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SMITHSONIAN CONTRIBUTIONS TO ANTHROPOLOGY • NUMBER 47

A Chronology of Middle Missouri Plains Village Sites

Craig M. Johnson

with contribution by
Stanley A. Ahler, Craig M. Johnson, Herbert Haas, and Georges Bonani

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ABSTRACT
Johnson, Craig M. *A Chronology of Middle Missouri Plains Village Sites*, with contribution by Stanley A. Ahler, Craig M. Johnson, Herbert Haas, and Georges Bonani. Smithsonian Contributions to Anthropology, Number 47, 344 pages, 69 figures, 34 tables, 2007. — A comprehensive and systematic research effort focusing on refining the chronology of individual Plains Village tradition sites from the Middle Missouri subarea of the Great Plains relies on a number of absolute and relative dating techniques. Seventy-four conventional and AMS radiocarbon dates from short-lived materials (seeds, corn) and charred ceramic pot residues are used in conjunction with ceramic ordinations of 225 components assigned to nine cultural variants or phases. Site stratigraphy, Euro-American trade materials, historic documentation, oral traditions, historical linguistics, and craniometric distance are also employed to help interpret temporal information derived from the ceramic ordinations and radiocarbon dates. The emphasis of this research is on the southern part of the Middle Missouri subarea, namely that portion along the Missouri River that flows through South Dakota and southern North Dakota. This area is the ancestral homeland of the Mandan and Arikara. The existing chronology of the Hidatsas who occupied the Knife region in north-central North Dakota is integrated into the Mandan and Arikara cultural sequence. Other cultural chronologies from the Northeastern (Cambria, Mill Creek, Great Oasis, lower James River) and Central Plains (Lower Loup/Historic Pawnee) are also related to the Middle Missouri and Coalescent tradition sequences of the Dakotas. This information is used to reconstruct the settlement history of the Mandan, Hidatsa, and Arikara in the Middle Missouri subarea, which is divided primarily into 50- and 100-year time segments. Areas of future research that would improve the Plains Village chronology or would benefit from a refined chronology are also reviewed. The results of the radiocarbon dating, which reviews 301 extant dates and the 74 Plains Village Dates (PVD) obtained during this study, suggest that 50 percent of the existing dates can be accepted, whereas 76 percent can be accepted for the PVD dates. A limited number of dates from the same site contexts also indicate that charred residues from ceramic vessels date 100 to 250 years earlier than their AMS counterparts on seeds and corn. The results also suggest a revision in the time span of the cultural variants to the following ranges: (1) Initial Middle Missouri, AD 1000–1300; (2) Extended Middle Missouri, AD 1200–1400; (3) Terminal Middle Missouri, AD 1400–1500; (4) Initial Coalescent, AD 1300–1500; (5) Extended Coalescent, AD 1400/1450–1650; and (6) Post-Contact Coalescent, AD 1650–1866. The distribution of sites along the Missouri River from AD 1000 to 1866 is complex and dynamic, reflecting multiple Late Woodland origins, locally available resources, cultural continuities and discontinuities, village consolidations and dispersals, widespread warfare, and the exposure to epidemic diseases and to Euro-American trade.

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Preface

The funding for this project was initiated through the efforts of Dan Rogers of the Smithsonian Institution. In November 1991, a purchase order (FP2016180000) to develop a chronology of archeological sites located in the Middle Missouri subarea of the Great Plains was granted to the author by the repatriation office of the Department of Anthropology, Smithsonian Institution. A second one was written for Stanley A. Ahler to assist the author in the radiocarbon chronology of the study. The terms of these purchase orders were fulfilled in December 1994 when a draft report was submitted. A final report was submitted early in 1995. In July 1995 Diane Tyler, managing editor of the Smithsonian Contributions and Studies Series, expressed an interest in publishing the report. Based on her comments, a revised report was submitted to the Department of Anthropology in August 1996. By October 1996, 20 additional radiocarbon dates became available for a series of Middle Missouri tradition sites, as part of an independent effort by Ahler. Thirty-four additional dates later became available for site 32MO291 and the Huff site as part of separate contract completion reports. This necessitated some revisions of the 1996 report. A decision was made to submit a third revised report in June 2001, a fourth in February 2003, and a fifth and final manuscript in July 2003 for publication. The 2001 version was sent out for peer review that year.

Although this study was initiated in 1991, in another sense this research really began years ago when I started my graduate studies in the Department of Anthropology, University of Nebraska-Lincoln. Lincoln, which is the former headquarters for the Smithsonian Institution's Missouri Basin Project in salvage archeology, served as a backdrop for my immersion into Middle Missouri archeology. My initiation began when I helped to computer code the ceramic vessels from the Walth Bay and Lower Grand sites under the direction of F.A. Calabrese of the Midwest Archeological Center, National Park Service, Lincoln, Nebraska. In 1975, I began my long association with Carl R. Falk, formerly chief of the Midwest Archeological Center and subsequently director of the Division of Archeological Research, Department of Anthropology, University of Nebraska-Lincoln. At this time I began the research for my thesis involving the analysis of the ceramic assemblage from the Medicine Crow site (39BF2), a Post-Contact Coalescent Talking Crow phase earthlodge village in the Big Bend reservoir.

This collection, then curated at the Midwest Archeological Center, was one of many excavated under the auspices of the Interagency Archaeological Salvage Program (ISAP). Falk and Ahler secured funding from Interagency Archeological Services (IAS), National Park Service in Denver, Colorado, to complete the site report from Medicine Crow, which contained an important pre-ceramic component of particular interest to Ahler. Then with the Illinois State Museum, Ahler acted as principal investigator on the project, mostly because of his interest in the pre-ceramic components present at the site. Additional contracts to complete the site reports from the Larson (39WW2), H. P. Thomas (39ST12), and Sommers (39ST56) Plains Village sites were taken on by Falk as the principal investigator through IAS with the help of Jack Rudy, J. J. Hoffman, and others of IAS-Denver. These projects, in addition to inventory surveys and excavations along the east bank of the Oahe and Big Bend reservoirs for the U.S. Army Corps of Engineers, served as a springboard into Middle Missouri archeology for me and for others, such as Dennis Toom, Terry Steinacher, and Darcy Morey.

My involvement with Falk and Ahler initiated a period of particularly intense research during my graduate and post-graduate career, focusing on statistics, electronic data processing on mainframe computers (then state-of-the-art), and detailed data collection and analysis of large numbers of lithic and ceramic artifacts. An integral part of my work on three of the four sites involved intersite stylistic comparisons of ceramic assemblages. This led me into various multivariate statistical techniques, such as factor and cluster analysis, to assess stylistic variability between sites. A portion of the data that appears in the present study was collected during this time (1976–1979). The results of these early efforts are similar to those presented herein and set the foundation for much of my subsequent research. The research emphasis was largely inductive in nature, focusing on a number of basic research questions important to understanding the occupational histories of these sites, the kinds of activities that took place within them, their relationships to other sites, and their culture-historical context. Although this occurred at a time when the "New Archeology" was in vogue, this theoretical school had little impact on my day-to-day research activities. The emphasis was mostly culture-historical in nature.

In many respects, this report is a culmination of my first 20 years of Middle Missouri research and represents a logical conclusion to this chapter of my professional and personal life. During this period, my interactions with Falk and Ahler have been intellectually satisfying and broadening experiences, providing me not only with the tools to further my career, but also with an appreciation for quality research and the effort and personal sacrifices it requires takes. I was not the only student at the University of Nebraska who might consider Falk and/or Ahler as mentors. Among others who owe their early research interests to them include Dennis Toom, Darcy Morey, Lynn Snyder, and Rob Bozell. All worked on various aspects of Falk and Ahler's long-term research program in the Middle Missouri, which had its beginning while they were graduate students under Ray Wood at the University of Missouri-Columbia. The enthusiasm and interest that Wood, Falk, and Ahler generated in their students and colleagues resulted in an *espirit de corps* among a small group of passionate and dedicated Middle Missouri archeologists. It is very satisfying to know that others share a deep professional and personal commitment to Middle Missouri archeology and are willing to make numerous sacrifices to further knowledge of its prehistory. Hopefully, our dedication to understanding the history of the Native Americans who once lived along the Missouri River in the Dakotas will continue to be passed on to future generations. Given the continuing problems in funding research in the Middle Missouri subarea and other extenuating circumstances, this goal will be even more difficult to attain in the future.

Although the authorship of this report reflects the actual division of writing responsibilities, the effort put into chapter five by Ahler, Haas, and Bonani far outweighs their scheduled commitments. Ahler in particular put in a major effort at selection, preparation, and transmittal of datable samples, far exceeding his planned workload. Haas and Bonani were very accommodating in their work on the project. This point can be underscored by the fact that Haas agreed to prepare, run, and transmit samples despite a heavy work schedule and during a time when his laboratory at Southern Methodist University was being terminated. Because this project renewed Ahler's interest in refining the Plains Village chronology in the Middle Missouri subarea, he secured additional funding from University of North Dakota sources to run an additional 19 radiocarbon dates from six sites. These data were submitted for analysis on 21 February 1996 and 11 March 1996 and were reported later that year. The results of these dates, together with those presented in this report and elsewhere, form the basis of a larger synthetic treatment of radiocarbon dating of Plains Village manifestations within the Middle Missouri subarea. Preliminary results appeared in Ahler et al. (1995). Despite his death earlier this year, Stan's inspiration lives on through me and others as we fulfill our shared commitment to understanding Middle Missouri Plains village archeology.

Any archeologist who has been immersed into a particular research area is well aware of the dangers of losing one's perspective on life. This problem commonly results in reducing or virtually eliminating one's personal relationships during particularly intensive periods of research and can result in strains within the family. This research effort is no exception. Throughout the 10 years of work on this project, my wife and children have coped during the times I was traveling or working evenings or weekends in my office. As much as anyone, Charlene has endured these hardships and bore the brunt of child rearing during this extended period of time. She has been responsible as much as anyone for maintaining my sanity during the course of this project. Although my daughters, Alicia and Rachel, were too young to fully appreciate their sacrifices, perhaps some day they will realize what it means to have an archeologist for a father. My mother and father, Eileen and Reuben, also deserve credit for taking care of the children on Saturdays and other particularly crucial periods of research activity. To all of those who have played such an important role in my professional and personal life, I dedicate this report.

1 Introduction

It has been more than 35 years since the publication of Donald J. Lehmer's (1971) *Introduction to Middle Missouri Archeology,* which has been used by a generation of archeologists to organize and interpret the prehistory of the Northern Plains. This publication shared with his earlier synthesis (Lehmer, 1954a:118–159) the same basic taxonomic structure and sequence of cultural events, but it added detail and an absolute time scale from information collected during the intervening years. In this sense, Lehmer's culture-historical model of the Middle Missouri villagers, the Mandan, Hidatsa, and Arikara and their prehistoric and protohistoric ancestors, is a formulation that had been defined very early from a limited number of often inadequately reported sites. Most of the research within the Middle Missouri subarea uses a model that is 50 years old. Logan (1977) discussed the events leading to the publication of Lehmer (1971).

