Five others were excavated by private contractors (with or without the help of the University) when skeletal remains were found during the survey and testing of sites. The companies involved with these recoveries include Powers Elevation, Historical Research Associates, Archaeological Consultants, and Mariah Associates. The most detailed analyses and complete documentation were conducted on skeletal remains from the Divide (Gill and Smith 1989), Bairoil (Sheridan et al. 1992), and Shute Creek (Gilliam 1989) sites.

Summary of Wyoming Bioarcheology

Bioarcheology in Wyoming does demonstrate some trends throughout the last 50 years. These changes can best be defined by examining the 80 sites and 160 individuals that were excavated systematically (Table 11). The earliest excavations date to the 1940s and include the River Basin Surveys. These are the smallest number of sites and individuals in the sample. Another nine burials were investigated during the next decade, half by the River Basin Survey. Five of these burials were recovered by people associated with the Wyoming Archaeological Society. Their work continued in the 1960s as another small increase of skeletal materials accrued. Other work was conducted by Mulloy and Frison at the University of Wyoming. In the 1970s and 1980s the number of burials investigated increased significantly, with 54 sites and 86 individuals recovered. Many of these burials were investigated by the University of Wyoming and the State Archaeologist's Office. A number were found during road construction. Although there has been a decrease in numbers, the last five years have shown continual additions to the data base of Wyoming bioarcheology.

Of the 214 sites from Wyoming, 80 were excavated by professionals or semiprofessionals (Table 12). Most of these sites (39%) have been excavated by academic professionals, usually from the University of Wyoming but in a few cases from community colleges. The second highest incidence, as described above, has been by the State Archaeologist (20%). Third highest (16%) are those conducted by knowledgeable amateur groups, mostly the Wyoming Archaeological Society. Other groups who have contributed are federal agencies (Smithsonian, Bureau of Land Management, National Park Service) (12%), private contractors (5%), museums (4%), and law enforcement (4%).

Salvaging burials is only the first step toward saving them. Properly qualified analysis of the human remains and associated artifacts must be done. Native American groups should be consulted. The results should be compared to other burials, and reports should be written and published. Bioarcheological information in Wyoming has been well distributed to a wider audience (Table 13). At least 36 articles have been published in state journals such as *The Wyoming Archaeologist* (e.g., Combs et al. 1992; Zeimens et al. 1987), another 20 in regional journals such as *Plains Anthropologist* (e.g., Bass and Lacy 1963; Gill 1981; Scheiber 1994) as well as three more in *American Antiquity*

Table 11. Mortuary Excavation and Analysis by Decade in Wyoming

Time Period	Total Sites	%	Indiv.	%	Basic Analysis % Sites	% Indiv.
1940-1949	1	1.2	2	1.2	100.0	100.0
1950-1959	9	11.0	12	7.5	77.8	83.3
1960-1969	8	9.8	17	10.6	100.0	100.0
1970-1979	26	31.7	34	21.3	88.5	91.1
1980-1989	28	34.1	63	39.4	89.3	93.7
1990-1994	10	12.2	32	20.0	100.0	100.0
Total	82	100.0	160	100.0	90.2	94.4

Note: For 80/214 sites (37.4%), 160/400 individuals (40.0%) systematically excavated with available dates from Wyoming
Site total (82) includes two sites excavated in multiple decades.

Table 12. Organizations Reporting and Recovering Human Remains in Wyoming

	Total Sites		Total Systematically Recovered	
	N	%	N	%
Amateur	123	58.6	13	16.2
Contractor	4	1.9	4	5.0
Federal	10	4.8	10	12.5
Medical/Legal	22	10.5	3	3.8
Museum	3	1.4	3	3.8
State	16	7.6	16	20.0
University	32	15.2	31	38.7
Total	210	100.0	80	100.0

Note: Combination efforts (N=23) divided among groups.
Unknown affiliation (N=4) not included.

Table 13. Publications in Wyoming Bioarcheology by Decade and Publication Type

	State Jour[1]	Reg. Jour[2]	Nat. Jour[3]	Book	Mss.[4]	Total	%
1930-1939	0	0	1	0	0	1	1.0
1940-1949	0	0	0	0	1	1	1.0
1950-1959	1	0	0	0	1	2	2.0
1960-1969	12	5	1	0	1	19	19.0
1970-1979	5	4	0	3	3	15	15.0
1980-1989	15	9	1	1	14	40	40.0
1990-1994	3	2	0	4	13	22	22.0
Total	36	20	3	8	33	100	
Percent	36.0	20.0	3.0	8.0	33.0	100.0	

[1]*The Wyoming Archaeologist, Wyoming Contributions to Anthropology, Occasional Papers in Wyoming Archaeology, University of Wyoming Publications, Archaeology in Montana.*
[2]*Plains Anthropologist, True West*
[3]*American Antiquity, National Geographic*
[4]Manuscripts on File: University of Wyoming Osteology Lab, Wyoming Cultural Records

(Agogino and Galloway 1963; Howells 1938) and *National Geographic* (Gibbons 1986). Two Master of Arts theses have also been written about the Wyoming bioarcheological collection (Davis 1992; Zitt 1992). In addition, Gill's synopsis of bioarcheology in Wyoming is included in a chapter of Frison's highly acclaimed 1991 edition of *Prehistoric Hunters of the High Plains* (Gill 1991).

A comparison of the number of burials excavated to the number of publications and manuscripts reveals similar patterns. Overall, 83 burials have been excavated. At least 100 articles have been written.

History of Bioarcheology in Montana

The field of bioarcheology in Montana is somewhat difficult to interpret. The information presented here is limited to published information and state site files. No syntheses of bioarcheological information were found. The details provided herein are therefore undoubtedly incomplete. However, the information that is available highlights overall trends.

Works Project Administration and the Montana Archaeological Survey

The earliest documented excavation of human skeletal remains in Montana occurred under the auspices of the WPA. This time period also marks the beginning of Montana archeology. The Montana Archaeological Survey was established as a public project to excavate and survey sites in the southern part of the state. They documented five sites which contained human remains along the Yellowstone Drainage near Billings. Three of these were found while conducting excavations at larger sites. William Mulloy of the University of Wyoming was involved with the recovery of information at all five sites. The most meaningful are excavations at Pictograph Cave (24YL1) and Ghost Cave (24YL2). Based on the materials found there, Mulloy established a framework of Northwestern Plains prehistory which is still used today (Mulloy 1958). During the course of the excavations, nine skeletons were found at Pictograph Cave and three at the nearby Ghost Cave (Snodgrass 1958). Work was discontinued when the Second World War started. Richard Snodgrass completed the analysis of the skeletons. His manuscript was included as an appendix in Mulloy's *Historical Outline of the Northwestern Plains,* published by the University of Wyoming Contributions (Snodgrass 1958). In it, Snodgrass compared craniometrics of a six-year-old child to various other ethnic groups. He thought that the individual possessed more Siouan than Shoshonean traits. This comparison of subadult cranial morphology is probably the only instance of its kind for all of Northwestern Plains bioarcheology.

Amateur Involvement

Avocational archeologists in south-central (the Billings area), northwestern (near Flathead Lake), and northeastern (Sheridan County) Montana have contributed to biological anthropology in the state primarily through documenting previously looted burials. A significant contribution was made by the Billings Archaeological Society (especially by Stuart Conner) who recorded at least seven sites during the 1960s. Often Conner talked to the people who participated in the activities at a site and determined site locations and some details of the burials. At other times he visited the sites after they had been disturbed and recorded context, time period, and other information. Because the human bones often were not available for study, osteological analyses were not possible. However, on two occasions, the Society did salvage complete burials and later submitted the skeletal material to qualified physical anthropologists back East.

Two articles appeared in *Plains Anthropologist.* One was a brief site report with only a cursory discussion of a Protohistoric multiple interment from Treasure County excavated by the Billings Archaeological Society in 1961 (Stephenson 1962). The other is a more complete osteological report by Bass and Barlow (1964). Stuart Conner submitted the young adult female skeleton found at Pryor Creek near Billings. Bass and Barlow concluded that she was probably Crow or Hidatsa as opposed to Lakotid (a Dakota Sioux group) on the basis of cranial morphology. Their only comparative female sample consisted of 10 Hidatsa from Hrdlicka (1927). This individual should have been used in later comparative studies but seems to have been ignored.

Work by other groups and individuals including Thain White in Lake County and Tom Jerde and others in Sheridan County also responsibly recorded and salvaged burials, especially during the 1950s and 1960s.

Academic Pursuits

The first academic mention of human skeletal analysis in Montana is included in a section about western Montana in Turney-High's (1937) *American Anthropological Memoirs* monograph. He analyzed the skeletons from two sites that had previously been disturbed. Turney-High compared the two individuals osteometrically and commented on their dolichocephalic skulls and other muscular indications, seeming to draw attention to comparisons to modern Indian groups and affinities to people to the West. Hrdlicka thought one of the individuals resembled the North Californian type (Turney-High 1937:19).

Nine sites were documented by the University of Montana and Montana State University between 1951 and 1977. Undoubtedly, more sites were recorded by universities but affiliation was not included on the state site form. Only two of the nine sites were excavated; the rest were left undisturbed or had previously been looted. Familiar names in Montana archeology such as Carling Malouf, Charline Smith, Leslie Davis, and Tom Roll appear on these sites forms. Interest was focused on the sites and archeology rather than a specialized interest in Plains bioarcheology.

Most often osteological information was derived from skeletons if they were present and available for study at either the University of Montana or the University of Wyoming. Osteological measurements were collected from individuals at five of the six sites with available human remains. One manuscript (at the

University of Wyoming) and three publications (all included in one volume of *The University of Montana Contributions to Anthropology* [Sharrock 1974]) were written. Unlike earlier publications which compared archeological human remains to Historic tribes, these reports do not compare groups. They are primarily isolated descriptions of skeletal remains.

One example of University involvement is the Rattlesnake Burial (24MO1071), which was recovered by the Missoula County sheriff and analyzed at the University of Montana (Taylor et al. 1974). The publication included site, artifact, and skeleton descriptions. The skeleton of this young adult male had fused third and fourth cervicals and possible spina bifida or arthritis (Taylor et al. 1974:91). A radiocarbon date of 490 years ago (GX2976) was obtained. This is one of the few radiocarbon dates obtained from skeletal remains in Montana. The authors believed the burials may be affiliated with the Columbia Plateau based on artifact and burial types—but not biological traits. Again, the osteometrics from this burial should be used in comparative studies, especially given its absolute date, but this work remains to be done.

Cultural Resource Management

Through the course of cultural resource management, human skeletal remains probably have been found. However, reports of discoveries are not readily available in the literature. The earliest CRM work was conducted by the River Basin Surveys in the 1950s and 1960s on the Missouri and Columbia river drainages. Four sites were recorded. The skeletal remains of all of these were fragmentary, and no analysis was conducted.

The most active presence in terms of site documentation by a single agency is the Bureau of Land Management (BLM). Nine site forms have been completed. Three of these sites were excavated; two were not disturbed. Only one report on the Iron Jaw Wilcox burial (24RB93) was published (Gill and Clark 1983). This elderly skeleton was salvaged by the BLM. The Frying Pan Basin individual (24BE1573) was officially recorded by the BLM in 1991 although it had been looted in the 1960s.

Twenty-one burial sites in Montana have been documented through cultural resource management. Most lack group affiliation and only five were excavated. The Overby's Headless Burial (24SH615) is one of the few documented excavations and published osteological analyses (Joyes et al. 1984). In 1982 Tom Jerde found debitage and scattered human bone in a recently plowed field. Those bones still in place were consequently recovered along with the surface finds. The excavators believed that originally a cairn had been placed on top of the burial. During excavation, four more skeletons were found in various stages of articulation and disturbance. Researchers at the University of Montana (presumably Peggy McCally, who is the second author) analyzed the skeletal remains. Four adults (a young female, an older male, and two of unknown sex) and one infant were found. Two projectile points were found embedded in the right and left femurs of one individual. One of these injuries may have partly healed before death. Possible cut marks may indicate "disarticulation or cleaning of the bones prior to burial " (Joyes et al. 1984:8). The side-notched points probably date to A.D. 1000-1750. At least four of the individuals represent secondary interment.

Summary of Montana Bioarcheology

Montana bioarcheology can be understood by examining the trends in site documentation and systematic recovery (Table 14). The first three burial sites were excavated by archeologists working for the WPA prior to World War II. The River Basin Surveys excavated two more sites during the 1950s. Over half of the recorded Montana burials were investigated during the next two decades, the 1960s and 1970s. Systematic recovery had declined since then. Professionals and semiprofessionals have recovered 22 of the 80 burial sites recorded in the state (Table 15). The three main contributors are federal agencies (36%), various amateurs (32%), and the universities (23%).

Published data first appeared in the 1930s with Turney-High's (1937) article. During the 1950s, two burials were mentioned in passing in Montana State University's *Sociology and Anthropology Papers* (White 1952). Snodgrass's (1958) analyses of Pictographic Cave and Ghost Caves were also published in the 1950s although the excavations had occurred 20 years before (Table 16). Twelve descriptive reports were published in the 1960s; three in *Plains Anthropologist* (e.g., Bass and Barlow 1964),

Table 14. Mortuary Excavation and Analysis by Decade in Montana

Time Period	Total Sites	%	Indiv.	%	Basic Analysis % Sites	% Indiv.
1940-1949	3	13.6	13	18.3	100.0	100.0
1950-1959	2	9.1	3	4.2	0.0	0.0
1960-1969	5	22.7	6	8.5	20.0	16.7
1970-1979	7	31.8	7	9.9	57.1	57.1
1980-1989	4	18.2	41	57.7	75.0	97.6
1990-1994	1	4.6	1	1.4	100.0	100.0
Total	22	100.0	71	100.0	54.5	83.1

Note: For 22/89 sites (24.7%),71/287 individuals (24.7%) systematically excavated with available dates from Montana.

Table 15. Organizations Reporting and Recovering Human Remains in Montana

	Total Sites		Total Systematically Recovered	
	N	%	N	%
Amateur	59	73.8	7	31.8
Federal	10	12.5	8	36.4
Medical/Legal	5	6.3	2	9.1
University	6	7.5	5	22.7
Total	80	100.0	22	100.0

Note: Combination efforts (N=4) divided among groups. Unknown affiliation (N=9) not included.

Table 16. Publications in Montana Bioarcheology by Decade and Publication Type

	State Jour[1]	Reg. Jour[2]	Nat. Jour[3]	Book	Mss.[4]	Total	Percent
1930-1939	0	0	1	0	0	1	2.6
1940-1949	0	0	0	0	0	0	0.0
1950-1959	4	0	0	1	0	5	13.2
1960-1969	12	3	0	0	0	12	31.6
1970-1979	9	0	1	1	5	13	34.2
1980-1989	6	0	0	1	0	4	10.5
1990-1994	3	0	0	0	3	3	7.9
Total	22	3	2	3	8	38	
Percent	57.9	7.9	5.3	7.9	21.1	100.0	

[1] *Archaeology in Montana, Trowel and Screen, University of Montana Contributions to Anthropology, Montana State University Anthropology and Sociology Papers, The Wyoming Archaeologist*
[2] *Plains Anthropologist*
[3] *Memoirs of American Anthropological Association, Science*
[4] Manuscripts on File: University of Montana Archaeological Records, University of Wyoming Osteology Lab

four in *Archaeology in Montana* (e.g., Brumley 1966), one in *University of Wyoming Publications,* one in *Trowel and Screen* (Billings Archaeological Society), and one in *The Wyoming Archaeologist.* Another burial was discussed in an Agricultural Report from Montana State University.

Mention of eight more burials can be found in publications which appeared in the 1970s. Most are again reports of skeletal remains which were published in statewide journals (Brumley 1974; Sharrock 1974). The article about the Anzick site which appeared in *Science* was indirectly about a burial although emphasis was placed on the associated Clovis artifacts (Lahren and Bonnichsen 1974). Lahren also described a few burials from the Upper Yellowstone area (Lahren 1971).

The early 1980s signifies a slowing of most bioarcheological publishing in Montana. Whether excavation and, more importantly, analysis have occurred since that time is unknown. Two articles appeared in *Archaeology in Montana* during the early 1980s (Joyes 1981; Joyes et al. 1984). An additional one by Gill and Clark (1983) was published in *Plains Anthropologist.* The 1989 book about the Battle of the Little Bighorn contains a section on the osteological analysis of 34 White soldiers (Snow and Fitzpatrick 1989). Nothing easily accessible has been published in the 1990s.

Distribution of Mortuary Components and Total Skeletal Sample Size for Wyoming and Montana

Methodology

This synthesis is based on a data base of human remains generated in part for this project. The data base fields include site number, site names, local numbers, federal information processing standard codes (FIPS) to identify state and county, number of components, number of skeletons identified, number of skeletons studied, level of analysis, burial context, burial period, burial tradition, burial variant, burial phase, tribal affiliation, drainage, geological unit, vegetative zone, adaptation type, reporting organization, organization type, project type, and reference citations. Several avenues were used as sources for this information in Wyoming and Montana.

1. University of Wyoming Department of Anthropology Osteology Laboratory Human Remains files: files pertaining to individuals located at the University of Wyoming curation facility. These are the most complete as they are updated frequently and are used in determining new osteological methods in race, age, and sex, as well as changes through time.

2. University of Wyoming Department of Anthropology Osteology Laboratory Data Base files: cases pertaining to individuals from sites in the area that passed through the laboratory, that were available in the published literature, or that were known through informants.

3. University of Wyoming Department of Anthropology Osteology Laboratory Forensic Case files: cases of individuals analyzed by the University of Wyoming, channeled through law enforcement because of the possibility of homocide or missing persons. Some are not recent cases, and some are available for future research.

4. Wyoming Cultural Record Site Files, State Historic Preservation Office: state site files and contract reports giving site descriptions, by Smithsonian numbers. Most of the contract reports pertaining to human remains were already on file at the University, since George Gill does most of the osteological analysis.

5. University of Montana Archaeological Records: state site files giving site descriptions, by Smithsonian numbers. Most of these contain site information, not skeletal information.

6. Montana State University: records provided by Jack W. Fisher, Jr. that were on file.

7. Journals: all pertinent national and regional anthropological journals including *American Antiquity, American Anthropologist,* and *Plains Anthropologist* were examined as well as state journals including *The Wyoming Archaeologist, Wyoming Contributions to Anthropology, Occasional Papers in Wyoming Anthropology, University of Wyoming Publications, Archaeology in Montana, University of Montana Contributions to Anthropology,* and *Montana State University Anthropology and Sociology Papers.*

Mortuary Data Base

The Wyoming data base is as comprehensive as possible. There were 214 burial sites included in an exhaustive search. This figure probably includes all burials that have been systematically excavated.

To identify the 89 sites in Montana, published information was reviewed and organized by publication type and decade. Next, site files from Archaeological Records at the University of Montana were used to help define project types that resulted in the recording of the sites. Few burials were systematically excavated; professionals have concentrated on documenting sites previously disturbed. Confidential Information from a half dozen sites on Bureau of Indian Affairs and Forest Service land were not included. No syntheses of bioarcheological sites in Montana were found and access to manuscripts was limited by time and space. Approximately two dozen human remains that were sent to the University of Wyoming to be analyzed by Gill, especially during the 1970s and 1980s, have already been incorporated into a regional data base.

Distribution by County

Wyoming

Burial sites are recorded in all 23 counties and Yellowstone National Park in Wyoming (Table 17). The highest number of sites have been recorded from Fremont County (11%) in the central part of the state, Goshen County (10%) in the southeast, and Washakie County (10%) in the north-central area. The lowest numbers have been reported from Crook and Lincoln counties in the southeast and northeast corners, respectively. Each of these counties has contributed less than 1% of the total number of burials. The number of reported burials per county reflects the county size. The average number of burials is 0.002 per square mile. Goshen and Washakie counties contain the highest number of burials by area. These two counties, both high in their overall frequency, average four and a half more burials per square mile greater than the state mean. Although

Table 17. Mortuary Components: Site Distribution by County, Total Sites, and Square Miles

County	Burial Sites N	Burial Sites %	Total Sites	B/S%	Sq. Mi.	B/SM (% x 10-3)
Wyoming[1,2]						
Albany	10	4.7	770	1.3	4392	2.27
Big Horn	7	3.3	1795	0.4	3217	2.20
Campbell	4	1.9	2826	0.1	4769	0.84
Carbon	14	6.5	5378	0.3	8094	1.73
Converse	9	4.2	1999	0.5	4299	2.10
Crook	2	0.9	1455	0.1	2906	0.69
Fremont	24	11.2	3367	0.8	9394	2.55
Goshen	22	10.3	339	6.5	2238	9.85
Hot Springs	3	1.4	656	0.5	2027	1.48
Johnson	11	5.1	1464	0.8	4207	2.61
Laramie	5	2.3	1170	0.4	2706	1.85
Lincoln	2	0.9	2845	0.1	4182	0.28
Natrona	14	6.5	2232	0.6	5385	2.61
Niobrara	2	0.9	329	0.6	2614	0.77
Park	17	7.9	1650	1.0	5493	3.09
Platte	7	3.3	677	1.0	2142	3.30
Sheridan	3	1.4	850	0.4	2563	1.18
Sublette	6	2.8	1554	0.4	5444	1.10
Sweetwater	15	7.0	9940	0.2	10583	1.42
Teton	3	1.4	749	0.4	2534	1.18
Uinta	6	2.8	1701	0.4	2025	2.90
Washakie	21	9.8	1296	1.6	2265	9.27
Weston	4	1.9	745	0.5	2428	1.65
Yellowstone Pk.	3	1.4	622	0.5	2930	1.02
Total	214	100.0	46409	—	97914	——
Average	9	4.2	1933	0.8	3955	2.41
Montana[3,4]						
Beaverhead	5	5.6	1248	0.4	5560	0.90
Big Horn	6	6.7	1544	0.4	5028	1.19
Blaine	2	2.2	849	0.2	4275	0.47
Broadwater	0	0.0	553	0.0	1193	0.00
Carbon	4	4.5	878	0.5	2067	1.94
Carter	0	0.0	411	0.0	3313	0.00
Cascade	0	0.0	393	0.0	2661	0.00
Chouteau	4	4.5	696	0.6	3927	1.02
Custer	1	1.1	607	0.2	3756	0.27
Daniels	0	0.0	63	0.0	1443	0.00
Dawson	0	0.0	392	0.0	2370	0.00
Deerlodge	0	0.0	326	0.0	740	0.00
Fallon	0	0.0	295	0.0	1633	0.00
Fergus	2	2.2	629	0.3	4242	0.47
Flathead	1	1.1	512	0.2	5137	0.19
Gallatin	4	4.5	767	0.5	2517	1.59
Garfield	0	0.0	248	0.0	4455	0.00
Glacier	1	1.1	503	0.2	2964	0.34
Golden Valley	2	2.2	91	2.2	1176	1.70
Granite	1	1.1	673	0.1	1733	0.58
Hill	3	3.4	846	0.4	2927	1.02
Jefferson	2	2.2	702	0.3	1652	1.21
Judith	1	1.1	181	0.6	1880	0.53
Lake	6	6.7	188	3.2	1434	4.18
Lewis and Clark	2	2.2	787	0.3	3476	0.58
Liberty	1	1.1	126	1.8	1439	0.69
Lincoln	2	2.2	1444	0.1	3714	0.54
McCone	0	0.0	307	0.0	2607	0.00
Madison	1	1.1	1131	0.1	3528	0.28
Meagher	0	0.0	334	0.0	2354	0.00
Mineral	1	1.1	255	0.4	1222	0.82
Missoula	2	2.2	616	0.3	2612	0.77
Musselshell	2	2.2	476	0.4	1887	1.06
Park	5	5.6	536	0.9	2626	1.90
Petroleum	0	0.0	212	0.0	1655	0.00
Phillips	1	1.1	3422	0.0	5213	0.19
Ponderosa	0	0.0	110	0.0	1645	0.00
Powder River	0	0.0	1074	0.0	3288	0.00
Powell	1	1.1	527	0.2	2336	0.43
Prairie	0	0.0	278	0.0	1730	0.00
Ravalli	1	1.1	543	0.2	2382	0.42
Richland	3	3.4	240	1.3	2079	1.44
Roosevelt	0	0.0	234	0.0	2385	0.00
Rosebud	2	2.2	1098	0.2	5037	0.40
Sanders	1	1.1	389	0.3	2778	0.36
Sheridan	7	7.9	617	1.1	1694	4.13
Silver Bow	1	1.1	495	0.2	715	1.40
Stillwater	0	0.0	273	0.0	1974	0.00
Sweet Grass	1	1.1	203	0.5	1840	0.54
Teton	0	0.0	232	0.0	2294	0.00
Toole	1	1.1	301	0.3	1950	0.51
Treasure	1	1.1	44	2.3	985	1.01
Valley	0	0.0	1211	0.0	4974	0.00
Wheatland	0	0.0	87	0.0	1420	0.00
Wibaux	0	0.0	119	0.0	890	0.00
Yellowstone Park	0	0.0	37	0.0	269	0.00
Yellowstone	8	9.0	715	1.1	2342	3.42
Total	89	100.0	32068	—	147138	——
Average	2	1.8	563	0.4	2581	0.67

Note: B/S = burial/total sites; B/SM - burial/square miles.

[1]Wyoming Cultural Records, State Historic Preservation Office, 3/94 (Wyoming total sites); [2] *Equality State Almanac 1993, Webster's New Geographical Dictionary* 1972 (Wyoming square miles); [3]University of Montana Archaeological Records (Montana total sites); [4]*Webster's New Geographical Dictionary* 1972 (Montana square miles).

Fremont County possessed the highest number of burials overall, it is also a large county and burials per square mile is no higher than most of the other counties. On the other extreme, Lincoln and Crook counties have densities below the average. Lincoln has nine times less burials per square mile and Crook has three and one half times less.

The intensity of CRM survey activities in an area may also contribute to the number of burials found. The ratio percentage of burial sites to total sites may demonstrate the degree to which the number of burials is related to completed cultural resource surveys. If all else is equal, more burials should be found when actively sought than from areas less intensely surveyed. As the number of sites increases, the number of burials should increase. The overall percentage would therefore remain fairly constant—meaning people were burying their dead in the areas of site concentrations, i.e. where they were living. However, if the percentage is greater than expected, then the number of burial sites is less dependent on survey intensity. This increase would suggest that something about the area was more attractive to people in terms of appropriate burial places. The number of burial sites per county averages 0.8% of the total recorded sites per county (Table 17). Most counties fall close to this average except Goshen County with 6.5% or eight times the average ratio of burial sites to total sites. Washakie County follows at 1.6%. A statistical correlation between total sites and total burials shows a very weak correlation ($r = 0.34$). This number explains only 12% of the variance. Therefore, the number of burials found is not highly dependent on the number of recorded archeological sites.

In summary, the distribution of burial sites by county in Wyoming were evaluated through frequency of burial sites by county, number of burial sites per square mileage, and percentage of burial sites per total number of recorded sites. Goshen and Washakie counties have some of the highest numbers of burial sites in every category. These areas were highly desirable, and the greater frequencies probably indicates travel areas along the North Platte and Bighorn Rivers and population concentrations. Lincoln and Crook counties consistently exhibit the fewest burial sites by all measures. It must be stressed, however, that the total sample size is small and probably not representative of actual populations.

Montana

Burial sites have been reported from 36 of 57 counties in Montana (Table 17). The highest numbers have been found in Big Horn (7%) and Yellowstone (9%) counties in the south-central part of the state, Sheridan County (8%) in the northeast part of the state, and Lake County (7%) in the northwest area. One-third of Montana counties have no burial sites on record; these areas are primarily in the northeast and far east sections and the west-central portion of the state. Nonrepresentative, unsystematic sampling may be largely responsible for this distribution.

Counties average 0.0007 burials per square mile with most ranging from 0.0004 to 0.002. Counties with the highest numbers of recorded burials per square mile include Lake, Sheridan, and Yellowstone, all with greater than 0.003 burials per square mile (Table 17). Again, the counties with no burials rank the lowest along with Flathead and Phillips counties.

In terms of CRM survey intensity, 0.4% of the total number of sites are burial sites (Table 17). Counties with higher percentages include Lake (3.2%), Treasure (2.3%), Golden Valley (2.2%), Liberty (1.8%), Richland (1.3%), Yellowstone (1.1%), and Sheridan (1.1%). Low percentages occur in Granite (0.1%), Lincoln (0.1%), and Madison (0.1%) as well as the counties with no recorded burials.

The frequency of Montana burial distribution by county suggests a few patterns. Highest distributions in all three methods occur in Lake, Yellowstone, and Sheridan counties, which are widely separated geographically. Areas with low burial site distributions occur on the western one-third and eastern one-third of the state. Notable exceptions are Lake County in the west and Sheridan County in the east which suggest the possibility of sampling problems.

Distribution by Drainage

The distribution of burial sites by river drainages provides another spatial perspective on burial sites, one that was more meaningful to prehistoric people than artificially created county boundaries. More than half of the state river systems in Wyoming drain into the Missouri River, about a third (in the western area across the Great Divide) drain the Upper Colorado, and a small section in the west-central area is part of the Pacific Northwest System. Burial sites have been recorded in 11 river drainages, but the most numerous occur on the North Platte River (31%), the Bighorn River (33%), and the Upper Green River (12%) (Table 18). These three drainages produced 76% of all the reported burial sites in the state, while each of the other eight

Table 18. Distribution of Burial Sites by Northwestern Plains Drainages

	Sites		Indiv.		Indiv.
Wyoming	N	%	N	%	per Site
Upper Yellowstone	5	2.4	6	1.5	1.2
North Platte	66	31.4	110	27.8	1.7
Powder-Tongue	15	7.1	42	10.6	2.6
Cheyenne	14	6.7	17	4.3	1.2
Niobrara	1	0.5	1	0.3	1.0
Bighorn	70	33.3	149	37.6	2.1
South Platte	5	2.4	8	2.0	1.6
Great Divide-Upper Green	27	12.4	45	11.4	1.7
White-Yampa	2	1.0	7	1.8	3.5
Bear	2	1.0	7	1.8	3.5
Upper Snake	4	0.9	4	1.0	1.0
Total	211	100.0	396	100.0	1.9
Montana					
Missouri Headwaters	10	11.2	11	3.8	1.1
Missouri-Marias	8	9.0	41	14.3	5.1
Missouri-Musselshell	11	12.4	14	4.9	1.3
Milk	5	5.6	6	2.1	1.2
Missouri-Popular	7	7.9	12	4.2	1.7
Upper Yellowstone	19	21.3	43	15.0	2.3
Big Horn	6	6.7	122	42.7	20.3
Powder-Tongue	1	1.1	1	0.3	1.0
Lower Yellowstone	5	5.6	11	3.8	2.2
Kootenai-P.Oreille-Spokane	17	19.1	23	8.7	1.4
Total	89	100.0	284	100.0	3.2

Note: Unknown drainage (N=3 Wyoming) not included.

drainages contain 7% or less of the total burial sites. The Niobrara, White-Yampa, and the Bear River encompass very little surface area in Wyoming and each drainage accounts for 1% or fewer of the burial sites.

Following the dominant pattern of the Northwestern Plains, the number of individuals per site does not vary much by drainage. The number of individuals may relate to larger or smaller populations of people or different cultural traditions. On the Northwestern Plains, these patterns should be fairly constant. In most cases, the number of individuals per site ranges from one to two for each drainage. The two drainages that show more than an average of three individuals per site are the White-Yampa and the Bear. As mentioned above, these rivers are also the least frequent drainages with burial sites, indicating that only a few burials contributed to the overall high average of individuals.

The river systems in Montana drain into the Missouri River except for the northwestern one-fourth that drains into the Pacific-Northwest. Ten drainages contain burials in Montana. The highest frequencies of burial sites by drainage occur in the Upper Yellowstone (21%), the Kootenai-Pend Oreille-Spokane (19%), and the Missouri-Musselshell (13%) (Table 18). An additional 48% of the burials were not found within these three main drainages. In Wyoming only one quarter (not one half) of the sites are located on other than the first three drainages. This difference could signify that (1) sites are fairly well distributed in Montana without obvious bias toward certain drainage areas, (2) drainage size is not as large in Montana, and (3) sample is skewed by lack of data in Montana. A combination of these three factors is probably the best interpretation. Sites are found with the least frequency on the Powder-Tongue River drainage (1%).

Like Wyoming, most of the drainages in Montana average less than three individuals per site. However, two drainages average more: the Bighorn and Missouri-Marias river drainages.

However, the Marias average is one individual per site, not five, when disregarding a group of 34 Protohistoric individuals from one cemetery. The Bighorn drainage includes a group of 74 individuals known to be from various sites in the area but which are considered as a single study group. Still, when they are not considered, the number remains at an average of 10 individuals per site which is extremely high.

An examination of the type of organization investigating different drainages reveals other patterns (Table 19). The data base from Wyoming alone is considered emphasizing systematic excavations. Organizations were divided into three categories: amateurs, universities and museums, and cultural resource management agencies. For almost every drainage, amateurs have recorded the most burials, averaging 63% per drainage. What this large number signifies is that amateurs have not concentrated their efforts exclusively in one area but have been a strong presence throughout the state. The highest percent by amateurs is the Niobrara and the Upper Snake River drainages (100.0%). However, the total number of burial sites from these areas is quite low.

University/museums and cultural resource management companies average a smaller number of excavations than amateurs per drainage. Universities and museums have been involved with a slightly smaller number of burials, 17% per drainage, than those involving cultural resource management agencies, who have contributed an average of 20% of the burials found in each drainage. The highest number recorded by universities is 40% for both the South Platte and White-Yampa river drainages. The highest number recorded for CRM is the burials from the Bear River (100%).

Table 19. Distribution of Burial Sites in Wyoming by Drainages and Recording Agency

Drainage	Amateurs		Univ/Mus.		CRM		Total	
	N	%	N	%	N	%	N	%
Upper Yellowstone	3	75.0	1	25.0	0	0.0	4	100.0
North Platte	42	72.4	9	15.5	7	12.1	58	100.0
Powder-Tongue	11	73.3	1	6.7	3	20.0	15	100.0
Cheyenne	9	69.2	2	15.4	2	15.4	13	100.0
Niobrara	1	100.0	0	0.0	0	0.0	1	100.0
Bighorn	40	54.8	15	20.5	18	24.7	73	100.0
South Platte	3	60.0	2	40.0	0	0.0	5	100.0
Great Divide-Up.Green	12	42.9	8	28.6	8	28.6	28	100.0
White-Yampa	2	40.0	2	40.0	1	20.0	5	100.0
Bear	0	0.0	0	0.0	2	100.0	2	100.0
Upper Snake	4	100.0	0	0.0	0	0.0	4	100.0
Average	12	62.5	3	17.4	4	20.1	19	

Note: Burials excavated by more than one group were counted once in each category.

Distribution by Vegetation

Each site with human remains was coded with the potential vegetation type in the area using maps produced by the University of Arkansas Center for Advanced Technology. Burials were located on 15 different types (Table 20). The highest frequencies were grama/needlegrass/wheatgrass (26%) and sagebrush steppe (25%). Lowest distributions occurred in the more restrictive Black Hills pine, mountain mahogany/oak scrub, and Northern Plains floodplain, with a combined distribution of less than 2% of all of the sites.

The 15 types were divided into three broader categories: foothills/montane, semi-arid grasslands/cool desert, and grasslands, which represent gradients from west to east as well as changes in elevation. On grasslands were located 58% of the total sites. Semi-arid grasslands accounted for 26% of the sites, and the foothills and mountains only account for 16% of the total.

Examining the three vegetation zones from Archaic, to Late Prehistoric, to Protohistoric show that there was little change over time. Between 15% and 18% of all reported burials lie within the foothills/montane areas during all three periods, while the semi-arid grasslands account for 23% to 30% of the sites per period. Grasslands account for 55% to 62% during all periods (Table 21).

In contrast, the people who migrated into the area after the middle of the nineteenth century—Whites, Blacks, and Chinese—settled in different areas and preferred different burial locations. The Historic burial sites were located on only half as many foothills regions (9%) and less grasslands (48%). The most favored locations were semi-arid grasslands with almost double the number found in the prehistoric periods (44%). These groups may have focused less on vegetation and more on other factors such as means of transportation and presence of towns and forts. Many people probably died when they left the richer river systems and grasslands in the east and traveled west. The dominant pattern of trails and settlement strategies were not in the mountains but on the flats.

Table 20. Distribution of Northwestern Plains Burial Sites by Vegetation Type

	Sites		Indiv.		Indiv.
	N	%	N	%	per site
Foothills/Montane					
Western Ponderosa	7	2.4	15	2.2	2.1
Douglas Fir	20	6.9	34	5.1	1.7
Western Spruce/Fir	4	1.4	4	0.6	1.0
Eastern Ponderosa	7	2.4	12	1.8	1.7
Black Hills Pine	2	0.7	3	0.4	1.5
Pine/Douglas Fir	5	1.7	10	1.5	2.0
Mtn. Mahogany/Oak Scrub	2	0.7	5	0.7	2.5
Semiarid Grasslands					
Saltbrush/Greasewood	3	1.0	9	1.3	3.0
Sagebrush Steppe	72	24.8	121	18.0	1.7
Grasslands					
Wheatgrass/Needlegrass Steppe	32	11.1	55	8.2	1.7
Foothills Prairie	19	6.6	136	20.2	7.2
Grama/Needlegrass/Wheatgrass	75	25.9	178	26.4	2.4
Grama/Buffalo Grass	25	8.6	61	9.1	2.4
Wheatgrass/Needlegrass	16	5.5	29	4.3	1.8
Northern Floodplain	1	0.3	1	0.1	1.0
Total	290		673		2.3

Note: Unknown vegetation types (N = 13) not included.

Table 21. Distribution of Northwestern Plains Burial Sites by Vegetation Zone and by Period

	All		Archaic		L. Pre.		Proto.		Historic	
	N	%	N	%	N	%	N	%	N	%
Foothill/Montane	47	16.2	3	15.0	8	17.8	11	15.1	2	8.7
Semi-arid Grassland	75	25.9	6	30.0	12	26.7	17	23.0	10	43.5
Grassland	168	57.9	11	55.0	25	55.6	46	61.9	11	47.8
Total	290	100.0	20	100.0	45	100.0	74	100.0	23	100.0

Distribution by Period

Eight identifiable cultural periods are represented by burials on the Northwestern Plains. These temporal affiliations span 10,000 years and follow the basic chronology for the area. At least one site from each of the periods defined by Frison (1991) has been reported.

Basically, the older skeletal remains are fewer in number (Table 22); the more recent the period, the more skeletal remains have been found. The smallest number of sites date to the Paleoindian, followed by the Early Archaic and the Middle Archaic, and the Late Archaic. The total number of Paleoindian and Archaic components comprise 12% of the entire sample of dated sites, and the number of individuals is 5% of the total. The preservation of burials greater than 1,500 years old is obviously not as good. Also, populations were probably not as high, thus fewer individuals will be found. However, analysis of at least a limited nature of these sites and individuals has been high—100% in all cases.

The four Woodland sites constitute only 3% of the number of sites but comprise 10% of the sample of individuals because of the high number of individuals found per site. All of these sites have been analyzed to some degree although only 53% of the individuals have been studied. This low number is due to the inaccessibility of 75% of the individuals from one site which was actively looted before salvage occurred.

More than two-thirds of the documented burial sites in Wyoming and Montana have been either Late Prehistoric or Protohistoric in affiliation. Late Prehistoric sites comprise 25% of the burial sites and 18% of the individuals. Approximately 80% of these sites and individuals have been analyzed. The Protohistoric involves 45% of the total sites along with 48% of the total number of individuals. The degree of analysis that has occurred on these Protohistoric burials, however, is less than that received by individuals from the earlier periods. Many of the remains that have not been analyzed are fragmentary or have not been available for scientific study. Many Protohistoric sites were documented by the presence of European trade goods while the skeletons were not made available or were not collected. Only 61% of the sites and 74% of the individuals were analyzed.

An additional 15% of the total sites and 18% of the individuals are from Historic contexts. These individuals include frontier Whites, Blacks, and Chinese. The level of analysis of these remains is similar to that of the earlier time periods (greater than 90%) largely because of the research interests of professionals at the University of Wyoming. A large number of burial sites are of unknown temporal affiliations (45%). Many of these individuals probably date to earlier periods rather than later ones since recent burials, i.e., Protohistoric, are more likely to be associated with diagnostic artifacts that can be used for dating.

Table 22. Cultural Affiliation and Analysis of Northwestern Plains Burials

Period	Sites		Individuals		% Analyzed	
	N	%	N	%	Sites	Indiv.
Paleoindian	1	0.6	2	0.4	100.0	100.0
Early Archaic	2	1.2	2	0.4	100.0	100.0
Middle Archaic	2	1.2	3	0.6	100.0	100.0
Late Archaic	15	9.1	17	3.6	100.0	100.0
Woodland	4	2.6	49	9.9	100.0	53.1
Late Prehistoric	41	24.8	88	17.9	78.0	80.7
Protohistoric	75	45.4	253	48.4	61.3	73.5
Historic	25	15.2	93	18.8	92.0	91.4
Total	165	100.0	507	100.0		

Note: For 165/303 sites (54.5%), 507/687 individuals (73.8%) from known temporal periods.

Bioarcheology of the Northwestern Plains

Although not a dominant research interest of many archeologists, the information gained through the study of mortuary sites has revealed patterns that are consistent with the rest of the archeological record. Conclusions based on the study of human skeletal remains often complement other archeological analyses in terms of what is known about past life style, the migration of groups into an area, quality of life, diet, group relationships and conflict, and settlement patterns. Yet archeologists are not always aware of what has been learned from bioarcheology so that both sources of information may be used in predicting new hypotheses. Likewise, information gained from Historical populations from Wyoming and Montana can assist historian's interpretations of life in the "Old West." This section will provide some information to fill existing gaps in the Historical record.

Another intention of this section is to integrate Northwestern Plains biological data with information from the rest of the Northern and Central Plains. Most of the bioarcheological analyses that have been published under the "Northern Plains" have been limited to the Missouri Trench area of North and South Dakota (Key 1994; Olsen and Shipman 1994; Owsley 1992, 1994; Snortland 1994; Williams 1994). The historical and environmental circumstances in the northwestern portion of the Northern Plains is different, yet both areas can be better understood by examining trends occurring in adjacent areas. Information presented for Wyoming and Montana will help produce a larger picture of the Northern and Central Plains as a whole and contribute to more regional investigations.

The final objective of this section is to provide information on the state of bioarcheological research for interested professionals and students as well as for cultural resource management bioarcheology. CRM bioarcheology, especially in Wyoming, is closely affiliated with the University. Most burials that are found are analyzed there, usually free of charge. Little money has been spent on the study of skeletal remains, and research usually occurs primarily because of the high degree of interest. Human skeletal remains are not often found and usually occur as single skeletons or sometimes in pairs. The number of burials that have so far been found during testing, survey, or planned excavation are very few (24 of 303 burials (8%), 36 of 687 individuals (5%). The majority have been recovered during salvage excavations to protect the graves from further damage. Contractors who do locate and uncover burials, however, will find this information useful in preparing meaningful management statements based on extant knowledge.

The bioarcheological information presented here is discussed by archeological time period. Two main sections will pertain to prehistoric (Paleoindian through Protohistoric) and historic populations. Montana and Wyoming are treated as a unit unless a particular culture did not extend beyond the boundary of either state.

The sections pertaining to the specific time periods focus on available information and research topics. These themes include sample sizes, geographic limits, dating methods, demographic profiles, quality of life, and a discussion of key sites. Conclusions about prehistoric population, demography, bone pathology (disease and injury), dental pathology, microevolution, and burial patterns are presented following the discussion of each archeological period. The section on Historic populations follows the same format, focusing primarily on skeletal injuries, demographics, and diet and disease of White and some non-White pioneers. Summaries and hypotheses for future data collection are provided at the end of each of the major sections (Prehistoric and Historic).

The data base discussed for the distribution of bioarcheological resources was employed as a basis for understanding the results of bioarcheological investigations. In this section, only burials with a designated temporal affiliation are used. This sample includes 74% of the individuals from 55% of the mortuary sites in Wyoming and Montana. In completing this compilation, the broadest definitions of time periods were used. Some dating techniques were more tenuous than others and are explained in more detail within the various sections. Time periods were assigned based on the presence of diagnostic artifacts, radiocarbon age determinations, and notes in the osteology files—information that sometimes can no longer be substantiated due to poor documentation or the absence of the archeologist who first examined the site or site materials.

The bioarcheological data have been obtained through books, published articles, manuscripts, and contract reports when possible. However, much of the information needed for this project is not available in a synthesized form. Most of the statistics were generated by the first author, based largely on osteology checklist forms completed by the second author and maintained at the University of Wyoming. Basic information gained from sources outside the recent University of Wyoming records (i.e., earlier accounts, some reports from Montana, etc.) used in basic sex and age tables appear quite consistent among the various researchers, thus facilitating data compilation and synthesis.

Prehistoric and Protohistoric Populations

This section discusses the bioarcheology of 11,000 years of Native American occupation of the Northwestern Plains. It is divided by recognizable time periods. These time periods include Paleoindian, Early Plains Archaic, Middle Plains Archaic, Late Plains Archaic, Plains Woodland, Late Prehistoric, and Protohistoric (see Frison 1991). The sections focus on sample numbers, dating, dominant trends, and discussions of major sites.

An overview of Prehistoric and Protohistoric populations on the Northwestern Plains is available in Gill's (1991) chapter "Human Skeletal Remains on the Northwestern Plains" in *Prehistoric Hunters of the High Plains* by George C. Frison. The report describes the University of Wyoming osteological collection and highlights various burial types. Most of the published synthetic analyses of the collection have focused on cranial variation (Gill 1974, 1981, 1991). Zitt (1992) also examined dental pathology in her Master's thesis. An additional article reported on skeletal pathology found in the collection (Fisher 1982). The information presented uses these sources, but also incorporates new data, new ways of examining previous data, and a presentation of Northwestern Plains burials by known time period. A list of radiocarbon dates associated with specific Northwestern Plains burials is included in Table 23, and key sites for each time period are listed in Table 24.

Paleoindian (11,200-7000 B.P.)

Paleoindian skeletal material is extremely rare. Early human remains in the study area are limited to southern Montana although Paleoindian sites have been documented throughout the Northwestern Plains (Frison 1991). The only human remains from Wyoming or Montana that date to the Paleoindian period were discovered in 1968 at the Anzick site (24PA506), a Clovis complex site located in south-central Montana. Two red ochre-covered subadult skeletons were found along with numerous artifacts including bifaces, Clovis projectile points, and mammoth bone foreshafts (Lahren and Bonnichsen 1974). Unfortunately, the original context was lost due to construction activities, although the assemblage apparently originated in a small rockshelter. Radiocarbon dates from the site range from 10,940 ± 90 B.P. (AA-2981) to 10,710 ± 100 B.P. (AA-2980) (Frison 1991). So-called burial caches may have been a common practice during early Paleoindian times. According to Frison (1991:41), caches were "likely an institutionalized part of Clovis."

Burial sites that date to other Paleoindian complexes such as Folsom, Hell Gap, Agate Basin, Cody complex, and others have not been found. Paleoindian burials comprise less than 1% of the individuals and sites in the study area. The only partially analyzed Paleoindian burial from a more general area was found at the Gordon Creek site (5LR99), 18 miles south of the Wyoming-Colorado border in northern Colorado. An adult female was found 2 m under the ground surface in a pit stained with red ocher. The remains were associated with red-ocher stained lithic tools, cut animal bones, and elk teeth. The burial was radiocarbon dated to 9700 ± 250 years ago (GX-0530). A complete list of osteometrics and discrete traits are available (Breternitz et al. 1971).

Early Plains Archaic (8000-5000 B.P.)

Two skeletal assemblages dating to the Early Plains Archaic have been recorded from the Northwestern Plains, both in Wyoming. They represent 1% or less of the number of burial sites and individuals in the total sample. The sites were dated by radiocarbon analysis, and both consist of an elderly individual buried within a habitation area (Tables 24 and 25).

Table 23. Radiocarbon Dates Associated with Northwestern Plains Burials

Period	Site Name (Site Number)	Date B.P. (Lab No.)	Source	Reference
Early Archaic	Dunlap-McMurry (48NA67)	5350 ± 160 (RL-651)	charcoal	Zeimens et al. 1978
		5250 ± 150 (RL-543)	charcoal	Zeimens et al. 1978
	Meadow Draw (48UT63)	5040 ± 160 (RL-1150) (MASCA corr. 5810 ± 160)	bone	UW Osteology Lab file
Late Archaic	Wind River Canyon (48HO10)	3520 ± 140 (RL-1876) (MASCA corr. 3880 ± 210)	charcoal	Frison and Van Norman 1985
	Jimmy Allen (48PA899)	2940 ± 260 (UW file)	charcoal	Wyo Cultural Records
	Whitewater (24PH9001)	2620 ± 200 (UW file)	bone	Lahren p.c., UW Lab File
	Boar's Tusk (48SW502)	2480 ± 110 (RL-617)	bone	Eakin 1980
	Iron Jaw (24RB93)	1790 ± 50 (TX-3066)	wood charcoal	Gill and Clark 1983
Woodland	Benick Ranch (48AB571)	2340 ± 70 (B-36257, ETH-6378)	bone beads	Davis 1992
		1510 ± 60 (B-49929)	bone	Davis 1992
		1400 ± 60 (B-48470)	bone	Davis 1992
	Dicken (48GO9004)	1570 ± 60 (B-37535)	bone	Adams 1991
Late Prehistoric	County Line Draw (48PL9001)	1700 ± 60 (UW file)	bone beads	Zeimens p.c., UW Lab File
	Bairoil (48SW7101)	1430 ± 60 (B-26887)	feature charcoal	Sheridan et al. 1992
	Mummy Cave (48PA201)	1230 ± 110 (I-1009)	debris	Husted and Edgar n.d.
	Shute Creek (48LN1296)	1100 ± 70 (UW file)	bone	Gillam 1989
		1060 ± 90 (B-27117)	bone	Gillam 1989
	PK Burial (48SH308)	990 ± 240 (A-548)	bone	Haynes et al. 1967
	Hanna Seminoe 1 (48CR121)	910 ± 100 (RL-736)	bone	Walker p.c., UW Lab File
	Espy-Cornwell (48CR4001)	890 ± 70 (B-10696)	juniper beads	Truesdale 1994
	Antelope Mine (48CO481)	790 ± 200 (UW file)	unknown	Greiser et al. 1982
	Turk (48WA301)	760 ± 160 (A-583)	bone	Haynes et al. 1967
	Rattlesnake (24MO1071)	490 ± 160 (GX-2976)	bone	Taylor et al. 1974
	Stone Fence (48CR933)	460 ± 110 (RL-1005) (MASCA corr. 520 ± 80)	bone	Miller and Gill 1980
Protohistoric	Bridger Gap (48UT920)	90 ± 60 (B-13156)	wood	Truesdale and Gill 1987

Note: Site numbers beginning with 9000 are temporary designations. Only dates from directly associated artifacts or features or from bone were included. Dates appear as in original publications, with calibrations when included.

Table 24. Key Sites in Northwestern Plains Bioarcheology

Site name (Site number)	Reference
Paleoindian	
Anzick (24PA506)	Lahren and Bonnichsen 1974
Early Archaic	
Dunlap-McMurry (48NA67)	Zeimens et al. 1978
Meadow Draw (48UT63)	Gill n.d.
Middle Archaic	
McKean (48CK7)	Stewart 1954; Haspel and Wedel 1983
Dead Indian Creek (48PA551)	Gill 1984
Late Archaic	
Iron Jaw Wilcox (24RB93)	Gill and Clark 1983
Sand Creek (48CR9003)	Gill 1978; Scoggin 1978
Wind River Canyon (48HO10)	Frison and Van Norman 1985
Boar's Tusk (48SW502)	Eakin 1980
Late Prehistoric	
Frying Pan Basin (24BE1573)	Gill 1990
Rattlesnake (24MO1071)	Taylor et al. 1974
Overby's Headless (24SH615)	Joyes et al. 1984
Pictograph Cave (24YL1)	Snodgrass 1958
Meadow Draw (48AB459)	Truesdale and Gill 1994
Robber's Gulch (48CR359)	Martindale and Gill 1983
Stone Fence (48CR933)	Miller and Gill 1980
Espy-Cornwell (48CR4001)	Truesdale 1994
Torrington (48GO6)	Howells 1938; Agogino and Galloway 1963
Shute Creek (48LN1296)	Gillam 1989
Mummy Cave (48PA201)	McCracken et al. 1978
PK Burial (48SH308)	Bass and Lacy 1963
Bairoil (48SW7101)	Sheridan et al. 1992
Turk (48WA301)	Birkby and Bass 1963
Protohistoric	
Lost River (24HL403)	Brumley 1966
Fox Burial (24HL413)	Brumley 1974
Saxton (24SH9001)	Joyes 1981
Mouat Cliff (24TE401)	Stephenson 1962
Pryor Creek (24YL404)	Bass and Barlow 1964
Thirty Mile Mesa (24YL9002)	Snodgrass 1965
Korell-Bordeaux (48GO54)	Gill 1987; Zeimens et al. 1987
Pitchfork (48PA42)	Gill 1976a; Scheiber 1994
Bridger Gap (48UT920)	Truesdale and Gill 1987
Marbleton (48UT9004)	Ottman 1992

Note: Site numbers beginning with 9000 are temporary designations.

The Dunlap McMurry site (48NA67) was salvaged in 1975 during highway construction near Casper, Wyoming, by a crew from the Office of the Wyoming State Archaeologist and the University of Wyoming (Zeimens et al. 1978). Associated fire pits were radiocarbon dated to 5250 ± 150 B.P. (RL-543) and 5350 ± 160 B.P. (RL-651). The skeleton represents a male 50-65 years in age.

The Meadow Draw skeleton was found during testing of a site (48UT63) in southwestern Wyoming (Uinta County) by private contractors during the late 1970s. This 50-65 year old female was possibly buried in a firepit covered by red-ocher stained metates (Gill n.d.). Radiocarbon dating of a bone sample yielded a date of 5040 ± 160 B.P. (RL-1150), MASCA corrected to 3860 B.C. (5810 B.P.) ± 160.

Middle Plains Archaic (5000-3000 B.P.)

Burials of the Middle Plains Archaic are represented by two sites and three individuals from northern Wyoming. Dating was established through stratigraphy and radiocarbon analysis. All individuals were recovered from habitation areas under living floors at campsites. Two of the three individuals are subadults (Tables 24 and 25), and all three were probably secondarily deposited.

The Dead Indian Creek site (48PA551) in northwestern Wyoming was excavated during the late 1960s and early 1970s by the University of Wyoming and the Wyoming Archaeological Society. Human remains were recovered by George Frison in August 1969 . The age of the burial was determined by stratigraphic association, presence of diagnostic projectile points, and site radiocarbon dates of 4430 ± 250 B.P. (W-2599), 4180 ±

Table 25. Northwestern Plains Burials, Age Distribution by Cultural Time Period

Age	EA No. (%)	MA No. (%)	LA No. (%)	WO No. (%)	LP No. (%)	PH No. (%)
B-1	0 (0.0)	0 (0.0)	0 (0.0)	1 (8.3)	3 (6.3)	2 (3.6)
1-4	0 (0.0)	0 (0.0)	0 (0.0)	1 (8.3)	4 (8.3)	7 (12.7)
5-9	0 (0.0)	1 (33.3)	0 (0.0)	2 (16.8)	4 (8.3)	4 (7.3)
10-14	0 (0.0)	1 (33.3)	0 (0.0)	0 (0.0)	2 (4.2)	0 (0.0)
15-19	0 (0.0)	0 (0.0)	1 (7.1)	0 (0.0)	1 (2.1)	4 (7.3)
20-29	0 (0.0)	0 (0.0)	1 (7.1)	0 (0.0)	8 (16.7)	18 (32.7)
30-39	0 (0.0)	1 (33.3)	2 (14.3)	3 (25.0)	6 (12.5)	10 (18.2)
40-49	0 (0.0)	0 (0.0)	2 (14.3)	1 (8.3)	10 (20.8)	3 (5.5)
50-59	2 (100.0)	0 (0.0)	5 (35.7)	3 (25.0)	6 (12.5)	3 (5.5)
60+	0 (0.0)	0 (0.0)	3 (21.5)	1 (8.3)	4 (8.3)	4 (7.3)
Total	2	3	14	12	48	55

Key: EA - Early Archaic, MA - Middle Archaic, LA - Late Archaic,
WO - Woodland, LP - Late Prehistoric, PH - Protohistoric/Historic

250 B.P. (W-2599), and 3800 ± 110 B.P. (RL-321), although no artifacts were definitely associated with the human remains (Gill 1984). The partial skeleton is that of a child aged 8-9 years.

Investigation at the McKean site (48CK7) began in the 1950s as a River Basin Survey project. The site is located on the Belle Fourche River in northeastern Wyoming. Excavations conducted by William Mulloy in 1951 yielded a human skull from the lower level. Stratigraphy and artifact association provided evidence for the age of the burial of about 4,000-4,500 years ago (Frison 1978). The remains are those of a 30-year-old female (Stewart 1954). Further investigations at the McKean site in 1983 by the University of Wyoming located another individual approximately 5 m from the one found three decades earlier (Haspel and Wedel 1983). The situation was similar to that of Dead Indian Creek with a child found amongst cultural material. A radiocarbon date from other site deposits of 4590 ± 160 B.P. (RL-1861) was obtained during the more recent excavation.

Another Middle Archaic interment, the Sidney burial, was found just outside of the study area near Sidney, Nebraska, located 60 miles east of the Wyoming-Nebraska border (Brooks et al. 1994). A young male individual and a two year old were found in an isolated burial along with a notched biface, turtle carapace, and feldspar beads. A radiocarbon date of 3710 ± 60 B.P. (BETA-66571, CAMS 9886) converted to 3910 ± 60 B.P. was obtained. The burial practices do not correspond with those of the McKean complex and may be a different Middle Archaic manifestation.

Complete adult osteological analysis (only partially available for one adult female from the Wyoming Middle Archaic specimens) provides evidence for early traits including a high cranial height. These traits have been associated with the "proto-Mongoloid migration into the New World—less pronounced mongoloid-sinodont features" (Brooks et al. 1994).

Late Plains Archaic (3000 - 1500 B.P.)

Fourteen probable Late Archaic burials have been recorded on the Northwestern Plains. They represent 9% of the dated burial sites and 4% of the individuals from the total sample. All but two of these (86%) contained one individual, with two in each of the others. Context is primarily isolated in-the-ground interments although burial in rock shelter, campsite, and cairn have been recorded. Late Archaic burials have been identified throughout most of Wyoming except for the central part of the state (Fremont County). Sites in Montana have been found in the eastern third of the state.

It is often difficult to identify Late Archaic burials without radiocarbon dating because of a lack of diagnostic artifacts and definitive burial practices. Of the 14 in this sample, only five have been dated through radiocarbon analysis and/or truly diagnostic artifacts. The remainder were dated by intuitional consideration of burial style, presence of ground stone, and cranial morphology. The problem with the latter approach is that studies of morphological trends may be based on dating suppositions that are not as reliable as possible. This limitation in the data base needs to be understood before conclusions are drawn on population averages.

Two well-dated sites that typify this period are Boar's Tusk in southwestern Wyoming and Iron Jaw in central Montana. The skeletal remains from Boar's Tusk (48SW502) were not actually part of a burial. This male, aged 50-65 years, apparently died of natural causes and fell face down in the sand. The remains were spotted by recreationists using a dune buggy in 1975 and were salvaged by the University of Wyoming. A bone date of 2480 B.P. ± 120 (RL-617) was obtained. The Boar's Tusk individual may represent early population intrusion from the west (Eakin 1980).

The Iron Jaw skeleton (24RB93) was found in a cairn in southern Montana and excavated by archeologists from the Bureau of Land Management, Miles City (Gill and Clark 1983). The site had been partially destroyed by road construction. Wood charcoal associated with the burial dated to 1790 ± 50 B.P. (TX-3066). This male was very old (70-plus years) at death and was suffering from severe arthritis, osteoporosis, and kyphosis of the spine which was probably caused by old age rather than infection (Gill 1983a:335).

Demographic analysis reveals that some people during the Late Plains Archaic lived to be very old and were in good health. The mean age of the available sample is about 50 years (47.5 years) (Table 25). No individual less than 19 years old has been recorded. Males and females are not equally represented. The adult sample consists of 56% males, 31% females, and 13% unknown (Table 26). They have high cranial vaults (hypsicranic form), wide orbital shapes, and dull nasal sills (Gill 1991). These traits changed in later periods.

Plains Woodland (1000-2000 B.P.) (A.D. 0-1000)

Burials that date to the Plains Woodland period are few in number; the sample constitutes 3% of the dated sites and 10% of the reported number of skeletons. They occur temporally as terminal Late Archaic or the beginning of the Late Prehistoric and constitute a continuation of Late Archaic adaptations with increasing specialization and mobility. "There is little to indicate (except in isolated refugium) that the basic adaptive strategies (e.g. broad spectrum hunting and foraging) of the intermontane Archaic Periods were not perpetuated into the Plains Woodland Period" (Davis 1992:27). They may represent migrating eastern Woodland populations from the Central and Northern Plains as well as diffusion of their ideas.

Woodland pottery is the first to appear on the Northwestern Plains. It has also occasionally been associated with Late Archaic Besant dart points at Wyoming sites such as Greyrocks, Butler-Rissler, and Muddy Creek (Frison 1991). Woodland burial site dates have been based primarily on radiocarbon age determinations and mortuary practices, not by the presence of diagnostic artifacts such as prehistoric ceramics or projectile points.

At least four burial sites on the Northwestern Plains represent probable Woodland populations. All are multiple burials of two to 30 individuals in earthen and rock moundlike structures. Geographically they are limited to southeastern Wyoming, along the North Platte River drainages. Undoubtedly, other Woodland burials exist but do not fit the "classic" pattern and have not been recognized as such. The four sites date from about 1,300 to 1,800 years ago (A.D. 200-700). These dates are near the beginning of the period and could be called Early Plains Woodland (which corresponds with the Middle Woodland in the Central and Northern Plains) (Key 1994).

Late Woodland burials have not been recognized. Perhaps burial practices changed as people diverted from earlier traditions and adapted to changing conditions on the Northwestern Plains with the onset of the "Late Prehistoric" period and more group migration into the area. Several burials unlike those described above have been found with small corner-notched projectile points that may date to Late Woodland times.

The Benick Ranch site (48AB571) is located in southern Albany County in southeastern Wyoming on a terrace of the Laramie River. It was excavated by the University of Wyoming for brief episodes during the summers of 1988, 1990, and 1991, and was the basis for a Master's thesis written by Davis (1992). This thesis is probably the most complete discussion of any single burial site or time period in the Northwestern Plains. Six individuals were recovered: three adults aged 44 to 65 years and three children aged 3-1/2 to 6-1/2 years. Radiocarbon dates indicate the site was used 1,500 years ago, ca. A.D. 450 (B-49929, B-48470). Dental abscesses, osteoarthritis of the vertebral column, and transverse lines of arrested growth were evident. These pathological conditions were common among hunter-gatherers and probably relate to subsistence strategies and diet (Davis 1992).

The Dicken site was salvaged during the winter of 1990 by a team from Eastern Wyoming College and the University of Wyoming when gravel operations in Goshen County exposed a minimum of 12 skeletons. They "comprise the largest complete multiple burial in Wyoming" (Adams 1991:5). This site was located on a terrace of the North Platte River. A radiocarbon date indicates that the site was used almost 1,600 years ago (A.D. 380) (1570 ± 60 B.P.: B-37535.). Because of the fragmentary, crushed, and commingled condition of the remains, an osteological analysis has not yet been completed. At least four adult females (three elderly and one younger), five adult males (35-plus years), one adolescent, and one child have been identified (Adams 1991).

Table 26. Northwestern Plains Burials, Sex Distribution by Time Period (Adults >= 15 Years)

Sex	EA No. (%)	MA No. (%)	LA No. (%)	WO No. (%)	LP No. (%)	PH No. (%)
Males	1	0	9	9	27	23
	(50.0)	(0.0)	(56.2)	(45.0)	(51.9)	(37.1)
Females	1	1	5	8	18	31
	(50.0)	(100.0)	(31.3)	(40.0)	(34.6)	(50.0)
Unknown	0	0	2	3	7	8
	(0.0)	(0.0)	(12.5)	(15.0)	(13.5)	(12.9)
Total	2	1	16	20	52	62

Key: EA - Early Archaic, MA - Middle Archaic, LA - Late Archaic, WO - Woodland, LP - Late Prehistoric, PH - Protohistoric/Historic

Although it is outside the Northwestern Plains study area, a Woodland burial found in Sioux County in western Nebraska (Gill and Lewis 1977) should be mentioned. This adult male was buried fully extended under 1 m of deposits with a large complete Woodland vessel. The burial practices resemble those of Central Woodland populations in Nebraska and Kansas (as opposed to those found in Wyoming), although morphologically the skeleton was identical to others from the Late Archaic and Woodland periods on the Northwestern Plains. These traits include higher cranial vaults, large rugged crania, greater robustness, and greater stature (Gill and Lewis 1977:72). A radiocarbon date of 750 ± 90 B.P. (NWU-61) (A.D. 1200) corresponds with the Late Woodland period, later than the Woodland burials in Wyoming which date earlier.

One of the questions to ask about Woodland populations is if they were more closely affiliated with Late Archaic or Late Prehistoric populations. Despite practicing similar subsistence strategies, demographic analysis of Woodland burials demonstrates a different mortality pattern from that during the Late Archaic period. The average age at death is 31 years (Table 25), which represents a bimodal distribution. Sixty-seven percent of the individuals are aged 30 to 60 years. Thirty-three percent are aged less than 10 years. Slightly more males (45%) have been recovered than females (40%) (Table 26). Adult individuals for which sex is not available account for 15% of the sample. The small sample available suggests a higher incidence of infant and youth mortality, which, if valid, may indicate increased competition between groups, increased population aggregates, and less residential mobility.

Using a larger Woodland sample that included remains from outside this study area, Davis (1992:132) found that "only about 74% of the sample survived to age five, yet over 34% lived beyond age 40 even though they could only expect to live another six years." Mobility may have played a part in this. "The group providers were surely more mobile and prone to the natural hazards of economic pursuit. As a result, they are probably underrepresented in the remains. Those less ambulate members and the very young might be overrepresented in the burial record by virtue of their sedentary roles" (Davis 1992:132). Lack of serious injuries on the skeletons may indicate less intense competition for resources than in the ensuing Late Prehistoric period. This pattern is also noted during the Late Archaic period.

In a preliminary comparison of cranial morphology, Davis (1992:125) found the Woodland sample to be more similar to Archaic period crania in their mesocranic form than to Woodland people from the south who tend to be more dolichocranic. Wyoming groups retain the Archaic appearance (Davis 1992:147). Meyer (1992) found the average cranial breadth to be smaller among Central Plains Woodland traditions in the south and east; skulls from Woodland populations in the Northern and Western Plains are broader and lower. Using discriminant function analysis of Woodland and earlier populations, Key (1994:186) also has noted "a long-term biological continuity in various regions of the Plains. This is especially true for the Northern Plains where the same biological populations may have been in place since the Archaic." Because Woodland crania in Wyoming are morphologically similar to those of Late Archaic groups, some individuals may have been misassigned to the Late Archaic period through morphological dating methods.

Late Prehistoric (1800-300 B.P.) (A.D. 200-1700)

The Late Prehistoric period is the best represented of the pre-Contact periods. Burials from this time period are easier to recognize because of time-sensitive artifacts often associated with the remains. Many groups entered the Northwestern Plains during this period, as evident in changes of projectile point types, ceramic styles, and craniofacial morphology. Archaic populations presumably also remained on the Northwestern Plains, adapting to the bow and arrow that characterizes the Late Prehistoric period.

Forty-one burial sites in the Northwestern Plains have a Late Prehistoric affiliation: 33 in Wyoming and eight in Montana. These account for 25% of the sites and 18% of the individuals in the dated sample. The number of skeletons per site ranges from one to nine although 95% of the sites contain five or less individuals. Late Prehistoric burials have been found throughout Wyoming with noticeable exceptions in the middle of the state (Fremont County) and the northeast. The highest numbers have been recovered from Washakie, Johnson, and Carbon counties. Recorded Late Prehistoric burials in Montana are distributed throughout the state with no notable patterns.

Burial contexts are for the most part isolated (50%), although more than one-third have been found in rockshelters (37%). This pattern represents a significant change from past time periods in which isolated interments dominate burial contexts with few recoveries from rockshelters. Other contexts (totalling 13%) include cairns/talus areas, habitations, and a bison bonebed.

The Stone Fence burial (48CR933) was salvaged from a crevice in south-central Wyoming in July 1977 (Miller and Gill 1980). Judging from the disarticulated nature of the skeletal elements and the absence of certain bones, this middle-aged man was probably part of a secondary bundle burial. Bundle burials may have been common during this time period but they have not often been identified. A bone sample yielded a date of 460 ± 110 B.P. with a MASCA correction to A.D. 1430 ± 80 (RL-1005). This individual retains traits common during the Archaic period, such as a mesocranic skull, small size, high vault, and less rugged cranium (Miller and Gill 1980:240), which appears to be more common in the area identified as the Wyoming Basin.

Evidence for increased conflict between groups (death by projectile points/severe injuries) is extensive, especially in comparison to the Late Archaic burials. Projectile points, either embedded in bone or simply present in the burial assemblage, are found in one-third of the sites (Table 27). Distributions of projectile points among males and females are equally high.

Prehistoric warfare is best evidenced at the Robber's Gulch site (48CR3595) in southern Wyoming. The burial was investigated by the University of Wyoming Department of Anthropology and the Office of the Wyoming State Archaeologist during the fall of 1982. Three individuals were found: an adult male aged 36 years and two juveniles aged 12 and 9 years. The adult was lying face down in a wash. Embedded in his skeleton and contained in the body cavity were 17 Late Prehistoric corner-notched projectile points. The presence of rocks on top of the bodies and apparent collapse of the bank is suggestive of hurried concealment (Martindale and Gill 1983). The male from the Bairoil burial (48SW7101), found in the region of the Robber's Gulch site, similarly revealed multiple signs of trauma (Sheridan et al. 1992). Apparently, competition between groups led to fatalities and severe injuries by the early Late Prehistoric period (ca. A.D. 500).

Increasing warfare has been noted in the Northern and Central Plains to the east, especially in present-day South Dakota (Blakeslee 1994; Hollimon and Owsley 1994; Olsen and Shipman 1994; Owsley 1994). Studies have shown "abundant evidence for

Table 27. Known Cases of Late Prehistoric Projectile Points from Northwestern Plains Burial Assemblages

Site Name	Sex	Number of Projectile Points found in burial	Number of Projectile Points imbedded in bone
Fence Creek	F	2	0
Mountain Meadow	F	8	0
Petsch Springs	F	0	1
Bairoil	M	0	1
Turk	B	1	0
PK Burial	M	0	1
Leath	M	0	26
Billy Creek	B	110	0
Mahoney	M	3	0
County Line Draw	F	0	1
Robber's Gulch	M	7	10
Lozeau	U	1	0
Overby's Headless	B	0	2

	All	Females	Males	Both	Unknown
Total Burials[1]	41	8	12	8	13
Projectile Burials	13	4	5	3	1
Percent	31.7	50.0	41.7	37.5	7.7

[1] Total Burials in which skeletal remains have been collected.

Key
F = Female (other individuals could not be determined)
M = Male (other individuals could not be determined)
U = Unknown
B = Both Males and Females present

increasing hostility and violence through time throughout the Plains.... Interpopulation violence was widespread throughout the northern Plains" (Ubelaker 1994:393-394).

The average age at death is 32 years old—almost two decades less than the average age during the Late Archaic period (Table 25). No age category is unrepresented, as the sample included infants through adults aged older than 60 years. The age category with the highest frequency is 40-49 years followed by 20-29 years. The number of adult males (52%) once again outnumbers adult females (35%) with 14% unknown (Table 26).

Protohistoric (A.D. 1700-1880)

The few centuries immediately preceding settling of the Northwestern Plains by Euro-Americans is represented by the most burials. Historically recognized Native American Plains groups, including the Shoshoni, Arapaho, Crow, Blackfoot, Teton Sioux, Cheyenne, Assiniboine, and Atsina, were living in Wyoming and Montana by that time as well as a number of Intermountain Plateau groups in northwestern Montana such as the Flathead, Kutenai, and Kalispell (Larson 1965; Malouf 1957). Also, the Wyoming Red Desert area may have shown some presence of Southwestern and Great Basin groups such as the Ute and Bannock. The Protohistoric sample constitutes 45% of all dated burial sites and 48% of the individuals in the dated sample, much more than any other time period. For this analysis, "Protohistoric" refers to any burial postdating the arrival of Euro-Americans and their trade goods, beginning no earlier than A.D. 1700 and continuing until the beginning of the twentieth century. Although differences between earlier (A.D. 1700- 1800) and later (A.D. 1800-1900) burials may exist, the sites usually cannot be so narrowly defined. The term "Historic" is reserved here for non-Indian interments.

Seventy-five sites have been designated as Protohistoric: 51 from Wyoming and 24 from Montana. This rise in numbers is due to several factors. These graves are probably the easiest to recognize and date because of the presence of European trade items including glass beads and metal pieces. Secondly, older sites may have been exposed to the elements longer and been ravaged by time and erosion. Older sites that do exist may also be more deeply buried and not as likely to be found, especially in areas with less agricultural production. Isolated interments, the dominant pattern in the earlier time periods, are not as protected from outside forces as those found in dry rockshelters, common during the later periods. Also, approximately one-third of the burials in the broader sample in this study are of unknown temporal affiliation. Because burials from earlier periods are more difficult to date, they are more likely to be assigned as "unknown." In fact, many of those with unknown time frames may be from the earlier periods. Additionally, the higher number of burials also represents increased populations of nomadic equestrians. Undoubtedly, a combination of factors, that is, rising populations, differential preservation, easier dating, and problematic "unknowns," have contributed to the rather large Protohistoric sample.

The number of individuals found ranges from one to 34. However, 78% of the sites contain one individual and all but two sites possess 10 individuals or less. The dominant burial context during the Protohistoric period is burial in a rockshelter or small cave (57%). The next common type are isolated burials (23%). It is difficult to know how many of these burials were secondarily deposited. Other types which are found (although none over 10%) include above ground (scaffold/tree burials), cairn/talus burials, actual cemeteries, and habitation areas.

The greatest number of Protohistoric burials from Wyoming are from Fremont, Washakie, and Goshen counties. The higher incidence in Fremont County is a marked change from the total absence of burials found in that county from the Late Prehistoric period. The high counts from Fremont County can probably be partly attributed to the establishment of the Wind River Reservation in 1868 (Fowler 1982). Even before that time, the area was frequently used by the Shoshonis and other groups. Washakie County in the Bighorn Basin was a traditional hunting and camping area for the Crow at least by A.D. 1600. In fact, the Crow came to the Plains as buffalo hunters even before the introduction of the horse (Frison 1967). The Big Horn Mountains also provided appropriate terrain for rockshelter burials, so common in the later periods. Goshen County also possesses a high number of Protohistoric burials. Some of this pattern may be attributed to the intensive farming that has unearthed many of these graves—all which were found in the ground along the North Platte River. Also, the presence of Fort Laramie attracted many different groups to southeastern Wyoming during its occupation from 1834 to 1890 (Lavender 1983).

Most Protohistoric burials from Montana have been recovered from the western two-thirds of the state with concentrations in the south-central and northwestern areas. Big Horn County along the southern border of Montana is the site of the present-day Crow Reservation, established in the early 1870s. The area in the northwest is in the vicinity of the Blackfeet and Flathead (Confederated Salish and Kutenai) Reservations. The entire state, though, saw the arrival of many Native American groups during Protohistoric and early Historic times, and much of the state became the locus for power struggles between various tribes for maintenance and control of status and lands (Calloway 1986; Malouf 1957). The burials probably represent all major groups during that time.

The Pitchfork burials (48PA42) exemplify Protohistoric interments on the Northwestern Plains. Two semimummified male individuals were found in a rockshelter in northwestern Wyoming and excavated by a team from the University of Wyoming in 1973. The two men were buried with an assortment of Historic trade items including glass beads, dentalia shells, shell hair pipes, and a blue coat with brass buttons (Gill 1976a). Careful osteological as well as cultural analyses have revealed that these men were probably buried sometime in the beginning of the nineteenth century and that they had been away from their home base for possibly a year (Gill and Owsley 1985; Scheiber 1994).

Another Protohistoric burial, although not necessarily typical, is the Korell-Bordeaux cemetery. Sixteen graves were found in southeastern Wyoming when Alan Korell was farming in the vicinity of the old Bordeaux Trading Post. The number of individuals and the number of artifacts associated with them makes this site unique among analyzed Protohistoric burials. Although other cemeteries of a similar time frame exist and have been recorded, little or no analysis has been conducted, usually because of looting activities. The graves represent six adult females aged 16-54 years, two adult males aged 22-37 years, and seven children aged 12 months to seven years (Gill 1987). Most of the individuals were probably buried in coffins. The artifact assemblage includes marbles and a miniature tea set with children's graves, copper bracelets, rings, sewing kits, tobacco pipes, knives, bullets, a gun barrel, and hundreds of glass trade beads (Zeimens et al. 1987). Several coins dating from 1832 to 1858 were also recovered. The individuals in the cemetery probably represent burial over a 50-year time frame. At least three individuals were suffering from chronic infections, demonstrated by periostitis (Fisher 1980). A comprehensive report has not yet been published.

The average age at death is slightly less than 27 years (Table 25), indicating that more were dying at young ages. The 20-29 year bracket has the highest number followed by the 30-39 year bracket. In fact, the skeletal remains of few old people have been found. For the first time, the number of recovered females (50%) is more than males (37%) (Table 26). Adults of unknown sex account for 13% of the sample.

For many years a fascination with tribal affiliation has characterized certain studies. Perhaps this appeal arises when anthropologists, ethnologists, and historians want to compare a particular skeleton or artifact to the ethnohistorical record. Biological relationships and the ability to trace migration and movement through time is also probably part of the attraction. Much of this has centered on some broad general types such as Neumann's (1952) classifications. Recently, attempts have been made to isolate tribal identity even more. For the most part, this is very difficult due to small sample sizes of individuals identified to known tribe and because differences are often too minute biologically to adequately differentiate, especially among culturally and biologically similar groups. A fairly good effort has been made to distinguish Plains groups (Arapaho, Blackfeet, Cheyenne, Crow, Teton Sioux) from Great Basin groups (Shoshoni, Ute) because of geographic and linguistic barriers as well as "climate-morphology correlations" (adaptations to different environments) (Jantz et al. 1992:457).

> The Plains tribes, especially the Northern Plains Sioux, Crow, and Blackfeet, are large bodied with high noses and faces and long, narrow heads. On the opposite extreme are the tribes of the Northwest Coast, the Great Basin, and California....Small body size is combined with smaller head and face size to produce the pattern seen in California and Great Basin tribes (Jantz et al. 1992:450).

Even so, other factors such as geographical location, exact time period, and sometimes burial assemblages may help to highlight certain choices.

Research has shown that many individuals from Montana and Wyoming (especially in the north and east) were probably Siouan (Gill 1991:445). Neumann's (1952) study of Dakota Sioux, which he called the "Lakotid Variety" helped provide comparative data. Siouan (or "Plains" Indian) traits include larger stature, higher orbits, and larger, longer skulls. Possible "Shoshonean" burials have been found in southwestern Wyoming. Characteristics include a smaller body size, gracile limbs, and a lower cranial vault (Gill 1991:446). This discussion should not be confused to mean actual Sioux and Shoshoni Indians, recognized as sociopolitical cultural entities. Undoubtedly these categories have at times included individuals from related tribes as well.

Prehistoric Populations in Southwestern Wyoming

Differences in skeletal morphology among individuals found in one area have raised the possibility of a unique population residing in southwestern Wyoming. This area is commonly called the Wyoming Basin or the Red Desert. A sample of eight males and eight females has accumulated. Miller (1991:4) has suggested that the "area was home to an indigenous population at least from the Early Archaic until early Late Prehistoric." These people may have been Athapaskan speakers. Shoshonean and other groups perhaps had limited or no migrations into the area until about 1,000 years ago. Similarities previous to that time may be due to similar subsistence strategies of living in a marginal Great Basin-type environment. Conflict about that time, and slightly earlier, is evidenced by the Robber's Gulch and Bairoil individuals (discussed above) and their injuries. They may indicate early migrations through and into the area.

The Wyoming Basin people have smaller and less rugged crania as well as shorter statures. They may have been "already preadapted to some extent to the limited protein resources of the marginal environment of the Wyoming Red Desert. More direct effects of the limited environment, in the form of reduced nutrition during life, may have also been a factor in the reduced stature of these desert people" (Gill 1991:439).

The Shute Creek burial (48LN1296) contained two adults—one elderly female and one young male. The burial dates to about 1,100 years ago (A.D. 850: B-27117) (Gillam 1989). Heavy tooth wear due to gritty diet is common in Wyoming Basin populations. The male exhibited slight cranial deformation in the form of a flattened occipital. This is the only clear case of artificial cranial deformation in the Northwestern Plains.

Discussion of Prehistoric Populations

Demography

The age distributions at death or the mortality distribution for these population samples are graphically compared using 10 standard age categories from birth to over 60 years (Figure 48). These categories are subdivided for summarization into two basic graphs: the percentage of preadults and the percentages of specific age categories of adults (teens, young adults, and old adults) (Figures 49 and 50).

Small numbers of individuals dating to over 3,000 years ago make it difficult to infer definite patterns. Four immature individuals aged less than 14 years have been recovered as well as three middle-aged individuals (age 40-49 years). Larger samples are available for Late Archaic human remains (3,000 to 1,500 years ago). The mortality distribution primarily contains individuals who were older than 50 years when they died. Few individuals were less than 30 years old (two in 14). Combining the Archaic populations shows that the number of preadults accounts for only 10% of the sample. Likewise, the number of teenagers and young adults that have been recovered (29%) is slight compared to those over 40 years of age (71%). Many people were living to an advanced age during the Archaic period.

Northwestern Plains Woodland burials typically contain a significant number of children and juveniles (one-third) as well as individuals over 30 years (two-thirds). At the same time, no individuals have been recovered that were 15-30 years old when they died. Preadults account for 23% of the individuals found. Again, no teenagers are included.

The presence of young adult interments is observed in greater frequency during the Late Prehistoric period. Individuals aged less than 15 years comprise about one-quarter of the sample—the same as Woodland populations. The largest bracket is 40-49 years; fewer individuals aged 50 years and older have been recovered. The percentage of individuals in the three adult age-categories is similar to the Woodland sample, with slightly more adults aged 20-39 years and slightly fewer adults greater than 40 years of age.

The Protohistoric period contains the largest percentage of children (aged less than 9 years), the largest percentage of young adults (20-29) and the smallest percentage of old adults (50-plus). People were dying in childhood and young adulthood. This pattern may be due to intensified or different kinds of intergroup conflict and the introduction of new diseases. The number of teenagers is higher than during any other period (10%), young adults aged 20-39 years constitute the largest percentage (67%), and the percentage of adults over 40 years is low (24%).

Patterns emerge when examining the demographic data through time (Figures 48-49). The percentage of Archaic preadults is small in comparison to the other time periods (9% compared to 24%). Despite differences in various ages at death between birth and 15 years (for example, higher frequencies of 5-9 year olds during the Woodland), the proportion of preadults dying is fairly constant throughout the last 2,000 years, averaging about one-quarter of all deaths.

A reduction in the average age at death of adults is evident through time. Interments of teenagers are uncommon during all time periods, such that 15 to 19 year olds had a lower probability of dying than individuals younger and older. The frequency of young adult deaths is low during the Archaic period and increases in frequency during succeeding periods to a maximum during the Protohistoric period. In contrast, old adult deaths are high during the Archaic period and decrease in proportion during the Protohistoric period. Individuals from more recent populations often died at younger ages than those who lived during earlier time periods. Increased young adult mortality through time probably relates to more people moving into the Northwestern Plains for longer periods. Competition for hunting territories and other resources probably contributed to intergroup social conflict, evidenced by more projectile points found in burials after the Archaic period. The increase of young adult deaths in the more recent periods undoubtedly relates to even more population movements caused by eastern and western expansions of Native American groups plus the devastation of European diseases (probably demonstrated at such sites as the Korell-Bordeaux Cemetery). The advent of Euro-American influences did not by itself change the patterns already occurring prehistorically among the Northwestern Plains populations, but they probably intensified them.

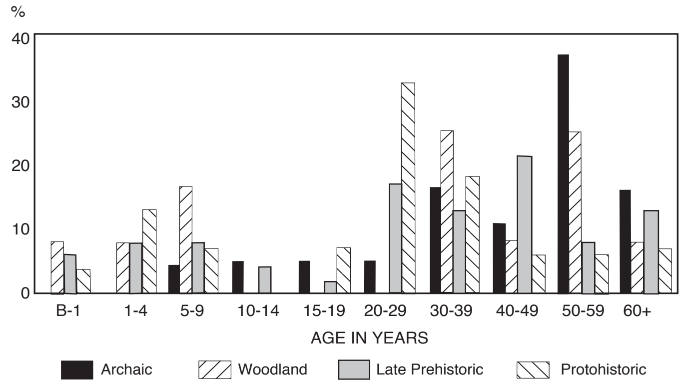

Figure 48 . Age distribution by time period in Northwestern Plains burials

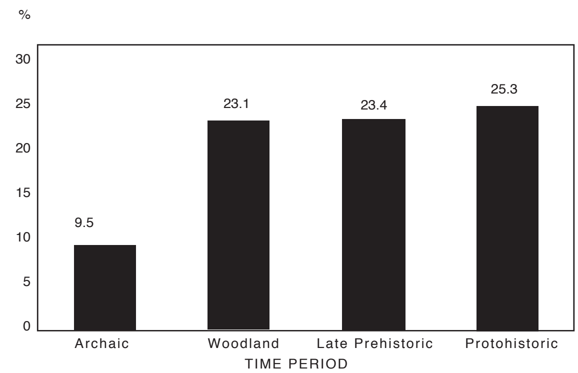

Figure 49. Distribution of preadults in Northwestern Plains burials

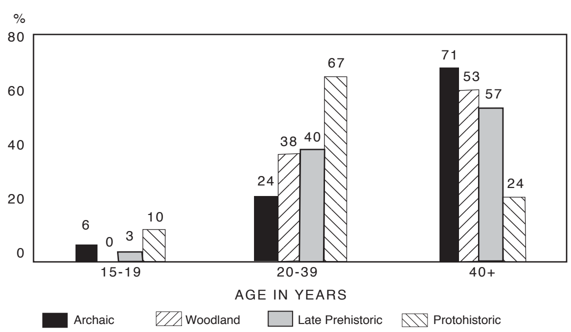

Figure 50 . Age-specific adult mortality in Northwestern Plains burials

The ratio of males to females through time also shows some change (Figure 51). The proportion of males and females recovered is fairly stable from the earliest times (Archaic) through the Late Prehistoric period with about four females found for every six males. The converse is true during the Protohistoric period in which the ratio is six to four in favor of females. A larger sample is needed to verify or explain this difference.

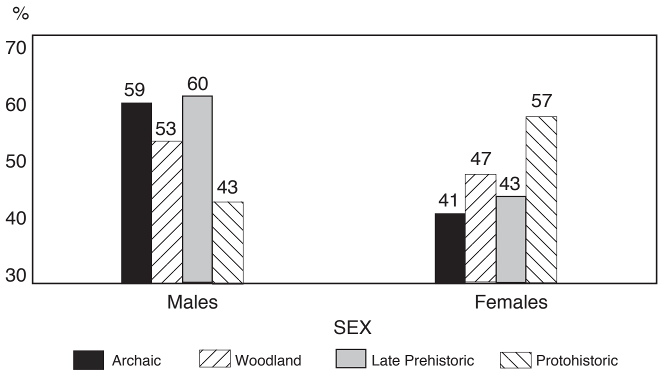

Figure 51. Sex distribution by time period in Northwestern Plains burials

Bone Pathology

Although signs of disease are observed in human skeletons from the Northwestern Plains, few studies of skeletal pathology have been published. Overall, the general health of prehistoric people living in this area appears to have been fairly good.

> The prehistoric populations of the Northwestern Plains were remarkably healthy. The skeletons show almost no signs of periostitis or the other skeletal manifestations of chronic infections. As dispersed hunters and gatherers inhabiting a cool, temperate environment, the incidence of infectious disease was probably quite low. The degenerative skeletal changes which normally accompany old age and/or an active life style are the most commonly observed ailments (arthritis, tooth loss, osteoporosis) (Gill 1991:442).

Fisher (1982) reported on the frequencies of bone pathology in skeletons curated in the University of Wyoming Repository. He studied 71 Native American skeletons from the Northwestern Plains. Data relating to disease collected since that time have not yet been tabulated.

Arthritis was the most common disease. Of 22 skeletons with vertebral columns, 65% had vertebral osteoarthritis. All were adults who were for the most part older than 40 years. The most common form was osteophytic lipping in the lumbar vertebrae. Nineteen skeletons showed degenerative joint disease, especially in the elbow. They were all adults, and of those that were precisely aged 73% were over 40 years old. "The high frequency of arthritis may reflect a vigorous physically stressful lifestyle, although arthritis is to some extent a normal process with increasing age" (Fisher 1982:85).

Eleven skeletons, or about 2.2% of the 321 represented bone elements, exhibited healed fractures on postcranial bones. No particular bones were broken more frequently than others, and the frequency of malaligned bone healing was high. Other vertebral defects including fused vertebrae, spondylosis, and sacral spina bifida were noted in a few specimens. The most common form of infectious disease was mild periostitis, which was present in 12 skeletons. Cases of osteomyelitis were also identified.

Another study conducted by Combs (1990) focuses specifically on injuries. Of 109 Plains Indian skeletons, a high percentage (46%) showed some cranial or postcranial injury. The largest proportion of injuries involved the frontal bone (32%) or the arms and legs (20%). Differences between sexes and time period were noted and related to seriousness and location of injury. Three basic conclusions were reached:

> First, the males and females sustained almost the same amount of cranial injures but the females show much more serious wounds. Second, one certain type of injury (small, circular dents) is seen consistently in both male and female and there is evidence of control exerted by the initiator of this wound. Third, there is a correlation from the Late Plains Archaic period to the Protohistoric/Historic time period that shows a change from the males receiving the bulk of the injuries (mostly postcranial) to the females being injured just as often and far more seriously (Combs 1990:vii).

Changing attitudes toward women may account for the increase in their injuries through time (Combs 1990:23). The kinds of injuries found suggests more conflict and aggression within a group rather than a high incidence of warfare or intergroup conflict.

Dental Pathology

The frequency of dental pathology on the Northwestern Plains has been examined by Zitt (1992). She compared frequencies of dental caries and alveolar abscesses in males and females, between young (15-29 years) and older (30-plus) adults, and during different time periods. For the present summary, Zitt's Protohistoric and Historic samples are combined into one group because Protohistoric and Historic populations have not been considered separately throughout the rest of this chapter. Also, Zitt's division of Protohistoric and Historic individuals was based on file information that was not truly accurate to the degree needed to distinguish between the two subperiods. Zitt tested for the differences between Protohistoric and Historic Pawnee; she chose to separate the Northwestern Plains data in a similar manner.

Caries affected 1.7% of the teeth in the 51 individuals with 1,380 teeth (Zitt 1992:75). Low caries rates are common in hunter-gatherers who ate a high proportion of meat, less vegetables, and low amounts of processed plants with high carbohydrates. Abscesses involved 7.8% of the dental sockets, which is indicative of hunter-gatherers with large amounts of grit in the diet.

The number of carious teeth was not statistically different between males (2.0%) and females (1.7%) or between age groups (Table 28), although older individuals (2.5%) had more carious lesions than young adults (0.5%). Males did however possess a statistically higher incidence of alveolar bone pathology (13.5%) than females (6.2%) (Table 29). Older individuals (8.1%) also showed more abscesses than younger adults (6.0%), although not significantly higher.

Differences in time periods were noted. Significant decreases in numbers of carious lesions were noted between Archaic populations and the later combined populations (Figure 52). No statistical differences were found between Late Prehistoric, Protohistoric, or Historic samples. Recombining the Protohistoric with the Historic data does show a decrease through time: Archaic (4.0%), Late Prehistoric (2.0%), Protohistoric/Historic (0.2%) (Table 30). Zitt (1992:72) attributed this decrease in the number of carious teeth to increased consumption of bison meat through time as opposed to greater dependence on plant foods and less meat consumption by Archaic foragers.

Alveolar bone pathology also shows decreases though time (Table 31). Zitt found statistical differences between the Archaic, Late Prehistoric/Protohistoric, and Historic samples. Refiguring the data shows an even more dramatic decrease in percentage of abscesses though time: Archaic (14.5%), Late Prehistoric (8.1%), Protohistoric/Historic (5.4%). Alveolar bone pathology can be caused by caries and attrition. Because caries were infrequent, abscesses were more often due to attrition. The decrease in attrition among Protohistoric-Historic populations may indicate changes in food processing and the subsistence pattern.

Microevolution

Temporal differences in skeletal morphology have been reported in several publications (Gill 1974, 1981, 1991). The pattern of physical traits in the Archaic groups is particularly interesting in that there is an almost complete lack of the developed “Mongoloid complex” of craniofacial traits. Even though the incisor teeth are shovel-shaped among Plains Archaic crania, the normally associated robust, flaring malars, heavy

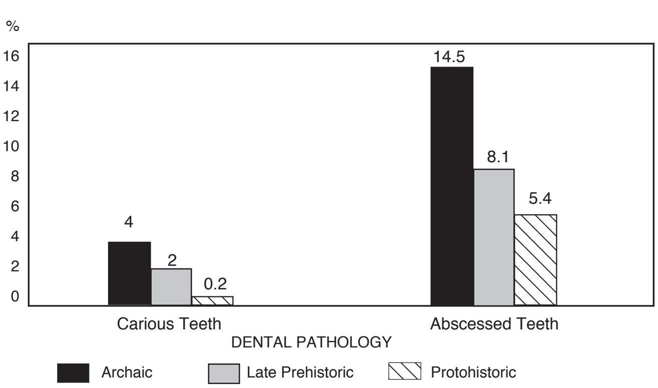

Figure 52. Dental pathology in Northwestern Plains burials

Table 28. Number of Carious Teeth in the Northwestern Plains by Age and Sex (Zitt 1992:90, 92)

	15-29			30+			Male			Female		
Tooth Type	N	C	%	N	C	%	N	C	%	N	C	%
Maxillary												
Incisors	40	0	0.0	65	1	1.5	63	1	1.6	40	0	0.0
Canines	22	0	0.0	33	0	0.0	35	0	0.0	19	0	0.0
Premolars	42	0	0.0	71	2	2.8	70	2	2.9	39	0	0.0
Molars	60	2	3.2	97	5	5.2	96	3	3.1	56	4	7.1
Mandibular												
Incisors	48	0	0.0	85	0	0.0	74	0	0.0	53	0	0.0
Canines	24	0	0.0	43	0	0.0	37	0	0.0	27	0	0.0
Premolars	46	0	0.0	121	6	5.0	111	4	3.6	66	2	3.0
Molars	65	0	0.0	121	6	5.0	111	4	3.6	66	2	3.0
Total	347	2	0.5	598	15	2.5	560	11	2.0	349	6	1.7

Key: N=number of permanent teeth, C=number of caries, %=percentage of teeth with carious lesions

Table 29. Alveolar Bone Pathology in the Northwestern Plains by Age and Sex (Zitt 1992:98, 99)

	15-29			30+			Male			Female		
Tooth Type	N	P	%	N	P	%	N	P	%	N	P	%
Maxillary												
Incisors	37	1	2.7	60	5	8.0	115	7	6.1	131	4	3.1
Canines	19	0	0.0	31	0	0.0	59	6	10.2	69	3	4.3
Premolars	38	0	0.0	64	4	6.3	118	11	9.3	142	14	10.0
Molars	58	7	12.1	91	18	19.8	171	36	21.1	206	15	7.3
Mandibular												
Incisors	40	1	2.5	69	3	4.3	129	7	5.4	206	5	2.4
Canines	20	0	0.0	40	3	7.5	64	6	9.4	103	2	2.0
Premolars	42	0	0.0	76	4	5.3	133	15	11.3	205	14	6.8
Molars	63	10	15.9	115	7	6.1	201	46	22.9	318	29	9.1
Total	317	19	6.0	546	44	8.1	990	134	13.5	1380	86	6.2

Key: N=number of permanent teeth, P=number of abscesses, %=percentage of teeth with alveolar bone pathology

Table 30. Number of Carious Teeth in the Northwestern Plains by Time Period (Zitt 1992:94)

	Archaic			Late Prehistoric			Protohistoric/ Historic		
Tooth Type	N	C	%	N	C	%	N	C	%
Maxillary									
Incisors	32	1	3.1	16	0	0.0	44	0	0.0
Canines	15	0	0.0	8	0	0.0	24	0	0.0
Premolars	31	1	3.2	18	1	5.5	48	0	0.0
Molars	42	3	7.1	28	2	7.1	67	0	0.0
Mandibular									
Incisors	28	0	0.0	36	0	0.0	54	0	0.0
Canines	14	0	0.0	16	0	0.0	28	0	0.0
Premolars	27	1	3.7	31	0	0.0	54	0	0.0
Molars	36	3	8.3	47	1	2.1	75	1	1.3
Total	225	9	4.0	200	4	2.0	394	1	0.2

Key: N=number of permanent teeth, C=number of caries, %=percentage of teeth with carious lesions

Table 31. Alveolar Bone Pathology in the Northwestern Plains by Time Period (Zitt 1992:101)

	Archaic			Late Prehistoric			Protohistoric/ Historic		
Tooth Type	N	P	%	N	P	%	N	P	%
Maxillary									
Incisors	26	3	11.5	16	0	0.0	42	1	2.4
Canines	13	0	0.0	8	0	0.0	22	0	0.0
Premolars	27	1	3.7	16	1	6.3	44	0	0.0
Molars	37	11	29.7	26	5	19.2	66	10	15.2
Mandibular									
Incisors	20	0	0.0	34	3	8.8	47	1	2.1
Canines	10	0	0.0	16	2	12.5	26	1	3.8
Premolars	26	2	7.7	28	1	3.6	48	1	2.1
Molars	34	11	32.4	41	3	7.3	76	6	7.9
Total	193	28	14.5	185	15	8.1	371	20	5.4

Key: N=number of permanent teeth, P=number of abscesses, %=percentage of teeth with alveolar bone pathology mandibles (with vertical ascending rami), and flat interorbital facial features (so common to later North American Indians and East Asians) are lacking in the Archaic period skulls from the Northwestern Plains. Recent research on First Americans throughout North America (Steele 1994; Steele and Powell 1992, 1993) has similarly shown this absence of developed Mongoloid characteristics. These observations are not new to North American physical anthropology. J.B. Birdsell (1951), after studying the First American remains available at the time characterized them as "vaguely Caucasoid." This characterization holds equally well for the Northwestern Plains Archaic populations. Most show high cranial vaults; many have prominent chins (some even bilateral in form); and a few reveal prominent, high-bridged noses. Virtually all have modest (Caucasoid-looking) cheekbones. Others (particularly females) show marked alveolar prognathism and dull or absent nasal sills. These latter traits are uncommon in recent populations of either Caucasoids or Mongoloids, but seem to represent a complex of craniofacial traits that had disappeared earlier across Eurasia and then seem to have begun a rapid decline in the Americas. These features are evident in the Northwestern Plains until at least the Late Archaic period, and then decline in frequency through the end of the Late Prehistoric period.

Other craniofacial traits common to the Northwestern Plains include wide orbits and a distinctive cranial outline sometimes called "Deneid," after Neumann (1952). These traits were more slow to change over time and are found among Late Prehistoric groups also. "The Northwestern Plains region for some reason exhibits a slower rate of microevolutionary change away from some of these archaic traits than one witnesses in the adjacent areas of the Central Plains and Midwest" (Gill 1991:438).

Beginning in the Late Prehistoric, other documented changes occur in human populations, especially a decrease in cranial vault height. "The skull vault is noticeably lower by late prehistoric and Historic times among both Wyoming and Montana Indians" (Gill 1991:440). This trend, also witnessed in other areas of the Plains, probably relates mostly to natural selection with some degree of gene flow. Other traits mentioned above, such as marked alveolar prognathism and reduced nasal sills, also diminish through time.

Physical traits that do seem to remain stable include a medium upper facial proportion with a shorter and broader total facial proportion as well as average (mesocranic) cranial length and breadth and medium nose form. This stability suggests "slow gradual gene flow (with minor quantitative shifts) in long, well-established morphological trait complexes" (Gill 1991:440).

Burial Contexts

Another trend revealed by this study is a change in preferred burial location (Figure 53). The most dramatic change occurs between the frequency of isolated and rockshelter burials through time and the occurrence of mound burials. Late Archaic burials are primarily found in isolated contexts (71%) with a few recovered from rockshelters and cairns. Late Prehistoric burials are also frequently isolated (50%), but rockshelter burials are more common (37%). During the Protohistoric period, rockshelter burials are much more common (57%) than isolated ones (23%), and other types such as cemeteries, scaffolds, and cairns account for just as many burials as isolated ones. Woodland burials have so far been restricted to mound-type structures containing multiple individuals. The presence of a burial mound seems to be more indicative of Woodland populations.

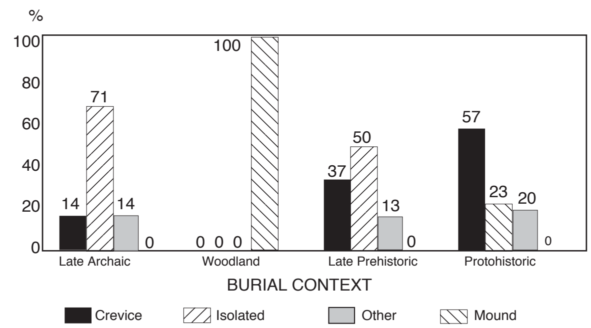

Figure 53. Burial contexts on the Northwestern Plains

Cultural Processes

Perhaps the most dramatic discoveries from the work presented here relate to mortality profiles. If the available samples are representative, the marked decline in average age at death from the Archaic period (47.5 years) to the Late Prehistoric period (32 years), and to the Protohistoric period (27 years) represents a dramatic decline in longevity. Potentially related changes occurred in site density, frequency of traumatic injuries, frequency of dental caries, and even craniofacial morphology. Actual population probably increased which heightened competition for available resources. Not only did the number of sites increase through time, but also new complexes of physical traits were introduced, suggesting at least some migration into the area from adjacent regions (primarily the Northern and Central Plains). Introduction of the bow and arrow probably contributed significantly to the new cultural dynamics of the Late Prehistoric and subsequent Protohistoric periods. The Robber's Gulch and Bairoil skeletons, as well as other less dramatic examples, illustrate the devastating effects of this new weapon technology, although direct killing probably influenced mortality less than the many complex indirect effects.

Increased utilization of bison and/or other meat sources is strongly suggested by the reduction in caries frequencies from the Archaic to the Late Prehistoric, and this continues into the Protohistoric as well. Turner (1979) has demonstrated the value of this kind of evidence in interpreting diet (at least the meat/carbohydrate balance). Hunting is a more dangerous activity than plant collecting which clearly would bring about new forces of selection on the expanding human population. Other indirect effects on the population would probably be such things as heightened competition for resources with periodic resource depletion (especially in the face of a possible increase in subsistence specialization).

Mortuary practices alter some during this time also. Probably most interesting is the steady increase in rockshelter burials. This context generally represents a more hastily prepared interment (little or no digging). If increased hunting produced corresponding changes in the nomadic movements of these groups, it might be expected to have effects on the time and energy available for preparing burial places.

The introduction of the horse and firearms during the Protohistoric period seems to have intensified the changes that were already set in motion centuries before. Average age at death drops to an even younger age and bison procurement seems to increase, judging from the healthier teeth. The most dramatic changes in burial practices at this time was the inclusion of impressive amounts of Euro-American trade items, such as guns, metal knives, glass beads, and metal earrings and bracelets.

Biological Change

Significant alterations in skeletal morphology accompanies the changes noted in mortality, diet, and cultural practices. Probably the most dramatic difference involves the emergence of the craniofacial pattern known as the "Mongoloid complex" of traits. In Wyoming and Montana, most of this replacement takes place sometime during the change from the Late Archaic to the Late Prehistoric periods. It seems to represent the final stage of a macroevolutionary trend that began in northeast Asia thousands of years ago, spread to Korea, China, and Japan and then, to a somewhat lesser degree, into southeast Asia, Polynesia, and the Americas. An early, widespread basically Caucasoid population was replaced by people with well-developed malars, wide faces, strong anterior teeth, and lower nasal bridges. This process occurred at different times and at different rates in each of these world areas. In Japan this replacement occurred at the beginning of the Bronze Age with the historically documented Yayoi invasions from Korea. In other regions, these changes are known through osteological research. This process of physical change was first described in detail in the Americas by the last generation of human osteologists (especially Howells, Birdsell, and Neumann) but even more detailed descriptions have been put forth in the last few years by Steele and Powell (1992, 1993) and Steele (1994) and for the Northwestern Plains by Gill (1991).

In Wyoming and Montana this distinct evolutionary change occurred in mosaic fashion beginning with the anterior dentition. Very high frequencies of shovel-shaped incisor teeth are documented from the earliest skeletons onward. Short wide elliptic palates, wide flaring malars, and broader flatter faces occur later. They seem, more or less, to come all at once at the beginning of the Late Prehistoric period. Migration and gene flow would seem to be a reasonable mode of introduction, but the eventual pervasive nature of these physical traits throughout the region supports a picture of reinforcement through a natural selection process. If some of the current thinking among physical anthropologists is correct—that the evolution of the "Mongoloid complex" of craniofacial traits is primarily in response to heavy chewing with anterior teeth (in northern cultures heavily reliant upon dried meat and the working of hides)—then the cultural changes mentioned above could be the forces of environmental change that shaped the observed genetic/morphological changes.

Other microevolutionary changes that occur in the Northwestern Plains at more or less that same time, but seem to be independent of the emergence of the "Mongoloid complex," relate to cranial vault changes. The virtually worldwide phenomenon of increased brachycephalization through time is revealed by our data, but not very strongly. Much more impressive is a dramatic lowering of cranial vault height during the past few centuries. This change runs counter to many microevolutionary trends elsewhere in the world (where vault height increases), but has been documented osteologically for decades throughout the western regions of North America. Jantz (1977), Jantz and Willey (1983), and Owsley and Jantz (1978) have documented this in the Northern and Central Plains area, but the trend is beginning to become fairly well documented in Montana and Wyoming also (Gill 1974, 1981, 1991). The rapidity and pervasiveness with which this change swept through the entire Northern Plains area (among virtually all Plains groups at the same time) suggests that migration and gene flow alone are insufficient in explaining this phenomenon (Gill 1991). Selective forces of some sort are probably linked to this microevolutionary change. At present it is not possible to hypothesize what the connections might be, if any, between a change in lifestyle towards more hunting and warfare and a lowering of the height of the brain case. Parallel changes may have occurred in Europe during the early Würm glacial, but the theories of paleoanthropologists dealing on a macroevolutionary level may not be appropriate for explaining microevolutionary changes. Future investigations and more extensive documentation may help resolve these questions.

Data Gaps

Human skeletal remains in the Northwestern Plains have been identified from all major time periods. However, only six sites are more than 3,000 years old, and not a fragment of an adult First American skeleton has yet come to light in either Montana or Wyoming. Likewise, the Plains Archaic is not well known, especially in terms of what diagnostic features and artifacts should be used to date sites. Protohistoric human remains are the most numerous and usually the most easily dated due to the presence of associated Euro-American trade items.

Regarding the kinds of osteological studies on Northwestern Plains skeletal materials, data gaps exist. Good studies have been done on craniofacial metrics and some basic postcranial metrics; but dental metrics have not been collected. Skeletal sample sizes and osteological data have simply been inadequate for most kinds of bioarcheological study until the last few years. However, sample sizes have now attained levels suitable for many kinds of scientific inquiry. Dental pathology studies have begun, and so have some preliminary examinations of stature and robustness. The very different physical characteristic of the inhabitants of the Red Desert and other parts of the Wyoming Basin, as well as what seems to be a different mode of adaptation and diet, needs to be studied further. As sample sizes increase from that area, as well as archeological investigations of various kinds, the magnitude of differences between that arid region and the Northwestern Plains grasslands will be more fully understood.

In summary, a few questions have been answered by bioarcheological investigations on the Northwestern Plains regarding diet, mortality, mortuary practices, and microevolutionary changes. New, exciting questions have been raised at the same time, however, especially regarding possible correlations between cultural and biological changes. These more complex, interesting questions await much more data and further analysis before they can be adequately answered.

Historic Populations

From within the Northwestern Plains region, the state of Wyoming has provided a surprisingly large sample of skeletons of pioneer Whites (N = 49). Some of these (N = 21) have become part of a contemporary, synthetic bioarcheological study (Gill 1994) that is focused primarily on skeletal injury. Others (N = 2) not included in that study have been reported elsewhere (Combs et al. 1992; Gibbons 1986; Hill and Franzwa 1985). Yet others, such as the remains from the Ft. Richard (Reshaw) fur trading post (N = 6) have not been fully described, but at least examined in preliminary fashion by trained human osteologists. Montana, on the other hand, has yielded very little bioarcheological information on Historic frontier populations. One notable exception is the osteological information reported from the Battle of the Little Bighorn (Scott and Fox 1987; Snow and Fitzpatrick 1989).

The skeletons of frontier Blacks (N = 2) and pioneer Chinese laborers (N = 7) have likewise been studied, as well as remains of four admixed individuals of American Indian/White ancestry (Gill 1976b, 1994; Joyes 1981; Snow and Fitzpatrick 1989). Half of these are from Wyoming and half from Montana.

Individual site reports, with skeletal analyses, exist for several pioneers (Buff 1990; Combs et al. 1992; Gill 1976b, 1988; Gill et al. 1984; Gill and Smith 1989; Joyes 1981). The only synthetic studies, however, of Historic period skeletons from the Northwestern Plains are the two alluded to above. One of these is the thorough study by Snow and Fitzpatrick (1989) of human remains left behind at the Custer Battlefield by the military reburial party. This report entitled "Human Osteological Remains from the Battle of the Little Bighorn" constitutes a full chapter within *Archaeological Perspectives on the Battle of the Little Bighorn* by Scott et al. (1989). The extent and complexity of the battlefield site, including the number of fragmentary and partial skeletons present (N = 34), necessitated a broad based investigation and synthesis. The other synthetic report from the region, "Skeletal Injuries of Pioneers" (Gill 1994) forms a chapter within *Skeletal Biology in the Great Plains,* edited by Owsley and Jantz. Some of the information presented here is drawn from that study. As the title suggests, it primarily concerns trauma analysis, although some demographic information is included also. The study is based on the large, documented sample of White pioneers, but includes some information on other frontier skeletons (Blacks, Chinese, and those of mixed ancestry including one probable Hispanic).

A considerable amount of comparative information from Historic pioneer sites from regions outside of (but adjacent to) the Northwestern Plains study area is presented in Gill (1994). One of these sites is an 1840s Mormon cemetery in the Salt Lake Valley, which produced a sample of 33 skeletons (Gill 1989; Tigner-Wise 1989). The other sites are two Historic graveyards, Boothill Cemetery (41CN4) and Coffey Cemetery (41CC81) in west-central Texas that contained 13 skeletons and were relocated as part of a reservoir project in 1989 (Earls et al. 1991). The three cemetery samples were subjected to thorough osteological analysis by University of Wyoming bioarcheologists and are fully described, but are cited here for comparative purposes since the sites fall outside the Northwestern Plains study area.

Frontier Blacks

Even though skeletal remains of two adult American Blacks from an early Historic context have been analyzed (see Table 32), only one was excavated by trained personnel from a secure archeological context. This partial skeleton of a male, 24-30 years of age, was found at the Rock Ranch Trading Post (also known as Ash Point Trading Post) located 4 miles west of Torrington, Wyoming (Gill 1988). In the 1850s a plantation owner from Missouri moved west to establish the ranch/trading post and brought with him a number of Black slaves.

Local stories report that a Black slave was killed and buried beneath the floor of one of the buildings. Excavation of the skeleton (Gill 1987) revealed that it was located inside the corner of a former building. Analysis showed multiple cranial gunshot wounds and a .44 caliber bullet lodged in the centrum of a lumbar vertebra (L3). The examination also revealed several craniofacial traits characteristic of African ancestry (Gill 1994). The local story is supported by both archeological and bioarcheological evidence. Varying angles of entry and possibly different sizes of bullets, as well as the excess number of "killing shots" found on the skeleton of the Rock Ranch slave, suggest perhaps an execution-style killing, or an ambush (Gill 1987:105).

Table 32. Skeletal Remains of Frontier Blacks from the Northwestern Great Plains

Individual/Site	Specimen No.	Sex	Age
Rock Ranch	HRO71	M	24-30 yrs
Shawnee Creek	DB054	F	50+ yrs

Frontier Whites

The Wyoming White pioneers (Table 33) show a surprising number of multiple gunshot wounds, as well as numerous additional traumatic injuries to the skeleton. Within the predominantly male sample of 49 are broken limb bones, sabre cuts, scalping marks, broken noses, and evidence of a mutilation killing—in addition to the large number of multiple gunshot wounds (Combs et al. 1992; Gill 1994). The only skeletons from Montana in Table 33 are those from the Bighorn Battlefield (Snow and Fitzpatrick 1989). Of interest demographically in the frontier White sample is a skewed sex ratio and a narrow range for the age at death (expected for the Battle of the Little Bighorn sample, but perhaps less expected for the entire Wyoming sample).

Most of the specimens listed in Table 33 are from the University of Wyoming Human Osteology Collection and have been included in the recent study by Gill (1994). One exception is the Slate Creek skeleton which was excavated in western Wyoming by amateurs of the Oregon and California Trail Association and never submitted for analysis (Gibbons 1986; Hill and Franzwa 1985). Remains from the Battle of the Little Bighorn are also part of a different study (Snow and Fitzpatrick 1989) and presently are not included in the University of Wyoming data base. Gill (1994) also omits three University of Wyoming forensic cases (UWFC 10, 51, 73) which are included here. They are fragmentary skeletons, but of value in certain demographic studies and therefore listed in Table 33.

A few other differences exist between the pioneer White sample included here, and the one treated in Gill (1994). The reburied remains from Ft. Richard, the Ash Point Trading Post (three White males killed by Plains Indians) and the Wagon Box burial from near the Bordeaux Trading Post (all listed in Table 33) were omitted by Gill (1994) since either limited osteological information exists on these skeletons, or no information at all. The interesting Ft. Caspar 3 skeleton reported by Combs et al. (1992) was excavated after the Gill (1994) report was submitted for publication, but is listed here. The recently excavated Lee Street Cemetery skeletons from Rock Springs, Wyoming, are not yet curated or studied even in preliminary form. The crania of two adult White males from the Buffalo Bill Historical Center, Cody, Wyoming, are listed in Table 1 of Gill (1994), but have been omitted here due to insufficient contextual information (original site not known). The partial cranium of the famous stagecoach robber Bignose George Parrot (immortalized in an oil painting by Charles Russell) is curated in a small museum in Rawlins, Wyoming (McMahan-Williams 1995).

Only one child exists in the Northwestern Plains sample of frontier Whites, and no infants, although some may be represented in the Lee Street Cemetery sample once it is studied. The Lee Street skeletal population, which does appear different demographically from the other Northwestern Plains samples, may prove to be of a later Historic date than most of the others. Iron coffins and other signs of late temporal placement are present.

Table 33 contains very few older adults: one 60-plus years and two at 50-59 years. All others died in their 20s, 30s, or early 40s. Figure 54 illustrates this skewed age distribution and compares it to the very different pattern found in the Mormon pioneers of the same period, who lived only a few hundred miles to the west but followed a different life style and pattern of adaptation.

Two-thirds of the Mormon cemetery sample consists of infants below the age of 2 years. Only one-third of the frontier Texans from the Boothill and Coffey cemeteries (Earls et al. 1991) are of that age, and none of the Northwestern Plains skeletal samples (at least of those studied so far). Judging from other nineteenth century cemetery samples, the Texas skeletal sample, which is somewhat bimodal in its age distribution at death (some older adults, some very young), is the only broadly representative frontier skeletal series.

Table 33. Skeletal Remains of Frontier Whites from the Northwestern Great Plains

Individual/Site	Specimen No.	Sex	Age
Harvey Morgan	DB026	M	25 yrs
Bignose George Parrot		M	Adult
Quintina Snoderly	DB093	F	43-55 yrs
Blind Bill Hoolihan	DB063a	M	30-36 yrs
William Gallagher	DB063b	M	30-36 yrs
John Sharp	HR058	M	37 yrs
Ft. Bridger 1b	HRO59	M	22-24 yrs
Ft Bridger 2	HR060	M	29-36 yrs
Glenrock	UWFC7a	M	65+ yrs
Glenrock child	UWFC7b	—	5-6 yrs
Korell-Bordeaux 15	HRO80	M	31-37 yrs
Ft. Caspar 1(S)	HR083	M	28-38 yrs
Ft. Caspar 2(N)	HR084	M	26-38 yrs
Ft. Caspar 3	HR166	M	48-52 yrs
Green River	DB020	M	25-33 yrs
Bates Creek	HR189	F	25-38 yrs
Shell Burial	DB064	M	50+ yrs
Slate Creek	DB073	F	Adult
Fremont/Hill St. 1	UWFC70-1	F	35-43 yrs
Fremont /Hill St. 2	UWFC70-2	M	50+ yrs
Fremont /Hill St. 3	UWFC70-3	M	45-55 yrs
Divide Burial	DB012	M	22-24 yrs
Fremont Co. 2	UWFC51	M	Adult
Goshen Co.	UWFC10	M	50+
Lewiston	UWFC73	M	Adult
Ft. Richard(Reshaw)	DB041	M(4) F(2)	—
Ash Point Trading Post	DB115	M(3)	—
Wagon Box	DB119	?(3)	—
Judge White Skull	DB134	M	Adult
Lee Street Cemetery	DB126	?(11)	—
Custer Battlefield (Bighorn)		M(34)	—

Regarding sex ratios, none of the frontier samples examined at University of Wyoming are balanced. The ratios of the Wyoming/Montana and the Texas samples are skewed noticeably toward an overabundance of males, and the Mormon sample to an overabundance of females. The Montana sample from the Custer Battlefield is understandably 100% male. The Wyoming sample is 80% adult male, 17.1% adult female, 2.8% children, and no infants/newborns. These calculations are based upon the entire known Wyoming pioneer White sample of 26 which omits only the Lee Street Cemetery sample and the three Wagon Box skeletons. The Mormon sample, in marked contrast, is 87.9% females and infants/newborns, and only 6.1% adult males, plus 6.1% children and adolescents.

This radical difference in the demographic profiles of the Northwestern Plains and the Salt Lake Valley is not so surprising given the known histories of settlement. Throughout much of the trans-Mississippi West, and especially in the Great Plains and Rocky Mountains, initial exploration was undertaken by lone males (hunters, trappers, soldiers) to be followed later by settler groups that included women and children. Because of this pattern of migration, the skeletons of Western pioneers from unmarked graves (which are generally the oldest graves) should be skewed heavily toward adult males.

In contrast, the Mormons moved entire communities of men, women and children to the Salt Lake Valley for immediate settlement and farming. The high percentage of women and children reflects this difference, but also the practice of polygyny.

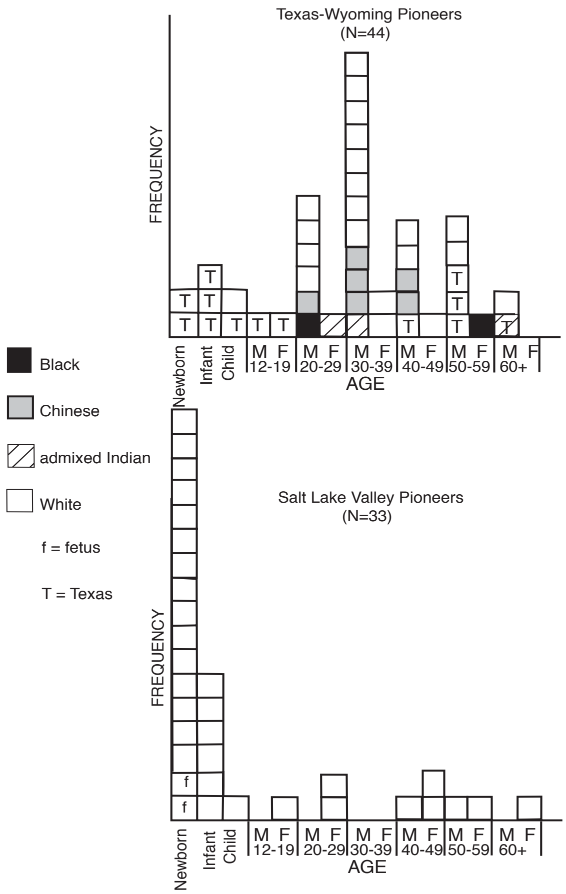

Figure 54. Age at death for the skeletal populations of Texas and Wyoming compared to those from the Salt Lake Valley, Utah (after Gill 1994).

The high infant mortality rate suggests a high risk involved in moving women and children into a frontier setting in the early stage of the settlement process.

Skeletal Trauma

A high number of bone injuries and signs of violence are evident in the Wyoming pioneers. Excluding those specimens that are largely incomplete and the single partial skeleton of the child, an exceedingly high percentage (82.4%) of individuals show signs of skeletal trauma (15 of 18 specimens). At least seven individuals (Morgan, Snoderly, Gallagher, Hoolihan, Parrot, Korell-Bordeaux 15 and Ft. Caspar 3) died a violent death (35.3%). All six of the males of that sample were killed at the hands of others; the one woman (Quintina Snoderly) was not. She was crushed under a wagon that overturned in a powerful current at a Platte River crossing along the Oregon Trail. Gunshot trauma probably accounts for all but one of the violent deaths within the Wyoming male sample (George Parrot was hanged), although in the case of the mutilation killing of Harvey Morgan at the hands of a Plains Indian war party, the exact cause of death is not known. He was scalped and had the queen pin of his wagon hitch (also called the wagon hammer) driven diagonally through his head. Nevertheless, he may have actually died from gunshot wounds.

Snow and Fitzpatrick (1989) found a high frequency of trauma even in the very few (and mostly small) bones that were recovered near old grave markers of the disinterred and reburied soldiers at the Battle of the Little Bighorn. They classified the perimortem skeletal traumas as having been most likely the result of gunshot wound (GSW), blunt force trauma (BFT) or cut marks (CUT). The human remains from the Custer Battlefield consist of 375 human bones (some fragmentary) and 36 teeth for a total of 411 elements. They estimate that the remains of 34 individuals are represented in this assemblage. One individual from the site (M85), however, consists of 141 bones, which makes up 34.3% of the entire sample of bones and teeth. Thus 33 individuals are represented by only 270 bones and teeth (Snow and Fitzpatrick 1989:273). There is an average from that sample of only 8.2 elements per individual, and these tend to be isolated ribs, vertebrae, and bones of the hands and feet. Such skeletal elements do not tell as much of the story of trauma and death as would larger elements. These larger elements were, of course, in nearly all cases, removed during the grave relocation effort in 1881 when a common grave was prepared. As Snow and Fitzpatrick (1989:276) point out, "one cannot help but regret that the reburial detachment did not include a team of medico-legal experts detailed to describe carefully each skeleton as it was exhumed. Even though the forensic science specialties were in their infancy in those days, such a systematic study undoubtedly could have answered many questions about the battle which still perplex the Custer scholars of today."

Nevertheless, the few bones and teeth that Snow and Fitzpatrick (1989) have examined provide some information. The 34 individuals reveal three cases of gunshot wounds, 13 blunt force trauma cases (nearly all of those with preserved cranial fragments) and eight individuals with cut marks. This evidence is consistent with earlier accounts that describe a fairly brief firefight in which all soldiers were killed or wounded (most of them severely wounded rather than actually killed), followed by crushing blows to the skull to dispatch the incapacitated survivors, and this in turn followed by mutilation and dismemberment of a high percentage of the slain soldiers.

Among the few Texas pioneers studied at the University of Wyoming, a significant number of bone injuries and signs of violence are likewise evidenced. Even though the adult sample is small it suggests a frequency of trauma somewhat comparable to that of the Wyoming pioneers. A few differences do exist. The Texas drovers show trauma to the dorsal skeleton (vertebrae, proximal ribs) covering wide areas over the back, as if caused by trampling by horses or cattle. They too, however, show blade wounds and recovered bullets like the Wyoming sample. Thus, Gill (1994) concludes that the variation between these two Plains populations (Northwestern and Southern Plains) may eventually prove to be slight as sample sizes expand.

The Mormon pioneer sample, on the other hand, stands in marked contrast to those from Montana, Wyoming, and Texas. No signs of violence to the skeleton have been found on the

Mormons and only one skeletal trauma (one of the two adult males reveals a severe double fracture, successfully healed). This contrast could be due in part to the radically different sex ratios, since among the Wyoming pioneers the women rarely show injury either, and none show signs of human violence. Yet differences in lifestyle probably account for these different osteobiographical profiles. The settled existence of Mormon farmers, leading a well-organized religious life, stands in marked contrast to conditions on the Wyoming frontier, or along the Chisholm Trail out of Texas, or among Custer's Seventh Calvary soldiers at the Little Bighorn in Montana.

Diet and Disease

Dental health among the Wyoming pioneers appears to be normal for a frontier population of the nineteenth century. Some unattended caries (which are usually small) have been observed, and occasional abscesses. A caries frequency of 20% has been calculated (Tigner-Wise 1989) for that sample of early Whites. Virtually no fillings are to be found among them.

The finest teeth among the pioneer Whites are among the Texas pioneers. The Coffey and Boothill cemeteries show a 1.8% caries frequency (Gill 1994), which compares well with frequencies for prehistoric hunters and gatherers and is much lower than frequencies for civilized agriculturists (between 10-27%).

Three-fifths of adult Texans show edge-to-edge occlusion. So does at least one Wyoming frontiersman. This is another trait of hunters that is rarely found among modern Whites. Perhaps chewing tough foods such as jerky and raw tubers since early childhood is the explanation for this unexpected occlusion pattern. The low caries frequency of the Texas drovers is probably more complicated and may involve diet, water supply, and even genetic factors.

Snow and Fitzpatrick (1989) state that no carious lesions are present in the 36 teeth of the Custer Battlefield soldiers from Montana. In fact, "The bones and teeth display none of the changes often observed in individuals who have suffered from chronic nutritional stress" (1989:277). The healthy condition of the soldiers is probably due both to selective factors (i.e., recruitment criteria.) and their young ages, plus a sample size that is extremely limited.

A very different situation is seen in the Salt Lake Valley. A caries frequency of 54% among adults is found there (Tigner-Wise 1989). According to Turner (1979) severe problems with dental health such as this occur among horticulturists who relied on starchy foods and less upon meat. Historical sources suggest that the Wyoming and Montana soldiers, trappers, and hunters, as well as the Texas cattle drovers ate more meat than the Mormon farmers.

Skeletal evidence within all pioneer samples suggest little problem with chronic disease. However, disease problems did affect the Mormon population. The high infant death rate suggests this association, as well as some transverse lines (Harris lines) of growth arrest in infant long bones. Also cribra orbitalia was observed in that skeletal sample (Gill 1989, 1994; Tigner-Wise 1989). According to Tigner-Wise (1989) these occurrences appear not to be out of the ordinary for populations in the United States during the mid-nineteenth century. Compared to the other frontier populations, the Mormon sample was less healthy.

Osteobiographical Outlines

A number of fascinating life histories of early Historic figures from the Northwestern Plains have been elucidated by osteological information. Others have come to be known solely from their osteobiographical profile with no known historical record of the individual at all.

Camp Brown Massacre. Perhaps the most dramatic story from the Northwestern Plains to be supported by osteological evidence is the story of the White frontiersman, Harvey Morgan, an expert rifleman from Camp Brown, near present-day Lander, Wyoming. He and two companions were killed June 27, 1870, by a large raiding party of Plains Indians. His story comes to us from a combination of military accounts recorded within hours after the massacre, and from the results of osteological analysis (Gill 1994). A full description, with photographs, has been completed (Gill 1994) of the massive cranial wound caused by a wagon hammer driven diagonally through Morgan's skull (still embedded in the cranium) and the pattern of cranial cut marks resulting from scalping wounds.

According to written reports, over 200 spent cartridges from Morgan's rifle were recovered at the massacre site, suggesting that he had dealt the greatest harm to the raiding party. It seems that once all ammunition was gone the three Whites were overtaken and killed. Morgan's comrades were scalped, and Morgan himself was scalped and further mutilated. Accounts based upon the reports of the military detachment that discovered the three bodies (see Gill 1994) state that the Indians, "cut the skin across the back of Morgan's neck and split the skin down the entire length of his back, and skinned the hide back about three inches on each side and took out the sinews of the back. They then drove the wagon hammer (also called the queen pin) through his head with the neck yoke." Further accounts state that his genitals were also removed and placed in his mouth.

The military report also states that, "The ground was literally packed down around the scene of battle by thousands of moccasin tracks. The Indians had ridden in a circle around the Whites while fighting, and had a beaten track. There seems to have been a large war party."

The three men were buried at Camp Brown and over the years their grave locations lost. Workers in Lander in 1908, however, inadvertently uncovered the graves, and Morgan's body was clearly identifiable with the wagon hammer still in place (the military personnel had been unable to remove the hammer at the time). All that remains today osteologically is Morgan's skull which is in the possession of the Fremont County Pioneer Association in Lander, Wyoming. In addition to the hammer entry and exit wounds, the primary indications of trauma on the skull are 19 cut marks associated with the scalping as well as severe radiating fracture lines caused by the hammer mutilation (see Gill [1994] for detailed descriptions of the cranial injuries).

Killing at the Bordeaux Trading Post. Within the confines of a small Plains Indian burial ground adjacent to the Historic Bordeaux Trading Post site (3 miles west of Lingle, Wyoming), the grave of a White frontiersman was found during excavation in the fall of 1980 (Gill et al. 1984). These explorations followed an earlier discovery and disinterment of 13 graves found by local ranchers involved in earth moving operations on their property. All burials were well endowed with Euro-American and Plains Indian artifacts and seem to have been associated with the trading post.

All graves appear to have been of Plains Indians except this single interment. It was less well provided with cultural associations and was the only one without a coffin. A tall, robust White frontiersman of about 34 years of age was in the grave. He seems to have died around 1869 or 1870 as determined by the dates on some coins in his possession. It seems as though he had been married and lost his wife shortly before his own death. This is suggested by a black ring of mourning next to his wedding ring of German silver. He was probably of British descent based upon some skeletal traits and cultural associations (particularly the mourning jewelry). He was placed in his grave with his boots on and a wide-brimmed black hat over his face. He had on buckskin pants, a shirt with small buttons, and a jacket with large metal buttons (Gill et al. 1984, Gill 1994).

Multiple gunshot wounds are evidenced on the skeleton. One large caliber projectile (.44 or .45) entered his skull above the left eye and exited on the right lower portion of the occipital bone. A badly fractured proximal (left) femur which shows clear perimortem fracturing represents another gunshot injury. Thus it has been concluded (Gill et al. 1984) that the severe trauma to the hip, considered in conjunction with a high angle of entry to the cranial gunshot wound, suggests that a gunshot wound to the hip brought the large man to the ground and was followed by a second shot above the left eye at close range, fired from above his head. He was also recovering from three broken ribs (10, 11, and 12 on the right side) at the time he was killed (Gill 1994).

Frontier Chinese

A skeletal sample of six male Historic Chinese from the Red Mountain area near Evanston, Wyoming, were excavated in 1982 by Wyoming State Crime Laboratory personnel. They were studied as forensic cases at the Crime Laboratory in Cheyenne at the time of recovery (Green 1995). Table 34 lists these six individuals, plus one additional Historic Chinese male from Hyattville, Wyoming. Since next of kin could not be found, the six Red Mountain skeletons, plus associated cultural remains, were eventually transferred to the University of Wyoming Human Osteology Collection. Complete osteological data collection was carried out following disinterment but no reports have been published. The single Nowood Creek specimen very recently acquired by the University of Wyoming is a cranium without postcranial skeleton and has not yet been described. The skull supposedly comes from an eroded and destroyed grave site from 1873 and represents a Chinese male. The cranium reflects extreme Mongoloid craniofacial characteristics indicative of East Asian ancestry and is clearly male, supporting local information about the provenience.

Table 34. Skeletal Remains of Frontier Chinese from the Northwestern Great Plains

Individual/Site	Specimen No.	Sex	Age
Red Mountain 1	HR090	M	42-45 yrs
Red Mountain 2	HR091	M	26-34 yrs
Red Mountain 3	HR092	M	34-42 yrs
Red Mountain 4	HR093	M	26-34 yrs
Red Mountain 5	HR094	M	25-30 yrs
Red Mountain 6	HR095	M	42-48 yrs
Nowood Creek	HR214	M	50+ yrs

All burials from the Red Mountain cemetery were in well constructed coffins with metal handles. Each man was buried in a suit of loose-fitting black clothes. The interments seem to date from the latter part of the last century. Preservation is excellent with some mummified tissue and also hair remaining. Mongoloid racial characteristics are evident in all cases. The young adult ages and the fact that this is an all male sample has created some speculation as to the cause of death. It is possible that the deaths may have resulted from one of the "Chinese Massacres" in the western Wyoming area in the late 1800s. One cut mark on a rib of one individual does suggest a perimortem knife wound, but no other obvious skeletal trauma could be detected.

Individuals of Indian/White Ancestry

A few skeletons have been recovered in the Northwestern Plains area that appear to represent examples of admixture between Whites and Plains Indians. These are listed in Table 35. One well-documented example comes from the work of Snow and Fitzpatrick (1989). Excavations at Markers 33-34 at the Little Bighorn Battlefield produced a partial facial skeleton of a male between 35 and 45 years of age that showed a combination of traits suggestive of Indian/White admixture. The only known Indian/White mixed-blood to have died in Major General Custer's command was Mitch Boyer, Custer's scout-interpreter. Boyer was a plainsman of considerable experience and was documented as a mixed-blood Sioux (Scott et al. 1989). Photographs of Mitch Boyer exist and therefore Snow and Fitzpatrick (1989) were able to carry out a convincing superimposition of photographic images. There appears to be little doubt that the human bones and teeth represent the remains of Mitch Boyer. Perimortem injuries are evident and consist of massive blunt-force trauma to the head. An arched dental wear pattern confined to the left anterior teeth indicates that Boyer was a habitual pipe smoker.

Another Montana skeleton that appears to represent Plains Indian and White admixture has been reported by Joyes (1981) from the Saxton site in Sheridan County. This well preserved skeleton from a Protohistoric burial context with both Plains Indian and Euro-American burial goods was examined by Charline Smith, a physical anthropologist at the University of Montana. It was her conclusion that the majority of skeletal traits fit a pattern consistent with Caucasian ancestry. Even though she and Joyes base part of their conclusion as to ancestry

Table 35. Skeletal Remains of Individuals of Mixed Indian/White Ancestry from the Northwestern Great Plains

Individual/Site	Specimen No.	Sex	Age
Mitch Boyer (Little Bighorn)	Markers 33-34	M	35-45 yrs
Saxton		F	59-61 yrs
Washakie County	UWFC45	M	26-35 yrs
Glendo	HR012	F	26-33 yrs

upon the Giles-Elliot (1962) discriminant function approach, which has since been shown by Fisher and Gill (1990) to be notoriously inaccurate for Northwestern Plains Indians, they also consider a number of other craniofacial characteristics that are known to be quite good for skeletal race attribution. Thus we are inclined to accept the conclusions of Joyes that this interesting burial from the northeastern corner of Montana represents a mixed-blood descendant of an early White and Plains Indian in that area. Such individuals are documented from that region and time period and apparently followed a lifestyle somewhat closer culturally to their Plains Indian ancestors. This affiliation is suggested at the Saxton burial site.

Two skeletons from the Wyoming skeletal collections have also been attributed to mixed Indian/White ancestry. These two, the Washakie County specimen and a skeleton from near Glendo, Wyoming, are both listed in Table 36 and in Table 1 of Gill (1994).

The young adult male skeleton from Washakie County (UWFC45) is not well known as it was not recovered by archeologists and the osteological findings have not been published. This specimen was collected in a forensic context in 1983 and was submitted to University of Wyoming for basic medico-legal determination. Gill (1983b) assessed the complete skull and partial postcranial skeleton as American Indian with the strong likelihood of Caucasian admixture. A large number of Caucasoid traits were recorded from the skull in combination with a slight majority of Amerindian characteristics. Associated Protohistoric artifact materials (1820-1880s) typical for Plains Indian burials were present. These associations plus an edge-to-edge dental occlusion, rather marked dental attrition and a few traits of the face and skull (malar prominence and cranial outline) showed not only a Plains Indian lifestyle and cultural context, but Amerindian ancestry as well. The recorded Caucasian traits, on the other hand, that are virtually diagnostic of White ancestry are almost equally well represented. For instance, the mandible shows a square, bilateral chin (with cupping below the incisors) and a bladelike (nonshoveled) left lateral lower incisor. Equally compelling were the high-bridged nasal bones and straight nasal profile. Also supportive of Caucasoid ancestry are such things as a curved zygomaticomaxillary suture, a jagged shape to the palatine suture, and a rather straight sutural pattern in the lambdoidal region. Application of the interorbital features method, however (which is almost 90% accurate [Gill et al. 1988]) places the skull securely within the American Indian sector. A patterning of craniofacial traits such as this on a skull from a late Protohistoric context in the Northwestern Plains leaves virtually only one conclusion regarding ancestry. That is, that the individual must have been of more or less evenly mixed ancestry from the White and Plains Indian populations.

A better known case from Wyoming of admixed Indian/White ancestry is the Glendo skeleton described by Gill (1976b). This young adult female from a Protohistoric Plains Indian cultural context shows a predominance of Caucasoid skeletal traits. There are just enough Amerindian characteristics discernible on the skeleton, however, to cause Gill to conclude that the genetic background represents a case of hybridization.

The only other skeletons known to the authors from the Northwestern Plains that might eventually prove to be of mixed Indian/White ancestry is a single specimen not yet published and some of the skeletons from the Korell-Bordeaux site in eastern Wyoming. These skeletons from a small cemetery above the old Bordeaux Trading Post have not yet been fully described. Neither has the rich assortment of associated artifacts from those graves which reveal an interesting blend of Plains Indian cultural material with Euro-American trade items. A recent study of femoral platymeria in the Northwestern Plains (Miller, n.d.) shows the femora to be morphologically intermediate between samples of Historic White femora and Plains Indian femora.

Summary and Conclusions

Human skeletons from historical contexts in the Northwestern Plains elucidate a fascinating period of frontier history. Pioneer White males show an unusual amount of traumatic injury to the skeleton. Nearly one half died by violence, if the total sample (including the Little Bighorn skeletons) is considered. Even omitting the Montana battlefield sample, over one-third of the frontier Whites from Wyoming died a violent death at the hands of other human beings. The few frontier Blacks probably experienced the same fate, judging from the small Wyoming sample and the limited historical documents available.

Attempts to view the Northwestern Plains frontier in broader context reveals some clear contrasts, especially with the Salt Lake Valley pioneers of Utah. A small sample of west Texas drovers from boothill cemeteries reveals a pattern that may prove to be similar to the Wyoming and Montana situation. The Mormon pioneers of Utah do not show the same profile of injury, conflict, and early death by violence. Nor do they show the skewed sex and age ratios of the Northwestern Plains. Migrating to the Salt Lake Valley as organized families in order to undertake a farming way of life produced a very different picture. Disease stress on women, miscarriages, and a high infant mortality were common. An exceedingly high caries frequency among the Salt Lake Valley pioneers also suggests that neither successful hunting practices nor animal husbandry was well developed in the initial stage of settlement. Lack of meat in the diet does not appear to have been a problem for the other pioneer groups.

Plains Indian skeletal samples from the Northwestern Plains show fewer and much less severe skeletal trauma in comparison with Whites. A number of reasons probably account for the contrast between these two groups. From all evidence and from historical accounts, the White frontiersmen appear to be a select group and not an average sampling from the White population. The Plains Indian sample, however, appears to be typical. Additionally, Euro-American weapons on the Plains at this time were capable of more devastating effects on the body and skeleton than those available over the millennia to Indians. Furthermore, a certain percentage of the White males constituting this frontier sample appear to have been Civil War veterans carrying old injuries incurred during an exceptionally brutal period of warfare. Finally, the pioneer Whites represent individuals exposed to the harshness of the Western Plains, beyond the protection afforded by their own civilization further east.

Additional information from these studies of pioneers suggests that at least the Whites were a select and unique group. Skeletal size appears to be above average, and male robustness, particularly in the bony joints (as well as cranial rugosity), was well developed. Cranial sizes are large and the skulls and faces are long. Possible explanations for these skeletal deviations from the norm could be natural selection (selective migration and/or differential survival), ancestry (local ethnic stocks producing the majority of pioneers), certain direct actions of the environment (especially dental health and occlusion), or a combination of these forces.

Data Gaps

In sum, recent studies of pioneer skeletons suggest a number of interesting dynamics on the Northwestern Plains, as well as other frontier regions. Certainly data gaps exist and need to be addressed, such as: (1) individual case studies are needed on some available pioneer skeletons that are still unstudied, (2) sample sizes from most adjacent frontier areas are still too small, and (3) very poor sample sizes exist for most non-White pioneer populations. Nevertheless, some studies have been possible, and they reveal many things. For instance, violent episodes were commonplace on the Northwestern Plains frontier. Also, sexual contact did occur early and perhaps extensively between the first frontiersmen and Plains Indian women. It also seems clear that the lone males moving out ahead of civilization were a select population with rugged skeletons and a number of distinctive craniofacial traits. A lot more was happening on the Northwestern Plains and in other frontier regions of the west than can be gleaned from history books alone.

8 Bioarcheology of the Northeastern Plains, by John Williams

The Northeastern and Middle Missouri Plains span three states, North and South Dakota and northwestern Minnesota, and these three areas were treated for this bioarcheological study as a single unit for the Archaic and Middle Missouri traditions. Because the Coalescent tradition represents two very different populations, Siouan in North Dakota and Caddoan in South Dakota, the Coalescent tradition in South Dakota was treated separately (see Owsley and Sandness 1996). Likewise, the South Dakota resource distribution is covered there. The Minnesota resource distribution and bioarcheology are fully covered in Benchley et al. (1997). For a complete overview of the bioarcheology of the Central and Northern Plains, refer to Owsley and Rose (1996).

Resource Distribution—North Dakota

Using site file information housed at the State Historical Society of North Dakota and the University of North Dakota Department of Anthropology, 200 sites/locations were identified as having yielded human skeletal remains. Only those sites where human remains had been physically observed were tallied. Unexcavated burial mounds and cemeteries, although likely to contain human skeletons, were not included. Not all sites where skeletal remains were observed were necessarily disinterred. In nine cases the remains were immediately reburied without further study. At an additional 25 sites, human skeletons were discovered but no further activity was reported. More significant, is the percentage of repatriated sites. Due to federal and state actions human skeletal remains recovered at 123 sites (62%) have been repatriated.

Burial Sites by County

Skeletal remains have been recovered from sites in 30 of North Dakota's 51 counties (Table 36). The distribution of these counties takes the form of a Y pattern centered on the Missouri River trench (Figure 55). Counties in the north-central, southeast, and southwest portions of the state lack recovered burials. Those counties without identified human skeletons are generally those lying outside a major watercourse (i.e., Missouri River, Red River of the North). Surprising in its exclusion is North Dakota's most populated county. Cass County, together with Trail and Richland counties, is located in east-central North Dakota partially within Lake Agassiz and the Red River Valley. Given the location of these counties, and in particular Cass County, the recovery of human skeletal remains would be heavily favored. The absence of identification and recovery in part may be due to agricultural development, as the Red River Valley is prime farmland. Prehistoric cemeteries may have been plowed under and destroyed long ago. History may also play a role in that, until very recently, little archeological activity has taken place in the southeastern corner of North Dakota.

Table 36. Site Distribution by County and Culture-Historic Association

County	Sites	Culture - Historic Association				
		Unkn.	Arch.	Wood.	Pl. Vill.	His.
Barnes	6	3	1	2	0	0
Benson	1	1	0	0	0	0
Burleigh	8	3	0	0	5	1
Bowman	2	2	0	0	0	0
Cavalier	1	1	0	0	0	0
Dunn	5	4	1	0	0	1
Eddy	1	0	0	1	0	1
Emmons	13	2	0	1	7	3
Grand Forks	13	8	1	4	0	0
Griggs	4	4	0	0	0	0
Grant	3	2	1	0	0	0
Hettinger	2	2	0	0	0	0
LaMoure	5	4	0	1	0	1
Logan	2	2	0	0	0	0
Mercer	31	12	0	3	14	3
McLean	5	2	0	1	1	1
Mountrail	4	1	0	1	0	2
Morton	24	4	1	2	15	4
Nelson	4	2	0	2	0	0
Oliver	6	3	0	0	3	0
Pembina	1	0	0	1	0	0
Ransom	9	3	0	5	1	1
Ramsey	4	2	0	2	0	0
Sargent	1	0	0	1	0	0
Sioux	11	4	0	2	5	0
Slope	1	1	0	0	0	0
Stutsman	23	18	1	3	1	0
Walsh	5	4	0	1	0	0
Wells	1	0	0	1	0	0
Williams	4	2	0	0	1	1
Total	208	95	6	34	54	19

Note: Total sites includes multicomponent sites.

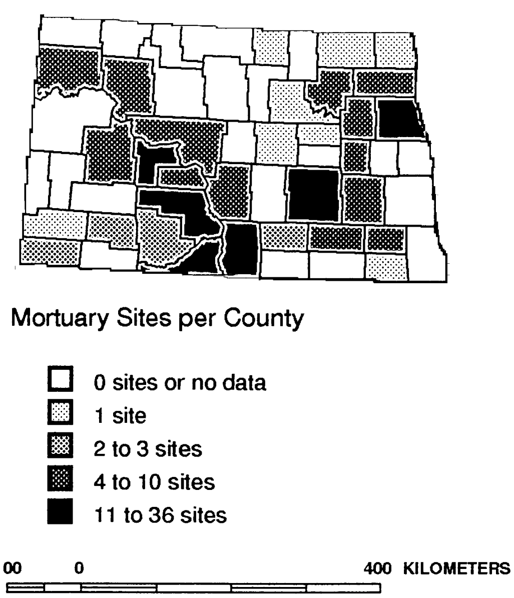

Figure 55. The distribution of burial sites in North Dakota counties.

The number of sites per county ranges from a single site in seven counties to 31 sites in Mercer County. Slightly less than half (98 sites) of the recorded sites are from seven contiguous counties (Burleigh, Emmons, Mercer, McLean, Morton, Oliver, and Sioux) stretching along the Missouri River from just north of the Bismarck area south to the South Dakota border. The remaining sites are distributed in fewer numbers over the other 24 counties. Two exceptions are Stutsman County (23 sites) and Grand Forks County (13 sites).

Burial Sites by Culture-Historic Association

Sites were categorized by culture-historic association as either being Archaic, Woodland, Plains Village, Historic, or Unknown (Table 36). The categories Woodland and Plains Village are inclusive of all taxonomic subdivision (i.e., Middle Woodland, Initial Middle Missouri). The largest single class of sites are those listed as unknown (45.7%). Stutsman County has the greatest number of unknown-designated sites at 18 sites. The high number of Plains Village sites is misleading. While they comprise 25.9% of the total number of sites, the number of analyzable skeletons recovered from these sites is disappointingly small. The converse is true of the Woodland sites. They are far fewer in number, totaling 16.3% of the sites, yet yielded a significantly greater number of skeletons. Eleven sites were identified as multicomponent. Six of these involved Plains Village as one of the two components. One site was multicomponent Woodland, site 32SN22 from Stutsman County.

Burial Sites by Burial Context

When burial context is considered several patterns emerge (Table 37). First, mounds are the most frequently encountered burial context (27%). This is not surprising in that mounds represent the most readily identifiable prehistoric burial context. Habitations follow at 22%. The high percentage of habitation related burials is a direct attribute of the large number of Plains Village earthlodge village sites, within which human burials are commonly located. Isolated burials are almost as frequent. Fifteen percent of the sites are of unknown context. The largest number of mound burial locations are from Stutsman County. These 22 sites make up 39% of the total mound sites. Eighty-nine percent of the habitation sites are located in the seven counties previously described as abutting the Missouri River. These same sites contain nearly all of the Plains Village designated sites. The remaining burial contexts, including cemeteries, are relatively infrequent. Where culture-historic association is identified, cairn burials are listed as Archaic.

Table 37. Sites By County and Burial Context

County	Md	Isol.	Unk.	Hab.	Other	Cem.	Cairn	Shel.
Barnes	3	2	1	0	0	0	0	0
Benson	0	1	0	0	0	0	0	0
Burleigh	0	0	2	5	1	0	0	0
Bowman	0	1	1	0	0	0	0	0
Cavalier	0	1	0	0	0	0	0	0
Dunn	0	0	3	0	0	0	1	1
Eddy	1	0	0	0	0	0	0	0
Emmons	0	4	2	4	0	1	2	0
Grand Forks	5	4	3	1	0	0	0	0
Griggs	2	2	0	0	0	0	0	0
Grant	0	1	2	0	0	0	0	0
Hettinger	0	1	1	0	0	0	0	0
LaMoure	4	1	0	0	0	0	0	0
Logan	1	0	1	0	0	0	0	0
Mercer	3	7	3	9	0	8	1	0
McLean	1	1	2	0	0	1	0	0
Mountrail	1	1	0	1	0	1	0	0
Morton	4	1	2	14	0	2	1	0
Nelson	4	0	0	0	0	0	0	0
Oliver	1	1	1	3	0	0	0	0
Pembina	1	0	0	0	0	0	0	0
Ransom	2	4	3	0	0	0	0	0
Ramsey	2	0	0	0	1	1	0	0
Sargent	1	0	0	0	0	0	0	0
Sioux	2	0	4	4	1	0	0	0
Slope	0	0	1	0	0	0	0	0
Stutsman	15	4	0	0	0	1	3	0
Walsh	2	1	1	1	0	0	0	0
Wells	1	0	0	0	0	0	0	0
Williams	0	3	0	0	0	0	1	0
Total	56	42	30	44	3	15	9	1
Percent	26.9	20.2	14.4	21.2	1.4	7.2	4.3	0.4

Bioarcheological History

Bioarcheology research in North Dakota can be divided into three historical periods; Pre-River Basin Survey, River Basin Survey, and the Post-Reburial. The period prior to 1946 marks the time before the Smithsonian Institution River Basin Surveys were initiated (Lehmer 1971). Bioarcheology was sporadic and dependent more on opportunity and interest than on any specific plan. Data are few and consist mostly of anecdotal statements regarding human skeletons (e.g., Montgomery 1910). There were, however, some planned studies, such as Jenks' (1932) excavation of the Arvilla site (32GF1). The year 1946 marked the beginning of the Corps of Engineers creation of five dams that would alter the flow of the Missouri River. In anticipation of the destruction of archeological sites located along the Missouri River, surveys and salvage excavations took place at numerous sites. After flooding had occurred, surveys and excavations continued along the Missouri River. The large number of sites recorded for the Missouri River counties can be attributed to this period. During the same period surveys were conducted along the James River and tributaries of the Red River (e.g., Cole 1968). Despite the discovery of numerous skeleton bearing sites, bioarcheology remained intermittent. This was in part due to funding and in part due to the lack of a resident bioarcheologist. Several bioarcheology research efforts were mounted (e.g., Rose et al. 1984; Williams 1985a, 1985b). Although few in number, the data generated added greatly to the bioarcheology data base (Williams and Snortland 1986).

In 1989 the State of North Dakota began to reinter its entire prehistoric human skeletal collection, a process completed in 1992. This decision was preceded by a cessation of all study of then curated human skeletons. A large body of potential data were lost. In 1989 the State of North Dakota adopted new rules regarding the continued disinterment, study, and reinterment of human skeletons. The set of rules regarding the future study of human skeletons have had both positive and negative impacts. On the negative side, analysis is greatly restricted in both scope and time frame: analysis of single burials must take place on site with reburial occurring as soon as possible; multiple burials may be studied off site but must be analyzed within 90 days. The benefit of these rules is that all skeletons are being studied, regardless of provenience (Williams 1993a, 1994b).

Sites by Level of Analysis

Of the 200 sites the skeletons at more than half (109 sites) have received no analysis (Tables 38 and 39). Under categories of levels in these tables "no analysis" indicates that not even the most basic level of analysis (identification of age and sex) has been provided. This lack of analysis is mostly due to the recent reburial effort within the State of North Dakota. Partial analysis is a very broad category and includes the most simple analysis (e.g., a skeletal inventory) to the full range of age and sex determination, mensurational analysis, and osteopathological interpretation. Unfortunately less than half the sites (44.4%) fall into this category. Of those sites that do, mound, isolated, and habitation sites are roughly 12% as likely to have had this level of analysis. Comprehensive analysis is recorded for two mound sites. This level of analysis is uncommon because of its stringent definition. To qualify a site must have complete analysis including stable isotope and radiographic studies.

When culture-historic association is considered, sites of unknown association are the least frequently studied, comprising slightly more than half (57%) of the unstudied sites. These are also more than twice as likely not to have any study performed. Of those sites with an established association, Plains Village sites lead in being the most often unstudied (20%) and partially studied (34%). Woodland sites, despite their numerical superiority make up only 22% of the partially analyzed sites. Historic sites are the only ones of known association where unstudied sites outnumber those that have been partially studied.

Excavation and Organization

The circumstances surrounding the discovery of human skeletal remains vary widely among these 200 sites. Federal agencies, museums, universities, cultural resource management contractors, and even local residents and amateur archeologists have been involved. Table 40 lists the number of sites for each county and the organizations involved. In general terms the discovery and/or recovery of human skeletal remains primarily falls into the hands of either museum (27%), federal agencies (21%), university based archeologists (26%), as well as a high percentage (22%) of amateurs. Included in the latter category are landowners. Private cultural resource management contractors are unlikely to be involved. They account for less than 3% of all burial activities. This probably results from the nature of their contracts. Counties that include federally controlled lands (i.e., Mercer, Morton, and Stutsman) also have the highest number of burial activities within the federal category. These same counties also have high proportions of amateur discovery.

Although the type of organization played a role in the level of analysis performed, it was not an absolute predictor (Table 41). With the exception of amateur activities, where the likelihood of analysis was only 16%, the other major organization type categories were about evenly split between no analysis and partial analysis. Universities, however, were slightly more likely to perform no analysis at all.

Table 38. Summary Site by Burial Context and Level of Analysis

Burial Context	Sites	Level of Analysis		
		None	Partial	Comprehensive
Mound	56	29	25	2
Isolated	42	19	23	0
Unknown	30	23	7	0
Habitation	44	19	25	0
Other	3	1	2	0
Cemetery	15	13	2	0
Cairn	9	4	5	0
Shelter	1	1	0	0
Total	200	109	89	2
Percent		54.5	44.5	1.0

Table 39. Level of Analysis by Culture-Historic Association

Association	Level of Analysis		
	None	Partial	Comprehensive
Archaic	2	4	0
Woodland	14	20	0
Plains Village	22	31	1
Historic	10	7	0
Unknown	64	30	1

Table 40. Organization Type by County

County	Type of Organization					
	Contract	Museum	Federal	Univers.	Amateur	State
Barnes	0	1	1	4	0	0
Benson	0	1	0	0	0	0
Burleigh	0	5	1	0	2	0
Bowman	0	0	1	0	1	0
Cavalier	0	0	0	1	0	0
Dunn	0	0	0	2	1	2
Eddy	1	0	0	0	0	0
Emmons	0	7	2	3	1	0
Grand Forks	1	0	0	8	4	0
Griggs	0	2	1	0	1	0
Grant	0	2	0	0	1	0
Hettinger	0	0	0	0	2	0
LaMour	0	1	0	3	1	0
Logan	0	1	0	0	1	0
Mercer	1	6	8	9	7	0
McLean	0	2	1	1	1	0
Mountrail	1	1	1	1	0	0
Morton	1	10	9	1	3	0
Nelson	0	0	0	3	1	0
Oliver	0	1	0	2	3	0
Pembina	0	0	0	1	0	0
Ransom	0	1	0	3	0	0
Ramsey	0	1	0	3	5	0
Sargent	0	0	0	1	0	0
Sioux	0	3	5	0	3	0
Slope	0	1	0	0	0	0
Stutsman	0	6	13	1	3	0
Walsh	0	1	0	3	1	0
Wells	0	0	0	0	1	0
Williams	0	3	0	0	1	0
Total	5	56	43	50	44	2
Percent	2.5	28.0	21.5	25.2	22.0	1.0

Table 41. Organization Type and Level of Analysis

Organization Type	Level of Analysis		
	None	Partial	Comprehensive
Contractor	2	3	0
Museum	26	30	0
University	26	24	0
Federal	17	24	2
Amateur	37	7	0
State	1	1	0
Total	109	89	2
Percent	54.5	44.5	1.0

Related to the type of organization is the type of activity which lead to the discovery of human skeletal remains (Table 42). These data apply only to professional activities and exclude amateur recovery and discovery. Salvage activities are in the clear majority at 59%. Surveys are much less likely to involve human remains, accounting for 28% of professional discoveries/ recoveries. Full scale excavations and site testing together account for 12% of human skeleton site activities. As with organization type those counties with federal controlled lands had the most professional projects, both salvage and survey. The seven counties that abut the Missouri River make up 34% of all professional burial related activities. Mercer and Morton counties alone comprise 29% of burial recoveries/discoveries.