To the uninitiated, the availability of a comprehensive treatment of Middle Missouri archeology tends to give the impression that the basic culture history of the subarea is complete. Other subarea specialists who continue to employ the Lehmer model of 1971 for lack of a suitable alternative, particularly those concerned with the cultural sequences in South Dakota, reinforce this perception. Breaking away from a mold that many archeologists have grown up with is a difficult task. Examinations of large series of radiocarbon dates also tend to substantiate a portion of Lehmer's (1971, table 2) chronology (Thiessen, 1977:64–65), despite problems with dating the cultural complexes of the subarea (Lehmer, 1971:57–58). The thought among some subarea researchers is that "the basic archeological complexes are blocked out, and by now, most are reduced to a fair degree of temporal control" (Caldwell and D. R. Henning, 1978:139). This view may be justified to some extent, for when salvage archeology ended with the dissolution of the Smithsonian Institution River Basin Surveys program in 1969, the pace of field investigations dramatically declined, and with it the timely dissemination of site reports, radiocarbon dates, and other associated information. In short, many casual readers of the literature of the Middle Missouri Plains villagers may be lulled into a sense of complacency, or overconfidence, that the culture history of these peoples has essentially been completed (see also Toom, 1994:483). Nothing could be further from the truth.

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Soon after its publication, some portions of Lehmer's (1971) synthesis of Native American life on the upper Missouri River began to be questioned by a small group of active and dedicated researchers. These inquiries focused on the taxonomic assignments of a number of villages and the time they were occupied (Ahler, 1977a:144; Falk and Calabrese, 1973; Falk and Ahler, 1988). More recent research has redefined the temporal limits of some taxonomic units, challenged the validity of others, and created new culture-historical frameworks (Ahler, 1993a:38; Lovick and Ahler, 1982:57–65; Steinacher, 1983:91–93). It is clear that an integrated program that focuses on the dating of a select number of the hundreds of excavated sites is needed to refine the Plains Village chronology.

Objectives

The objective of this research was to develop a refined chronology of Plains Village pattern components from the Middle Missouri subarea of the Great Plains. The project had six specific goals: (1) assign as many components to specific time periods as possible; (2) establish dating parameters for each of the six cultural variants; (3) evaluate the feasibility of dating short-lived macrobotanical remains and carbon residues on pottery; (4) assess the reliability of radiocarbon dates run by various laboratories; (5) construct a settlement history of the Plains villagers who lived along the Missouri River in the Dakotas; and (6) recommend future research within the Middle Missouri subarea, particularly as it applies to chronology. These goals were accomplished by employing eight interrelated absolute and relative dating techniques: (1) intersite ceramic ordinations; (2) radiocarbon dating; (3) site stratigraphy; (4) Euro-American trade materials; (5) historic documentation; (6) oral traditions; (7) historical linguistics; and (8) craniometric or biological distance. Most previous efforts to refine the chronology of the Plains villagers focused on taxonomic units rather than on individual sites, with the exceptions of Ahler and Haas (1993). The research presented herein attempts to greatly refine the chronology of the Plains Village pattern by assigning a large number of components to 50- and 100-year periods.

The 225 site components involved in this study are from extant archeological collections recovered by various governmental agencies, universities, museums, and individuals. Twelve regional ordinations or seriations, distinguished by employing traditionally defined ceramic types from various phases, variants, and traditions, were the focus of this research. In several instances, the intersite ordinations were interpreted with the aid of intrasite ordinations, site stratigraphy, and other temporal indicators. Absolute dates were assigned to the temporal dimensions in each ordination by dating a select number of components through the use of radiocarbon dating of short-lived organic materials, such as botanical remains, grass, and twigs. Previously dated components also were included in this study. Historic documentation of village sites occupied after about AD 1800 was used to anchor the late end of the protohistoric or Post-Contact period components in time and to link the long prehistoric and protohistoric cultural sequences to the tribal groups who occupied the Middle Missouri subarea in historic times, namely the Mandan, Hidatsa, and Arikara. The resulting temporal sequences also were compared with the related Mill Creek and Pawnee/Lower Loup chronologies, whose sites in Iowa and Nebraska fall outside of the Middle Missouri subarea.

A secondary goal of this project was to provide the Office of Repatriation of the Smithsonian Institution with information useful in determining which modern Native American tribes are culturally affiliated with the occupants of specific Plains Village archeological sites or the taxonomic units created to assign these sites to an overall culture history framework. The Mandan, Hidatsa, and Arikara were the three ethnic groups in the Middle Missouri subarea participating in a Plains Village lifestyle at the time of European and American contact. Of particular interest to Native Americans are the excavated human skeletal remains and associated funerary objects of their ancestors and the ultimate repatriation of these remains. As a consequence, an emphasis in this report is placed on those villages and associated cemeteries containing human skeletal remains. The chronology developed in this report facilitates the assignment of particular sites to the various ethnic groups and tribes who occupied the Middle Missouri subarea during the prehistoric, protohistoric, and historic periods. This effort is seen as providing a culture-historical context for the human skeletal remains, thereby assisting the Office of Repatriation of the Smithsonian Institution in fulfilling its responsibilities under the National Museum of the American Indian Act (20 U.S.C., section § 80q). The large quantity of human skeletal remains and associated artifacts from Plains Village sites in the Middle Missouri subarea can only be put in their proper context by a methodical examination of the context or location within each village or cemetery. This stems from three basic facts of Middle Missouri archeology: (1) many of the archaeological sites within the subarea and included in the current study have not been fully reported; (2) many sites contain a number of discrete and often mixed occupations or components; and (3) there is no a priori reason to associate any particular cemetery population with a specific village or component. Again, only after a detailed analysis of the archaeological context of the recovered skeletal remains and associated artifacts can any assurance be made concerning their relationship with a component. Of particular interest to the Smithsonian Institution is the chronological placement and cultural relationships through time of the Sully (39SL4), Mobridge (39WW1), Black Widow Ridge (39ST203), Fay Tolton (39ST11), Buffalo Pasture village and cemetery (39ST6/39ST216), Cheyenne River (39ST1), Leavitt (39ST215), Indian Creek (39ST15), and Swan Creek (39WW7) sites.[1]

In addition to providing information useful in determining the ancestral relationships between the sites in this study and today's Native American tribes, establishing refined and site- specific chronologies is crucial to any analyses of culture process. Up to this point, most of the chronologies have focused on the phase or variant level, providing only the coarsest of temporal controls and little specific information about sites other than those that are directly dated. This is a particular problem for some studies that propose cultural or biological process models of varying sophistication without chronologies of comparable refinement (Jantz, 1973; Key and Jantz, 1981; Ramenofsky, 1987; Rogers, 1990, 1993; Zimmerman and Bradley, 1993). It is no exaggeration to reiterate that "archeology is a historical science, so time and temporal variability in archeological phenomena are of paramount importance . . . we must keep striving for better temporal control over our data, for without improved chronologies our cultural-historical scenarios lack the precision necessary to guide processual studies into meaningful lines of inquiry" (Toom, 1992a:126).

Environmental and Cultural Setting

The Middle Missouri subarea of the Plains (Wedel, 1961, fig.1; 1983, fig. 6.1; Lehmer, 1971, fig. 20) is defined as the area along the Missouri River where it flows through North and South Dakota (Figure 1). The subarea consists of four distinct physiographic zones, including the uplands, the breaks, the river terraces and floodplain, and the river itself (Lehmer, 1971:49–53). The valley is greatly modified by the construction of five mainstem dams operated by the U.S. Army Corps of Engineers. These dams created reservoirs that have destroyed and/or inundated thousands of archeological sites. A number of sites are currently being directly affected by these reservoirs and by vandals, particularly in the tailwaters of Lake Oahe near Mobridge, South Dakota, and in the Big Bend reservoir (Lake Sharpe). The Interagency Archeological Salvage Program (IASP) was established to salvage a small portion of these cultural resources. Between 1945 and 1969 the IASP coordinated the efforts of (1) the Smithsonian Institution River Basin Surveys (SI-RBS) Missouri Basin Project; (2) cooperating institutions, such as universities and historical societies; and (3) the National Park Service Midwest Archeological Center (NPS-MWAC) (Ahler, 1993a:30; Thiessen, 1994a:18, 1999). Most of the data used in this report was derived from IASP. Details of the administration of the IASP program, as well as life in the field, are found in Wedel (1967), Lehmer (1971:1–23), Jennings (1985), Smith (1992), Thiessen (1994a, 1994b, 1999), Wood and Hoffman (1994), Hurt (1995), Wood (1995), Gradwohl (1997), and Grange (1997).

In his synthesis of Middle Missouri Archeology, Lehmer (1971, fig. 21) divided the subarea into the Big Bend, Bad-Cheyenne, Grand-Moreau, Cannonball, Knife-Heart, and Garrison regions. The portion of the river below the Big Bend region was not included within Lehmer's (1971:37) regional scheme, although it is apparent that the area, herein labeled the Fort Randall region (Figure 1), has cultural relationships to the Big Bend region, as well as to other plains subareas. In an earlier report of Middle Missouri archeology that proved to be a draft of his 1971 synthesis, Lehmer (1965:K28) defined the Lower Fort Randall district or region as encompassing the area between the White and Niobrara Rivers. One year later, Lehmer and Caldwell (1966) dropped the Ft. Randall and Garrison districts in their application of the Willey and Phillips (1958) taxonomy to the Middle Missouri subarea. Ahler (1993b:58–59) proposed two additional tentative regions, not depicted in Figure 1 (Lower Yellowstone, Little Missouri), as well as a separation of the Knife-Heart region into two distinct areas. Related sites located off the Missouri River that had been assigned to the Initial variant of the Middle Missouri tradition (Knudson, 1967:278–280; Lehmer, 1971:98; Alex, 1981a; Tiffany, 1983; Toom, 1992a; A. Johnson, 1993), as well as the Coalescent Lower Loup phase and the historic Pawnee (Grange, 1968; O'Shea, 1989) extended the area of interest into western and southeastern South Dakota, northwestern Iowa, southwestern Minnesota, and Nebraska (Figure 2). Most of the sites that form the basis of this study are located along the Missouri River in South Dakota (Figure 3). Sites from other Plains subareas are incorporated for comparative purposes.