When the type of professional activity is compared with the level of analysis an unexpected association appeared (Table 43). Salvage activities have a very high probability of involving some level of bioarcheological analysis. Sixty-five percent of all salvage recoveries included some degree of skeletal analysis. Survey activities, on the other hand, included analysis in only 28% of the cases. One possible explanation for this disparity is the nature of surveys. Their purpose is to provide a summary of observations and not to perform excavations. Any bones recovered during a survey are likely to be few in number. A complete skeleton or skeletons, alternatively, would likely lead to a salvage recovery.

Watershed and Vegetation

Two other site variable associations were examined, watershed and vegetation. Using the predetermined watershed distributions these 200 sites fell into one of six North Dakota watersheds (Table 44). No sites fell within the Souris River watershed. As this watershed encompasses the north-central portion of North Dakota, this lack of association is expected, as no sites have been identified from any of the counties in this region. The largest single category is the Red River watershed. The Red River drainage accounts for 38% of site locations. However, when the four Missouri River drainage are combined, these comprise 62% of all burial locations. Of the Missouri drainages it is the Missouri-Little Missouri and Missouri-Oahe that dominate the site distribution. Together these two drainages account for slightly more than half of the recorded sites. These associations are not unexpected given the history of bioarcheology in the region. A significant amount of salvage and survey activities have focused on the Missouri River and its tributaries. Similarly, but in a smaller degree, the Red River and its tributaries have served as a second focus of activity. Prehistoric settlement patterns play an equally important role in the distribution of burial sites within North Dakota. Using a single vegetation category, Northern Floodplain, 140 of the 200 sites were identified. Although this is not an absolute correlation, it is clear that burial locations have a high probability (70%) of being discovered within a river valley location within the state of North Dakota.

Table 42. Excavation Type by County

County	Type			
	Excavation	Salvage	Survey	Test
Barnes	1	3	2	0
Benson	0	1	0	0
Burleigh	1	2	3	0
Bowman	0	1	0	0
Cavalier	0	1	0	0
Dunn	1	3	0	0
Eddy	0	0	1	0
Emmons	0	8	2	0
Grand Forks	2	4	0	3
Griggs	0	3	0	0
Grant	0	2	0	0
Hettinger	0	0	0	0
LaMoure	0	1	3	0
Logan	0	0	1	0
Mercer	0	7	16	1
McLean	0	2	2	0
Mountrail	0	0	4	0
Morton	4	16	1	0
Nelson	0	2	1	0
Oliver	1	2	0	0
Pembina	1	0	0	0
Ransom	1	2	1	0
Ramsey	1	1	2	0
Sargent	0	0	1	0
Sioux	0	8	0	0
Slope	0	1	0	0
Stutsman	2	16	2	0
Walsh	1	2	1	0
Wells	0	0	0	0
Williams	0	3	0	0
Total	16	92	43	4
Percent	8.0	46.0	21.5	2.0

Table 43. Excavation Type by Level of Analysis

Excavation Type	Level of Analysis		
	None	Partial	Comprehensive
Excavation	5	10	1
Salvage	27	53	1
Survey	38	15	0
Test	1	3	0

Regional Data Summaries

History and Background

Following Wedel (1961) and Lehmer (1971) the Plains area can be divided into five spatial subareas: the Central Plains, the Northwestern Plains, the Southern Plains, the Middle Missouri, and the Northeastern Plains (Anfinson 1982; Schneider 1982c). The Middle Missouri and Northeastern Plains subareas respectively can be approximately defined as the trench of the Missouri River and the Red River valley in North and South Dakota and Northwestern Minnesota.

Table 44. Distribution of Sites by Watershed

Watershed	Number of Sites
Souris	0
Red	77
Lower Yellowstone	5
Missouri-Little Missouri	48
Missouri-Oahe	53
James	17

The prehistory of the Middle Missouri and Northeastern Plains begins approximately 11,500 years ago with the Paleoindian tradition (Table 45). Little is known about these peoples in the Northern Plains (senso lato) except that they were for the most part specialized hunters of large game such as the mammoth and extinct forms of bison. What is known comes predominately from surface finds of tools, projectile points such as those of the Clovis, Folsom, and Plano complexes (Gregg

1985b). Several Paleoindian period sites are known from the Middle Missouri subarea, for example Moe (32MN101) (Schneider 1975), Walth Bay (39WW203) (Ahler et al. 1974), and Travis II (39WW15) (Ahler et al. 1977), but none have been extensively studied. No human skeletal remains from either of these regions have been associated to date with this temporal stage.

Following at approximately 6000 B.C. is the Archaic tradition. The Archaic peoples were also hunters of smaller animals including the modern forms of bison (Lehmer 1971). Included in the technology of the Archaic peoples are notched projectile points like those of the McKean complex, and ground stone tools such as axes and grinding basins (Gregg 1985b; Lass 1981). It is during the Archaic too that the first evidence of human skeletal remains appears. Among the oldest known human skeletons from the Northern Plains are those of the Early Archaic Smilden-Rostberg (32GF123) near Larimore, North Dakota (Gill 1991b; Larson and Penny 1991), the Late Archaic Pipestem Creek (32SN102) near Jamestown, North Dakota (1591 B.C.) (Fox and Williams 1982), and Medicine Crow (39BF2) near Fort Thompson, South Dakota (5000-2000 B.C.) (Bass 1976).

Moving closer to the present, our knowledge of Northern Plains prehistory increases. At approximately 500 B.C., the Woodland tradition is encountered. The Woodland is characterized by the first use of pottery and burial mound constructions. The Woodland peoples may have become more sedentary, possibly because of experimentation with cultivation. This is evidenced in part by their elaborate burial mounds (an eastern influence) and trade (Wedel 1961). A possible transition to horticulture was not rapid, however, and bison hunting continued to play a central part in the subsistence base. Cultivated plants appeared very late on the Northern Plains (Schneider 1982c). Johnson and Wood (1980) go as far as to characterize the Northern Plains Woodland as the Plains Archaic with pottery and burial ceremonialism. This view is supported by Woodland skeletal remains that differ significantly from their eastern counterparts with respect to general health patterns (Lallo and Rose 1979; Lallo et al. 1977; Mensforth et al. 1978; Williams 1982, 1985a, 1985b). With the elaborate burial mounds of the Woodland come larger and more numerous burial samples. Those of the Sonota complex are prominent in the Middle Missouri. Sonota complex cemeteries include three sites in Dewey County, South Dakota; Swift Bird (39DW233), Grover Hand (39DW240), and Arpan (39DW252) (Bass and Phenice 1975; Neuman 1975), and the Jamestown Mounds (32SN22) in Stutsman County, North Dakota (Snortland n.d.; Williams 1985a). To the east, along the Red River valley of North and South Dakota, it is the Arvilla complex and its two major cemeteries, Arvilla (32GF1) and De Spiegler (39RO23), which dominate the Woodland data base (Johnson 1973; Obey 1974; Syms 1982; Williams n.d.a). Although recovered skeletons from Woodland cemeteries greatly outnumber those of the Archaic, the Woodland remains largely understudied (Bass 1981; Lass 1981). Recent discoveries such as evidence for precontact tuberculosis (Williams and Snortland-Coles 1986) and the presence of hydatid disease (Williams 1985c) show the potential information contained in these skeletons.

At A.D. 900 the Plains Village tradition is the last of the truly prehistoric stages in the Dakotas. The Village peoples as horticulturists are characterized by a highly complex culture typified by the earthlodge and large farming communities. The historic Mandan, Hidatsa, and Arikara are the descendants of this tradition. Lehmer (1971) recognizes two subdivisions within the Plains Village tradition, the Middle Missouri tradition followed by the Coalescent tradition (Gregg 1985b). The earlier Middle Missouri tradition consists of three variants. The Initial Middle Missouri, ca. A.D. 900-1400, marks the beginning of the Plains Village tradition and the first appearance of Plains Village peoples in the Big Bend and Bad-Cheyenne subareas of South Dakota. The Extended Middle Missouri, ca. A.D. 1000-1550, occurs throughout both Dakotas. This variant is also noted for the presence of fortifications surrounding the villages. The Terminal Middle Missouri variant, ca. A.D. 1550-1675, is the concluding stage of the Middle Missouri tradition. Like earlier villages, those of the Terminal Middle Missouri are also fortified but more heavily, and are larger in size and fewer (Lehmer 1971).

The Coalescent tradition and its four variants begins at least as early as the fourteenth century and is characterized by the movement of what are thought to be Caddoan-speaking peoples into the Middle Missouri from the Central Plains. This migration

Table 45. Chronology of the Middle Missouri and Northeastern Plains Subareas

Tradition	Taxonomic Subdivision	Temporal Range	Representative Skeletal Samples
Paleoindian	Clovis Folsom Plano	9500-6000 B.C.	None
Archaic	Undetermined	6000-500 B.C.	Pipestem Creek (32SN102) (Fox and Williams 1982) Crow (39BF2) (Bass 1976)
Woodland	Sonata	500 B.C.-A.D. 600	Swift Bird (39DW233), Grover Hand (39DW240), Arpan (39DW252) (Bass and Phenice 1975), Jamestown Mounds (32SN22) (Williams 1985a)
	Arvilla	A.D. 600-900	Arvilla (32GF1) (Obey 1974, Williams n.d.), DeSpiegler (39RO23) (Obey 1974, Williams n.d.a)
Village	Initial-Middle Missouri	A.D. 1000-1550	None
	Terminal Middle Missouri	A.D. 1550-1675	Huff (32MO11)(Bass and Birkby 1962)
	Initial Coalescent	A.D. 1400-1550	Crow Creek (39BF11) (Willey 1982)
	Extended Coalescent	A.D. 1550-1675	Anton Rygh (39CA4) (Bass 1983), Mobridge (39WW1) (Jantz 1972)
	Post-Contact Coalescent	A.D. 1675-1780	Larson (39WW2) (Jantz 1972), Anton Rygh (39CA4) (Bass 1983), Mobridge (39WW1) (Jantz 1972)
	Disorganized Coalescent	A.D. 1780-1862	Leavenworth (39CO9) (Bass et al. 1971)

began during the Initial Coalescent. Conflict during this and later times is evident at Crow Creek (39BF11) where nearly 500 people were brutally massacred during the late fourteenth century (Owsley et al. 1977; Willey 1982; Zimmerman et al. 1981). The high incidence of nutritional and infectious disease at Crow Creek suggests that drought or other environmental factors played a role in this conflict (Gregg et al. 1981). By A.D. 1400 during the Extended Coalescent variant, Caddoan-speaking peoples occupied all of the Missouri trench in South Dakota. During the Postcontact Coalescent after ca. A.D. 1675 Plains peoples began to incorporate European elements into their culture. The horse made its first appearance on the Plains during this time. European diseases also were introduced resulting in devastating epidemics. It is during the Disorganized Coalescent variant ca. A.D. 1780 that the period of historic records begin.

Associated with the large, characteristic villages of the Coalescent tradition are large cemeteries. These, like the villages themselves, are for the most part located on high terraces overlooking the Missouri River. The largest and best documented are those associated with the Extended and later Coalescent variants. These include the Initial Coalescent Crow Creek (39BF11) (strictly speaking not a cemetery), the Extended and Postcontact Coalescent Anton Rygh (39CA4) and Mobridge (39WW1), the Postcontact Coalescent Larson (39WW2), and the Disorganized Coalescent Leavenworth (39CO9). In stark contrast, the Middle Missouri tradition is poorly represented by skeletal samples (Key 1983; Wood 1976).

The lives of Native Americans are poorly documented for the years before statehood in the Dakotas. As one of the last regions to be added to the United States and as an area far from the heavily populated East, Euro-American excursions into the Plains were uncommon. The earliest records of Euro-American activity in the Northern Plains are those of the trappers and traders. They were to enter this uncharted region and make contact with the various American Indian peoples. Among the first to encounter the Mandan are the La Verendryes who set out from Fort La Reine (Portage La Prairie, Manitoba) in 1738 (Haxo 1941; Helgevold 1981). Other trader/explorers continued contact with the Mandan, Hidatsa and Arikara. The first permanent direct trade did not take place until 1795 when the Hudson's Bay Company established the Mandan villages of the upper Missouri as a hub trade location for the other tribes of the region (Wood and Thiessen 1985).

By the beginning of the nineteenth century the U.S. government began to take interest in the Northern Plains and the lands to the west. At various times, explorers accompanied by soldiers mounted explorations into the region. The Lewis and Clark expedition of 1804 is a well known example (DeVoto 1953; Meyer 1977). Although the journals of Lewis and Clark are concerned primarily with recording events of the exploration party, many descriptions of Upper Missouri peoples can be found. The artist George Catlin and Prince Maximilian of Wied also traveled through the upper Missouri valley during this time and provide other glimpses of early Euro-American contact (Mooney 1975; Thwaites 1906). Included in these historic recordings are significant references to the occupation and abandonment of Coalescent villages (Bass et al. 1971; Lehmer 1971).

The rise and fall of these villages is directly linked to trade. The central and crowded location of the Mandan, Hidatsa, and Arikara villages that made them logical and ideal locations as permanent trading centers unfortunately made them ideal for the spread of epidemic infections for which they had no natural immunity. Francis Chardon, a trader at Fort Clark, provides dramatic firsthand description of the origin and the rapid decimation resulting from the 1837 smallpox epidemic (Abel 1932; Herman 1972). A telling statement of the severity of these infectious epidemics is seen in the simple demographic observations made by various Euro-Americans who traveled through the region. In the year 1780, during the early years of Euro-American contact, the Mandan and Hidatsa lived in 24 villages and numbered an estimated 12,000. Twenty-four years later they numbered only 3,750 people living in just five villages. Data such as these support the idea that a "disease frontier" preceded Euro-American western expansion (Utley 1984).

Early Archeological Investigations—Pre-River Basin Surveys

In one sense the earliest record of interest in the prehistory of the Northern Plains can be attributed to nonarcheologists like Prince Maximilian of Wied. During the early 1830s both he and John Audubon collected human skulls from recently abandoned villages along the Missouri River (Audubon and Coues 1898; Bass et al. 1971; Helgevold 1981; Thwaites 1906). However, it was not until the late 1800s and early 1900s that archeologists began to take a scientific interest in the Northern Plains. Montgomery (1906, 1908) and Nickerson (Capes 1963) excavated burial mounds throughout the Red River valley and adjoining areas of the Northeastern Plains. The Hill-Lewis survey of 1881-1895 also stands out in the early history of archeological investigation on the Northern Plains (Keyes 1928). A. J. Hill, a philanthropist with an interest in history and archeology, hired T. H. Lewis to conduct a survey of North American earthworks. Over a 15 year period, 18 states, including North and South Dakota, and the Canadian province of Manitoba, were mapped (Helgevold 1981; Zimmerman 1985). To the west in North Dakota, George Will and Herbert Spinden began research in the Middle Missouri Plains (Lehmer 1971). Their excavation at Double Ditch (32BL8) in 1905, which included the recovery of human skeletons, was published as a part of an ethnographic account of the Mandan people (Will and Spinden 1906). George Will remained active in Middle Missouri archeology (Will 1910, 1924, 1933). Will, together with Thad Hecker, produced a synthesis of prehistoric and early historic sites along the Missouri River valley in North and South Dakota (Will and Hecker 1944).

In South Dakota, M. W. Stirling of the United States National Museum can be counted among the first to conduct research along the Missouri River valley (Bass et al. 1971; Wedel 1955). Stirling excavated several cemeteries including those at

Leavenworth (39CO9) and Mobridge (39WW1). W. H. Over is another prominent name in the early archeology of South Dakota (Helgevold 1981; Zimmerman 1985). Although Over never published his research, his extensive field notes have been compiled. These notes document that Over removed human skeletons from the Leavenworth and Mobridge cemeteries, and from many other sites in South Dakota (Sigstad and Sigstad 1973). Another archeologist of note is Alfred Bowers. Bowers' work, like that of Will and Spinden, was a combination of ethnohistory and archeology. It serves as a significant source of information concerning the Mandan and Hidatsa of contact and precontact times (Bowers 1948).

While scores of human skeletons were removed from cemeteries throughout North and South Dakota, and Northwestern Minnesota, analysis was often limited to a few simple measurements of skull diameter. In many places cemeteries were also destroyed either intentionally or unintentionally by the expansion of the railroads over the Northern Plains (Jenks 1932). While a significant amount of archeological investigation took place during the late nineteenth and early twentieth centuries little concrete information about the skeletal biology of these peoples emerged.

The River Basin Surveys

Salvage Archeology to the Present

The year 1946 initiated a new phase in the archeology of the Northern Plains, especially along the Missouri Trench. In that year work was begun on the five dams that would eventually flood most of the Missouri River in the Dakotas (Helgevold 1981; Lehmer 1971). During the ensuing years "salvage" and "contract" archeology would become common place terms. Through the Smithsonian Institution sponsored River Basin Surveys sites too numerous to list were identified (Cooper and Stephenson 1953; Lehmer 1971; Huscher and McNutt 1958). Given the size of the problem only a small percentage of sites were excavated. Among these were a large number of cemeteries. With limited time and funding even those sites that were "salvaged" were not always completely excavated resulting in continued exposure due to shoreline erosion (i.e., Anton Rygh [39CA4] and Mobridge [39WW1]) (Williams 1988).

What emerged with this rapid and extensive influx of human osteological remains was the subdiscipline of bioarcheology. Human osteology had progressed from the simple study of the human skeleton to the study of human osteological remains in an archeological context. At first, the focus of attention was on sites along the Missouri Trench. Consequently these sites and accompanying cemeteries are better documented (Hughey 1980). For many of these sites emphasis has shifted from mere description to specific problem oriented research in skeletal biology (Bass 1981). This research includes work on skeletal growth (Jantz and Owsley 1984a, 1984b; Merchant and Ubelaker 1977), craniometric relationships, genetic affiliation, temporal changes, and microevolution (Jantz 1972, 1973, 1976, 1977b; Key 1983; Key and Jantz 1981; Owsley and Jantz 1978b; Owsley et al. 1981), and paleodemography and paleopathology (Gregg and Gregg 1987; Gregg et al. 1965; Gregg et al. 1981; Owsley and Bass 1979; Owsley et al. 1977; Palkovich 1981; Steele et al. 1965; Williams 1994a). The breadth of this research has substantially contributed to our knowledge of these people. Perhaps nowhere else in North America is the biology of prehistoric populations better understood. Elsewhere, especially for the Eastern Woodlands, research is still primarily geared toward the compilation of basic raw data (e.g., Gill 1981; Williams 1985b).

Reburial legislation, at the state and federal levels, has further altered the picture of Northern Plains bioarcheology. The need for preinterment analysis of pre- and protohistoric Amerindian skeletons has focused the efforts of bioarcheologists back on general description. Analysis is often restricted to a limited time frame and usually involves skeletons recovered from unconnected burial locations (e.g., Langdon et al. 1989; Matternes et al. 1992; Rose et al. 1983, 1984; Willey et al. 1987; Williams 1988, 1993b).

Bioarcheology Research

Paleoindian Tradition—North and South Dakota

While Paleoindian sites have been documented in North and South Dakota, to date no human remains from this tradition have been recovered or identified.

Archaic Tradition—North and South Dakota

The Archaic tradition fares slightly better in terms of human skeletal remains. Six sites, one in South Dakota and five in North Dakota, have yielded Archaic age skeletal remains (Table 46). Remains found at two additional sites, Fisher (32DU156) and Hehn (32GT128), while Archaic in culture-historic association have received no analysis.

The Medicine Crow site (39BF2) is a multicomponent site containing both Archaic and Village components. In 1957, prior to the formation of the Big Bend Reservoir, a poorly preserved young adult male cranium was discovered (Bass 1976). The skull was found in context with several Duncan points. This led to an approximate age of ca. 4000 B.P., although the component itself may be as old as 7000 B.P. William Bass restored the skull and, through comparisons with other early prehistoric crania from the region, observed its general congruity. In 1980 additional human skeletal remains eroded out of the shoreline embankment.

Table 46. Archaic Burial Sites in North and South Dakota

Site	Age	Reference
Medicine Crow (39BF2)	5000-2000 B.P.	Bass 1976, Rose et al. 1984
Section 22 Burial (32BA100)	8000-2500 B.P.	Williams 1987b
Fisher Hill (32DU156)	8000-2500 B.P.	
32GT101	8000-2500 B.P.	Key 1983
Hehn (32GT128)	8000-2500 B.P.	
Smilden-Rostberg (32GF123)	5800 B.P.[1]	Gill 1991
Bahm (32MO97)	1900 B.P.[2]	Williams n.d.b, 1994c
Pipestem Creek (32SN102)	3200 B.P.[3]	Fox and Williams 1982

[1]uncorrected radiocarbon date 5793 ± 137 B.P. Three dates were obtained: 7195 B.P., 5660 B.P, and 5860 B.P. The older dates is considered aberrant, while the younger two have been averaged (Larson 1991).
[2]uncorrected radiocarbon date 1920 ± 140 B.P.
[3]uncorrected radiocarbon date 3205 ± 70 B.P.

These remains, subsequently recovered by the U.S. Army Corps of Engineers, consist of two individuals, a 30-34 year old female and a young juvenile (Rose et al. 1984). The adult remains included an intact cranium. Rose argues that the attrition pattern and low vault height are compatible with the previously recovered cranium.

The Section 22 Burial (32BA100) consists of a single flexed burial discovered in 1966 at a Barnes County gravel pit. An adult male was identified. Heavy red ochre deposits were present on the remains. Preservation was very poor, however, with few intact bones present. This preservation hindered detailed analysis, and no attempt was made to compare this burial with other Archaic burials (Williams 1987a).

Site 32GT101 was recorded in 1953. An adult male skull together with several artifacts, including an atlatl weight, were recovered. Key (1983) included this site in his craniometric overview of the Plains. He found the biological distance of this skull to be in general concordance with other Plains Archaic samples.

Smilden-Rostberg (32GF123) is an Archaic campsite located in east-central North Dakota. Radiocarbon dates place this site in the Early Archaic. The site was excavated to mitigate improvements on a county road (Larson, Penny et al. 1986; Larson and Penny 1991). A fragmentary right maxilla with four teeth in place was recovered together with a large number of faunal remains. A single molar associated with this maxilla was found in an adjacent excavation unit. Gill (1991b) analyzed this maxilla fragment. The teeth, while worn, are heavily damaged. This damage is postmortem and greatly limited the level of study. Based on enamel attrition, the age of the individual was 30-35 years. The small size and gracility of the maxilla suggested a female. Gill indicates that this maxilla has a level of prognathism comparable to that of modern Black crania. He further concludes that this specimen is unusual for Northern Plains Amerindians, but consistent with an expectation of a Late Paleoindian/Early Archaic age.

As a salvage activity, in December 1982, the State Historical Society of North Dakota excavated human skeletal remains from a cutbank along the Heart River, near the town of Flasher, North Dakota. During the process of excavation it became apparent that this site represented a secondary cairn burial. Two sets of disarticulated adult and juvenile long bones were found within the cairn. Seven adult crania were recovered from the area directly above the cairn (G. Fox 1982b). Also present were two sets of disarticulated mandibles and two fragmentary juvenile skulls. The adult and subadult infracranial remains in both assemblages are incomplete although well preserved. Missing were elements of the hands and feet, the vertebral and thoracic skeletons, and the pelvises. This selective interment pattern suggests scaffolding or other preinterment practice. In each long bone assemblage a high proportion of an infant skeleton was found. The presence of such small bones as the vertebrae and ribs indicates that at least two primary interments were involved. On the basis of a similar level of skeletal growth, a subadult infracranial skeleton recovered from the second long bone assemblage was linked to one of the disarticulated skulls. This was not possible for the remaining infracranial remains. There were also fewer infracranial remains than tallied skulls and mandibles. In at least one case, adult infracranial remains from one long bone assemblage could be linked with those from the other. There appears to be no specific reason for the segregation of these remains into the groups observed. Also, given the mingling of the infracranial and cranial remains it would seem that this cemetery represents a single interment episode. Sixteen individuals were identified, nine adults and subadults and seven juveniles. Using the crania alone, five males and six females were identified (Williams n.d.b). The crania are very well preserved, although all but one is missing most of the cranial base. The skull profile is long and narrow and very low in height. This low vault height, as given by the auricular mean-height index, is comparable to that of Medicine Crow (39BF2) and later Middle Missouri/Mandan samples (Jantz and Willey 1983). However, no attempt has been made to place this site in a biological distance paradigm.

In the late autumn of 1993 a second salvage recovery was conducted at Bahm. Several wet summers had resulted in significant erosion of the cutbank and further exposure of additional burials. Recovered were the cranial and infracranial remains of at least seven individuals (Williams 1994c). These skeletons were segregated on the basis of age differences as two juveniles and one subadult and based on the largest number of bones present, four adults. The remains generally were in a good state of preservation. Four infracranial bones, representing two individuals, were partially bleached. This bleaching is indicative of a significant period of atmospheric exposure, in excess of one year. Juvenile remains included both cranial and infracranial elements. Adult remains were exclusively infracranial and primarily represented the upper appendicular skeleton. With the subsequent reinterment of the original series of skeletons it is impossible to determine if this second set can be linked with those of the first.

The original series of remains recovered from site 32MO97 were noteworthy for the common presence of fine cutmarks near the articular surfaces of both cranial and infracranial elements. These remains have the same pattern. Four bones from three separate individuals show these fine marks near either the proximal or distal articular surfaces.

Pipestem Creek (32SN102) consists of salvage excavated human burials. This burial location was discovered in 1977 eroding from the slope of the Pipestem Reservoir in the area that was formerly the Pipestem Creek. The poorly preserved remains of four individuals were recovered (Fox and Williams 1982). These consisted of both cranial and infracranial elements. Poor preservation limited description, but three adults and one juvenile were identified. The best preserved and most complete individual was a young adult female. Although the cranium is warped, it is more mesocranic than the Bahm site crania. Like those crania it is very low vaulted. This characteristic, however, is in part a function of warpage. A bone sample from this young adult was used to obtained a radiocarbon age. This date places Pipestem Creek within the Middle to Late Archaic. Like the remains from 32MO97 these have not been placed in any biological distance with other skeletal samples.

Woodland Tradition—North and South Dakota

The Woodland tradition in the extreme Northern Plains is a series of contrasting sites. There are burial locations like Arvilla (32GF1), the type location of the Arvilla Burial complex, that have good provenience and a well established culture-historic association. The Arvilla site also marks the dividing line between current and past excavation practices. This site, consisting of three mounds, was excavated in 1932 as if it was a single burial episode. The Jamestown Mounds (32SN22) excavated in 1982 demonstrate that some burial mounds cannot be treated as simple cemeteries. From this salvage effort, four radiocarbon dated components were identified, showing a temporal use or reuse of this site in excess of 1700 years (Snortland n.d.). Then there are sites like the Colony Mound (32GF305) that was test excavated by Kenneth Cole in 1967. Although identified as Woodland, no clear culture-historic association was established. Such arbitrary assignments present serious problems with the Woodland tradition; it is often used as a catch all category for pre-Village burials. In part, this is due to the frequent lack of diagnostic artifacts and radiocarbon dating for the majority of these burial locations, but it also points to another feature of many Woodland cemeteries. They often involve single burials (e.g., 32RM201 and 39HU203). Because of a lack of resources and because of poor provenience, these sites may not receive adequate attention (Williams 1988, 1991a). Sites located within specific governmental control (i.e., U.S. Army Corps of Engineers) or where policies and funding permit (i.e., State of South Dakota) become the focus of bioarcheological research contracts (cf. Langdon et al. 1989; Willey et al. 1987; Williams 1993b). The large sites, typically located along major drainages (e.g., 32GF1, 32SN22, 39RO23) have received fairly adequate attention. Smaller sites may receive none at all. The result is that there is spotty reporting. What appears as an impressive list of sites (Tables 47, 48, and 49) must be viewed from these different perspectives and the difficulty of tying them together into a single temporal synthesis. At the same time, the data derived from Woodland burials must be tempered by the knowledge that nearly all the skeletons have been reinterred. For many of these skeletons, not even the most basic elements of data collection was obtained.

Middle Woodland Tradition

The Middle Woodland is both a temporal and spatial category. Temporally this marks the start of a recognizable archeological construct, the Sonota complex. It is also spatially distinct in that all currently identified Middle Woodland burials are located within the Middle Missouri subarea. The Sonota complex is synonymous with the Middle Woodland. Neuman (1975) established this archeological complex from excavations he and others conducted on several sites in north-central South Dakota and south-central North Dakota (Table 50). Bass and Phenice (1975) conducted the skeletal analysis of the remains recovered from three burial mounds; Swift Bird (39DW233), Grover Hand (39DW240), and Arpan (39DW252).

Swift Bird Mound site is located in Dewey County South Dakota approximately 7.5 miles downstream from the city of Mobridge. The site consists of two mounds, Mound 1 and Mound 2, situated above the west bank of the Missouri River. Two radiocarbon dates were obtained, one from each mound 1825 B.P. and 1600 B.P. respectively. Mound 1 contained eight burials for a total of 18 individuals. While the eight burials of Mound 2 yielded an additional 40 individuals. Of these 58 individuals only one was classified as a primary burial. The remainder were secondary, consisting of commingled infracranial and in some burials cranial remains (Neuman 1975). Some bone charring was evident, the apparent result of an in situ burning of the wood covering of the main burial pit in Mound A. Red ochre stains were prevalent as well. Bass and Phenice (1975) reported an unusually high percentage of juveniles in the burial sample, accounting for 72% of the total with 42% within the first two years of life. Cranial morphology varied from mesocranic to brachycranic. At this cemetery, as with all three, the remains showed significant postmortem dissection.

Grover Hand is situated over one-half mile downstream of Swift Bird. Three of its four mounds were excavated in 1962. Radiocarbon dates from these three mounds range from 650 B.P. to 1720 B.P. Eighty-seven individuals were identified from 17 burials. All burials were secondary, consisting of commingled infracranial and cranial elements. Some infracranial elements were partially articulated (i.e., axial skeleton). Despite poor to fair preservation, enough crania were present and in sufficient condition to describe them as dolicocranic and of medium vault height (Bass and Phenice 1975). An interesting demographic feature of these three mounds is the differential survival present. Mound 1 is comprised of slightly more than half juveniles, while Mounds 2 and 3 are less than one-third juvenile (32% and 25% respectively). It is unclear why this difference exists; differential preservation of juvenile remains is one possibility.

One mile farther downstream from Grover Hand is situated the three mounds of the Arpan Mound site (39DW252). Only one of the three mounds was excavated. A radiocarbon date of 1850 B.P. was obtained. Thirty-five individuals were recovered from six burials. These all were entirely secondary, with long bones arranged in rows. Red ochre staining was prevalent. Slightly less than two-thirds (62%) of the individuals were juvenile, with an extraordinary 53% two years of age or less. Although preservation was less than ideal, cranial morphology ranged from dolicocranic to mesocranic.

Neuman (1975) argues that additional sites can also be regarded as part of the Sonota complex. These are the Schmidt Mounds (32MO20), the Alkire Mounds (32SI200), the Boundary Mounds (32SI1), and the Baldhill Mounds (32BA1). The Schmidt and Alkire mounds yielded few human remains, and although these received only minor study they have since be reinterred. The Baldhill and Boundary mounds also have yielded a number of human skeletons. These are currently under study at Indiana University and the Smithsonian Institution.

Table 47. Woodland Burial Sites in North and South Dakota

Site	Age	Reference
Lake Bronson (21KT1)	Late Woodland	Obey, 1974, Williams n.d.k
Snake River Mound (21MA1)	Late Woodland	Obey, 1974, Williams n.d.j
Haarstad Mound (21MA6)	Late Woodland, 1165 B.P. and 3200 B.P	Obey, 1974, Williams n.d.h
Karlstad Ossuary (21MA10)	Late Woodland	Scott and Loendorf 1976, Williams 1991a
Slininger Mounds (21NR1)	Late Woodland	Obey, 1974, Williams n.d.l
Habben Mound (21NR2)	Late Woodland	Obey, 1974, Williams n.d.f
Warner Mound (21PL3)	Late Woodland	Obey, 1974, Williams n.d.c
Peter Lee Mound (21PL13)	Late Woodland	Obey, 1974, Williams n.d.d
Stumne Mound (21PN5)[1]	Late Woodland	Obey, 1974
Red Lake River Mounds (21RL1)	Late Woodland	Obey, 1974, Williams n.d.e
Wilson Mound (21TR2)	Late Woodland	Obey, 1974, Williams n.d.i
Baldhill Mounds (32BA1)	Middle Woodland, 1860 ± 150 B.P.	
32BA403	Woodland	Williams 1991a
32CV401	Woodland	Williams, 1991a
Langley-Sermguard Site (32ED3)	Woodland	
Linton Site (32EM369)	Woodland	
Arvilla Site (32GF1)	Late Woodland	Obey 1974, Williams n.d.a
32GF4	Woodland	Williams 1991a
Hegre Mound (32GF10)	Woodland	
Boundary Mounds (21SI1)	Middle Woodland, 1540 ± 160 B.P, 1340 ± 150 B.P., 1700 ± 125 B.P.	
Alkire Mounds (32SI200)	Middle Woodland, 1650 ± 200 B.P.	
32SN19	Woodland	Williams 1991a
Jamestown Mounds (32SN22)	Middle Woodland, 960 ± 210 B.P. to 1920 B.P.	Williams 1985a
32SN42	Woodland	
Spiritwood Lake (32SN103)	Woodland	
Fordville Mound (32WA1)	Woodland	Williams 1991a
Blasky Mound no. 1 (32WA1)	Woodland	Williams n.d.g
Karas Site (32WA32)	Woodland	Williams 1991a
Heimdal Mounds (32WE401)	Late Woodland	Key 1983
Truman Mound (39BF224)	Late Woodland	Key 1983
Sitting Crow (39BF225)	Woodland	Willey et al. 1987
Old Quarry Site (39BF234)	Late Woodland	Key 1983
Oldham Site (39CH7)	Late Woodland	Key 1983
Ufford Mounds (39CL2)	Woodland	Willey et al. 1987
Enemy Swim Mound (39DA3)	Late Woodland	Key 1983
Swift Bird Site (39DW233)	Middle Woodland, 1825 ± 120 B.P., 1600 ± 100 B.P.	Bass and Phenice 1975
Grover Hand Mounds (39DW240)	Middle Woodland, 680 ± 200 B.P., 1720 ± 75 B. P., 1670 ± 80 B.P.	Bass and Phenice 1975
Arpan Site (39DW252)	Middle Woodland, 1850 ± 90 B.P.	Bass and Phenice 1975
Inkster Site (32GF19)	Middle Woodland, 1380 ± 100 B.P., 1670 ± 140 B.P.	Williams 1982
Colony Site (32GF305)	Woodland	Williams 1991a
Grunzie Mound (32GF308)	Woodland	Williams 1991a
32LM403	Woodland	
High Butte (32ME13)	Middle Woodland	
Lobodi (32ME411)	Woodland	
32ML850	Woodland	Williams 1994b
32MN401	Woodland	
Schmidt Mounds (32MO20)	Middle Woodland	
32MO98	Woodland	
Lakota Site (32NE301)	Woodland	Williams 1991a
32NE411	Woodland	
Dennis Warner (32PB2)	Woodland	
Lisbon Burial (32RM201)	Late Woodland	Williams 1991a
32RM205	Woodland	
Ranes Mound (32RM217)	Late Woodland	Key 1983
Anderson Mound (32RM236)	Woodland	
Kjelbertson Site (32RY100)	Late Woodland?,1140 ± 110 B.P.	Williams 1985c
32RY205	Woodland	
Lake Tewaukon (32SA211)	Middle Woodland	Williams 1994d
Scalp Creek (39GR1)	Late Woodland	Key 1983
39GR21	Woodland	Rose et al. 1984
Lake Poinsett A (39HL4)	Woodland	Williams 1993a
Hofer Mound (39HT2)	Late Woodland	Key 1983
Howes Site (39HU203)	Woodland, 1260 ± 75 B.P.	Williams 1988
39LM256	Woodland, 1725 ± 120 B.P., 1620 ± 80 B.P., 1170 ± 60 B.P.	Williams 1988
Madison Pass Mound (39LK2)	Late Woodland	Key 1983
Lake Madison Site (39LK7)	Early Woodland	Willey et al. 1987
Spawn Mound (39LK201)	Woodland	
Newton Hills Site (39LN10)	Woodland	Willey et al. 1987
Sherman Park Mounds (39MH5)	Woodland	Willey et al. 1987
Burkman Site (39MH34)	Late Woodland	Willey et al. 1987
Montrose Mound (39MK1)	Late Woodland	Key 1983
Madsen Mound (39RO2)	Late Woodland	Key 1983
Buchannon Mound (39RO3)	Late Woodland	Key 1983
Hartford Beach Mound (39RO4)	Late Woodland	Key 1983
Daugherty Mound (39RO10)	Late Woodland, 1350 ± 110 B.P.	Key 1983
De Spiegler Site (39RO23)	Late Woodland	Obey 1974, Williams n.d.a
Kallstrom Mound (39RO301)	Late Woodland	Obey 1974
Arbor Hill Site (39UN1)	Late Woodland	Key 1983

Note: All B. P. dates are uncorrected radiocarbon dates.

Table 48. Sonota Burial Sites

Site	Age
Baldhill Mounds (32BA1)	1860 B.P.
Schmidt Mounds (32MO20)	
Boundary Mounds (32SI1)	1700-1340 B.P.
Alkire Mound (32SI200)	1650 B.P.
Jamestown Mounds (32SN22)	1930-950 B.P.[1]
Grover Hand Mounds (39DW240)	1720-650 B.P.
Swift Bird Site (39DW233)	1825-1600 B.P.
Arpan Site (39DW252)	1850 B.P.

[1]This site has four dated components: I-III fall within the Middle Woodland; IV has uncorrected radiocarbon dates raning from 850-150 B.P.

Table 49. Arvilla Complex Burial Sites

Site	Location
Lake Bronson Mounds (21KT1)	Northwestern Minnesota
Snake River Mound (21MA1)	Northwestern Minnesota
Haarstad Mound (21MA6)	Northwestern Minnesota
Slininger Mounds (21NR1)	West-Central Minnesota
Habben Mound (21NR2)	West-Central Minnesota
Warner Mound (21PL3)	Northwestern Minnesota
Peter Lee Mound (21PL13)	Northwestern Minnesota
Stumne Mound (21PN5)[1]	Central Minnesota
Red Lake River Mounds (21RL1)	Northwestern Minnesota
Wilson Mound (21TR2)	Northwestern Minnesota
Arvilla Site (32GF1)	Northwestern Minnesota
De Spiegler Site (39RO23)	Northwestern Minnesota

Note: Key (1983) also identifies three Roberts County, South Dakota sites as part of the Arvilla Complex: Buchannon Mound (39RO3), Hartford Beach Mound (39RO4), and Dougherty Mound (39RO10).
[1]Located in east-central Minnesota and outside the Northeastern Plains, this site was included by Johnson (1973) within the Arvilla complex.

Beyond the artifact assemblages of the Sonota complex there is a clear pattern of burial characteristics. These include a single subfloor burial pit into which the majority of burials are located, the almost exclusive use of secondary commingled interments, and the presence of partially articulated skeletons.

This pattern is repeated in another prominent Sonota burial site, the Jamestown Mounds (32SN22). This site, now located within the city limits of Jamestown, North Dakota, originally consisted of nine mounds and interconnecting earthworks. In 1982 housing construction on the site required the State Historical Society of North Dakota to salvage three mounds (Snortland n.d.). Burials were recovered from two mounds (Mound A and Mound B). Four components and construction episodes were identified and dated using a series of 15 radiocarbon dates.

Mound A was the larger of the two mounds and contained in sequence the three oldest components. Component I with a radiocarbon date range of 1930-1350 B.P. included a wood-covered subfloor pit containing an ossuary. Twenty-eight individuals were identified from this ossuary, which accounted for 51% of all the Mound A individuals. A second set of commingled remains was found at the interface between this component and Component II (1550-1180 B.P.). Twelve individuals were identified. Together these two commingled sets comprised 73% of the Mound A remains. One burial found in this second commingled set was a partially articulated appendicular and axial skeleton. What makes this burial unique is its prone interment. Both femora were also recovered and were at the time of interment flexed at the hip. The remaining 15 individuals consisted of nine secondary burials and six primary burials, three of the latter appear intrusive. As with the previously described Sonota burials, partially articulated skeletons were present, including upper and lower appendicular and axial elements. Some apparent dissection marks were observed on both cranial and infracranial elements, although not to the extent seen in the three Dewey County, South Dakota sites. Burning of some bone was also observed, as was red ochre staining. Sixty-two percent of the individuals (N=34) were juveniles. Crania, although damaged, ranged from dolicocranic to mesocranic in form, but were low vaulted (Williams 1985a).

Mound B was a contrast in many ways. This mound also contained three components; I, III, and IV. Although there was some temporal continuity between the two mounds, it was not complete. Preservation was very poor, most likely due to burial conditions. There were no mass commingled burials, only primary burials and secondary bundles. Twenty individuals were identified, 50% of which were juvenile. Poor preservation greatly limited description of Mound B skeletons.

Intact crania from site 32SN22 were used to create a biological distance dendrogram. As Component I had the largest single number of intact crania, these were compared as a separate taxonomic unit. A pooled component group was also used. For both sets a close association with the existing Sonota crania was found. This was especially true of the females. Key (1983) included Sonota crania in his comprehensive study. He found that they formed a consistent clustering with other Northern and central Plains Woodland populations, in particular the "South Arvilla."

One exception to the previous statement regarding the correspondence of the Middle Woodland tradition and the Middle Missouri subarea is the Inkster site (32GF19). This cemetery, which has radiocarbon dates ranging from 1380 B.P. to 1670 B.P., is located in the Northeastern Plains subarea within the Red River Valley of the North. In late 1981 members of the Forest River Hutterite Colony discovered human remains while installing an irrigation system. These skeletal remains, 28 individuals in all, were apparently interred in a natural feature on top of a hill overlooking the Forest River. These skeletons, with few exceptions, were secondary bundle burials. At least one of the three primary burials appears to have been intrusive. Grave goods were present and included copper beads found with a young adult male. These artifacts were not diagnostic, however. Several damaged crania were recovered. These did not display the low vaulted dolico/mesocranic Sonota form but rather a more mesocranic high vaulted shape (Williams 1982). Like Sonota skeletons, cutmarks were frequently observed. Outside of its Middle Woodland age and lack of Sonota appearance, no culture-historic association has been established for this site.

Late Woodland Tradition

Just as the Middle Woodland is considered synonymous with the Sonota complex, the Late Woodland is often equated with the Arvilla complex. The Arvilla complex arose out of the work of Alfred Jenks. During the 1930s Jenks, then with the University of Minnesota, excavated several burial mounds in northeastern North Dakota and northwestern Minnesota. The burials and artifacts recovered from these mounds became the basis of the Arvilla culture (Table 49). Two Arvilla burial sites were later to be radiocarbon dated: Haarstad Mound 1165 B.P., De Spiegler site 1350-670 B.P. These dates place the Arvilla complex within the Late Woodland tradition. Geographically the Arvilla complex, in its original construction, is distributed roughly along the Red River Valley of the North from the Manitoba border south to South Dakota. Johnson (1973) has extended the Arvilla complex eastward into east-central Minnesota with the inclusion of the Stumne Mound (21PN5) and northward into the Province of Manitoba with the inclusion of the Fiddler Mounds (EaLf-3). Wilford (1970) at one time separated the Arvilla complex into a northern and southern component. He later placed all of the Arvilla sites within one single complex (Johnson 1973). Ossenberg (1974) was to follow this earlier segregation of sites in her nonmetric distance assessment of Upper Great Lakes populations.

The type site of the Arvilla complex is the Arvilla site (32GF1). This cemetery is located near the town of Arvilla, North Dakota approximately 15 miles west of the city of Grand Forks. The site at the time of Jenks' excavation in 1932 consisted of three barely discernible mounds. Field cultivation had reduced the mounds to the point that only the landowner's memory of the site location permitted excavation. Twenty-five years previously in 1908, local informants related that a larger burial on the Arvilla site had been disturbed by a gravel pit used by the Great Northern Railroad. Although the report must be taken with some skepticism, apparently 100 burials were disturbed, each containing from four to eight skeletons (Jenks 1932). If this was the case, the whereabouts of such a large number of skeletons is unknown. That such a discovery would have gone unnoticed by Henry Montgomery, who was at that time with the University of North Dakota, and active in northeastern North Dakota archeology, is hard to understand. This story led Jenks to excavate the site. In 1933 and again in 1935, excavations were carried out at the three mounds. Forty-seven skeletons were eventually recovered (Williams n.d.a). Of these, 22 were adult (eight male and 12 female) and 25 were juvenile (53%). Burials consisted of primary and secondary interments. The primary burials were placed together in pits, indicating a single burial episode for each pit. One of the unusual features of these primary burials is the frequent flexed sitting burial mode. Sixteen relatively undamaged and intact crania were present, and their shape were mesocranic and moderately low in height.

Ten other cemeteries complete the original list of Arvilla complex sites (Johnson 1973). These account for an additional 168 individuals. The pattern seen in the Arvilla site is repeated. Flexed sitting, flexed primary, and secondary bundles occur routinely among the burials of these sites. The same is true of the biological characteristics, such as cranial morphology. The crania are generally mesocranic to almost brachycranic and of medium-low vault height. Two sites deserve some mention as they point to a question regarding the unity of these sites within a single burial complex. The first is Red Lake River Mounds (21RL1). This site, located in northwest Minnesota on the periphery between the Northeastern Plains and the Eastern Woodlands, consists of six mounds. Jenks excavated three of these in 1936. These mounds were heavily disturbed by badgers. One bundle burial displayed what is described as bone tapping. This removal of bone near the popliteal joint has been described as a characteristic of the Laurel complex of central Minnesota (Stoltman 1973). This feature was also present on the remains of one individual from the Inkster site (32GF19). Unique among Arvilla complex sites is De Spiegler (39RO23). This site, located in Roberts County, South Dakota, was salvaged by the University of Minnesota in 1953 (Johnson 1973), and is one of two sites that provided radiocarbon dates for the Arvilla complex Inside the single burial area, 24 burial pits were identified; seventy individuals were recovered. All but 11 were from secondary interments. These secondary burial pits contained crania, mandibles and arranged groups of long bones. The primary burials presented an unusual burial pattern. All but one lacked a skull and the bones of the arms and forearms. One particular individual, a subadult, was buried prone with the legs flexed at the hips. The arms had been removed leaving the hands and distal forearm epiphyses. This skeleton was also unique in its size. At 13 years of age, stature estimation placed this individual in excess of 6 feet (Williams n.d.a).

The Arvilla complex has generated a great deal of discussion from a strictly archeological, as well as bioarcheological, perspective. Syms (1982) has raised the question of whether the Arvilla complex is a unified complex. He examined the type traits and found a lack of congruence among the purported sites. Obey (1974), who examined the Arvilla complex burials as the subject of her 1962 Master's thesis, alludes to a lack of biological integrity, especially with respect to the De Spiegler site. As noted above, the burial practices at this site are markedly different from those of the other sites. Cranial morphology is also different. Length is shorter, causing the crania to tend toward a brachycranic form (Obey 1974; Williams n.d.a). Using Neuman's (1967) Lakotid cranial form, Obey recognized a graded variation in the Arvilla crania.

An even more controversial topic involving the Arvilla complex is its relationship to modern populations. Ossenberg (1974) using nonmetric cranial traits established biological linkages between several prehistoric skeletal populations and modern tribes. Included among the prehistoric populations were Arvilla samples. For unstated reasons, Ossenberg divided the Arvilla into North Arvilla and South Arvilla. The latter group contained as its main contributor the De Spiegler site. Her results were that North Arvilla is a composite group of Blackduck and South Arvilla. She goes further to directly connect the North Arvilla with the Cheyenne. The South Arvilla is associated through trait frequencies with the Blackfoot. Ossenberg's (1974) conclusions have been criticized from several directions. Michlovic et al. (1977) argue from a strictly historical perspective that the Cheyenne never occupied the region where North Arvilla sites are located. Methodological criticism include the lack of other Northern Plains historic samples such as Mandan and Arikara. Ossenberg also created artificial prehistoric groups. The North Arvilla, while primarily composed of the North Dakota and Minnesota Arvilla samples, also includes unprovenienced crania from eastern North Dakota excavated by Montgomery in

1908. Her Devils Lake group is likewise a group more of geographic unity than biological. There is also the question of a closed dendrogram paradigm. In any procedure of this type, with a finite set of samples, all samples will be clustered, regardless of whether that clustering is correct. The addition or deletion of samples will directly influence the final clustering.

Key's (1983) craniometric analysis unfortunately sheds little light on the Arvilla questions. Key used a very small sample of purported "South Arvilla" sites from Roberts County, South Dakota. None of the previously described samples were studied. Thus their position within his larger scheme of Woodland and Village populations is unknown. There remains much disagreement as to whether the Arvilla represents a single archeological complex and whether the samples are biologically related. There is no doubt that these populations were decidedly different from the Middle Woodland Sonota.

While the Arvilla complex dominates bioarcheological interests in the Late Woodland, other skeletal samples exist, which while lacking a direct cultural affiliation, provide useful insights into this temporal period. The first of these is the Kjelbertson site (32RY100). This site was excavated from a gravel pit in September 1993 by the State Historical Society of North Dakota. Excavation yielded eight burial features. These, together with three rodent burrows and bulldozer backfill, provided the skeletal remains of 31 individuals (Williams 1985b). An uncorrected radiocarbon date of 1140 B.P. places this site well within the Late Woodland. The site was discovered when heavy earth moving equipment uncovered a burial feature. Unfortunately, this was the most significant burial, and several crania were heavily damaged. Slightly more than half of the recovered individuals (58%) were juveniles. Burial modes ranged from primary extended to secondary. No clear pattern could be identified, in part due to the destruction of the largest burial feature. Intact crania were mesocranic in form and of low-medium vault height. This site is most significant in the pathological features present. Unlike Woodland populations, this sample displays an extremely high level of dental disease. Thirty percent of the permanent dentitions displayed one or more carious teeth and more than 50% displayed one or more alveolar abscesses (Williams 1985b). Coupled with this is the presence of several pathological bones. These include mild porotic hyperostosis, possible rickets, and healed cribra orbitalia. In combination, these pathological conditions point to a population in metabolic/nutritional flux, perhaps related to experimentation with domesticated foodstuffs. In a very limited distance assessment the crania from Kjelbertson is associated with some degree of distance from the Arvilla and Sonota samples, and with some degree of closeness to the Mandan sample (Williams 1991a). The location and radiocarbon date of the Kjelbertson site alludes to a Devils Lake-Sourisford association. There is a general similarity between the crania from this site and the Devils Lake-Sourisford Moose Bay Burial Mound (EdMq-1) of southeast Saskatchewan (Hanna 1976). Unfortunately other existing Devils Lake-Sourisford samples have been reinterred without further analysis. Key (1983) included two crania from the Heimdal Mounds (32WE401) in his craniometric distance assessment. These formed an association with the Sonota and South Arvilla samples.

The Karlstad Ossuary, while not radiocarbon dated, is identified on the basis of artifacts as having a Late Woodland association. In October 1974, human burials were uncovered by workers at a gravel pit near the town of Karlstad in extreme northwest Minnesota (Scott and Loendorf 1976). At the request of the University of Minnesota, a team from the University of North Dakota Anthropology Department visited the site. Over a two-day period, they recovered several human burials and associated artifacts that had collapsed out of the gravel pit. The Karlstad Ossuary, like the Arvilla complex burial sites, is located on the eastern margin of glacial Lake Agassiz. In fact, three burial mounds attributed to the Arvilla complex are located nearby. Two, the Haarstad Mound (21MA6) and the Snake River Mounds (21MA1), are located south of the Karlstad Ossuary, while the third, the Lake Bronson site (21KT1), is located approximately 16 miles to the northwest in southern Kittson County. Nine individuals were identified, five adult and four juveniles. These burials were represented by well preserved crania. These crania were dolico-mesocranic in shape and low in vault height (Williams 1991b). This cemetery is unusual in the underrepresentation of infracranial elements and in the relatively young age (<35 years) of the interred individuals. While five adult crania are present, at no point were more than three of any sided infracranial element identified. Only a single pair os coxae and 12 thoracic vertebrae represent the axial skeleton. No hand or foot bones were recovered. Atypical eburnation displayed by one cranium suggests these individuals were purposefully handled before their final interment. The absence of atmospheric weathering and rodent damage suggests that scaffolding was not practiced. Dissection is evident for the crania, however. The culture-historic position of this cemetery is undefined. The artifacts recovered were few and undiagnostic beyond identification as Late Woodland in age (Scott and Loendorf 1976). A limited distance assessment of the male and female crania supports this general assessment. Both male and female crania cluster closely with the Kjelbertson site (32RY100).

In July 1983, an archeological survey conducted by the Center for Western Studies at Augustana College discovered human skeletal remains eroding out of a cutbank along the west bank of Lake Francis Case at site 39LM256. The remains of several individuals, primarily skulls, together with artifacts and faunal remains, were recovered from a bell-shaped pit. Site 39LM256 is an occupation and burial site with historic (ca. 1890-1920) and unknown prehistoric components (Winham and Lueck 1984). Three radiocarbon samples were obtained from the bone collagen of three femora. The tests produced dates of 1725 B.P., 1620 B.P., and 1170 ± 60 B.P., indicating a Middle to Late Woodland temporal context. However, the lack of congruity in the radiocarbon age determinations is problematic. The bone collagen, σ^{13}Cs, are in agreement and indicate a premaize diet. Seven crania and commingled infracranial remains were recovered from the burial pit. From these, seven crania were identified for the same number of individuals, four adults and three juveniles (Williams 1988). The crania were poorly preserved so that craniometric description was limited. One adult cranium was in good enough condition to describe it as dolicocranic, a shape not inconsistent with a Woodland age.

The Woodland burials described up to this point have involved multiple interments. The Lisbon site (32RM201) is an exception. In April 1974, a work crew exposed a human burial at a gravel pit adjacent to the Sheyenne River in central Ransom County near the town of Lisbon, North Dakota (Good 1975). Kent Good, then with the University of North Dakota Department of Sociology and Anthropology, visited the site, recovered bones already removed from context, and proceeded to excavate a single human burial from the gravel pit. The skeleton of an adult female was found in a circular burial pit in a flexed position on its left side. A "toolkit" was recovered with the skeleton as were several squash seeds. These seeds provided an uncorrected radiocarbon date of A.D. 850 ± 105 years B.P. Only the feet and a few small bones of the hands are missing from this nearly complete and well preserved skeleton. Presumably the bones that are missing were lost in the gravel pit and not recovered. The skull is very narrow and of medium height (Williams 1991a). The culture-historic position of this single burial is problematic. The artifacts recovered, while indicative of the Initial Middle Missouri tradition, are not uniquely diagnostic (Good 1975). The radiocarbon date obtained from the squash seeds also falls in the interface between the Late Woodland and the Initial Middle Missouri. Nor is cranial morphology helpful, as the cranial shape and vault height are characteristic of both Woodland and Middle Missouri crania. In a limited sample biological distance study, the Lisbon burial clustered closely with site 32RY100 (Williams 1991a). This site, like 32RM201, has a radiocarbon date which falls in the interface of the Late Woodland and Initial Middle Missouri. The close grouping of these two sites supports Good's interpretation of the recovered artifacts and is in concordance with the radiocarbon date obtained for this site.

Miscellaneous Woodland

The Woodland tradition suffers from a temporal cultural lack of precision. When a burial lacks diagnostic artifacts and a diagnostic biological presence and is in a mound, it is usually designated Woodland. This grouping has created a broad category of burial sites that may or may not be temporally or culturally coherent. Despite potential and perhaps real problems with interpretation, these sites can still provide useful information about this general stage in regional prehistory (cf. Langdon et al. 1989; Matternes et al. 1992; Rose et al. 1983, 1984; Willey et al. 1987; Williams 1988, 1991a, 1993b).

During the summer of 1967 Kenneth Cole, with the University of North Dakota Department of Sociology and Anthropology, conducted a survey of the Forest River in Grand Forks and Walsh counties of North Dakota (Cole 1968). Thirty-four sites were recorded along the Forest River between the towns of Fordville and Inkster. During this survey, the Colony Mound (32GF305), was test excavated. This excavation uncovered two burials, a primary juvenile interment and a secondary adult bundle. These remains were recovered and removed to the University of North Dakota. Although Cole indicated that he was to return during the next field season for a more intensive excavation, no record of such an event exists nor are any additional burials from this site housed at the University of North Dakota (Cole 1967). The adult burial included an intact cranium. This cranium was mesocranic and relatively high vaulted. In a simple distance assessment, this cranium was closest in association with the Kjelbertson site (32RY100). This classification in part supports Cole's conclusion that, although Late Woodland, this site was probably Blackduck or Laurel in affinity.

Grand Forks and Walsh counties of North Dakota contain a large number of prehistoric cemeteries. The most notable is the previously discussed Arvilla site (32FG1). Located near the Colony Mound, and on the property of the Forest River Hutterite Community, is the Inkster site (32GF19). Although less important in terms of recovered burials, the Fordville Mounds (32WA1) are located approximately six miles northwest of the Colony Mound. The extensive earthworks of the Fordville Mound Group makes this perhaps the most spectacular prehistoric site in North Dakota. The site is located on the east side of the Forest River in south-central Walsh County near the town of Fordville. The site was first identified in 1883 by Henry Montgomery who, at that time, was with the University of North Dakota. Montgomery mapped 35 circular mounds and four linear earthworks, the largest of which was 2,688 feet in length (Montgomery 1906). He excavated three mounds and recovered seven burials. The present location of these skeletons is unknown but they may be housed at the Royal Ontario Museum where Montgomery was later to relocate. Three years later, T. H. Lewis surveyed the site during his survey of North American Indian earthworks (Keyes 1928; Wilford 1970). During his survey Lewis identified 43 mounds and four linear earthworks. In 1909, construction of the Soo Line Railroad bisected the site and damaged or destroyed a number of the mounds and earthworks. An undetermined number of burials were disturbed and removed from the site (Hlady 1950). The whereabouts of these skeletons is unknown.

The next activity at the site occurred in 1935 when Alfred Jenks and Lloyd Wilford, with the University of Minnesota Department of Anthropology, excavated two mounds south of the railroad right of way on property owned by W. B. Blasky (Wilford 1970). These mounds, although part of the Fordville Mound complex have been referred to in subsequent publications and notes as the Blasky Mounds. These mounds are regarded as having a more eastern Mille Lacs association, while the remainder are probable Arvilla (Johnson 1973). Central burial pits were encountered in both mounds. An undetermined number of skeletons were recovered from each mound pit. These burials were secondary ossuary interments. In 1967 Cole surveyed the site during his larger survey of the Forest River. At the time of his survey the majority of the mounds had been leveled by agricultural activity. Only the larger mounds, such as Montgomery's Mound 1, were still visible (Cole 1968). During a recent survey of the Forest River conducted in 1985 by Larson-Tibesar Associates, 10 mounds were mapped. In addition, Archaic and Scottsbluff artifacts were recovered (Larson, Penny et al. 1986).

In 1947 Gordon Hewes, a member of the University of North Dakota Department of Sociology and Anthropology, visited the Fordville Mound Group (32WA1) and partially excavated a burial mound, identified as Mound C. No human skeletons and only a few artifacts were recovered. In November 1949, George Dixon and Walter Hlady, students of the Department of Sociology and Anthropology, revisited the site and continued excavation of Mound C. At least three burials were recovered from a single burial pit. Artifacts were recovered from an associated occupation site. In addition to Knife River Flint lithics, pottery assigned to the Blackduck focus was recovered. The University of North Dakota excavations recovered the commingled cranial and infracranial remains of at least four individuals. Two are juveniles and two are adult. The adults are represented entirely by infracranial elements. In the absence of diagnostic artifacts and crania, the culture-historic affiliation of the Fordville Mounds remains unclear. The work of previous researchers indicates a Late Woodland association of both the Arvilla and Mille Lacs cultures. Beyond this little can be stated except that the osteological remains display no features inconsistent with such an identification.

During the same 1967 Forest River survey, Cole partially excavated a disturbed burial mound, the Grunzie Mound (32GF308), and recovered several burials. This site i located approximately one mile east of the Colony Mound site (32GF305) and is associated with an occupation site and perhaps is part of a contiguous site created by 32GF307, 32GF308, and 32GF309. While Cole (1968) makes reference to an upcoming report on the excavation at 32GF308, no such report appears to have been prepared. As a result, there is no provenience regarding the location of the recovered burials, burial modes, or any recovered artifacts.

Cole apparently recovered 10 burials from site 32GF308. The numbering of these burials is somewhat enigmatic, as there are no human skeletal remains representing Burial 6 and Burial 9. Because of these inconsistencies and because additional individuals were noted during laboratory analysis, a new series of burial numbers were applied for a total of 11 individuals. These were identified as five adults and four juveniles, including a partial late term fetus (Williams 1991a). Cole (1968) indicates that this site is apparently associated with the Late Woodland Blackduck focus or Manitoba focus. However, the absence of intact crania and diagnostic artifacts makes the precise identification of the culture-historic position of this site impossible. This indefinite classification is further compounded by the incomplete nature of Cole's initial survey.

Site 32SN19 consists of two circular mounds located on a bluff overlooking Pipestem Creek southwest of the Jamestown Stockyards to the west of the city limits of Jamestown, North Dakota. Site 32SN19, referred to in some reports as the Jamestown Mound, has a complex and, at times, poorly recorded history. The site was recorded in 1952 by H. Thomas Cain as part of the River Basin Surveys. Two years previous to this, the larger of the two mounds had been excavated by a local amateur archeologist David Robertson Jr., at which time an undisclosed number of human skeletons had been recovered. Human skeletal remains were also recovered from the larger mound at the time of the Cain survey (Cain 1952). These were studied by Bass and Phenice (n.d.), at that time associated with the University of Kansas. They identified four individuals, three juveniles and one adult. In 1952, Walter Hlady, a student at the University of North Dakota Department of Sociology and Anthropology, continued excavation at site 32SN19 with the help of Robertson. According to field notes on file at the University of North Dakota Department of Anthropology, Hlady recovered two primary and two secondary burials.

The James River Valley is the site of numerous burial mound sites (Brown et al. 1982; Gregg et al. 1985; Kordecki and Gregg 1986; Wheeler n.d.). The most prominent of these is the Jamestown Mounds (32SN22). This Woodland cemetery is located approximately two miles east of 32SN19 within the city limits of Jamestown. Richard Wheeler with the Smithsonian Institution River Basin Surveys also excavated burial mounds in the James River Valley. In 1952 he directed the excavation of two mounds (Wheeler n.d.). The first, the Krop Mound (32SN8) is located approximately seven miles north of the City of Jamestown, North Dakota on the east bank of the James River. Twenty burials were recovered from this site and were later analyzed by Bass by that time with the University of Tennessee. Neuman (1967) obtained a radiocarbon date of A.D. 1245 ± 85 years from charcoal recovered from the site. This date places these skeletons within an undefined Village culture-historic context. The second of the two mounds excavated by Wheeler in 1952 is Mound 1 of the Birks Mound Group (32SN28). The Birks Mound Group is located approximately five miles north of the city of Jamestown on the east bank of the James River. This site consists of 21 elliptical and circular mounds (Wheeler and Stephenson 1953). At least one individual recovered from Mound 1 was later analyzed by Bass, Woolworth, and Wheeler. Another significant burial site from the James River Valley is the Archaic Pipestem Creek site (32SN102). This site is located approximately six miles northwest of the city of Jamestown on the east bank of the Pipestem Creek.

Eighteen individuals were identified at site 32SN19. Of these 18, 15 are adults (83%). Nine of the adults were sexed, creating a nearly even sex ratio of four males and five females. The individuals consisted of commingled boxed remains. No notes existed to explain what procedure was used to curate these skeletons. Each box was treated as unique. The lack of connection between the bones of one box and the next supported this approach. Despite a fairly large skeletal sample, no intact crania were present. In the absence of intact crania, a radiocarbon date, or diagnostic artifacts, the culture-historic position of site 32SN19 is unclear. Given the presence of numerous Woodland burial mounds in North Dakota and in close proximity to site 32SN19, this site is most probably of Woodland age.

Middle Missouri Tradition—North and South Dakota

While a substantial number of Middle Missouri tradition burials sites are known (Table 50), knowledge of Middle Missouri skeletal biology is not extensive. The reasons for this lack of data are several. First, few sites have received comprehensive analysis. Where such study has been undertaken, data are limited by a small number of burials, typically fewer than 10 individuals recovered from any single site. This is due in part to the frequent discovery of these burials in cache pits and house floors (i.e., Breeden and Fay Tolton). No true Middle Missouri cemeteries have been identified. Compounding these difficulties are normal variations in skeletal preservation.

The Middle Missouri tradition is generally regarded as the precursor to the Siouan-Mandan peoples. Craniometric descriptions using various discriminant functions (e.g., Jantz 1976; Key 1983) support this association. Through time, there is a general shift of Middle Missouri burial sites northward as the Extended and Terminal variants are encountered. Presumably the Middle Missouri peoples experienced a northward movement brought on by the southern Caddoan (Arikara) peoples (Lehmer 1971).

One of the earliest modern descriptions of Middle Missouri skeletal biology is that of the Huff site (32MO11). This Terminal Middle Missouri fortified earthlodge village was excavated at three different times. During the 1960 field season, three burials were uncovered (Bass and Birkby 1962). Two were recovered within house floor cache pits. Both were primary interments. One relatively intact skull was recovered; this cranium is dolicocranic and of medium-low vault height. This shape is considered characteristic of the Middle Missouri-Mandan (Bass and Birkby 1962; Jantz and Willey 1983). Although their sample of Mandan crania is small, Bass and Birkby recognize the congruence of the Huff cranium with that of other Mandan samples.

Fay Tolton (39ST11) is an Initial Middle Missouri habitation site located in Stanley County, South Dakota on the west bank of the Missouri River. Like the majority of Initial Middle Missouri sites, it is located in the south-central portion of South Dakota. During excavations carried out in 1957, five burials were recovered from house floor pits and cache pits. Two individuals were adult, both male, two were subadults, and one was a juvenile (Bass and Berryman 1976). The skeletons, although articulated, were interred in unusual if not unnatural positions. One skeleton was buried with the skull just above the house floor. Three other skeletons were in a position suggesting that the house had been burned and collapsed on top of the bodies. This led to the conjecture that these deaths were violent (Butler 1976), a conclusion that was later confirmed by Hollimon and Owsley (1994). Unfortunately cranial elements were damaged to the extent that craniometric analysis was limited. Crania were mesocranic and of medium vault height. Jantz (1976) using a newly devised Mandan-Arikara discriminant function placed the only relatively intact skull on the Mandan side of the sectioning point.

This pattern of habitation-oriented cache pit burials is repeated at Red Horse Hawk (39CO34), Pretty Head (39LM232), Langdeau (39LM209), and Breeden (39ST16) (Bass 1969; Bass and Ubelaker 1969; Brown 1974; Williams 1988). While it may be considered the norm for Middle Missouri burials, it does not appear to be an absolute pattern. Site 39CA102 was excavated in 1991 by the South Dakota Archaeological Research Center. A single burial pit was encountered. Long bones and other infracranial elements such as ribs were scattered through the burial pit. Two exceptions were a young juvenile skeleton with an articulated thorax and the articulated legs and partial pelvis of a subadult.

This burial location is adjacent to, and considered part of, site 39CA102, a previously identified surface scatter of artifacts. This site was identified in 1979 as part of a survey of the east shore of Lake Oahe conducted by the University of Nebraska (Pepperel and Falk 1986). It is located in northern Campbell County immediately north of the confluence of Spring Creek and the Missouri River. Surface collection yielded lithics, ceramics, and bone. Beyond their association with the Plains Village tradition these artifacts were undiagnostic. Several Plains Village sites are identified in Campbell County (Lehmer 1971; Pepperel and Falk 1986). South and slightly east of 39CA102 is the Extended Middle Missouri Keens Village (39CA2). Farther north near the North Dakota-South Dakota border is another Extended Middle Missouri village, Vanderbuilt Village (39CA1). Approximately eight miles south is Helb (39CA208). This fortified earthlodge Terminal Middle Missouri village recently yielded human skeletal remains (Williams 1991c).

Ten individuals were identified in the 39CA102 series sample (Williams 1993b). Three adults, two males and one female, two subadult skeletons, and five juveniles were distinguished. Ages ranged from newborn to young adult (<30 years). A single skull of a subadult female was recovered. It is dolicocranic and very low vaulted. Using Jantz's Mandan-Arikara discriminant function, this cranium falls well within the Mandan side of the female sectioning point. Pepperel and Falk (1986) conclude that 39CA102 is of an undetermined Plains Village component. Site location and the Siouan cranial morphology support this conclusion. Given this site's close proximity to Keens Village (39CA2), it is not improbable to conclude that 39CA102 is of Extended Middle Missouri culture-historic association.

The Blue Blanket Point (39WW98) is located on a small peninsula beach access area of Lake Oahe in Walworth County five miles southeast of Mobridge, South Dakota. Beginning in the summer of 1983 and concluding in the spring of 1985, skeletal remains were recovered eroding from the river bank (Williams 1988). The skeletal remains were recovered directly adjacent to the Washboard site (39WW47). The Washboard site consists of lithic scatter present on the beach of this same small peninsula. No diagnostic materials have been recovered to assign this site to a specific cultural tradition (Weston et al. 1979).

Nine individuals were identified from this disjointed series of burial collections. These comprised five adults, three males and two females, and four juveniles. Ages ranged from newborn to older adult. Three of the adults were in excess of 40 years.

Table 50. Middle Missouri Burial Sites in North and South Dakota

Site	Age	Reference
32BL7	Extended	
Havens (32EM1)	Extended, 733 ± 77 B.P.	Owsley 1992, Rose et al. 1983
Tony Glas (32EM3)	Terminal	Owsley 1992
Shermer (32EM10)	Terminal	Bass 1968
32EM61	Terminal	Williams 1983
32EM101		
Bendish (32MO2)	Extended, 647 ± 69 B.P.	Owsley 1992
Huff (32MO11)	Terminal, 460 ± 60 B.P.	Bass and Birkby 1962, Owsley 1992
Jennie Grainer (32MO12)	Terminal	
Scattered Village (32MO31)	Extended	
32MO104	Terminal	
Bagnell (32OL16)	Extended	
Fire Heart Creek (32SI2)	Extended, 728 ± 88 B.P.	
Robert Zahn (32SI3)	Extended	Rose et al. 1983
Paul Brave (32SI4)	Extended, 880 ± 77 B.P.	Langdon et al. 1989
Slab Town (32SI5)	Extended	Owsley 1992
South Cannonball (32SI19)	Extended, 734 ± 56 B.P.	
39CA102	Unspecified	Williams 1993a
Helb (39CA208)	Extended, 921 ± 51 B.P.	Williams 1991d
Jake White Bull (39CO6)	Extended/Terminal	Langdon et al. 1989
Red Horse Hawk (39CO34)	Extended, 980 ± 75 B.P.	Williams 1988
Mitchell (39DV2)	Initial	Langdon et al. 1989
Bloom Village (39HS1)	Initial	Willey et al. 1987
Twelve Mile Creek (39HT1)	Initial	Key 1983
Thomas Riggs (39HU1)	Extended, 499 ± 73 B.P.	
Brandon (39MH1)	Initial	Key 1983
Medicine Creek (39LM2)	Initial	Key 1983
Dinehart (39LM33)	Initial	Key 1983
Fort Lookout II (39LM57)	Initial, 1080 ± 75 B.P.	Williams 1988
Langdeau (39LM209)	Initial, 866 ± 48 B.P.	Bass and Ubelaker 1969
Pretty Head (39LM232)	Initial, 665 ± 143 B.P.	Bass 1969
C.B. Smith (39SL29)	Extended	
Fay Tolton (39ST11)	Initial, 886 ± 46 B.P.	Bass and Berryman 1976
Breeden (39ST16)	Initial, 920 ± 48 B.P.	Brown 1974
Blue Blanket Point (39WW98)	Unspecified	Williams 1988

Note: All B.P. dates are uncorrected radiocarbon dates.

The three crania recovered ranged in shape from dolicocranic to mesocranic and from low to high vaulted (Williams 1988). Using Jantz's Arikara-Mandan discriminant function, all three crania fell on the Mandan side of the sectioning point. The culture-historic position of this site is unknown. However, given location and cranial morphology, a Middle Missouri association seems probable, as the crania are clearly neither Woodland nor Caddoan-Arikara. The lack of diagnostic artifacts and the presence of one cedar wrapped bundle burial, atypical of Middle Missouri burials, casts some doubt on this speculation.

Coalescent Tradition—North Dakota

The Coalescent tradition in North Dakota, despite a substantial number of burial locales (Table 51), is very poorly understood. Like the Middle Missouri, burials are few in number. Lehmer (1971) suggests that this is a function of scaffold burial, a characteristic of the historic Mandan and other Siouan peoples of North Dakota. This lack of data has been worsened by the recent reinterment, without further study, of many Coalescent burials in North Dakota. As Table 51 shows, few sites have received any but the most limited analysis. Following the generally held view that the Middle Missouri peoples were pushed northward, the majority of Coalescent sites are located in central North Dakota, far north of the earlier Middle Missouri locations. Although Arikara are known from some sites, the Coalescent of North Dakota is represented by the Mandan and to a lesser extent the Hidatsa. The latter is virtually unknown in terms of osteological research.

While Coalescent Mandan are cited in various studies, one of the few that is comprehensive is Bass and Birkby's report on the Huff site (32MO11). Although this is a Terminal Middle Missouri site, Bass and Birkby (1962) took the opportunity to discuss the question of Mandan cranial morphology. Drawing on the then known samples, they measured 35 Mandan crania. They noted that as a group these crania were low vaulted, substantially so when compared to Arikara and Central Plains tradition crania. This cranial dimension has been noted many times since and has been the focus of some research regarding Mandan and Arikara origins (Jantz and Willey 1983; Owsley et al. 1981). Another feature of note is the variable shape of Mandan crania. Male crania are predominately dolicocranic while female crania are more mesocranic. Although Mandan crania have been used in several craniometric comparisons (e.g., Key 1983), historical circumstances regarding the discovery and eventual reburial of Mandan skeletons has directly affected the likelihood of future discoveries and study.

Demography

The demographic composition of prehistoric skeletal samples varies considerably. The analysis of these differences, however, is not routinely performed. Small samples and single burials allow little beyond basic age and sex determination. Where samples are large enough, demography can be a useful tool in the interpretation of general health, paleopathology, and the quality of life (cf. Owsley and Bass 1979; Palkovich 1981). Demography can also provide specific insights into population attributes. For example, Owsley, Berryman, and Bass (1977) compared demographic profiles of village and cemetery burials at the Postcontact Coalescent Larson site (39WW2). They found a much smaller number of infants and young children in the village than in the cemetery proper. They also found that the highest percentage of village burials were adolescent and young adult. They interpreted these demographic differences to be due to the impact of raiding and warfare on Larson village by other groups.

Age Profiles by Tradition

Using available published and unpublished data, Archaic, Woodland, and Village burials were categorized by age. Fetal skeletons and those adults lacking accurate age estimations were classified under collective headings of fetal and adult respectively (Table 52). The Middle Woodland Sonota complex and Late Woodland Arvilla complex burials are identified as specific culture-historic subsets of the Woodland tradition and are treated separately (Table 53).

The number of age-counted burials per site ranged from one to 85 (Table 54). In gross numbers, Woodland tradition burials were the best represented, with an average of 15.4 individuals per site. Archaic sites followed with a smaller range of variation and smaller average of 6.4 individuals per site. Village sites fared the poorest averaging only 3.0 individuals per site. Village sites also had the highest number (N=7) of single individual burials, accounting for 30% of Village burial sites. This deficiency is seen as a result of the common occurrence of house pit burials and the infrequent recovery of large cemetery interments.

Using these age-segregated data, a life table (Table 55) was constructed (Pollard et al. 1981). The Archaic demographic data are characterized first by a lack of fetal representation. There follow two peaks of mortality, one at early childhood and the second at early adulthood. Despite this the Archaic samples have the highest life expectancy at birth of all the compiled samples (Table 56). Life expectancy remains high even into the fourth decade.

The Woodland demographics are similar yet very different. Fetal individuals (N=23), for example, comprise 3.7% of all tallied individuals. There is also a high infant mortality, a rate which increases and extends through the first five years of life (Tables 57 and 58). As with the Archaic, a second peak of mortality occurs during the second and third decades of life. Life expectancy at birth is low and only exceeds 20 years during the second five years of life. In separating the Sonota and Arvilla samples it is apparent that the Woodland life table is a composite and not a uniform pattern. The Sonota have a very high mortality through the first decade; these first 10 years of life account for a cumulative 57.8% of deaths. Life expectancy at birth is exceptionally low, below 15 years and never reaches 20 years at any age interval. If the 15 fetal individuals were included, the mortality rate would be even higher. Also striking is the absence of any individuals above 50 years of age. The Arvilla complex presents a softer mortality picture. Only 39.2% of deaths occur during the first decade. Life expectancy is correspondingly higher at birth, just under 20 years, and remains strong until the third decade.

The Village life table and demographic data are more difficult to interpret because of limited sampling. Village burials have not contained more than 10 individuals and most contain two or less. It cannot be assumed with any certainty that the true demographic profile of these populations is represented by these samples. If representative, the Village pattern falls somewhere in between the Archaic and the Late Woodland Arvilla complex. A moderate level of early childhood mortality is present, but the mortality curve is otherwise flat through the third decade.

Using the crude death rate (Table 59) as an indicator of overall population mortality, the Archaic samples rank first with the lowest rate (44.6%). The Sonota complex samples have the highest mortality in general with a rate of 68.0%. Although in broad terms the Sonota rank as the worst rate of population mortality, individually the Village samples have the highest infant mortality rate of 24.4%. The Sonota samples, however, have the highest rate of mortality for the 5-9 year age group (28%). If the Sonota influence on the combined Woodland sample is taken into account, no other sample exceeds 10% for this age group. Given the substantial number of individuals representing the Sonota samples, the unique position of the Sonota does not appear to be an attribute of sampling. It is evident that the Middle Woodland of the Middle Missouri region was a stressful period, far more stressful than the later Village, or even the transitional Late Woodland.