The Plains villagers of the Middle Missouri subarea lived in circular and rectangular lodges arranged in a variety of village plans and subsisted on a dual economy of

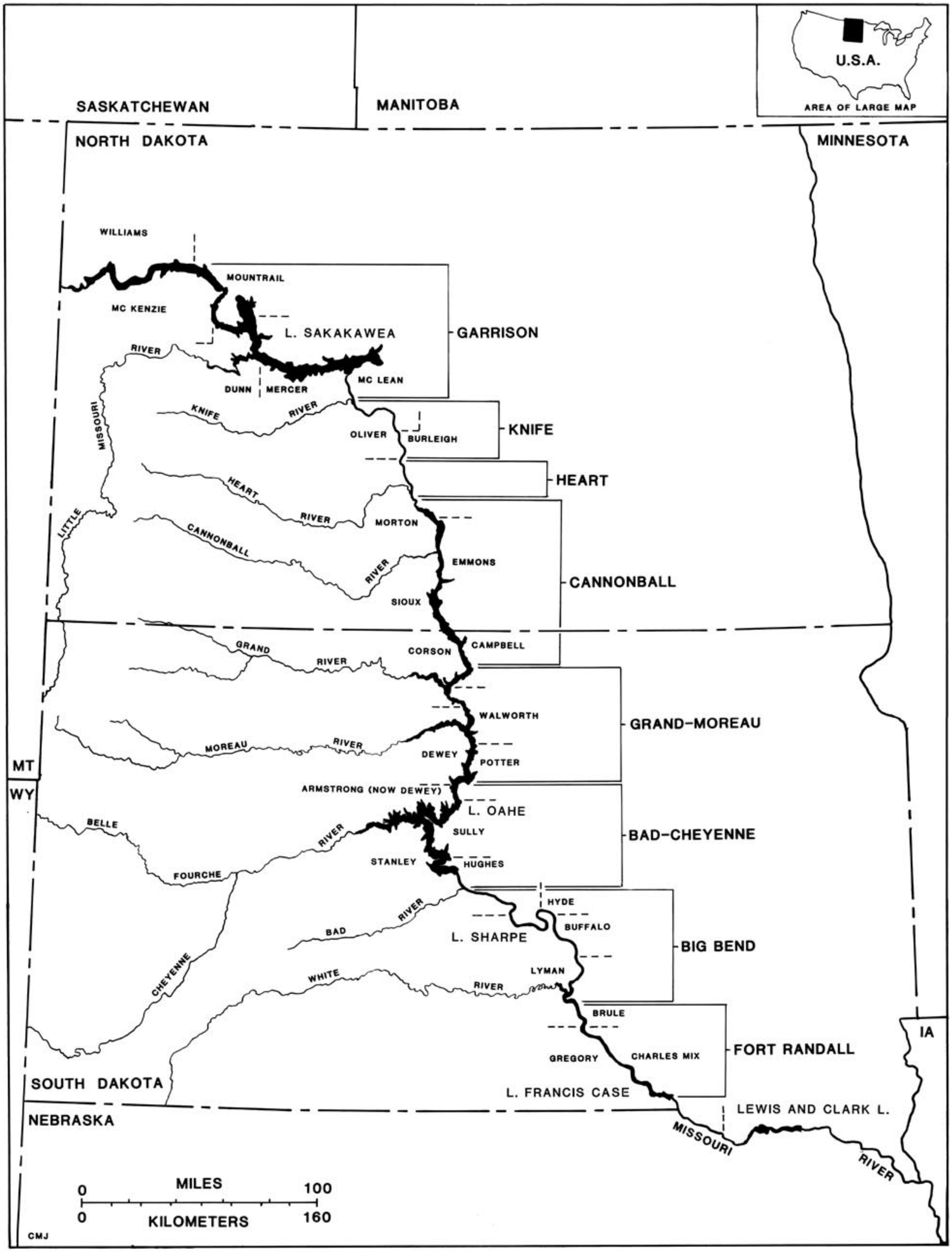

FIGURE 1. The Middle Missouri subarea with archeological regions, counties, and reservoirs depicted.

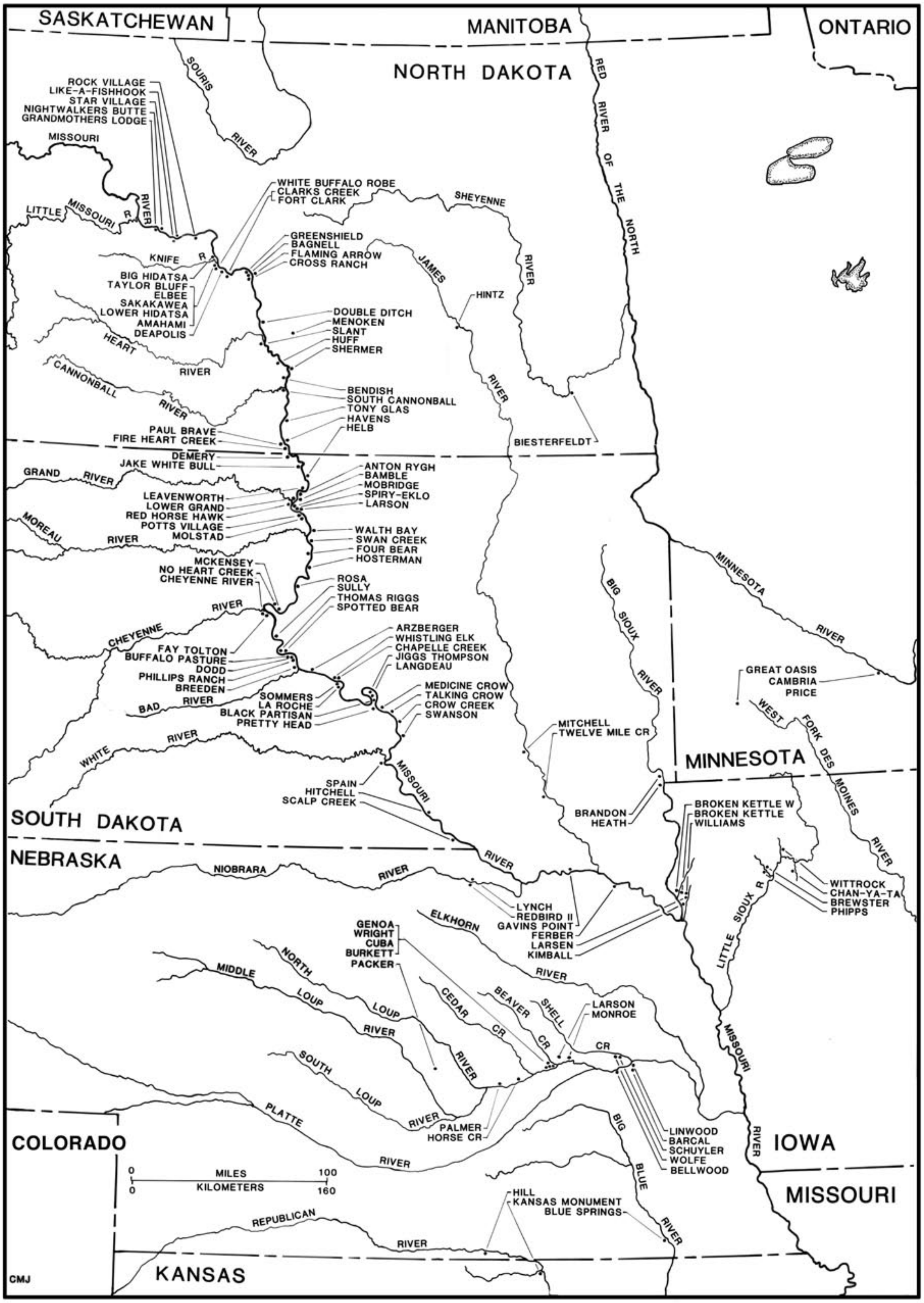

FIGURE 2. Location of selected Plains Village archeological sites from the Middle Missouri, Central Plains, and Northeastern Plains subareas.

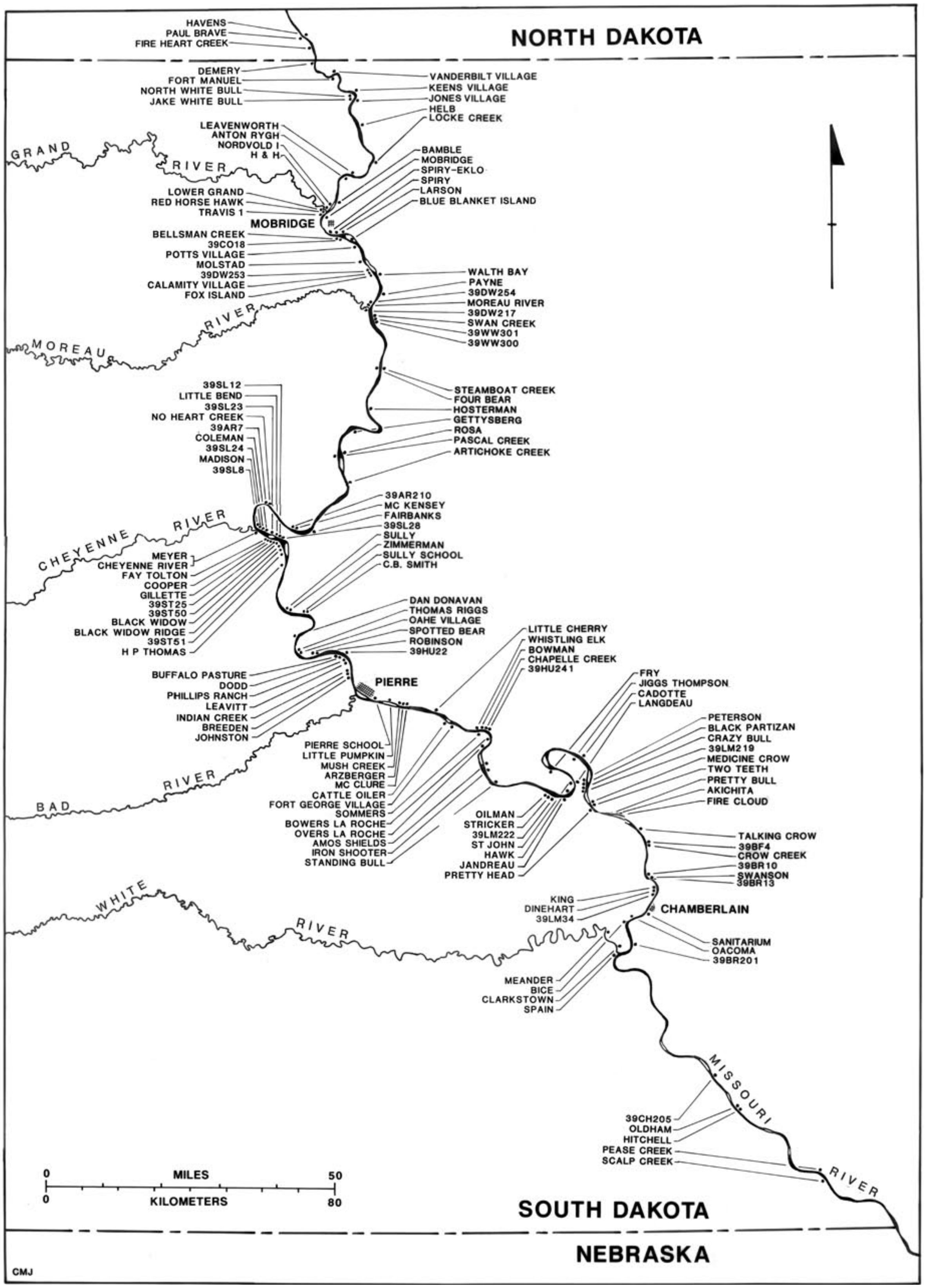

FIGURE 3. Plains Village sites located in South Dakota and southern North Dakota employed in the ceramic ordinations.

bison hunting and horticulture (Wilson, 1917; Lehmer, 1954a:139–140; Lehmer and Wood, 1977; Toom, 1992b). The hunting of smaller animals and the gathering of plants added to this subsistence base, which revolved around an annual cycle (see Hurt, 1969). The relative importance of their subsistence activities is a source of debate, with recent evidence suggesting a greater reliance on bison in one case (Tuross and Fogel, 1994:288). Villages were located on a series of Missouri River terraces and consisted of from several to 200 or more houses, many fortified by a combination ditch and inner wood-post palisade system. Historically, the houses were constructed from wood frames covered with earth (Wilson, 1934). Most villages were probably occupied for one or perhaps two generations (Toom, 1992a:124, 1995:363), but some may have been inhabited for a period of two centuries or more, as indicated by thick midden deposits (Ahler, 1993b, table 25.2). Rectangular Middle Missouri tradition houses usually ranged in length between 30 and 50 feet and were normally 20 to 30 feet wide. Circular, and more rarely square, Coalescent tradition lodges were usually 30 to 40 feet in diameter but could have been as much as 70 feet. Most houses were semi-subterranean and probably earth covered with a central fire hearth and a number of storage/refuse pits dug into their floors. Most village sites contained large quantities of broken grit-tempered ceramic vessels, ground and chipped stone tools, chipped stone flaking debris, bone tools, fire-cracked rock, and unmodified vertebrate remains indicative of rather intensive occupations. Small amounts of Euro-American trade items made from metal or glass have been found in villages dating after about AD 1600/1650. Human remains were occasionally found on house floors or in pits but were most commonly found in separate cemeteries associated with late Extended Coalescent and Post-Contact Coalescent period villages (AD 1600–1780). Summaries of both the Middle Missouri and Coalescent traditions have been reported in Lehmer (1954a, 1971, 2001), Winham and Lueck (1994), Toom (1996), C. Johnson (1998a, 1998c), Winham and Calabrese (1998), Wood (1998, 2001), and Krause (2001). Descriptions of the history and culture of their Mandan, Hidatsa, and Arikara descendents have been published by Wood and Irwin (2001), Stewart (2001), and Parks (2001), respectively.