Table 51. Coalescent Tradition Burial Sites in North Dakota

Site	Variant	Reference
Menoken (32BL2)	Postcontact	
Sperry (32BL4)	Postcontact	
Double Ditch (32BL8)	Postcontact	
Larson (32BL9	Postcontact	
32EM102		Rose et al. 1983
Fort Clark (32ME2)	Disorganized	
Big White Village (32ME4)	Postcontact	
Deapolis (32ME5)	Disorganized	
Amahami (32ME8)	Disorganized	
Lower Hidatsa River (32ME11)		
Big Hidatsa (32ME12)	Disorganized	
32ME74		
Sakakawea (32ME493)	Disorganized	
Like a Fishhook (32ML2)	Disorganized	Owsley 1992
32ML35		
Barrett (32MO25)		
On a Slant Village (32MO26)	Postcontact	
Motsiff (32MO29)	Postcontact	
32MO30		
Scattered Village (32MO31)	Postcontact	
32MO33		
Boley (32MO37)	Postcontact	Williams 1993b
32MO81		
Lower Sanger (32OL11)	Postcontact	
Bagnell (32OL16)	Postcontact	
Krop Mound (32SN28)		

Table 52. Demographic Profile of Archaic, Woodland, and Plains Village Burials

Site	Age Interval											
Archaic	0-1	2-4	5-9	10-14	15-19	20-29	30-39	40-49	50-59	60+	Adult	Fetal
39BF2	0	1	0	0	0	1	1	0	0	0	0	0
32BA100	0	0	0	0	0	0	1	0	0	0	0	0
32GF123	0	0	0	0	0	0	1	0	0	0	0	0
32MO97	4	2	1	2	2	3	2	1	2	0	4	0
32SN102	0	1	0	0	0	2	0	0	0	0	1	0
Total	4	4	1	2	2	6	5	1	2	0	5	0
Woodland												
21KT1	1	1	1	2	0	0	0	0	0	0	2	0
21MA1	0	0	0	2	0	0	2	0	0	0	0	0
21MA6	0	0	0	0	0	1	0	0	0	0	0	0
21MA10	1	1	1	1	1	2	2	0	0	0	0	0
21NR1	0	2	0	0	0	3	1	0	0	0	2	0
21NR2	0	1	0	0	1	0	0	0	0	0	0	0
21PL3	0	0	0	0	0	9	3	0	0	0	1	0
21PL13	2	1	2	1	2	1	0	1	0	0	1	2
21RL1	0	6	3	0	0	3	3	2	0	0	0	0
21TR2	2	0	0	1	0	0	0	0	0	0	2	0
32BA403	0	0	0	0	0	0	2	0	0	1	0	0
32CV401	0	0	0	0	1	0	0	0	0	0	0	0
32GF1	5	17	2	1	3	1	10	2	2	0	5	0
32GF4	0	0	0	0	0	0	0	0	0	0	4	0
32GF19	0	6	3	2	0	4	4	2	1	0	6	0
32GF305	1	2	0	0	0	1	0	0	0	0	3	0
32GF308	2	1	0	0	1	1	0	0	0	0	5	1
32ML850	0	0	1	0	3	3	2	1	0	0	0	0
32NE301	0	0	0	0	1	1	0	0	0	0	1	0
32RM201	0	0	0	0	0	0	0	1	0	0	0	0
32RY100	6	6	2	0	0	5	8	1	0	0	2	1
32SN19	1	2	0	0	0	4	0	1	0	0	9	0
32SN22	9	22	6	3	4	2	4	9	2	0	10	4
32WA132WA1	0	2	0	0	1	0	0	0	0	1	0	
32WA1	1	1	0	0	0	2	1	0	0	0	1	1
32WA32	0	0	0	0	0	0	0	1	0	0	0	0
39BF225	0	0	0	0	0	1	0	0	0	0	0	0
39CL2	1	0	0	1	0	0	0	0	0	0	5	0
39DW233	8	10	10	4	3	1	1	0	0	0	13	12
39DW240	7	11	11	3	4	11	10	9	0	0	13	5
39DW252	7	7	5	0	3	2	2	1	0	0	5	3
39GR21	0	0	0	2	0	0	0	0	0	0	4	0
39HL4	0	0	0	0	0	0	0	0	0	0	1	0
39HU203	0	0	0	0	0	0	1	0	0	0	0	0
39LM256	0	2	1	0	0	1	1	2	0	0	0	0
39LK7	0	0	0	0	0	0	0	0	0	0	1	0
39LN10	0	0	0	1	0	0	0	0	0	0	0	0
39MH5	0	0	0	0	0	0	0	0	0	0	2	0
39MH34	0	0	3	3	0	0	0	0	0	0	4	0
39RO23	8	6	2	3	2	10	15	7	2	0	14	0
Total	62	105	55	30	29	70	72	40	7	1	117	23
Village												
Middle Missouri												
32EM10	2	0	0	0	0	0	0	0	0	0	1	0
32EM61	0	0	0	0	0	0	1	0	0	0	0	0
32MO2	2	0	0	0	0	0	0	0	0	0	0	0
32MO11	0	0	0	0	0	1	0	2	0	0	0	0
32SI3	0	0	0	0	0	0	0	0	0	0	2	0
32SI4	0	0	0	0	0	0	0	1	0	0	1	0
32SI5	0	0	0	0	0	0	0	1	0	0	0	0
39CA102	2	2	1	1	2	1	0	0	0	0	1	0
39CA208	0	0	0	0	0	0	0	0	0	0	1	0
39CO6	0	0	0	0	1	0	0	0	0	0	0	0
39CO34	0	0	0	0	0	0	0	1	0	0	0	0
39DV2	0	2	0	0	0	0	2	0	0	0	0	0
39HS1	1	0	0	0	0	1	0	0	0	0	2	1
39LM57	0	1	0	0	0	1	0	0	0	0	1	0
39LM209	1	0	0	0	0	1	0	0	0	0	0	0
39LM232	1	0	0	0	0	0	0	0	0	0	1	0
39ST11	0	0	1	1	1	1	1	0	0	0	0	0
39WW98	1	0	1	2	0	1	1	2	0	0	1	0
Coalescent												
32EM102	0	0	0	0	0	0	0	0	0	0	1	0
32ML2	0	0	0	0	0	0	0	0	0	0	1	0
32MO37	2	0	0	0	1	0	1	0	0	0	0	0
Total	12	5	3	4	5	7	6	7	0	0	13	0

Table 53. Demographic Profile of Sonota and Arvilla Complex Burials

Site	Age Interval										
Sonata	0-1	2-4	5-9	10-14	15-19	20-29	30-39	40-49	50-59	60+	Adult	Fetal
39DW233	8	10	10	4	3	1	1	0	0	0	13	12
39DW240	7	11	11	3	4	11	10	9	0	0	13	5
39DW252	7	7	5	0	3	2	2	1	0	0	5	3
32SN22 (CI)	6	13	2	2	2	0	4	9	0	0	0	4
Total	28	41	28	9	12	14	17	19	0	0	31	24
Arvilla												
21KT1	1	1	1	2	0	0	0	0	0	0	2	0
21MA1	0	0	0	2	0	0	2	0	0	0	0	0
21MA6	0	0	0	0	0	1	0	0	0	0	0	0
21NR1	0	2	0	0	0	3	1	0	0	0	2	0
21NR2	0	1	0	0	1	0	0	0	0	0	0	0
21PL3	0	0	0	0	0	9	3	0	0	0	1	0
21PL13	2	1	2	1	2	1	0	1	0	0	1	2
21RL1	0	6	3	0	0	3	3	2	0	0	0	0
21TR2	2	0	0	1	0	0	0	0	0	0	2	0
32GF1	5	17	2	1	3	1	10	2	2	0	5	0
39RO23	8	6	2	3	2	10	15	7	2	0	14	0
Total	18	34	10	10	8	28	34	12	4	0	27	2

Table 54. Tallied Individuals - Summary by Tradition

Population	Range	n	Mean
Archaic	1-23	5	6.4
Woodland	1-85	40	15.4
Village	1-10	23	3.0

Table 55. Life Table: Archaic, Woodland, Sonata, Arvilla and Village Burials

Age	Dx	dx	lx	qx	Lx	Tx	ex
Archaic							
0-1	4	14.8	100.0	.15	92.6	2245.2	22.4
2-4	4	14.8	85.2	.17	268.8	2152.6	25.2
5-9	1	3.7	70.4	.05	389.0	1883.8	26.8
10-14	2	7.4	66.7	.11	342.8	1494.8	22.4
15-19	2	7.4	59.3	.12	315.0	1152.0	19.4
20-29	6	22.2	51.9	.43	408.0	837.0	16.1
30-39	5	18.5	29.7	.62	204.5	429.0	14.4
40-49	1	3.7	11.2	.33	187.0	224.5	20.4
50-59	2	7.4	7.5	1.00	37.5	37.5	5.0
Woodland							
0-1	62	13.2	100.0	.13	93.4	1722.7	17.2
2-4	105	22.3	86.8	.26	302.6	1629.3	18.8
5-9	55	11.7	64.5	.18	293.2	1326.7	20.6
10-14	30	6.4	52.8	.12	248.0	1033.5	19.6
15-19	29	6.2	46.4	.13	216.5	785.5	16.9
20-29	70	14.9	40.2	.37	327.5	569.0	14.2
30-39	72	15.3	25.3	.60	176.5	241.5	9.5
40-49	40	8.5	10.0	.85	57.5	65.0	6.5
50-59	7	1.5	1.5	1.00	7.5	7.5	5.0
Sonota Complex							
0-1	28	16.7	100.0	.17	91.6	1468.0	14.7
2-4	41	24.4	83.3	.29	284.4	1376.4	16.5
5-9	28	16.7	58.9	.28	252.8	1092.0	18.5
10-14	9	5.4	42.2	.13	197.5	839.2	19.7
15-19	12	7.1	36.8	.19	166.2	641.7	17.4
20-29	14	8.3	29.7	.28	255.5	475.5	16.0
30-39	17	10.1	21.4	.47	163.5	220.0	10.3
40-49	19	11.3	11.3	1.00	56.5	56.5	5.0
50-59	0	0.0	0.0	0.00	0.0	0.0	0.0
Arvilla Complex							
0-1	18	11.4	100.0	.11	94.3	1965.5	19.6
2-4	34	21.5	88.6	.24	311.4	1871.2	21.1
5-9	10	6.3	67.1	.09	319.8	1559.8	23.2
10-14	10	6.3	60.8	.10	288.2	1240.0	20.4
15-19	8	5.1	54.5	.09	259.8	951.8	17.5
20-29	28	17.7	44.4	.36	405.5	692.0	14.0
30-39	34	21.5	31.7	.68	209.5	286.5	9.0
40-49	12	7.6	10.2	.74	64.0	77.0	7.5
50-59	4	2.5	2.6	1.00	13.0	13.0	5.0
Village Burials.							
0-1	12	24.4	100.0	.24	87.8	1802.1	18.0
2-4	5	10.2	75.6	.13	282.0	1714.3	22.7
5-9	3	6.1	65.4	.09	311.8	1432.3	21.9
10-14	4	8.2	59.3	.14	276.0	1120.5	18.9
15-19	5	10.2	51.1	.19	230.0	844.5	16.5
20-29	7	14.3	40.9	.35	337.5	614.5	15.0
30-39	6	12.2	26.6	.46	205.0	277.0	10.4
40-49	7	14.3	14.4	1.00	72.0	72.0	5.0
50-59	0	0.0	0.0	0.0	0.0	0.0	0.0

Key: Dx, number of deaths; dx, percentage of deaths; lx, number of survivors; qx, probability of dying; Lx, number of years lived by survivors; Tx, number of years left for survivors; ex, life expenctancy for survivors

Table 56. Life Expectancy/Age Interval

Population	0-1	2-4	5-9	10-14	15-19	20-29	30-39	40-49	50-59
Archaic	22.4	25.2	26.8	22.4	19.4	16.1	14.4	20.4	5.0
Woodland	17.2	18.9	20.6	19.6	16.9	14.2	9.5	6.5	5.0
Sonota	14.7	16.5	18.5	19.9	17.4	16.0	10.3	5.0	0.0
Arvilla	19.6	21.1	23.2	20.4	17.5	14.3	9.0	7.5	5.0
Village	18.0	22.7	21.9	18.9	16.5	15.0	10.4	5.0	0.0

Table57. Mortality Rate/Age Interval

Population	0-1	2-4	5-9	10-14	15-19	20-29	30-39	40-49	50-59
Archaic	.15	.17	.05	.11	.12	.43	.62	.32	1.00
Woodland	.13	.26	.18	.12	.13	.37	.60	.85	1.00
Sonota	.17	.29	.28	.13	.19	.28	.47	1.00	0.00
Arvilla	.11	.24	.09	.10	.09	.36	.68	.74	1.00
Village	.24	.13	.09	.14	.19	.35	.46	1.00	0.00

Table 58. Percentage of Deaths/Age Interval

Population	0-1	2-4	5-9	10-14	15-19	20-29	30-39	40-49	50-59
Archaic	14.8	14.8	3.7	7.4	7.4	22.2	18.5	3.7	7.4
Woodland	13.2	22.3	11.7	6.4	6.2	11.9	15.3	8.9	1.5
Sonota	16.7	24.4	16.7	5.4	7.1	8.3	10.1	11.3	0.0
Arvilla	11.4	21.5	6.3	6.3	5.1	17.7	21.5	7.6	2.5
Village	24.4	10.2	6.1	8.2	10.2	14.3	12.2	14.3	0.0

Table 59. Crude Death Rate by Tradition

Population	Crude Death Rate
Archaic	44.6
Woodland	58.1
Sonota	68.0
Arvilla	51.0

Sex Profiles by Tradition

In a manner similar to that used for age distributions, sexed adult skeletons were tabulated by site for Archaic, Woodland, and Village samples. Again, Sonota and Arvilla complex subsets were included (Table 60). Because not all adult skeletons can be sexed, the distribution of male and female skeletons must be interpreted with this sampling factor in mind. As with age distributions, sites with single burials (i.e., Village) may not be representative of the larger populations from which they are derived.

Table 60. Sex Distribution - Woodland Burials

Site	Male n	Male %	Female n	Female %
21KT1	1	50%	1	50%
21MA1	1	50%	1	50%
21MA6	1	100%	0	0%
21MA10	3	60%	2	40%
21NR1	4	80%	1	20%
21NR2	0	0%	1	100%
21PL3	6	46%	7	54%
21PL13	2	50%	2	50%
21RL1	4	50%	4	50%
21TR2	0	0%	1	100%
32BA403	2	67%	1	33%
32CV401	0	0%	0	0%
32GF1	6	35%	11	65%
32GF4	2	100%	0	0%
32GF19	8	53%	7	47%
32GF305	2	100%	0	0%
32GF308	0	0%	1	100%
32ML850	4	57%	3	43%
32NE301	1	50%	1	50%
32RM201	0	0%	1	100%
32RY100	8	53%	7	47%
32SN19	4	50%	4	50%
32SN22	8	50%	8	50%
32WA1	0	0%	0	0%
32WA1	2	50%	2	50%
32WA32	1	100%	0	0%
39CL2	2	50%	2	50%
39BF225	0	0%	1	100%
39DW233	11	79%	3	21%
39DW240	25	61%	16	39%
39DW252	8	73%	3	22%
39GR21	2	100%	0	0%
39HL4	0	0%	1	100%
39HU203	1	100%	0	0%
39LM256	2	50%	2	50%
39LK7	0	0%	0	0%
39LN10	0	0%	0	0%
39MH5	1	100%	0	0%
39MH34	2	100%	0	0%
39RO23	22	55%	18	45%
Total	146	56%	112	44%
Sonota Complex Burials.				
39DW233	11	79%	3	21%
39DW240	25	61%	16	39%
39DW252	8	73%	3	22%
32SN22 (CI)	7	64%	4	36%
Total	51	66%	26	34%
Arvilla Complex Burials.				
21KT1	1	50%	1	50%
21MA1	1	50%	1	50%
21MA6	1	100%	0	0%
21NR1	4	80%	1	20%
21NR2	0	0%	1	100%
21PL3	6	46%	7	54%
21PL13	2	50%	2	50%
21RL1	4	50%	4	50%
21TR2	0	0%	1	100%
32GF1	6	35%	11	65%
39RO23	22	55%	18	45%
Total	47	56%	37	44%
Village Burials, Middle Missouri				
32EM10	0	0%	1	100%
32EM61	1	100%	0	0%
32MO2	0	0%	0	0%
32MO11	0	0%	3	100%
32SI3	0	0%	1	100%
32SI4	1	100%	0	0%
32SI5	1	100%	0	0%
39CA102	2	67%	1	33%
39CA208	0	0%	1	100%
39CO6	1	100%	0	0%
39CO34	0	0%	1	100%
39DV2	2	100%	0	0%
39HS1	1	33%	2	67%
39LM57	0	0%	1	100%
39LM209	0	0%	1	100%
39LM232	1	100%	0	0%
39ST11	2	50%	2	50%
39WW98	3	60%	2	40%
Coalescent				
32EM102	0	0%	0	0%
32ML2	0	0%	1	100%
32MO37	1	50%	1	50%
Total	16	47%	18	53%

Table 61. Sex Distribution - Range and Average by Population

Population	Male Range	Male Mean	Female Range	Female Mean
Archaic	0-4	1.4	0-5	1.8
Woodland	0-25	3.6	0-18	2.8
Sonota Complex	7-25	12.8	3-16	5.2
Arvilla Complex	0-22	4.3	0-18	3.4
Village	0-3	0.8	0-3	1.0

Describing sex distribution differences of these five sample populations is made simpler by the fact that only two categories are considered, male and female (Table 61). In gross proportions, percentages of males and females ranged from 0 to 100%. The greatest range of extremes (0%-100%) occurred in the Archaic and Village samples where single burials are frequently encountered. Although some single burials occurred among the Woodland samples, proportions of males and females showed fewer extreme variations from site to site. The Archaic and the Village samples were similar too in their slight female advantage (56% and 53% respectively). As with age data, small sample sizes make it difficult to draw any firm conclusions as to the significance of this observation. In contrast, Woodland samples (pooled, Sonota, and Arvilla) all show a clear excess of males. For the pooled Woodland samples, males outnumber females by an approximate 1.3 to 1 ratio. The difference in male and female proportions becomes more apparent when the Sonota and Arvilla samples are treated separately. The Arvilla samples follow the pooled pattern of a moderate excess of males. The Sonota, however, show a 2:1 ratio of males to females. This excess of males is present for all four Sonota samples and almost reaches a 4:1 ratio of males to females for Swift Bird (39DW233). The Sonata are demographically unique in both age and sex distributions.

Osteopathology

Following Williams (1994a), evidences of osteopathology were broadly classified. This allows for some latitude in individual interpretation and identifications as well as providing interpretable groups of data. The choice of categories was dictated by prior experience concerning the relative frequencies of various bone diseases in this region. While by no means ideal, the categories of osteoarthritis, trauma, inflammatory, and metabolic encompass the most frequent disease cases. Uncommon forms of osteopathology such as neoplasms were not included as compiling these data would not permit any level of significant interpretation. The compilations presented here are derived from both published and unpublished data.

Osteoarthritis Distribution

One hundred and four skeletons were reported to show some manifestation of degenerative arthritis (degenerative joint disease) (Table 62). While trauma may be considered a factor in the incidence of degenerative joint disease, as with vertebral osteophytosis, simple aging is a more likely cause (Ortner and Putschar 1981; Steinbock 1976). Due to the large number of different affected joints and the lack of complete representation

Table 62. Osteoarthritis Distribution by Site and Skeletal Location

Site	Functional Individuals	Appendicular Upper	Appendicular Lower	Other
Archaic				
32MO97	3	3	2	0
Subtotal	3	3	2	0
Woodland				
21KT1	2	1	2	1
21MA1	1	0	0	1
21MA6	1	0	0	1
21MA10	2	2	0	0
21NR1	2	0	2	1
21PL3	5	2	2	2
21PL13	3	3	2	1
21RL1	5	5	5	3
32BA403	3	2	1	1
32GF1	8	7	6	0
32GF19	6	2	2	3
32GF305	1	1	0	0
32NE301	1	0	1	0
32ML850	1	1	1	0
32RM201	1	1	0	0
32RY100	6	4	4	0
32SN19	4	2	2	0
32SN22	11	11	11	1
32WA132WA1	1	2	2	
32WA32	1	1	1	0
39DW233	1	1	0	0
39DW240	3	2	0	1
39HU203	1	1	0	1
39LM256	2	0	2	0
39RO23	14	13	8	2
Subtotal	87	63	54	21
Middle Missouri				
32MO11	2	2	1	2
32SI3	1	1	1	1
32SI4	1	0	1	0
39CA102	2	2	0	0
39CO34	1	1	0	0
39HS1	1	0	1	0
39LM232	1	1	0	0
39WW98	3	2	2	1
Coalescent				
32EM102	1	0	1	0
32ML2	1	0	1	0
Subtotal	14	9	8	4
Total	104	72	64	25

Note: Due to the commingling of some skeletons, this is a rough approximation of the number of individuals represented by these cases of osteoarthritis.

of all skeletal elements, joint incidence was reduced to three categories: upper appendicular, lower appendicular, and other. This last category includes such joints as the temporo-mandibular and the arthrodial joints of the vertebral column. Every major load bearing joint was affected: the shoulder, pelvis, knee, and elbow. Locations on the upper and lower appendages appear nearly even in their distribution. One case reported from the Coalescent Like-A-Fishhook (32ML21) is a probable example of septic arthritis. Here, in an older aged female, the talus and tibia are ankylosed (Owsley 1992b).

Vertebral osteophytosis was also frequent with at least 51 adult cases having been identified (Table 63). Taken in context, 69% of all adults represented by a vertebral column display some level of vertebral osteophytosis (spondylitis deformans). Although some cases were severe, in only one instance was ankylosis involved. As is characteristic of this condition, the weight-bearing lumbar region was the most common focus (84% of all adults displaying vertebral osteophytosis), followed by the cervical, and thoracic vertebrae (Steinbock 1976).

Both forms of degenerative arthritis display a relative consistency of pattern across culture-historic boundaries. For the weight-bearing joints of the appendicular skeleton, the upper appendages of the shoulder and elbow joints are slightly more frequent than the knee and pelvis. This favoring of the upper appendages, while not dramatic, is the same for all three archeological traditions. Evidences of arthritis on nonweight-bearing joints such as the temporo-mandibular are almost exclusively Woodland in distribution. As there are limited samples of the Village and Archaic populations, this lack of reporting may be more a function of sampling than of lifestyle. At the same time, the relative infrequency of these affected joints indicates that the prehistoric lifestyle, both foraging and horticultural, was equally hard on the remainder of the skeleton.

Because the spine is less well represented, the frequency of vertebral osteophytosis is lower and less widely distributed than degenerative arthritis. Still it is an extraordinarily common disease and other than for the Archaic populations (lacking vertebral columns altogether) is similar in pattern for both pre- and posthorticultural groups. Degenerative processes, modified by activity patterns, appear as a constant in the Northern Plains.

Trauma

Trauma takes many forms from highly visible fractures to more ordinary bones spurs. Evidences of trauma were confined to the major forms of trauma, those more likely to be reported. Bone fracture is the most frequent form of major trauma. Thirty-six cases were identified in the literature (Table 64). These ranged from simple and well resolved fractures to comminuted and other poorly resolved cases. In the latter category several unusual examples were noted. From the Late Woodland Inkster site (32GF19) a pseudoarthrosis was found in conjunction with an apparent fractured clavicle (Williams 1982). Poorly resolved fractures are not uncommon, but this appears to be the only documented pseudoarthrosis (false joint) from this area of North America. An apparent comminuted fracture of the distal humerus was noted in an adult at site 39CA102. The articular surfaces of the humerus and the proximal radius and ulna were grossly deformed and created a modified pattern of elbow movement (Williams 1993b). Another atypical fracture is an example of protrusio acetabuli. Acetabular protrusion can occur as a developmental defect and as a result of trauma. In its former expression, a bilateral occurrence is typical (Turek 1984). This particular case was found at the Woodland Grunzie Mound (32GF305). It involved a unilateral expression and moderate remodeling of the femoral head and is believed to be traumatic in origin (Williams 1991d). The majority of fractures were not as extreme as these three and were relatively well resolved, showing minimal to moderate deformity.

One particular form of fracture that was repeatedly reported is spondylolysis. Spondylolysis, or separate neural arch, is thought to represent a fatigue or stress fracture (Bridges 1989). That this typically develops on the lower lumbar spine supports stress as a

Table 63. Vertebral Osteophytosis Distribution by Site and Spine Location

Site	Individuals	Cervical	Thoracic	Lumbar	Sacral
Woodland					
21KT1	1	1	1	1	0
21MA1	1	0	1	1	0
21NR1	2	0	1	2	0
21PL3	1	0	0	1	0
21PL13	2	1	0	1	0
32BA403	2	1	2	2	1
32GF1	4	2	2	4	1
32GF19	2	0	1	2	1
32RY100	2	1	2	1	1
32SN19	1	1	1	1	0
32Sn22	12	6	7	8	1
32WA32	1	1	1	1	0
39DW233	2	1	0	1	0
39DW240	2	0	1	2	1
39GR21	1	0	1	1	0
39HL4	1	0	0	1	0
39LM256	1	1	0	0	0
39R023	7	5	2	7	0
Subtotal	45	21	23	37	5
Middle Missouri					
32MO11	2	0	2	2	0
32SI3	1	1	1	1	0
39CO34	1	0	0	1	0
39WW98	2	0	0	2	0
Subtotal	6	1	3	6	0
Total	51	22	26	43	5

Table 64. Fracture Distribution by Site and Location

Site	Description
Archaic	
32MO97	Mandible - Simple Fracture
Woodland	
21MA10	Fibula - Aknylosed w/Tibia
21NR2	Rib - Simple Fracture
21PL3	Skull - Compression Fracture
21Pl3	Fibula - Simple Fracture
21PL13	Vertebra - Compression Fracture
21RL1	Rib - Simple Fracture; Radius - Colles Fracture
32BA403	Metacarpal - Simple Fracture
32GF1	Vertebra - Spondylolysis (3 cases)
	Tarsal Phalanx - Simple Fracture
	Ulna - Simple Fracture
	Skull - Compression Fracture
	Vertebra - Compression Fracture
32GF19	Clavicle - Simple Fracture w/Pseudoarthroses
32GF305	Os Coxa - Protrusio Acetabuli
32RM201	Rib - Simple Fracture
	Vertebra - Spondylolysis
32RY100	Femur - Simple Fracture
32SN22	Ulna - Simple Fracture
	Vertebra - Spondylolysis (2 cases)
	Vertebra - Compression Fracture w/Ankylosis
39GR21	Humerus - Simple Fracture
39LM256	Radius - Colles Fracture
39RO23	Radius - Simple Fracture
	Skull - Compression Fracture
	Vertebra - Spondylolysis (3 cases)
Middle Missouri	
32MO11	Vertebra - Spondylolysis
	Wrist - Fracture w/Ankylosis
39CA102	Humerus - Comminuted Fracture
39CO23	Vertebra - Spondylolysis

causal agent. Spondylolysis also has distinct familial patterns of incidence (Wiltse et al. 1975). In this particular series of samples, 11 cases were reported. This accounts for 30% of all fractures. Taken in the context of reported vertebral columns there is a 16% incidence for this type of fracture among all samples.

The other forms of fracture are varied in both type (simple and comminuted) and location. There is a pattern, however, that the upper appendicular skeleton (nine cases/25%) is three times as likely to be a location of trauma than the lower appendicular skeleton (three cases/8%). This pattern is exclusive of culture-historic association. The small number of reported fractures for so large a sample of sites indicates that this form of trauma, while dramatic, is not overly common.

Another form of major trauma is joint subluxation (Table 65). Dislocation can occur for any joint, but unless the subluxation is unresolved there is no permanent record. The shoulder and pelvis are common joints involving unresolved subluxations (Ortner and Putschar 1981). Two subluxations were noted in the literature. The first involves a grossly deformed left scapula of an adult arm recovered from the Jamestown Mounds (32SN22). This arm while articulated in situ was not part of a larger skeleton. A secondary joint was formed on the anterior surface of the scapula. The humerus head was flattened and distorted due to this atypical articulation (Williams 1985a). The second example comes from site 39LM256. The temporo-mandibular joints of an adult male were flattened and distorted. In the absence of arthritic erosion and lipping, this was interpreted as a dislocation of the mandibular condyles (Williams 1988).

One form of trauma that was all but nonexistent was violent trauma. Depression fractures of the skull were reported but of themselves are not conclusive of aggression. Scalping cutmarks have been documented, but even these may be linked to postmortem activities unrelated to scalping as a violent act. Only a single example of aggression trauma has been noted for this region. At the Jamestown Mounds (32SN22) a young adult female was discovered with an in situ projectile point embedded in her lower spine. As this primary burial was being excavated, a projectile point was found in the space between L5 and the sacrum. The point had entered posteriorly and damaged the inferior body surface of L5. No reactive tissue had formed indicating that the projectile injury occurred near the time of death (Williams 1985a).

Inflammation

Bone inflammation and infection are nearly synonymous terms. Two forms of inflammation were considered: periostitis and osteomyelitis. Periostitis as a nonspecific inflammation of the periosteal surface of bone was recorded as present on the skeletal remains of individuals from 19 sites (Table 66). Thirty-one adults and 11 juveniles were identified. As expected, the majority (83%) of cases involved tibial and/or fibular foci (Table 67). With few exceptions, periostitis as described here is nonspecific, meaning there is no identified causal agent. The incidence of periostitis is relatively low for most sites. The one exception is the Grover Hand site (39DW240). This Sonota complex site had a periostitis rate of 38% when normal versus pathological tibiae were compared.

Table 65. Nonfracture Trauma

Site	Description
32SN22	Shoulder Subluxation
	Projectile Point Trauma
39LM256	Mandible Subluxation

At two sites, the Middle Woodland Swift Bird (39DW233) and the Middle Missouri site 39CA102, bone inflammation was linked to treponemal disease. Treponematosis targets the bones of the lower leg but varies in its expression from osteomyelitic to periostitic. In the former, the bone surface is described as having a "snail track," while a periostitic buildup of new bone on the anterior surface of the tibia leads to a so-called "saber shin." Bass and Phenice (1975) describe osteomyelitis/periostitis of the tibiae and fibulae of an adult female as suggestive of "syphilis." At site 39CA102 two adults and one juvenile display "saber shin" tibiae (Williams 1993b). While these descriptions are not indisputable evidence of precontact treponematosis, they strongly support the possibility that this disease has a great antiquity on the Northern Plains.

Table 66. Periostitis by Site and Age of Individual

Site	Adult	Juvenile
Archaic		
32MO97	1	0
Woodland		
21NR1	1	0
21PL3	2	0
21PL13	1	0
21RL1	2	0
32BA403	1	0
32GF1	0	2
32GF19	1	3
32NE301	1	0
32RY100	1	2
32SN19	1	0
32SN22	2	0
32WA32	1	0
39DW233	3	4
39DW240[1]	10	0
39DW252	3	0
Middle Missouri		
39CA102	4	0
39WW98	3	0
Coalescent		
32ML2	1	0
Total	31	11

[1] May include juveniles because no distinction was made between the ages of individual cases.

Evidence is better documented for a second specific infectious disease, tuberculosis. This disease affects the skeleton in less than 10% of pulmonary cases. When present it is generally necrotic or lytic in its action. The spine and hip are preferentially affected. At the Jamestown Mounds (32SN22), an adult female was described with a probable case of the pelvic form of the disease (Williams and Snortland-Coles 1986). Pott's disease is the spinal variety. Here destruction of the vertebral body leads to spinal collapse and the formation of an angularly kyphosed spine. When present, this form of the disease is almost exclusively juvenile. One such case was reported from the Late Woodland Arvilla site (32GF1). An 11 year old was discovered with a gibbus kyphosis of the lower spine in conjunction with massive destruction of the vertebral bodies (Williams 1985d). Other possible examples of tuberculosis are more equivocal. These are usually described as erosive lesions, an example of which is seen at Lake Poinsett (39HL4). Large lytic lesions on an adult female left ilium may represent a psoas abscess (Williams 1993b). This particular form

Table 67. Periostitis by Site and Location

Site	Tibia	Fibula	Other
Archaic			
32MO97	Bilateral		Bilateral Femora
Woodland			
21NR1	Single		
21PL3	Bilateral		
21PL13	Bilateral		Bilateral Femora
21RL1	Bilateral		Bilateral Ulnae, Right Radius
	Bilateral		Bilateral Humeri, Radii, Right ulna
32BA403	Single	Single	
32GF1	Bilateral	Bilateral	Bilateral Femora
			Left Femur
32GF19			Left Ulna
	Single		
	Single	Bilateral	Right Femur
32NE301	Bilateral		
32RY100	Bilateral		
	Bilateral		
	Single		Left Femur
32SN19	Bilateral		
32SN22	Single		
	Bilateral		
	Bilateral	Bilateral	
32WA32	Bilateral	Bilateral	
39DW233	Bilateral		Right Humerus
		Single	Bilat. Radii, Ulnae, Femora,
			R. Humerus, L.Clavicle
	Bilateral		
	Bilateral	Single	Bilateral Radii, Left Ulna
	Single	Single	
39DW240	Single and		
(N=10)	Bilateral		
39RO23	Bilateral	Bilateral	
			Bilateral Femora
Middle Missouri			
39CA102	Single		
	Single		
	Single	Single	
39WW98	Single	Single	
			Humerus, Radius, Ulna
Coalescent			
32ML2	Single		

of skeletal tuberculosis occurs when the infection travels down the spine along the psoas muscle, forming an abscess that rests on the internal surface of the pelvis (Ortner and Putschar 1981).

Also in the category of specific infection is a probable hydatid cyst. This calcified cyst was recovered from the burial matrix of a 45 year old female at the Jamestown Mounds (32SN22) (Williams 1985a, 1985b). The nematode parasite of hydatid disease is associated with hunting societies where it is normally found in canid hosts and only incidentally infects humans.

Osteomyelitis, unlike periostitis, which may be traumatic rather than infectious in origin, represents hematogenous infection of bone (Ortner and Putschar 1981). It is an exceptionally rare disease, having been reported at only three locations (32BA403, 32SN22, and 39DW233) (Bass and Phenice 1975; Williams n.d.l, 1985b).

Metabolic Disease

The principal example of metabolic osteopathology from these samples is porotic hyperostosis and its variations. This condition manifests itself as one of three cranial abnormalities. Only two expressions were noted: cribra orbitalia and the benign expression of ectocranial porosis (Table 68). The latter comprised the majority of cases (70%). There is some question as to whether ectocranial porosis (an orange peel appearance on the frontal, parietal, and occipital bones, sometimes accompanied by a bossing of the sagittal suture region) constitutes a variation of porotic hyperostosis (Mann and Murphy 1990). It is possible that this mild porosity of the cranial vault is an example of normal variation. However, ectocranial porosis is not distributed randomly but affects only a small percentage of crania. Cribra orbitalia was not encountered in large numbers. Most cases involve minor pitting of the superior orbits. One full blown case was reported at the Peter Lee Mound (21PL13). A 15-year-old juvenile displays a full expansion of spongy bone into the upper orbits (Williams n.d.i). This individual displays other abnormalities such as systemic osteoporosis, collapsed and kyphosed spinal elements, and a honey combed pelvis suggestive of a broader metabolic disease.

The presence of scurvy and rickets has also been reported from Northern Plains skeletons. Scurvy, which would be unusual for foraging and horticultural populations, is suggested by the presence of sclerous scar tissue on the upper orbits of an adult male calvarium recovered from the Late Woodland Kjelbertson site (32RY100) (Williams 1987b). At the Red Lake River Mounds (21RL1) an adult female displayed multiple focal periosteal lesions on both tibiae, fibulae, ulnae, and right radius. The multiple nature and locations suggests hematoma induced periosteal reactions. Scurvy is a possible cause (Williams 1991b). The Kjelbertson site also yielded possible evidence of rickets. A 1-year-old child was found with broadly flared metaphyses and somewhat columnar diaphyses. Although a rachitic rosary was not observed, the appearance of these bones suggests a rachitic origin (Williams 1987b).

Dental Pathology

Dental pathology receives less attention than other areas of skeletal biology. One reason is the all too common lack of usable teeth due to postmortem damage or loss. Williams (1985b, 1991a, 1993b) has reported postmortem tooth loss in excess of 60%. With enamel attrition, the amount of derivable dental data is further reduced.

Caries

Carious lesions are relatively infrequent in this series. Thirty-five individuals from 16 sites had one or more caries, averaging 2.2 lesions per individual (Table 69). The number of cavities per person ranged from one to a maximum of seven in a single individual from the Kjelbertson site (32RY100) (Williams 1985b). This site has the largest number of carious lesions (14) and affected individuals (7). When present, cavities tended to occur in several teeth per individual. Carious lesions were distributed across culture-historic boundaries and were recorded in Archaic, Woodland, and Village burials.

Table 68. Porotic Hyperostosis by Site and Type

Site	Ectocranial Porosis	Cribra Orbitalia
21KT1	1	0
21MA1	1	0
21MA6	1	1
21MA10	3	1
21PL3	2	0
21PL13	0	1
32GF19	0	1
32RY100	7	1
32S!4	1	0
32SN22	0	2
39LN10	0	1
39RO23	1	1
39WW98	2	0
Total	19	8

Periodontal Disease and Abscessing

Unlike caries incidence, periodontal disease was regularly reported as high (Bass and Phenice 1975; Langdon et al. 1989; Willey et al. 1987; Williams 1985b, 1991a, 1993b). Using alveolar resorption as an approximate indicator virtually every adult included in a recent overview study showed some degree of periodontal disease (Williams 1994a). Associated with this observed level of gum disease is the presence of substantial calculus deposits. Although calculus was not always detected, when present it was associated with moderate to advanced alveolar resorption. Dental abscesses were equally high. Abscesses can be influenced by gum disease as well as caries. As caries rates are low in these samples, it can be effectively argued that rapid toothwear increased the abscess rate. Nearly every reported adult dentition was marked by one or more alveolar abscess. The number of abscesses per individual ranged from a single abscess in 21 individuals to a high of 18 in one individual from the Late Woodland De Spiegler site (39RO23) (Williams n.d.a). Occasionally an abscess perforated the maxilla and subsequently involved the sinus. Bass and Phenice (1975) described a 44% dental pathology rate of abscess and tooth loss at the Sonota complex Grover Hand site (39DW240). As with caries, when abscesses were present they were typically multiple. The sequelae of periodontal disease and abscessing is the premature loss of teeth. It is rare to find an individual over the age 45 years still retaining a functional set of adult teeth.

Trauma and Attrition

Chipped and/or fractured teeth were common. Their incidence varied widely in part due to reporting but also to site specific dietary factors. At Red Lake River Mounds (21RL1) no antemortem tooth damage was observed, while at Inkster (32GF19) extensive chipping and fractures were recorded (Williams n.d.j, 1981). Both sites are Late Woodland, and therefore contemporary, and less than 80 miles apart. The amount

Table 69. Caries Incidence by Site

Site	Individuals	Caries
21MA1	1	4
21MA6	1	2
21MA10	2	3
21PL3	2	5
21PL13	3	5
32GF1	2	7
32MO97	2	4
32RM201	1	2
32RY100	7	14
32SN22	3	5
32WA1	1	1
39CL2	3	4
39CO34	1	3
39DW240	2	2
39GR21	2	4
39LM57	2	3
Total	35	78

of damage can be substantial. At Kjelbertson (32RY100) and Blue Blanket Point (39WW98) teeth were observed with massive fractures exposing the root surface of premolar and molar teeth. In both instances the exposed dentin was polished, indicating a lengthy period of post trauma activity (Williams 1985b, 1988). Even where trauma was less significant, attrition was evident. Excessive enamel attrition, both occlusal and interproximal, were recorded for all adult dentitions. Individuals older than 25 years show significant dentin exposure. The incisors and first molars are the earliest targeted teeth. By 40 years of age it is unusual to find intact enamel on any tooth surface (Williams 1985a, 1985b, 1991a, 1993b). This wear is an additional factor in antemortem tooth loss.

Although not viewed as a form of trauma, interproximal grooving of teeth has been regularly reported in these samples (Table 70). These grooves, typically located between molars, may or may not be associated with carious lesions at the same location. Interproximal grooves were noted on teeth from eight sites. All but one of these sites is Woodland. With the exception of Kjelbertson (32RY100), there does not appear to be any connection between interproximal grooving of teeth and dental disease. At Kjelbertson, five grooves were recorded on five different individuals. This site also has a very high caries and abscess rate. Interproximal grooving, while noteworthy, is idiopathic in nature.

Linear Enamel Hypoplasia

Enamel hypoplasias (linear and pit) were recorded for 31 individuals at 14 sites (Table 71). Hypoplasias are not overly common in this region. In part this is a reflection of a low stress environment, but it is also a function of tooth preservation. Postmortem loss of permanent and deciduous teeth is high. Even when teeth are present, enamel attrition rapidly reduces crown height. This means that hypoplastic events for earlier ages will be underrepresented as these episodes will be lost to attrition first as the crown wears from the tip to the cemento-enamel junction. Sites represented by hypoplasias involve all three culture-historic groups. Sample sizes are too small to form any conclusions regarding adaptation level and stress. The number of individuals with enamel hypoplasias ranged from one to five.

Goodman and colleagues (1984) theorize that a yearly spacing of hypoplastic episodes corresponds with a seasonal stress, possibly related to maize horticulture. Hypoplastic spacing of less than one year is more typical of Woodland populations. Hypoplasia episodes were tallied using interval of 0.5 years (Table 72). Of 63 reported hypoplastic episodes, the highest number (14 episodes) occurred at 3 years. If a broader extension of age intervals is used, 52 episodes fall within the two year period of 2.5-4.5 years. This possibly marks a period of weaning stress (Goodman et al. 1984). Stresses at the youngest ages (i.e., 1 year) were only recorded in the juveniles and subadults as these hypoplastic episodes occur high (near the occlusal edge) on the tooth crown and were lost to attrition by young adulthood.

Taphonomy

Bone Inventories

Bone representation is a function of several taphonomic variables. Soil diagenesis is one important factor as soil conditions have a direct impact on bone preservation. Mortuary practices including bone alteration and interment (primary versus secondary) also affect which bones are recovered and in what condition. Finally, there is burial recovery. Some sites such as Kjelbertson (32RY100) have been identified through inadvertent destruction of the site and destruction of human skeletons (Williams 1985b, 1993b, 1994b). Bone inventories, therefore, reflect each of these factors. The importance of bone representation beyond taphonomy is in population reconstruction. For example, juvenile diaphysis length is a direct function of growth and development patterns. Underrepresentation of juvenile bones could present an incorrect picture of growth patterns. Similarly, in reconstructing levels of osteopathology the frequency of a pathological condition is given as a percentage of bones present. If specific counts are not taken into consideration, patterns of disease may appear abnormally high or low. In a recent overview of prehorticultural disease patterns on the Northern Plains, spina bifida occulta was found to have an uneven distribution among certain sites (Williams 1994a). On closer examination, it was discovered that the

Table 70. Interproximal Grooving by Site

Site	Locations
21MA1	Left Maxillary Third Molar
21NR1	Left Mandibular Second Molar
21NR2	Maxillary Second Premolar
32RY100	Right Mandibular Second Premolar
	Left maxillary Second and Third Molars
	Right Maxillary First Molar
	Left Maxillary Third Molar
	Right Mandibular First Molar
39CO34	Left Maxillary First Molar
39GR21	Mandibular Third Molars
39HU203	Left Maxillary Second Molar
39LM256	Right Maxillary Third Molar

Table 71. Enamel Hypoplasias by Site

Site	Affected Individuals
Archaic	
32BA100	1
32MO97	3
Woodland	
21KT1	1
21MA10	1
21PL3	5
21PL13	2
32GF19	4
32RM201	1
32SN22	2
39CL2	1
39GR21	2
39LN10	1
39MH34	4
Village	
39WW98	3
Total	31

Figure 72. Linear Enamel Hypoplasia Episode Distribution

Age of Episode	Episode Count
1.0	1
1.5	2
2.0	0
2.5	9
3.0	14
3.5	9
4.0	11
4.5	9
5.0	7
5.5	1
Total	63

distribution of this benign spinal defect was a function more of where vertebral columns were recovered than of population factors.

Skeletal inventories unfortunately are not always reported. The main exceptions are bioarcheology contract reports (e.g., Willey et al. 1987; Williams 1993b), where bone inventories are routine. Using published and unpublished inventories, a tally was made of adult long bones and os coxae, crania, and vertebral columns. Only intact bones are included. These tallies are arranged by tradition (Table 73). The same procedure was followed for juvenile skeletons, with the exception that only long bones were identified. For the os coxa, the ilium, ischium, and pubis had to be present to count as an intact bone.

Several adult patterns were observed. For Archaic populations the upper appendicular skeleton is better represented. Os coxae are almost nonexistent. Given small sample sizes this is very likely a sampling problem. In the much larger Woodland samples the lower appendicular bones are marginally more numerous than their upper torso counterparts. While os coxae are again the least represented major bone, the margin of difference is not as great as for the Archaic. Village samples show a nearly even distribution of both upper and lower appendicular elements due to the common occurrence of primary interments. No consistent pattern of side differences in bone recovery was observed. Although individual bones do show an excess of left versus right elements, the side varies from group to group. In addition the number differences for left versus right are small and never exceed seven bones. Adult crania, like the long bones, are well represented. Due to the high proportion of primary interments the number of crania for Archaic and Village samples correspond with the maximum number of any single bone for those samples. For the Woodland, however, crania are substantially underrepresented. There are, for example, 111 right femora counted among the Woodland burials. For those same samples, only 86 crania exist. There are at least two reasons for this disparity. First, only intact crania are counted. Crania in general are more easily damaged than femora and other long bones. Second, it may represent a burial related difference in Woodland mortuary practices. At De Spiegler (39RO23) it was noted that several burial pits contained disarticulated crania. The presence of vertebral columns is another matter. In both Archaic and Woodland samples the spine is grossly lacking in representation. Only in the Village samples are the number of vertebral columns comparable to the number of appendicular elements. For the Archaic samples no vertebral columns were recovered, while for the Woodland spinal elements are only slightly more than half as frequent (53%) as the most common single long bone (right femur). While preservation may be a factor, the low numbers of Woodland vertebral columns is clearly linked to the high frequency of secondary burials.

Although fewer in absolute numbers, juvenile long bones show the same general patterns as those of the adults. The humerus and femur are typically the most often recovered, a function of their durability and resulting preservation. The os coxa is the least frequently recovered juvenile element. Side differences are again random.

Soil Diagenesis

No systematic studies of diagenesis have been completed for these subareas of the Northern Plains. The closest proximation to such a study is the routine description of skeletal remains on the basis of physical condition (e.g., good, fair, poor) (cf. Bass and Phenice 1975; Williams 1985a, 1988, 1993b). This absence of regional soil diagenetic background has been cited as a significant detriment to the interpretation of trace element concentrations in prehistoric human bone (Williams 1993c).

An exception involves the Jamestown Mounds (32SN22). This site as excavated in 1982 consists of two closely placed Woodland burial mounds (A and B). Although less than 100 m apart and sharing contemporaneous components, burial preservation between the two mounds varied greatly. Burials recovered from Mound A were generally in good condition, while those from Mound B were almost uniformly in a poor state of preservation (Williams 1985a). What appeared in Mound B as intact bones in situ disintegrated into minute fragments in the laboratory. At first it was unclear why the remains should be so disparate in their preservation. Soil depth and antiquity did not appear to correlate with bone condition, as some of the oldest remains were among the best preserved. However, the majority (75%) of the Mound B bones were impregnated with a white crystalline material. This substance, also present in the burial fill, later was identified as gypsum. Gypsum or calcium sulfate is

Table 73. Bone Count - Burials

Site	Humerus		Radius		Ulna		Os Coxa		Femur		Tibia		Fibula	
Archaic	left	right	left	right	left	right	left	right	left	right	left	right	left	right
39BF2	1	0	0	0	0	0	0	0	0	0	0	0	0	0
32BA100	1	0	1	0	1	0	0	0	0	0	1	0	0	0
32GF123	0	0	0	0	0	0	0	0	0	0	0	0	0	0
32MO97	6	6	6	7	7	6	0	0	3	2	3	2	4	5
32SN102	3	2	1	1	1	1	1	2	2	2	1	2	1	1
Total	11	8	8	8	9	7	1	2	5	4	5	4	5	6
Woodland														
21KT1	1	1	0	1	1	1	0	0	1	1	1	1	0	0
21MA1	2	2	2	2	2	2	2	2	2	2	2	2	2	2
21MA10	2	2	2	3	3	2	1	1	2	2	3	3	2	3
21NR1	1	2	1	1	2	2	2	2	3	2	3	2	0	1
21NR2	0	0	0	0	0	0	1	0	0	0	0	0	0	0
21PL3	4	5	2	2	4	3	2	2	4	5	4	4	2	2
21PL13	3	4	2	3	3	2	1	1	1	3	0	1	1	0
21RL1	5	5	3	4	4	5	1	1	5	7	4	6	4	4
21TR2	1	1	1	1	1	1	1	1	1	1	1	1	11	
32BA403	1	1	1	2	1	2	0	1	2	2	2	2	2	2
32GF1	14	11	12	13	13	11	8	7	13	12	13	14	10	10
32GF4	0	2	0	0	0	0	0	0	1	2	0	0	0	0
32GF19	8	7	5	4	6	6	5	7	5	6	9	7	7	7
32GF305	1	1	1	1	1	1	2	1	1	1	1	1	0	0
32GF308	1	1	0	1	0	2	0	0	1	3	1	0	0	0
32ML850	1	1	0	2	0	0	2	2	1	1	0	1	0	0
32NE301	0	0	1	0	1	0	2	1	2	2	2	2	0	1
32RM201	1	1	1	1	1	1	1	1	1	1	1	1	11	
32RY100	11	9	7	7	9	7	10	10	12	11	12	8	8	9
32SN19	3	0	3	0	1	0	2	1	4	2	2	4	41	
32SN22	11	11	11	8	7	9	9	9	11	12	10	10	10	11
32WA1	1	4	3	4	2	2	0	1	2	3	4	2	2	1
32WA32	1	1	1	1	1	1	1	1	1	1	1	1	1	1
39CL2	0	1	0	0	0	0	0	0	0	0	0	0	0	0
39HL4	0	0	0	0	0	0	1	1	0	0	0	0	0	0
39HU203	0	0	0	0	0	0	0	0	0	1	0	0	0	0
39LM256	1	1	1	2	1	0	1	2	3	2	1	1	0	1
39RO23	22	22	20	23	19	20	15	15	25	26	18	15	16	15
Total	96	96	80	86	83	80	70	70	104	111	95	89	73	73
Village														
Middle Missouri														
32MO11	2	1	2	1	1	1	2	2	2	2	2	2	2	1
32SI3	1	1	1	1	1	1	1	1	1	1	1	1	1	1
39CA102	2	1	2	3	4	0	0	1	1	1	1	2	1	2
39CO6	0	0	0	0	0	0	0	0	0	1	1	0	1	0
39CO34	1	1	1	1	1	0	0	1	1	3	1	1	1	0
39HS1	1	1	1	0	1	1	0	0	1	1	1	0	0	0
39LM57	0	0	0	0	0	0	0	0	0	1	0	0	0	0
39LM209	0	0	0	0	0	0	0	0	0	0	0	0	1	0
39ST11	2	2	2	2	2	2	2	2	2	2	2	2	2	2
39WW98	3	6	2	4	4	5	5	4	4	3	4	4	2	4
Coalescent														
32EM102	0	0	0	1	0	0	1	0	1	0	0	00	0	
32ML2	0	1	0	1	0	1	1	1	1	1	1	1	1	1
32MO37	0	0	1	1	0	0	0	0	2	0	0	0	0	0
Total	12	14	12	15	14	11	13	12	16	16	14	13	12	11

water soluble and readily absorbed by bone. Seasonal fluctuations in the water table apparently created conditions of repetitive crystallization, ultimately causing bone deterioration. Confirmation of this explanation came from Mound A where a series of poorly preserved bones was associated with gypsum crystals (Williams 1985a). Porter (1962) has described gypsum crystals in the context of Middle Missouri artifacts. While gypsum use among the Arikara has been described ethnohistorically, its presence in the burials at 32SN22 appears to be due to naturally occurring soil deposits.

Defleshing and Bone Modification

No comprehensive study of burials from this region has been made regarding the intentional modification of the skeleton. Cutmarks and possible scalping have been identified (cf. Bass and Phenice 1975; Williams 1985a, 1988, n.d.h, n.d.i, n.d.j). These cases can be divided into two categories; mortuary practices and aggression (Tables 74 and 75). Twelve sites, spanning the Archaic and Woodland periods, have exhibited mortuary modifications to the skeleton. These range from multiple cutmarks to physical removal of a portion of individual bones (i.e., proximal or distal extremity, gonion). The location of

Table 74. Mortuary Modification of the Skeleton by Site

Site/Age/Sex	Description
Archaic	
32MO97	
(14) Adults >23 years	Cutmarks - Longbones
Juvenile 1-1.5 years	Cutmarks - Longbones
Juvenile 0-1.0 years	Cutmarks - Longbones
Female 40-50 years	Polishing - Cranium
(6) Adults >23 years	Cutmarks - Cranium
Woodland	
21MA10	
Juvenile 11-12 years	Cutmarks/Removal - Cranium
Male 25-35 years	Removal - Mandible and Cranium
Female 17-25 years	Removal - Cranium
Female 17-25 years	Removal - Cranium
21PL3	
Female 20-25 years	Cutmarks -Cranium
Female 20-29 years	Removal - Longbones
21PL13	
Male >40 years	Cutmarks - Longbones
21RL1	
Female 25-30 years	Removal - Longbones
Male 40-45 years	Removal (bone tapping) - Longbones
Female 30-35 years	Removal - Longbones and Mandible
	Removal (bone Tapping) - Longbones
Female 35-45 years	Removal - Longbones
Male 25-35 years	Removal - Mandible
Male 35-40 years	Removal Mandible
Juvenile ca 2 years	Removal - Cranium
32GF19	
Male 25-30 years	Cutmarks - Skull, Removal - Longbones
	Removal (bone tapping) - Longbones
Male 30-35 years	Cutmarks/Removal - Mandible
Male 40-45 years	Cutmarks/Removal - Mandible
Female >40 years	Removal - Longbones
Male 25-35 years	Removal - Mandible
Female >23 years	Removal - Cranium and Longbones
Female >23 years	Removal - Longbones
Female 20-25 years	Removal - Longbones
32NE301	
Male 22-28 years	Cutmarks - Longbones
32SN22	
Female 15-20 years	Cutmarks - Longbones
Adult >23 years	Cutmarks - Longbones
Adult >23 years	Cutmarks - Longbones
Female 25-35 years	Cutmarks -Cranium
Juvenile 12-14 years	Cutmarks -Cranium
Male >50 years	Cutmarks - Cranium
32WA1	
Female	Removal - Mandible
Adult	Cutmarks - Mandible
Female	Cutmarks - Mandible
Male	Cutmarks - Cranium
Female	Cutmarks - Cranium
39DW233	
(23) Adults and Juveniles	Cutmarks - Crania/Longbones
39DW240	
Adults and Juveniles	Cutmarks - Crania/Longbones
39DW252	
(21) Adults and Juveniles	Cutmarks - Crania/Longbones

Table 75. Aggression Modification of the Skeleton by Site

Site	Age/Sex	Description
Archaic: 32MO97	Juvenile 11-12 years	Cutmarks - Cranium
Woodland: 21PL3	Female 17-25 years	Cutmarks - Cranium
	Female 20-25 years	Cutmarks - Cranium
	Female 17-27 years	Cutmarks - Cranium

cutmarks is indicative of dissection as the cuts are not randomly placed on bones but are located at the site of muscle attachments. For example, crania typically display these cutmarks approximately midway up the parietal at the origin of the temporalis muscle (Bass and Phenice 1975; Williams 1991e). These cutmarks are usually multiple and point to repeated cutting to dissect the muscle. At the Archaic Bahm site (32MO97) every adult long bone is marked by multiple cuts. At this site too an adult female cranium displays an interesting feature. Present on the left frontal and parietal is a polished area 22 mm x 84 mm in diameter. It is unlikely that this is a diagenetic artifact. This feature, together with the multiple dissection marks and differential interment of skeletal elements, leads to the interpretation that the bones buried at this site were transported for some period of time prior to burial. This would explain the absence of small bones of the hands and feet, ribs, and vertebrae, the necessity for thorough dissection, and the polishing of this particular skull.

Bass and Phenice (1975) report high levels of dissection cutmarks at three Sonota complex sites in north-central South Dakota. While dissection has been found at the Sonota complex Jamestown Mounds (32SN22), the level is not as high. Although there are exceptions (e.g., Bahm [32MO97]), the presence of cutmarks on the skeleton is associated with the Sonota and Arvilla complex burials. Among the latter it is restricted to the smaller sites of northwestern Minnesota. The Arvilla site (32GF1) consists mainly of primary burials. Dissection would not be characteristic of this burial mode. The De Spiegler site (39RO23) does contain a high number of secondary and ossuary interments. No cutmarks have been recorded for this site, but this appears to be the result of a lack of recognition. Burials from both sites have been reinterred, and it is impossible to complete a follow up assessment of these remains.

Physical removal of portions of bones was reported at five sites. At the Middle Woodland Inkster (32GF19) the proximal and distal extremities of various long bones were removed from five different individuals. In several cases only a portion of the articular surface was missing. Unlike the fine cutmarks encountered elsewhere, this mortuary processing involved a cruder reduction of the skeleton (Williams n.d.n). Present also at this site and at Red Lake River Mounds (21RL1) is a feature referred to as bone tapping. This involves the puncturing of specific infracranial elements, typically the distal femur and proximal tibia. It is common among the more eastern Minnesota Laurel complex populations. At both of these sites the femora and tibia of three individuals were marked by this procedure. Neither of these sites is described as Laurel, but there appears to have been some influence from this Eastern population.

Seven individuals at four sites show cranial cutmarks indicative of scalping. This typically involve relatively deep frontal incisions with increasingly fainter parietal incisions. These crania are present at both Archaic and Woodland sites. The antiquity of this practice on the Northern Plains is, at a minimum, 2,000 years old. The interpretation of this scalping is more difficult. It might represent an extension of mortuary practice and have no aggressive intent. This interpretation would be plausible, and may be correct, except for two cases of apparent scalping. In both, there is evidence to suggest that scalping occurred prior to death. Both crania display substantial osteomyelitic remodeling. In this first instance the cranium of an 11 year old juvenile at the Bahm site (32MO97) has a circular lytic lesion encompassing the cranial vault. This lesion is approximately 5 mm in diameter. There is no evidence of sclerous remodeling, indicating an active lytic process at death (Williams 1987c). Other interpretations are possible, but it appears that an incision was made into the scalp circumscribing the calvarium. The scalp does not appear to have been removed as there is no necrosis of the calvarium. Instead an infection occurred at the site of the incision, leaving the lytic destruction observable. The second example is an adult male cranium recovered at the Fordville Mounds (32WA1). This expansive burial mound complex is considered Late Woodland in age but is argued to have multiple components. The calvarium shows a characteristic granulomatous response. The surface is nodular and irregular (Williams 1991e). While treponemal disease cannot be excluded, the lack of stellate scars and the appearance of this lesion high on the calvarium suggest that these changes represent the sequelae of antemortem scalping. Necrosis of the periosteum and resulting granulomatous response led to the calvarium morphology. Two deep incisions are present on the posterior margin of this lesion. Scalping as a violent act has substantial antiquity on the Northern Plains.

9 Northern Plains Adaptation Types, by George C. Frison, Dennis L. Toom, and Robert C. Mainfort

Human adaptations in the Northern Plains span a period of at least 12,000 years. This chapter summarizes archeological data presented in the preceding chapters within the framework of cultural adaptation types. The concept of adaptation types was first used by Fitzhugh (1972, 1975), although there are strong links to the much earlier cultural ecology studies of Julian Steward (1938). Like any other classificatory scheme, the synthetic units employed here, namely adaptation types, highlight perceived similarities at the expense of variability.

In archeology, classification is both the *sine qua non* and the bane of the discipline. Even at the fundamental level of artifact classification—stone tools and ceramics, for example—unambiguous definitions simply do not exist. Indeed, it is often difficult to find consensus among researchers as to precisely what variables should be considered in formulating types, much less, how specific attributes should be combined for creating types. In many cases, variables recognized as critical by most researchers are ignored for the sake of "analytical" expediency. Attribution of function, with its typological implications, to stone tools without microscopic examination of use wear patterns is an obvious example.

It should go without saying, that such classificatory problems become compounded at successively higher levels of analysis. This, coupled with increasingly limited data sets at each level (i.e., there may be thousands of a specific point type within a region, but very few, if any, completely excavated settlements of the same time period), seriously undermines the usefulness of most larger archeological synthetic units such as phases and cultural periods.

The use of adaptation types, in lieu of traditional culture periods, in this summary clearly does not solve the problem of synthetic unit formulation. By using the concept simply as an organizing framework, certain problems with traditional McKernian taxonomy can be minimized, e.g., the "problem" of what specific combinations of attributes constitutes Mississippian. Moreover, unlike concepts like "Archaic" or "Mississippian," which have been applied across vast and diverse geographic areas, adaptation types are, in principle, restricted to specific, distinctive ecological regions.

Sabo et al. (1990) have used adaptation types to good advantage in their archeological overview of the Ozark and Ouachita Mountain regions of Arkansas. Following the lead of Simmons et al. (1989), these researchers utilize 11 data categories to summarize information about each of their adaptation types. Most of these data categories are fairly straightforward and represent classes of data that most, if not all, archeologists would agree are important avenues for research. Baseline chronological information and site distribution data are central to archeological inquiry. Given the current state of archeological knowledge about the Northern Plains area, however, any summary statements about social organization and ideology fall entirely within the range of speculation. Instances of archeological data that *may* relate to these data categories will be noted as appropriate. Other comments on these topics will be kept to a minimum and must be seen for what they are—speculations that may have some grounding in ethnographic analogy.

The adaptation types discussed below are based primarily on interpretations of regional prehistory by Frison, Toom, Williams, and Gregg et al. (this volume). There are several notable difficulties that attend archeological interpretations in the study area; these are mentioned here as caveats for the discussion of adaptation types that follow.

Foremost among these is a strong thread of environmental possibilism, if not outright determinism, that permeates some interpretations of the archeological data. Such notions have virtually no explanatory value and, when coupled with limited and/or outdated discussions of paleoenvironmental conditions in the study area, can potentially lead to serious interpretive difficulties. In the same vein, subjective (and sometimes simplistic) characterizations of past environmental conditions (e.g., the "deleterious" effects of the Altithermal and the "rich biotic potential" of mesic conditions) can further cloud the issues. Obviously, environmental changes altered local ecologies, but existing biotic zones did not disappear during "deleterious" warmer and drier conditions; they simply shifted locations. While mesic conditions may have allowed expansion of grasslands, these same conditions may have adversely affected the habitats of edge-area species such as deer.

This leads to a second point, namely the focus of many studies on large mammal procurement. While it is clear that the bison herds of the study area represented a unique resource and that ethnographic accounts vividly recount the importance of bison to human groups during the post A.D. 1700 period, too little research has been directed toward other aspects of prehistoric Plains subsistence. Moreover, the historic importance of bison seems to color interpretations of other aspects of subsistence. For example, in discussing the Plains Village period, some researchers refer to agriculture as "gardening," a minor semantic difference perhaps, but one that de-emphasizes the importance of tended crops. While it should be recognized that the growing season (and, consequently the specific varieties of maize that were grown) precluded the development of agriculture in the study area on a level comparable to maize-based adaptations in the Mississippi Valley, agriculture was central to Plains Village culture.

Adaptation Types in the Northern Plains

Pleistocene-Holocene Transition Adaptation

Date Range

At present, there is no unambiguous evidence for human presence on the Northern Plains during the final centuries of the Pleistocene, and although earlier settlement seems to be a logical necessity, the evidence remains largely equivocal (Meltzer 1989; but see Whitley and Dorn 1993). Geologic context and reliable dating will be crucial to the identification of possible pre-Clovis groups.

Radiocarbon evidence from an increasing number of good contexts at a variety of sites brackets Paleoindian occupation of the Northern Plains between approximately 12,000 and 8,000 radiocarbon years before present (e.g., Frison 1991a; Haynes 1993). Identified cultural complexes include Clovis, Folsom, Goshen, Cody, and Allen/Frederick.

Environmental Context

Paleobiotic studies in the Northern Plains have lagged behind those in eastern North America (e.g., Delcourt and Delcourt 1981; Royall et al. 1991). Limited evidence suggests that the Northern Plains grasslands were established prior to the appearance of Clovis (Barnosky 1989; Barnosky et al. 1987; Markgraf and Lennon 1986; MacDonald 1974).

At Elk Lake, Minnesota, provides a definitive picture of the Pleistocene-Holocene transition for the Northeastern Plains. At this locality, between 10.2 and 10.0 ka, the postglacial open spruce forest was rapidly replaced by mixed pine forests. The spruce-pine transition was time-transgressive from south to north and represents an increase in July temperatures of roughly 4 degrees centigrade, as well as an increase in annual precipitation to approximately modern levels (Bradbury et al. 1993; Whitlock et al. 1993).

A similar pattern is documented throughout the north-central United States. For example, in southern South Dakota, the spruce forest was replaced along its southern margin by prairie around 12,000 years ago. Various hardwoods, including oak, poplar, and ash, expanded into this area, mixing with spruce, by around 11,000 years ago. The development of prairie occurred about 1,000 years later (Barnosky et al. 1987).

During the period 9.5 to 9.1 ka, a significant change to a warmer, drier than modern climate is indicated at Elk Lake, followed by an eastward expansion of the prairie between 9.0 and 7.0 ka. Pine forests underwent major reductions between 9.0 and 8.0 ka, with sagebrush, and later grass, becoming dominant in the pollen record. Sagebrush first appeared around 8.7 ka, marking the initial eastward expansion of prairie environments. Pollen evidence suggests a relatively gradual transition into the prairie period, but geochemical data indicate that this transition spanned only about 100 years (Bradbury et al. 1993). The onset of the mid-Holocene arid prairie period (the Hypsithermal or Altithermal) occurs at 8.2 ka at Elk Lake.

Pollen records from two localities in northwestern Montana, Guardipee Lake and Lost Lake, differ significantly from those in the eastern Great Plains and the Midwest. There is no evidence of a late glacial spruce forest. Rather, pollen data indicate the presence of temperate grassland, with shrubs occupying mesic habitats, by approximately 12,000 years ago. The nearby slopes evidently supported pine, spruce, and fir; this would be consistent with findings in montane settings that indicate the presence of pine parklands. After 11,500 years ago, increasingly dry climates are marked by the increased importance of sagebrush relative to grass (Barnosky 1989). At Guardipee Lake, the Altithermal began around 8,400 years ago (9,400 RCYBP), an age intermediate between the Pacific Northwest and portions of the eastern Great Plains (Barnosky 1989).

A key point is that Late Pleistocene-Early Holocene environments and ecologies were significantly different than conditions found anywhere today (Graham et al. 1987). Not only were floral and faunal communities compositionally different, but the rate of environmental change in the wake of the retreating glacial ice sheets has no modern parallel.

Disharmonious faunal associations, presumably reflecting reduced seasonal extremes in climate, appear to be the norm throughout the region at this time. In the eastern portion of the study area, the formation and lowering of large postglacial lakes (e.g., Lake Agassiz), including massive outflows of water that produced massive alterations of local geomorphology, is unique to this time period. The time-transgressive nature of environmental changes throughout the study area complicates interpretations of the archeological record. By approximately 10,500 B.P., generally mesic conditions prevailed at the prairie/boreal forest ecotone in western South Dakota, as documented at the Lange-Ferguson mammoth kill site (Semken and Falk 1987).

The presence of megafauna, notably mammoth, stands as perhaps the most dramatic example of the differences between terminal Pleistocene times and the present. By Early Holocene times, these animals had become extinct or significantly reduced in size (e.g., bison). Also vanished was the environment(s) to which these massive beasts were adapted. Humans may have contributed to the demise of the mammoth, but there is little evidence to suggest that the extinction of other Pleistocene species such as camel and horse was caused by hunting. As noted in the preceding chapters, big game hunting remained a key to human adaptations on the Northern Plains into Historic times, but within a landscape characterized by modern and relatively stable ecosystems.

Cultural Context

It is generally assumed, and at least not contradicted by the archeological record, that groups inhabiting the Northern Plains during the Pleistocene-Holocene transition were highly mobile, small-scale societies that heavily relied on hunting large herbivores for subsistence. Permanent and/or long-term habitation sites are unknown and would not be expected. Presumably, aggregations of small economic units ("bands") occurred seasonally or cyclically to provide marriage partners, exchange information, and trade valued resources (e.g., Seeman 1994). Such a view of Paleoindians may be somewhat simplistic. For example, some researchers suggest that the Lindenmeir site in northern Colorado represents a locality at which Folsom peoples congregated on a regular basis for many years (Wilmsen and Roberts 1978). Further, some kill sites of large mammals may represent communal hunting events (Bamforth 1988).

Technology and Subsistence

Late glacial Paleoindian social groups are represented archeologically primarily by surface finds of distinctive Clovis projectile points, but excavated specimens are documented at sites like Dent and Anzick, both located adjacent to the study area. An assessment of Clovis radiocarbon dates on materials other than bone suggests these artifacts were produced within a few centuries of 11,000 B.P. (Haynes 1993). Although several sites have produced slightly more recent dates (e.g., Dent and Anzick), Clovis almost certainly represents a pre-10,500 B.P. phenomenon.

Most researchers view the subsistence of early Native American groups as focused on megafauna. Although mammoth unquestionably were taken by early Northern Plains peoples, it remains unclear if these animals were actively hunted, scavenged when possible, or both. The role of smaller game is not well documented, but this undoubtedly reflects a strong bias of the available data. It is difficult to imagine a myopic fixation on megafauna, while smaller species were ignored. Evidence from the Colby site demonstrates that not only mammoth, but also bison, camel, horse, pronghorn, and jackrabbit were taken by small human groups.

Fluted Clovis lance points are characteristic of this time period, and the represent the pinnacle of percussion biface technology. These points evidently were inserted into detachable ivory foreshafts that were affixed to lances. Other Clovis lithic items included end scrapers, gravers, and a variety of relatively unmodified blade tools. Worked bone and ivory are poorly represented archeologically, but undoubtedly comprised an important component of material culture. At the Colby site, features interpreted as cold weather meat caches were recorded. Meat storage facilities would seem requisite if large game was regularly taken.

In the Northern Plains and elsewhere, Clovis artifacts, particularly those in caches, were made from superior lithic materials (exotic cherts, obsidian, quartz) obtained from widespread sources (e.g., Frison 1991a; Lahren and Bonnichsen 1974). The cultural mechanisms involved in the distribution of exotic lithics are unknown, but Seeman (1994) suggests that periodic aggregations of Clovis peoples may have provided contexts for exchange.

Since most evidence for the first human occupants of the Northern Plains consists of surface collected points or kill sites, little can be said about settlement patterns, or even types of sites. If some traditional assumptions are correct, it is likely that populations were small, highly mobile, and their presence was unlikely to create large archeological records.

Trade and Exchange

It is clear that Paleoindian groups acquired high-quality lithics from numerous sources located at considerable distances from the localities at which finished artifacts crafted of these materials entered into the archeological record. Opinions vary on the mechanisms through which exotic raw materials were acquired. Hayden (1982) suggests that trade is most likely, while other researchers feel that use of a variety of lithics simply reflects the high mobility attributed to these early inhabitants (e.g., Goodyear 1982; Meltzer 1989; Wheat 1972; see also Seeman 1994).

Ideology

Burial of the dead at sites such as Anzick provides intimations of ideology, but burials dating to this time period are very uncommon. Clovis caches presumably had ideological significance; the few recorded instances of red ochre associated with caches hint that this may have been a widespread and typical practice. Although some researchers assume that the ochre has ritual connections, Titmus and Woods (1991) offer a technological explanation.

Bioarcheology

Skeletons from this time period are exceedingly rare and only two have been located in the study area. A juvenile human cranial fragment from the Anzick site in Montana has been radiocarbon dated at 10,680 ± 50 B.P. (Lahren and Bonnichsen 1974; Stafford 1994). The Gordon Creek skeleton, from north-central Colorado near the Wyoming border, has an uncorrected radiocarbon age of 9,700 ± 250 B.P. The remains are those of a woman, aged 25-30 years. Tooth wear patterns suggest that plant foods formed part of the diet (Powell and Steele 1994:189). Steele and Powell (1992, 1994) present descriptions and analyses of all North American skeletons dating prior to 8,500 B.P.

Data Gaps and Research Questions

Although Clovis points are present throughout the Northern Plains, preserved sites in good geologic contexts are rare. With the exception of the Sheaman site (Frison 1982a), preserved habitation sites are unknown; such sites hold the key to understanding Pleistocene-Holocene transition subsistence patterns. Additional geomorphological studies are essential both to locating additional sites, as well as understanding the processes that produced the archeological record as presently known. Detailed paleoenvironmental studies spanning the Pleistocene-Holocene transition are a pressing need, particularly on the Northwestern Plains. Regional variation in Paleoindian technology is now well-documented and needs to be further explored. In some portions of the Northern Plains, it appears that groups using late Paleoindian technologies persisted well into the Holocene. The subsistence and settlement systems of these peoples needs to be explicated and compared to those of earlier Paleoindians. Of overriding importance is the need to resolve the question of Clovis origins.

Broad Spectrum Hunter-Gatherer Adaptation Type

Date Range

The beginning of this adaptation type is generally correlated with the onset of the Hypsithermal period approximately 8,000 years ago. In the western portion of the study area, the same basic adaptation continued into protohistoric times, while the

Middle Missouri subarea gave rise to the Pre-Villager adaptation type around A.D. 1. A variety of complexes traditionally subsumed within Plains Archaic, as well as later Paleoindian complexes, are included in the Broad Spectrum Hunter- Gatherer adaptation type.

Environmental Context

In the Northern Plains, the earliest portion of the Holocene was characterized by rapidly changing ecologies that presaged the onset of the arid and warm Hypsithermal (or Altithermal) around 8,400 B.P. (Barnosky 1989). At Elk Lake, Minnesota, the onset of the Hypsithermal occurs at 8.2 ka. Between 8.0 and 7.0 ka, grass dominates the pollen assemblage, with a progressive influx of oak in the savannah vegetation. Pollen assemblages from southern Saskatchewan, as well as data from Elk Lake, suggest a cold, dry climate between 7.8 and 6.6 ka (Whitlock et al. 1993; Bartlein and Whitlock 1993).

Throughout much of the Hypsithermal, annual precipitation in northwestern Minnesota probably was about 100 mm less than present, and July temperatures were approximately 2 degrees centigrade warmer than present (Bartlein and Whitlock 1993), as the dry westerly winds of the Pacific airstream became increasingly dominant. In northwestern Iowa, the severity of Hypsithermal xeric conditions are reflected in the depression of the water table by 10 m between about 7,200 and 6,400 years ago (Bradbury et al. 1993). During the latter portion of the mid-Holocene (6 to 4 ka), oak remains prominent in the Elk Lake pollen record, with decreases in grass and sagebrush.

Several lines of evidence suggest, but do not conclusively demonstrate, that climates during the Hypsithermal/Altithermal caused a reduction in the bison population within portions of the Northern High Plains, with a concomitant decline in communal bison hunting.

Although the Hypsithermal may be broadly characterized as a time of drier and warmer climates, it is important to recognize that climatic fluctuations occurred during this period, and that the effects were not uniform across the whole of the Northern Plains region. The mid-Holocene was a dynamic period of climatic change, characterized by rapid transitions between dry and moist intervals (Bradbury et al. 1993).

Data from Elk Lake, Minnesota, indicate the establishment of modern climatic and environmental regimes by around 4.0 ka. Around 3.5 ka, mean temperatures apparently were 1.5-2.0 degrees centigrade warmer than the present, with annual precipitation about 100 mm greater (Bartlein and Whitlock 1993). By around 2.7 ka, a cooler interval produced mixed conifer-hardwood forests that replaced the oak savannah around Elk Lake. Temperatures may have decreased by as much as 6 degrees centigrade during this period.

The lowest level of the Mondrian Tree site in west-central North Dakota, dating to approximately 4,500 years ago, yielded a steppe-like mammal assemblage reflective of drier conditions, and a scrub gallery forest is suggested by pollen data from this level. By around 4,000 years ago, a more mesic climate is suggested by a major increase in boreomontane mammals. Boreal elements increase between about 3,500 and 3,000 years ago, implying a cooler, more moist climate. During this time, the site area probably consisted of an open grassland, with a shrub gallery forest nearby. Further increases in the number of boreoforest ecotypes suggest similar climatic conditions between about 2,500 and 2,200 years ago.

With the end of the Hypsithermal, relatively stable, modern climates were established. Minor fluctuations in temperature and moisture (e.g., the Sub-Atlantic and Scandic episodes) subsequently occurred, but at present there is relatively little solid evidence to link post-Altithermal climate changes to human adaptational shifts, either within the Northern Plains or elsewhere within the continental United States.

Cultural Context

Population increases are implied by a general increase in the numbers of reported archeological sites over time, although some portions of the study area may have experienced population reductions during the Hypsithermal. Much of the existing archeological information for this adaptation type is derived from bison procurement sites. Therefore, while changes in communal bison procurement strategies over time are well documented, many other aspects of the Broad Spectrum Hunter-Gatherer adaptation type are rather poorly known.

Presumably, social groups operated as foragers, in the sense of Binford's (1980) work, and probably were characterized by considerable mobility linked to seasonal exploitation of resource patches and the movements of herd animals. No information about group size or territoriality is available.

Technology and Subsistence

With the possible exception of a several thousand year interval beginning around 8,000 B.P., communal bison hunting was a major focus of Northern High Plains subsistence strategies from Paleoindian times, beginning around 11,000 B.P. with Goshen, until the near extinction of the bison in the late nineteenth century. While not to downplay the importance of bison, the term Broad Spectrum Hunter-Gatherer adaptation is used here. This adaptation type spans almost the entire archeological record and includes numerous traditional taxonomic units (periods, complexes), as well as major technological changes, such as the introduction of the bow and arrow. Although material culture changed considerably, the basic adaptation appears to have been relatively constant.

Use and perhaps dependence on bison may have been significantly more intense in northern portions of the Northern High Plains than immediately adjacent areas to the south. Particularly during later Paleoindian times, mountain sheep and mule deer, rather than bison, were the major subsistence focus of groups occupying the foothills-mountain area. Some researchers view this adaptation as highly distinctive, but given the current limitations of the data, seasonality cannot be ruled out as a factor.

Although the available archeological evidence and various ethnohistoric accounts suggest that bison procurement was the focus of Northern High Plains subsistence for roughly 11,000 years, several caveats to this statement are in order. First, while large mammal kill sites have received considerable archeological attention, excavated data from other kinds of sites are notably scant, raising questions about sampling bias. Other large game, notably pronghorn and mule deer, are represented in faunal collections, and smaller animals, such as rabbits, are unlikely to have been overlooked by bison hunting groups. Ethnohistoric documents indicate that even after the Wind River Shoshoni acquired horses and became bison hunters in protohistoric times, bison meat was available during half the year. Deer and elk also were important game animals, and a variety of plant foods, including roots, tubers, berries, greens, and seeds, were gathered (Shimkin 1947).

Represented in the botanical sample from Leigh Cave were wild onion, sego lily bulbs, buffalo berry, prickly pear, chokecherry, limber pine nuts, and yucca pods. Several hundred roasted Mormon crickets were found in the same deposits. Thus, although bison probably were the single most crucial component of Northern High Plains subsistence, perhaps even exceeding the importance of white-tailed deer in the Eastern Woodlands, the overall subsistence strategy included exploitation of a broad spectrum of edible resources.

Given the vast time span represented, only a few highlights of Broad Spectrum Hunter-Gatherer adaptation type cultural content will be presented here; details are amply documented in the preceding chapters. Projectile points, which are viewed as important horizon markers in the study area, underwent considerable changes over time. Late Paleoindian point styles, including Goshen, Folsom, Agate Basin, Hell Gap, and Scottsbluff, characterize the period of circa 11,000 to 8,000 B.P. The appearance of side-notched projectile points around 8,000 B.P. marks the start of the Early Plains Archaic period, and the general style persisted for several thousand years. Presumably these and later point forms prior to the introduction of the bow and arrow were affixed to darts that were propelled by atlatls. Oxbow points, distinguished by side notches and deep basal concavities, are dated between approximately 5,500 and 3,500 B.P. Corner-notched Pelican Lake and Besant dart points are typical of the period between 3,000 and 1,500 B.P.

Avonlea groups evidently introduced the bow and arrow on the Northern High Plains around A.D. 500, marking the beginning of the Late Prehistoric period. The shift from atlatl and dart technology to the bow and arrow is reflected in the replacement of larger dart points with small side-notched Avonlea points. These points are usually made from high quality materials and exhibit excellent workmanship. Individual specimens are often difficult to distinguish from other Late Prehistoric side-notched points.

Grinding stones (manos and metates) and roasting pits, both present during Early Plains Archaic, occur more frequently during the Middle Plains Archaic. Coiled basketry is well-documented in Late Archaic dry rockshelter and cave contexts, and probably was developed much earlier. Also found in Late Archaic contexts are digging tools fashioned from elk antlers and wood; such tools probably were used for obtaining roots and tubers. Corner-tang knives first appeared during the Early Plains Archaic, but are especially characteristic of Late Plains Archaic.

Ceramics first appear during the Late Plains Archaic in association with Besant material culture. Pottery is more common and widespread during the succeeding Late Prehistoric period, and wares of several ceramic traditions, including Plains Woodland, are represented in the study area.

Avonlea sites are distinguished by large artifact assemblages, including decorative items of antler, bone, and shell. Sandstone arrowshaft abraders also are common. The function of Avonlea notched flakes remains unknown. Pictograph Cave produced a large assemblage of Late Prehistoric perishable materials, including artifacts of bark, wood, plant fiber, sinew, and hide.

Evidence of simple structures, perhaps conical pole tipis, was identified in Folsom deposits at the Hanson and Agate Basin sites (Frison and Bradley 1980; Frison and Stanford 1982). Semisubterranean pit houses are first documented toward the end of the Early Plains Archaic, around 6,000 B.P. These structures are seemingly well-suited for the harsh winters in the study area, but evidence for seasonality is lacking. Stone circles, or tipi rings, occur in Middle Plains Archaic (6,000 to 3,000 B.P.) contexts and continue into historic times. These features are interpreted as a means of temporarily anchoring conical pole structures. Stone circles occur singly and in groups of over 100. The larger concentrations may represent periodic aggregations of several mobile groups. Foothill-mountain rockshelters were frequently utilized by Middle Plains Archaic peoples. Several Avonlea semisubterranean lodges approximately 4.5 m in diameter have been reported based on amateur excavations.

Following an apparent hiatus of several thousand years, communal bison hunting utilizing arroyo traps returned to prominence by roughly 6,000 B.P. The resemblance of the bison procurement strategies at the Hawken site (ca. 6,400 B.P.) to earlier Paleoindian communal traps suggests continuity, rather than the recurrence of the older strategy. This raises the possibility that the inferred disappearance of communal bison during the Early Plains Archaic may actually reflect masking of deposits by geologic activity.

Current evidence suggests that during Late Paleoindian times, bison procurement was primarily a cold weather activity. In contrast, Late Plains Archaic and Late Prehistoric kills indicate that late summer-early fall was the peak time for bison hunting. Bison jumps are particularly common during the Late Prehistoric period (post-A.D. 500), especially in the northern portions of the study area. In southern areas, bison seem to have been less numerous, and local subsistence strategies were less reliant on these animals.

Communal bison hunting strategies evolved over time. Two localities at the Hawken site in northeast Wyoming document the use of arroyo traps between 6,500 and 6,000 years ago (Frison et al. 1976). Communal bison hunting utilizing a fence at the base of a steep slope is reported at the Scoggin site in south-central Wyoming at about 4,500 B.P. (Lobdell 1973). Arroyo bison kills associated with Yonkee material culture proliferate around 3,000 B.P. in the western portion of the study area, and evidence from the Kobold site in southern Montana demonstrates that Yonkee groups also jumped bison (Frison 1970a). Coincident with the appearance of Besant material culture about 2,000 years ago was the introduction of large bison corral and drive complexes (e.g., Frison 1971a). During late prehistoric times, a variety of communal bison hunting techniques were employed, including the use of jumps, arroyos, sinkholes, and corrals or pounds; stampedes over a steep, low bluff into a corral at the base are especially common. It should be noted that although bison procurement complexes are found throughout the study area, they are much more numerous in northern portions. Adaptations in the southern portions may represent more broad spectrum hunting and gathering strategies, although the present data are inconclusive.

Trade and Exchange

Prior to the protohistoric period and the arrival of Euro-American goods, evidence of trade and exchange in the Northern High Plains is scant, with the notable exception of the movement of high-quality lithics during Paleoindian times. Small numbers of *Dentalium* and *Olivella* shells, as well as nonlocal cherts from the Missouri River valley, have been reported at Late Prehistoric sites in the study area, usually from burial contexts.

Ideology

Archeological evidence of possible ritual activities have been recovered from several sites. At the Late Plains Archaic (Besant) Ruby site, a large structure and special treatment of bison skulls probably represent a supernatural activities related to the operation of a bison line drive and associated corral. Small stone circles near bison jumps and careful placement of bison skulls in bone beds may also indicate ritual activities. Broken carved steatite pipes were found in the Late Prehistoric bison jumping level at the Kobold site (Frison 1970a). Rock art, which is ubiquitous throughout the study area, includes motifs such as large animals penetrated by arrows. These and other figures seem to beg interpretations invoking shamanistic activities, but such notions must remain conjectural.

Bioarcheology

Bioarcheological data for this adaptation type are fairly sparse. Skeletal remains have been recovered from eight sites in North and South Dakota; radiocarbon determinations are available for three of these. Buffalo Creek (39BF2), Pipestem Creek (32SN102), and Bahm (32MO97) are particularly noteworthy.

Cranial morphology is generally characterized by low vault height and a tendency toward a dolicocranic form. The small number of recovered intact skeletons limits broad interpretation of osteopathological and dental features. Pathological conditions are uncommon in the sample, but include osteoarthritis (especially of the upper appendages) and periostitis. Carries also are uncommon, but enamel attrition is excessive at early ages. This general level of good health is mirrored by the demographic profiles of the samples. Although there is a high level of infant and early childhood mortality, this adaptation type exhibits the highest life expectancy at birth, with life expectancy remaining high well into the fourth decade of life.

Both primary and secondary interments are recorded. The Bahm site is noteworthy for the occurrence of numerous dissection cutmarks on skeletal elements and the selective interment of specific bones. This suggests that after mortuary processing (dissection), certain bones were retained for a period of time prior to final interment. Probable evidence of scalping was observed also at Bahm, which, if substantiated, indicates considerable antiquity for this practice.

Data Gaps and Critical Research Questions

Chronological relationships, especially with respect to late Paleoindian bison hunters, are considered to be less clear now than was believed even a decade ago. Postulated evolutionary developments between complexes should be reassessed using better stratigraphic evidence and AMS dating. More and better paleoclimatic data are a pressing need, particularly since many interpretations of area culture history are framed in terms of paleoclimatic evidence that is at best limited.

Knowledge of Late Paleoindian subsistence is severely hampered by a lack of data from occupation sites in good geologic contexts. More sophisticated taphonomic studies must be brought to bear on bone beds. Kill sites of large mammals have received a disproportionately large share of attention from researchers in the study area. Not only has this seriously detracted from developing an accurate picture of subsistence practices, but also superimposes a strong element of gender bias on interpretations, i.e., an overwhelming evidence on (presumed) male hunters.

A reassessment of early ceramics, particularly in western portions of the study area, clearly is overdue. While Frison (1978, 1991a) may well be correct is his interpretation of “intrusive” ceramics (e.g., Blackfoot and Crow), such interpretations are largely speculative in the absence of detailed stylistic and technological studies.

Historic Plains Bison Hunters

The introduction of horses and Euro-American goods during protohistoric and historic times produced significant and fairly rapid changes in Northern Plains lifeways. Not only did new subsistence strategies develop, but traditional social and political systems underwent considerable evolution. Warfare became institutionalized and individual wealth became an important objective. Settlement remained highly mobile, although more efficient subsistence allowed larger group size. Winter camp placement was governed by the availability of food for horses.

Near the end of the seventeenth century, Great Basin Shoshoneans had acquired sufficient numbers of horse that they soon eliminated small, local bison populations, and moved on to the Plains, where they wrought depredations on the traditional inhabitants into the early eighteenth century. Several well-known Northern Plains groups, notably the Blackfeet, Cheyenne, and Sioux, did not become mounted hunters until the latter portion of the eighteenth century.

The nineteenth century saw increasing pressure on the seemingly limitless bison population, and by the early 1880s, all of the large herds had been virtually eliminated. This, coupled with increasing encroachments by Euro-Americans and the establishment of U.S. Army military superiority, brought an end to the mobile bison hunter adaptation.

Acquisition of horses (with attendant equipage) and firearms can be singled out as the most significant changes in material culture. Corollary to these changes in material culture was the emergence of structured inequality, which was linked to the evolution of a complex redistributive system rooted in traditional concepts of reciprocity (Nugent 1993). The horse and gun produced significant changes in bison hunting strategies. Cooperative hunting, no longer a necessity, became increasingly rare. Even during group "surrounds," distribution of meat was individualized, each dead animal being claimed by the hunter personally responsible for killing it.

Throughout this period, Euro-American goods were becoming increasingly available, in some cases supplanting traditional items of material culture, particularly with respect to weaponry and butchering/processing tools. The availability of horses for transport allowed construction of larger tipis. Highly decorated elbow pipes, usually of catlinite, replaced earlier tubular forms.

The development of the fur trade produced an unprecedented influx of nonlocal (in this case, Euro-American) goods into Northern Plains societies. Captives taken during raids could be sold as slaves in the Southwest; Shoshoneans were particularly active in the slave trade.

Ethnographic sources stress the importance of individual vision quests for the purpose of acquiring supernatural power and/or assistance. Specific objects, such as shields, were felt to be repositories of supernatural power. The Ghost Dance religion of the later nineteenth century represents a major revitalization movement.

Environmental Context

Between A.D. 1600 and A.D. 1635, average temperature and precipitation were within the modern range throughout virtually all of the Northern Plains; southwestern Wyoming was warmer and drier. During the interval A.D. 1637-1666, the western United States were significantly warmer and drier than areas to the east. Montana and Wyoming experienced higher temperatures; drier conditions prevailed in western Wyoming, most of southern and eastern Montana, and most of North Dakota. By A.D. 1717, most of the United States was characterized by warmer temperatures, with decreased precipitation in portions of the west, including most of the Northern Plains. Around A.D. 1761, temperatures decreased somewhat across the United States. Much of the country experienced lower precipitation, the Northern Plains being a notable exception (Fritts and Shao 1992).

Bioarcheology

No data were available for this study.

Data Gaps and Research Questions

Although the protohistoric and historic periods on the Northern Plains are relatively well-known through historic and ethnographic accounts, the movements of many tribes during this time were apparently so abrupt and complex that many details remain unclear. European diseases such as smallpox affected the nomadic Northern Plains groups, but the actual impacts have yet to be documented.

The perishable portions of historic bison drive lines, animal traps, habitation structures, and ritual structures, such as those associated with vision quests are rapidly deteriorating and being destroyed by natural forces. These features have enormous interpretive potential, and stronger efforts to record them are imperative, lest they be irretrievably lost.

Adaptation Types in the Middle Missouri

Prior to the introduction of ceramics, around A.D. 1, the prehistoric cultures of the Middle Missouri were generally similar to those within the Northern Plains as a whole, and even during Plains Woodland times (roughly A.D. 1 to 1000) differences do not appear to have been pronounced. Developments during the succeeding Plains Village period ushered in an adaptation type that is unique to the Middle Missouri.

Pre-Villager Adaptation Type

Date Range

The Pre-Villager adaptation type in the Middle Missouri generally equates with the Plains Woodland period. As noted above, the Pre-Villager adaptation type in the subarea is not markedly different than contemporary adaptations elsewhere in the Northern Plains, and Plains Woodland is much more distinctive in the Northeastern Plains subarea than in the Middle Missouri. Nonetheless, insofar as Plains Village developed out of Plains Woodland, the Pre-Villager adaptation type is a useful organizing construct and provides a basis for comparisons with the Villager adaptation type.

The Pre-Villager adaptation type dates roughly to the first millennium A.D. This time period is typically divided into the Middle Plains Woodland (A.D. 1-600) and Late Plains Woodland (A.D. 600-1000) periods. Few cultural complexes have been identified. These include the Sonota complex (Neuman 1975) and Valley variant (Benn 1990) of the Middle Plains Woodland period, and the Late Plains Woodland Boyer and Loseke variants (Benn 1990). With the exception of Sonota-Besant, which is linked to Hopewellian manifestations in the Eastern Woodlands, these complexes are restricted to the southern portion of the Middle Missouri subarea in South Dakota.

Environmental Context

Some geomorphological and pedological data suggest that climates during Middle Plains Woodland times were generally more mesic than during the preceding Late Plains Archaic. Such climatic conditions may have favored the rise of horticulture in the Eastern Woodlands, but there is presently no evidence for a comparable shift in subsistence within the Middle Missouri until the Plains Village period.

Cultural Content

Recorded Middle Plains Woodland sites are more numerous than sites of the preceding Late Plains Archaic, suggesting a population increase. Fewer Late Plains Woodland sites have been recorded, however, causing some researchers to posit a population decline in response to climatic conditions; more paleoenvironmental and archeological data are required to clarify this issue.

Current data suggest that relatively small-scale political structures are represented by Plains Woodland cultures in the subarea. Some degree of social ranking may be implied by the construction of burial mounds, although status differentials between individuals appears to have been less pronounced than that seen in the Northeastern Plains. Construction of burial mounds implies an increased sense of territorialism.

Although poorly known, Plains Woodland settlement in the subarea is generally regarded as seminomadic (e.g., Murdock 1967). The harsh winter conditions of the Northern Plains makes a fully nomadic settlement pattern seem impractical, and it seems likely that a fixed winter base would have been a necessity. Current evidence indicates Woodland settlement was no more sizable or complex than that of the Plains Archaic, and most reported habitation sites are interpreted as short-term, temporary camps.

Technology and Subsistence

Two notable technological innovations appeared during the Plains Woodland period. The beginning of the period is defined by the introduction of ceramic vessels around A.D. 1. Conoidal jars are the most common vessel form. In the Eastern Woodlands, the use of pottery is generally associated with increased sedentism.

Around A.D. 600, introduction of the bow and arrow marks the start of the Late Plains Woodland period. This weaponry system replaced the atlatl and dart for hunting. Ceramic technology improved during this time period, as vessels exhibit thinner walls and exhibit more elaborate decoration. Globular jars became the dominant vessel form.

Two sites in the Big Bend region have yielded evidence of Middle Plains Woodland structures (Hoffman 1968; Toom 1989). In the Northeastern Plains subarea, Gregg (1987, 1990) reports Woodland houses at the Naze site. These structural remains may reflect increased sedentism, but since there are no known Plains Archaic houses in the subarea, it is possible that such structures have some time depth.

Plains Woodland subsistence seems to have differed little from the preceding Late Plains Archaic. Broad spectrum hunting and gathering, with bison playing a central role, is indicated by current data. No evidence of domesticated plants has been reported in the subarea during Plains Woodland times, but this aspect of subsistence has received less attention by researchers than in, for example, the American Bottom.

Trade and Exchange

The sparse evidence for trade and external relations beyond the Middle Missouri suggests an east-west flow of goods and information. Materials such as obsidian and Knife River flint moved through the subarea en route to Hopewellian groups in the Eastern Woodlands. The very limited quantities of marine shell and copper obtained by Middle Plains Woodland groups are known almost exclusively from burial mound contexts, and the subarea represents the westernmost extent of burial mound use in the Dakotas.

Ideology

The interment of certain individuals in earthen burial mounds is a hallmark of Plains Woodland cultures in the Middle Missouri; more elaborate examples are found in the Northeastern Plains. Ceremonialism on this scale is unknown during the Plains Archaic. The presence of secondary burials suggests the presence of mortuary processing facilities.

Bioarcheology

The Sonota complex is well represented by skeletal remains and the bioarcheology is adequate. Eight Sonota complex sites have been identified. Swift Bird (39DW233), Grover Hand (39DW240), and Arpan (39DW252), all described by Bass and Phenice (1975), as well as component I of Jamestown Mounds (32SN22), provide most of the bioarcheological data (Williams 1985a).

Final interment typically consisted of placing partially articulated and disarticulated remains in secondary pits. Cut marks from skeletal processing (dissection) are common. Cranial morphology is low vaulted, but varies from dolicocranic to mesocranic in form. Osteoarthritis and vertebral osteophytosis are common. Fractures, sublaxations, and periostitis occur frequently. Individuals from Jamestown Mounds exhibit evidence of skeletal tuberculosis and the tapeworm infestation, hydatid disease. A young adult female from the same site was injured by a projectile point. Sonota complex sites exhibit very high levels of periostitis, which is suggestive of poor health. This is also reflected in the sample demographic profiles. Both collectively and individually, Sonota sites have very high levels of mortality through the first decade, including a high proportion of fetal skeletons. Life expectancy at birth is under 15 years and at no point does life expectancy exceed 20 years. The crude death rate is the highest of any time period studied. Thus, Sonota complex populations can be characterized as groups experiencing considerable disease stress.

The Late Woodland Arvilla complex of North and South Dakota and northwestern Minnesota is represented by 12 sites and over 150 well-preserved skeletons. Both primary and secondary interments are reported, but the large number of the former accounts in part for the good level of bioarcheology.

Arvilla cranial morphology differs somewhat from earlier populations, in that vault height is low to medium, with a mesocranic to brachycranic form. This suggests a lack of continuity with the more western Siouan populations. Biological distance assessments are incomplete and have generated some degree of controversy. Bone disease patterns are generally comparable to those of the Broad Spectrum Hunter-Gatherer adaptation type, although periostitis levels are substantially lower. As a probable correlate, Arvilla groups also exhibit higher life expectancy at birth and later ages. Moreover, Arvilla sites collectively have the lowest infant mortality rate of all the populations studied.

There is also considerable evidence of bone disease. An example of Pott's disease (skeletal tuberculosis of the spine) was observed at the Arvilla site (32GF1). A 15 year old from the Peter Lee Mound (21PL13) exhibits considerable cribra orbitalia. Cutmarks compatible with scalping have been recorded at several sites. Dentition is characterized by a low rate of caries, high attrition levels, and a high incidence of periodontal disease.

Non-Arvilla Late Woodland skeletal samples have also been recovered. An example is the Kjelbertson site (32RY100), which provides a different bioarcheological profile. Individuals from this site have very high rates of caries. This, combined with several metabolic-related pathological conditions, suggests probable nutritional stress among these incipient horticulturists.

Data Gaps and Research Questions

Although the extent of Plains Woodland investigations in the Middle Missouri is second only to Plains Village research, the period is not well understood, as indicated above. Culture history and chronology remain sketchy, while subsistence and settlement practices are virtually unknown. The possible existence of horticulture during Plains Woodland is a problem that warrants further, detailed investigation. Although traditional views of Middle Missouri Woodland political organization and complexity may be essentially correct, at this point such interpretations are largely conjectural.

In light of the preceding discussion, it should come as no surprise that the origins of Plains Woodland in the subarea is a problem as yet unresolved. Debate centers on the issue of indigenous development versus outside migration. Importantly, the relationship between Middle Missouri Woodland groups and the succeeding Plains Villagers is unclear. Some investigators view the transition to Plains Village as a local evolutionary development, while others see a discontinuity best explained by migration from the east (see Toom 1992a).

Resolution of these and other issues requires more basic research into Middle Missouri Woodland archaeology.

Villager Adaptation Type

The Villager adaptation type is essentially unique to the Middle Missouri subarea, and it is Plains Village culture that distinguishes the subarea from other parts of the Northern Plains during late prehistoric and early historic times. It should be noted, however, that the Villager adaptation type also occurs in the southern portions of the Northeastern Plains, and the adaptation may have initially evolved in that region. Nonetheless, based on numbers of sites and intensity of occupation, the Middle Missouri was the center of Plains Village culture.

Date Range

Plains Village culture dominated the Middle Missouri from about A.D. 1000 into the late eighteenth century, and persisted in altered form into the late 1800s. Two subtraditions—the Middle Missouri and Coalescent—and several variants are subsumed within Plains Village. A number of phases, often using incompatible or nonexplicit criteria, have also been proposed within Plains Village times. The current cultural taxonomy scheme in the subarea is complex, unwieldy, and in need of refinement.

Later prehistory in the Middle Missouri is complex, evidently reflecting extensive migrations of populations. Notable in this regard is the Coalescent subtradition, during which villagers from the Central Plains moved into southern parts of the subarea. The appearance of fortified late Middle Missouri sites suggests that relations with these southern immigrants were not friendly.

In the mid-eighteenth century, coincident with the beginnings of the Euro-American fur trade, the expanding horse and gun frontiers converged at the Missouri River in the Dakotas. Middle Missouri villagers were strategically positioned as middlemen in the lucrative trade of these commodities. This economic boon was cut short by epidemics of European disease, especially smallpox, which ravaged Native American populations in A.D. 1780-1781 (Lehmer 1971; Toom 1979). Thereafter, Middle Missouri villagers were dominated by nomadic equestrian tribes, principally the Sioux.

By the late 1800s, numerous Euro-Americans had settled in the subarea, and the remaining native peoples were forcibly confined to reservations.

Environmental Context

Some researchers (e.g., Lehmer 1970, 1971; Toom 1992a) have linked the development of Plains Village culture to warmer on moister conditions that are thought to characterize the Neo-Atlantic climatic episode, which dates to approximately A.D. 1000-1250. Since maize agriculture had become established in the American Bottom prior to this period (Bareis and Porter 1984), it is possible that the role of environmental conditions in the rise of Plains Village culture has been overstated. Moreover, it is increasingly evident that considerable variation occurred within climatic episodes (e.g., Bamforth 1990). This suggests that the adoption of agriculture was multicausal and not prompted solely or primarily by climatic changes.

Cultural Content

During Plains Village times in the Middle Missouri, human population increased substantially, as reflected in numbers of sites and measures of occupation intensity (Toom 1992a, 1992c). Historical data suggest that the population of the subarea may have numbered in the tens of thousands (see Lehmer 1971). Whatever the actual numbers, it is clear that Plains Village populations greatly exceeded those of the preceding Plains Woodland period.

Settlement in large villages and the importance of agriculture were undoubtedly accompanied by significant changes social and political structures. Plains Village societies probably were organized in ways similar to what have traditionally been referred to as "tribal" societies (Service 1962), which are characterized by some degree of social ranking (some of which was hereditary) and sodalities.

Subsistence and Technology

Earthlodge villages, some of which were fortified, are a hallmark of Plains Village material culture. The importance of agriculture required a variety of specialized implements (e.g., bison scapula hoes) and new forms of storage facilities (e.g., cache pits). Improvements in ceramic technology also occurred during Plains Village times; large, globular cooking jars were the principal vessel form. Plains Village arrowpoints tend to be somewhat larger and heavier than Plains Woodland styles.

Plains Village subsistence included three major components: agriculture, bison hunting, and broad spectrum foraging (Toom 1992a, 1992c). Agriculture, including maize, beans, squash, sunflower, and tobacco, is central to the Villager adaptation type. Prior to the Plains Village period, there is no evidence of cultigens in the Middle Missouri, although this may be a function of inadequate recovery techniques.

In contrast to some areas to the east, agriculture seems to have been strictly confined to river bottoms. The relative dietary importance of specific foodstuffs is not known, and represents an outstanding research opportunity. Enormous quantities of bison bone found at most village sites testify to the importance of these animals, which may have been taken in relatively close proximity to the villages. Middle Missouri Villagers might, therefore, best be characterized as bison hunting farmers.

The nature of Plains Village settlement patterns is an unresolved issue. Based on ethnographic analogy, Toom (1992a) has proposed a seasonal round that includes spring-fall agricultural villages, summer and winter communal bison hunts, and winter villages.

Some researchers (e.g., Wedel 1986) dispute the importance of communal bison hunts. The matter awaits resolution based on archeological evidence; faunal collections could provide crucial insights into seasonality.

Trade and Exchange

Interregional exchange continued to be important in the Middle Missouri during late prehistoric and historic times. Knife River flint was traded to peoples outside the subarea in exchange for nonlocal materials, including marine shell and copper, although the latter are not common in the subarea. Tiffany (1991a, 1991b) suggests that Mill Creek villages in northwestern Iowa maintained direct trade relations with Cahokia in the American Bottom. In this scenario, bison hides and dried meat were major commodities produced and provided by Plains Villagers. Unfortunately, such perishables are seldom preserved in the archeological record, making the hypothesis difficult to empirically test.

Ideology

Little is known about Plains Villager ideology and ceremonialism. Both primary and secondary burials are reported, with interment often taking place in sub-floor pits within houses.

Bioarcheology

Although represented by 35 sites, the bioarcheology of this adaptation types can be characterized as marginal. The numbers of skeletons from individual sites is not large and few intact remains have been described. Both primary and secondary interments are reported. Skeletons often occur within houses in subfloor pits. There is considerable evidence that violence was relatively commonplace among Plains Villagers (Holliman and Owsley 1994).

Cranial morphology differs from Sonota samples. Vault height is low to medium and shape ranges from dolicocranic to mesocranic. Distance assessments suggest strong congruence of Middle Missouri cranial samples with historic Mandan crania, suggesting an indigenous development on the Northern Plains. Osteopathological features are rare, but include the usual osteoarthritis and periostitis. The general lack of disease indicators may simply be a function of small sample size. At site 39CA102, possible "saber-shin" tibiae, characteristic of treponemal disease, were observed.

Assuming that the extant remains constitute a representative sample of the actual population, the demographic profile suggests a high level of infant and early juvenile mortality, although not so extreme as observed for the Broad Spectrum Hunter-Gatherer adaptation type. Given sampling limitations, Plains Villager populations appear to be fairly similar to those of the earlier Late Woodland groups.

Data Gaps and Research Questions

Although Plains Village culture has been intensively studied in the Middle Missouri, most of the field research and analysis was conducted over 25 years ago, and reflects the field methods, analytical techniques, and theoretical paradigms of that time. While not to detract from the contributions of this earlier research, there clearly is a need for extensive reanalysis of previously gathered materials, as well as new excavations.

Current models of culture history in the subarea and throughout the Northern Plains in general posit strong links (causality, in many instances) between culture change and the environment. Such "explanations" for culture change, in fact, explain nothing. Unfortunately, paleoenvironmental studies within the region lag behind comparable research in the Eastern Woodlands, although the situation shows signs of improving (e.g., Barnosky 1989). An emerging theme of recent studies (e.g., Bamforth 1990; Fritts and Shao 1992) is that the effects of various climatic episodes were quite variable across regions and that even within a relatively small area, there was considerable variability during these episodes. Such new evidence challenges archeologists to seek explanations for observed changes in material culture within the archeological record itself.

There is considerable dissatisfaction with prehistoric cultural taxonomy in the subarea. Ahler's (1993b) recent study represents a potentially valuable advance toward refinement and revision. Phase definitions are lacking throughout much of the Middle

Missouri, but although phase construction probably is necessary to unravel the complex culture history, phase definitions must be based on explicit, quantifiable evidence.

Additional radiocarbon dates are a pressing need, not only to clarify temporal relationships among various diagnostic artifact types, but also to unravel the complexities of Plains Village settlement. Refinements in artifact typologies could also be of benefit here, as could studies that focus on attributes rather than "types" (e.g., Ahler and Swenson 1993).

Studies of long-term subsistence trajectories, comparable to those in the American Bottom, have not been conducted in the Middle Missouri. Even during the extensively documented Plains Village period, subsistence models are very rudimentary. It is not presently known if Plains Woodland peoples engaged in limited agriculture as did their contemporaries to the east. Nor are the processes that gave rise to maize agriculture in the subarea adequately documented or understood. During Plains Village times, the relative contributions of maize, bison, and other foodstuffs is not known, and the presumed seasonality of Plains Villagers lacks solid empirical basis. Bioanthropological studies of human skeletal remains could provide important data in this regard, and indicators of seasonality should be present in faunal collections.

The nature and extant of Plains Village settlement is not well understood. Basic data such as the length of occupation represented at various earthlodge village sites is presently unavailable. The processes responsible for the appearance of fortifications over time and space remains conjectural. Because of the emphasis on earthlodge village sites, comparatively little is known about Plains Village temporary campsites and specialized extractive/processing sites. Possible ties between Plains Villagers and mass bison kills beyond the Middle Missouri should be investigated.

References Cited

Aaberg, S. A.
1975 The Drake Site (24YL51): A Prehistoric Fall-Rock Shelter in the Yellowstone Valley. *Archaeology in Montana* 16(2 and 3):73-89.

Abel, A. H.
1921 Trudeau's Description of the Upper Missouri. *Mississippi Valley Historical Review* 89 (1 and 2):149-179.

Abel, A. H. (editor)
1932 *Chardon's Journal at Fort Clark, 1834-1839.* State Historical Society of South Dakota, Pierre.
1939 *Tabeau's Narrative of Loisel's Expedition to the Upper Missouri.* Translated by R. W. Wright. University of Oklahoma Press, Norman.

Adamczyk, T. J.
1975 *Archeological Inventory, Missouri River Reach Between Fort Benton, Montana, and Sioux City, Iowa*. Submitted to the U.S. Army Corps of Engineers, Omaha District.

Adams, R.
1991 Preliminary Report on the Dicken Site: A Multiple Burial in Southeastern Wyoming. Manuscript on file, Human Osteological Laboratory, University of Wyoming.
1992 *Pipes and Bowls: Steatite Artifacts from Wyoming and the Region*. Unpublished Master's thesis, Department of Anthropology, University of Wyoming, Laramie.

Agenbroad, L. D.
1978 *The Hudson-Meng Site: An Alberta Bison Kill in the Nebraska High Plains*. University Press of America, Washington, D.C.

Agogino, G. A.
1972 Excavations at a Paleo-Indian Site (Brewster) in Moss Agate Arroyo, Eastern Wyoming. *National Geographic Research Reports* 1955-1960:1-6.

Agogino, G. A., and E. Galloway
1963 The Skulls from Torrington, Wyoming: A Re-evaluation. *American Antiquity* 29(1):106-109.
1965 The Sister's Hill Site: A Hell Gap Site in North-Central Wyoming. *Plains Anthropologist* 10:190-195.

Ahler, S. A.
1975 *Pattern and Variety in Extended Coalescent Lithic Technology*. Unpublished Ph.D. dissertation, Department of Anthropology, University of Missouri, Columbia. University Microfilms, Ann Arbor.
1977a Lithic Resource Utilization Patterns in the Middle Missouri Sub Area. In *Trends in Middle Missouri Prehistory: A Festschrift Honoring the Contributions of Donald J. Lehmer*, edited by W. R. Wood, pp. 132-150. Plains Anthropologist Memoir 13.
1977b *Archeological Reconnaissance and Test Excavation at the Jake White Bull Site, 39CO6, Oahe Reservoir, South Dakota*. Department of Anthropology, University of North Dakota, Grand Forks. Submitted to the U.S. Army Corps of Engineers, Omaha District.
1979 Functional Analysis of Nonobsidian Chipped Stone Artifacts: Terms, Variables, and Quantification. In *Lithic Use-wear Analysis*, edited by B. Hayden, pp. 301-328. Academic Press, New York.
1980 *Evaluation of the Condition of the Travis 2 Archeological Site, 39WW15, Oahe Reservoir, South Dakota, November 1979*. Department of Anthropology, University of North Dakota, Grand Forks. Submitted to the U.S. Army Corps of Engineers, Omaha District.
1986 *The Knife River Flint Quarries: Excavations at Site 32DU508*. State Historical Society of North Dakota, Bismarck.
1993a Archeological Study Previous to the KNRI Program. In *Phase I Archeological Research Program for the Knife River Indian Villages National Historic Site, Part I: Objectives, Methods, and Summaries of Baseline Studies*, edited by T. D. Thiessen. Occasional Studies in Anthropology No. 27, Midwest Archeological Center. U.S. Department of the Interior, National Park Service, Midwest Archeological Center, Lincoln.
1993b Plains Village Cultural Taxonomy for the Upper Knife-Heart Region. In *The Phase I Archeological Research Program for the Knife River Indian Villages National Historic Site, Part IV: Interpretation of the Archeological Record*, edited by T. D. Thiessen. Occasional Studies in Anthropology No. 27, Midwest Archeological Center. U.S. Department of the Interior, National Park Service, Midwest Archeological Center, Lincoln.

Ahler, S. A. (editor)
1984 *Archeological Investigations at the Elbee Site, 32ME408, Knife River Indian Villages National Historic Site*. Department of Anthropology, University of North Dakota, Grand Forks. Submitted to the National Park Service, Midwest Archeological Center, Lincoln.
1988 *Archeological Mitigation at Taylor Bluff Village (32ME366), Knife River Indian Villages National Historic Site*. Department of Anthropology, University of North Dakota, Grand Forks. Submitted to the National Park Service, Midwest Archeological Center, Lincoln.

Ahler, S. A., A. M. Cvancara, D. B. Madsen, and R. W. Kornbrath
1977 *Archaeological Reconnaissance and Test Excavation at the Travis 2 Site, 39WW15, Oahe Reservoir, South Dakota.* Report. Department of Anthropology and Archaeology, University of North Dakota, Grand Forks. Submitted to U.S. Army Corps of Engineers, Omaha District.

Ahler, S. A., D. K. Davies, C. R. Falk, and D. B. Madsen
1974 Holocene Stratigraphy and Archaeology in the Middle Missouri River Trench, South Dakota. *Science* 184:905-908.

Ahler, S. A., C. R. Falk, and P. R. Picha
1982 *Cross Ranch Archeology: Test Excavations at Twelve Sites in the Breaks and Upland Zones, 1981-82 Program*. Department of Anthropology, University of North Dakota, Grand Forks. Submitted to the State Historical Society of North Dakota, Bismarck.

Ahler, S. A., D. A. Goulding, and T. Weston
1979 *Consol 3 Project: Archeological Reconnaissance and Test Excavation in the Glenharold Mine Area, Mercer County, North Dakota*. Department of Anthropology, University of North Dakota, Grand Forks. Submitted to the Consolidation Coal Company, Stanton, North Dakota.

Ahler, S. A., C. H. Lee, and C. R. Falk
1981 *Cross Ranch Archeology: Test Excavations at Eight Sites in the Breaks Zone, 1980-81 Program*. Department of Anthropology, University of North Dakota, Grand Forks. Submitted to the State Historical Society of North Dakota, Bismarck.

Ahler, S. A., E. L. Mehrer, and P. R. Picha
1981 *Consol 4 Project: Archeological Reconnaissance and Test Excavation in the Glenharold Mine Area, Oliver County, North Dakota*. Department of Anthropology, University of North Dakota, Grand Forks. Submitted to the Consolidation Coal Company, Stanton, North Dakota.

Ahler, S. A., F. Schneider, and C. H. Lee
1981 *Test Excavation at the Slant Village Site (32MO26), Fort Lincoln State Park, North Dakota*. Department of Anthropology, University of North Dakota, Grand Forks. Submitted to the North Dakota State Parks and Recreation Department, Bismarck.

Ahler, S. A., and A. A. Swenson
1985 *Test Excavations at Big Hidatsa Village (32ME12), Knife River Indian Villages National Historic Site*. Department of Anthropol-

ogy, University of North Dakota, Grand Forks. Submitted to the National Park Service, Midwest Archeological Center, Lincoln.

1993 Plains Village Cultural Taxonomy for the Upper Knife-Heart Region. In *Phase I Archeological Research Program for the Knife River Indian Villages Historic Site, Part IV: Interpretations of the Archeological Record*, edited by T. D. Thiessen. Occasional Studies in Anthropology No. 27, Midwest Archeological Research Center, U. S. Department of the Interior, National Park Service, Lincoln.

Ahler, S. A., T. D. Thiessen, and M. K. Trimble

1991 *People of the Willows: The Prehistory and Early History of the Hidatsa Indians*. University of North Dakota Press, Grand Forks.

Ahler, S. A., and D. L. Toom (editors)

1989 *Archeology of the Medicine Crow Site Complex (39BF2), Buffalo County, South Dakota*. Illinois State Museum Society, Springfield. Submitted to Branch of Interagency Archeological Services, National Park Service, Rocky Mountain Region, Denver.

Ahler, S. A., and J. VanNest

1985 Temporal Change in Knife River Flint Reduction Strategies. In *Lithic Resource Procurement: Proceedings from the Second Conference on Prehistoric Chert Exploitation*, edited by S. C. Vehik, pp. 183-198. Occasional Paper No. 4. Center for Archaeological Investigations, Southern Illinois University, Carbondale.

Ahler, S. A., and T. Weston

1981 *Test Excavations at Lower Hidatsa Village (32ME10), Knife River Indian Villages National Historic Site*. Department of Anthropology, University of North Dakota, Grand Forks. Submitted to the National Park Service, Midwest Archeological Center, Lincoln.

Ahler, S. A., T. Weston, and K. D. McMiller

1980 *Cutbank Profiling and Test Excavations at Sakakawea Village (32ME11), Knife River Indian Villages National Historic Site*. Department of Anthropology, University of North Dakota, Grand Forks. Submitted to the National Park Service, Midwest Archeological Center, Lincoln.

AHPD, SHSND (Archeology and Historic Preservation Division, State Historical Society of North Dakota)

1990 *The North Dakota Comprehensive Plan for Historic Preservation: Archeological Component.* Archeology and Historic Preservation Division, State Historical Society of North Dakota, Bismarck.

Albanese, J. P.

1982 Geology of the Agate Basin Site. In *The Agate Basin Site: A Record of the Paleoindian Occupation of the Northwestern High Plains*, edited by G. Frison and D. Stanford. Academic Press, New York.

Alex, L. M.

1979 39BU2: A Fortified Site in Western South Dakota. *Newsletter of the South Dakota Archaeological Society* 9(3):3-7.

1980 *Exploring Iowa's Past*. University of Iowa Press, Iowa City.

1989 *Archaeological Testing and Analysis of Prehistoric Fortifications in Butte County, South Dakota*. Project 46-88-30125B018. State Historical Preservation Center, Rapid City, South Dakota.

Alex, L. M., and J. E. Martin

1993 The Occurrence of Fossil and Recent Dentalium at Four Late Prehistoric Archaeological Sites in the Black Hills Periphery, Western South Dakota. In *Prehistory and Human Ecology of the Western Prairies and Northern Plains*, edited by J. A. Tiffany, pp. 131-144. Plains Anthropologist Memoir 27.

Alex, R. A.

1981a Village Sites Off the Missouri River. In *The Future of South Dakota's Past*, edited by L. J. Zimmerman and L. C. Stewart, pp. 39-45. Special Publication No. 2. South Dakota Archaeological Society, Vermillion.

1981b *The Village Cultures of the Lower James River Valley, South Dakota*. Unpublished Ph.D. dissertation. Department of Anthropology, University of Wisconsin, Madison.

Anderson, D. C.

1987 Toward a Processual Understanding of the Initial Variant of the Middle Missouri Tradition: The Case of the Mill Creek Culture of Iowa. *American Antiquity* 52:522-537.

Anderson, D. C., and H. A. Semken, Jr. (editors)

1980 *The Cherokee Excavations*. Academic Press, New York.

Andrichuk, J. M.

1956 Devonian Stratigraphy in Northern Wyoming and Adjoining Areas. Wyoming Geological Association, Eleventh Annual Field Conference *Guidebook*:43-50.

Anfinson, S. F.

1982 The Prehistoric Archaeology of the Prairie Lake Region: A Summary from a Minnesota Perspective. *Journal of the North Dakota Archaeological Association* 1:65-90.

1987 *The Prehistory of the Prairie Lake Region in the Northeastern Plains*. Unpublished Ph.D. dissertation, Department of Anthropology, University of Minnesota, Minneapolis.

Anfinson, S. F. (editor)

1979 *A Handbook of Minnesota Prehistoric Ceramics*. Occasional Publications in Minnesota Anthropology No. 5. Minnesota Archaeological Society, Fort Snelling.

Anfinson, S. F., and H. E. Wright, Jr.

1990 Climatic Change and Culture in Prehistoric Minnesota. In *The Woodland Tradition in the Western Great Lakes: Papers Presented to Elden Johnson*, edited by G. E. Gibbon, pp. 213-232. Publications in Anthropology No. 4. Department of Anthropology, University of Minnesota, Minneapolis.

Antevs, E.

1955 Geologic-Climatic Dating in the West. *American Antiquity* 20:317-335.

Armitage, C. L., S. D. Creaseman, and L. C. Mackey

1982 The Deadman Wash Site: A Multi-Component (Paleo-indian, Archaic, Late Prehistoric) Site in Southwestern Wyoming. *Journal of Intermountain Archaeology* 1:1-11.

Arthur, G. W.

1962 The Emigrant Drives of Paradise Valley, Montana. In *Symposium on Buffalo Jumps*, pp. 16-27. Montana Archaeological Society Memoir 1.

1966 *An Archaeological Survey of the Upper Yellowstone River Drainage, Montana*. Agricultural Economics Research Report No. 26. Montana State University.

Artz, J. A.

1995 Geological Contexts of the Early and Middle Holocene Archaeological Record in North Dakota and Adjoining Areas of the Northeastern Plains. In *Archaeological Geology of the Archaic Period in North America*, edited by E. A. Bettis III, pp. 67-86. Special Paper 297. Geological Society of America, Boulder.

Artz, J. A., E. A. Hayden, C. E. Haury, J. Arndt, and D. Hopkins

1991 *Southwest Pipeline Archeology: The 1987 Survey and Test Excavation Programs at Prehistoric Sites in Mercer and Dunn Counties, North Dakota (Segments A and B2)*. Department of Anthropology, University of North Dakota, Grand Forks. Submitted to the North Dakota State Water Commission, Bismarck.

Artz, J. A., and M. J. Root

1983 Summary of Project Results: Prehistoric Settlement along the Northern Border Pipeline. In *Archaeology of the Northern Border Pipeline, North Dakota: Test Excavations*, edited by M. J. Root and M. L. Gregg, pp 1418-1478. Department of Anthropology and Archaeology, University of North Dakota, Grand Forks. Submitted to the Northern Border Pipeline Co., Omaha.

Athearn, R. G.

1967 *Forts of the Upper Missouri*. University of Nebraska Press, Lincoln.

Atherton, L.
1960 *The Cattle Kings*. Indiana University, Bloomington.
Audubon, M. R., and E. Coues
1898 *Audubon and His Journal,* Volume II. John Nimmo, London.
Bachrach, R.
1956 Tensleep-Amsden Sections of the Gros Ventre-Snake River Area, Northwestern Wyoming. Wyoming Geological Association, Eleventh Annual Field Conference *Guidebook*:64-65.
Baer, J. L., V. D. Ott, and R. L. Chamberlain
1980 Stratigraphy of the Crawford Mountains, Rich County, Utah, and Lincoln County, Wyoming. Wyoming Geological Association, Thirty-first Annual Field Conference *Guidebook*:185-190.
Baerreis, D. A., and R. A. Bryson
1965 Climatic Episodes and the Dating of Mississippian Cultures. *Wisconsin Archaeologist* 46(4):203-220.
Baerreis, D. A., and J. E. Dallman
1961 *Archaeological Investigations Near Mobridge, South Dakota*. Archives of Archaeology, No. 14. Society for American Archaeology, Ann Arbor.
Bailey, V.
1926 *A Biological Survey of North Dakota: II, the Mammals*. North American Fauna No. 49. Bureau of Biological Survey, U. S. Department of Agriculture, Washington, D.C.
Bamforth, D. B.
1988 *Ecology and Human Organization on the Great Plains*. Plenum Press, New York.
1990 An Empirical Perspective on Little Ice Age Climatic Change on the Great Plains. *Plains Anthropologist* 35:359-366.
Banks, L. D.
1990 *From Mountain Peaks to Alligator Stomachs: a Review of Lithic Resources in the Trans-Mississippi South, the Southern Plains, and Adjacent Southwest*. Oklahoma Anthropological Society Memoir No. 4.
Barbour, E. H., and C. B. Schultz
1932 *The Scottsbluff Bison Quarry and Its Artifacts*. Bulletin No. 34. Nebraska State Museum.
Bareis, C. J., and J. W. Porter (editors)
1984 *American Bottom Archaeology*. University of Illinois Press, Urbana.
Barnosky, C. W.
1989 Postglacial Vegetation and Climate in the Northwestern Great Plains of Montana. *Quaternary Research* 31:57-73.
Barnosky, C. W., E. C. Grimm, and H. E. Wright, Jr.
1987 Towards a Postglacial History of the Northern Great Plains: A Review of the Paleoecologic Problems. *Annals of the Carnegie Museum* 56:259-273.
Barsness, L.
1985 *Heads, Hides, and Horns: The Compleat Buffalo Book*. Texas Christian University Press, Fort Worth.
Bartlein, P. J., I. C. Prentice, and T. Webb III
1984 Holocene Climatic Change in the Northern Midwest: Pollen-Derived Estimates. *Quaternary Research* 22:361-374.
Bartlein, P. J., and T. Webb III
1982 Holocene Climatic Changes Estimated from Fossil Pollen Data from the Northern Midwest. In *Quaternary History of the Driftless Area, with Special Papers*, edited by J. C. Knox, pp. 67-82. Field Trip Guide Book No. 5. Geological and Natural History Survey, University of Wisconsin, Madison.
Bartlein, P. J., and C. Whitlock
1993 Paleoclimatic Interpretation of the Elk Lake Pollen Record. In *Elk Lake Minnesota: Evidence for Rapid Climate Change in the North-Central United States*, edited by J. P. Bradbury and W. E. Dean, pp. 275-293. Special Paper 276. Geological Society of America, Boulder.
Bartlett, R. A.
1962 *Great Surveys of the American West*. University of Oklahoma Press, Norman.
Bass, W. M.
1969 *Human Skeletal Material from 39LM232, the Pretty Head Site, Lyman County, South Dakota.* Smithsonian River Basin Surveys, Publications in Salvage Archaeology No. 13, p. 87.
1970 Excavations of a Paleo-Indian Site at Agate Basin Wyoming. *National Geographic Society Research Reports* 1961-1962:21-25.
1976 An Early Indian Cranium from the Medicine Crow Site (39BF2), Buffalo County, South Dakota. *American Journal of Physical Anthropology* 45:695-700.
1981 Skeletal Biology of the United States Plains: A History and Personal Narrative. Memoir 17. *Plains Anthropologist* 26:3-18.
Bass, W. M., and J. C. Barlow
1964 A Human Skeleton from the Pryor Creek Burial, 24YL404, Yellowstone County, Montana. *Plains Anthropologist* 9(23):29-36.
Bass, W. M., and H. E. Berryman
1976 Physical Analysis. In F*ay Tolton and the Initial Middle Missouri Variant,* edited by W. R. Wood. Research Series No. 13. Missouri Archaeological Society, Columbia.
Bass, W. M., and W. H. Birkby
1962 The First Human Skeletal Material from the Huff Site, 32MO11, and a Summary of Putative Mandan Skeletal Material. *Plains Anthropologist* 7:164-177.
Bass, W. M., D. R. Evans, and R. L. Jantz
1971 *The Leavenworth Site Cemetery: Archaeology and Physical Anthropology.* Publications in Anthropology No. 2. University of Kansas, Lawrence.
Bass, W. M., and D. C. Lacy
1963 Three Human Skeletons from the PK Burial, Sheridan County, Wyoming. *Plains Anthropologist* 8(21):142-163.
Bass, W. M., and T. W. Phenice
1975 Prehistoric Human Skeletal Material from Three Sites in North and South Dakota. In *The Sonota Complex and Associated Sites on the Northern Great Plains,* edited by R. W. Neuman. Publications in Anthropology No. 6. Nebraska State Historical Society.
n.d. *Fragments of Four Human Skeletons from Site 32SN19 Stutsman County, North Dakota.* Report prepared by the Department Anthropology, University of Kansas.
Bass, W. M., and D. H. Ubelaker
1969 An Analysis of Skeletal Material from the Langdeau Site, 39LM209. In *The Grand Detour Phase,* edited by W. W. Caldwell and R. E. Jensen. Smithsonian River Basin Surveys, Publications in Salvage Archaeology No. 13.
Baugh, T. G., and F. W. Nelson, Jr.
1988 Archaeological Obsidian Recovered from Selected North Dakota Sites and its Relationship to Changing Exchange Systems in the Plains. *Journal of the North Dakota Archaeological Association* 3:74-94.
Bauxar, J. J.
1947a Preliminary Appraisal of the Archeological and Paleontological Resources of Des Lacs Reservoir, North Dakota. Ms. on file, Midwest Archeological Center, U.S. National Park Service, Lincoln, NE.
1947b Preliminary Appraisal of the Archeological and Paleontological Resources of Jamestown Reservoir, North Dakota. Ms. on file, Midwest Archaeological Center, Lincoln, NE.
Beardsley, G. C.
1875 Field Notes of the Survey of the Subdivision of Township 137 North, Range 63 West, Stutsman County, North Dakota. U.S. Surveyor General's Office, General Land Office Survey. On file, State Water Commission, Bismarck, ND.

Beckes, M. R., and J. Keyser
1983 *The Prehistory of the Custer National Forest: An Overview*. USDA Forest Service Region 1, Missoula.
Beiswenger, J. M.
1987 *Late Quaternary Vegetational History of Grays Lake, Idaho and the Ice Slough, Wyoming*. Unpublished Ph. D. dissertation, Department of Botany, University of Wyoming, Laramie.
Benchley, E. D., B. Nansel, C. A. Dobbs, S. Myster, and B. O'Connell
1997 *The Archeology and Bioarcheology of the Northern Woodlands: A Volume in the Central and Northern Plains Archeological Overview*. In press. Research Series. Arkansas Archeological Survey, Fayetteville.
Benedict, J. B.
1979 Getting Away from It All: A Study of Man, Mountains, and the Two-Drought Altithermal. *Southwestern Lore* 45(3):1-12.
Benedict, J. B., and B. L. Olson
1973 Origins of the McKean Complex: Evidence from Timberline. *Plains Anthropologist* 18(62):323-327.
Benn, D. W
1974 Seed Analysis and its Implications for an Initial Middle Missouri Site in South Dakota. *Plains Anthropologist* 19:55-72.
1981 Ceramics from the M.A.D. Sites and Other Prairie Peninsula and Plains Complexes. In *Archaeology of the M.A.D. Sites*. Preliminary draft, D. W. Benn, compiler. Iowa State Historical Department, Division of Historic Preservation, Iowa City.
1982 Woodland Cultures of the Western Prairie Peninsula: An Abstract. In *Interrelations of Cultural and Fluvial Deposits in Northwest Iowa*, edited by E. A. Bettis III, and D. M. Thompson, pp. 37-52. Association of Iowa Archaeologists, Ames.
1983 Diffusion and Acculturation in Woodland Cultures on the Western Prairie Peninsula. In *Prairie Archaeology: Papers in Honor of David A. Baerreis*, edited by G. E. Gibbon, pp. 75-85. Publications in Anthropology No. 3. University of Minnesota, Minneapolis.
1986 *The Western Iowa Rivers Basin: An Archaeological Overview*. Iowa River Basin Report Series (Vol. 3). Center for Archaeological Research, Southwest Missouri State University, Springfield. Submitted to the Iowa State Historic Preservation Office, Des Moines.
1989 Hawks, Serpents, and Bird-Men: Emergence of the Oneota Mode of Production. *Plains Anthropologist* 34(125):233-160.
1992 Late Prehistoric Ceramics from the Lake Oscar Locality, West-central Minnesota. Paper presented at the Fiftieth Plains Conference, Lincoln, NE.
Benn, D. W. (editor)
1990 *Woodland Cultures on the Western Prairies: The Rainbow Site Investigations*. Report No. 18. Office of the State Archaeologist, University of Iowa, Iowa City.
Bentzen, R. C.
1962a The Powers-Yonkee Bison Trap. *Plains Anthropologist* 7(18):113-118.
1962b *The Mavrakis-Bentzen-Roberts Bison Trap, 48SH311*. Report of the Sheridan Chapter, Wyoming Archaeological Society.
Benz, B.
1987 Seeds from the Naze Site. In *Archeological Excavation at the Naze Site (32SN246)*, edited by M. L. Gregg, pp. 304-328. Department of Anthropology, University of North Dakota, Grand Forks. Submitted to the U.S. Bureau of Reclamation, Billings, MT.
Berg, E. L.
1938 Notes on Catlinite and the Sioux Quartzite. *American Mineralogist* 23:258-268.
Bernabo, J. C., and T. Webb III
1977 Changing Patterns in the Holocene Pollen Record of Northeastern North America: A Mapped Summary. *Quaternary Research* 8:64-96.
Berry, J. J.
1978 *Arikara Middlemen: The Effects of the Fur Trade on an Upper Missouri Society*. Unpublished Ph.D. dissertation, Indiana University. University Microfilms, Ann Arbor.
Bettis, E. A., III, and D. W. Benn
1984 An Archaeological and Geomorphological Survey in the Central Des Moines River Valley, Iowa. *Plains Anthropologist* 29:211-227.
Bies, M. T.
1993 *Rock Art in the Bighorn Basin, Wyoming*. Paper presented at the First Rocky Mountain Anthropology Conference, Jackson, Wyoming.
Binford, L. R.
1980 Willow Smoke and Dogs' Tails: Hunter-Gatherer Settlement Systems and Archaeological Site Formation. *American Antiquity* 45(1):4-20.
Birdsell, J. B.
1951 The Problem of the Early Peopling of the Americas as Viewed from Asia. In *Papers on the Physical Anthropology of the American Indian,* edited by W. S. Laughlin, pp. 1-68. Edwards Brothers, Ann Arbor.
Birk, D. A.
1984 John Sayer and the Fond du Lac Trade: The Northwest Company in Minnesota and Wisconsin. In *Rendezvous: Selected Papers of the Fourth North American Fur Trade Conference, 1981*, edited by T. C. Buckley, pp. 51-61. North American Fur Trade Conference, St. Paul, MN.
Birk, D. A., and E. Johnson
1992 The Mdewakanton Dakota and Initial French Contact. In *Calumet Fleur-De-Lys: Archeology of Indian and French Contact in the Midcontinent*, edited by J. A. Walthall and T. E. Emerson, pp. 203-240. Smithsonian Institution Press.
Birkby, W. H., and W. M. Bass
1963 Possible Shoshone Skeletal Material from the Turk Burial Site, 48WA301. *Plains Anthropologist* 8(20):103-114.
Birkeland, P. W.
1984 *Soils and Geomorphology*. Oxford University Press, New York.
Blakeslee, D. J.
1978 *Survey and Evaluation of Archaeological Resources, Desoto National Wildlife Refuge, Iowa and Nebraska*. Ms. on file, SHPO, Des Moines, Iowa.
1993 Modeling the Abandonment of the Central Plains: Radiocarbon Dates and the Origin of the Initial Coalescent. In *Prehistory and Human Ecology of the Western Prairies and Northern Plains*, edited by J. A. Tiffany, pp. 199-214. *Plains Anthropologist Memoir* 27.
1994 The Archaeological Context of Human Skeletons in the Northern and Central Plains. In *Skeletal Biology in the Great Plains: Migration, Warfare, Health, and Subsistence*, edited by D. W. Owsley and R. L. Jantz, pp. 9-32. Smithsonian Institution Press, Washington, D.C.
Blasing, R. K., and M. Pawlikowski
1990 Mineralogical Identification of Trachyte in Trego County, Kansas. Paper presented at the Forty-eighth Plains Conference, Oklahoma City.
Bliss, W. L.
1950 Birdshead Cave, a Stratified Site in the Wind River Basin, Wyoming. *American Antiquity* 15(3):187-196.
Bluemle, J. P.
1977 *The Face of North Dakota: The Geologic Story*. Educational Series No. 11. North Dakota Geological Survey, Grand Forks.
Boeckerman, R. B., and A. J. Eardley
1956 Geology of the Southwest Jackson Quadrangle, Lincoln County, Wyoming. Wyoming Geological Association, Eleventh Annual Field Conference *Guidebook*:179-183.

Boettger, W. M.
1986 *Origin and Stratigraphy of Holocene Sediments, Souris and Des Lacs Glacial-Lake Spillways, North-Central North Dakota*. Unpublished Master's thesis, Department of Geology, University of North Dakota. Grand Forks.

Bonney, R. A.
1970 Early Woodland in Minnesota. *Plains Anthropologist* 15-50(1):302-304.

Bonnichsen, R.
1980 High-Altitude Adaptation at False Cougar Cave: A Preliminary Statement. Paper presented at the 38th Annual Plains Conference, Iowa City, Iowa. On file, Montana State Historic Preservation Office, Helena.

Bonnichsen, R., M. T. Beatty, M. D. Turner, and M. Stoneking
1992 What Can Be Learned from Hair: A Hair Record from the Mammoth Meadow Locus, Southwestern Montana. On file, Butte District Office, Bureau of Land Management.

Bonnichsen, R., D. Douglas, M. Beatty, M. D. Turner, J. C. Turner, and W. Stanyard
1990 New Paleoindian Discoveries at Mammoth Meadows, Southwestern Montana. *Current Research in the Pleistocene* 7:3-4.

Bonnichsen, R., D. Douglas, B. Stanyard, A. C. Macwilliams, M. Beatty, M. D. Turner, and J. C. Turner
1990 Change in Lithic Procurement Systems from Southwestern Montana: Culture History or Environmental Forcing? Paper presented at "Chronostratigraphy of the Paleolithic of North, Central, East Asia, and Americas," Novosobirisk, USSR. On file, Butte District Office, Bureau of Land Management.

Bonnichsen, R., and J. S. Oliver (editors)
1981a *Archaeological Research in the Pryor Mountains, South Central Montana: 1980 Technical Report of Activities*. Pryor Mountain Paper No.10. Institute for Quaternary Studies, University of Maine, Orono.
1981b *Archaeological Research in the Pryor Mountains, South Central Montana: 1981 Technical Report of Activities*. Pryor Mountain Paper No. 14. Institute for Quaternary Studies, University of Maine, Orono.
1986 False Cougar and Shield Trap Caves, Pryor Mountains, Montana. *National Geographic Research* 2(3):276-290.

Bonnichsen, R., and R. T. Will
1980 *A Report on 1979 Pryor Mountain Archaeological Research Project*. Pryor Mountain Paper No. 1. Institute for Quaternary Studies, University of Maine, Orono.

Bonnichsen, R., and D. Young
1979 *The 1978 Pryor Mountain Archaeological Field School and Research Project: a Preliminary Report*. Pryor Mountain Paper No. 1. Institute for Quaternary Studies, University of Maine, Orono.

Borchers, G. A.
1980 *Soil Survey of Stanley County, South Dakota*. Soil Conservation Service, U.S. Department of Agriculture, Washington, D.C.

Borchert, J. L.
1995 Evaluative Testing in the Turtle Mountain, Site 32RO19. North Dakota Department of Transportation, Bismarck. Ms. on file, Archeology and Historic Preservation Division, State Historical Society, Bismarck.

Borchert, J. R.
1950 The Climate of the Central North American Grasslands. *Annals of the Association of American Geographers* 40:1-39.

Bourne, E. G.
1922 *Voyages in New France*. Allerton, New York.

Bowers, A. W.
1948 *A History of the Mandan and Hidatsa.* Unpublished Ph.D. dissertation, Department of Anthropology, University of Chicago, Chicago.
1950 *Mandan Social and Ceremonial Organization*. University of Chicago Press, Chicago.
1965 *Hidatsa Social and Ceremonial Organization*. Bureau of American Ethnology Bulletin 194. Smithsonian Institution, Washington, D.C.

Bradbury, J. P., and W. E. Dean (editors)
1993 *Elk Lake, Minnesota: Evidence for Rapid Climate Change in the North-Central United States*. Special Papers 276. Geological Society of America, Boulder.

Bradbury, J. P., W. E. Dean, and R. Y. Anderson
1993 Holocene Climatic and Limnologic History of the North-Central United States as Recorded in the Varved Sediments of Elk Lake, Minnesota: A Synthesis. In *Elk Lake, Minnesota: Evidence for Rapid Climatic Change in the North-Central United States*, edited by J. P. Bradbury and W. E. Dean, pp. 309-328. Special Paper 276. Geological Society of America, Boulder.

Bradley, B. A.
1974 Comments on the Lithic Technology of the Casper Site Materials. In *The Casper Site: A Hell Gap Bison Kill on the High Plains*, edited by G. Frison. Academic Press, New York.
1982 Flaked Stone Technology and Typology. In *The Agate Basin Site: A Record of the Paleoindian Occupation of the Northwestern Plains*, edited by G. Frison and D. Stanford, pp. 181-212. Academic Press, New York.
1991 Flaked Stone Technology in the Northern High Plains. In *Prehistoric Hunters of the High Plains* (2nd ed.), edited by G. C. Frison, pp. 369-395. Academic Press, New York.

Bradley, B. A., and G. Frison
1987 Projectile Points and Specialized Bifaces from the Horner Site. In *The Horner Site: The Type Site of the Cody Cultural Complex*, edited by G. Frison and L. Todd, pp. 199-231. Academic Press, Orlando.

Bradley, B. A., and D. Stanford
1987 The Claypool Study. In *The Horner Site: The Type Site of the Cody Cultural Complex*, edited by G. Frison and L. Todd, pp 405-434. Academic Press, Orlando.

Bradley, W. H.
1929 *Algal Reef and Oolites of the Green River Formation*. U. S. Geological Survey Professional Paper 154G.

Brady, F. H.
1958 Evaporite Deposits in the Minnelusa Formation in the Sundance-Beulah Area, Crook County, Wyoming. Wyoming Geological Association, Thirteenth Annual Field Conference *Guidebook*:45-47.

Bray, E. C., and M. C. Bray
1976 *Joseph N. Nicollet on the Plains and Prairies*. Minnesota Historical Society Press, St. Paul.

Breternitz, D. A., A. C. Swedlund, and D. C. Anderson
1971 An Early Burial from Gordon Creek, Colorado. *American Antiquity* 36(2):170-182.

Bridges, P. S.
1989 Spondylolysis and Its Relationship to Degenerative Joint Disease in the Prehistoric Southeastern United States. *American Journal of Physical Anthropology* 79:321-329.

Brisbin, J. S.
1959 *The Beef Bonanza: Or, How to Get Rich on the Plains, Being a Description of Cattle-Growing, Sheep-Farming, Horse-Raising and Dairying in the West*. University of Oklahoma Press, Norman.

Brooks, M., G. Carlson, J. Bozell, T. Steinacher, and G. Gill
1994 Unique Skeletal Traits and Archaeology of a Middle Archaic Burial from Western Nebraska. Manuscript on file, Human Osteological Laboratory, University of Wyoming.

Brophy, J. A., and J. P. Bluemle
1983 The Sheyenne River: Its Geological History and Effects on Lake Agassiz. In *Glacial Lake Agassiz*, edited by T. J. Teller and L. Clayton,

pp. 173-186. Special Paper No. 26. Geological Association of Canada.

Brown, B.

1932 The Buffalo Drive. *Natural History* 32(1):75-82.

Brown, I. W.

1989 The Calumet Ceremony in the Southeast and Its Archaeological Manifestations. *American Antiquity* 54:311-331.

Brown, K. L., M. E. Brown, and K. P. Zimmerman

1982 *Prehistoric and Historic Resources Within the Jamestown Reservoir Project. Dakota Interactive Services, Vermillion*. Report submitted to the Bureau of Reclamation, Billings, Montana.

Brown, L.

1963 The Fort Smith Medicine Wheel, Montana. *Plains Anthropologist* 8(22):225-230.

1968 Archeology of the Lower Bighorn Canyon, Montana. *Archaeology in Montana* 9(4).

Brown, L. A.

1967 The Chapelle Creek Site (39HU60), South Dakota. Ms. on file, Midwest Archeological Center, National Park Service, Lincoln, Nebraska.

1974 The Archaeology of the Breeden Site. Memoir 10. *Plains Anthropologist* 19:1-90.

Brown, R. W.

1958 Fort Union Formation in the Powder River Basin, Wyoming. Wyoming Geological Association, Thirteenth Annual Field Conference *Guidebook*:111-113.

Brumley, J. H.

1966 The Lost River Burial (24HL403). *Archaeology in Montana* 7(4):1-15.

1971 Preliminary Report on Area A, Wahpa Chu'gn Site (24HL101): Results of the 1970 Field Season. *Archaeology in Montana*12(1):11-39.

1976 *The Wahkpa Chu'gn Archaeological Site*. Report. Submitted to H. Earl Clack Memorial Museum, Havre, Montana.

1984 The Laidlaw Site: An Aboriginal Antelope Trap from Southeastern Alberta. In *Archaeological Survey of Alberta*, edited by Dave Burley. Occasional Paper No. 23. Edmonton.

1989 *Evaluation Excavations at Sites 24MA93 and 24MA778 Within the Confines of the Varney-east Road Project*. Report #RS249-1(1)17. Montana Department of Transportation, Helena.

1990 Investigations at Herdegen's Birdtail Butte Site 24BL1152. *Archaeology in Montana* 32(1):17-86.

Brumley, L. M.

1974 The Fox Burial Site (24HL413) near Havre, Montana. *Archaeology in Montana* 15(2):1-26.

Bryson, R. A.

1966 Air Masses, Streamlines, and the Boreal Forest. *Geographical Bulletin* 8:228-269.

1987 On Climates of the Holocene. In *Man and the Mid-Holocene Climatic Optimum*, edited by N. A. McKinnon and G. S. L. Stuart, pp. 1-13. Proceedings of the Seventeenth Annual Conference of the Archaeological Association of the University of Calgary. University of Calgary, Calgary.

Bryson, R. A., and D. A. Baerreis

1968 Introduction and Project Summary. In *Climatic Change and the Mill Creek Culture of Iowa, Part I*, edited by D. R. Henning, pp. 1-34. Volume 15 (whole volume) of the *Journal of the Iowa Archeological Society*.

Bryson, R. A., and C. Padoch

1980 On the Climates of History. *Journal of Interdisciplinary History* 10:583-597.

Bryson, R. A., and W. M. Wendland

1967 Tentative Climatic Patterns for Some Late Glacial and Post-Glacial Episodes in Central North America. In *Life, Land, and Water*, edited by W. J. Mayer-Oakes, pp. 271-298. University of Manitoba Press, Winnipeg.

Bryson, R. A., D. A. Baerreis, and W. M. Wendland

1970 The Character of Late Glacial and Post-Glacial Climatic Changes. In *Pleistocene and Recent Environments of the Central Great Plains*, edited by W. Dort, Jr., and J. K. Jones, Jr., pp. 53-73. University of Kansas Press, Lawrence.

Buchner, A. P.

1979 *The 1978 Caribou Lake Project, Including a Summary of the Prehistory of East-central Manitoba*. Papers in Manitoba Archaeology, Final Report No. 8. Manitoba Department of Cultural Affairs and Historical Resources, Historic Resources Branch, Winnipeg.

1980 *Cultural Responses to Altithermal (Atlantic) Climate along the Eastern Margins of the North American Grasslands, 5000 to 3000 B.C.* Paper No. 97. Archaeological Survey of Canada, Ottawa. National Museum of Man, National Museums of Canada, Ottawa.

1981 *Sinnock: A Paleolithic Camp and Kill Site in Manitoba*. Papers in Manitoba Archaeology, Final Report No. 10. Manitoba Department of Cultural Affairs and Historical Resources, Historic Resources Branch, Winnipeg.

1986 A Brief Note on the Lockport Site Radiocarbon Dates. *Manitoba Archaeological Quarterly* 10(1):72-73.

1988 The Geochronology of the Lockport Site. *Manitoba Archaeological Quarterly* 12(2):27-31.

Buchner, A. P., P. Carmichael, G. Dickson, I. Dyck, B. Fardoe, J. Haug, T. Jones, L. Jones, D. Joyes, O. Mallory, M. Mallot, D. Meyer, D. Miller, R. Nash, L. Pettipas, C. T. Shay, E. L. Syms, M. A. Tisdale, and J. P. Whelan

1983 *Introducing Manitoba Prehistory*. Papers in Manitoba Archaeology, Popular Series No. 4. Manitoba Department of Cultural Affairs and Historical Resources, Winnipeg.

Buchner, A. P., and L. F. Pettipas

1990 The Early Occupations of the Glacial Lake Agassiz Basin in Manitoba; 11,500 to 7,700 B.P. In *Archaeological Geology of North America*, edited by N. P. Lasca and J. Donahue, pp. 51-59. Centennial Special Volume 4. Geological Society of America, Boulder.

Buechler, J.

1984 *Management Plan for Archaeological Resources in South Dakota. Part 1: Study Units* (working draft). Contract No. 120401-405-004(85). Dakota Research Services, Rapid City, South Dakota. Submitted to South Dakota State Archaeological Research Center, Ft. Meade.

Buff, C.

1990 The Excavation of an Oregon Trail Burial. *The Wyoming Archaeologist* 33(3-4):51-62.

Bump, R. J.

1987 The Powers-Yonkee Bison Trap: A New Look at an Old (Or Not So Old) Site. *Archaeology in Montana* 28(1):27-37.

Bupp, S. L.

1981 *The Willow Springs Bison Pound: 48AB130*. Unpublished Master's thesis, Department of Anthropology, University of Wyoming, Laramie.

Burgess, R. L., W. C. Johnson, and W. R. Keammerer

1973 *Vegetation of the Missouri River Flood Plain in North Dakota*. North Dakota Water Resources Research Institute, North Dakota State University, Fargo.

Burkhardt, M. R.

1976 *Pollen Biostratigraphy and Late Quaternary Vegetation History of the Big Horn Mountains*, Wyoming. Ph. D. dissertation, University of Iowa, Iowa City.

Burns, J.

1990 Paleontological Perspectives of the Ice-Free Corridor. In *Megafauna and Man: Discovery of America's Heartland*, edited by L.

Agenbroad, J. Mead, and L. Nelson, pp. 61-66. Scientific Papers No. 1. The Mammoth Site of Hot Springs, South Dakota.

Butler, B. M., and E. E. May

1984 *Prehistoric Chert Exploitation: Studies from the Midcontinent*. Southern Illinois University Center for Archaeological Investigations Occasional Paper No. 2, Carbondale.

Butler, B. R.

1963 An Early Man Site at Big Camas Prairie, South-Central Idaho. *Tebiwa* 6(1):22-33.

1965 A Report on Investigations of an Early Man Site near Lake Channel, Southern Idaho. *Tebiwa* 8(2):1-20.

Butler, R. B.

1981 Late Period Cultural Sequences in the Northeastern Great Basin and Their Implications for the Upper Snake and Salmon River Country. *Journal of California and Great Basin Anthropology* 3(2):245-256.

Butler, W. B.

1976 Archaeological Context of Human Remains. In *Fay Tolton and the Initial Middle Missouri Variant*, edited by W. R. Wood. Missouri Archaeological Society, Columbia, Missouri.

Cain, H. T.

1952 *Site File, 32LM104*. State Historical Society of North Dakota, Bismarck.

Calabrese, F. A.

1972 *Cross Ranch: A Study of Variability in a Stable Cultural Tradition*. Plains Anthropologist Memoir 9.

Caldwell, W. W.

1964 Fortified Villages in the Northern Plains. *Plains Anthropologist* 9:1-7.

1966 *The Black Partisan Site*. Publications in Salvage Archeology No. 2. Smithsonian Institution, River Basin Surveys, Lincoln, Nebraska.

Caldwell, W. W., and D. E. Henning

1978 The North American Plains. In *Chronologies in New World Archaeology*, edited by R. E. Taylor and C. W. Meighan, pp. 113-145. Academic Press, New York.

Caldwell, W. W. and R. E. Jensen

1969 *The Grand Detour Phase*. Publications in Salvage Archeology No. 13. Smithsonian Institution, River Basin Surveys, Lincoln, Nebraska.

Caldwell, W. W., L. G. Madison, and B. Golden

1964 Archeological Investigations at the Hickey Brothers Site (39LM4), Big Bend Reservoir, Lyman County, South Dakota. River Basin Surveys Papers No. 36. *Bureau of American Ethnology Bulletin* 189:267-289. Smithsonian Institution, Washington, D.C.

Call, H.

1942 *Golden Fleece*. Houghton Mifflin, Boston.

Callender, E.

1968 *The Post Glacial Sedimentology of Devils Lake, North Dakota*. Ph.D. dissertation, Department of Geology, University of North Dakota, Grand Forks.

Calloway, C. G.

1986 "The Only Way Open to Us": The Crow Struggle for Survival in the Nineteenth Century. *North Dakota History* 53:25-34.

Capes, K. H.

1963 The W. B. Nickerson Survey and Excavations, 1912-1915, of the Southern Manitoba Mounds.

Carlson, G. F., and C. A. Peacock

1975 Lithic Distribution in Nebraska. In *The Lithic Source Notebook*, edited by R. A. Thomas. Section of Archaeology, Division of Historical and Cultural Affairs, State of Delaware, Milford.

Carmichael, P. H.

1981 Blackduck Social Organization: A New Hypothesis. In *Various Papers Presented at the Conference on Current Topics in Northern Plains, Midwest Archaeology*, edited by R. A. Fox, pp. 24-45. Anthropological Papers No. 3. University of North Dakota, Grand Forks.

1986 *Prehistory of the Turtle Mountain District, An Initial Sketch*. Papers in Manitoba Archaeology, Popular Series No. 2. Manitoba Culture, Heritage, and Preservation, Heritage Resources Branch, Winnipeg, MB.

Cassells, E. S., D. B. Miller, and P. V. Miller

1984 *Paha Sapa: A Cultural Resource Overview of the Black Hills National Forest, South Dakota and Wyoming*. Report, Contract No. 53-67TO-3-90. Plano Archaeological Consultants, Longmont, Colorado. Submitted to USDA Forest Service, Black Hills National Forest, Custer, South Dakota.

Catlin, G.

1973 *Letters and Notes on the Manners, Customs, and Conditions of North American Indians* (2 vols.). Reprint of 4th ed., 1844. Dover, New York. First ed. originally published 1841, London.

Catto, N., and C. Mandryk

1990 Geology of the Postulated Ice-Free Corridor. In *Megafauna and Man: Discovery of America's Heartland*, edited by L. D. Agenbroad, J. I. Mead, and L. W. Nelson, pp. 80-86. Scientific Papers No. 1. The Mammoth Site of Hot Springs, South Dakota.

Chaffee, S. D., M. Hyman, and M. W. Rowe

1994a Direct ^{14}C Dating of Rock Paintings. In *New Light on Old Art: Recent Advances in Hunter-Gatherer Rock Art Research*, edited by D. S. Whitley and L. L. Loendorf, pp. 9-12. Monograph No. 36. UCLA Institute of Archaeology.

1994b Dating a Pictograph in the Pryor Mountains, Montana. *Plains Anthropologist* 39(148):195-201.

Champagne, A.

1968 *Les La Verendrye et le Poste de l'ouest*. Les Presses de l'Universite Laval, Quebec.

1971 *Nouvelles Etudes sur "Les La Verendrye et le Poste de l'ouest."* Les Presses de l'Universite Laval, Quebec.

Charles, D. K., and J. E. Buikstra

1983 Archaic Mortuary Sites in the Central Mississippi Drainage: Distribution, Structure, and Behavioral Implications. In *Archaic Hunters and Gatherers in the American Midwest*, edited by J. L. Phillips and J. A. Brown, pp. 117-145. Academic Press, New York.

Chittenden, H. M.

1902 *The American Fur Trade of the Far West*. 3 vols. Francis P. Harper, New York.

1954 *The American Fur Trade of the Far West* (2 vols.). Reprinted. Academic Reprints, Stanford. Originally published 1902 in three vols., Francis P. Harper, New York.

Chomko, S. A.

1976 Faunal Exploitation in the Initial Middle Missouri Variant. In *Fay Tolton and the Initial Middle Missouri Variant*, edited by W. R. Wood, pp. 35-41. Research Series No. 13. Missouri Archaeological Society, Columbia.

Chomko, S. A., and W. R. Wood

1973 Linear Mounds in the Northeastern Plains. *Archaeology in Montana* 14(2):1-19.

Christensen, R. C.

1992 *N.D. Highway 23 Archaeology: Evaluative Testing at 32MN395*. North Dakota Department of Transportation, Bismarck.

Clark, F.

1984 Knife River Flint and Interregional Exchange. *Midcontinental Journal of Archaeology* 9:173-198.

Clark, G. R., and M. Wilson

1981 The Ayers-Frazier Bison Trap (24PE30): A Late Middle Period Bison Kill on the Lower Yellowstone River. *Archaeology in Montana* 22(1):23-77.