NOTE

1. The site numbers appearing in this report are based upon a trinomial, or Smithsonian Institution, site designation system. The three components are codes that represent the state, county, and site within each county. The 48 contiguous states are listed in alphabetical order and are given a number between 1 and 48, with Alaska and Hawaii given the final two state numbers. Counties within each state are given a two letter designation. Sites within each county are given a number that is generally based upon their order of discovery. The five state numbers in this report are Iowa (13), Minnesota (21), Nebraska (25), North Dakota (32), and South Dakota (39). Thus, using this system, Cheyenne River (39ST1) is the first site in Stanley County, South Dakota, to be given a site number.

2

Previous Culture-Historical Reconstructions

Throughout the history of systematic archeological investigations in the Middle Missouri subarea of the Plains, archeologists have focused on developing Plains Village culture taxonomies and chronologies (Wood, 1969). These have taken the form of culture-historical syntheses, which were based mainly upon intuitive understandings of the information at hand and data-based ceramic seriations or ordinations. The former efforts were in vogue from about 1940 to 1971, whereas ceramic ordinations, in conjunction with radiocarbon dates and other temporal indicators (e.g., site stratigraphy, historic documentation, metal trade artifacts), generally began to be used after that period. The addition of radiocarbon dating during the 1960s facilitated the construction of the most commonly accepted taxonomic and chronological framework (Lehmer, 1971). Work at the Knife River Indian Villages National Historic Site (KNRI) resulted in a revised developmental sequence for the Knife and Heart regions (Ahler, 1993b). Ahler (1993a:32–41), Billeck and Byrd (1996:4–30), and Toom (1996:60–65) presented summaries of archeological research and taxonomy within the Middle Missouri. These and other taxonomies provide the historic context of the present study.

DESCRIPTION AND EARLY CLASSIFICATION PERIOD (1883–1945)

This period began with the explorations of the Northwestern Archaeological Survey by Theodore Lewis in 1883 and continued through the work of George Will and Herbert Spinden at Double Ditch and other sites in North Dakota. William D. Strong (1940) formulated the first widely accepted chronology of Plains Village sites within the Dakotas. He assigned the villages to the Mandan, Hidatsa, and Arikara through the direct-historic approach, using a variety of historic, protohistoric, and prehistoric components that he excavated in the 1930s. A related effort by Wedel (1940) dealt with cultural developments in the Central Plains. The next synthesis to appear (Will and Hecker, 1944) was based upon a large number of sites in North Dakota and north-central South Dakota (c.f. Will, 1924). They assigned those sites to three sequential periods (Archaic

Mandan, Middle Mandan, Later Heart River) that are the approximate equivalents of the Extended Middle Missouri variant, Terminal Middle Missouri variant, and the Heart River phase, respectively.

Bowers (1948a) developed a culture-historical model of the Mandan and Hidatsa on the basis of ethnographic information and data recovered from test excavations at a large number of sites in North and South Dakota from 1929 to 1933 for the Logan Museum, Beloit College, Beloit, Wisconsin. He organized the components into 15 foci (Arzberger, Cannonball, Cheyenne, Crow Creek, Ft. Sully, Heart River, Huff, La Roche, Lower Grand, Meyers, Painted Woods, Pierre, Sommers-Fort-George, Upper Grand, Woodlands), some of which have been recognized in modified form in later syntheses. Some of these units have been identified with particular subgroups of the Mandan and Hidatsa. Bowers' cultural reconstruction, based upon the direct-historic approach, never received broad acceptance because neither his dissertation nor the primary data upon which it was based were ever published (Ahler, 1993a:35). His model was later eclipsed by the one proposed by Lehmer (1954a, 1971). Subsequent work at the Knife River Indian Villages National Historic Site adds credibility to Bower's model (Ahler, 1993a:35).

SALVAGE ARCHEOLOGY AND CULTURE HISTORY PERIOD (1945–1970)

The construction of dams and reservoirs in the Missouri River basin by the U.S. Army Corps of Engineers and the Bureau of Reclamation after World War II prompted archeologists to begin to survey and excavate numerous Plains Village sites. This was done under the auspices of the Interagency Archeological Salvage Program (IASP), a multi-agency program composed of the Smithsonian Institution (which sponsored the Smithsonian Institution River Basin Surveys [SI-RBS]) and various cooperating entities (e.g., universities and historical societies) (Thiessen, 1999). The accumulating mass of information from this program prompted Robert Stephenson (1954), along with other archeologists, to develop a cultural taxonomy of the Middle Missouri and Central Plains subareas that was based upon the Midwestern Taxonomic System. This model has five aspects and at least eight foci that focus on the Plains Village components concentrated in the Bad-Cheyenne and Big Bend regions. Many of these divisions are recognized today, although the names and assigned components have changed. The five aspects of concern here and their current equivalents are the Pahuk (Talking Crow phase, Historic Pawnee-Lower Loup phase), Sanish (Bad River phase), Chouteau (Extended Coalescent variant), Aksarben (Initial Coalescent variant), and Chamberlain (Anderson phase) aspects. A sixth unnamed aspect includes five Over focus components (Swanson, Mitchell, Brandon, Twelve Mile Creek, Dinehart), which are now assigned to the Initial Middle Missouri variant. A good summary of many of these taxonomic units from the perspective of the Arzberger site appears in Spaulding (1956:65–110).

During the 1950s, Wesley Hurt produced a series of site reports on his work in South Dakota in which he defined a number of foci. The reports in this series contained essentially the same chronology chart dealing with the full range of Middle Missouri and Coalescent taxonomic units, including those defined by Hurt's contemporaries. The Over focus of the Mill Creek aspect, initially formulated by Over and Meleen (1941:40–41) from villages along the James and Big Sioux Rivers (Brandon, Mitchell, Twelve Mill Creek), was expanded to include the Swanson and Brandon sites (Hurt, 1951:15–16). Hurt's work at the Thomas Riggs site formed the basis for the Thomas Riggs focus (Hurt, 1953:47–48), a unit now included within the Extended Middle Missouri variant. He also postulated the Bennett, La Roche, and Akaska foci to include Coalescent components in the Chamberlain, Pierre, and south Mobridge areas (Hurt, 1957:26–30, 80). Today, these taxonomic units are part of the Extended variant of the Coalescent tradition. His Le Beau focus, currently the Le Beau phase of the Post-Contact Coalescent, was based upon excavations at the Swan Creek site (Hurt, 1957).

At about the same time, Donald Lehmer (1954a: 114–159; 1954b:138–159) developed a culture-historical taxonomy that gained widespread acceptance by incorporating some more recent minor modifications. This model proposed a Plains Village pattern encompassing all semi-permanent villages in the Central Plains and Middle Missouri subareas. This pattern, or tradition as it later became to be known, is composed of the Middle Missouri, Coalescent, and Central Plains traditions. The Plains Village chronological sequence in the Oahe Dam area was designated the Fort Pierre Branch in an earlier synthesis (Lehmer, 1952a), a short-lived term that is no longer used. Based upon the superpositioning of circular Coalescent earthlodges upon rectangular Middle Missouri tradition houses at the Dodd site (39ST30), Lehmer was able to develop a relative chronological relationship between the two traditions, anchoring the late Coalescent sites into historically documented Mandan, Hidatsa, and Arikara villages. He envisioned the Coalescent tradition as a blending, or "coalescence," of cultural traits of the

Middle Missouri and Central Plains traditions. A series of radiocarbon dates were instrumental in establishing approximate temporal spans of the two traditions and their variants (Lehmer, 1971:33). A dendrochronological dating program in the Middle Missouri subarea was undertaken by Weakly (1971), although the results did not gain widespread acceptance because of a variety of problems (Caldwell and Snyder, 1983). Thiessen (1977) and Toom (1992a, 1992b) completed examinations of Middle Missouri tradition radiocarbon dates. Their results generally supported Lehmer's temporal positions of Middle Missouri tradition variants.

Most taxonomies developed in the 1960s dealt with low-order integrative units, such as the phase. Most notable among these are the Grand Detour phase (Caldwell and Jensen, 1969), the Bad River phase (Hoffman and Brown, 1967), and the Felicia focus (Caldwell, 1966a:80). A broader based taxonomic system, incorporating the Willey and Phillips (1958) system, appears in Deetz (1965:7–18). Deetz discussed two regional sequences, incorporating two phases (Aksarben, Lower Loup) and the historic Pawnee from the Central Plains, and five phases (Middle Missouri, Arzberger, La Roche, Stanley, Snake Butte) from the Middle Missouri region. Soon after, Lehmer and Caldwell (1966) and Lehmer (1966:53–54) presented a revised version of the Lehmer (1954a:114–154) taxonomic scheme, incorporating the units of the Willey and Phillips (1958) system. Lehmer (1966:56–60), in his analysis of the Fire Heart Creek site, defined the Fort Yates phase to include all Extended Middle Missouri tradition sites in the Knife-Heart and Cannonball regions, then called districts. He also drew comparisons to similar sites in the Bad-Cheyenne district, which was assigned to the Thomas Riggs focus. Except for a few modifications made since then, the Lehmer and Caldwell system remains essentially unchanged. Wood (1967:112–146), in a report of his Huff site excavations in the Cannonball region, proposed the Huff focus. It represents the final phase of the Middle Missouri tradition stretching back to the Extended Middle Missouri Thomas Riggs focus and the Initial Middle Missouri Chamberlain aspect found to the south in the Bad-Cheyenne and Big Bend regions. Wood's Thomas Riggs focus included all sites currently included within the Extended Middle Missouri.