Clayton, L., W. B. Bickley, Jr., and W. J. Stone
1970 Knife River Flint. *Plains Anthropologist* 15(50):282-290.
Clayton, L., and S. R. Moran
1982 Chronology of Late Wisconsinan Glaciation in Middle North America. *Quaternary Science Reviews* 1:55-82.
Clayton, L., S. R. Moran, and W. B. Bickley, Jr.
1976 *Stratigraphy, Origin, and Climatic Implications of Late Quaternary Upland Silt in North Dakota*. Miscellaneous Series No. 54. North Dakota Geological Survey, Grand Forks.
Cohen, F. S.
1942 *Handbook of Federal Indian Law*. University of New Mexico Press, Albuquerque.
Cole, K. A.
1967 *The Colony Mound, 32GF305: A Test Excavation of 1967.* Field Reports in Archaeology No. 4. Department of Sociology and Anthropology, University of North Dakota.
1968 *The Forest River Survey, 1967.* Field Reports in Archaeology No. 1. Department of Sociology and Anthropology, University of North Dakota.
Combs, E. A.
1990 Prehistoric Plains Indian Skeletal Injuries. Manuscript on file, Human Osteological Laboratory, University of Wyoming.
Combs, E. A., G. W. Gill, M. E. Miller, and C. M. Buff
1992 A Frontier Burial from Fort Caspar, Wyoming. *The Wyoming Archaeologist* 36(1-2):31-41.
Comfort, A. J.
1873 Indian Mounds Near Fort Wadsworth, Dakota Territory. *Smithsonian Institution Annual Report for 1871*:389-402.
Conner, J. L., and J. F. Hatch
1980 Stratigraphy of the Sage Valley and Elk Valley Quadrangles, Western Wyoming and Southeastern Idaho. Wyoming Geological Association, Thirty-first Annual Field Conference *Guidebook*:263-277.
Conner, S. W.
1960 The Owl Canyon Pictograph Site. *Archaeology in Montana* 2(3 and 4):7-11.
1962 *A Preliminary Survey of Prehistoric Picture Writing on Rock Surfaces in Central and South Central Montana*. Anthropology Paper No. 2. Billings Archaeological Society.
1984 The Petroglyphs of Ellison's Rock. *Archaeology in Montana* 25(2-3):123-145.
Conner, S. W., and B. L. Conner
1971 *Rock Art of the Montana High Plains*. Exhibition for the Art Galleries, University of California, Santa Barbara.
Coogan, A. H.
1987 *Holocene Geomorphic and Stratigraphic Framework of Archeological Sites Along the Missouri River, Central South Dakota*. Department of Geology, Kent State University, Kent, Ohio. Submitted to U. S. Army Corps of Engineers, Omaha District.
Cooper, L. R., and E. Johnson
1964 Sandy Lake Ware and Its Distribution. *American Antiquity* 29:474-479.
Cooper, P. L.
1947 *Preliminary Appraisal of the Archeological and Paleontological Resources of the Fort Randall Reservoir, South Dakota*. Missouri Basin Project, Smithsonian Institution. Report on file, National Park Service, Midwest Archeological Center, Lincoln.
Cooper, P. L., and R. L. Stephenson
1953 *Appraisal of the Archaeological Resources of the Oahe Reservoir, North and South Dakota.* Report for the Missouri Basin Project, Smithsonian Institution.
Coues, E. (editor)
1965a *New Light on the Early History of the Greater Northwest: The Manuscript Journals of Alexander Henry and David Thompson, 1799-1814* (2 vols.). Ross and Haines, Minneapolis. Originally published 1897 in 3 vols., Francis P. Harper, New York.
1965b *The Manuscript Journals of Alexander Henry and David Thompson, 1797-1814*. Ross and Haines, Minneapolis.
Craig, C.
1983 *Lithic Resource Analysis and Interpretation in Northwest Wyoming and Southeastern Montana*. Unpublished Master's thesis, Department of Anthropology, University of Wyoming, Laramie.
Crandell, D. R.
1953 Pleistocene Geology of Part of Central South Dakota. *Bulletin of the Geological Society of America* 64:581-598.
Cumming, R. B.
1953 *Appraisal of the Archeological and Paleontological Resources of the Fort Randall Reservoir, South Dakota: Supplement*. Missouri Basin Project, Smithsonian Institution. Report on file, National Park Service, Midwest Archeological Center, Lincoln.
Cvancara, A. M., L. Clayton, W. B. Bickley, Jr., A. F. Jacob, A. C. Ashworth, J. A. Brophy, C. T. Shay, L. D. Delorme, and G. E. Lammers
1971 Paleolimnology of Late Quaternary Deposits, Seibold Site, North Dakota. *Science* 171:172-174.
Cygan, N. E., and F. L. Koucky
1963 The Cambrian and Ordovician Rocks of the East Flank of the Bighorn Mountains, Wyoming. Wyoming Geological Association and Billings Geological Society, First Joint Field Conference *Guidebook*:26-37.
Dahlberg, J. C., and J. C. Whitehurst
1990 An Overview of Souris Basin Prehistory in North Dakota. *Journal of the North Dakota Archaeological Association* 4:76-110.
Davis, C., and J. D. Keyser
1982 The Highwalker Site: Late Prehistoric Hunters of the Powder River Basin. *Archaeology in Montana* 23(1):43-97.
Davis, D. P.
1992 *The Archaeology and Human Osteology of the Benick Ranch Site (48AB571)*. Unpublished Master's thesis, Department of Anthropology, University of Wyoming, Laramie.
Davis, L. B.
1975 *The Prehistory of the Whitewater-Frenchman Creek/Milk River Locality, Northeastern Montana: An Introduction*. Report. Montana State University. Submitted to Malta District, Bureau of Land Management and Whitewater School District #20AA.
1976 The Dodge Site (24RB225): A McKean Phase Lithic "Cache" in the Tongue River Valley. *Archaeology in Montana* 17(1 and 2):35-51.
1978 The 20th-Century Commercial Mining of Northern Plains Bison Kills. In *Bison Procurement and Utilization: A Symposium*, edited by L. B. Davis and M. Wilson, pp. 254-286. Plains Anthropologist Memoir 14.
1980 In Quest of the "Old Cherry Creek Trail." Special Issue Number 2, *Archaeology in Montana* 21(3):149-178.
1982 *Archaeology and Geology of the Schmitt Chert Mine, Missouri Headwaters*. Guidebook for field trip, 35th Annual Meeting of the Geological Society of America. Montana State University, Bozeman.
1983 Stone Circles in the Montana Rockies: Relict Households and Transitory Communities. In *From Microcosm to Macrocosm: Advances in Tipi Ring Investigation and Interpretation*, edited by L. B. Davis, pp. 235-278. Plains Anthropologist Memoir 19.
1984 Late Pleistocene to Mid-Holocene Adaptations at Indian Creek, East-Central Montana. *Current Research in the Pleistocene* 1:9-10.
1988 (editor) *Avonlea Yesterday and Today: Archaeology and Prehistory*. Saskatchewan Archaeological Society, Saskatoon.
1989 Cultural Succession at the Hoffer site (24CH669) and Eagle Creek Confluence, Upper Missouri National Wild and Scenic River, North-Central Montana High Plains. *Archaeology in Montana* 30(1 and 2).

1993 Paleo-Indian Archaeology in the High Plains and Rocky Mountains of Montana. In *From Kostenki to Clovis: Upper Paleolithic-Paleo-Indian Adaptations*, edited by O. Soffer and N. D. Praslov, pp. 263-277. Plenum, New York.

Davis, L. B., and S. Aaberg

1978 *Upper Missouri Wild and Scenic River Followup Cultural Resources Investigation*. Report. Montana State University. Submitted to U.S.D.I. Bureau of Land Management, Lewistown Distric Office.

Davis, L. B., S. Aaberg, and W. Eckerle

1989 Preliminary Geoarchaeology of the Lower Yellowstone Badlands: A Paleoindian Site Predictive Model for East-Central Montana. *Current Research in the Pleistocene* 6:5-6.

Davis, L. B., S. Aaberg, and J. Fisher, Jr.

1980 *Cultural Resources in the Limestone Hills Army National Guard Training Site*. Report #80-MT-070-075-40. Submitted to Montana Department of Military Affairs, Helena.

Davis, L. B., S. Aaberg, M. Wilson, and R. Ottersberg

1982 *Stone Circles in the Montana Rockies: Systematic Recovery and Cultural-Ecological Inference*. Report. Montana State University, Bozeman. Submitted to Montana Department of Military Affairs, Helena.

Davis, L. B., and J. Fisher, Jr.

1988 Avonlea Predation on Wintering Plains Pronghorns. In *Avonlea Yesterday and Today: Archaeology and Prehistory*, edited by L. B. Davis, pp. 101-118. Saskatachewan Archaeological Society.

Davis, L. B., S. T. Greiser, and T. W. Greiser

1987 Spring Cleanup at a Folsom Campsite in the Northern Rockies. *Current Research in the Pleistocene* 4:5-6.

Davis, L. B., and E. Stallcop

1965 *Keaster Site (24BW559): A Stratified Bison Kill Occupation in the Missouri Breaks Area of North-Central Montana*. Memoir No. 2. Montana Archaeological Society.

1966 *The Wahkpa Chu'gn Site (24HL101): Late Hunters in the Milk River Valley, Montana*. Memoir 3. Montana Archaeological Society.

Davis, L. B., and M. Wilson

1978 *Bison Procurement and Utilization: A Symposium*. Plains Anthropologist Memoir 14.

Davis, L. B., and C. Zier

1978 Multi-Phase Late Period Bison Procurement at the Antonson Site, Southwestern Montana. In *Bison Procurement and Utilization: A Symposium*, edited by L. B. Davis and M. Wilson, pp. 222-235. Plains Anthropologist Memoir 14.

Deaver, K.

1980a *Archaeological Site Distribution in North Blaine County, Montana*. Report #80-MT-066-208. Submitted to Lewistown District Office, Bureau of Land Management.

1980b *Archaeological Site Distribution in South Phillips County, Montana*. Report. Submitted to Lewistown District Office, Bureau of Land Management.

1983 Rings at the Johnson Bison Kill Site, 24PH8. In *From Microcosm to Macrocosm: Advances in Tipi Ring Investigation and Interpretation*, edited by L. B. Davis, pp. 59-70. Plains Anthropologist Memoir 19.

1985 (editor) *Mitigation of the Anderson Tipi Ring Site (32ML111), McLean County, North Dakota*. Ethnoscience, Billings, Montana. Submitted to Falkirk Mining Company, Bismarck.

1990 (editor) *Mitigation of Site 32ME220, Mercer County, North Dakota*. Ethnoscience, Billings, Montana. Submitted to Coteau Properties Company, Bismarck.

1991 (editor) *Excavations at the Twin Buttes Site, 32DU32/32ME617, in West Central North Dakota*. Ethnoscience, Billings, Montana. Submitted to HKM Associates, Billings, Montana.

Deaver, K., and S. Aaberg

1977 *Report of the Archaeological Survey of the Kansas-Nebraska Project Area: Phillips County, Montana* (3 vols.). Report. Submitted to Federal Energy Regulatory Commission. Manuscript on file, Montana State Historic Preservation Office, Helena.

Deaver, K., and S. Deaver

1987 *Dancing Grouse, A Tipi Ring Site in Central North Dakota*. Ethnoscience, Billings, Montana. Submitted to Falkirk Mining Company, Bismarck.

Deaver, K., S. Deaver, and M. Bergstrom

1989 *Onion Ring Site, 32ME166, A Tipi Ring Site in Central North Dakota*. Ethnoscience, Billings, Montana. Submitted to Coteau Properties Company, Bismarck.

Deaver, S.

1982 *Site Distribution and Lithic Resource Utilization in the Big Dry Resource Area, East-Central Montana*. Report. Submitted to Lewistown District Office, Bureau of Land Management.

1984 *Butte District Archaeology: A Class I Inventory of Prehistoric Resources*. Report. Submitted to Butte District Office, Bureau of Land Management.

Deaver, S., and K. Deaver

1986 *An Archaeological Overview of Butte District Prehistory*. Cultural Resource Series No. 2. Bureau of Land Management, Montana State Office, Billings.

1988 *Prehistoric Cultural Resource Overview of Southeast Montana*. Report. Submitted to Miles City District Office, Bureau of Land Management.

Deer, W. A., R. A. Howie, and J. Zussman

1966 *An Introduction to the Rock Forming Minerals*. Longman Group, Essex, England.

Deetz, J. F.

1965 *The Dynamics of Stylistic Change in Arikara Ceramics*. Illinois Studies in Anthropology No. 4. University of Illinois Press, Urbana.

Delcourt, P. A., and H. R. Delcourt

1981 Vegetation Maps for Eastern North America: 40,000 B.P. to the Present. In *Geobotany II*, edited by R. C. Romans, pp. 123-166. Plenum, New York.

DeMallie, R. J., Jr.

1975 Joseph N. Nicollet's Account of the Sioux and Assiniboin in 1839. *South Dakota History* 5(4):343-359.

Devore, S. L.

1992 *Beads of the Bison Robe Trade*. Friends of the Fort Union Trading Post, Williston, North Dakota.

DeVoto, B. (editor)

1953 *The Journals of Lewis and Clark.* Houghton Mifflin, Boston.

Dibble, D. D., and D. Lorrain

1968 *Bonfire Shelter: A Stratified Bison Kill Site, Val Verde County, Texas*. Miscellaneous Papers 1. Texas Memorial Museum.

Dick, H. W., and B. Mountain

1960 The Claypool Site: A Cody Complex Site in Northeastern Colorado. *American Antiquity* 26(2):223-235.

Dill, C. L.

1975 *Hidatsa Culture History: An Identification of Problems*. Unpublished Master's thesis, Department of Anthropology, University of Kansas.

Dobbs, C. A., and G. W. Christianson III

1991 The Granite Falls Bison Kill Site 1990 Research Update. *Newsletter of the South Dakota Archaeological Society* 21(1):5-6.

Dobyns, H. F.

1983 *Their Numbers Become Thinned: Native American Population Dynamics in Eastern North America*. University of Tennessee Press, Knoxville.

Dondanville, R. F.
1963 The Fall River Formation, Northwestern Black Hills: Lithology and Geologic History. Wyoming Geological Association and Billings Geological Society, First Joint Field Conference *Guidebook*:87-89.

Donohue, J. A., and N. Hanenberger
1993 A Preliminary Report on Excavations at the Jim Pitts Site, a Stratified Paleoindian Occcupation Located in the Southwestern Black Hills of Custer County, South Dakota. Paper presented at the 51st Plains Anthropological Conference, Saskatoon, Canada.

Drever, J. I.
1988 *The Geochemistry of Natural Waters* 2nd ed. Prentice Hall, Englewood Cliffs.

Duguid, J. O.
1968 The Irvine Site: A Possible Avonlea Site in Eastern Wyoming. *The Wyoming Archaeologist* 11(2):24-34.

Dyck, I. G.
1983 The Prehistory of Southern Saskatchewan. In *Tracking Ancient Hunters, Prehistoric Archaeology in Saskatchewan*, edited by H. T. Epp and I. Dyck, pp. 63-139. Saskatchewan Archaeological Society, Regina.

Eakin, D. H.
1980 Implications of a Human Skeleton from Southwest Wyoming. *Wyoming Contributions to Anthropology* 2:114-119.
1987 *Final Report of Salvage Investigations at the Split Rock Ranch Site (48FR1484)*. Highway Project SCPF-020-2(19), Fremont County, Wyoming. Submitted to Wyoming Highway Department.

Earls, A., C. Lintz, G. Gill, P. O'Neill, W. Trierweiler
1991 *Investigations of Historic Cemeteries at O. H. Ivie Reservoir, Coleman, Concho, and Runnels Counties, Texas*. Mariah Technical Report No. 403.

Eddy, J. A.
1974 Astronomical Alignment of the Bighorn Medicine Wheel. *Science* 184:1035-1043.
1977 Mystery of the Medicine Wheels. *National Geographic* 15(1):140-146.

Edgar, R.
1966 A Pryor Complex Site in the Bighorn Mountains of Wyoming. *The Wyoming Archaeologist* 9(2):14-16.

Egan, M. H.
1917 *Pioneering the West: 1846 to 1878*, edited by W. M. Egan. Salt Lake City.

Ehrenhard, J. E.
1972 Time, Space, and Climate in the Middle Missouri. *Transactions of the Nebraska Academy of Sciences* 1:11-19.

Eisenbarth, D. and H. Earl
1989 News from the High Plains Chapter. *The Wyoming Archaeologist* 32(1-2):iv-xvii.

Emerson, A. M., and R. A. Fox, Jr.
1991 *The Archaeology Program at the Central Barracks Site, Fort Abraham Lincoln State Park, North Dakota: Results of the 1989 Investigations*. Draft. Department of Anthropology, University of North Dakota, Grand Forks. Submitted to the Fort Abraham Lincoln Foundation, Bismarck.

Entzminger, D. J.
1980 The Upper Cretaceous Stratigraphy in the Big Hole Mountains, Idaho. Wyoming Geological Association, Thirty-first Annual Field Conference *Guidebook*:163-172.

Evans, G. E.
1961 *A Reappraisal of the Blackduck Focus of Headwaters Lake Aspect*. Unpublished Master's thesis, Department of Anthropology, University of Minnesota, Minneapolis.

Ewen, J., and N. D. Ewen
1982 *Bibliographical Dictionary of Rocky Mountain Naturalists: A Guide to the Writings and Collections of Botanists, Zoologists, Artists, and Photographers, 1682-1932*. Kluwer, Hingam, Massachusetts.

Ewers, J. C.
1954 Indian Trade of the Upper Missouri Before Lewis and Clark. *Bulletin of the Missouri Historical Society* 10:429-446.
1955 *The Horse in Blackfoot Indian Culture*. Bulletin No. 159. Bureau of American Ethnology.
1968 The Indian Trade of the Upper Missouri Before Lewis and Clark. In *Indian Life on the Upper Missouri*, by J. C. Ewers, pp. 14-33. University of Oklahoma Press, Norman.

Ewers, J. C. (editor)
1961 *Five Indian Tribes of the Upper Missouri: Sioux, Arickaras, Assiniboines, Crees, Crows*, by E. T. Denig. University of Oklahoma Press, Norman.

Falk, C. R.
1977 Analyses of Unmodified Vertebrate Fauna from Sites in the Middle Missouri Subarea: A Review. *Plains Anthropologist Memoir* 13:151-161.

Falk, C. R. (editor)
1984 *Archeological Investigations within Federal Lands Located on the East Bank of the Lake Sharpe Project Area, South Dakota: 1978-1979 Final Report*. Division of Archeological Research, Department of Anthropology, University of Nebraska, Lincoln. Submitted to the U.S. Army Corps of Engineers, Omaha District.

Falk, C. R., and S. A. Ahler
1988 *Archeological Investigations in the Mobridge Area, South Dakota, 1969-1970: Lower Grand (Davis), 39CO14; Walth Bay, 39WW203; and Helb, 39CA208*. Department of Anthropology, University of Missouri, Columbia. Submitted to the National Park Service, Rocky Mountain Region, Denver.

Falk, C. R., and C. M. Johnson
n.d. Archeological Investigations at the Larson Site (39WW2), Walworth County, South Dakota. Division of Archeological Research, Department of Anthropology, University of Nebraska, Lincoln. Report to Interagency Archeological Services, National Park Service, Denver, in preparation.

Falk, C. R., C. M. Johnson, and J. T. Richtsmeier
n.d. *Archeological Investigations at the H.P. Thomas Site (39ST12), Stanley County, South Dakota*. Division of Archeological Research, Department of Anthropology, University of Nebraska, Lincoln. Report to Interagency Archeological Services, National Park Service, Denver, in preparation.

Falk, C. R., and R. E. Pepperl (compilers and editors)
1986 *A Cultural Resource Survey of the East Shore of Lake Oahe, South Dakota: Final Report*. Division of Archeological Research, Department of Anthropology, University of Nebraska, Lincoln. Submitted to the U.S. Army Corps of Engineers, Omaha District.

Falk, C. R., T. Steinacher, and C. M. Johnson
n.d. *Archeological Investigations at the Sommers Site (39ST56), Stanley County, South Dakota*. Division of Archeological Research, Department of Anthropology, University of Nebraska, Lincoln. Report to Interagency Archeological Services, National Park Service, Denver, in preparation.

Farnsworth, K. B., and T. E. Emerson (editors)
1986 *Early Woodland Archeology*. Center for American Archeology Press, Kampsville, IL.

Fenenga, F., and P. Cooper
1951 *Appraisal of the Archaeological and Paleontological Resources of the Sun River Basin, Montana*. Report, Missouri River Basin Survey. On file, Midwest Archaeological Center, National Park Service, Lincoln, Nebraska.

Fenneman, N. M.
1931 *Physiography of the Western United States*. McGraw-Hill, New York.
1938 *Physiography of Eastern United States*. McGraw-Hill, New York.

Feyhl, K. J.
1972 The Stark-Lewis Site, 24GV401. *Archaeology in Montana* 13(2):1-55.

Figgins, J. D.
1927 The Anitquity of Man in America. *Natural History* 27(3):229-239.

Finnigan, J. T., D. R. Russell, and O. Klimko
1990 Recent Research along the Upper Souris River: The Souris Basin Heritage Study. *Journal of the North Dakota Archaeological Association* 4:111-130.

Fisher, A. K., W. D. Frankforter, J. A. Tiffany, S. J. Schermer, and D. C. Anderson
1985 Turin: A Middle Archaic Burial Site in Western Iowa. *Plains Anthropologist* 30(109):195-218.

Fisher, J. H.
1963 Tensleep Sandstone of the Eastern Bighorn Mountains, Wyoming. Wyoming Geological Association and Billings Geological Society, First Joint Field Conference *Guidebook*:54-60.

Fisher, J. W., Jr.
1980 A Preliminary Analysis of the Human Skeletons from the Korell-Bordeaux and Rock Ranch Sites. Manuscript on file, Human Osteological Laboratory, University of Wyoming.
1982 The Paleopathology of a Human Skeletal Sample from the Northwestern Plains. *Wyoming Contributions to Anthropology* 3:77-90.

Fisher, T. D., and G. W. Gill
1990 Application of the Giles and Elliot Discriminant Function Formulae to a Cranial Sample of Northwestern Plains Indians. In *Skeletal Attributes of Race: Methods for Forensic Anthropology*, edited by G. W. Gill and S. Rhine, pp. 59-63. Anthropological Papers No. 4. Maxwell Museum of Anthropology.

Fitzhugh, W. W.
1972 *Environmental Archaeology and Cultural Systems in Hamilton Inlet, Labrador*. Smithsonian Contributions to Anthropology No. 16. Smithsonian Institution Press, Washington, D.C.
1975 A Comparative Approach to Northern Maritime Adaptations. In *Prehistoric Maritime Adaptations of the Circumpolar Zone*, edited by W. W. Fitzhugh, pp. 339-386. Mouton, The Hague.

Flenniken, J. J.
1978 Reevaluation of the Lindenmeier Folsom: A Replication Experiment in Lithic Technology. *American Antiquity* 43(3):473-480.

Flint, R. F.
1955 *Pleistocene Geology of Eastern South Dakota*. Professional Papers No. 262. U.S. Geological Survey, Washington, D.C.

Floodman, M. G.
1989a *A Cultural Resources Inventory of Lands Owned by the Omaha District, U.S. Army Corps of Engineers, Along the Shoreline of Lake Sakakawea, Mercer County, North Dakota*. Archaeology Department, Powers Elevation Company, Aurora, Colorado. Submitted to the U.S. Army Corps of Engineers, Omaha District.
1989b *Final Report of an Archaeological Inventory of Portions of the Devils Lake Basin, Benson, Eddy, Nelson, and Ramsey Counties, North Dakota.* Powers Elevation, Aurora, CO. Submitted to U.S. Army Corps of Engineers, St. Paul District, MN.
1989c *Graham's Island Recreation Area Cultural Resources Inventory Benson and Ramsey Counties, North Dakota*. Powers Elevation Company, Aurora CO. Submitted to USDI Bureau of Reclamation, Bismarck, ND.

Forbis, R. G.
1962 The Old Women's Buffalo Jump, Alberta. *National Museum of Canada Bulletin* 180:56-123.
1992 The Mesoindian (Archaic) Period in the Northern Plains. In *Revista de Arqueologia Americana*, Numero 5, pp. 27-70. Instituto Panamericano de Geografia e Historia.

Forbis, R. G., and J. D. Sperry
1952 An Early Man Site in Montana. *American Antiquity* 18:127-133.

Forbis, R. G., W. D. Strong, and M. E. Kirkby
n.d. Signal Butte and MacHaffie: Two Stratified Sites on the Northern Great Plains.

Fosha, M.
1994 A Clovis Point from Davison County, South Dakota. *Newsletter of the South Dakota Archaeological Society* 24(2):4-5.

Foss, J. E., M. E. Timpson, and R. J. Lewis
1995 Soils in Alluvial Sequences: Some Archaeological Implications. In *Pedological Perspectives in Archaeological Research*, edited by M. E. Collins, B. J. Carter, B. G. Gladfelter, and R. J. Southard, pp. 1-14. SSSA Special Publication No. 44. Soil Science Society of America, Madison, WI.

Fowler, L.
1982 *Arapahoe Politics, 1871-1978: Symbols in Crises of Authority*. University of Nebraska Press, Lincoln.

Fox, G. L.
1982a *A Late Nineteenth Century Village of a Band of Dissent Hidatsa: the Garden Coulee Site (32WI18)*. Reprints in Anthropology No. 37. J and L Reprint, Lincoln, Nebraska.
1982b *Report of Recovery of Human Skeletal Remains from the Bahm Site, 32MO97.* State Historical Society of North Dakota, Bismarck.

Fox, R. A., Jr.
1990 *Archaeological Investigations at Fort Abraham Lincoln State Park: The Commissary Building Site*. Department of Anthropology, University of North Dakota, Grand Forks. Submitted to the Fort Abraham Lincoln Foundation, Bismarck.
1993 *Archaeology, History, and Custer's Last Battle: The Little Big Horn Reexamined*. University of Oklahoma Press, Norman.

Fox, R. A., Jr., and A. M. Emerson
1991 *Results of the 1990 Commissary Mitigation Archaeology Investigations, Fort Abraham Lincoln State Park (32MO141), North Dakota*. Department of Anthropology, University of North Dakota, Grand Forks. Submitted to Fort Abraham Lincoln Foundation, Bismarck.

Fox, R. A., and J. A. Williams
1982 The Pipestem Burial: An Archaic Interment from Southeastern North Dakota. *North American Archaeologist* 3:51-78.

Fox, S. J.
1982a *Excavations at the Irvin Nelson Site, 32BE208*. North Dakota State University, Fargo. Submitted to U.S. Fish and Wildlife Service, Department of the Interior, Denver.
1982b NDSU Excavations at the Irvin Nelson Site (32BE208). *Notes on North Dakota Archaeology* 2(1):2.

Fraley, D. C.
1988 Avonlea and Besant in Eastern Montana: Archaeological Distributions in the Lower Yellowstone Region. In *Avonlea Yesterday and Today*, edited by L. B. Davis, pp. 129-136. Saskatchewan Archaeological Society, Saskatoon.

Francis, J. E.
1979 Chipped Stone Raw Material Sources in the Bighorn Mountains of North Central Wyoming: A Preliminary Statement. Paper presented at the Thirty-seventh Plains Conference, Kansas City, Missouri.
1983 *Procurement and Utilization of Chipped Stone Raw Materials: A Case Study from the Bighorn Mountains and Basin of North Central Wyoming*. Ph.D. dissertation, Department of Anthropology, Arizona State University, Tempe.

1988 Chipped Stone Raw Materials at the Milliron Site, Southeast Montana. Paper presented at the Fifty-third Meeting of the Society for American Archaeology, Phoenix.

1989 Rock Art at Legend Rock. In *Legend Rock Petroglyph Site (48HO4), Wyoming: 1988 Archaeological Investigations*, edited by D. N. Walker and J. E. Francis, pp.151-208. Office of the Wyoming State Archaeologist. Submitted to Wyoming Recreation Commission, Cheyenne.

1991 An Overview of Wyoming Rock Art. In *Prehistoric Hunters of the High Plains* (2nd ed.), edited by G. Frison, pp. 397-430. Academic Press, San Diego.

1994 Cation-Ratio Dating and Chronological Variation within Dinwoody Tradition Rock Art in Northwestern Wyoming. In *New Light on Old Art: Recent Advances in Hunter-Gatherer Rock Art Research*, edited by D. S. Whitley and L. L. Loendorf, pp. 37-49. Monograph No. 36. UCLA Institute of Archaeology.

Francis, J. E., L. L. Loendorf, and R. I. Dorn

1993 AMS Radiocarbon and Cation-Ratio Dating of Rock Art in the Bighorn Basin of Wyoming and Montana. *American Antiquity* 58:711-737.

Francis, J. E., and M. E. Miller

1993 They Aren't Just Foragers Anymore: New Perspectives on Early Archaic Adaptations in the Upper Green River Basin, Wyoming. Paper presented at the 1st biennial Rocky Mountain Anthropology Conference, Jackson, Wyoming.

Fredlund, D. E.

1969 Vision Quest Sites and Structures. *Archaeology in Montana* 10(1 and 2):14-16.

1976 Fort Union Porcellanite and Fused Glass: Distinctive Lithic Materials of Coal Burn Origin on the Northern Plains. *Plains Anthropologist* 21(73):207-212.

Fredlund, L. B.

1979 *Benson's Butte 24BH1726.* Report of Investigations No. 8. Cultural Resources Division, Montana Tech Alumni Foundation, Butte, Montana.

1981 *Southeastern Montana in the Late Prehistoric Period: Human Adaptation and Projectile Point Chronology*. Unpublished Ph. D. dissertation, Department of Archaeology, Simon Fraser University.

1988 Distribution and Characteristics of Avonlea South of the Yellowstone River in Montana. In *Avonlea Yesterday and Today*, edited by L. B. Davis, pp. 171-182. Saskatchewan Archaeological Society, Saskatoon.

Fredlund, L. B., D. P. Herbort, and G. Munson

1984 *The Mitigation of Archeological Site 32OL270, Glenharold Mine, North Dakota*. GCM Services, Butte, Montana. Submitted to Basin Cooperative Services, Bismarck.

Freeman, V.L., E. T. Ruppel, and M. R. Klepper

1958 *Geology of Part of the Townsend Valley, Broadwater and Jefferson Counties, Montana*. U. S. Geological Survey Bulletin 1042N.

Fremont, Gen. J. C.

1887 *Memoirs of My Life*. Belford, Clark and Company, Chicago and New York.

Friis, H. R.

1975 The Role of United States Topographical Engineers in Compiling a Cartographic Image of the Plains Region. In *Images of the Plains: The Role of Human Nature in Settlement*, edited by B. W. Blouet and M. P. Lawson, pp. 59-74. University of Nebraska Press, Lincoln.

Frison, G. C.

1962 Wedding of the Waters Cave: A Stratified Site in the Bighorn Basin of Northern Wyoming. *Plains Anthropologist* 7(18):246-265.

1965 Spring Creek Cave, Wyoming. *American Antiquity* 31(1):81-94.

1967a The Piney Creek Sites, Wyoming. *University of Wyoming Publications* 33(1):1-92.

1967b *Archaeological Evidence of the Crow Indians in Northern Wyoming: A Study of a Late Prehistoric Period Buffalo Economy*. Unpublished Ph. D. dissertation, University of Michigan, Ann Arbor.

1968a Daugherty Cave, Wyoming. *Plains Anthropologist* 13(42):253-295.

1968b Site 48SH312: An Early Middle Period Bison Kill in the Powder River Basin of Wyoming. *Plains Anthropologist* 13(39):31-39.

1970a The Kobold Site, 24BH406: A Post-Altithermal Record of Buffalo-Jumping for the Northwestern Plains. *Plains Anthropologist* 15(47):1-35.

1970b *The Glenrock Buffalo Jump, 48CO304: Late Prehistoric Buffalo Procurement and Butchering*. Plains Anthropologist Memoir 7.

1971a The Buffalo Pound in Northwestern Plains Prehistory: Site 48CA302, Wyoming. *American Antiquity* 36(1):77-91.

1971b Shoshonean Antelope Procurement in the Upper Green River Basin, Wyoming. *Plains Anthropologist* 16(54):258-284.

1973a Early Period Marginal Cultural Groups in Northern Wyoming. *Plains Anthropologist* 18(62):300-312.

1973b *The Wardell Buffalo Trap 48SU301: Communal Procurement in the Upper Green River Basin, Wyoming*. Anthropological Papers No. 48. Museum of Anthropology, University of Michigan.

1974a *The Casper Site: A Hell Gap Bison Kill on the High Plains*. Academic Press, New York.

1974b The Application of Volcanic and Non-volcanic Natural Glass Studies to Archaeology in Wyoming. In *Applied Geology and Archaeology: The Holocene History of Wyoming*, edited by M. Wilson. Report of Investigations No. 10, Geological Survey of Wyoming.

1975 Man's Interaction with Holocene Environments on the Plains. *Quaternary Research* 5:289-300.

1976a Crow Pottery in Northern Wyoming. *Plains Anthropologist* 21(71):29-44.

1976b The Chronology of Paleo-Indian and Altithermal Period Groups in the Bighorn Basin, Wyoming. In *Cultural Change and Continuity: Essays in Honor of James Bennett Griffin*, edited by C. E. Cleland, pp. 147-173. Academic Press, New York.

1978 *Prehistoric Hunters of the High Plains*. Academic Press, New York.

1980 A Composite, Reflexed, Mountain Sheep Horn Bow from Western Wyoming. *Plains Anthropologist* 25(88):173-176.

1981 Linear Arrangements of Cairns in Wyoming and Montana. In *Megaliths to Medicine Wheels: Boulder Structures in Archaeology*, edited by M. Wilson, K. L.Road, and K. J. Hardy, pp. 133-147. Proceedings of the Eleventh Chacmool Conference, Department of Anthropology, University of Calgary, Alberta, Canada.

1982a The Sheaman Site: A Clovis Component. In *The Agate Basin Site: A Record of the Paleoindian Occupation of the Northwestern High Plains*, edited by G. Frison and D. Stanford, pp. 143-156. Academic Press, New York.

1982b Sources of Steatite and Methods of Prehistoric Procurement and Use in Wyoming. *Plains Anthropologist* 27(98):273-286.

1983a The Lookingbill Site, Wyoming 48FR308. *Tebiwa* 20:1-16.

1983b Stone Circles, Stone-filled Fire Pits, Grinding Stones and High Plains Archaeology. In *From Microcosm to Macrocosm: Advances in Tipi Ring Investigation and Interpretation*, edited by L. B. Davis, pp. 81-92. Plains Anthropologist Memoir 19.

1984 The Carter/Kerr-McGee Paleoindian Site: Cultural Resource Management and Archaeological Research. *American Antiquity* 49(2):288-314.

1988a Avonlea and Contemporaries in Wyoming. In *Avonlea Yesterday and Today: Archaeology and Prehistory*, edited by L. B. Davis, pp. 155-170. Saskatchewan Archaeological Society, Saskatoon.

1988b Paleoindian Subsistence and Settlement During Post-Clovis Times on the Northwestern Plains, the Adjacent Mountain Ranges, and Intermontane Basins. In *Americans Before Columbus: Ice-Age Origins*, edited by R. C. Carlisle, pp. 83-108. Ethnology Monographs No. 12. Department of Anthropology, University of Pittsburgh.

1989 Experimental Use of Clovis Weaponry and Tools on African Elephants. *American Antiquity* 54(4):766-784.

1991a *Prehistoric Hunters of the High Plains* (2nd ed.). Academic Press, San Diego.

1991b The Clovis Cultural Complex: New Data from Caches of Flaked Stone and Worked Bone Artifacts. In *Raw Material Economies Among Prehistoric Hunter-Gatherers*, edited by A. Montet-White and S. Holen, pp. 321-334. Anthropology No. 19. University of Kansas Publications.

1991c The Goshen Paleoindian Complex: New Data for Paleoindian Research. In *Clovis Origins and Adaptations*, edited by R. Bonnichsen and K. L. Turnmire, pp. 133-151. Center for the Study of the First Americans. Oregon State University, Corvallis.

1992 The Foothills-Mountains and the Open Plains: A Dichotomy in Paleoindian Subsistence Strategies Between Two Ecosystems. In *Ice-Age Hunters of the Rockies*, edited by D. Stanford and J. Day, pp. 323-342. University of Colorado Press, Boulder.

1996 *The Mill Iron Site 24CT30*. University of New Mexico Press, Albuquerque.

Frison, G. C., J. M. Adovasio, and R. C. Carlisle

1986 Coiled Basketry from Northern Wyoming. *Plains Anthropologist* 31(112):163-167.

Frison, G. C., R. L. Andrews, J. M. Adovasio, R. C. Carlisle, and R. Edgar

1986 A Late Paleoindian Animal Trapping Net from Northern Wyoming. *American Antiquity* 51(2):352-361.

Frison, G. C., and B. Bradley

1980 *Folsom Tools and Technology at the Hanson Site, Wyoming*. University of New Mexico Press, Albuquerque.

1981 Fluting Folsom Points: Archaeological Evidence. *Lithic Technology* 10(1):13-16.

Frison, G. C., and C. Craig

1982 Bone, Antler, and Ivory Artifacts and Manufacture Technology. In *The Agate Basin Site: A Record of the Paleoindain Occupation of the Northwestern High Plains*, edited by G. Frison and D. Stanford, pp. 157-173. Academic Press, New York.

Frison, G. C., and D. C. Grey

1980 Pryor Stemmed, a Specialized Paleo-Indian Ecological Adaptation. *Plains Anthropologist* 25(87):27-46.

Frison, G. C., and M. Huseas

1968 Leigh Cave, Wyoming, Site 48WA304. *The Wyoming Archaeologist* 11(3):20-33.

Frison, G. C., C. A. Reher, and D. N. Walker

1990 Prehistoric Mountain Sheep Hunting in the Central Rocky Mountains of North America. In *Hunters of the Recent Past*, edited by L. B. Davis and B. O. K. Reeves, pp. 208-240. Unwin-Hyman, London.

Frison, G. C., and D. J. Stanford (editors)

1982 *The Agate Basin Site: A Record of the Paleoindian Occupation of the Northwestern High Plains*. Academic Press, New York.

Frison, G. C., and L. C. Todd

1986 *The Colby Mammoth Site: Taphonomy and Archaeology of a Clovis Kill in Northern Wyoming*. University of New Mexico Press, Albuquerque.

1987 *The Horner Site: The Type Site of the Cody Cultural Complex*. Academic Press, Orlando.

Frison, G. C., and Z. Van Norman

1985 The Wind River Canyon Burial and Cache. *Archaeology in Montana* 26(2):43-52.

1993 Carved Steatite and Sandstone Tubes: Pipes for Smoking or Shaman's Paraphernalia? *Plains Anthropologist* 38(143):163-176.

Frison, G. C., and D. N. Walker (editors)

1984 The Dead Indian Creek Site: An Archaic Occupation in the Absaroka Mountains of Northwest Wyoming. *The Wyoming Archaeologist* 27(1-2):11-122.

Frison, G. C., and M. Wilson

1975 An Introduction to Bighorn Basin Archaeology. *Wyoming Geological Association, Twenty-seventh Annual Field Conference Guidebook*:19-35.

Frison, G. C., M. Wilson, and D. N. Walker

1978 *The Big Goose Creek Site: Bison Procurement and Faunal Analysis*. Occasional Papers on Wyoming Archaeology No. 1. Wyoming State Archaeologist's Office, Laramie.

Frison, G. C., M. Wilson, and D. J. Wilson

1976 Fossil Bison and Artifacts from an Early Altithermal Period Arroyo Trap in Wyoming. *American Antiquity* 41(1): 28-57.

Frison, G. C., and G. M. Zeimens

1980 Bone Projectile Points: An Addition to the Folsom Cultural Complex. *American Antiquity* 45(2):231-237.

Fritts, H. C., and X. M. Shao

1992 Mapping Climate Using Tree-Rings from Western North America. In *Climate since A.D. 1500*, edited by R. S. Bradley and P. D. Jones, pp. 269-295. Routledge, New York.

Fry, G. R.

1971 Preliminary Report on the Foss-Thomas Site. *The Wyoming Archaeologist* 14(1):15-22.

Galloway, E.

1963a The Mahoney Burial near Fort Laramie, Wyoming. *The Wyoming Archaeologist* 6(1):12-14.

1963b The Ramsbottom Burial. *The Wyoming Archaeologist* 6(3):9-11.

Gant, R. D.

1967 *Archeological Investigations at the Arp Site, 39BR101, Brule County, South Dakota, 1961*. Archeological Studies Circular No. 12. W. H. Over Dakota Museum, University of South Dakota, Vermillion.

Gant, R., and W. Hurt

1965 The Sturgis Archaeological Project: An Archaeological Survey of the Northern Black Hills. *South Dakota Museum News* 26(7-8):1-51.

Gardner, A. Dudley, R. L. Tanner, and D. Heffington

1983 Final Recommendations for the Cross Mountain Quarry Site. Manuscript on file, Archaeological Services, Western Wyoming College, Rock Springs.

Gebhard, D. S.

1969 *The Rock Art of Dinwoody, Wyoming*. The Art Galleries, University of California, Santa Barbara.

Gebhard, D. S., and H. A. Cahn

1950 The Petroglyphs of Dinwoody, Wyoming. *American Antiquity* 15:219-228.

Gibbon, G. E., and C. A. H. Caine

1980 The Middle to Late Woodland Transition in Eastern Minnesota. *Midcontinental Journal of Archaeology* 5:57-72.

Gibbons, B.

1986 Life and Death on the Oregon Trail: The Itch to Move West. *National Geographic* 170:147-178.

Gibson, T. H., and P. McKeand

1992 *Excavation of the Crane Site, DiMv-93*. Western Heritage Services, Inc. Saskatoon.

Gilbertson, J. P. (editor)

1989 Quaternary Geology of Northeastern South Dakota. *Department of Water and Natural Resources, Division of Geological Survey Guidebook 3*. University of South Dakota Science Center, Vermillion.

Gill, G. W.

1974 Human Skeletons from Wyoming and their Bearing on the Concept of Morphological Dating. In *Applied Geology and Archaeology: The Holocene History of Wyoming*, edited by M. Wilson, pp. 100-107. Report of Investigations No. 10. Geological Survey of Wyoming.

1976a The Glendo Skeleton and its Meaning in Light of Post-Contact

Racial Dynamics in the Great Plains. *Plains Anthropologist* 21(72):81-88.
1976b Two Mummies from the Pitchfork Rockshelter in Northwestern Wyoming. *Plains Anthropologist* 21(74):301-310.
1978 The Sand Creek Skeleton. *The Wyoming Archaeologist* 21(3):21-30.
1981 Human Skeletal Populations of the Northwestern Plains: A Preliminary Analysis. In *Progress in Skeletal Biology of Plains Populations*, edited by R. L. Jantz and D. H. Ubelaker, pp. 57-70. Plains Anthropologist Memoir 17.
1983a Additional Comment and Illustration Relating to the Iron Jaw Skeleton. *Plains Anthropologist* 28(102-3):335-336.
1983b U. W. Forensic Case No. 45: Unidentified Human Skeleton. Manuscript on file, Human Osteological Laboratory, University of Wyoming.
1984 The Partial Skeleton of a Child from Dead Indian Creek. In *The Dead Indian Creek Site: An Archaic Occupation in the Absaroka Mountains of Northwestern Wyoming*, edited by G. C. Frison and D. N. Walker. *The Wyoming Archaeologist* 27(1-2):97.
1987 Human Skeletons from the Rock Ranch and Korell-Bordeaux Sites. *The Wyoming Archaeologist* 30(3-4):103-107.
1988 A Partial Human Skeleton from the Rock Ranch Site, Southeastern Wyoming. Manuscript on file, Human Osteological Laboratory, University of Wyoming.
1989 *Osteological Analysis of the Salt Lake Valley Pioneers*. Manuscript on file, Human Osteological Laboratory, University of Wyoming. Report prepared for Office of Public Archaeology, Brigham Young University, Provo, Utah.
1990 *Analysis of the Frying Pan Basin Skeleton*. Report prepared for Bureau of Land Management, Billings, Montana. Ms. on file, Human Osteological Laboratory, University of Wyoming.
1991a Human Skeletal Remains on the Northwestern Plains. Appendix in *Prehistoric Hunters of the High Plains*, 2nd ed., by G. C. Frison, pp. 431-447. Academic Press, New York.
1991b Human Osteological Material. In *The Smilden-Rostberg Site: An Early Archaic Component in the Northeastern Plains,* edited by T. K. Larson and D. M. Penny. Larson-Tibesar Associates, Laramie. Report submitted to KBM, Inc., Grand Forks.
1994 Skeletal Injuries of Pioneers. In *Skeletal Biology in the Great Plains: Migration, Warfare, Health, and Subsistence*, edited by D. W. Owsley and R. L. Jantz, pp. 159-172. Smithsonian Institution Press, Washington, D.C.
n.d. A Partial Skeleton from the Meadow Draw Site in Southwestern Wyoming. Manuscript on file, Human Osteological Laboratory, University of Wyoming.

Gill, G. W., and G. R. Clark
1983 A Late Plains Archaic Burial from Iron Jaw Creek, Southeastern Montana. *Plains Anthropologist* 28(101):191-198.

Gill, G. W., J. W. Fisher, Jr., and G. M. Zeimens
1984 A Pioneer Burial near the Historic Bordeaux Trading Post. *Plains Anthropologist* 29(105):229-238.

Gill, G. W., and R. O. Lewis
1977 A Plains Woodland Burial from the Badlands of Western Nebraska. *Plains Anthropologist* 22(75):67-73.

Gill, G. W., and D. W. Owsley
1985 Electron Microscopy of Parasite Remains on the Pitchfork Mummy and Possible Social Implications. *Plains Anthropologist* 30(107):45-50.

Gill, G. W., and S. Rhine (editors)
Skeletal Attribution of Race: Methods for Forensic Anthropology. Maxwell Museum of Anthropology, Anthropological Papers No. 4.

Gill, G. W., and C. S. Smith
1989 The Divide Burial from near Wamsutter, Sweetwater County, Wyoming. *The Wyoming Archaeologist* 32(3-4):61-80.

Gillam, C.
1989 Human Skeletal Remains from the Shute Creek Site, Southwestern Wyoming. *The Wyoming Archaeologist* 32(3-4):55-59.

Gilman, C., and M. J. Schneider
1987 *The Way to Independence: Memories of a Hidatsa Indian Family, 1840-1920*. Publications of the Minnesota Historical Society, Museum Exhibit Series No. 3. Minnesota Historical Society Press, St. Paul.

Gilmore, M. R.
1919 *Uses of Plants by the Indians of the Missouri River Region*. Thirty-third Annual Report of the Bureau of American Ethnology. Smithsonian Institution, Washington, D.C. (1977 reprint, University of Nebraska Press, Lincoln.).
1924 Old Assiniboine Buffalo-Drive in North Dakota. *Indian Notes* 1:204-211.
1926 Arikara Commerce. *Indian Notes* 3:13-18.
1927 Notes on Arikara Tribal Organization. *Indian Notes* 4:332-350.
1930 The Arikara Tribal Temple. *Michigan Academy of Science, Arts and Letter, Papers* 12:95-120.
1931 The Sacred Bundles of the Arikara. *Michigan Academy of Science, Arts and Letters, Papers* 16:33-50.

Goetzmann, W. H.
1967 *Exploration and Empire: The Explorer and The Scientist in the Winning of the American West*. Knopf, New York.
1987 *New Lands, New Man: America and the Second Great Age of Discovery*. Viking Penguin, New York.

Goldschmidt, V. M.
1958 *Geochemistry*. Oxford University Press, London.

Good, K. N.
1975 The Lisbon Burial-32RM201. Manuscript on file, Department of Anthropology, University of North Dakota.
1977 Archaeological Survey in the Central North Dakota Section, Garrison Diversion Project, North Dakota. In *Cultural Resource Inventory in Portions of the Central North Dakota Section, Garrison Diversion Unit, North Dakota, 1975 Field Season,* by F. Schneider, K. Good, and K. Schweigert, pp. 3-37. Department of Anthropology and Archaeology, University of North Dakota, Grand Forks. Submitted to the U.S.D.I., Bureau of Reclamation, Billings, MT.
1988 *1987 Custer House Excavation: "The Final Phase" (Ft. Abraham Lincoln)*. Fort Abraham Lincoln Foundation, Bismarck. Submitted to the State Historical Society of North Dakota and the North Dakota Department of Parks and Recreation, Bismarck.
1989 *Class III Cultural Resource Survey, Fort Abraham Lincoln State Park, North Dakota, 1988*. Fort Abraham Lincoln Foundation, Bismarck. Submitted to the State Historical Society of North Dakota and the North Dakota Department of Parks and Recreation, Bismarck.

Good, K. N. (editor)
1981 *Historical and Archaeological Survey and Testing Project—Proposed Mining Area—Falkirk Mine, McLean County, North Dakota*. Historical and Archaeological Surveys, Inc., Bismarck. Submitted to Falkirk Mining Company, Bismarck.

Good, K. N., J. C. Dahlberg, T. Larson, B. Benz, and F. Schneider
1977 *Archaeological Investigations of the Hendrickson III Site, 32SN403, LaMoure-Oakes Project, Garrison Diversion, North Dakota*. Department of Anthropology and Archaeology, University of North Dakota, Grand Forks. Submitted to U.S. Bureau of Reclamation, Billings, MT.

Good, K. N., J. C. Dahlberg, W. Tibesar, and S. Vehik
1976 *Archaeology Investigations in the LaMoure-Oakes Project Area, Garrison Diversion, North Dakota*. Department of Anthropology and

Archaeology, University of North Dakota, Grand Forks. Submitted to U.S. Bureau of Reclamation, Billings, MT.

Good, K. N., and J. L. Hauff

1979 *Archaeological Test Excavations at the Anderson Tipi Ring Site (32ML111), McLean County, North Dakota: A Cultural Resource Study in Center North Dakota*. Department of Anthropology, University of North Dakota, Grand Forks. Submitted to Falkirk Mining Company, Bismarck.

Good, K. N., W. Kinney, C. Greenshields, and B. Benz

1977 *Archaeological Investigations in the LaMoure-Oakes and Wild Rice River Project Areas, Garrison Diversion, North Dakota*. Department of Anthropology and Archaeology, University of North Dakota, Grand Forks. Submitted to U.S. Bureau of Reclamation, Billings, MT.

Good, K. N., and L. L. Loendorf

1974 *The Results of Archaeological Survey in the Grapevine Creek Area, Big Horn Canyon National Recreation Area: 1972 Field Season*. Report. University of North Dakota, Grand Forks. Submitted to National Park Service, Denver.

Goodman, A. H., G. J. Armelagos, and J. C. Rose

1984 The Chronologic Distribution of Enamel Hypoplasias From Prehistoric Dickson Mounds Populations. *American Journal of Physical Anthropology* 65:259-266.

Goodyear, A. C.

1982 The Chronological Position of the Dalton Horizon in the Southeastern United States. *American Antiquity* 47(2):382-395.

Gorman, D. R.

1963 Stratigraphic-Sedimentational Aspects of the Amsden Formation, Bighorn Mountains, Wyoming. Wyoming Geological Association and Billings Geological Society, First Joint Field Conference *Guidebook*:67-70.

Goulding, D. A.

1980 *Post-contact Chipped Stone Technological Change at the Lower Hidatsa Site and Sakakawea Site, Knife River Indian Villages National Historic Site*. Unpublished Master's thesis, Department of Anthropology, University of Colorado, Boulder.

Graham, M. A., M. C. Wilson, and R. W. Graham

1987 Paleoenvironments and Mammalian Faunas of Montana, Southern Alberta, and Southern Saskatchewan. In *Late Quaternary Mammalian Biogeography and Environments of the Great Plains and Prairies*, edited by R. Graham, H. Semken, Jr., and M. Graham, pp. 410-459. Scientific Papers Vol. 22. Illinois State Museum, Springfield.

Gramley, R. M.

1993 *The Richey Clovis Cache*. Monographs in Archaeology. Persimmon Press, Buffalo, New York.

Grande, L.

1984 *Paleontology of the Green River Formation, with a Review of the Fish Fauna*. Geological Survey of Wyoming Bulletin 63.

Grant, C.

1967 *Rock Art of the American Indian*. Promontory Press, New York.

Grant, M.

1981 *Aboriginal Settlement and Land Use Patterns in the Big Horn Mountains, Wyoming* (Vol. 1). Western Cultural Resource Management, Inc., Boulder, Colorado.

Green, V. D.

1995 Bioarcheological Investigation of a Historic Chinese Cemetery. Paper presented at the 53rd Annual Plains Anthropological Conference, Laramie.

Greene, A. M.

1967 *The Betty Greene Site: A Late Paleo-Indian site in Eastern Wyoming*. Unpublished Master's thesis, Department of Anthropology, University of Pennsylvania, Philadelphia.

1968 Age and Archaeological Association of Oblique Flaked Projectile Points at the Betty Greene Site, Eastern Wyoming. *Abstracts of Papers*, Thirty-third Annual Meeeting, Society for American Archaeology, Santa Fe.

Greer, J. W.

1978 Worthan Shelter: An Avonlea Site in the Bighorn River Canyon, Wyoming. *Archaeology in Montana* 19(3):1-104.

Greever, W. S.

1963 *The Bonanza West: The Story of the Western Mining Rushes, 1848-1900*. University of Oklahoma Press, Norman.

Gregg, J. B., and P. S. Gregg

1987 *Dry Bones: Dakota Territory Reflected.* Sioux Printing, Sioux Falls.

Gregg, J. B., J. P. Steele, and A. M. Holzheuter

1965 Roentgenographic Evaluation of Temporal Bones from South Dakota. *American Journal of Physical Anthropology* 23:51-62.

Gregg, J. B., and L. J. Zimmerman

1986 Malnutrition in 14th Century South Dakota: Osteopathological Implications. *North American Archaeologist* 7:191-214.

Gregg, J. B., L. J. Zimmerman, J. P. Steele, H. Ferwerda, and P. S. Gregg

1981 Ante-mortem Osteopathology at Crow Creek. *Plains Anthropologist* 26:287-300.

Gregg, M. L.

1985a Archaeological Classification and Chronology for Western and Central North Dakota. In *An Overview of the Prehistory of Central and Western North Dakota*, edited by M. Gregg and D. Davidson, pp. 67-78. Bureau of Land Management, Billings, Montana.

1985b *An Overview of the Prehistory of Western and Central North Dakota.* Cultural Resources Series No. 1. Bureau of Land Management.

1989 An Early Woodland Structure in the Northeastern Plains. *Plains Anthropologist* 35:29-44.

1994a Archaeological Complexes of the Northeastern Plains and Prairie-Woodland Border, A.D. 500-1500. In *Plains Indians, AD. 500-1500: The Archaeological Past of Historic Groups*, edited by K. H. Schlesier, pp. 71-95. University of Oklahoma Press, Norman.

Gregg, M. L. (editor)

1987 *Archaeological Excavation at the Naze Site (32SN246).* Department of Anthropology, University of North Dakota. Submitted to U.S. Bureau of Reclamation, Bismark, North Dakota.

1994b *Horner-Kane Site (32RY77), Archeological Excavations, Grahams Island State Park, Ramsey County, North Dakota, 1991 Field Season*. Department of Anthropology, University of North Dakota, Grand Forks. Submitted to U.S. Bureau of Reclamation, Bismarck, ND.

Gregg, M. L., C. Kordecki, and P. R. Picha

1985 *Archaeological Investigations in the Southern Section of the Garrison Diversion Unit in North Dakota, 1984.* Department of Anthropology, University of North Dakota, Grand Forks. Submitted to the U.S. Bureau of Reclamation, Billings, Montana.

Gregg, M. L., B. Olson, and C. Stiles-Hanson

1983 32EM61. In *Archeology of the Northern Border Pipeline, North Dakota: Test Excavations*, edited by M. J. Root and M. L. Gregg, pp. 1063-1095. Department of Anthropology, University of North Dakota, Grand Forks. Submitted to the Northern Border Pipeline Company, Omaha, Nebraska.

Gregg, M. L., and P. R. Picha

1989 Early Plains Woodland and Middle Plains Woodland Occupation of the James River Region in Southeastern North Dakota. *Midcontinental Journal of Archaeology* 14(1):38-61.

1990 *Des Lacs-Souris Drainage Basin Erosion Control Study Area Cultural Resources Review. Part 1: Prehistoric Cultural Resources Overview*. Department of Anthropology, University of North Dakota, Grand Forks. Submitted to U.S.D.A., Soil Conservation Service, Bismarck. ND.

1991 *James Reservoir Archeological Site Survey in Spink and Beadle Counties, South Dakota*. Department of Anthropology, University of North Dakota, Grand Forks. Submitted to U.S. Bureau of Reclamation, Bismarck, ND.

Gregg, M. L., P. R. Picha, C. Kordecki, F. E. Swenson, and C. E. Haury

1986 *Test Excavations at Eight Archeological Sites on the James River in Stutsman and LaMoure Counties, North Dakota*. Department of Anthropology, University of North Dakota, Grand Forks. Submitted to U.S. Bureau of Reclamation, Billings, MT.

Gregg, M. L, F. E. Swenson, P. R. Picha, C. Kordecki, C. E. Haury, and C. Quinn

1987 *Test Excavations at 15 Archeological Sites Along the James River in Stutsman and LaMoure Counties, North Dakota*. Department of Anthropology, University of North Dakota, Grand Forks. Submitted to U.S. Bureau of Reclamation, Billings, MT.

Greiser, S. T.

1984 Projectile Point Chronologies of Southwestern Montana. *Archaeology in Montana* 25(3):35-51.

Greiser, T. W., and S. T. Greiser

1984 *Report of Findings Resulting from Phase I Mitigation of Adverse Impacts to Cultural Resource Sites in Mine Area I of the Glenharold Mine, Mercer County, North Dakota. Vol. 1: Prehistoric Sites*. Historical Research Associates, Inc. Submitted to Basin Cooperative Services, Bismarck, North Dakota.

Greiser, S. T., T. W. Greiser, S. M. Vetter, and A. L. Stanfill

1983 *Sun River (24CA74): A Stratified Pelican Lake and Oxbow Occupation Site near Great Falls, Montana*. Report. Submitted to Omaha District, U.S. Army Corps of Engineers.

Greiser, S. T., J. S. Stevens, A. L. Stanfill, H. Plochman, T. W. Greiser, S. Vetter

1982 *Eastern Powder River Basin Prehistory: Archaeological Investigations at the Antelope Mine*. Report. Historical Research Associates. Submitted to Northern Energy Resources Company, Inc. Ms. on file, Human Osteological Laboratory, University of Wyoming.

Grey, D. C.

1961 Turk Burial Site, 48WA301. *The Wyoming Archaeologist* 4(8):1-9.

1963a Bighorn Medicine Wheel, 48BH302. *Plains Anthroplogist* 8(19):27-41.

1963b The Turk Burial Site, 48WA301. *Plains Anthropologist* 8(20):98-102.

Griffin, D. E.

1977 Timber Procurement and Village Location in the Middle Missouri Subarea. *Plains Anthropologist Memoir* 13:177-185.

1984 *South Cannonball (32SI19): An Extended Middle Missouri Village in Southern North Dakota*. American Archaeology Division, Department of Anthropology, University of Missouri, Columbia. Submitted to National Park Service, Rocky Mountain Region, Denver, Colorado.

Grinnell, G. B.

1918 Early Cheyenne Villages. *American Anthropologist* (n.s.) 20(4).

1923 *The Cheyenne Indians: Their History and Ways of Life* (Vols. 1 and 2). Yale University Press, New Haven.

Grodinsky, J.

1962 *Transcontinental Railway Strategy, 1869-1893*. University of Pennsylvania Press, Philadelphia.

Gruger, J.

1973 Studies on the Late Quaternary Vegetation History of Northeastern Kansas. *Bulletin of the Geological Society of America* 84:239-250.

Gryba, E. M.

1980 The Early Side-Notched Point Tradition on the Central and Northern Plains. In *Directions in Manitoba Prehistory: Papers in Honor of Chris Vickers*, edited by L. Pettipas. Association of Manitoba Archaeologists and Manitoba Archaeological Society, Winnipeg.

Haberman, T. W.

1979 *Test Excavation and Evaluation of 39ST80: A Plains Woodland Site in Stanley County, South Dakota*. South Dakota Archaeological Research Center, Rapid City. Submitted to the South Dakota Department of Transportation, Pierre.

1981 *Evaluation of 39SP101: Drifting Goose's Village at Armadale Island*. South Dakota Archaeological Research Center, Office of Cultural Preservation, Department of Education and Cultural Affairs, Fort Meade, South Dakota. Submitted to the Historical Preservation Center, Vermillion, SD.

1983a *James River Survey, Spink and Beadle Counties, South Dakota 1980*. Contract Investigations Series 68-II. Submitted to the South Dakota Archaeological Research Center, Fort Meade.

1983b The Early Plains Village Component at the Dirt Lodge Village Site, Spink County, South Dakota. Ms. on file, South Dakota Archaeological Research Center, Rapid City.

1984 Evidence for Aboriginal Tobaccos in Eastern North America. *American Antiquity* 49:269-287.

1993 The Randall Phase Component at the Dirt Lodge Village Site, Spink County, South Dakota: Late Woodland/Early Plains Village Transitions on the Northeastern Plains. *Plains Anthropologist Memoir* 27:75-116.

Haberman, T. W. (editor)

1982 *Archaeological Excavations at the Travis I Site, Corson County, South Dakota*. South Dakota Archaeological Research Center, Rapid City. Submitted to the South Dakota Department of Transportation, Pierre.

Haberman, T. W., and F. E. Schneider

1975 *1974 Archaeological Survey of Portions of the Garrison Reservoir Shoreline, North Dakota*. Department of Anthropology, University of North Dakota, Grand Forks. Submitted to the National Park Service, Midwest Archeological Center, Lincoln.

Hafen, L. R., and A. Hafen (editors)

1965 *The Mountain Men and the Fur Trade of the Far West*. 10 vols. Arthur H. Clark, Glendale, California.

Haines, F.

1938 The Northward Spread of Horses Among the Plains Indians. *American Anthropologist* 8(19):27-41.

Hallberg, G. R., and T. J. Kemmis

1986 Stratigraphy and Correlation of the Glacial Deposits of the Des Moines and James Lobes in Adjacent Areas in North Dakota, South Dakota, Minnesota, and Iowa. *Quaternary Science Reviews* 5:65-68.

Hamilton, S., W. Ferris, S. Hallgrimson, G. McNeely, K. Sammons, E. Simonds, and K. Topinka

1981 *1979 Excavations at the Stott Site (DlMa-1): With Interpretations of Cultural Stratigraphy*. Miscellaneous Papers in Manitoba Archaeology No. 12. Historical Resources Branch, Manitoba Cultural Affairs and Historical Resources, Winnipeg.

Hanna, M. G.

1976 *The Moose Bay Burial Mound.* Anthropological Series No. 3. Saskatchewan Museum of Natural History.

Hannus, L. A.

1982 *Cultural Resources Investigations of the South Dakota Segment of the Northern Border Pipeline Project* (5 vols). Northern Plains Natural Gas Co., Omaha, NE.

1985 *The Lange/Ferguson Site. An Event of Clovis Mammoth Butchery with the Associated Bone Tool Technology: The Mammoth and Its Track*. Ph. D. dissertation, Department of Anthropology, University of Utah. University Microfilms, Ann Arbor, Michigan.

1986 *Report on 1985 Test Excavations at the Ray Long Site (39FA65), Angostura Reservoir, Fall River County, South Dakota*. Archaeological Contract Series No. 27. Archaeology Laboratory of the Center for Western Studies, Augustana College, Sioux Falls, South Dakota. Submitted to South Dakota State Archaeological Research Center, Ft. Meade. Contract No. 86C-016.

1989 Flaked Mammoth Bone from the Lange-Ferguson Site, White River Badlands Area, South Dakota. In *Bone Modifications*, edited by R. Bonnichsen and M. Sorg, pp. 395-412. Peopling of the Americas Publications. Center for the Study of the First Americans, University of Maine, Orono.

1990 Mammoth Hunting in the New World. In *Hunters of the Recent Past*, edited by L. B. Davis and B. O. K. Reeves, pp. 47-67. Unwin-Hyman, London.

1994 Cultures of the Heartland: Beyond the Black Hills. In *Plains Indians, A.D. 500-1500*, edited by K. Schlesier, pp. 176-198. University of Oklahoma Press, Norman.

Hannus, L. A., P. R. Bjork, J. Butterbrodt, D. B. Miller, T. R. Nowak, and E. M. White

1983 *A Cultural Resources Survey of a Portion of the South Fork of the Cheyenne River, Fall River County, South Dakota*. Publications in Anthropology No. 1. Archaeology Laboratory, South Dakota State University, Brookings. Submitted to State Historical Preservation Center, Vermillion.

Hannus, L. A., J. M. Butterbrodt, E. J. Lueck, T. R. Nowak, and E. M. White

1989 *An Archaeological Survey of Selected Areas Within Fog Creek, Babby Butte Canyon and Lower Cain Creek in Shannon and Pennington Counties, South Dakota*. White River Badlands Regional Research Project Report, Vol. 7. Revised 1989. Archaeological Laboratory, Augustana College, Sioux Falls, South Dakota. Draft report originally completed in 1983 as Publications in Anthropology No. 4, Archaeology Laboratory, South Dakota State University, Brookings.

Hannus, L. A., E. J. Lueck, and R. P. Winham

1986 *Cultural Resource Investigation of the Historic Fort Randall Post Cemetery, Gregory County, South Dakota*. Archeology Laboratory, Augustana College, Sioux Falls. Submitted to the U.S. Army Corps of Engineers, Omaha District.

Hannus, L. A., and T. R. Nowak

1983 Archaeological Investigations of the Fog Creek Drainage, White River Badlands, South Dakota, 1981. Manuscript on file, Archaeology Laboratory, Augustana College, Sioux Falls, South Dakota.

1988 Avonlea: A Point Industry Surfaces in South Dakota, or Archers on the March. In *Avonlea Yesterday and Today: Archaeology and Prehistory*, edited by L. B. Davis, pp. 183-189. Saskatchewan Archaeological Society, Saskatoon.

Hanson, J. A.

1975 *Metal Weapons, Tools, and Ornaments of the Teton Dakota Indians*. University of Nebraska Press, Lincoln.

Hanson, J. R.

1979 Ethnohistoric Problems in the Crow-Hidatsa Separation. *Archaeology in Montana* 20(3):73-85.

Hargreaves, M. W. M.

1957 *Dry Farming in the Northern Great Plains, 1900-1925*. Harvard University Press, Cambridge.

Harrell, L. L., and S. T. McKern

1986 *The Maxon Ranch Site: Archaic and Late Prehistoric Habitation in Southwest Wyoming*. Cultural Resource Management Report 18, Archaeological Services, Western Wyoming College, Rock Springs.

Harrington, H. D.

1967 *Edible Native Plants of the Rocky Mountains*. University of New Mexico Press, Albuquerque.

Haspel, H. L., and D. L. Wedel

1983 A Middle Plains Archaic Child Burial from the McKean Site in Northeastern Wyoming. In *McKean/Middle Plains Archaic: Current Research*, edited by M. Kornfeld and L. C. Todd. Occasional Papers on Wyoming Archaeology 4:105-108.

Haug, J. K.

1982 *Excavations at the Winter Site and at Hartford Beach Village, 1980-1981*. South Dakota Archaeological Research Center, Rapid City.

1983 Early Plains Village Sites in Northeastern South Dakota. Paper presented at the Forty-first Plains Conference, Rapid City, SD.

1995 The Hartford Beach Site (Again). *Newsletter of the South Dakota Archaeological Society* 25(4):1-2.

Haug, J. K. (editor)

1986 *Report of a 1981 Archeological Salvage Excavation at the Crow Creek Site, 39BF11, Buffalo County, South Dakota*. South Dakota Archaeological Research Center, Rapid City. Submitted to the U.S. Army Corps of Engineers, Omaha District.

Haug, J. K., M. Fosha, J. Abbott, C. Hjort, and R. Mandel

1994 Exploring the Bloom Site, 1993-1994. *South Dakota Archaeology* 18:29-71.

Haury, C. E.

1987 Vertebrate Faunal Remains from the Naze Site. In *Archeological Excavation at the Naze Site (32SN246)*, edited by M. L. Gregg, pp. 343-385. Department of Anthropology, University of North Dakota, Grand Forks. Submitted to the U.S. Bureau of Reclamation, Billings, MT.

1990 *In the Footsteps of T. H. Lewis: Retracing of the Northwestern Archaeological Survey in North Dakota*. Department of Anthropology, University of North Dakota, Grand Forks. Submitted to the State Historical Society of North Dakota, Bismarck.

Haury, C. E., and F. E. Schneider

1986 *Cultural Resources Survey in the Sheyenne River Drainage*. Department of Anthropology, University of North Dakota, Grand Forks. Submitted to State Historical Society of North Dakota, Bismarck.

Haxo, H. E.

1941 *The Journal of La Verendrye, 1738-39.* North Dakota History 8:229-271.

Hayden, B.

1982 Interaction Parameters and the Demise of Paleo-Indian Craftsmanship. *Plains Anthropologist* 27:109-123.

Haynes, C. V., Jr.

1968 Geochronology of Late Quaternary Alluvium. In *Means of Correlation of Quaternary Successions*, edited by R. B. Morrison and H. E. Wright, Jr., pp. 591-631. University of Utah Press, Salt Lake City.

1993 Clovis-Folsom Geochronology and Climatic Change. In *From Kostenki to Clovis: Upper Paleolithic-Paleoindian Adaptations*, pp. 219-236. Plenum, New York.

Haynes, C. V. Jr., D. C. Grey, P. E. Damon, and R. Bennett

1967 Arizona Radiocarbon Dates VII. *Radiocarbon* 9:1-14.

Helgevold, M. K.

1981 *A History of South Dakota Archaeology.* Special Publication No. 3. South Dakota Archaeological Society, Vermillion.

Henbest, L. G.

1956 Foraminifera and Correlation of the Tensleep Sandstone of Pennsylvanian Age in Wyoming. Wyoming Geological Association, Eleventh Annual Field Conference *Guidebook*:58-63.

Hendry, M. H.

1983 *Indian Rock Art in Wyoming*. Privately published. Augstums Pringing Service, Inc., Lincoln, Nebraska.

Henning, D. D.

1965 The Alkire Mound Site (32SI200). *Plains Anthropologist* 10:146-151.

Henning, D., and E. Henning

1978 *Great Oasis Ceramics*. Occasional Publications in Minnesota Anthropology No. 2. Minnesota Archaeological Society, St. Paul.

Henning, E., and D. Henning

1982 Great Oasis-Mill Creek Interrelationships. In *Interrelations of Cultural and Fluvial Deposits in Northwest Iowa*, edited by E. A. Bettis and D. M. Thompson, pp. 10-14. Association of Iowa Archeologists, Iowa City.

Herbort, D. P.

1988 *Excavation and Mitigation of the Toston site, 24BW182*. Report. Submitted to Montana Department of Natural Resources and Conservation, Helena.

Herbort, D. P., and G. Munson
1984 Archaeological Investigations at the Ellison's Rock Site. *Archaeology in Montana* 25(2 and 3):65-122.

Herman, F. T.
1972 *Historical and Cultural Reconstruction of the Mandan and Arikara Indians as Reported by the Observations of Early American Travellers: 1770-1870.* Unpublished Master's thesis, Northern State College, Aberdeen, South Dakota.

Hester, T., S. L. Black, D. G. Steele, B. W. Olive, A. A. Fox, K. J. Reinhard, and L. C. Bement
1989 *From the Gulf to the Rio Grande: Human Adaptation in Central, South, and Lower Pecos, Texas*. Research Series No. 33. Arkansas Archeological Survey, Fayetteville.

Hewes, G. W.
1948 Early Tribal Migrations in the Northern Great Plains. *Plains Archaeological Conference Newsletter* 1:49-61.
1949 Burial Mounds in the Baldhill Area, North Dakota. *American Antiquity* 14:322-328.

Hickey, L. J.
1972 Stratigraphic Summary of the Golden Valley Formation (Paleocene-Eocene) in Western North Dakota. In *Depositional Environments of the Lignite Bearing Strata of Western North Dakota*, edited by F. T. C. Ting, pp.105-122. Miscellaneous Series No. 50. North Dakota Geological Survey, Bismarck.

Hill, W. E., and G. M. Franzwa
1985 Who Lies Here? *Overland Journal* 3(4):4-10.

Hlady, W. M.
1950 Mound C, Fordville Mound Group, Walsh County, North Dakota: Its Excavation and Archaeology. *North Dakota History* 17:253-260.

Hoffman, J. J.
1953 *Comments on the Use and Distribution of Tipi Rings in Montana, North Dakota, South Dakota, and Wyoming*. Anthropology and Sociology Papers No. 14. Montana State University, Bozeman.
1963 Investigation of the Swift Bird House (39DW233) in the Oahe Reservoir, South Dakota. *Plains Anthropologist* 8:249-256.
1967 *Molstad Village*. Publications in Salvage Archeology No. 4. Smithsonian Institution, River Basin Surveys, Lincoln, Nebraska.
1968 *The La Roche Site*. Publications in Salvage Archeology No. 11. Smithsonian Institution, River Basin Surveys, Lincoln, Nebraska.
1970 Two Arikara Villages: A Study in Bad River Phase Material Culture. Ms. on file, National Park Service, Midwest Archeological Center, Lincoln.

Hofman, J. L. (editor)
1996 *Archeology and Paleoecology of the Central Great Plains: A Volume in the Central and Northern Plains Overview.* Research Series No. 48. Arkansas Archeological Survey, Fayetteville.

Hofman, J. L., R. L. Brooks, D. W. Owsley, R. L. Jantz, M. K. Marks, and M. H. Manhein
1989 *From Clovis to Comanchero: Archeological Overview of the Southern Great Plains*. Research Series No. 35. Arkansas Archeological Survey, Fayetteville.

Holder, P.
1958 Social Stratification Among the Arikara. *Ethnohistory* 5:210-218.
1970 *The Hoe and the Horse on the Plains*. University of Nebraska Press, Lincoln.

Hollimon, S. E., and D. W. Owsley
1994 Osteology of the Fay Tolton Site: Implications for Warfare during the Initial Middle Missouri Variant. In *Skeletal Biology in the Great Plains: Migration, Warfare, Health, and Subsistence*, edited by D. W. Owsley and R. L. Jantz, pp. 345-354. Smithsonian Institution Press, Washington, D.C.

Hovde, D. M.
1982 *Archaeological Excavations at the Bull Site, 39HU191, Hughes County, South Dakota*. South Dakota Archaeological Research Center, Rapid City. Submitted to the South Dakota Department of Transportation, Pierre.

Howard, E. B.
1943 The Finley Site: Discovery of Yuma Points in Situ near Eden Wyoming. *American Antiquity* 8(3):224-234.

Howard, J. H.
1962a *Report of the Investigation of the Tony Glas Site, 32EM3, Emmons County, North Dakota, 1958*. Anthropological Papers No. 1. University of North Dakota, Grand Forks.
1962b *Report of the Investigation of the Huff Site, 32MO11, Morton County, North Dakota, 1959*. Anthropological Papers No. 2. University of North Dakota, Grand Forks.
1965 *The Plains-Ojibwa or Bungi: Hunters and Warriors of the Northern Prairies with Special Reference to the Turtle Mountain Band*. Dakota Museum Anthropological Papers No. 1. University of South Dakota, Vermillion. Also 1977 Reprints in Anthropology 7, J and L Reprint Company, Lincoln, NE.
1966 *The Dakota or Sioux Indians, a Study in Human Ecology*. Dakota Museum Anthropological Papers No. 2. University of South Dakota, Vermillion. Also Reprints in Anthropology 20, J and L Reprint Company, Lincoln, NE.
1972 Notes on the Ethnogeography of the Yankton Dakota. *Plains Anthropologist* 17:281-302.
1976 *Yanktonai Ethnohistory and the John K. Bear Winter Count*. Plains Anthropologist Memoir 11.

Howard, J. H., and L. Black
n.d. James River Valley Sites: A Reconnaissance of Sites Located in Spink County, South Dakota, Along the Banks of the James Rivers and Its Tributaries. Ms. on file, South Dakota Archaeological Research Center, Fort Meade.

Howells, W. W.
1938 Crania from Wyoming Resembling "Minnesota Man." *American Antiquity* 3(4):318-326.

Hoxie, F.
1984 *A Final Promise: The Campaign to Assimilate the Indians, 1880-1920*. University of Nebraska Press, Lincoln.

Hrdlicka, A.
1927 Catalogue of Human Crania in the United States National Museum Collections. *Proceedings of the United States National Museum* 69(5):1-127.

Hughes, J. T.
1949 Investigations in Western South Dakota and Northeastern Wyoming. *American Antiquity* 14(4):266-277.

Hughes, J. T., and T. White
n.d. The Long Site: An Ancient Camp in Southwestern South Dakota. Manuscript on file, Midwest Archaeological Center, Lincoln, Nebraska.

Hughes, S. S.
1981 *Projectile Point Variability: A Study of Point Curation at a Besant Kill Site in Southcentral Wyoming*. Unpublished Master's thesis, Department of Anthropology, University of Wyoming.

Hughey, D. V.
1980 An Overview of Great Plains Physical Anthropology. In *Anthropology on the Great Plains,* edited by W. R. Wood and M. Liberty. University of Nebraska Press, Lincoln.

Hultkrantz, A.
1987 *Native Religions of North America: The Power of Visions and Fertility*. Harper, San Francisco.

Hunt, C. B.
1974 *Natural Regions of the United States and Canada*. W. H. Freeman, San Francisco.

Hurt, W. R., Jr.
1951 *Report of the Investigation of the Swanson Site, 39BR16, Brule County, South Dakota*. Archaeological Studies Circular No. 3. South Dakota Archaeological Commission, Pierre.
1952 *Report of the Investigations of the Scalp Creek Site, 39GR1, and the Ellis Creek Site, 39GR2, Gregory County, South Dakota, 1941, 1951*. Archaeological Studies Circular No. 4. South Dakota Archaeological Commission, Pierre.
1953 *Report of the Investigation of the Thomas Riggs Site, 39HU1, Hughes County, South Dakota, 1952*. Archaeological Studies Circular No. 5. South Dakota Archaeological Commission, Pierre.
1954 *Report on the Investigation of the Spotted Bear Site, 39HU26, and the Cottonwood Site, 39HU43, Hughes County, South Dakota, 1953*. Archaeological Studies Circular No. 6. South Dakota Archaeological Commission, Pierre.
1957 *Report of the Investigation of the Swan Creek Site, 39WW7, Walworth County, South Dakota, 1953*. Archaeological Studies Circular No. 6. South Dakota Archaeological Commission, Pierre.
1959 The Rosa Site, 39PO3, Potter County, South Dakota, 1957. Archaeological Studies Circular No. 9. South Dakota Archaeological Commission, Pierre.
1970 A Report of the Investigation of the No Heart Creek Site, 39AR2, Dewey County, South Dakota, 1960. *Plains Anthropologist* 15:169-215.
1974 *Report of the Investigations of the Rosa Site, 39PO3, Potter County, South Dakota, 1957*. Archaeological Studies Circular No. 9. South Dakota Department of Cultural Affairs, Pierre. [Reissue of the 1959 report.]

Hurt, W. R., Jr., W. G. Buckles, E. Fugle and G. A. Agogino
1962 *Report of the Investigations of the Four Bear Site, 39DW2, Dewey County, South Dakota, 1958-1959*. Archaeological Studies Circular No. 10. W. H. Over Museum, University of South Dakota, Vermillion.

Huscher, H. A., and C. H. McNutt
1958 *Appraisal of the Archaeological Resources of the Big Bend Reservoir, South Dakota.* Report for the Missouri Basin Project, Smithsonian Institution.

Husted, W. M.
1969 *Bighorn Canyon Archaeology*. Publications in Salvage Archaeology No. 12. Smithsonian Institution River Basin Surveys.

Husted, W. M., and R. Edgar
n.d. The Archaeology of Mummy Cave, Wyoming: An Introduction Shoshonean Prehistory. Unpublished ms. on file, Department of Anthropology, University of Wyoming.

Hyde, G. E.
1974 *Spotted Tail's Folk: A History of the Brule Sioux* (2nd ed). University of Oklahoma Press, Norman.

Ingbar, E. E., and G. C. Frison
1987 The Larson Cache. In *The Horner Site: Type Site of the Cody Cultural Complex*, edited by G. Frison and L. Todd, pp. 461-473. Academic Press, Orlando.

Irwin, H. T.
1967 *The Itama: Late Pleistocene Inhabitants of the Plains of the United States and Canada, and the American Southwest*. Unpublished Ph.D. dissertation, Harvard University, Cambridge.

Irwin, H. T., and H. M. Wormington
1970 Paleo-Indian Tool Types in the Great Plains. *American Antiquity* 35:24-34.

Irwin-Williams, C., H. T. Irwin, G. Agogino, and C. V. Haynes, Jr.
1973 Hell Gap: Paleo-Indian Occupation on the High Plains. *Plains Anthropologist* 18(59):40-53.

Jablow, J.
1950 *The Cheyenne in Plains Indian Trade Relations, 1795-1840*. American Ethnological Society Monograph 19.

Jackson, K. C.
1970 *Textbook of Lithology*. McGraw-Hill, New York.

Jameson, J. H., Jr.
1977 *Archaeological Investigations in the Area of the Proposed Middle Fork Dam and Reservoir, Johnson County, Wyoming*. Unpublished Master's thesis, Department of Anthropology, University of Wyoming, Laramie.

Jantz, R. L.
1972 Cranial Variation and Microevolution in Arikara Skeletal Populations. *Plains Anthropologist* 17:20-35.
1973 Microevolutionary Change in Arikara Crania: a Multivariate Analysis. *American Journal of Physical Anthropology* 38:15-26.
1976 Discriminant Function. In F*ay Tolton and the Initial Middle Missouri Variant,* edited by W. R. Wood. Research Series No. 13. Missouri Archaeological Society, Columbia.
1977a Craniometric Relationships of Plains Populations: Historical and Evolutionary Implications. Trends in Middle Missouri Prehistory: A Festschrift Honoring the Contributions of Donald J. Lehmer. Memoir 13. *Plains Anthropologist* 22(78):162-176.
1977b Addendum to Murrill's Analysis. In *The Talking Crow Site: Multicomponent Earthlodge Village in the Big Bend Region, South Dakota,* edited by C. S. Smith. Publications in Anthropology No. 9. University of Kansas, Lawrence.

Jantz, R. L., D. R. Hunt, A. B. Falsetti, and P. J. Key
1992 Variation among North Amerindians: Analysis of Boas's Anthropometric Data. *Human Biology* 64(3):435-461.

Jantz, R. L., and D. W. Owsley
1984a Long Bone Growth Variation in the Northern and Central Plains. *American Journal of Physical Anthropology* 63:13-20.
1984b Temporal Changes in Limb Proportionality Among Skeletal Samples of Arikara Indians. *Annals of Human Biology* 11:157-163.

Jantz, R. L., and P. Willey
1983 Temporal and Geographic Patterning of Relative Head Height in the Central Plains and Middle Missouri Areas. *Plains Anthropologist* 28(99):59-67.

Jenks, A. E.
1932 The Problem of the Culture from the Arvilla Gravel Pit. *American Anthropologist* 34:455-466.
1937 *Minnesota's Browns Valley Man and Associated Burial Artifacts*. Memoir 49. American Anthropological Association.

Jensen, R. L.
1965 *An Archeological Survey of the Oahe Reservoir Area, North Dakota*. Missouri Basin Project, Smithsonian Institution. Report on file, National Park Service, Midwest Archeological Center, Lincoln.

Jepsen, G. L.
1953 Ancient Buffalo Hunters of Northwestern Wyoming. *Southwestern Lore* 19:19-25.

Jeter, M. D., J. C. Rose, G. I. Williams, Jr., and A. M. Harmon
1989 *Archeology and Bioarcheology of the Lower Mississippi Valley and Trans-Mississippi South in Arkansas and Louisiana*. Research Series No. 37. Arkansas Archeological Survey, Fayetteville.

Johnson, A. E., and W. R. Wood
1980 Prehistoric Studies on the Plains. In *Anthropology on the Great Plains,* edited by W. R. Wood and M. Liberty, pp. 35-51. University of Nebraska Press, Lincoln.

Johnson, A. M.
1977a The Dune Buggy Site 24RV1, and Northwestern Plains Ceramics. *Plains Anthropologist* 22(75):37-49.
1977b Woodland and Besant in the Northern Plains: A Perspective. *Archaeology in Montana* 18(1):27-41.
1977c Testing the Modified Initial Middle Missouri Variant. *Plains Anthropologist Memoir* 13:14-20.
1979a The Problem of Crow Pottery. *Archaeology in Montana* 20(3):17-29.

1979b *Extended Middle Missouri Components in the Big Bend Region, South Dakota*. Special Publication No. 1. South Dakota Archaeological Society, Vermillion.

1988 Parallel Grooved Ceramics: An Addition to Avonlea Material Culture. In *Avonlea Yesterday and Today: Archaeology and Prehistory*, edited by L. B. Davis, pp. 137-144. Saskatchewan Archaeological Society, Saskatoon.

1993a Comments on Late Plains Woodland. *Newsletter of the South Dakota Archaeological Society* 23(4):1-3.

1993b Initial Middle Missouri in Western South Dakota: A Summary. In *Prehistory and Human Ecology of the Wesern Prairies and Northern Plains*, edited by J. A. Tiffany, pp. 117-130. Plains Anthropologist Memoir 27.

Johnson, A. M., and B. Kallevig

n.d. Nollmeyer. Unpublished manuscript.

Johnson, A. M., P. A. Treat, and R. F. Thompson

1990 Sugarloaf Butte. *Archaeology in Montana* 31(2):59-80.

Johnson, C. M.

1977a *Stylistic Variation in Ceramics From the Medicine Crow Site (39BF2), South Dakota*. Unpublished Master's thesis, Department of Anthropology, University of Nebraska, Lincoln.

1977b Factor Analysis as a Technique for Exploring Patterned Variability in Archeological Remains. *Plains Anthropologist Memoir* 13:38-52.

1980 *Ceramic Classification in the Middle Missouri Subarea of the Plains*. Division of Archeological Research, Department of Anthropology, University of Nebraska, Lincoln.

Johnson, E.

1961 Cambria Burial Mounds in Big Stone County. *Minnesota Archaeologist* 23:53-81.

1962 The Prehistory of the Red River Valley. *Minnesota History* 38(4):157-165.

1964 Copper Artifacts and Glacial Lake Agassiz Beaches. *The Minnesota Archaeologist* 25:5-23.

1969 *Prehistoric Peoples of Minnesota*. Minnesota Historical Society, St. Paul.

1973 *The Arvilla Complex.* Minnesota Prehistoric Archaeology Series No. 9. Minnesota Historical Society, St. Paul.

1988 *The Prehistoric Peoples of Minnesota* (revised 3rd ed.) Minnesota Prehistoric Archeology Series No. 3. Minnesota Historical Society Press, St. Paul.

1991 Cambria and Cahokia's Northwestern Periphery. In *New Perspectives on Cahokia: Views from the Peripheries*, edited by J. B. Stoltman, pp. 307-317. Monographs in World Archaeology No. 2. Prehistory Press, Madison, WI.

Johnson, J. R., and J. T. Nichols

1970 *Plants of South Dakota Grasslands: A Photographic Study*. Bulletin No. 566. Agricultural Experiment Station, South Dakota State University, Brookings.

Johnston, R. B.

1967 The Thomas Riggs Site (39HU1) Revisited, Hughes County, South Dakota. *American Antiquity* 32:393-395.

1982 *Archaeology of the McClure Site (39HU7) and the Protohistoric Period in the Big Bend Region of South Dakota.* Plains Anthropologist Memoir 18.

Jones, D. T.

n.d. The Archeology of the Jandreau Site (39LM225), Big Bend Reservoir, South Dakota. Ms. on file, National Park Service, Midwest Archeological Center, Lincoln.

Joyes, D. C.

1970 The Culture Sequence at the Avery Site at Rock Lake. In *Ten Thousand Years: Archaeology in Manitoba*, edited by W. M. Hlady, pp. 209-222. D. W. Friesen and Sons, Altona, Manitoba.

1981 The Saxton Site: Questions of Race and Culture. *Archaeology in Montana* 22(3):1-25.

1988 A Summary and Evaluation of Avonlea in Manitoba. In *Avonlea Yesterday and Today: Archaeology and Prehistory*, edited by L. B. Davis, pp. 227-236. Saskatchewan Archaeological Society, Saskatoon.

Joyes, D. C., P. McCallum, and T. Jerde

1984 Overby's Headless Burial (24SH615). *Archaeology in Montana* 25(1):1-16.

Kapler, T.

1991 *Little Cherry: Report on the 1990 Excavations at an Extended Coalescent Site (39HU126) in Hughes County, South Dakota*. South Dakota Historical Preservation Center, Vermillion.

Kappler, C. J. (editor)

1971 *Indian Affairs, Law, and Treaties*. 7 vols. General Printing Office, Washington, D.C.

Karamanski, T.

1983 *Fur Trade and Exploration: Opening the Far Northwest, 1821-1852*. University of Oklahoma Press, Norman.

Kay, M. F.

1973 *An Archeological Reconnaissance of Fort Randall Reservoir Shoreline Areas, South Dakota*. National Park Service, Midwest Archeological Center, Lincoln.

Keefer, W. R.

1969 General Stratigraphy and Depositional History of the Fort Union, Indian Meadows, and Wind River Formations, Windriver Basin, Wyoming. Wyoming Geological Association, Twenty-first Annual Field Conference *Guidebook*:19-28.

Kehoe, A. B.

1958 Pottery in Montana. *Archaeology in Montana* 1(4):2-3.

1959 Ceramic Affiliation in the Northwestern Plains. *American Antiquity* 25(2):237-246.

Kehoe, T. F.

1960 Stone Tipi Rings in North-cental Montana and the Adjacent Portion of Alberta, Canada: Their Historical, Ethnological, and Archaeological Aspects. *Smithsonian Institution Bureau of American Ethnology Anththropolical Papers* 173(62):417-473.

1966a The Small Side-Notched Point System of the Northern Plains. *American Antiquity* 31:827-841.

1966b The Distribution and Implications of Fluted Points in Saskatchewan. *American Antiquity* 31:530-539.

1967 *The Boarding School Bison Drive Site*. Plains Anthropologist Memoir 4.

1973 *The Gull Lake Site: A Prehistoric Bison Drive in Southwestern Saskatchewan*. Publications in Anthropology and History No. 1. Milwaukee Public Museum, Milwaukee.

1974 The Large Corner-notched Point System of the Northern Plains and Adjacent Woodlands. In *Aspects of Upper Great Lakes Anthropology*, edited by E. Johnson, pp. 103-114. Minnesota Prehistoric Archeology Series 11. Minnesota Historical Society, St. Paul.

Kehoe, T. F., and B. A. McCorquodale

1961 The Avonlea Point: Horizon Marker for the Northwestern Plains. *Plains Anthropologist* 6(13):179-188.

Keller, M., P. Froelich, and P. Winham

1984 *Test Excavations at Sites 39JK63 and 39JH68, Pass Creek*. White River Badlands Regional Research Project Report, Vol 4. Archaeology Laboratory, Augustana College, Sioux Falls, South Dakota. Submitted to State Historical Preservation Center, Vermillion.

Keller, S. W., and R. Keller

1982 *Volume III, James River Survey, Spink County, South Dakota, 1982*. South Dakota Archaeological Research Center, Rapid City.

1983 *Volume IV, James River Survey, Brown County, South Dakota, 1983*. South Dakota Archaeological Research Center, Rapid City.

Key, P. J.

1983 *Craniometric Relationships Among Plains Indians: Culture-historical and Evolutionary Implications.* Report of Investigations No. 34. Department of Anthropology, University of Tennessee, Knoxville.

1994 Relationships of the Woodland Period on the Northern and Central Plains: The Craniometric Evidence. In *Skeletal Biology in the Great Plains: Migration, Warfare, Health, and Subsistence*, edited by D. W. Owsley and R. L. Jantz, pp. 179-188. Smithsonian Institution Press, Washington, D.C.

Key, P., and R. L. Jantz

1981 A Multivariate Analysis of Temporal Changes in Arikara Craniometrics: A Methodological Approach. *American Journal of Physical Anthropology* 55:247-259.

Keyes, C. R.

1928 The Hill-Lewis Archaeological Survey. *Minnesota History* 9:96-108.

Keyser, J. D.

1974 The LaMarche Game Trap: An Early Historic Game Trap in Southwestern Montana. *Plains Anthropologist* 19(65):173-179.

1977a Audrey's Overhang: A Pictograph Maze in Central Montana. *Plains Anthropologist* 22(77):183-187.

1977b Writing-on-Stone: Rock Art on the Northwestern Plains. *Canadian Journal of Archaeology* 1:15-80.

1979 Late Prehistoric Period Bison Procurement on the Milk River in North-Central Montana. *Archaeology in Montana* 20(1):1-241.

1984 Rock Art of Western South Dakota: The North Cave Hills. In *Rock Art of Western South Dakota*, edited by L. A. Hannus, pp. 3-51. Special Publication No. 9. South Dakota Archaeological Society, Sioux Falls.

Keyser, J. D., and C. M. Davis

1981 *Highwalker-One Bear: 1979 Archaeological Excavation on the Ashland Division, Custer National Forest. Site 24PR627*. Northern Region Report No. 3. USDA Forest Service.

1985 Lightning Spring and Red Fox: McKean Research in the Grand River Drainage. In *McKean/Middle Plains Archaic: Current Research*, edited by M. Kornfeld and L. C. Todd, pp. 123-126. Occasional Papers on Wyoming Archaeology No. 4. Office of Wyoming State Archaeologist, Department of Anthropology, University of Wyoming, Laramie.

Keyser, J. D., C. M. Davis, B. Alex, T. Haberman, and T. Chevance

1984 Lightning Spring: 4000 years of Pine Parkland Prehistory. *Archaeology in Montana* 25(2):1-64.

Keyser, J. D, and J. L. Fagan

1993 McKean Lithic Technology at Lightning Spring. In *Prehistory and Human Ecology of the Western Prairies and Northern Plains*, edited by J. A. Tiffany, pp. 37-52. Plains Anthropologist Memoir 27.

Keyser, J. D., and G. C. Knight

1976 The Rock Art of Western Montana. *Plains Anthropologist* 21(71):1-12.

Kidwell, A. S., Jr.

1968 *The Conical Timbered Lodge on the Northwestern Plains: Historical, Ethnological, and Archaeological Evidence*. Unpublished Master's thesis, Department of Anthropology, University of Oregon.

Kivett, M.

1948 *Preliminary Appraisal of the Archeological and Paleontological Resources of the Garrison Reservoir, North Dakota*. Missouri Valley Project, River Basin Surveys, Smithsonian Institution. Report on file, National Park Service, Midwest Archeological Center, Lincoln.

1958 The Oacoma Site, Lyman County, South Dakota. Ms. on file, Midwest Archeological Center, National Park Service, Lincoln.

Kivett, M., and R. E. Jensen

1976 *Archeological Investigations at the Crow Creek Site (39BF11), Fort Randall Reservoir Area, South Dakota*. Publications in Anthropology No. 7. Nebraska State Historical Society, Lincoln.

Klimko, O., and M. G. Hanna

1988 The Avonlea Type Site Revistited: A Report on Excavations and Ceramic Analysis. In *Avonlea Today and Yesterday: Archaeology and Prehistory*, edited by L. B. Davis, pp. 25-31. Saskatchewan Archaeological Society, Saskatoon.

Knauth, L. P.

1979 A Model for the Origin of Chert in Limestone. *Geology* 7:274-277.

Knudson, R.

1967 Cambria Village Ceramics. *Plains Anthropologist* 12:247-299.

1983 *Organizational Variability in Late Paleo-Indian Assemblages*. Reports of Investigations No. 60. Laboratory of Anthropology, Washington State University, Pullman.

Knudson, R., J. M. Moe, and A. W. Bowers

1983 *The Anton Rygh Excavations and Assemblage, Campbell County, South Dakota*. Laboratory of Anthropology, University of Idaho, Moscow. Submitted to the National Park Service, Rocky Mountain Region, Denver.

Kordecki, C., and M. L. Gregg

1985 *Archeological Site Survey of the James River Banks from Jamestown to Grand Rapids, North Dakota*. Department of Anthropology, University of North Dakota, Grand Forks. Submitted to U.S. Bureau of Reclamation, Billings, MT.

1986 *James River Valley Archaeological Site Survey,1985.* Contributions No. 231. Department of Anthropology, University of North Dakota. Report submitted to the Bureau of Reclamation, Billings, Montana.

Kordecki, C., and D. L. Toom

1996 *Drift Prairie Freshwater Lakes Sample Survey Project at Lake Jessie, Griggs County, and Spiritwood Lake, Stutsman County, North Dakota, 1995 Field Season*. Department of Anthropology, University of North Dakota, Grand Forks. Submitted to the Archeology and Historic Preservation Division, State Historical Society of North Dakota, Bismarck.

Korell, A.

1981 Comments on the Korell-Bordeaux Site. *The Wyoming Archaeologist* 24(1):28-34.

Kornegay, G. L., and R. C. Surdam

1980 The Laney Member of the Green River Formation, Sand Wash Basin, Colorado, and It's Relationship to Wyoming. Wyoming Geological Association, Thirty-first Annual Field Conference *Guidebook*:191-204.

Kornfeld, M., and L. C. Todd (editors)

1985 *McKean/Middle Plains Archaic: Current Research*. Occasional Papers on Wyoming Archaeology No. 4. Wyoming State Archaeologist's Office, Laramie.

Kornfeld, M., J. Saysette, and J. Miller

n.d. Goshen-Plainview Complex at Upper Twin Mountain Sites, Colorado: One Avenue for Future Research. Unpublished manuscript on file at Department of Anthropology, University of Wyoming, Laramie.

Krause, R. A.

1969 Correlation of Phases in Central Plains Prehistory. In *Two House Sites in the Central Plains: An Experiment in Archaeology*, edited by W. R. Wood, pp. 82-96. Plains Anthropologist Memoir 6.

1972 *The Leavenworth Site: Archaeology of An Historic Arikara Community*. Publications in Anthropology No. 3. University of Kansas, Lawrence.

1977 Taxonomic Practice and Middle Missouri Prehistory: A Perspective on Donald J. Lehmer's Contributions. *Plains Anthropologist Memoir* 13:5-13.

1995 A Production Stage Grammar of Nollmeyer Potting Practices. *Archaeology in Montana* 36(2):19-44.

Kroeber, A. L.
1939 *Cultural and Natural Areas of Native North America*. University of California Press, Berkeley.

Krumbein, W. C., and L. L. Sloss
1963 *Stratigraphy and Sedimentation*. W. H. Freeman, San Francisco.

Krynine, P. D.
1948 The Megascopic Study and Classification of Sedimentary Rocks. *Journal of Geology* 56:130-165.

Kucera, C. L.
1991 Tall-Grass Prairie. In *Natural Grasslands: Introduction and Western Hemisphere, Ecosystems of the World 8A*, edited by R. T. Coupland, pp. 227-268. Elsevier, New York.

Kuchler, A. W.
1964 *Potential Natural Vegetation of the Coterminous United States*. Special Publication No. 36. American Geographical Society.

Kuehn, D. D.
1984 *Test Excavations at the Tysver-Olson Site (32DU605) and Norred Creek Site (32DU593), Dunn County, North Dakota*. Department of Anthropology, University of North Dakota, Grand Forks. Submitted to Amoco Production Company, Killdeer, North Dakota.

Kuehn, D. D., and J. W. Hodny
1984 *National Register Evaluations of Twelve Archaeological Sites and Eight Historical Sites in the Coteau Mine Areas D and J, Mercer County, North Dakota*. Department of Anthropology, University of North Dakota (UNDAR-West), Belfield. Submitted to Coteau Properties Company, Bismarck.

Kuehn, D. D., and L. A. Perry
1986 *Archaeologial and Historical Investigations Along the Voigt Bay Road, Dunn County, North Dakota*. Department of Anthropology, University of North Dakota (UNDAR-West), Belfield. Submitted to Veigel Engineering and the Dunn County Commission, Dickinson, North Dakota.

Kuehn, D. D., C. R. Falk, and A. Drybred
1982 *Archeological Data Recovery at Midipadi Butte, 32DU2, Dunn County, North Dakota*. Department of Anthropology, University of North Dakota, Grand Forks. Submitted to the U.S. Army Corps of Engineers, Omaha District.

Kuehn, D. D., C. R. Falk, and M. L. Gregg
1984 Recent Excavations at Midipadi Butte. *Plains Anthropologist* 29:303-320.

Kurtz, W. M., and S. W. Keller
1986 *Belle Fourche River Project, Western Meade County, South Dakota* (Vol. 3). Contract Investigations Series 144-III. South Dakota State Archaeological Research Center, Rapid City.

Lageson, D. R.
1980 Depositional Environments and Diagenesis of the Madison Limestone, Northern Medicine Bow Mountains, Wyoming. Wyoming Geological Association, Thirty-first Annual Field Conference *Guidebook*:53-65.

Lahren, L. A.
1971 Archaeological Investigations in the Upper Yellowstone Valley, Montana: A Preliminary Synthesis and Discussion. In *Aboriginal Man and Environments on the Plateau of Northwest America,* edited by A. H. Styrd and R. A. Smith, pp. 168-182. The University of Calgary Archaological Association.
1976 *The Myers-Hindman Site: An Exploratory Study of Human Occupation Patterns in the Upper Yellowstone Valley from 7000 B. C. to A. D. 1200*. Anthropologos Researches International Incorporated, Livingston, Montana.
1977 *The Impact of Coal Development on the Cultural Resources of Southeastern Montana*. Report. Submitted to U.S. Geological Survey, Washington, D.C.
1979 *Cultural Resource Investigations of the Kansas-Nebraska Natural Gas Pipeline Route, Phillips County, Montana*. Report. Submitted to Federal Energy Regulatory Commission, Washington, D.C.

Lahren, L. A., and R. Bonnichsen
1974 Bone Foreshafts from a Clovis Burial in Southwestern Montana. *Science* 186:147-150.

Lahren, L. A., J. G. Runkel, and C. D. Washburn
1978 *Archaeological Investigations of the Crooked Coulee Site Complex (24LT25)*. Report. Submitted to U.S.D.I. Bureau of Reclamation, Billings, Montana.

Lallo, J. W., and J. C. Rose
1979 Patterns of Stress, Disease and Mortality in Two Prehistoric Populations from North America. *Journal of Human Evolution* 8:323-335.

Lallo, J. W., G. J. Armelagos, and R. P. Mensforth
1977 The Role of Diet, Disease, and Physiology in the Origin of Porotic Hyperostosis. *Human Biology* 49:471-485.

Landals, A.
1994 *The Miniota Site, an Avonlea Component in Southwestern Manitoba*. Fedirchuk McCullough and Associates, Calgary.
1995 The Miniota and Broadview Sites: Two Avonlea Loci on the Northeastern Plains. *Manitoba Archaeological Journal* 5(1):1-27.

Langdon, S. P., P. Willey, P. H. Moore-Jansen, R. L. Jantz, L. Meadows, and R. W. Cummins
1989 *Human Skeletons from the South Dakota Archaeological Research Center.* Report. Department of Anthropology, University of Tennessee. Submitted to the South Dakota Archaeological Research Center.

Lanning, E. P.
1973 Archaeology of the Rose Spring Site INY-372. *University of California Publications in American Archaeology and Ethnology* XLIX:236-335.

Larson, M. L.
1990 *The Archaic of the Bighorn Mountains,Wyoming*. Unpublished Ph. D. dissertation, Department of Anthropology, University of California, Santa Barbara.

Larson, M. L., M. Kornfeld, and D. Rapson
1995 *High Altitude Hunting and Gathering Adaptations in the Middle Rocky Mountains: 1988-1994 Investigations*. Technical Report No. 4. Manuscript on file, Department of Anthropology, University of Wyoming.

Larson, T. A.
1965 *History of Wyoming*. University of Nebraska Press, Lincoln.

Larson, T. K. (editor)
1992 *1989 Archeological Investigations at 32ME797, 32ME799, and 32ME847 along the Southwest Pipeline Project, Mercer County, North Dakota*. Larson-Tibesar Associates, Laramie. Submitted to the North Dakota State Water Commission, Bismarck.

Larson, T. K., and D. M. Penny
1991 *The Smilden-Rostberg Site: An Early Archaic Component in the Northeastern Plains.* Report. Larson-Tibesar Associates, Laramie. Submitted to KBM, Inc., Grand Forks.

Larson, T. K., and D. M. Penny (editors)
1994 *Results of the 1993 Archeological Investigations at 32MN395, Mountrail County, North Dakota*. Draft Report. Larson-Tibesar Associates, Inc., Laramie. Submitted to the North Dakota Department of Transportation, Bismarck.

Larson, T. K., D. M. Penny, J. D. Benko, and R. S. Hillman
1986 *The 1985 Forest River Survey: A Class II Cultural Resources Inventory, Grand Forks and Walsh Counties, North Dakota*. Larson-Tibesar Associates, Laramie, WY. Submitted to State Historical Society of North Dakota, Bismarck.

Larson, T. K., K. P. Schweigert, S. A. Chomko, and W. R. Wood
1983 *A Cultural Resource Inventory of Proposed Recreation Areas, Lake Oahe: Emmons, Morton and Sioux Counties, North Dakota*. Larson-Tibesar Associates, Laramie. Submitted to the U. S. Army Corps of Engineers, Omaha District.

Larson, T. K., K. P. Schweigert, K. H. Dueholm, and D. M. Penny
1986 *A Cultural Resource Inventory of the Left Bank of Lake Oahe: Burleigh and Emmons Counties, North Dakota*. Larson-Tibesar Associates, Laramie. Submitted to the U.S. Army Corps of Engineers, Omaha District.

Lass, B.
1980 Archaeological Reconnaissance in the Coteau des Prairies Region of Northeastern South Dakota. Ms. on file, South Dakota State Archaeological Research Center, Rapid City, SD.
1981 South Dakota Prehistory. In *The Future of South Dakota's Past,* edited by L. J. Zimmerman and L. C. Stewart. Special Publication No. 2. South Dakota Archaeological Society, Vermillion.

Lass, W. E.
1962 *A History of Steamboating on the Upper Missouri River*. University of Nebraska Press, Lincoln.

Lavender, D.
1983 *Fort Laramie and the Changing Frontier*. Handbook, No. 118. United States Department of the Interior, National Park Service.

Leaf, G. R.
1976 *Shoreline Survey of Lake Sakakawea: The Badlands in Southern Dunn County, North Dakota*. Department of Anthropology, University of North Dakota, Grand Forks. Submitted to National Park Service, Midwest Archeological Center, Lincoln.

Lee, C. H. (editor)
1980 *The Archeology of the White Buffalo Robe Site. Department of Anthropology, University of North Dakota, Grand Forks* (2 vols.). Submitted to Stearns-Roger Engineering Corporation, Denver, Colorado.

Leechman, D.
1951 Bone Grease. *American Antiquity* 16:355-356.

Leeder, M. R.
1982 *Sedimentology: Process and Product*. George Allen and Unwin, London.

Lees, W. B., M. E. Brown, and R. D. Mandel
1985 *Cultural Resource Reconnaissance Along the Lower West Bank of Lake Francis Case in Gregory and Lyman Counties, South Dakota*. Museum of Anthropology, University of Kansas, Lawrence. Submitted to the U.S. Army Corps of Engineers, Omaha District.

Lehmer, D. J.
1954 *Archeological Investigations in the Oahe Dam Area, South Dakota, 1950-51*. River Basin Surveys Papers No. 7. Bureau of American Ethnology Bulletin 158. Smithsonian Institution, Washington, D.C.
1966 *The Fire Heart Creek Site*. Publications in Salvage Archeology No. 1. Smithsonian Institution, River Basin Surveys, Lincoln.
1970 Climate and Culture History in the Middle Missouri Valley. In *Pleistocene and Recent Environments of the Central Great Plains*, edited by W. Dort and J. K. Jones, Jr., pp. 117-129. Special Publication No. 3. Department of Geology, University of Kansas, Lawrence.
1971 *Introduction to Middle Missouri Archaeology.* Anthropological Papers No. 1. U.S. Department of the Interior National Park Service.

Lehmer, D. J., and W. W. Caldwell
1966 Horizon and Tradition in the Northern Plains. *American Antiquity* 31(4):522-516.

Lehmer, D. J. and D. T. Jones
1968 *Arikara Archeology: the Bad River Phase*. Publications in Salvage Archeology No. 7. Smithsonian Institution, River Basin Surveys, Lincoln.

Lehmer, D. J., L. K. Meston, and C. L. Dill
1973 Structural Details of a Middle Missouri House. *Plains Anthropologist* 18(6):160-166.

Lehmer, D. J., W. R. Wood, and C. L. Dill
1978 *The Knife River Phase*. Dana College and University of Missouri. Submitted to the National Park Service, Rocky Mountain Region, Denver, Colorado.

Lepley, J. G., and S. Lepley
1992 *The Vanishing West: Hornaday's Buffalo—the Last of the Wild Herds*. River and Plains Society, Fort Benton.

Lewis, H. P.
1947 *Buffalo Kills in Montana*. Report on file at National Park Service, Midwest Archaeological Center, Lincoln, Nebraska.

Lewis, R. O.
1985 Phytolith Analysis from the McKean Site, Wyoming. In *McKean/Middle Plains Archaic: Current Research*, edited by M. Kornfeld and L. Todd, pp.45-50. Occasional Papers on Wyoming Archaeology No. 4. Laramie.

Lewis, T. H.
1886a Ancient Rock Inscriptions in Eastern North Dakota. On file, Department of Anthropology, University of North Dakota, Grand Forks.
1886b Mounds of the Red River of the North. *The American Antiquarian* 8:369-371. On file, Department of Anthropology, University of North Dakota, Grand Forks.
1890a Effigy-mound in the Valley of the Big Sioux River. *Science* 15:275.
1890b Stone Monuments in Northwestern Iowa and Southwestern Minnesota. *American Anthropologist* 3:267-274.
n.d. T. H. Lewis Field Notebooks 10 and 31. North-western Archaeological Surveys, Minnesota Historical Society Archives, St. Paul.

Libby, O. G.
1910 The Proper Identification of Indian Village Sites in North Dakota: A Reply to Dr. Dixon. *American Anthropologist* (n.s.) 12:123-128.
1913 Field Work. *Collections of the State Historical Society of North Dakota* 4:30. Bismarck.

Lippincott, K.
1992 *Belle Fourche River Project Addendum and Belle Fourche Archaeological Region Overview* (Vol. 6). Contract Investigations Series 144-6. South Dakota State Archaeological Research Center, Rapid City.

Lobdell, J. E.
1973 *The Scoggin Site: An Early Middle Period Bison Kill*. Unpublished Master's thesis, Department of Anthropology, University of Wyoming, Laramie.

Loendorf, L. L.
1969 Pryor Mountain Archaeology. *Archaeology in Montana* 10(1 and 2):21-52.
1971 *The Results of Archaeological Survey in the Pryor Mountain-Big Horn Canyon Area: 1969 Field Season*. Report. Submitted to National Park Service, Midwest Archaeological Center, Lincoln, Nebraska.
1973 *Prehistoric Settlement Patterns in the Pryor Mountains, Montana*. Unpublished Ph.D. dissertation, Department of Anthropology, University of Missouri, Columbia.
1974 *The Results of Archaeological Survey in the Pryor Mountain-Big Horn Canyon Area, 1971 Field Season*. Report. Submitted to National Park Service, Midwest Archaeological Center, Lincoln, Nebraska.
1984 *Documentation of Rock Art, Petroglyph Canyon, Montana, 24CB601*. Contribution No. 207. Department of Anthropology, University of North Dakota, Grand Forks.
1990 A Dated Rock Art Panel of Shield-Bearing Warriors in South Central Montana. *Plains Anthropologist* 35(127):45-54.

1991 *Archaeological Sites in Weatherman Draw, Carbon County, Montana*. Department of Anthropology, University of North Dakota, Grand Forks.

1993 The Water Ghost Woman Along the Wind River, Wyoming. Paper presented at the Conference of Shamanism and Rock Art: Interpretations from around the World. Trinity University and the Witte Museum, San Antonio.

1994 Traditional Archaeological Methods and Their Applications at Rock Art Sites. In *New Light on Old Art: Recent Advances in Hunter-Gatherer Rock Art Research*, edited by D. S. Whitley and L. L. Loendorf, pp. 95-103. Monograph No. 36. UCLA Institute of Archaeology.

Loendorf, L. L., S. A. Ahler, and D. Davidson

1984 The Proposed National Register District in the Knife River Flint Quarries in Dunn County, North Dakota. *North Dakota History* 51:4-20.

Loendorf, L. L., and J. L. Brownell

1980 The Bad Pass Trail. *Archaeology in Montana* 21(3):11-102.

Loendorf, L. L., J. C. Dahlberg, and L. O. Western

1981 *The Pretty Creek Archaeological Site, 24CB4 and 5*. Report. Submitted to Department of the Interior, National Park Service, Midwest Archaeological Center. University of North Dakota, Grand Forks.

Loendorf, L. L. and J. E. Francis

1987 Three Rock Art Sites on the Middle Fork of the Powder River, Wyoming. *Archaeology in Montana* 28(2):18-24.

Loendorf, L. L., K. Hackett, J. D. Benko, D. M. Penny, J. K. Michaelsen, and T. K. Larson

1990 *The Cottonwood Creek Rock Art Survey*. Larson-Tibesar Associates, Laramie. Submitted to the USDI Bureau of Land Management, Montana State Office, Billings.

Loendorf, L. L., D. D. Kuehn, and N. F. Forsman

1984 Rainy Buttes Silicified Wood: A Source of Lithic Raw Material in Western North Dakota. *Plains Anthropologist* 29(106):335-338.

Loendorf, L. L., and A. Porsche

1985 *The Rock Art Sites in Carbon County, Montana*. Contribution No. 224. Department of Anthropology, University of North Dakota, Grand Forks.

Lofstrom, T.

1987 The Rise of Wild Rice Exploitation and its Implications for Population Size and Social Organization in Minnesota Woodland Period Cultures. *Minnesota Archaeologist* 46:3-15.

Lohman, K. E., and G. W. Andrews

1968 *Late Eocene Non-Marine Diatoms from the Beaver Divide Area, Fremont County, Wyoming*. U. S. Geological Survey Professional Paper 593E.

Love, C. M.

1977 Geological Influences on Prehistoric Populations of Western Wyoming. Wyoming Geological Association, Twenty-ninth Annual Field Conference *Guidebook*:15-29.

Love, J. D.

1956 Cretaceous and Tertiary Stratigraphy of the Jackson Hole Area, Northwestern Wyoming. Wyoming Geological Association, Eleventh Annual Field Conference *Guidebook*:76-94.

1961 *Split Rock Formation (Miocene) and Moonstone Formation (Pliocene) in Central Wyoming*. U. S. Geological Survey Bulletin 1121I.

Loveseth, B.

1983 *Historical Resources Impact Assessment and Archaeological Conservation Studies: Sundance Oil Canada Ltd. 1981 Oil Gathering System Expansion and Alterations, Wintering Hills, Alberta*. Report on file, Archaeological Survey of Alberta, Canada.

Lovick, S. K., and S. A. Ahler

1982 *Cultural Resource Reconnaissance in the Knife River Indian Villages National Historic Site*. Department of Anthropology, University of North Dakota, Grand Forks. Submitted to the National Park Service, Midwest Archeological Center, Lincoln.

Lueck, E. J., and J. M. Butterbrodt

1984 *Cultural Resources Surveys at Pass Creek, Nelson Butte, Babby Butte, Squaw-Humper Creek and Cuny Table in Jackson (Washabaugh) and Shannon Counties, South Dakota*. White River Badlands Regional Research Project Report (Vol. 3). Archaeology Laboratory, Augustana College, Sioux Falls, South Dakota. Submitted to State Historical Preservation Center, Vermillion.

Lueck, E. J., K. Lippincott, and R. P. Winham

1989 *Cultural Resource Reconnaissance in Dewey County, South Dakota, from Below the Moreau River to the Forest City Recreation Area*. Archeology Laboratory, Augustana College, Sioux Falls. Submitted to the U.S. Army Corps of Engineers, Omaha District.

Lueck, E. J., K. Lippincott, R. P. Winham, and L. A. Hannus

1990 *Cultural Resource Reconnaissance of U. S. Army Corps of Engineers Land Alongside Lake Sakakawea and Audubon Lake in McLean County, North Dakota*. Archaeological Contract Series No. 58. Archaeology Laboratory, Augustana College, Sioux Falls, South Dakota. Submitted to U.S. Army Corps of Engineers, Omaha District. Contract No. DACW45-88-C-0260.

1992 *Cultural Resource Reconnaissance of U.S. Army Corps of Engineers Land Alongside Lake Sakakawea and Audubon Lake in McLean County, North Dakota*. Archeology Laboratory, Augustana College, Sioux Falls, South Dakota. Submitted to the U.S. Army Corps of Engineers, Omaha District.

Lundell, L. L., and R. C. Surdam

1975 Playa Lake Deposition: Green River Formation, Piceance Creek Basin, Colorado. *Geology* 3:493-497.

MacDonald, L. L.

1974 *Opal Phytoliths as Indicators of Plant Succession in North-Central Wyoming*. Master's thesis, Department of Range Management, University of Wyoming, Laramie.

MacNeish, R. S.

1954 *The Stott Mound and Village near Brandon, Manitoba*. Bulletin 132. National Museums of Canada, Ottawa.

1958 *An Introduction to the Archaeology of Southeastern Manitoba*. Bulletin 157. National Museums of Canada, Ottawa.

MacNeish, R. S., and K. Capes

1958 The United Church Site near Rock Lake, Manitoba. *Anthropologica* 6:119-155.

Madsen, D. B.

1975 Dating Paiute-Shoshoni Expansion in the Great Basin. *American Antiquity* 40:82-86.

Magne, M P. R. and M. A. Klassen

1991 A Multivariate Study of Rock Art Anthropomorphs at Writing-on-Stone, Southern Alberta. *American Antiquity* 56:389-418.

Malainey, M. E.

1991 *Internal and External Relationships of Saskatchewan Plains Pottery Assemblages ca. A.D. 1300 to Contact*. Unpublished Master's thesis, Department of Anthropology and Archaeology, University of Saskatchewan, Saskatoon.

n.d. *The Lozinsky Site: A Late Pre-Contact Bison Processing Camp*. Occasional Paper No. 1. Saskatoon Archaeological Society.

Mallory, O. L.

1963 *An Archaeological Appraisal of the Missouri Breaks Region in Montana*. Missouri River Basin Project, River Basin Surveys. Smithsonian Institution, Lincoln, Nebraska.

1965 *Reappraisal of Archeological Sites in the Fort Randall Reservoir, South Dakota: Supplement to Appraisals of 1947 and 1953*. Missouri Basin Project, Smithsonian Institution. Report on file, National Park Service, Midwest Archeological Center, Lincoln.

1966 An Archeological Appraisal of the Pipestem Reservoir, Stutsman

County, North Dakota. Ms. on file, Midwest Archeological Center, Lincoln, NE.

1967 Notes and Field Forms of the 1967 Cottonwood Springs Reservoir Area Survey. River Basin Surveys. Manuscript on file, South Dakota State Archaeological Research Center, Ft. Meade.

Mallouf, R. J.

1989 A Clovis Quarry Workshop in the Callahan Divide: The Yellow Hawk Site, Taylor County. *Plains Anthropologist* 34(124):81-103.

Malouf, C.

1957 Montana's Aboriginal Inhabitants - The Indians. In *A History of Montana*, Vol. 1, by M. G. Burlingame and K. R. Toole, pp. 31-53. Lewis Historical Publishing, New York.

1961a Pictographs and Petroglyphs. *Archaeology in Montana* 3(1):1-13.

1961b Tipi Rings of the High Plains. *American Antiquity* 26(3):381-390.

1962 Notes on the Logan Buffalo Jump. In *Symposium on Buffalo Jumps*, edited by C. Malouf and S. Connor. Montana Archaeological Society Memoir No. 1.

1963 *Crow-Flies-High (32MZ1), a Historic Hidatsa Village in the Garrison Reservoir Area, North Dakota*. River Basin Surveys Papers No. 29. Bureau of American Ethnology, Bulletin 185. Smithsonian Institution, Washington, D.C.

Malouf, C., and S. Conner

1962 *Symposium on Buffalo Jumps*, edited by C. Malouf and S. Conner. Montana Archaeological Memoir No. 1.

Mann, R. W., and S. P. Murphy

1990 *Regional Atlas of Bone Disease: A Guide to Pathologic and Normal Variation in the Human Skeleton*. Charles C. Thomas, Springfield.

Markgraf, V., and T. Lennon

1986 Paleoenvironmental History of the Last 13,000 Years of the Eastern Powder River Basin, Wyoming, and Its Implication for Prehistoric Cultural Patterns. *Plains Anthropologist* 31:1-12.

Martin, J. E., R. A. Alex, L. M. Alex, J. P. Abbot, R. C. Benton, and L. F. Miller

1993 The Beaver Creek Shelter (39CU779): A Holocene Succession in the Black Hills of South Dakota. In *Prehistory and Human Ecology of the Western Prairies and Northern Plains*, edited by J. A. Tiffany, pp. 17-36. Plains Anthropologist Memoir 27.

Martin, J. E., R. A. Alex, and R. C. Benton

1988 Holocene Chronology of the Beaver Creek Shelter, Wind Cave National Park, South Dakota. *Proceedings, South Dakota Academy of Science* (Vol. 67).

Martin, W. D., H. J. Fischer, R. J. Keogh, and K. Moore

1980 The Petrography of the Limestones in the Upper Gros Ventre and Gallatin Limestone Formations (Middle and Upper Cambrian), Northwestern Windriver Basin, Wyoming. Wyoming Geological Association, Thirty-first Annual Field Conference *Guidebook*:37-51.

Martindale, S. W., and G. W. Gill

1983 A Late Prehistoric Killing in Robber's Gulch, Southern Wyoming. Paper presented at the 41st Annual Plains Anthropological Conference, Rapid City, South Dakota. On file, Human Osteological Laboratory, University of Wyoming.

Matternes, H. B., W. M. Bass, S. P. Langdon, M. K. Marks, and S. M. Holcomb

1992 *Analysis and Interpretation of Human Osteological Remains from the South Dakota Archaeological Research Center.* Report. Department of Anthropology, University of Tennessee, Knoxville, Tennessee. Submitted to the State of South Dakota and the South Dakota Archaeological Research Center.

Mattes, M. J.

1949 *Report on Historic Sites in the Fort Randall Reservoir Area, Missouri River, South Dakota*. South Dakota Historical Collections No. 24. State Historical Society of South Dakota, Pierre.

1960 *Historic Sites Archeology on the Upper Missouri*. River Basin Surveys Papers No. 15. Bureau of American Ethnology, Bulletin 176. Smithsonian Institution, Washington, D.C.

Mattison, R. H.

1951 *Report on the Historical Aspects of the Garrison Reserovir Area, Missouri River, North Dakota*. Missouri Basin Project, Smithsonian Institution. Report on file, National Park Service, Midwest Archeological Center, Lincoln.

1954 *Report on Historic Sites in the Oahe Reservoir, Missouri River, South and North Dakota*. South Dakota Historical Collections No. 27. South Dakota State Historical Society, Pierre. [1953 report on file, National Park Service, Midwest Archeological Center, Lincoln.]

1962 *Report on the Historic Sites in the Big Bend Reservoir Area, Missouri River, South Dakota*. South Dakota Historical Collections No. 31. South Dakota State Historical Society, Pierre. [1962 report on file, National Park Service, Midwest Archeological Center, Lincoln.]

McCracken, H. (editor)

1978 *The Mummy Cave Project in Northwestern Wyoming*. The Buffalo Bill Historical Center, Cody, Wyoming.

McCracken, H., W. Wedel, R. Edgar, J. Moss, H. Wright, Jr., W. Husted, and W. Mulloy

1978 *The Mummy Cave Project in Northwestern Wyoming*. The Buffalo Bill Historical Center, Cody, Wyoming.

McDonnell, J. A.

1991 *The Dispossession of the American Indian, 1887-1934*. Indiana University Press, Bloomington.

McFarling, L. (editor)

1955 *Exploring the Northern Plains, 1804-1876*. Caxton, Caldwell, Indiana.

McGuire, D. A., K. Joyner, R. Kainer, and M. Miller

1984 *Final Report of Archaeological Investigations of the Medicine Bow Mine Archaeological District in the Hanna Basin, Southcentral Wyoming*. Mariah Associates, Inc.

McKee, D. F.

1988 *A Faunal Analysis of the River Bend Site (48NA202): Evidence of Protohistoric Subsistence on the Northwest Plains*. Unpublished Master's thesis, Department of Anthropology, University of Wyoming.

McKibbin, A., K. D. Black, R. J. Rood, M. A. Van Ness, and M. D. Metcalf

1988 *Archaeological Excavations at 48CA1391, Campbell County, Wyoming*. Metcalf Archaeological Consultants, Inc. Eagle, Colorado.

McLean, G.

1976 *Archaeological Test Excavation and Evaluation Program: Ashland Division Custer National Forest*. Report. Submitted to USDA Forest Service, Custer National Forest, Billings, Montana.

McMahan-Williams, K. E.

1995 Osteological Analysis of a Wyoming Outlaw. Paper presented at the 53rd Annual Plains Anthropological Conference, Laramie.

Mehringer, P. J., Jr.

1988 Clovis Cache Found: Weapons of Ancient Americans. *National Geographic* 174:500-503.

1989 Of Apples and Archaeology. *Universe* 1(2):2-8.

Meleen, E. E., and J. J. Pruitt, Jr.

1941 A Preliminary Report on the Rock Shelters in Fall River County, South Dakota. Manuscript on file, South Dakota State Archaeological Research Center, Ft. Meade.

Meltzer, D. J.

1989 Why Don't We Know When the First People Came to America? *American Antiquity* 54(3):471-490.

Mensforth, R. P., C. O. Lovejoy, J. W. Lallo, and G. J. Armelagos
1978 The Role of Constitutional Factors, Diet, and Infectious Disease in the Etiology of Porotic Hyperostosis and Periosteal Reactions in Prehistoric Infants and Children. *Medical Anthropology* 2:1-59.

Mercer, A. S.
1954 *Banditti of the Plains*. University of Oklahoma Press, Norman.

Merchant, V. L., and D. M. Ubelaker
1977 Skeletal Growth of the Protohistoric Arikara. *American Journal of Physical Anthropology* 46:61-71.

Mertie, J. B., Jr., R. P. Fischer, and S. W. Hobbs
1951 *Geology of the Canyon Ferry Quadrangle, Montana*. U. S. Geological Survey Bulletin 972.

Metcalf, G.
1963a *Star Village: A Fortified Historic Arikara Site in Mercer County, North Dakota*. River Basin Surveys Papers No. 26. Bureau of American Ethnology, Bulletin 185. Smithsonian Institution, Washington, D.C.
1963b *Small Sites on and about Fort Berthold Indian Reservation, Garrison Reservoir, North Dakota*. Bureau of American Ethnology Bulletin 185, River Basin Survey Papers No. 26. Washington, D.C.

Metcalf, G., and T. E. White
1953 *Appraisal of the Archeological and Paleontological Resources of the Garrison Reservoir, North Dakota: Supplement*. Missouri Basin Project, Smithsonian Institution. Report on file, National Park Service, Midwest Archeological Center, Lincoln.

Metcalf, M. D.
1987 Contributions to the Prehistoric Chronology of the Wyoming Basin. In *Perspectives on Archaeological Resources Management in the "Great Plains,"* edited by A. J. Osborn and R. C. Hassler, pp. 233-261. I and O, Omaha.

Meyer, D., and P. C. Thistle
1995 Saskatchewan River Rendezvous Centers and Trading Posts: Continuity in a Cree Social Geography. *Ethnohistory* 42(3):403-444.

Meyer, J.
1992 *Plains Woodland Ceramics of Wyoming: Vessel Morphology as an Indicator of Subsistence*. Unpublished Master's thesis, Department of Anthropology, University of Wyoming.

Meyer, R. W.
1977 *The Village Indians of the Upper Missouri.* University of Nebraska Press, Lincoln.

Meyers, J. T.
1970 *Chert Resources in the Lower Illinois Valley*. Report of Investigations No. 18. Illinois State Museum, Springfield.

Michael, W.
1993 Ceramic Beads from the Huston-Fox site, Meade County South Dakota and Notes on the Good River Complex. In *Prehistory and Human Ecology of the Western Prairies and Northern Plains*, edited by J. A. Tiffany, pp. 145-150. Plains Anthropologist Memoir 27.

Michaelson, J. K.
1983 *A Study of Lithic Procurement Behavior in the Red Desert Region of Wyoming*. Unpublished Master's thesis, Department of Anthropology, University of Wyoming, Laramie.

Michlovic, M. G.
1983 The Red River Valley in the Prehistory of the Northern Plains. *Plains Anthropologist* 28:23-31.
1985 The Problem of the Teton Migration. In *Archaeology, Ecology and Ethnohistory of the Prairie-Forest Border Zone of Minnesota and Manitoba*, edited by J. Spector and E. Johnson, pp. 131-145. J and L Reprint, Lincoln, NE.
1986 The Archaeology of the Canning Site. *The Minnesota Archaeologist* 45(1):3-36.
1988 The Archaeology of the Red River Valley. *Minnesota History* 51:55-62.
1995 Preliminary Report on Excavations at 32RI775, An Early Archaic Site on the Northeastern Plains. Paper presented at the Sixtieth Annual Meeting of the Society for American Archaeology, Minneapolis.

Michlovic, M. G., J. Bartura, T. Connolly, and F. Wieck
1977 Is North Arvilla Ancestral Cheyenne? *The Minnesota Archaeologist* 36:155-160.

Michlovic, M. G., and F. Schneider
1988 *The Archaeology of the Shea Site (32CS101)*. Moorhead State University, Moorhead, MN. Submitted to State Historical Society of North Dakota, Bismarck.

Michlovic, M. G., and F. E. Swenson
1993 Classifying Northeastern Plains Ceramics. Unpublished ms. on file, Archeology and Historic Preservation Division, State Historical Society of North Dakota, Bismarck.

Miller, C. F.
1960 *The Excavation and Investigation of Fort Lookout Trading Post II (39LM57) in the Fort Randall Reservoir, South Dakota*. River Basin Surveys Papers No. 17. Bureau of American Ethnology, Bulletin 176. Smithsonian Institution, Washington, D.C.
1963 Archaeological Manifestations in the Toole County Section of the Tiber Reservoir Bain, Montana. *Smithsonian Institution Bureau of American Ethnology Bulletin* 26(31):235-256.
1964 *Archeological Investigations at the Hosterman Site (39PO7), Oahe Reservoir Area, South Dakota, 1956*. River Basin Surveys Papers No. 35. Bureau of American Ethnology, Bulletin 189. Smithsonian Institution, Washington, D.C.

Miller, J. C.
1990 Lithic Resources in the Troublesome Formation. Manuscript on file, Archaeological Service, Western Wyoming College, Rock Springs.
1991a Lithic Resources. In *Prehistoric Hunters of the High Plains*, by G. C. Frison, Chapter 12. 2nd ed. Academic Press.
1991b Origin, Affinity, and Character of the Western Wyoming Basin Population. On file at the University of Wyoming Human Osteological Laboratory.

Miller, J. C., and T. K. Larson
1990 Knife River Flint Studies: Part I, Geological and Physical Characterization. In *The Highway 22 Project: Archaeological excavations at 32DU178 and 32DU179, Dunn County, North Dakota*, edited by T. K. Larson and D. M. Penny, pp. 83-95. Manuscript on file, Larson-Tibesar Associates, Laramie.

Miller, K. G.
1988 *A Comparative Analysis of Cultural Materials from Two Big Horn Mountains Archaeological Sites: A Record of 10,000 Years of Occupation*. Unpublished Master's thesis, Department of Anthropology, University of Wyoming.

Miller, M., and G. W. Gill
1980 A Late Prehistoric Bundle Burial from Southern Wyoming. *Plains Anthropologist* 25(89):235-246.

Miller, M. E.
1976 *Communal Bison Procurement During the Middle Plains Archaic: A Comparative Study*. Unpublished Master's thesis, Department of Anthropology, University of Wyoming.
1984 Preliminary Results from the Test Excavations at the Cache Hill Bison Kill-Butchery Site in the Powder River Basin, Wyoming. Paper presented at the 42nd Plains Anthropological Conference, Lincoln, Nebraska.

Miller, M. E., and B. R. Waitkus
1989 The Butler-Rissler Site: Plains Woodland Occupation Along the North Platte River, Wyoming. *The Wyoming Archaeologist* 32(1-2):1-37.

Miller, M. J.
1995 Genetic and Environmental Influences on Femoral Platymeria. Paper presented at the 53rd Annual Plains Anthropological Conference, Laramie.

Miller, W. P.
1992 *A Survey and Analysis of Surface Collected Paleo-Indian Points from Bottineau County, North Dakota*. Unpublished B.A. Honors thesis, Department of Anthropology, University of North Dakota, Grand Forks.

Mills, J. E.
1960 *Historic Sites Archeology in the Fort Randall Reservoir, South Dakota*. River Basin Survey Papers No. 16. Bureau of American Ethnology, Bulletin 176. Smithsonian Institution, Washington, D.C.

Mintz, L. W.
1987 *The Trail: A Bibliography of Travelers on the Overland Trail to California, Oregon, Salt Lake City and Montana during the Years 1841-1864*. University of New Mexico Press, Albuquerque.

Moerman, D. E. and D. T. Jones
1966a The John Ketchen Site (39ST223). In *Investigations at the Cattle Oiler Site, 39ST224, Big Bend Reservoir, South Dakota*, by D. E. Moerman and D. T. Jones, Appendix A. Ms. on file, National Park Service, Midwest Archeological Center, Lincoln.
1966b *Investigations at the Cattle Oiler Site, 39ST224, Big Bend Reservoir, South Dakota*. Ms. on file, National Park Service, Midwest Archeological Center, Lincoln.

Montgomery, H.
1889 Aboriginal Monuments of North Dakota. *Proceedings of the American Association for the Advancement of Science* 38:342-344.
1906 Remains of Prehistoric Man in the Dakotas. *American Anthropologist* 8:640-651.
1908 Prehistoric Man in Manitoba and Saskatchewan. *American Anthropologist* 10:33-40.
1910 The Calf Mountain Mound in Manitoba. *American Anthropologist* 12:49-57.

Mooney, M. M.
1975 *George Catlin Letters and Notes on the North American Indians.* Clarkson Potter, New York.

Morey, G. B.
1984 Sedimentology of the Sioux Quartzite in the Fulda Basin, Pipestone County, Southwestern Minnesota. In *Shorter Contributions to the Geology of the Sioux Quartzite (Early Proterozoic), Southwestern Minnesota*, edited by D. L. Southwick, pp. 59-73. Report of Investigations 32. Minnesota Geological Survey.

Moss, J. H., in collaboration with K. Bryan, G. W. Holmes, L. Satterthwaite, Jr., H. P. Hansen, C. B. Schultz, and W. D. Frankforter
1951 *Early Man in the Eden Valley*. Museum Monographs No. 6. University of Pennsylvania.

Moulton, G. E.
1983 *Atlas of the Lewis and Clark Expedition*. Journals of the Lewis and Clark Expedition (Vol. 1). University of Nebraska Press, Lincoln.

Mulloy, W. T.
1942 *The Hagen Site*. Publications in the Social Sciences No.1. University of Montana.
1943 A Prehistoric Camp Site near Red Lodge, Montana. *American Antiquity* 9(2):170-179.
1953 The Ash Coulee Site. *American Antiquity* 19(1):73-75.
1954a The McKean Site in Northeastern Wyoming. *Southwestern Journal of Anthropology* 10(4):432-460.
1954b Archaeological Investigations in the Shoshone Basin of Wyoming. *University of Wyoming Publications* 18(1):1-70.
1958 A Preliminary Historical Outline for the Northwestern Plains. *University of Wyoming Publications* 22(1).
1959 The James Allen Site near Laramie, Wyoming. *American Antiquity* 25(1):112-116.
1965 Archaeological Investigations along the North Platte River in Eastern Wyoming. *University of Wyoming Publications* 31(2):24-51.

Mulloy, W. T., and L. C. Steege
1967 Continued Archaeological Investigations along the North Platte River in Eastern Wyoming. *University of Wyoming Publications* 33(3):169-233.

Munson, G.
1980 *Old Homestead Kill Site (24RB1014)*. Cultural Resources Division, Mineral Research Center, Montana Tech Foundation, Butte.
1990 *Archaeological Investigations at 24RB1164*. Report. Submitted to Montana Department of State Lands, Helena.

Munson, P. J.
1990 Folsom Fluted Projectile Points East of the Great Plains and Their Biogeographical Correlates. *North American Archaeologist* 11:255-272.

Murdock, G. P.
1967 *Ethnographic Atlas*. University of Pittsburgh Press, Pittsburgh.

Nelson, L. S.
1973 The Results of the Archaeological Survey in Portions of Southeastern North Dakota, Northeastern South Dakota, and West-Central Minnesota. Department of Sociology and Anthropology, University of North Dakota, Grand Forks. Ms. on file, State Historical Society of North Dakota, Bismarck.

Nelson, N. C.
1942 Camping on Ancient Trails. *Natural History* 49:262-267.
1943 Contributions to Montana Archaeology. *American Antiquity* 9(2):162-169.

Nelson, W. H.
1963 *Geology of the Duck Creek Pass Quadrangle, Montana*. U. S. Geological Survey Bulletin 1121J.

Nero, R. W., and B. A. McCorquodale
1958 Report on an Excavation at the Oxbow Dam Site. *The Blue Jay* 16(2):82-92.

Neuman, R. W.
1960 The Truman Mound Site, Big Bend Reservoir Area, South Dakota. *American Antiquity* 26:78-92.
1961a Salvage Archaeology at a Site Near Ft. Thompson, South Dakota. *Plains Anthropologist* 6:189-200.
1961b The Olson Mound (39BF223) in Buffalo County, South Dakota. *Plains Anthropologist* 6:164-170.
1964a Projectile Points from Preceramic Occupations near Fort Thompson, South Dakota: a Preliminary Report. *Plains Anthropologist* 9(25):173-189.
1964b *The Good Soldier Site (39LM238), Big Bend Reservoir, Lyman County, South Dakota*. River Basin Surveys Papers No. 37. Bureau of American Ethnology, Bulletin 189. Smithsonian Institution, Washington, D.C.
1967 Radiocarbon Dated Archaeological Remains on the Northern and Central Plains. *American Antiquity* 32:471-486.
1975 *The Sonota Complex and Associated Sites on the Northern Great Plains*. Publications in Anthropology No. 6. Nebraska State Historical Society, Lincoln.

Neumann, G. K.
1952 Archaeology and Race in the American Indian. In *Archaeology of Eastern United States*, edited by J. B. Griffin, pp. 13-34. University of Chicago Press, Chicago.

Newberry, J. C., and C. Harrison
1986 *The Sweetwater Creek Site*. Cultural Resource Management Report No. 19. Western Wyoming College, Rock Springs.

Nicholas, G. P., II, and L. R. Johnson
1986 The Greenshield Site, 320L17. In *Papers in Northern Plains Prehistory and Ethnohistory*, edited by W. R. Wood, pp. 186-194. South Dakota Archaeological Society, Special Publication No. 10. Sioux Falls.

Nicholson, B. A.
1990 Ceramic Affiliations and the Case for Incipient Horticulture in Southwestern Manitoba. *Canadian Journal of Archaeology* 14:33-60.
1991a Modeling a Horticultural Complex in South-Central Manitoba During the Late Prehistoric Period: The Vickers Focus. *Midcontinental Journal of Archaeology* 16(2):163-188.
1991b Report on the 1991 Field School Excavations at the Lovstrom Site (DjLx-1), Southwestern Manitoba. *Manitoba Archaeological Journal* 1(2):51-93.
1994 Interactive Dynamics or Intrusive Horticultural Groups Coalescing in South-Central Manitoba During the Late Prehistoric Period-The Vickers Focus. *North American Archaeologist* 15(2):103-127.

Nickel, R. K.
1974 *Plant Resource Utilization at a Late Prehistoric Site in North-Central South Dakota*. Unpublished Master's thesis, Department of Anthropology, University of Nebraska, Lincoln.
1977 The Study of Archaeologically Recovered Plant Materials from the Middle Missouri Subarea. *Plains Anthropologist Memoir* 13:53-58.

Nimmo, B. W.
1971 Population Dynamics of a Wyoming Pronghorn Cohort from Eden-Farson Site, 48SW304. *Plains Anthropologist* 16(54):285-288.

Noisat, B., J. Campbell, G. L. Moore, and K. Schweigert
1986 *A Reconnaissance Survey and Preliminary Assessment of the Cultural Resources of Lake Sakakawea in Williams and McKenzie Counties, North Dakota*. Overland Associates, Inc., Lyons, Colorado. Submitted to the U.S. Army Corps of Engineers, Omaha District.

Noisat, B., P. V. Miller, and J. Buechler
1991 A Cultural Resource Overview Update of the Black Hills National Forest, South Dakota-Wyoming. Draft report on file, South Dakota State Archaeological Research Center, Rapid City.

Nowak, T. R.
1983 Lower Antelope Creek (39ST106): An Examination of a Prehistoric Arikara Village Excavated Under the Avocational Archeological Assistance Program of the U.S. Army Corps of Engineers. *South Dakota Archaeology* 7:1-34.

Nowak, T. R., and L. A. Hannus
1983 An Overview of Archaeology in Southwestern South Dakota and Its Place in Northern Plains Prehistory. In *A Cultural Resources Survey of a Portion of the South Fork of the Cheyenne River, Fall River County, South Dakota*, edited by L. A. Hannus, pp. 4.1-4.93. Publications in Anthropology No. 1. Archaeology Laboratory, South Dakota State University, Brookings.
1985 Lithic Raw Materials from the West Horse Creek Site (39SH37). *South Dakota Archaeology* 8-9:98-114.

Nugent, D.
1993 Property Relations, Production Relations, and Inequality: Anthropology, Political Economy, and the Blackfeet. *American Ethnologist* 20(2):336-362.

Nute, G. L.
1930 Posts in the Minnesota Fur-Trading Area, 1660-1855. *Minnesota History* 11:353-385.

Obey, W. A.
1974 The Arvilla People. *The Minnesota Archaeologist* 33:1-33.

Olsen, S. L., and P. Shipman
1994 Cutmarks and Perimortem Treatment of Skeletal Remains on the Northern Plains. In *Skeletal Biology in the Great Plains: Migration, Warfare, Health, and Subsistence*, edited by D. W. Owsley and R. L. Jantz, pp. 377-390. Smithsonian Institution Press, Washington, D.C.

Olson, B. L.
1992 *The White Owl Site (32DU621): A Late Prehistoric-Protohistoric Campsite and Knife River Flint Procurement Locality on the Fort Berthold Indian Reservation, Dunn County, North Dakota*. Archaeology Department, Powers Elevation Company, Inc., Aurora, Colorado. Submitted to the North Dakota Department of Transportation, Bismarck.

Olson, G. D., and L. J. Zimmerman (editors)
1979 *A Cultural Resources Reconnaissance of the Federal Lands on the East Bank of Lake Francis Case, South Dakota*. Augustana Research Institute, Augustana College, Sioux Falls, South Dakota, and the Archeology Laboratory, University of South Dakota, Vermillion. Submitted to the U.S. Army Corps of Engineers, Omaha District.

Ortner, D. J., and W. G. Putschar
1981 *Identification of Pathological Conditions in Human Skeletal Remains.* Contributions to Anthropology No. 28. Smithsonian Institution, Washington, D.C.

Osgood, E. S.
1970 *The Day of the Cattleman*. Reprint, University of Chicago Press.

Ossenberg, N. S.
1974 Origins and Relationships of Woodland Peoples: The Evidence of Cranial Morphology. In *Aspects of Upper Great Lakes Anthropology: Papers in Honor of Lloyd Wilford*. Minnesota Prehistoric Archaeology Series No. 11. St. Paul.

Ottman, J.
1992 The Lonetree Mummy. *Wyoming Wildlife* 56(2):4-7.

Over, W. H.
1915 Mollusca of South Dakota. *Nautilus* 29:78-81, 90-95.
1932 *Flora of South Dakota*. University of South Dakota, Vermillion.
1936 The Archaeology of Ludlow Cave and its Significance. *American Antiquity* 2:126-129.
1941 *Indian Picture Writing in South Dakota*. Archaeological Studies Circular 4. University of South Dakota, Vermillion.

Over, W. H., and E. P. Churchill
1941 *Mammals of South Dakota*. Museum and Department of Zoology, University of South Dakota, Vermillion.

Owsley, D. W.
1992a Demography of Prehistoric and Early Historic Northern Plains Populations. In *Disease and Demography in the Americas*, edited by J. W. Verano and D. H. Ubelaker, pp. 75-86. Smithsonian Institution Press, Washington, D.C.
1992b *Inventory of Federally Controlled Human Skeletal Remains Housed at the State Historical Society of North Dakota.*
1994 Warfare in Coalescent Tradition Populations of the Northern Plains. In *Skeletal Biology in the Great Plains: Migration, Warfare, Health, and Subsistence*, edited by D. W. Owsley and R. L. Jantz, pp. 333-344. Smithsonian Institution Press, Washington, D.C.

Owsley, D. W., and W. M. Bass
1979 A Demographic Analysis of Skeletons from the Larson Site (39WW2), Walworth County, South Dakota: Vital Statistics. *American Journal of Physical Anthropology* 51:145-154.

Owsley, D. W., and R. L. Jantz
1978a Intracemetery Morphological Variation from the Sully Site (39SL4), Sully County, South Dakota. *Plains Anthropologist* 23(80):139-147.
1978b Intracemetery Morphological Variation in Arikara Crania from the Sully Site (39SL4), Sully County, South Dakota. *Plains Anthropologist* 23:139-147.

Owsley, D. W., H. E. Berryman, and W. M. Bass
1977 Demographic and Osteological Evidence for Warfare at the Larson Site, South Dakota. *Plains Anthropologist* 22:119-131.

Owsley, D. W., D. F. Morey, and W. B. Turner
1981 Inferring History from Crania: Biological Distance Comparisons of Mill Creek and Middle Missouri Tradition Crania with Mandan and Arikara Populations Samples. *Plains Anthropologist* 26:301-310.

Owsley, D. W., and J. C. Rose (editors)
1996 *The Bioarcheology of the North-Central United States.* Research Series No. 49. Arkansas Archeological Survey, Fayetteville.

Owsley, D. W., and K. L. Sandness
1996 Bioarcheological Research in Northeastern Colorado, Northern Kansas, Nebraska, and South Dakota. In *Archeology and Paleoecology of the Central Great Plains: A Volume in The Central and Northern Plains Archeological Overview*, edited by J. L. Hofman, pp. 178-338. Research Series No. 48. Arkansas Archeological Survey, Fayetteville.

Palkovich, A.
1981 Demography and Disease Patterns in a Protohistoric Plains Group: A Study of the Mobridge Site (39WW1). Memoir 17. *Plains Anthropologist* 26:71-84.

Parmalee, P. W.
1977 The Avifauna from Prehistoric Arikara Sites in South Dakota. *Plains Anthropologist* 22:189-222.

Paul, R.
1963 *The Mining Frontier of the Far West, 1848-1880*. Holt, Rinehart and Winston, New York.

Peebles, T. C.
1981 *A Class II Cultural Resource Inventory of the Eastern Powder River Basin*. Final Report. Metcalf-Zier Archaeologists, Eagle, Colorado. Submitted to the Casper District, Wyoming Bureau of Land Management.

Pelzer, L.
1936 *The Cattleman's Frontier*. Arthur H. Clark, Glendale, California.

Penny, D. M., and T. K. Larson
1992 *Results of the 1991 Archaeological Testing at the Central Barracks and Granary, Fort Abraham Lincoln*. Draft. Larson-Tibesar Associates, Inc., Laramie. Submitted to the Fort Abraham Lincoln Foundation, Bismarck.

Penny, D. M., T. K. Larson, K. H. Dueholm, K. P. Schweigert, and P. H. Sanders
1987 *A Cultural Resource Inventory of the Right Bank of Lake Oahe in Morton and Sioux Counties, North Dakota*. Larson-Tibesar Associates, Laramie. Submitted to the U.S. Army Corps of Engineers, Omaha District.

Penny, D. M., T. K. Larson, W. L. Tibesar, and K. H. Dueholm
1991 *Evaluative Archeological Excavations at Four Sites along the Right Bank of Lake Francis Case, Lyman County, South Dakota*. Larson-Tibesar Associates, Laramie. Submitted to the U.S. Army Corps of Engineers, Omaha District.

Pepperl, R. E., and C. R. Falk
1986 *A Cultural Resource Survey of the East Shore of Lake Oahe, South Dakota, Final Report.* Division of Archaeological Research, Department of Anthropology, University of Nebraska. Submitted to U.S. Army Corps of Engineers, Omaha District.

Pettipas, L. F.
1982 A Reconsideration of Late Paleo-Indian (Plano) Prehistory. *Manitoba Archaeological Quarterly* 6(4):44-77.

Pettipas, L. F., and A. P. Buchner
1983 Paleo-Indian Prehistory of the Glacial Lake Agassiz Region in Southern Manitoba, 11,500 to 6500 B.P. In *Glacial Lake Agassiz*, edited by T. J. Teller and L. Clayton, pp. 421-451. Special Paper No. 26. Geological Association of Canada.

Pettyjohn, W. A.
1966 *Eocene Paleosol in the Northern Great Plains*. U. S. Geological Survey Professional Paper 550C.

Phillips, P. C.
1961 *The Fur Trade*. 2 vols. University of Oklahoma Press, Norman.

Picha, P. R.
1996 *Riviere A Jacque and the James River Dakota Rendezvous: An Exploratory Study of Dakota Sioux Ethnohistory*. Unpublished Master's thesis, Department of Anthropology, University of Missouri, Columbia.

Picha, P. R., and M. L. Gregg
1987 Chipped Stone Flaking Debris from the Naze Site. In *Archeological Excavation at the Naze Site (32SN246)*, edited by M. L. Gregg, pp. 184-230. Department of Anthropology, University of North Dakota, Grand Forks. Submitted to U.S. Bureau of Reclamation, Billings, MT.
1991 *Test Excavations in 1990 at the Horner-Kane Site (32RY77), Grahams Island State Park, North Dakota.* Department of Anthropology, University of North Dakota, Grand Forks. Submitted to U.S. Bureau of Reclamation, Bismarck, ND.
1993 Chronostratigraphy of Upper James River Floodplain Sediments: Implications for Southeastern North Dakota Archaeology. *Geoarchaeology* 8:203-215.

Polk, M. R.
1979 *Bison Jump Sites in the Northwestern Plains of North America: A Locational Analysis*. Thesis, Department of Anthropology, Michigan State University.

Pollard, A. H., F. Yusuf, and G. N. Pollard
1981 *Demographic Techniques,* (2nd ed.) Pergamon, New York.

Porter, J. W.
1962 Notes on Four Lithic Types Found in Archaeological Sites Near Mobridge, South Dakota. *Plains Anthropologist* 7:267-269.

Powell, J. F., and G. D. Steele
1994 Diet and Health of Paleoindians: An Examination of Early Holocene Human Dental Remains. In *Paleonutrition: The Diet and Health of Prehistoric Americans*, edited by K. D. Sobolik, pp. 178-194. Occasional Paper No. 22. Center for Archeological Investigations, Southern Illinois University, Carbondale.

Radle, N. J.
1981 *Vegetation History and Lake-Level Changes at a Saline Lake in Northeastern South Dakota*. Unpublished Master's thesis, University of Minnesota, Minneapolis.

Ramenofsky, A. F.
1987 *Vectors of Death: The Archaeology of European Contact*. University of New Mexico Press, Albuquerque.

Randall, A. G.
1960 Catalog of Formation Names for the Overthrust Belt and Vicinity, Western Wyoming. Wyoming Geological Association, Fifteenth Annual Field Conference *Guidebook*:169-177.

Rapson, D. J.
1990 *Pattern and Process in Intrasite Spatial Analysis: Site Structural and Faunal Research at the Bugas-Holding Site*. Unpublished Ph.D. dissertation, Department of Anthropology, University of New Mexico, Albuquerque.

Ready, T.
1979 Cambria Phase. In *A Handbook of Minnesota Prehistoric Ceramics*, edited by S. F. Anfinson, pp. 51-65. Occasional Publications in Minnesota Anthropology No. 5. Minnesota Archaeological Society, St. Paul.

Reeves, B. O. K.
1970 *Culture Change in the Northern Plains: 1000 B.C.-A.D.1000.* Unpublished dissertation, Department of Archaeology, University of Calgary.
1973 The Concept of an Altithermal Cultural Hiatus in Northern Plains Prehistory. American Anthropologist 75:1221-1253.
1978 Head-Smashed-In: 5500 Years of Bison Jumping in the Alberta Plains. In *Bison Procurement and Utilization: A Symposium*, edited

by L. B. Davis and M. Wilson, pp. 151-174. Plains Anthropologist Memoir 14.

1983 *Culture Change in the Northern Plains: 1000 B.C.-A.D. 1000*. Occasional Paper 20. Archeological Survey of Alberta, Edmonton.

1988 Prom Napi's World: Avonlea in Perspectife. In *Avonlea Yesterday and Today: Archaeology and Prehistory*, edited by L. B. Davis, pp. 311-313. Saskatchean Archaeologial Society.

1990 Communal Bison Hunters of the Northern Plains. In *Hunters of the Recent Past*, edited by L. B. Davis and B. O. K. Reeves, pp. 168-194. Unwin Hyman, London.

Regan, A. B.

1934 Some Notes on the History of the Uintah Basin in Northeastern Utah to 1850. *Proceedings, Utah Academy of Science, Arts, and Letters* 11:55-64.

Reher, C. A.

1971 *A Survey of Ceramic Sites in Southeastern Wyoming*. Unpublished Master's thesis, University of Wyoming, Laramie.

1974 Population Study of the Casper Site Bison. In *The Casper Site: A Hell Gap Bison Kill on the High Plains*, edited by G. C. Frison, pp. 113-124. Academic Press, New York.

1979 Western Powder River Survey. Manuscript on file, Office of Wyoming State Archaeologist, University of Wyoming, Laramie.

1983 Analysis of Spatial Structure in Stone Circle Sites. In *From Microcosm to Macrocosm: Advances in Tipi Ring Investigation and Interpretation*, edited by L. B. Davis, pp. 193-222. Plains Anthropologist Memoir 19.

1987 *Documentation and Evaluation of the Muddy Creek Archaeological Site Complex*. Report. Submitted to Bureau of Land Management, Rawlins District, Wyoming. Ms. on file, Department of Anthropology, University of Wyoming.

Reher, C. A., and G. C. Frison

1980 *The Vore Site, 48CK302: A Stratified Buffalo Jump in the Wyoming Black Hills*. Plains Anthropologist Memoir 16.

Reher, C. A., G. M. Zeimens, and G. C. Frison

1985 The Cordero Site 48CA75: A Middle Plains Archaic Bison Processing Station in the Central Powder River Basin. In *McKean/Middle Plains Archaic: Current Research*, edited by M. Kornfeld and L. C. Todd. Occasional Papers on Wyoming Archaeology No. 4. Wyoming Recreation Commission, Cheyenne.

Reidel, D. W.

1969 Geology of the Tepee Trail Formation, Badwater area, Fremont and Natrona Counties, Wyoming. Wyoming Geological Association, Twenty-first Annual Field *Guidebook*:39-42.

Reiten, J.

1983 *Quaternary Geology of the Knife River Indian Villages National Historic Site*. Unpublished Master's thesis, Department of Geology, University of North Dakota.

Renaud, E. B.

1936 Pictographs and Petroglyphs of the High Western Plains. *Archaeological Survey of the High Western Plains, Eighth Report*. Department of Anthropology, University of Denver.

Richtsmeier, J. T.

1980 *Precipitation, Temperature, and Maize Agriculture: Implications for Prehistoric Populations in the Middle Missouri Subarea, A.D. 900-1675*. Unpublished Master's thesis, Department of Anthropology, University of Nebraska, Lincoln.

Riegel, R. E.

1926 *The Story of Western Railroads*. MacMillan, New York.

Ritterbush, L. W.

1991 *The Fur Trade of Northeastern North Dakota: The 1990 Fur Trade Sites Project*. Department of Anthropology, University of North Dakota, Grand Forks. Submitted to Archeology and Historic Preservation Division, State Historical Society of North Dakota, Bismarck.

Ritzma, H. R.

1965 Fossil Soil at the Base of Paleocene Rocks, Southern Rock Springs Uplift, Wyoming. Wyoming Geological Association, Nineteenth Annual Field Conference *Guidebook*:136-139.

Roberts, F. H. H.

1935 A Folsom Complex: A Preliminary Report on Investigations at the Lindenmeier Site in Northern Colorado. *Smithsonian Miscellaneous Collections* 94:1-35.

1943 A New Site. *American Antiquity* 8:100.

Robinson, D.

1966 *History of North Dakota*. University of Nebraska Press, Lincoln.

1974 *A History of the Dakota or Sioux Indians*. Reprinted. Ross and Haines, Minneapolis.

Rogers, J. D.

1990 *Objects of Change: The Archeology and History of Arikara Contact with the Europeans*. Smithsonian Institution Press, Washington, D.C.

Roll, T. E.

1978 *Tiber Reservoir, Montana: 1974*. Report. Archaeological Survey. Submitted to Billings Office, USDI Bureau of Reclamation.

1982 *Kootenai Canyon Archaeology: The 1979 LAURD Project Final Mitigation Report*, edited by T. E. Roll. Report. Department of Sociology, Montana State University. Submitted to Seattle District, U.S. Army Corps of Engineers.

1988a Personal communication by letter. Montana State University, Bozeman.

1988b Focus on a Phase: Expanded Geographical Distribution and Resultant Taxonomic Implications for Avonlea. In *Avonlea Yesterday and Today: Archaeology and Prehistory*, edited by L. B. Davis, pp. 237-250. Saskatchewan Archaeological Society, Saskatoon.

1992 *Ulm Pishkun 24CA1012, 1991 Archaeology: A Preliminary Brief of Excavation Results, May 18-June 8, 1992*. Report. Submitted to Montana Department of Fish, Wildlife and Parks, Helena.

Roll, T. E., and K. Deaver

1978 *The Bootlegger Trail Site: A Late Prehistoric Spring Bison Kill*. Report. Submitted to USDI Bureau of Reclamation, Billings, Montana Office.

Rollans, M., O. Klimko, P. McKeand, and M. Greene

1992 *The Ratigan Site, DhMs-10*. Western Heritage Services, Saskatoon.

Rollins, G. W.

1979 *The Struggle of the Cattleman, Sheepman, and Settler for Control of Lands in Wyoming, 1867-1910*. Arno Press, New York.

Root, M. J.

1983 The Wounded Knee Site, 32EM21. In *Archeology of the Northern Border Pipeline, North Dakota: Test Excavations*, edited by M. J. Root and M. L. Gregg, pp. 944-1002. Department of Anthropology, University of North Dakota, Grand Forks. Submitted to the Northern Border Pipeline Company, Omaha, Nebraska.

Root, M. J., and M. L. Gregg (editors)

1983a *Archeology of the Northern Border Pipeline, North Dakota: Survey and Background Information* (2 parts). Department of Anthropology, University of North Dakota, Grand Forks. Submitted to the Northern Border Pipeline Company, Omaha, Nebraska.