Drawing on his earlier syntheses (Lehmer, 1954a:114–159, 1966:53–67), the taxonomic outline by Lehmer and Caldwell (1966), and a summary of Middle Missouri archaeology (Lehmer, 1965), Lehmer (1971) presented his most influential and lasting contribution to the archeology of the subarea. Because his 1971 synthesis was formulated on information available prior to this time, it is placed in the "Salvage Archeology and Culture History Period." In it, Lehmer defined six regions of the subarea (Garrison, Knife-Heart, Cannonball, Grand-Moreau, Bad-Cheyenne, Big Bend) that are almost identical in their boundaries to the earlier defined districts (Lehmer and Caldwell, 1966). The Plains Village pattern or major cultural tradition is divided into two distinct traditions, the Middle Missouri and the Coalescent, that are in turn subdivided into seven variants, which supersede the earlier defined horizons (Lehmer, 1971:28–33).

CONTRACT ARCHEOLOGY AND CULTURAL ECOLOGY PERIOD (1970–PRESENT)

This period begins with the dissolution of the SI-RBS program and the beginning of problem-oriented research. Although this transition began several years prior to 1970, this date is chosen as an approximate demarcation point. From 1968 until his death in 1975, Donald J. Lehmer of Dana College in Blair, Nebraska, together with W. Raymond Wood and his graduate students from the University of Missouri-Columbia, conducted field investigations at more than 20 Plains Village sites in the upper Knife-Heart region (Lehmer, 1967; Lehmer et al., 1978:v–ix; Wood, 1986a:x–xi). This region was chosen because its archeology was largely unknown, and it is the only large portion of the Middle Missouri subarea unmodified by the construction of the mainstem reservoirs. National Park Service-Midwest Archeological Center excavations from 1969 to 1973, under the overall direction of Carl R. Falk and Stanley A. Ahler, targeted three Plains Village sites (Helb, Walth Bay, Lower Grand) in the upper Oahe Reservoir (Falk and Ahler, 1988; Thiessen, 1999:59–61). Unlike the earlier work in the upper Knife-Heart region, these investigations focused on intensive large-scale excavations. The two programs were not only influential in refining field procedures and the cultural sequences in the Knife, Cannonball, and Grand-Moreau regions, but more importantly, they introduced a number of Wood's graduate students to Plains Village archeology. Some of these students, such as Stanley A. Ahler and Carl R. Falk, have continued their interest in the subarea, representing a "third generation" of Middle Missouri archeologists who, in turn, became mentors to and influenced their own students and colleagues, including this author. Ray Wood's enthusiasm for research in the subarea has encouraged a number of his students to pursue research into the expanded fields of ethnohistory, cultural ecology, and disease ecology.

The results of some of the 1968 field work in the upper Knife-Heart (i.e., Knife) region, as it pertains to culture history and archeological taxonomy, is summarized in Lehmer (1971: 203–206). Two studies, Lehmer et al. (1978) and Wood (1986a:7–24), have portions devoted to cultural chronology and taxonomy based upon Lehmer's framework. Lehmer et al. (1978) focused on the last period of Plains Village life, the Knife River phase, whereas Wood (1986a:7–24) summarized the culture history of the region from the Middle Missouri through the Coalescent traditions, ending with the non–Plains Village historic Dakota occupations at several sites. Despite the fact that his synthesis largely reflects earlier culture history formulations, Wood extended the Heart River phase, originally placed fully within the protohistoric period at AD 1675 to AD 1780 by Lehmer, well back into the prehistoric period at AD 1450 to AD 1780. In summary, both the Lehmer and Wood syntheses have been eclipsed by recent developments stemming from the research program within the Knife River Indian Villages National Historic Site.

The validity of the Lehmer culture-historical model, particularly as it pertains to the Coalescent tradition, also has been called into question as a result of recent research within the Knife River Indian Villages National Historic Site (Lovick and Ahler, 1982:57–65; Ahler, 1993a:38–39). This problem was traced, at least in part, to the fact that Lehmer's scheme developed from his early work in South Dakota, where the Caddoan-speaking Arikara were the dominant group. On the other hand, the North Dakota prehistoric record is largely based upon the Siouan-speaking Mandan and Hidatsa. The results indicate that the Coalescent tradition, as it is defined by Lehmer (1971:115–120), is most similar to the Willey and Phillips (1958:33) horizon and does not account for the cultural diversity present within the Knife and Heart regions of the Middle Missouri subarea. There appears to be at least three cases in which the process of coalescence or diffusion occurred, but they did not occur sequentially nor did they always involved the same groups: (1) when Caddoan speakers moved from the Central Plains to the Middle Missouri; (2) when the southern Mandan adopted architectural and ceramic traits from others while in the Black Hills; and (3) when the three groups of Hidatsa and two groups of Mandan interacted in the Knife and Heart regions (Ahler, 1993a:38). According to John Ludwickson, it is diffusion, precipitated by climatic change ("little Ice Age"), large-scale warfare, and pre-European epidemic diseases that led to widespread borrowing among groups. Diffusion and not micro-evolution within ethnic groups led to the dramatic material culture changes encompassed under the banner of the "Coalescent tradition" (pers. comm., 1993). Lehmer (1971:99, 104, 125–128) also identified a number of cases of borrowing between different variants.

Bowers' (1948a, 1965:10–25, 476–489) model, although limited by a lack of taxonomic rigor, is better able to accommodate the complex cultural developments within the Knife and Heart regions. As a result, five partially contemporaneous and sequential cultural complexes (Charred Body, Middle Missouri, Painted Woods, Heart River, Knife River), encompassing 11 phases, are defined for the Knife and Heart regions (Ahler et al., 1991:27; Ahler, 1993b). The Middle Missouri complex includes the Fort Yates phase and is followed by the Huff phase in the Cannonball region, which was assigned by previous researchers to the Extended and Terminal variants of the Middle Missouri tradition. The Charred Body complex is partially contemporaneous with the Fort Yates phase and represents the earliest villagers in the Knife, Heart, and Garrison regions. The next two phases, Clark's Creek and Nailati, have components assigned to both the Middle Missouri and Painted Woods complexes. The Scattered Village and Mandan Lake phases also are assigned to the Painted Woods complex, with the latter also containing components of the Heart River complex. The Heart River complex includes almost all late villages in the Heart region assigned to the Heart River phase (Lehmer, 1971:203–205). Because there is so little systematic research within the Heart region, phases are not defined for the Heart River complex there. Data from only two of these sites, Double Ditch and Slant, have been reported (Will and Spinden, 1906; Ahler, Schneider et al., 1980; Ahler, 1997). Heart River complex components in the Knife region are included in the Mandan Lake, Hensler, and Willows phases. Some components of the Willows phase also are assigned to the Knife River complex, as are all succeeding Minnetaree, Roadmaker, and Four Bears phase villages. Knife River complex components represent the protohistoric villages of the Mandan and Hidatsa, including remnant Arikara groups from South Dakota. This complex most closely corresponds to Lehmer's (1971:203–206) Heart River 2 and Knife River 1 and 2 subphases. The latter two subphases are assigned to Lehmer's Disorganized Coalescent variant. The dating of the late village components, traditionally assigned to the Coalescent tradition in the Knife and Heart regions, also has been modified. Many were occupied up to 200 years earlier than previously believed (Ahler, 1993b, figs. 25.1–25.2).

Other efforts at refining the Middle Missouri tradition taxonomy focused on Initial variant sites along the lower James River in southeastern South Dakota and in the Mill Creek sites in northwestern Iowa (Alex, 1981b:171–186;

Tiffany, 1982:93–98, 1983). Alex included the Mitchell, Bloom, Twelve Mile Creek, and Goehring sites in the Lower James phase. Tiffany proposed adding the Swanson and Brandon phases along with the conversion of three foci to phases (Anderson, Cambria, Thomas Riggs). The Chamberlain and Mill Creek variants, two spatial variants of the Initial Middle Missouri, also were added to the growing list of taxonomic units. The Chamberlain variant is similar to Hurt's (1953, chart III) Chamberlain aspect. Tiffany's two new spatial variants are further solidified with the differentiation of the Initial Middle Missouri variant into western and eastern divisions (Toom, 1992a, 1992b). Steinacher (1990, table 2) presented a summary of Initial Middle Missouri taxonomy.

In addition to the work at the Knife River Indian Villages National Historic Site, a series of research results from sites in South Dakota has raised questions about the validity of the widely accepted Lehmer model of Plains Village taxonomy and development within the Middle Missouri subarea. One of these challenges the concept that the earliest Coalescent tradition villages, those assigned to the Initial variant, represent admixtures of Central Plains and Middle Missouri tradition cultural traits (Steinacher, 1983:91–95). Despite earlier pronouncements by Lehmer (1971:111), the results of this research indicate that at least some of these Initial Coalescent villages are essentially Central Plains tradition sites that lack evidence of a blending of traits. Additional radiocarbon dates also indicate that the Initial Coalescent began about AD 1300, some 100 years before the commonly accepted date for the variant (Toom, 1992b, table 1; C. Johnson, 1998a:308), and the time span for the Initial Middle Missouri variant along the Missouri River was compressed from Lehmer's AD 900 to AD 1400, to AD 1000 to AD 1300 (Tiffany, 1982, fig. 27; 1983, fig. 5; Toom, 1992a: 125, 1992b, table 1). Other archeologists have questioned the taxonomic assignments of Extended Middle Missouri villages in South Dakota (Falk and Calabrese, 1973; Ahler, 1977a:14–145; A. Johnson, 1977). The implications of these results are addressed in chapter 6.

These developmental sequences and taxonomies, encompassing the period between AD 900 and AD 1886, is reconstructed in Figure 4. It is based upon existing radiocarbon dates and the discussions by Lehmer (1971), Steinacher (1983), Tiffany (1983), Toom (1992a, 1996), Ahler (1993b), and C. Johnson (1998a) but does not include the findings in the present study. The resulting taxonomy, composed of the Middle Missouri and Coalescent traditions, is essentially unchanged from Lehmer's (1971:33), except for the Knife, Heart, and Cannonball regions, where Ahler's system was adopted. The contrast between the Lehmer and Ahler systems is presented in Table 1. The dating of the Middle Missouri and Coalescent traditions and the variants and phases they subsume, however, is in the process of being revised. Six of Lehmer's seven variants (Initial, Extended, and Terminal Middle Missouri; Initial, Extended, and Post-Contact Coalescent) also are recognized, with the Disorganized variant absorbed into the Post-Contact Coalescent. The Initial variant of the Middle Missouri tradition is divided into nine phases included within eastern (Great Oasis, Big Sioux, Little Sioux, Brandon, Cambria, Lower James phases) and western (Swanson, Grand Detour, Anderson phases) divisions following the conventions of Tiffany (1983) and Toom (1992a, 1992b). The Extended Middle Missouri variant, or Middle Missouri complex, includes four phases (Thomas Riggs, Fort Yates, Clark's Creek, Nailati), whereas Huff is the sole phase of the Terminal variant. The Initial Coalescent variant is divided into two phases (Campbell Creek and Arzberger), with the Anoka phase formulated to include the Lynch site in Nebraska (not depicted in Figure 4). The Extended variant of the Coalescent tradition is separated into a large number of foci and phases. The most recent, although poorly defined, scheme (Lehmer, 1971:120) proposed six phases for the Extended Coalescent (Shannon, Bennett, La Roche, Akaska, Le Compte, Redbird). Four of Lehmer's (1971:201–206) six Post-Contact Coalescent phases (Felicia, Talking Crow, Bad River, Le Beau) also were recognized, pending future modifications. His Knife and Heart River phases are eliminated in favor of the Knife and Heart River complexes of Ahler (1993b). Detailed discussions of the cultural taxonomy of the Plains Village pattern are presented with each ceramic ordination in chapter 6.