1983b *Archeology of the Northern Border Pipeline, North Dakota: Test Excavations* (3 parts). Department of Anthropology, University of North Dakota, Grand Forks. Submitted to the Northern Border Pipeline Company, Omaha, Nebraska.

Rose, J. C., M. Kay, B. A. Burnett, and E. B. Riddick Jr.

1983 *Analysis of Human Osteological Remains, Multi-County Areas, North Dakota.* Report. Department of Anthropology, University of Arkansas, Fayetteville. Submitted to U.S. Army Corps of Engineers, Omaha District.

Rose, J. C., M. K. Marks, and M. Kay
1984 *Analysis of Human Osteological Remains from Multi-County Areas, South Dakota.* Report. Department of Anthropology, University of Arkansas, Fayetteville. Submitted to U.S. Army Corps of Engineers, Omaha District.
Rothrock, E. P.
1943 *A Geology of South Dakota: Part I, the Surface*. Bulletin No. 13. South Dakota Geological Survey, Rapid City.
Royall, P. D., P. A. Delcourt, and H. R. Delcourt
1991 Late Quaternary Paleoecology and Paleoenvironments of the Central Mississippi Alluvial Valley. *Geological Society of America Bulletin* 103:157-170.
Ruebelmann, G. N.
1983 An Overview of the Archaeology and Prehistory of the Lewistown BLM District, Montana. *Archaeology in Montana* 34(3).
1988 The Henry Smith Site: An Avonlea Bison Procurement and Ceremonial Complex in Northern Montana. In *Avonlea Yesterday and Today: Archaeology and Prehistory*, edited by L. B. Davis, pp. 191-202. Saskatchewan Archaeological Society, Saskatoon.
Ruhe, R. V.
1970 Soils, Paleosols, and Environment. In *Pleistocene and Recent Environments of the Central Great Plains*, edited by W. Dort, Jr., and J. K. Jones, Jr., pp. 37-52. University of Kansas Press, Lawrence.
Running, G. L.
1995 Archaeological Geology of the Rustad Quarry Site (32RI775): An Early Archaic Site in Southeastern North Dakota. *Geoarchaeology* 10(3):183-204.
Ruple, S. D.
1984 *Analysis of Artifacts from a Test Excavation at the Site of Fort Sully I (39HU52), Hughes County, South Dakota*. Department of Anthropology, University of Tennessee, Knoxville. Submitted to the U.S. Army Corps of Engineers, Omaha District.
Russ, J., M. Hyman, H. J. Shafer, and M. Rowe
1990 Radiocarbon Dating of Prehistoric Rock Paintings by Selective Oxidation of Organic Carbon. *Nature* 348:710-711.
1991 ^{14}C Dating of Ancient Rock Art: A New Application of Plasma Chemistry. *Plasma Chemistry and Plasma Processes* 11:515-527.
Russell, O.
1921 *Journal of a Trapper*. Syms-York, Boise, Idaho.
Sabo III, G., A. M. Early, J. C. Rose, B. A. Burnett, L. Vogele, Jr., and J. P. Harcourt
1988 *Human Adaptation in the Ozark and Ouachita Mountains*. Research Series No. 31. Arkansas Archeological Survey, Fayetteville.
Sanders, P. H., T. K. Larson, M. L. McFaul, L. S. Cummings, S. C. Mulholland, G. Rapp, Jr., and L. Granthum
1988 *Results of the 1987 Archeological Investigations at the Travis 2 Site, 39WW15, Walworth County, South Dakota*. Larson-Tibesar Associates, Laramie. Submitted to the U.S. Army Corps of Engineers, Omaha District.
Sanders, P. H., D. M. Penny, T. K. Larson, M. L. McFaul, and K. H. Dueholm
1988 *The 1986 Cultural Resource Inventory of Portions of Lake Oahe, Corson and Dewey Counties, South Dakota*. Larson-Tibesar Associates, Laramie. Submitted to the U.S. Army Corps of Engineers, Omaha District.
Sanders, P. H., D. M. Penny, M. L. McFaul, K. H. Dueholm, K. P. Schweigert, and T. K. Larson
1987 *A Cultural Resource Inventory of Portions of Lake Oahe, Corson County, South Dakota*. Larson-Tibesar Associates, Laramie. Submitted to the U.S. Army Corps of Engineers, Omaha District.
Sanders, T. N.
1990 *Adams: The Manufacturing of Flaked Stone Tools at a Paleoindian Site in Western Kentucky*. Monographs in Archaeology. Persimmon Press, Buffalo, New York.
Sandoval, J. H.
1986 *Historic Ranches of Wyoming*. University of Nebraska Press, Lincoln.
Saul, J. M.
1969 Study of Spanish Diggings, Aboriginal Flint Quarries of Southeastern Wyoming. National Geographic Research Reports, 1964 Projects, pp. 183-199.
Scheans, D. J.
1957 *The Archeology of the Battle-Procupine Creek Area, Sioux County, North Dakota*. State Historical Society of North Dakota, Bismarck. Ms. on file, National Park Service, Midwest Archeological Center, Lincoln.
Scheiber, L. L.
1994 A Probable Early Nineteenth Century Crow Burial: the Pitchfork Rockshelter Reexamined. *Plains Anthropologist* 39(147):37-51.
Schell, Herbert S.
1975 *History of South Dakota*. (3rd ed.) University of Nebraska Press, Lincoln.
Schlesier, K. H.
1987 *The Wolves of Heaven: Cheyenne Shamanism, Ceremonies, and Prehistoric Origins*. University of Oklahoma Press, Norman.
Schneider, F. E.
1975 *The Results of Archaeological Investigations at the Moe Site, 32MN101, North Dakota*. Department of Anthropology, University of North Dakota, Grand Forks. Submitted to the National Park Service, Midwest Archeological Center, Lincoln.
1976 *Archaeological Investigations in the Proposed Lonetree Reservoir*, *Garrison Diversion Project*, *North Dakota*: *1974 Investigations* (Part 1). Department of Anthropology and Archaeology, University of North Dakota, Grand Forks. Submitted to U.S. Bureau of Reclamation, Denver.
1982a Sprenger: A Tipi Ring Site in Central North Dakota. In *Pathways to Plains Prehistory*, edited by D. G. Wyckoff and J. L. Hofman, pp. 175-198. Memoir No. 3. Oklahoma Anthropological Society.
1982b A Preliminary Investigation of Paleo-Indian Cultures in North Dakota. *Manitoba Archaeological Quarterly* 6:16-43.
1982c A Model of Prehistoric Cultural Developments in the James River Valley of North Dakota. *Journal of the North Dakota Archaeological Association* 1:113-133.
1983 The Sharbono Site, Devils Lake. *Newsletter of the North Dakota Archaeological Association* 4(2):7-20.
1988 Sharbono Site Test Excavations: 1986. Ms. on file, Department of Anthropology, University of North Dakota, Grand Forks.
Schneider, F. E., and J. Kinney
1978 Evans: A Multi-Component Site in Northwestern North Dakota. *Archaeology in Montana* 19(1 and 2):1-39.
Schneider, F. E., and P. Treat
1974 *Archaeological Excavations at the Sprenger Tipi Ring Site, 32SH205, Sheridan County, North Dakota*. Report. Department of Anthropology and Archaeology, University of North Dakota, Grand Forks. Submitted to U.S. Bureau of Reclamation, Denver.
Schuster, H. H.
1987 Tribal Identification of Wyoming Rock Art: Some Problematic Considerations. *Archaeology in Montana* 28(2):25-43.
Schwab, D.
1987 *A Spatial Analysis of the Ghost Cave (24YL2) Archaeological Assemblage*. Thesis, Department of Anthropology, University of Montana, Missoula.
Science Applications and Overland Archeology
1982 *A Cultural Resources Inventory of Eastern Portions of Lake Sakakawea, North Dakota (Mercer and McLean Counties)*. Science Applications, Inc., Golden, Colorado, and Overland Archeology, Inc., Boulder, Colorado. Submitted to the U.S. Army Corps of Engineers, Omaha District.

Scoggin, W. E.
1978 The Sand Creek Burial from Central Wyoming. *The Wyoming Archaeologist* 21(3):10-20.

Scott, D. D.
1989 *Archaeological Perspectives on the Battle of the Little Bighorn*. University of Oklahoma Press, Norman.

Scott, D. D., and R. A. Fox
1987 *Archeological Insights into the Custer Battle: An Assessment of the 1984 Field Season*. University of Oklahoma Press, Norman.

Scott, D. D., R. A. Fox, Jr., M. A. Connor, and D. Harmon
1989 *Archaeological Perspectives on the Battle of the Little Bighorn*. University of Oklahoma Press, Norman.

Scott, G. T., and L. L. Loendorf
1976 *Karlstad Ossuary 21MA10.* University of North Dakota, Grand Forks.

Scott, K. W., and M. Wilson
1984 Dead Indian Creek Local Fauna. In *The Dead Indian Creek Site: An Archaic Occupation in the Absaroka Mountains of Northwestern Wyoming*, edited by G. C. Frison and D. N. Walker. *The Wyoming Archaeologist* 27(1-2):51-62.

Scott-Cummings, L.
1996 Paleoenvironmental Interpretations for the Mill Iron Site: Stratigraphic Pollen and Phytolith Analysis. In *The Mill Iron Site*, edited by G. Frison, pp. 177-193. University of New Mexico Press, Albuquerque.

SDGS
1971a *Major Physiographic Divisions of South Dakota*. Educational Series Map No. 4. South Dakota Geological Survey, Rapid City.
1971b *Generalized Glacial Map of South Dakota*. Educational Series Map No. 2. South Dakota Geological Survey, Rapid City.

Secoy, F. R.
1953 *Changing Military Patterns on the Great Plains*. Monograph No. 21. The American Ethnological Society. University of Washington Press, Seattle.

Secrist, K.
1960 *Pictographs in Central Montana* (Pt I). Anthropology and Sociology Papers No. 20. University of Montana.

Seeman, M. F.
1994 Intercluster Lithic Patterning at Nobles Pond: A Case for "Disembedded" Procurement Among Early Paleoindian Societies. *American Antiquity* 59(2):273-288.

Sellards, E. H., G. L. Evans, and G. E. Meade
1947 Fossil Bison and Associated Artifacts from Plainview, Texas, with Description of Artifacts by Alex D. Krieger. *Geological Society of America Bulletin* 58:927-954.

Semken, H. A., Jr., and C. R. Falk
1987 Late Pleistocene/Holocene Mammalian Faunas and Environmental Changes on the Northern Plains of the United States. In *Late Quaternary Mammalian Biogeography and Environments of the Great Plains and Prairies,* edited by R. W. Graham, H. A. Semken, Jr., and M. A. Graham, pp. 176-313. Scientific Papers Vol. 22. Illinois State Museum, Springfield.

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

Sharrock, S. R. (editor)
1974 *Collected Papers in Salvage Anthropology, 1971-72.* University of Montana Contributions to Anthropology No. 4.

Sharrock, S. R., and J. D. Keyser
1974 Culture History of the Missouri River from Fort Benton, Montana to the Garrison Reservoir, North Dakota: An Inventory of Prehistoric and Early Historic Sites. Unpublished Special Report. University of Montana Statewide Archaeological Survey, Missoula.

Shay, C. T.
1978 Bison Procurement on the Eastern Margin of the Plains: The Itasca Site. In *Bison Procurement and Utilization: A Symposium*, edited by L. B. Davis and M. Wilson, pp. 140-150. Plains Anthropologist Memoir 14.

Sheldon, R. P.
1955 Stratigraphy of the Phosphoria Formation in the Wyoming and Windriver Ranges, Wyoming. Wyoming Geological Association, Tenth Annual Field Conference *Guidebook*:64.
1956 Stratigraphy of the Phosphoria Formation in the Jackson Hole Region, Wyoming. Wyoming Geological Association, Eleventh Annual Field Conference *Guidebook*:66-69.

Shelford, V. E.
1963 *The Ecology of North America*. University of Illinois Press, Urbana.

Sheridan
1972 *Outline of Posts*. Old Army Press, Fort Collins, Colorado.

Sheridan, S. G., J. L. Mobley-Tanaka, D. P. Van Gerven, and W. L. Shields
1992 A Case of Late Prehistoric Mutilation on the Northwest Plains. *Plains Anthropologist* 37(141):289-298.

Shimkin, D. B.
1947 Wind River Shoshone Ethnogeography. *Anthropological Records* 5(4).

SHSND
1990 *The North Dakota Comprehensive Plan for Historic Preservation: Archeological Component*. Archeology and Historic Preservation Division, State Historical Society of North Dakota, Bismarck.

Shumate, M.
1950 *The Archaeology of the Vicinity of Great Falls, Montana*. Anthropology and Sociology Papers No. 2. University of Montana.
1960 *Pictographs in Central Montana (Pt. 2). Panels near Great Falls*. Anthropology and Sociology Papers No. 20. Montana State University.
1967 The Taft Hill Buffalo Jump. *Archaeology in Montana* 8(4):12-34.

Sigstad, J. S.
1973 *The Age and Distribution of Catlinite and Red Pipestone*. Unpublished Ph.D. dissertation, University of Missouri, Columbia. University Microfilms, Ann Arbor, MI.
1983 A Report of the Archaeological Investigations, Pipestone National Monument, 1965 and 1966. Reprinted. *The Minnesota Archaeologist* 42(1, 2). Originally published 1970, *Journal of the Iowa Archaeological Society* 17:1-51.

Sigstad, J. S., and J. K. Sigstad (editors)
1973 *Archaeological Field Notes of W. H. Over.* Research Bulletin No. 1. Office of the South Dakota State Archaeologist, South Dakota Archaeological Research Center, Rapid City.

Simmons, A. H., A. L. W. Stodder, D. D. Dykeman, and P. A. Hicks
1989 *Human Adaptations and Cultural Change in the Greater Southwest*. Research Series No. 32. Arkansas Archeological Survey, Fayetteville.

Simms, S. C.
1903 A Wheel-Shaped Stone Monument in Wyoming. *American Anthropologist* (n. s.) 5(1):1107-110.

Singler, C. R., and M. D. Picard
1979 Petrography of White River Group (Oligocene) in Northwest Nebraska and Adjacent Wyoming. *University of Wyoming Contributions to Geology* 18:1:51-67.

Smith, C. S.
1975 The Stricker Site. *Plains Anthropologist* 20:1-25.
1977 *The Talking Crow Site, a Multi-Component Earthlodge Village in the Great Bend Region, South Dakota*. Publications in Anthropology No. 9. University of Kansas, Lawrence.

Smith, C. S., and R. T. Grange Jr.
1958 *The Spain Site (39LM301), A Winter Village in Fort Randall Reservoir, South Dakota*. River Basin Surveys Papers No. 11. Bureau of American Ethnology, Bulletin 169. Smithsonian Institution, Washington, D.C.

Smith, C. S. and A. E. Johnson
1968 *The Two Teeth Site*. Publications in Salvage Archeology No. 8. Smithsonian Institution, River Basin Surveys, Lincoln, Nebraska.

Smith, G. H.
1960a *Fort Pierre II (39ST217), a Historic Trading Post in the Oahe Dam Area, South Dakota*. River Basin Surveys Papers No. 18. Bureau of American Ethnology, Bulletin 176. Smithsonian Institution, Washington, D.C.
1960b *Archeologial Investigations at the Site of Fort Stevenson (32ML1), Garrison Reservoir, North Dakota*. River Basin Surveys Papers No. 19. Bureau of American Ethnology, Bulletin 176. Smithsonian Institution, Washington, D.C.
1968 *Big Bend Historic Sites*. Publications in Salvage Archeology No. 9. Smithsonian Institution, River Basin Surveys, Lincoln.
1972 *Like-A-Fishhook Village and Fort Berthold, Garrison Reservoir, North Dakota*. Anthropological Papers 2. National Park Service, Washington D.C.
1980 *The Explorations of the La Verendryes in the Northern Plains, 1738-43*. Edited by W. R. Wood. University of Nebraksa Press, Lincoln.

Smith, G. H. and J. Ludwickson
1981 *Fort Manuel: The Archeology of an Upper Missouri Trading Post of 1812-1813*. Special Publication No. 7. South Dakota Archaeological Society, Vermillion.

Smith, H. I.
1906 The Data of the Archaeology of the Dakotas. *Collections of the State Historical Society of North Dakota* 1:74-78.

Smith, J. S.
1984 Historical Background, Lake Sharpe Area, South Dakota. In *Archeological Investigations within Federal Lands Located on the East Bank of the Lake Sharpe Project Area, South Dakota: 1978-1979 Final Report* (Vol. 3, Sec. N), edited by C. R. Falk. Division of Archeological Research, Department of Anthropology, University of Nebraska-Lincoln. Submitted to the U.S. Army Corps of Engineers, Omaha District.

Snodgrass, R. M.
1958 The Human Skeletal Remains from Pictograph and Ghost Caves, Montana. *University of Wyoming Publications* 22(2).
1965 The Skeleton from Thirty-Mile Mesa. Appendix in The Indian Village at Thirty-Mile Mesa, Montana by William T. Mulloy, pp. 18-20. *University of Wyoming Publications* 31(1):1-21.

Snortland, J. S.
1994 Northern Plains Woodland Mortuary Practices. In *Skeletal Biology in the Great Plains: Migration, Warfare, Health, and Subsistence*, edited by D. W. Owsley and R. L. Jantz, pp. 51-72. Smithsonian Institution Press, Washington, D.C.

Snortland, J. S., and K. N. Good
1987 The Archeological Component of the Devils Lake Burial Site (32RY100). Paper presented at the Forty-fifth Plains Conference, Columbia, MO.

Snortland, J. S., and F. E. Swenson
1992 Reassessment of the Devils Lake-Sourisford Complex. Paper presented at the Fiftieth Plains Conference, Lincoln, NE.

Snortland-Coles, J. S. (editor)
1985 *The Jamestown Mounds Project*. State Historical Society of North Dakota, Bismarck.

Snow, C. C., and J. Fitzpatrick
1989 Human Osteological Remains from the Battle of the Little Bighorn. Appendix in *Archaeological Perspectives on the Battle of the Little Bighorn*. by D. Scott, R. Fox, Jr., M. Connor, and D. Harmon, pp. 243-282. University of Oklahoma Press, Norman.

Soil Survey Staff
1975 *Soil Taxonomy*. Agriculture Handbook No. 436. Soil Conservation Service, U.S. Department of Agriculture, Washington, D.C.

Soister, P. E.
1967 *Geology of the Puddle Springs Quadrangle, Fremont County, Wyoming*. U. S. Geological Survey Bulletin 1242C.

Sollberger, J. B.
1985 A Technique for Folsom Fluting. *Lithic Technology* 14(1):41-50.

Sowers, T. C.
1941 *The Wyoming Archaeological Survey*. Federal Works Agency, Works Project Administration, State of Wyoming. University of Wyoming, Laramie.

Spaulding, A. C.
1956 *The Arzberger Site, Hughes County, South Dakota*. Occasional Contributions No. 16. Museum of Anthropology, University of Michigan, Ann Arbor.

Sperry, J. E.
1968 *The Shermer Site (32EM10)*. Plains Anthropologist Memoir 5.
1982 *The Havens Site (32EM1): 1967 and 1968 Excavations*. State Historical Society of North Dakota, Bismarck. Submitted to the National Park Service, Rocky Mountain Region, Denver.

Speth, J. D.
1983 *Bison Kills and Bone Counts*. University of Chicago Press, Chicago.

Spiss, P. B.
1968 Old Copper Artifacts from North Dakota. *Wisconsin Archeologist* 49:125-126.

Stafford, M. D.
1990 *The Powars II Site 48PL330: A Paleoindian Red Ochre Mine in Eastern Wyoming*. Unpublished Master's thesis, Department of Anthropology, University of Wyoming, Laramie.

Stafford, T. W., Jr.
1994 Accelerator C-14 Dating of Human Fossil Skeletons: Assessing Accuracy and Results on New World Specimens. In *Method and Theory for Investigating the Peopling of the Americas*, edited by R. Bonnichsen and D. G. Steele, pp. 45-56. Center for the Study of the First Americans, Corvallis.

Stafford, T. W., Jr., P. E. Hare, L. Currie, A. J. T. Jull, and D. J. Donahue.
1991 Accelerator Radiocarbon Dating at the Molecular Level. *Journal of Archaeological Science* 18:35-72.

Stanfill, A. L.
1988 Avonlea Projectile Point Manufacture: A Testable Model. In *Avonlea Yesterday and Today: Archaeology and Prehistory*, edited by L. B. Davis, pp. 252-256. Saskatchewn Archaeological Society.

Stanford, D. J.
1978 The Jones-Miller Site: An Example of Hell Gap Bison Procurement Strategy. In *Bison Procurement and Utilization: A Symposium*, edited by L. B. Davis and M. Wilson, pp. 90-97. Plains Anthropologist Memoir 14.
1991 Clovis Origins and Adaptations: An Introductory Perspective. In *Clovis Origins and Adaptations*, edited by R. Bonnichsen and K. Turnmire, pp. 1-13. The Center for the Study of the First Americans, Oregon State University, Corvallis.

Stanley, D. G.
1989 *Phase 1 Reconnaissance Survey of Selected Tracts Within the Blood Run Locality, Lyon County, Iowa*. Bear Creek Archaeology, Decorah, IA. Submitted to Iowa Bureau of Historic Preservation, Ames.

Steege, L. C.
1960 A Probable Middle Period Burial in Wyoming. *Plains Anthropologist* 5(10):82-84.

Steele, D. G.

1994 The Paleobiology of the Wilson-Leonard Female. Paper presented at the 52nd Annual Plains Anthropological Conference, Lubbock, Texas.

Steele, D. G., and J. F. Powell

1992 Peopling of the Americas: Paleobiological Evidence. *Human Biology* 64(3):303-336.

1993 Paleobiology of the First Americans. *Evolutionary Anthropology* 2(4):138-146.

1994 Paleobiological Evidence of the Peopling of the Americas: A Morphometric View. In *Method and Theory for Investigating the Peopling of the Americas*, edited by R. Bonnichsen and D. G. Steele, pp. 141-163. Center for the Study of the First Americans, Corvallis.

Steele, J. P., J. B. Gregg, and A. M. Holzhueter

1965 Paleopathology in the Dakotas. *South Dakota Journal of Medicine* 18:17-29.

Steere, P. L.

1980 *Preliminary Report: Sly Bison Site Excavation*. Cultural Resources Division, Mineral Research Center, Montana Tech Foundation, Butte.

Stegner, W.

1964 *The Gathering of Zion: The Story of the Morman Trail*. McGraw-Hill, New York.

Steinacher, T. L.

1981 *Archeological Survey and Investigations of Selected Federal Lands on the West Bank of the Lake Sharpe/Big Bend Project Area, South Dakota: 1980*. Division of Archeological Research, Department of Anthropology, University of Nebraska-Lincoln. Submitted to the U.S. Army Corps of Engineers, Omaha District.

1984a Archeological Investigations at the Diamond-J Site (39HU89), 1978-1979. In *Archeological Investigations Within Federal Lands Located on the East Bank of the Lake Sharpe Project Area, South Dakota: 1978-1979 Final Report*, edited by C. R. Falk. Division of Archeological Research, Department of Anthropology, University of Nebraska, Lincoln. Submitted to the U.S. Army Corps of Engineers, Omaha District.

1984b Archeological Investigations at the Rousseau Site (39HU102), 1978-1979. In *Archeological Investigations within Federal Lands Located on the East Bank of the Lake Sharpe Project Area, South Dakota: 1978-1979 Final Report*, edited by C. R. Falk. Division of Archeological Research, Department of Anthropology, University of Nebraska-Lincoln. Submitted to the U.S. Army Corps of Engineers, Omaha District.

1984c Archeological Investigations at the Whistling Elk Site (39HU242), 1978-1979. In *Archeological Investigations within Federal Lands Located on the East Bank of the Lake Sharpe Project Area, South Dakota: 1978-1979 Final Report*, edited by Carl R. Falk. Division of Archeological Research, Department of Anthropology, University of Nebraska, Lincoln. Submitted to the U.S. Army Corps of Engineers, Omaha District.

1990 *Settlement and Ceramic Variability at the Sommers Site (39ST56) Stanley County, South Dakota*. Unpublished Ph.D. dissertation, Department of Anthropology, University of Oklahoma, Norman.

Steinacher, T. L., and D. L. Toom

1985 *A Proposed National Register of Historic Places, Multiple Resource Nomination, for the Historic Resources of the Big Bend Area, South Dakota. Partial Inventory: Prehistoric and Historic Archeological Sites*. Revised 1980 nomination statement. Division of Archeological Research, Department of Anthropology, University of Nebraska-Lincoln. Submitted to the U.S. Army Corps of Engineers, Omaha District.

Steinbock, R. T.

1976 *Paleopathological Diagnosis and Interpretation.* Charles Thomas, Springfield.

Steinbring, J.

1970 Evidences of Old Copper in a Northern Transitional Zone. In *Ten Thousand Years*, edited by W. M. Hlady, pp. 47-75. Manitoba Archaeological Society, Winnipeg.

1974 The Preceramic Archaeology of Northern Minnesota. In *Aspects of Upper Great Lakes Anthropology; Papers in Honor of Lloyd A. Wilford*, edited by E. Johnson, pp. 64-73. Minnesota Historical Society, St. Paul.

1980 *An Introduction to Archaeology on the Winnipeg River*. Papers in Manitoba Archaeology, Miscellaneous Paper 9. Manitoba Department of Cultural Affairs and Historical Resources, Historic Resources Branch, Winnipeg.

Stephenson, R. L.

1954 Taxonomy and Chronology in the Central Plains-Middle Missouri River Area. *Plains Anthropologist* 1:15-21.

1962 The Mouat Cliff Burials (24TE401). *Plains Anthropologist* 7(16):94.

1969 Blue Blanket Island (39WW9), An Historic Contact Site in the Oahe Reservoir, near Mobridge, South Dakota. *Plains Anthropologist* 14:1-31.

1971 The Potts Village Site (39CO19), Oahe Reservoir, North-Central South Dakota. *The Missouri Archaeologist* 33.

Stevens, O. A.

1963 *Handbook of North Dakota Plants*. North Dakota Institute for Regional Studies, Fargo, ND.

Steward, J. H.

1938 *Basin-Plateau Aboriginal Sociopolitical Groups*. Bulletin No. 120. Bureau of American Ethnology.

Stewart, J. J.

1989 Distribution Analysis of a Petroglyph Motif from Legend Rock Petroglyph Site (48HO4), Hot Springs County, Wyoming. In *Legend Rock Petroglyph Site (48HO4), Wyoming: 1988 Archaeological Investigations*, edited by D. N. Walker and J. E. Francis. Office of the Wyoming State Archaeologist, Laramie. Submitted to the Wyoming Recreation Commission, Cheyenne.

Stewart, T. D.

1954 The Lower Level Human Skull. Appendix in The McKean Site in Northeastern Wyoming by W. T. Mulloy. *Southwestern Journal of Anthropology* 10:432-468.

1964 The McKean Site in Northeastern Wyoming, Appendix: The Lower Level Human Skull. *The Wyoming Archaeologist* 7(1):16-41.

Stoltman, J. B.

1973 *The Laurel Culture in Minnesota*. Minnesota Prehistoric Archaeology Series No. 8. Minnesota Historical Society, St. Paul.

Storti, C.

1991 *Incident at Bitter Creek: Store of the Rock Springs Massacre*. Iowa State University Press, Ames.

Story, D. A., J. A. Guy, B. A. Burnett, M. D. Freeman, J. C. Rose, D. G. Steele, B. W. Olive, and K. J. Reinhard

1990 *The Archeology and Bioarcheology of the Gulf Coastal Plain*. 2 vols. Research Series No. 38. Arkansas Archeological Survey, Fayetteville.

Stout, Howard R., William F. Freymiller, Francis J. Glatt, Robert D. Heil, Monte C. McVay, James H. Thiele, and Paul K. Weiser

1974 *Soil Survey of Burleigh County, North Dakota*. U.S. Department of Agriculture, Soil Conservation Service, Washington, D.C.

Stoutamire, J. W.

1973 The Upper Sanger Site (32OL12), North Dakota. *Plains Anthropologist* 18(61):139-252.

Strong, W. D.

1933 Studying the Arikara and Their Neighbors on the Upper Missouri. In *Explorations and Fieldwork of the Smithsonian Institution in 1932*, pp. 73-76. Smithsonian Institution, Washington, D.C.

1935 An Introduction to Nebraska Archaeology. *Smithsonian Institution Miscellaneous Collections* 39(10).

1940 From History to Prehistory on the Northern Great Plains. In *Essays in Historical Anthropology in North America*, pp. 353-394. Miscellaneous Collections 100. Smithsonian Institution, Washington, D.C.

1941 Arikara and Cheyenne Earth Lodge Sites in North and South Dakota. *North Dakota Historical Quarterly* 8(3):157-166.

Struever, S., and G. L. Houart

1972 An Analysis of the Hopewell Interaction Sphere. In *Social Exchange and Interaction*, edited by E. N. Wilmsen, pp. 47-79. Anthropological Papers 46. University of Michigan, Museum of Anthropology, Ann Arbor.

Stuart, R.

1935 *The Discovery of the Oregon Trail*, edited by P. A. Rollins. Charles Scribner's Sons, New York.

Stucky, R. K.

1977 Archaeological Survey of Sand Wash Basin, Northwestern Colorado. Unpublished Master's thesis, Department of Anthropology, University of Colorado, Boulder.

Sunder, J. E.

1965 *The Fur Trade on the Upper Missouri, 1840-1865.* University of Oklahoma Press, Norman.

Sundstrom, L.

1984 *Rock Art of Western South Dakota and the Southern Black Hills*. South Dakota Archaeological Society Publication No. 9. Augustana College, Sioux Falls, South Dakota.

1987 Vertical Series Rock Art and its Relation to Protohistoric Plains Indian Symbolism. *Archaeology in Montana* 28(2):3-17.

1989 *Culture History of the Black Hills with Reference to Adjacent Areas of the Northern Great Plains*. Reprints in Anthropology No. 40. J. and L. Reprint Company, Lincoln, Nebraska.

Surdam, R. C., and H. P. Eugster

1976 Mineral Reactions in the Sedimentary Deposits of the Magadi Region, Kenya. *Geological Society of America Bulletin* 87:1739-1752.

Swenson, F. E.

1987 Prehistoric Ceramics from the Naze Site. In *Archeological Excavation at the Naze Site (32SN246)*, edited by M. L. Gregg, pp. 123-183. Department of Anthropology, University of North Dakota, Grand Forks. Submitted to U.S. Bureau of Reclamation, Billings, MT.

Swenson, F. E., and M. L. Gregg

1988 A Devils Lake-Sourisford Mortuary Vessel from Southeastern North Dakota. *Journal of the North Dakota Archaeological Association* 3:1-15.

Syms, L.

1977 *Cultural Ecology and Ecological Dynamics of the Ceramic Period in Southwestern Manitoba*. Plains Anthropologist Memoir 12.

1979 The Devils Lake-Sourisford Burial Complex on the Northern Plains. *Plains Anthropologist* 24:283-308.

1980 *A Description and Analysis of the Nash Random Survey Sample, Southwestern Manitoba, 1972-1973: A Compendium.* Brandon University, Southman Human Adaptation and Paleoenvironmental Explorations, Data Log 1. Brandon, Manitoba.

1982 The Arvilla Burial Complex: A Re-assessment. *Journal of the North Dakota Archaeological Association* 1:135-166.

1985 Fitting People into the Late Prehistory of the Northeastern Plains: A Need to Return to a Holistic Anthropological Approach. In *Archaeology, Ecology and Ethnohistory of the Prairie-Forest Border Zone of Minnesota and Manitoba*, edited by J. Spector and E. Johnson, pp. 73-107. J and L Reprint, Lincoln, NE.

Tanner, H. H. (editor)

1987 *Atlas of Great Lakes Indian History*. University of Oklahoma Press, Norman.

Taylor, D. C.

1971 *Preliminary Excavations at the Madison Buffalo Jump (24GA314).* Report. Submitted to Montana Department of Fish, Wildlife and Parks, Helena.

Taylor, D. C., C. G. Smith, E. A. Hedges, and J. D. Keyser

1974 *The Rattlesnake Burial (24MO1071).* Collected Papers in Salvage Anthropology, 1971-72. Contributions to Anthropology 4(3). University of Montana.

Teller, J. T., and L. Clayton

1983 An Introduction to Glacial Lake Agassiz. In *Glacial Lake Agassiz*, edited by J. T. Teller and L. Clayton, pp. 3-5. Special Paper No. 26. Geological Association of Canada.

Thiessen, T. D.

1975 The Bendish Site (32MO2), Morton County, North Dakota. Ms. on file, National Park Service, Midwest Archeological Center, Lincoln.

1976 *Middle Missouri Tradition Occupational Sequences for the Cannonball and Knife-Heart Regions*. Unpublished Master's thesis, Department of Anthropology, University of Nebraska, Lincoln.

1977 A Tentative Radiocarbon Chronology for the Middle Missouri Tradition. *Plains Anthropologist Memoir* 13:59-82.

Thiessen, T. D. (editor)

1993 *The Phase I Archeological Research Program for the Knife River Indian Villages National Historic Site* (4 parts). Occasional Studies in Anthropology No. 27, Midwest Archeological Center. U.S. Department of the Interior, National Park Service, Midwest Archeological Center, Lincoln.

Thomas, C.

1873 Ancient Mounds of Dakota. *U.S. Geological and Geographical Survey of the Territories*. Annual Report 6 (for 1872):655-658.

1891 *Catalogue of Prehistoric Works East of the Rocky Mountains*. Bulletin 12. Bureau of American Ethnology, Washington, D.C.

Thomas, D., and K. Ronnefeldt (editors)

1976 *People of the First Man: Life Among the Plains Indians in Their Final Days of Glory, the Firsthand Account of Price Maximilian's Expedition Up the Missouri River, 1833-34*. E. P. Dutton, New York.

Thompson, R. G.

1990 *The Archaeology of the Dahnke-Reinke Site (32CS29)*. University of Iowa. Submitted to State Historical Society of North Dakota, Bismarck.

Thornbury, W. D.

1965 *Regional Geomorphology of the United States*. John Wiley and Sons, New York.

Thornthwaite, C. W.

1941 *Atlas of Climatic Types in the United States, 1900-1939*. Miscellaneous Publication No. 421. U.S. Department of Agriculture, Washington, D.C.

Thwaites, R. G.

1906 E*arly Western Travels, 1748-1846,* Vol. 24. Arthur Clark, Cleveland.

Thwaites, R. G. (editor)

1966a *Travels in the Interior of America, in the Years 1809, 1810, and 1811*, by John Bradbury. Early Western Travels, Vol. 5. Reprinted. AMS Press, New York. Originally published 1904, Arthur P. Clark, Cleveland.

1966b Journal of a Voyage up the River Missouri, by H. M. Brackenridge. *Early Western Travels* 6:21-166. Reprinted. AMS Press, New York. Originally published 1904, Arthur P. Clark, Cleveland.

1966c *Travels in the Interior of North America, by Maximilian, Prince of Wied*. Translated by H. E. Lloyd. Early Western Travels, Vols. 22-24. Reprinted. AMS Press, New York. Originally published 1906, Arthur P. Clark, Cleveland.

1969 *Original Journals of the Lewis and Clark Expedition, 1804-1806* (8 vols.). Reprinted. AMS Press, New York. Originally published in 1904-1905, Dodd, Meade, and Company, New York.

Tibesar, W. L., P. H. Sanders, M. L. McFaul, and K. H. Dueholm

1986 *Evaluative Testing of Selected Sites along the Left Bank of Lake Francis Case, South Dakota*. Larson-Tibesar Associates, Laramie. Submitted to the U.S. Army Corps of Engineers, Omaha District.

Tiffany, J. A.

1983 An Overview of the Middle Missouri tradition. In *Prairie Archaeology: Papers in Honor of Davis A. Baerreis*, edited by G. E. Gibbon, pp. 87-107. Publications in Anthropology No. 3. University of Minnesota, Minneapolis.

1991a Models of Mississippian Culture History in the Western Prairie Peninsula: A Perspective from Iowa. In *Cahokia and the Hinterlands: Middle Mississippian Cultures of the Midwest*, edited by T. E. Emerson and R. B. Lewis, pp. 183-192. University of Illinois Press, Urbana.

1991b Modeling Mill Creek-Mississippian Interaction. In *New Perspectives on Cahokia: Views from the Periphery*, edited by J. B. Stoltman, pp. 319-347. Monographs in World Archaeology No. 2. Prehistory Press, Madison, Wisconsin.

Tigner-Wise, L. F.

1989 *Skeletal Analysis of a Mormon Pioneer Population from Salt Lake Valley, Utah*. Unpublished Master's thesis, Department of Anthropology, University of Wyoming.

Tipps, B. L. and A. R. Schroedl

1985 *The Riverton Rock Art Study, Fremont County, Wyoming*. P-III Associates, Salt Lake City, Utah. Submitted to USDI Bureau of Reclamation, Billings, Montana.

Tisdale, M. A.

1978 *Investigations at the Stott Site: A Review of Research From 1947 to 1977*. Papers in Manitoba Archaeology, Final Report 5. Manitoba Department of Tourism, Recreation and Cultural Affairs, Historic Resources Branch, Winnipeg.

Titmus, G. L., and J. C. Woods

1991 A Closer Look at Margin "Grinding" on Folsom and Clovis Points. *Journal of California and Great Basin Anthropology* 13(2):194-203.

Toom, D. L.

1979 *The Middle Missouri Villagers and the Early Fur Trade: Implications for Archeological Interpretation*. Unpublished Master's thesis, Department of Anthropology, University of Nebraska, Lincoln.

1984a Plains Woodland Period Mound Sites in the Lake Sharpe Area: East Bank. In *Archeological Investigations within Federal Lands Located on the East Bank of the Lake Sharpe Project Area, South Dakota: 1978-1979 Final Report* (Vol. 2, sec. E), edited by C. R. Falk. Division of Archeological Research, Department of Anthropology, University of Nebraska, Lincoln. Submitted to U. S. Army Corps of Engineers, Omaha District.

1984b Archeological Investigations at the Little Elk Site (9HU221), 1978-1979. In *Archeological Investigations within Federal Lands Located on the East Bank of the Lake Sharpe Project Area, South Dakota: 1978-1979 Final Report* (Vol. 2, sec. D), edited by C. R. Falk. Division of Archeological Research, Department of Anthropology, University of Nebraska, Lincoln. Submitted to U. S. Army Corps of Engineers, Omaha District.

1988 A Preliminary Statement on the Archaeology and Radiocarbon Dating of the Flaming Arrow Site (32ML4), McLean County, North Dakota. *Journal of the North Dakota Archaeological Association* 3:51-73.

1989 *Archeological Test Excavations at Three Sites in the Lake Sharpe Project Area, Lyman County, South Dakota, 1988*. Department of Anthropology, University of North Dakota, Grand Forks. Submitted to the U.S. Army Corps of Engineers, Omaha District.

1990a *Archeological Test Excavations at Eight Sites in the Lake Sharpe Project Area of Hughes, Lyman, and Stanley Counties, South Dakota, 1987*. Western Cultural Resource Management, Inc., Boulder, Colorado. Submitted to the U.S. Army Corps of Engineers, Omaha District.

1990b Little Sites, Small Pots, and Plains Village Task Groups: The Case of the Rattlesnake Keeper Site (39LM160). *South Dakota Archaeology* 14:1-23.

1991 *Archeological Excavations at the Travis 2 Site (39WW15), Walworth County, South Dakota, 1989*. Department of Anthropology, University of North Dakota, Grand Forks. Submitted to the U.S. Army Corps of Engineers, Omaha District.

1992a *Climate and Sedentism in the Middle Missouri Subarea of the Plains*. Unpublished Ph.D. dissertation, University of Colorado, Boulder. University Microfilms, Ann Arbor.

1992b *Archeological Reconnaissance and Test Excavations at the Little Pumpkin Site (39HU97), Hughes County, South Dakota, 1991*. Department of Anthropology, University of North Dakota, Grand Forks. Submitted to the South Dakota Department of Game, Fish, and Parks, Pierre.

1992c Early Village Formation in the Middle Missouri Subarea of the Plains. In *Research in Economic Anthropology, Supplement 6: Long-Term Subsistence Change in Prehistoric North America*, edited by D. R. Croes, R. A. Hawkins, and B. L. Isaac, pp. 131-191. JAI Press, Greenwich, CT.

1992d Radiocarbon Dating of the Western Initial Middle Missouri Variant: Some New Dates and a Critical Review of Old Dates. *Plains Anthropologist* 37:115-128.

n.d. Horner-Kane Site (32RY77) Archeological Excavations, Grahams Island State Park, Ramsey County, North Dakota, 1992 Field Season. Department of Anthropology, University of North Dakota, Grand Forks, in preparation. In preparation for the U.S. Bureau of Reclamation, Missouri-Souris Projects Office, Bismarck.

Toom, D. L., and J. A. Artz

1985 *An Archeological Survey of Selected Federal Lands on the West Bank of Lake Oahe, Oahe Dam Vicinity, Stanley County, South Dakota, 1984*. Department of Anthropology, University of North Dakota, Grand Forks. Submitted to the U.S. Army Corps of Engineers, Omaha District.

Toom, D. L., and M. L. Gregg (editors)

1983 *The Archeology of the Mondrian Tree Site (32MZ58), McKenzie County, North Dakota, Grand Forks* (3 vols.). Department of Anthropology, University of North Dakota, Grand Forks. Submitted to the Northern Border Pipeline Company, Omaha, Nebraska.

Toom, D. L., and P. R. Picha

1984 *An Archeological Survey of Selected Federal Lands on the West Bank of the Lake Sharpe/Big Bend Project Area, South Dakota, 1983*. Department of Anthropology, University of North Dakota, Grand Forks. Submitted to the U.S. Army Corps of Engineers, Omaha District.

Tratebas, A. M.

1978 Archaeological Surveys in the Black Hills National Forest, South Dakota, 1975-1977. Manuscript on file at the South Dakota Archaeological Research Center.

1979 *Archaeological Surveys in the Black Hills National Forest, South Dakota (1977-1978)*. Contract Investigations Series No. 5. South Dakota State Archaeological Research Center, Ft. Meade.

1981 Current Status of Research on the Mckean Complex in South Dakota. In *The Future of South Dakota's Past*, edited by L. J. Zimmerman and L. C. Steward, pp. 21-28. Special Publication No. 2. South Dakota Archaeological Society, Vermillion.

1986 *Black Hills Settlement Patterns: Based on a Functional Approach*. Ph.D. dissertation, Indiana University. University Microfilms International, Ann Arbor, Michigan.

1993 Cultural Continuity in Paleoindian and Archaic Petroglyphs. Paper presented at the 58th Annual Meeting of the Society for American Archaeology, St. Louis, Missouri.

Tratebas, A., and A. Johnson
1988 Three Avonlea Bison Kill Sites in the Milk River Drainage of Northeastern Montana. In *Avonlea Yesterday and Today: Archaeology and Prehistory*, edited by L. B. Davis, pp. 89-100. Saskatchewan Archaeological Society, Saskatoon.

Truesdale, J. A.
1994 The Wyoming Archeological Society Joseph Cramer Grant and the 1990 Archaeological Investigations at 48CR4001: The Espy-Cornwell Site, Carbon County, Wyoming. *The Wyoming Archaeologist* 38(1-2):19-21.

Truesdale, J. A., and G. W. Gill
1987 The Bridger Gap Burial from Southwestern Wyoming. *Plains Anthropologist* 32:17-28.
1994 The Mountain Meadow Ranch Burial from Southeastern Wyoming. *The Wyoming Archaeologist* 38(1-2):23-40.

Tucker, G. C., Jr., and B. L. Olson
1992 *The Figure Four Road Project: Data Recovery at Two Archaeological Sites on the Fort Berthold Indian Reservation, McKenzie and Dunn Counties, North Dakota*. Archaeology Department, Powers Elevation Company, Inc., Aurora, Colorado. Submitted to the Bureau of Indian Affairs, Aberdeen Area Office, Aberdeen, South Dakota.

Turek, S. L.
1984 *Orthopaedics: Principals and Their Application* (4th ed.). Lippincott, Philadelphia.

Turner, C. G.
1979 Dental Anthropological Indications of Agriculture Among the Jomon People of Central Japan. *American Journal of Physical Anthropology* 51(4):619-636.

Turney-High, H. H.
1937 *The Flathead Indians of Montana.* Memoirs of the American Anthropological Association, No. 48.

Ubelaker, D. H.
1994 An Overview of Great Plains Human Skeletal Biology. In *Skeletal Biology in the Great Plains: Migration, Warfare, Health, and Subsistence*, edited by D. W. Owsley and R. L. Jantz, pp. 391-395. Smithsonian Institution Press, Washington, D.C.

Upham, W.
1896 *The Glacial Lake Agassiz.* Monograph No. 25. United States Geological Survey.

U.S. Department of the Interior
1975 *Executive Orders Relating to Indian Reservations, 1855-1922*. Scholarly Resources, Wilmington, Delaware.

U.S. National Archives and Records Administration
1989 *Guide to Records in the National Archives*. National Archives and Records Administration, Washington, D.C.

Utley, R. M.
1973 *Frontier Regulars: The United State Army and the Indian, 1866-1891*. Macmillan, New York.
1984 *The Indian Frontier of the American West, 1846-1890*. University of New Mexico Press, Albuquerque.

Van Houten, F. B.
1964 *Tertiary Geology of the Beaver Rim Area, Fremont and Natrona Counties, Wyoming*. U. S. Geological Survey Bulletin 1164.

Van Hoy, T. P., and R. Nathan
1983 *Phase I Intensive Cultural Resources Inventory of Selected Recreation Areas in the West Portion of Lake Sakakawea, Dunn, McKenzie, Mountrail and Williams Counties, North Dakota*. Department of Anthropology, University of North Dakota, Grand Forks. Submitted to the U.S. Army Corps of Engineers, Omaha District.

Vehik, R.
1976 Archaeological Survey of Bank Stabilization Areas Along the James River and of the Proposed Oakes Canal and Irrigation Areas. Section II, *Archaeological Surveys in the Garrison Diversion Unit*, by F. Schneider and R. Vehik. Department of Anthropology and Archaeology, University of North Dakota, Grand Forks. Submitted to National Park Service, Midwest Archeological Center, Lincoln, NE.

Vehik, S. C.
1977 Bone Fragments and Bone Grease Manufacturing: A Review of Their Archaeological Use and Potential. *Plains Anthropologist* 22:169-182.
1985 *Lithic Resource Procurement: Proceedings from the Second Conference on Prehistoric Chert Exploitation*. Occasional Paper No. 4. Center for Archaeological Investigations, Southern Illinois University, Carbondale.

Verbicky-Todd, E.
1984 *Communal Buffalo Hunting Among the Plains Indians*. Occasional Paper No. 24. Archaeological Survey of Alberta, Edmonton.

Vickers, C.
1945 Archaeology in the Rock and Pelican Lake Area of Central Manitoba. *American Antiquity* 11(2):88-94.
1948 Cultural Affinity in the Minnesota-Manitoba Region. *Minnesota Archaeologist* 14(2):38-41.

Vickers, J. R.
1986 Alberta Plains Prehistory: A Review. In *Archaeological Survey of Canada*, pp. 1-139. Occasional Papers Nos. 27 and 28. Edmonton.

Walde, D.
1994 *The Mortlach Phase*. Unpublished Ph.D. dissertation. Department of Archaeology, University of Calgary.

Walker, D. N.
1982 Early Holocene Vertebrate Fauna. In *The Agate Basin Site: A Record of the Paleoindian Occupation of the Northwestern Plains*, edited by G. C. Frison and D. Stanford, pp. 274-308. Academic Press, New York.

Walker, D. N., and G. C. Frison
1980 The Late Pleistocene Mammalian Fauna from the Colby Mammoth Kill Site. *Contributions to Geology, University of Wyoming* 19(1):69-79.

Walker, D. N., and G. Zeimens
1976 Results of an Archaeological Survey of the Arch Mineral Corporation Seminoe No. 1 Mine, Hanna, Wyoming. Manuscript on file, Department of Anthropology, University of Wyoming, Laramie.

Wattrall, C. R.
1974 Subsistence Pattern Change at the Cambria Site: A Review and Hypothesis. In *Aspects of Upper Great Lakes Anthropology: Papers in Honor of Lloyd A. Wilford*, edited by E. Johnson, pp. 138-142. Minnesota Historical Society, St. Paul.

Watts, W. A., and H. E. Bright
1968 Pollen, Seed and Mollusk Analysis of a Sediment Core from Pickerel Lake, Northeastern South Dakota. *Bulletin of the Geological Society of America* 77:1339-1360.

Watts, W. A., and H. E. Wright, Jr.
1966 Late Wisconsin Pollen and Seed Analysis from the Nebraska Sand Hills. *Ecology* 47:202-210.

Weakly, W. F.
1971 *Tree Ring Dating and Archeology in South Dakota.* Plains Anthropologist Memoir 8.

Weaver, J. E.
1968 *Prairie Plans and Their Environment: A Fifty-Year Study in the Midwest*. University of Nebraska Press, Lincoln.

Webb, T., III, E. J. Cushing, and H. E. Wright, Jr.
1983 Holocene Changes in the Vegetation of the Midwest. In *Late-Quaternary Environments of the United States: Volume 2, The Holocene*, edited by H. E. Wright, Jr., pp. 142-165. University of Minnesota Press, Minneapolis.

Wedel, M. M.
1974 Le Sueur and the Dakota Sioux. In *Aspects of Upper Great Lakes Anthropology*, edited by E. Johnson, pp. 151-171. Minnesota Prehistoric Archaeology Series 11. Minnesota Historical Society, St. Paul.

Wedel, W. R.
1947a *Preliminary Appraisal of the Archeological and Paleontological Resources of Certain Proposed Reservoir Areas in the Lower Platte Sub-Basin Nebraska.* Ms. on file, BUREC, Lower Missouri Region, Denver, Colorado.
1947b Prehistory and the Missouri Valley Development Program: Summary Report on the Missouri River Basin Archeological Survey in 1946. *Smithsonian Miscellaneous Collections* 107(6):1-17.
1948 Prehistory and the Missouri Valley Development Program. Summary Report on the Missouri River Basin Archaeological Survey in 1947. *Smithsonian Miscellaneous Collections* 111(2):1-52.
1954 Earthenware and Steatite Vessels from Northwestern Wyoming. *American Antiquity* 19(4):403-409.
1955 *Archaeological Materials from the Vicinity of Mobridge, South Dakota.* Bureau of American Ethnology Bulletin 157:69-188.
1961 *Prehistoric Man on the Great Plains*. University of Oklahoma Press, Norman.
1983 The Prehistoric Plains. In *Ancient North Americans*, edited by J. D. Jennings, pp. 203-241. W. H. Freeman, San Francisco.
1986 *Central Plains Prehistory*. University of Nebraska Press, Lincoln.

Wedel, W. R., W. M. Husted, and J. Moss
1968 Mummy Cave: Prehistoric Record from the Rocky Mountains of Wyoming. *Science* 160:184-186.

Wellmann, K. F.
1979 *A Survey of North American Indian Rock Art*. Akademische Druck-u. Verlagsanstalt, Graz, Austria.

Wendland, W. M.
1978 Holocene Man in North America: the Ecological Setting and Climatic Background. *Plains Anthropologist* 23:273-287.

Wendland, W. M., A. Benn, and H. A. Semken, Jr.
1987 Evaluation of Climatic Changes on the North American Great Plains Determined from Faunal Evidence. In *Late Quaternary Mammalian Biogeography and Environments of the Great Plains and Prairies*, edited by R. Graham, H. Semken, Jr., and M. Graham, pp. 460-472. Scientific Papers Vol. 22. Illinois State Museum, Springfield.

Wendland, W. M., and R. A. Bryson
1974 Dating Climatic Episodes of the Holocene. *Quaternary Research* 4:9-24.

Wessel, T. R. (editor)
1977 *Agriculture in the Great Plains, 1876-1936.* Agricultural History Society, Washington, D.C.

Weston, T.
1986 *Acculturation in the Upper Middle Missouri Valley as Reflected in Modified Bone Assemblages*. Unpublished Ph.D. dissertation, Department of Anthropology, University of Kansas, Lawrence.
1993 Acculturation in the Middle Missouri Valley as Reflected in Modified Bone Assemblages. *Plains Anthropologist* 38:79-100.

Weston, T., S. A. Ahler, D. E. Griffin, and J. M. Kjos
1980 *Cultural Resource Survey of the Cross Ranch, Oliver County, North Dakota*. Department of Anthropology, University of North Dakota, Grand Forks. Submitted to the North Dakota State Parks and Recreation Department, Bismarck.

Weston, T., D. A. Goulding, and S. A. Ahler
1979 *Archaeological Monitoring and Shoreline Reconnaissance at the Travis 2 Site, 39WW15, Oahe Reservoir, South Dakota.* Department of Anthropology and Archaeology, University of North Dakota. Report submitted to U. S. Army Corps of Engineers, Omaha District.

Wettlaufer, B.
1955 *The Mortlach Site in the Besant Valley of Central Saskatchewan*. Anthropological Series No. 1. Saskatchewan Department of Natural Resources, Regina.

Wettlaufer, B., and W. J. Meyer-Oakes
1960 *The Long Creek Site*. Anthropological Series No. 2. Saskatchewan Department of Natural Resources, Regina.

Wettstaed, J. R.
1989 *Prehistoric Land Use Patterns in Southeastern Montana*. Northern Region Report No. 12. USDA Forest Service, Missoula.

Wheat, J. B.
1972 *The Olsen-Chubbuck Site: A Paleo-Indian Bison Kill*. Memoir No. 26. Society for American Archaeology.
1979 *The Jurgens Site*. Plains Anthropologist Memoir 15.

Wheeler, R. P.
1952 A Note on the "Mckean Lanceolate Point." *Plains Anthropological Conference Newsletter* 4(4):39-44.
1954a Two New Projectile Point Types: Duncan and Hanna Points. *Plains Anthropologist* 1:7-14.
1954b Selected Projectile Point Types of the United States: 2. *Bulletin of the Oklahoma Anthropological Society* 2:1-5.
1958 Archaeological Remains in the Angostura Reservoir Area, South Dakota, and in the Keyhole and Boysen Reservoir Areas, Wyoming. Unpublished manuscript on file, Midwest Archaeological Center, Lincoln, Nebraska.
1963 *The Stutsman Focus: An Aboriginal Culture Complex in the Jamestown Reservoir Area, North Dakota*, pp. 167-233, plates 27-36. Bureau of American Ethnology Bulletin 185. Smithsonian Institution, Washington, D.C.
n.d. *Mounds and Earthworks in the Jamestown Reservoir Area, North Dakota.* River Basin Surveys, Smithsonian Institution.

Wheeler, R. P., and R. L. Stephenson
1953 *Appraisal of the Archaeological and Paleontological Resources of the Jamestown Reservoir North Dakota: Supplement.* Missouri Basin Project, Smithsonian Institution, Washington.

White, T.
1952 *The Battle Pits of the "Koyokees."* Anthropology and Sociology Papers, No. 10. Montana State University, Missoula.

Whitley, D. S.
1992 The Numic Vision Quest: Ritual and Rock Art in Far Western North America. Paper presented ath the 1992 Great Basin Anthropological Conference, Boise, Idaho. In press.
1994 Ethnography and Rock Art in the Far West. In *New Light on Old Art: Recent Advances in Hunter-Gatherer Rock Art Research*, edited by D. S. Whitley and L. L. Loendorf, pp. 81-93. Monograph No. 36. UCLA Institute of Archaeology.

Whitley, D. S., and R. I. Dorn
1993 New Perspectives on the Clovis vs. Pre-Clovis Controversy. *American Antiquity* 58(4):626-647.

Whitlock, C., P. J. Bartlein, and W. A. Watts
1993 Vegetation History of Elk Lake. In *Elk Lake, Minnesota: Evidence for Rapid Climate Change in the North-Central United States*, edited by J. Bradbury and W. Dean, pp. 251-274. Special Paper 276. Geological Society of America, Boulder.

Wilford, L. A.
1941 A Tentative Classification of the Prehistoric Cultures of Minnesota. *American Antiquity* 6:231-249.

1945 The Prehistoric Indians of Minnesota: The Headwaters Lakes Aspect. *Minnesota History* 26:321-329.

1955 A Revised Classification of the Prehistoric Cultures of Minnesota. *American Antiquity* 21:130-142.

1970 *Burial Mounds of the Red River Headwaters*. Minnesota Prehistoric Archaeology Series No. 5. Minnesota Historical Society, St. Paul.

Will, G. F.

1909 Some Observations in Northwestern South Dakota. *American Anthropologist* 11(2).

1910 Some New Missouri River Valley Sites in North Dakota. *American Anthropologist* 12:58-60.

1924 *Archaeology of the Upper Missouri Valley.* Anthropological Papers Vol. 22 (Part 6). American Museum of Natural History, New York.

1933 A Resume of North Dakota Archaeology. *North Dakota Historical Quarterly* 7:150-161.

Will, G. F., and T. C. Hecker

1944 The Upper Missouri River Valley Aboriginal Culture in North Dakota. *North Dakota Historical Quarterly* 11:5-126.

Will, G. F., and G. E. Hyde

1917 *Corn Among the Indians of the Upper Missouri*. University of Nebraska Press, Lincoln.

Will, G. F., and H. J. Spinden

1906 *The Mandans. A Study of Their Culture, Archaeology, and Language.* Peabody Museum of American Archaeology and Ethnology, Volume 3. Harvard University, Cambridge.

Willey, G. R.

1966 *An Introduction to American Archaeology: Volume 1, North and Middle America*. Prentice-Hall, Englewood Cliffs, New Jersey.

Willey, G. R., and P. Phillips

1958 *Method and Theory in American Archaeology*. University of Chicago Press, Chicago.

Willey, G. R., and J. A. Sabloff

1980 *A History of American Archaeology*. (2nd ed.). W. H. Freeman, San Francisco.

Willey, P.

1982 *Osteology of the Crow Creek Massacre.* Unpublished Ph. D. dissertation, University of Tennessee, Knoxville.

1990 *Prehistoric Warfare on the Great Plains*. Garland, New York.

Willey, P., and T. E. Emerson

1993 The Osteology and Archaeology of the Crow Creek Massacre. In *Prehistory and Human Ecology of the Western Prairies and Northern Plains*, edited by J. A. Tiffany, pp. 227-269. Plains Anthropologist Memoir 27.

Willey, P., R. W. Mann, P. H. Moore-Jansen, R. L. Jantz, M. Guilbeau, and L. Meadows

1987 *Human Skeletal Material from the South Dakota Archaeological Research Center.* Report. Department of Anthropology, University of Tennessee, Knoxville, Tennessee. Submitted to the State of South Dakota and the South Dakota Archaeological Research Center.

Williams, J. A.

1981 *Skeletal Biology of the Inkster Burial (32GF19), a Woodland Mortuary from the Northern Plains.* Report submitted to the State Historical Society of North Dakota.

1982 The Inkster Burial, 32GF19: Skeletal Biology of a Northeastern Plains Woodland Population. *Journal of the North Dakota Archaeological Association* 1:181-215.

1983 Analysis of Human Skeletal Remains from Sites 32EM59 and 32EM61. In *Archaeology of the Northern Border Pipeline, North Dakota: Test Excavations,* edited by M. J. Root and M. L. Gregg. Contribution No. 195. Department of Anthropology, University of North Dakota.

1985a *Volume II: Skeletal Biology. In The Jamestown Mounds Project.* The State Historical Society of North Dakota, Bismarck.

1985b Site 32RY100: Skeletal Biology of the Infracranial Skeleton and Related Parameters. Contract report. Submitted to the State Historical Society of North Dakota, Bismarck.

1985c Evidence of Hydatid Disease in a Plains Woodland Burial. *Plains Anthropologist* 30:25-28.

1985d Evidence of Pre-Contact Tuberculosis in Two Woodland Skeletal Populations from the Northern Plains. *American Journal of Physical Anthropology* 66:242-243.

1987a *Human Skeletal Remains Recovered from Site 32BA100.* Report submitted to the State Historical Society of North Dakota.

1987b Possible Nutritional Stress in a Plains Woodland Skeletal Population. *Proceedings of the North Dakota Academy of Science* 41:61.

1987c Possible Evidence of Scapling in a Plains Late Archaic/Early Woodland Mortuary. Poster presented at the Annual Meeting of the Paleopathology Association, New York.

1988 *Analysis of Miscellaneous Human Osteological Remains Recovered from Multi-County Areas of South Dakota.* Report submitted to the U.S. Army Corps of Engineers, Omaha District.

1991a *Miscellaneous Human Skeletal Remains from North Dakota and Northwestern Minnesota*. Contribution No. 253. Department of Anthropology, University of North Dakota, Grand Forks.

1991b Possible Evidence of Scurvy in a Prehistoric Skeleton From the Northeastern Plains. *Proceedings of the North Dakota Academy of Science* 45:29.

1991c *Identification of Skeletal Remains Recovered from Federal Lands Near Mobridge, South Dakota.* Forensic report. Submitted to Federal Bureau of Investigation. Pierre, South Dakota.

1991d Acetabular Protrusion in a Northeastern Plains Burial. Poster presentation at the Annual Meeting of the American Anthropological Association, Chicago.

1991e Evidence of Scalping from a Woodland Cemetery on the Northern Plains. Paper presented at the Annual Meeting of the American Association of Physical Anthropologists, Milwaukee.

1993a *Unidentified Human Skeletal Remains Recovered from the Perimeter of the Boley Site (32MO37), Morton County, North Dakota.* Report submitted to the State Historical Society of North Dakota.

1993b *Analysis of Miscellaneous Human Osteological Remains Recovered From Multi-County Areas of South Dakota*. Report submitted to the South Dakota State Historical Society, Rapid City.

1993c Benefits and Obstacles of Routine Elemental and Isotopic Analysis in Bioarchaeological Research Contracts. In *Investigation of Ancient Human Tissue: Chemical Analysis in Paleoanthropology,* edited by M. K. Sandford. Gordon and Breach, New York.

1994a Disease Profiles of Archaic and Woodland Populations in the Northern Plains. In *Skeletal Biology in the Great Plains: Migration, Warfare, Health, and Subsistence*, edited by D. W. Owsley and R. L. Jantz, pp. 91-108. Smithsonian Institution Press, Washington, D.C.

1994b *Unidentified Human Skeletal Remains Recovered from Site 32ML850, Falkirk Mine, Mclean County, North Dakota.* Osteological report. Submitted to the State Historical Society of North Dakota.

1994c *Unidentified Human Skeletal Remains Recovered from the Bahm Site (32MO97), Morton County, North Dakota.* Osteological report. Submitted to the State Historical Society of North Dakota.

1994d *Human Skeletal Remains Recovered from the Lake Tewaukon Site (32SA211).* Report submitted to U.S. Fish and Widlife Service, Denver.

n.d.a Description of Human Skeletal Remains from the Arvilla Site (32GF1), Grand Forks County, North Dakota and the De Spiegler Site (39RO23), Roberts County, South Dakota. Ms. on file, Department of Anthropology, University of North Dakota.

n.d.b Description of Human Skeletal Remains from the Bahm Site (32MO97), Morton County, North Dakota. Ms. on file, Department of Anthropology, University of North Dakota.

n.d.c Description of Human Skeletal Remains from the Lake Bronson Mounds (21KT1), Kittson County, Minnesota. Ms. on file, Department of Anthropology, University of North Dakota.

n.d.d Description of Human Skeletal Remains from the Snake River Mounds (21MA1), Marshall County, Minnesota. Ms. on file, Department of Anthropology, University of North Dakota.

n.d.e Description of Human Skeletal Remains from the Harstad Mound (21MA6), Marshall County, Minnesota. Ms. on file, Department of Anthropology, University of North Dakota.

n.d.f Description of Human Skeletal Remains from the Slininger Mounds (21NR1), Norman County, Minnesota. Ms. on file, Department of Anthropology, University of North Dakota.

n.d.g Description of Human Skeletal Remains from the Habben Mound (21NR2), Norman County, Minnesota. Ms. on file, Department of Anthropology, University of North Dakota.

n.d.h Description of Human Skeletal Remains from the Warner Mounds Site (21PL3), Polk County, Minnesota. Ms. on file, Department of Anthropology, University of North Dakota.

n.d.i Description of Human Skeletal Remains from the Peter Lee Mound (21PL13), Polk County, Minnesota. Ms. on file, Department of Anthropology, University of North Dakota.

n.d.j Description of Human Skeletal Remains from the Red Lake River Mounds (21RL1), Red Lake County, Minnesota. Ms. on file, Department of Anthropology, University of North Dakota.

n.d.k Description of Human Skeletal Remains from the Wilson Mounds (21TR2), Traverse County, Minnesota. Ms. on file, Department of Anthropology, University of North Dakota.

n.d.l Description of Human Skeletal Remains from Site 32BA403, Barnes County, North Dakota. Ms. on file, Department of Anthropology, University of North Dakota.

n.d.m Description of Human Skeletal Remains from the Fordville Mounds (32WA1), Walsh County, North Dakota. Ms. on file, Department of Anthropology, University of North Dakota.

n.d.n Description of Human Skeletal Remains from Site 32GF19, Grand Forks County, North Dakota. Ms. on file, Department of Anthropology, University of North Dakota.

Williams J. A., and J. S. Snortland

1986 Pre-Contact Tuberculosis in a Plains Woodland Mortuary. *Plains Anthropologist* 31:249-252

Wilmeth, R.

1958 *Report of the Investigation of the Payne Site, 39WW302, Walworth County, South Dakota, 1956*. Archaeological Studies Circular No. 8. South Dakota Archaeological Commission, Pierre.

Wilmsen, E. N., and F. H. H. Roberts

1978 *Lindenmeier, 1934-1974: Concluding Report on Investigations.* Smithsonian Contributions to Anthropology No. 24.

Wilson, G. L.

1917 *Agriculture of the Hidatsa Indians: An Indian Interpretation*. Studies in the Social Sciences No. 9. University of Minnesota, Minneapolis.

1924 *The Horse and Dog in Hidatsa Culture*. Anthropological Papers Vol. 15, Pt. 2. American Museum of Natural History, New York.

1928 *Hidatsa Eagle Trapping*. Anthropological Papers of the American Museum of Natural History 3(4). New York.

1934 *The Hidatsa Earthlodge*. Anthropological Papers Vol. 33, Pt. 5. American Museum American Museum of Natural History, New York.

1971 *Waheenee, An Indian Girl's Story Told by Herself*. University of Nebraska Press, Lincoln.

Wilson, M.

1974 The Casper Site Local Fauna and Its Fossil Bison. In *The Casper Site: A Hell Gap Bison Kill on the High Plains*, edited by G. C. Frison, pp. 125-171. Academic Press, New York.

1975 *Holocene Fossil Bison from Wyoming and Adjacent Areas*. Unpublished Master's thesis, Department of Anthropology, University of Wyoming.

1978 Archaeological Kill Site Populations and the Holocene Evolution of the Genus *Bison*. In *Bison Procurement and Utilization: A Symposium*, edited by L. B. Davis and M. Wilson, pp. 9-22. Plains Anthropologist Memoir 14.

1995 The Household as a Portable Mnemonic Landscape: Archaeological Implications for Plains Stone Circle Sites. In *Beyond Subsistence: Plains Archaeology and the Post Processual Critique*, edited by P. Duke and M. Wilson, pp. 169-192. University of Alabama Press, Tuscaloosa.

Wilson, M., K. L. Road, and K. J. Hardy (editors)

1981 Megaliths to Medicine Wheels: Boulder Structures in Archaeology. *Proceedings of the 11th Chacmool Conference*. University of Calgary, Alberta.

Wiltse, L. L., E. H. Widell, and D. W. Jackson

1975 Fatigue Fracture: The Basic Lesion in Isthmic Spondylolisthesis. *Journal of Bone and Joint Surgery* 57:17-22.

Winham R. P., and L. A. Hannus

1990 *South Dakota State Plan for Archaeological Resources. Introduction and Overview to Historic Contexts and Archaeological Management Regions for Research and Planning: A Working Draft*. Archaeology Laboratory, Augustana College, Sioux Falls, South Dakota. Submitted to South Dakota State Archaeological Research Center, Rapid City. Contract No. 89C-349.

1991 *South Dakota State Plan for Archaeological Resources 1990-1991*. Archaeology Laboratory, Augustana College, Sioux Falls, South Dakota. Submitted to State Historical Preservation Center, Vermillion. Grant in aid 46-90-50121.015.

Winham, R. P., L. A. Hannus, and E. J. Lueck

1989 *White River Badlands Archaeological Region. A Synthesis*. South Dakota State Plan Archaeological Region Reports No 8. Archaeology Laboratory, Augustana College, Sioux Falls, South Dakota. Submitted to State Historical Preservation Center, Vermillion, South Dakota.

Winham, R. P., K. Lippincott, L. A. Hannus, and E. J. Lueck

1987 *Cultural Resource Reconnaissance of U.S. Army Corps of Engineers Land Alongside Lake Sakakawea in Dunn County, North Dakota*. Archeology Laboratory, Augustana College, Sioux Falls, South Dakota. Submitted to the U.S. Army Corps of Engineers, Omaha District.

1988 *Cultural Resource Reconnaissance of U.S. Army Corps of Engineers Land Alongside Lake Sakakawea in Dunn County, North Dakota*. Archaeological Contract Series 23. Archaeology Laboratory, Augustana College, Sioux Falls, South Dakota. Submitted to U.S. Army Corps of Engineers, Omaha District. Contract No. DACW45-85-C-0340.

Winham, R. P., K. A. Lippincott, and E. J. Lueck

1987 *Cultural Resource Reconnaissance of U.S. Army Corps of Engineers Land Alongside Lake Sakakawea in Mountrail County, North Dakota*. Archeology Laboratory, Augustana College, Sioux Falls, South Dakota. Submitted to the U.S. Army Corps of Engineers, Omaha District.

1988 *Cultural Resources Reconnaissance along the Cheyenne River Arm of Lake Oahe in Dewey, Haakon, Stanley and Zieback Counties, South Dakota*. Archeology Laboratory, Augustana College, Sioux Falls, South Dakota. Submitted to the U.S. Army Corps of Engineers, Omaha District.

Winham, R. P., and E. J. Lueck

1983 *Report of Test Excavations at Sites with Indian Creek, West Whitlocks and Little Bend Recreation Areas, Lake Oahe, South Dakota within the Counties of Walworth, Potter and Sully*. Archeology Laboratory, Augustana College, Sioux Falls. Submitted to the U.S. Army Corps of Engineers, Omaha District.

1984 *Report of a Cultural Resources Reconnaissance of Selected Areas along the White River and along the West Bank of Lake Francis Case*. Archeology Laboratory, Augustana College, Sioux Falls, South Dakota. Submitted to the U.S. Army Corps of Engineers, Omaha District.

1987 *Cultural Resource Reconnaissance along portions of Lake Oahe in Stanley and Dewey Counties, South Dakota*. Archeology Laboratory, Augustana College, Sioux Falls, South Dakota. Submitted to the U.S. Army Corps of Engineers, Omaha District.

Winters, H. D.

1984 The Significance of Chert Procurement and Exchange in the Middle Woodland Traditions of the Illinois Area. In *Prehistoric Chert Exploitation: Studies from the Midcontinent*, edited by B. M. Butler and E. E. May, pp. 3-22. Occational Paper No. 2. Center for Archaeological Investigations, Southern Illinois University, Carbondale.

Winther, O. O.

1964 *The Transportation Frontier: Trans-Mississippi West, 1865-1885*. Holt, Rinehart and Winston, New York.

Wishart, D. J.

1979 *The Fur Trade of the American West, 1807-1840: A Geographic Synthesis*. University of Nebraska Press, Lincoln.

Wissler, C.

1906 "Diffusion of Culture in the Plains of North America." International Congress of Americanists, 15th Session. Quebec.

Wood, W. R.

1960 The Boundary Mound Group (32SI1): An Eastern Woodland Complex in North Dakota. *Plains Anthropologist* 5:71-78.

1963 Lisbon Flared Rim and Owego Flared Rim Wares. In *The Stutsman Focus: An Aboriginal Culture Complex in the Jamestown Reservoir Area, North Dakota*, by R. P. Wheeler, Appendix, pp. 167-233. Bureau of American Ethnology Bulletin 185. Smithsonian Institution, Washington, D.C.

1967 *An Interpretation of Mandan Culture History*. River Basin Surveys Papers No. 39. Bureau of American Ethnology, Bulletin 198. Smithsonian Institution, Washington, D. C.

1971 *Biesterfeldt: A Post-Contact Coalescent Site on the Northeastern Plains*. Contributions to Anthropology 15. Smithsonian Institution, Washington, D.C.

1972 Contrastive Features of Native North American Trade Systems. In *For the Chief: Essays in Honor of Luther S. Cressman*, edited by F. Voget and R. Stephenson, pp. 154-169. Anthropological Papers 4. University of Oregon.

1974 Northern Plains Village Cultures: Internal Stability and External Relationships. *Journal of Anthropological Research* 30(1):1-6.

1980b Plains Trade in Prehistoric and Protohistoric Intertribal Relations. In *Anthropology on the Great Plains*, edited by W. R. Wood and M. Liberty, pp. 98-109. University of Nebraska Press, Lincoln.

1986a Introduction: Cultural Chronology of the Upper Knife-Heart Region. In *Papers in Northern Plains Prehistory and Ethnohistory*, edited by W. R. Wood, pp. 7-24. Special Publication No. 10. South Dakota Archaeological Society, Sioux Falls.

1986c *The Origins of the Hidatsa Indians: A Review of Ethnohistorical and Traditional Data*. 1986 reprint by the J and L Reprint, Reprints in Anthropology, Volume 32. Lincoln, NE.

Wood, W. R. (compiler)

1993 Joseph N. Nicollet's 1839 Manuscript Maps of the Missouri River and Upper Mississippi Basin. *Illinois State Museum Scientific Papers* No. 24. Illinois State Museum, Springfield.

Wood, W. R. (editor)

1976 *Fay Tolton and the Initial Middle Missouri Variant.* Research Series No. 13. Missouri Archaeological Society, Columbia.

1980a *The Exploration of the Verendryes in the Northern Plains, 1738-1743*. University of Nebraska Press, Lincoln.

1986b *Papers in Northern Plains Prehistory and Ethnohistory*. (The Ice Glider Site, 32OL110.) Special Publication No. 10. South Dakota Archaeological Society, Sioux Falls.

Wood, W. R., and A. M. Johnson

1973 High Butte, 32ME13: A Missouri Valley Woodland-Besant Site. *Archaeology in Montana* 14(3):35-83.

Wood, W. R., and T. D. Thiessen

1985 *Early Fur Trade on the Northern Plains: Canadian Traders Among the Mandan and Hidatsa Indians, 1738-1818.* University of Oklahoma Press, Norman.

Wood, W. R., and A. R. Woolworth

1964 *The Paul Brave Site (32SI4), Oahe Reservoir Area, North Dakota*. River Basin Surveys Papers No. 33. Bureau of American Ethnology, Bulletin 189. Smithsonian Institution, Washington, D.C.

Woolworth, A. R.

1956 Archaeological Investigations at Site 32ME9 (Grandmother's Lodge). *North Dakota History* 23(2):78-102.

Woolworth, A. R., and W. R. Wood

1960 *The Archeology of a Small Trading Post (Kipp's Post, 32MN1) in the Garrison Reservoir, North Dakota*. River Basin Surveys Papers No. 20. Bureau of American Ethnology, Bulletin 176. Smithsonian Institution, Washington, D.C.

1964 *The Demery Site (39CO1), Oahe Reservoir Area, South Dakota*. River Basin Surveys Papers No. 34. Bureau of American Ethnology, Bulletin 189. Smithsonian Institution, Washington, D.C.

Wooster, R. A.

1988 *The Military and the United States Indian Policy, 1865-1903*. Yale University Press, New Haven.

Wormington, H. M.

1957 *Ancient Man in North America*. Popular Series No. 4. Denver Museum of Natural History.

Wormington, H. M., and R. G. Forbis

1965 An Introduction to the Archaeology of Alberta, Canada. *Proceedings No. 11*, Denver Museum of Natural History.

Wright, G.

1978 The Shoshonean Migration Problem. *Plains Anthropologist* 23(80):114-137.

Wright, H. E., Jr.

1970 Vegetational History of the Central Plains. In *Pleistocene and Recent Environments of the Central Great Plains*, edited by W. Dort, Jr., and J. K. Jones, Jr., pp. 157-172. University of Kansas Press, Lawrence.

Zalucha, L. A.

1982 *Methodology in Paleoethnobotany: A Study in Vegetational Reconstruction Dealing with the Mill Creek Culture of Northwestern Iowa*. Unpublished Ph.D. dissertation, University of Wisconsin-Madison. University Microfilms, Ann Arbor.

1983 An Analysis of Charcoal from the Helb Site (39CA208), South Dakota. In *Prairie Archaeology: Papers in Honor of David A. Baerreis*, edited by G. E. Gibbon, pp. 109-129. Publications in Anthropology No. 3. University of Minnesota, Minneapolis.

Zeimens, G. M.

1975 *48AB301: A Late Prehistoric Site in the Shirley Basin of Wyoming*. Unpublished Master's thesis, Department of Anthropology, University of Wyoming, Laramie.

Zeimens, G. M., A. Korell, D. Housh, D. Eisenbarth, and B. Curry

1987 The Korell-Bordeaux and Rock Ranch Protohistoric Sites: A Preliminary Analysis. *The Wyoming Archaeologist* 30(3-4):68-92.

Zeimens, G., D. Walker, T. K. Larson, J. Albanese, and G. W. Gill

1978 The Dunlap-McMurry Burial (48NA67) Natrona County, Wyoming. *The Wyoming Archaeologist* 21(4):15-40.

Zeller, H. D., and E. V. Stephens
1969 *Geology of the Oregon Buttes Area, Sweetwater, Sublette, and Fremont Counties, Southwest Wyoming*. U. S. Geological Survey Bulletin 1256.

Zimmerman, L. J.
1985 *Peoples of Prehistoric South Dakota.* University of Nebraska Press, Lincoln.

Zimmerman, L. J., and L. E. Bradley
1993 The Crow Creek Massacre: Initial Coalescent Warfare and Speculations about the Genesis of Extended Coalescent. In *Prehistory and Human Ecology of the Western Prairies and Northern Plains*, edited by J. A. Tiffany, pp. 215-226. Plains Anthropologist Memoir 27.

Zimmerman, L. J., T. Emerson, P. Willey, M. Swegle, J. B. Gregg, P. Gregg, E. White, C. White, T. Haberman, and M. P. Bumstead
1981 *The Crow Creek Site (39BF11) Massacre: A Preliminary Report.* University of South Dakota Archaeology Laboratory. Report submitted to U.S. Army Corps of Engineers, Omaha District.

Zitt, J. O.
1992 *Prehistoric and Early Historic Subsistence Patterns and Dental Pathology on the Northern Great Plains*. Unpublished Master's thesis, Department of Anthropology, University of Wyoming.

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