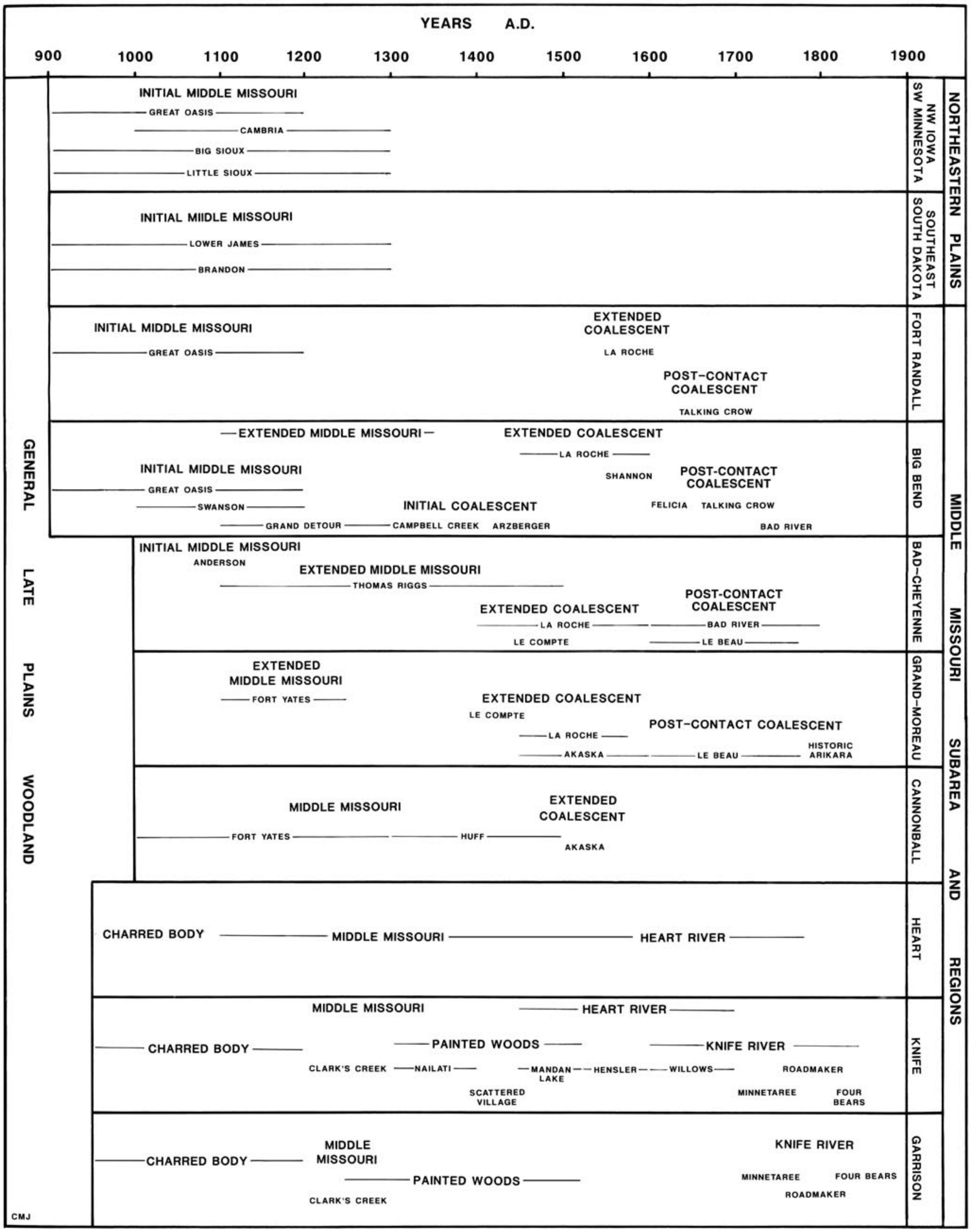

FIGURE 4. Cultural chronology of the Middle Missouri subarea.

TABLE 1. Commonly used Middle Missouri subarea Plains Village taxonomic systems (Lehmer, 1971; Ahler, 1993b).*

LEHMER TAXONOMY
(All Middle Missouri subarea regions)

Tradition	Variant	Phase/Focus/Aspect	Type Sites/Important Sites
Middle Missouri	Initial (AD 900–1400)	Anderson	Dodd, Breeden, Fay Tolton
	(AD 1000–1300)	Grand Detour	Jiggs Thompson, Pretty Head, Langdeau
		Swanson	Swanson, Crow Creek, King
		Lower James	Mitchell, Bloom, Twelve Mile Cr., Ghoering, Ethan
		Brandon	Brandon
		Cambria	Cambria, Price
		Big Sioux	Broken Kettle, Kimble
		Little Sioux	Phipps, Brewster, Wittrock, Chan-Ya-Ta
		Great Oasis	Great Oasis, Broken Kettle W., Hitchell, Oldham
	Extended (AD 1100–1500)	Clark's Creek	Clark's Creek
	(AD 1100–1500)	Nailati	Cross Ranch
		Fort Yates	Fire Heart Creek, Paul Brave, Jake White Bull
		Thomas Riggs	Thomas Riggs, Pitlick, Cheyenne River
	Terminal (AD 1500–1675)	Huff	Huff, Shermer
	(AD 1500–1650)		
Coalescent	Initial (AD 1400–1500)	Arzberger	Arzberger
	(AD 1300–1500)	Campbell Creek	Talking Crow, Crow Creek
		Anoka	Lynch
	Extended (AD 1550–1675)	Le Compte	Potts, Molstad, Moreau River
	(AD 1500–1650)	Akaska	Swan Creek
		La Roche	Scalp Creek, La Roche, McClure, Robinson
		Bennett	Black Widow B, Meyers
		Shannon	Spain A, Clarkstown B
		Redbird	Redbird II
	Post-Contact (AD 1675–1862)	Knife	Deapolis, Rock Village, Nightwalker's Butte
	(AD 1650–1886)	Heart River	Double Ditch, Slant, Boley, Mandan L, Smith Farm
		Le Beau	Four Bear, Anton Rygh, Spiry-Eklo, Swan Creek
		Bad River	Dodd, Buffalo Pasture, Philips Ranch
		Talking Crow	Medicine Crow, Talking Crow, Oacoma, Oldham
		Felicia	Two Teeth, Cadotte, Black Partizan

AHLER TAXONOMY
(Cannonball, Heart, Knife and Garrison regions only)

Complex	Phase	Type Sites/Important Sites
Charred Body (AD 900/1000–1200)	—	Flaming Arrow, Menoken
Middle Missouri (AD 1000–1450/1500)	Fort Yates (AD 1000–1300)	Fire Heart Creek, Paul Brave, Jake White Bull
	Huff (AD 1300–1500)	Huff
	Clark's Creek (AD 1200–1300)	Clark's Creek, Steifel, Grandmother's Lodge
	Nailati (AD 1300–1400)	Cross Ranch
Heart River (AD 1450–1785)	Mandan Lake (AD 1450–1525)	Mandan Lake
	Hensler (AD 1525–1600)	Lower Hidatsa, White Buffalo Robe
	Willows (AD 1600–1700)	Lower Hidatsa
Painted Woods (AD 1300–1525)	Clark's Creek (AD 1200–1300)	Clark's Creek, Steifel, Grandmother's Lodge
	Nailati (AD 1300–1400)	Cross Ranch, White Buffalo Robe, Amahami
	Scattered Village (AD 1400–1450)	Big Hidatsa, Upper Sanger, Mandan Lake
	Mandan Lake (AD 1450–1525)	Mandan Lake, Mahhaha
Knife River (AD 1600–1886)	Willows (AD 1600–1700)	Mahhaha, Big Hidatsa
	Minnetaree (AD 1700–1785)	Lower Hidatsa, Big Hidatsa, Molander
	Roadmaker (AD 1785–1830)	Big Hidatsa, Sakakawea, Deapolis, Ft. Clark
	Four Bears (AD 1830–1886)	Ft. Clark, Deapolis, Rock Village, Like-a-Fishhook

* The first series of dates for the Lehmer variants are those appearing in Lehmer (1971, table 2). The second series below these are those proposed by Toom (1996, table 8). Lehmer's Disorganized Coalescent variant is included in the Post-Contact Coalescent. Some phases and sites included in the Lehmer scheme have been added by later researchers. Lehmer did not include the Cambria, Big Sioux, Little Sioux, or Great Oasis phases in his taxonomy; they were added later by other archeologists.

3 Methods of Dating

Archeologists divide dating techniques into two general classes, absolute and relative. Absolute techniques rely on a number of procedures, such as radiocarbon dating, to determine the age of a particular sample. Relative techniques, one of the most popular being seriation, or ordination, place various strata, artifacts, or groups of artifacts from a common provenience unit in an order that is interpreted to be temporal in nature. Because ceramic ordination plays a major role in refining the Plains Village chronology of the Middle Missouri subarea, the subject of this study, several theoretical and methodological issues are addressed.

CERAMIC ORDINATION

Archeologists have employed seriation, or ordination, as a relative dating or ordering technique since the nineteenth century, beginning with the work of a number of Old World archeologists. Willey and Sabloff (1993) discussed early applications in the New World. James A. Ford, together with several of his colleagues, applied the technique to a large number of collections from the lower Mississippi River valley (Phillips et al., 1951). One of his more influential studies described the technique in detail (Ford, 1962). As a consequence of the work of Ford and others, and of concurrent advances in seriation techniques by Brainerd (1951) and Robinson (1951), a large number of early chronologies were built upon ceramic seriations, including a number from the Middle Missouri subarea of the Plains.

Applications in the Middle Missouri Subarea

The role of pottery in assessing the similarities between components and what these relationships entail for cultural chronologies and taxonomies has been explicitly addressed in a number of seriations and ordinations within the Middle Missouri subarea. These efforts, focusing on intrasite and intersite ceramic variability, provide a context for the ceramic ordinations developed for this report. Beginning with modest efforts in the early 1960s, ceramic seriation was applied with increasing frequency because of the development of various computerized and noncomputerized quantitative techniques. The first of these (Smith, 1960, 1963) relies on the Ford (1962) technique of visually arranging ceramic types from various components into lenticular or "battleship" curves. Shortly thereafter, the techniques developed by Brainerd (1951), Robinson (1951), and Meighan (1959, as modified by Ascher, 1959) began to be used with increasing regularity as additional sites were excavated. Several of the more notable analyses in this regard are by Hoffman (1963a, 1972). More recently, multivariate statistical techniques, such as principal components analysis, have been used to assess the chronological relationships between large numbers of provenience units within particular sites or between site components (C. Johnson, 1977a, 1977b; Falk, Johnson, and Richtsmeier, in prep.; Falk, Steinacher, and Johnson, in prep.; Falk and Johnson, in prep.). The following discussion briefly summarizes these studies for each Plains Village variant, including related sites not situated along the Missouri River in southeastern South Dakota and northwestern Iowa.

Initial Middle Missouri

The earliest attempt to use a quantitative statistical measure to assess the ceramic relationships between provenience units at a site was by Lehmer (1954a:73–83), for artifacts excavated at the Dodd site (39ST30), a multicomponent village containing two and perhaps three distinct Plains Village occupations. As noted earlier, the data obtained from the excavations at this site also was instrumental in developing Lehmer's cultural taxonomy within the subarea. Lehmer used the mean standard error and the index of association to assign particular provenience within the site to three components, one Post-Contact Coalescent component and two Initial Middle Missouri components. His analysis, not a seriation in the strictest sense of the word, was the first to evaluate the nature of intrasite variations with a full range of material classes. Because of its limited applicability (Robinson, 1952), the mean standard error did not become popular, and Lehmer's early interest in quantitative analyses waned in his later research. A study by Ehrenhard (1971) used a factor analysis of ceramics in an attempt to determine if the King site (39LM55) represents a hybridization of the Initial and Extended Middle Missouri, as represented by the Sommers and Thomas Riggs sites, respectively. Like Lehmer's Dodd site study, this was not a seriation, but it represents the first study to use factor analysis to evaluate intersite relationships within the Middle Missouri subarea.

Several analyses by Johnson (Falk and Johnson, in prep.; Falk, Johnson, and Richtsmeier, in prep.) and Steinacher (Falk, Steinacher, and Johnson, in prep.) used multivariate statistical techniques to order Initial variant sites along several dimensions of variability. Johnson's analyses used an r-mode principal components procedure of five ceramic types to order nine Missouri River components along two factors based upon their factor scores. One of the extracted factors was interpreted to be temporal in nature, although there was an insufficient amount of independent information, in the form of site stratigraphy and radiocarbon dates, to support this interpretation. Steinacher's study used a variety of techniques (cluster analysis, principal components analysis, multidimensional scaling) to arrange a larger set of Initial Middle Missouri, Great Oasis, Mill Creek, and Extended Middle Missouri components. Only the Initial variant components located along the Missouri River, including the Mitchell site, were subjected to an intensive analysis. The final analysis used 18 of these components and a number of ceramic types and attributes to distill what Steinacher interpreted to be temporal dimensions in the data, supported by radiocarbon dates. The results conflict with Johnson's earlier findings. In his intrasite analysis of the Sommers site pottery, Steinacher (1990) used the Brainerd-Robinson technique, principal components and cluster analysis, and a number of additional statistical measures to assess stylistic variability and complexity. His goal was to test four models of site settlement, with the results indicating that the village was a single large settlement that subsequently contracted into a smaller fortified area.

Several ceramic seriations have used Initial Middle Missouri sites located off of the Missouri River along the lower James River in southeastern South Dakota and with Mill Creek components from northwestern Iowa. Alex (1981b) used the Ascher (1959) modification of the Meighan (1959) seriation technique to order units, some composed of very small amounts of pottery, from the Mitchell, Goerhing, and 12 Mill Creek sites based upon the percentages of two wares. A number of seriations of Mill Creek components and/or provenience units also have been accomplished. The first of these (Flanders, 1960) used the Brainerd-Robinson approach on a number of surface and excavated collections from the Little Sioux locality. Flanders' analysis formed the basis of a number of subsequent seriations. The second effort to seriate Mill Creek components was by Vis and D. R. Henning (1969), who used the Ascher and Brainerd-Robinson techniques on as many as 11 components. A key to this analysis was the inclusion of two stratigraphically related zones (upper and lower) from each of two sites, Wittrock and Phipps. Their results support a division of the Little Sioux sites into early and late phases. In a similar seriation, Anderson (1981:104–109) used percentages of the same two pottery types (Kimball and Mitchell Modified Lip) on the same basic set of site units and on an expanded number of proveniences from the Brewster site (13CK15). The Brewster site included a series of stratigraphic units used to support the order of the seriation. Anderson (1981:108) concluded that there was no evidence to support a separation of the Little Sioux phase into early and late subphases. Tiffany (1982:56–66) performed an r-mode principal components analysis of 14 pottery types from the Chan-Ya-Ta site in order to determine the occupational sequence at the site. His claim of two separate components, however, cannot be evaluated without a re-analysis of the distributions of ceramic types within the Brewster provenience units, perhaps by an r-mode principal components analysis linked with factor scores of these units. Tiffany's intersite analysis of Little Sioux locality sites was similar to the previous studies, using the Ascher-Meighan approach. He concluded that his seriation reflected a developmental, diachronic sequence as opposed to Anderson's interpretation that the seriation simply reflected variations of contemporaneous village groups. Finally, D. R. Henning and King (1982:113–130) performed an intrasite seriation of 10 provenience units from the Larsen site (13PM61), a Great Oasis/Mill Creek site from the Big Sioux locality in northwestern Iowa. They used the Brainerd-Robinson and Meihgan techniques and concluded that the site had a single component amalgam of Great Oasis and Mill Creek ceramics.

Extended Middle Missouri

In contrast to the Initial variant of the Middle Missouri tradition, there are virtually no ceramic ordinations of Extended Middle Missouri villages. Calabrese (1972:49–65) performed a discriminant analysis of various metric pottery attributes from three sites (Fire Heart Creek, Paul Brave, Cross Ranch), although his intention was not to develop a chronological ordering but to determine which attributes best discriminate between these sites and how the sites related to each other in discriminant space. It also is of interest to note that he conducted similar analyses with arrow points. Lippincott (1970) ordered a number of Extended Middle Missouri and Post-Contact Coalescent Plains Village components from the upper Knife-Heart region by using the Ford technique on attributes instead of types. C. Johnson (1999) presented a detrended correspondence analysis of 13 Extended Middle Missouri tradition components from North and South Dakota based upon generalized pottery types. Two dimensions were extracted from the data, one relating to spatial variation between the sites. The lack of significant amounts of ceramic variation within the Extended variant and radiocarbon dates prevents any conclusive statements regarding the relationships between chronology and ceramic relationships between the components.

Initial Coalescent

The earliest attempt to seriate Initial Coalescent provenience units was by Smith (1960, 1977:141–149) from his work at the Talking Crow site. He used pottery types and body sherd surface treatment to order up to 21 units from this partially mixed multicomponent Initial and Post-Contact Coalescent site. Steinacher (1983) performed an intersite seriation of five Initial Coalescent components, including the Whistling Elk site (39HU242), using the Brainerd-Robinson procedure on types and attributes. The ceramic assemblages from the ordered sites were compared with five Central Plains tradition sites from Nebraska and Kansas, and one Initial Middle Missouri site (Langdeau) based upon attributes. Steinacher concluded that the earliest Initial Coalescent site, Whistling Elk, was very similar to the Central Plains tradition sites and that this affinity decreased through time within the Initial Coalescent. The results of this analysis contradicted Lehmer's (1971:111) notion that the Initial Coalescent, in its earliest manifestations, represented an admixture or blending of Central Plains and Middle Missouri cultural traits.

Extended Coalescent

Smith (1960, 1963) and Hoffman (1963a) conducted the first seriations of Extended Coalescent components, both relying on the Ford technique to arrange their units. Smith's seriation included three Extended variant components and three early post-contact (Felicia phase) sites in the Big Bend Region. The results support the assignment of the sites to their respective taxonomic units. Hoffman's temporal ordering of the Chouteau aspect (Extended Coalescent) was more ambitious; 11 Extended and seven Post-Contact Coalescent components, from almost the entire length of the Missouri River in South Dakota, were the basis for the analysis. He discovered that these components, although varying along a single temporal continuum, were divided into three temporal units. Hoffman (1967:59–61, 78–79; 1968:65–66, 73–75) pursued his early interests in seriation as a way of assessing the ceramic similarities between sites in his reports on the La Roche and Molstad Village sites. Both efforts compute Brainerd-Robinson coefficients between the two reported sites and from 8 to 19 additional components based upon traditionally defined pottery types. His report of the La Roche sites also included an intrasite seriation of four separate and pooled provenience units in order to determine the number of components present at the two adjacent La Roche sites. From his seriation of Molstad Village, Hoffman concluded that the results support previously defined taxonomic units, leading him to postulate a Le Compte focus consisting of the Molstad, No Heart Creek, and possibly Potts Village sites. The seriation in the La Roche site report also was used to assign components to taxonomic units and to assist in the dating of these villages. Brown (1967:153–162) also took a similar approach in determining the relationship between component B at the Chapelle Creek site and eight Extended Coalescent and Felicia phase villages. More recently, C. Johnson (1977a:22–24; 1977b) advocated arranging components in multidimensional space through the use of principal components analysis. This approach recognizes the possibility that a number of underlying dimensions in a data set might be isolated, instead of traditional seriation techniques that attempt to reduce all ceramic variability down to a single, temporal dimension. Johnson's approach was to use groups of pottery types from sites located along the entire length of the Missouri River in South Dakota. More than 32 Extended Coalescent and Felicia phase components were included in these analyses (C. Johnson, 1984a). The results isolated a single major source of variation, interpreted to be temporal in nature, although the corroborating information (i.e., radiocarbon dates) did not unequivocally support this conclusion. Johnson (1988) also arranged a number of Extended Coalescent and Felicia phase components based upon a plot of the percentages of three ceramic types. All of Johnson's findings are very similar to those of past investigators, such as Smith and Hoffman.

Post-Contact Coalescent

No other variant or taxonomic unit defined for the Middle Missouri subarea has received as much attention from archeologists seeking to order and date villages as has the Post-Contact or protohistoric period. There is a long list of researchers involved in a number of attempts to arrange or group sites and provenience units within sites, using a variety of techniques. The earliest of these seriations includes those by Lehmer (1954a:80–83), Smith (1960), Krause (1967:182–192), and Pollnac and Pollnac (1969). The Lehmer and Smith analyses are discussed above. Krause seriated 12 post-contact villages, including Leavenworth, using Spaulding's (1960:81–82) index of ceramic likeness, which is almost identical to the one developed by Robinson (1951). Krause presented a partial matrix of these values for the sites, although he apparently did not attempt any formal arrangement of the full matrix. It is unclear how these indices were computed, but presumably a number of ceramic modes were used in the computation (Krause, 1967:244–252). He also assigned absolute dates to these components. The Pollnac and Pollnac study was based upon a Q-mode factor analysis of the data presented in Krause (1967:244–252). It is a study of the variation of these modes in time and space rather than a seriation of sites, because they use the same village dates as Krause. Hoffman (1970b:290–311, 1972) relied on the Brainerd-Robinson and Ascher modification of the Meighan techniques to order eight Bad River phase villages, based upon the percentages of Stanley ware types from the villages. Hoffman used this seriation to question Lehmer and Jones' (1968:97–100) division of the Bad River phase into two temporal subphases. In his report of the Chapelle Creek, Brown (1967:147–153) calculated indices of likeness (Spaulding, 1960:81–82) between the site and six additional Bad River phase components based upon four ceramic types. From this analysis, he developed a relative order of the villages, although it is unclear how this sequence relates to his seriation. D. M. Healan performed a Q-mode factor analysis of five lodges and a pit from the Biesterfeldt site on the basis of seven ceramic attributes (Wood, 1971). He concluded that the pottery from the site exhibits a high degree of homogeneity from one provenience unit to the next. Lippincott (1970) ordered a number of Extended Middle Missouri and Post-Contact Coalescent Plains Village components from the upper Knife-Heart region by using the Ford technique on attributes instead of types. In his report on the McClure site, Johnston (1982:42–50) used a computerized seriation program (Craytor and Johnson, 1968) to arrange 16 late Extended and Post-Contact Coalescent components on the basis of ceramic type percentages. From this chronology, he then reconstructed the changing settlement patterns in the Big Bend region during late Coalescent times.

C. Johnson (1977a, 1977b), C. Johnson et al. (1995), Falk and Johnson (in prep.), and Falk, Johnson, and Richtsmeier (in prep.), in a series of intrasite and intersite ceramic analyses, performed r-mode principal components. They used both traditionally defined pottery types (intersite) and attributes (intrasite) to arrange components or provenience unit factor scores in multidimensional space.

All of these studies isolate what is interpreted to be temporal dimensions in the data, partially supported by site stratigraphy, radiocarbon dates, and historic documentation. In a recent review, Toom (1994:483) criticized previous ceramic seriations by Johnson because they lacked corroborative temporal evidence and were too broadly based. As the analyses presented in chapter 6 demonstrate, there is supporting evidence for interpreting some kinds of ceramic variation along temporal lines, recognizing that there are other types of variability that can complicate this general and somewhat simplistic perspective. The results of these analyses indicate that various levels of confidence can be assigned to each ceramic ordination, depending on the amount of independent chronological controls.

A somewhat different approach to dating was proposed by Grange (1981), who used the mean ceramic date approach initially developed for historic European ceramics. His analysis was an outgrowth of his interests in developing a Pawnee-Lower Loup temporal sequence through ceramic formula dating (Grange, 1968, 1984). He calculated a series of mean dates for a large number of Coalescent components, focusing on the Post-Contact period, but also included a smaller set of Initial and Extended variant villages. Grange then proposed a series of conclusions about the origin of particular ceramic wares and types, and the settlement of the Missouri River valley in South Dakota through time.

The last major attempt to order Post-Contact period villages was by Ramenofsky (1987, appendix C). As a way of establishing temporal control in her study of the spread of contagious Euro-American derived diseases among Native Americans, she seriated sites from a full range prehistoric and protohistoric contexts, including Middle Missouri and early Coalescent villages. The ceramic data used in these seriations was based upon the percentages of three classes of attributes (rim shape, extra clay to rim, rim decoration). The particular technique used in these seriations is not made explicit, although it appears that the Ford (1962) technique was used (Ramenofsky, 1987, fig. 22). Additional supporting information used to develop her five period chronology (AD 1030–1359, 1416–1649, 1649–1780, 1780–1837, 1845–1885) included radiocarbon dates, seriation of metal occurrences, and cumulative frequencies of trade glass.

Knife Region and Related Areas

Principal components analysis and other analytical techniques are used to arrange components within the Knife River Indian Villages National Historic Site (KNRI) based upon both ceramic attributes and types. The first of these evaluates the relationships of the anomalous Elbee site, a component with close ties to Extended Coalescent developments in South Dakota (Ahler, 1984a). Using a series of descriptive ceramic categories (types), Ahler concluded that Elbee is most similar, in terms of Euclidean distances, to the Mondrian Tree in North Dakota, Demery, and Swan Creek A components from north-central South Dakota. An r-mode image factor analysis of the percentages of the pottery types from 17 components yielded a factor interpreted to be temporal in nature. On this dimension, Elbee is similar to the Payne and Demery sites, both Extended Coalescent villages in north-central South Dakota.

In his analysis of the ceramics from Taylor Bluff, Ahler (1988) conducted two cluster analyses and one r-mode principal components analysis of 11 components, including Greenshield and Fort Clark, based upon 11 ethnic and temporally sensitive variables and attributes. Both Greenshield and Fort Clark were occupied at various times by the Mandan and Arikara. Leavenworth, a historically documented Arikara village in the Cannonball region of South Dakota, was used for comparative purposes but not formally included in the multivariate analyses. This analysis, for the first time within the Middle Missouri subarea, attempts to systematically evaluate the ethnic identity of the occupants of a particular village (i.e., Taylor Bluff). He concluded that it was most likely occupied by the Hidatsa (Awatixa and/or Hidatsa proper subgroups) and not by any other groups, including the Arikara. Ahler's analysis of the Taylor Bluff pottery represented a concern with assigning components to the various Hidatsa and Mandan ethnic groups in the Knife region, an interest he peruses in the ceramic synthesis of the KNRI project.

In his analysis of the Mondrian Tree site ceramic assemblage, C. Johnson (1983) performed a principal coordinate analysis or multidimensional scaling of nine components both within and outside of the Knife River Indian Villages National Historic Site on the basis of ceramic types. A cluster analysis also was performed on this data. Results indicated that Mondrian Tree was most similar to Scattered Village Complex components within KNRI, and that two dimensions are tentatively defined as temporal in nature.

In their synthesis of ceramic variation within the upper Knife-Heart region, Ahler and Swenson (1993) used 42 metric and nonmetric variables and attributes of various artifact classes in an r-mode principal components analysis and several cluster analyses of 78 ceramic batches or components. The principal components analysis isolated three temporally sensitive factors and the variables making up these factors. Plotted factor scores of the batches agree with the placement of the components when site stratigraphy, historic documentation, and a large series of radiocarbon and thermoluminescent dates are considered. Cluster analysis was used to group the batches into eight temporal periods and subperiods, forming the basis of a culture taxonomy (Ahler, 1993b; Ahler and Swenson, 1993). A cluster analysis of 43 late period (Heart River and Knife River phase) batches was able to discern tribal and subtribal ceramic differences. These differences are helpful in assigning the batches to ethnic groups. Ahler and Swenson defined temporal trends in ceramic variation within KNRI, including differences among contemporaneous batches attributable to ethnic groups. Their results have four broad-ranging implications for ceramic seriation within the Middle Missouri subarea and beyond: (1) ceramic types mask important temporal and ethnic group variation that are more adequately explored by a consideration of variables and attributes; (2) ceramic variation because of differences between contemporaneous villages occupied by different ethnic groups can lead to incorrect temporal assignments without supporting chronometric dating techniques; (3) multivariate statistical techniques, such as principle components analysis, is able to isolate varying sets of temporally sensitive ceramic variables and attributes depending on the time period involved, assuming adequate independent temporal measures are available; and (4) there is a close correspondence between native oral tradition history and culture-history derived from the archeological record. Any attempts to reconstruct late prehistoric culture-history without a firm basis in oral traditions may be severely compromised, depending on the nature, specificity, and depth of these traditions. The impact these observations have on the current project is dealt with in greater detail in chapter 6.

Methodological Considerations

Seriation is defined as "the placing of items in a series so that the position of each best reflects the degree of similarity between that item and all other items in the data set" (L. Johnson, 1972:310). Similar definitions have appeared in Spaulding (1971:10), Cowgill (1972:381), and Marquardt (1978:258). Ordination, on the other hand, may be viewed as a more general approach in which the units of interests are positioned in two or more dimensions rather than along a single scale (see also Sneath and Sokal, 1973:245). The "items" in the current study are site components, and the "degree of similarity" is measured between all components on the basis of ceramic descriptive category or "type" frequencies, making it a frequency (similarity) seriation rather than abundance (presence/absence) seriation (Rowe, 1961:326; Dunnell, 1970:308). This analysis relies on detrended correspondence analysis to order the components in multivariate space represented by a reduced number of dimensions from a larger number of ceramic types. Because these analyses are not necessarily limited to a single dimension or "series" as are more traditional seriation techniques, the depiction of components in relation to each other is best described as an ordination. Interpretation of one or more of these dimensions along temporal grounds is called a seriation, however. Dunnell (1970:305–306) pointed out that in the past, seriation was treated as a technique, when in reality it should be viewed as a method with its own series of underlying assumptions and corollaries that are organized for the solution of a particular problem (i.e., chronology building). These assumptions are the focus of the following discussion.

In their influential analysis of ceramic surface collections from the lower Mississippi River valley, Phillips, Ford, and Griffin (1951:219–223) presented seven assumptions necessary for a seriation to reflect chronology: (1) geographically stable population; (2) short period of site occupation; (3) gradual change in pottery over time and through space; (4) defined ceramic types are sensitive at measuring spatial and temporal variation; (5) types exhibit unimodal, lenticular or battleship curves through time if assumptions 1 and 3 are true; (6) if assumption 5 is true, the unimodal distributions of the pottery types at any particular time forms a unique pattern; and (7) the combined site collections, consisting of random samples of at least 50 sherds/site, is representative of the entire range of temporal variability within the study area so that there are no gaps in the seriation. Many of these assumptions were subsequently discussed by Ford (1962:42–43), Dunnell (1970), and McNutt (1973:46). To this list Dunnell (1970:311, 318) added several additional conditions for seriation to reflect a chronological ordering: (1) all groups (e.g., components) must be of comparable duration; (2) components must belong to the same cultural tradition; (3) components must come from the same locality; and (4) deviations from unimodal type distributions or the model of continuous artifact changes are due only to sampling errors. Deetz and Dethlefsen (1965:196–196, 206) also pointed out that seriation assumes equal rates of ceramic change, meaning that any type employed originates and spreads from a single locus and that sites farther away from the locus exhibit frequency occurrences later in time compared with those near the center of origination (i.e., Doppler effect). This time lag in the popularity of a decorative type is used in chapter 6 to correlate the northern Extended Coalescent temporal sequence with the Hensler phase.

Several archaeologists think that chronologies are more discriminating if the artifact classes, types, or attributes have short temporal spans or change relatively rapidly (Meighan, 1959:210; Ford, 1962:43). A number of researchers note problems in their own results, commonly attributed to violations in the above assumptions. Most problems seem to arise when dimensions other than time are represented in the data (Brainerd, 1951:305; Cowgill, 1968:374; Renfrew and Sterud, 1969:271; Gelfand, 1971a:271–273, 1971b:199; Kruskal, 1971; L. Johnson, 1972:324; Johnson and Johnson, 1975:283; LeBlanc, 1975:33).

The ways this study adheres to or violates these assumptions is presented in the following discussion. The assumption of a geographically stable population is related to the condition of restricting a seriation to a confined spatial unit, such as the locality. This is to prevent the problem of the confounding temporal effects of diffusing styles through space (i.e., the Doppler effect). That is, as a particular temporally sensitive trait diffuses, the period when it reaches its height of popularity is generally later the farther a particular site is from the point of trait origin. This principal was demonstrated by Deetz and Dethlefsen (1965) in their study of the spread of historic grave headstone styles in the northeastern United States. In addition, if there are population movements into and out of a locality or region, the pottery of each village group presumably reflects the development of their ceramic tradition from their point of origin or homeland. This study attempts to partially control the confounding effects of time and space by limiting, to the extent possible, each ordination to a region or a phase. This approach, along with the use of correspondence analysis, has the potential of beginning to unravel multiple sources of variation in the archeological record. This partially ameliorates a recent criticism by Toom (1994:483) of this methodology. Because of the small number of components in some regions, the stability of potting traditions across regions, and the desire to correlate regional chronologies, some chronologies combine components from different regions. Finally, geographic stability (i.e., movements) of the Plains villagers must be assumed to be equal through time and space because it is very difficult to control for this factor with the available information. Certainly within the late protohistoric and early historic period, there are numerous cases of village movements (Wedel, 1955:77–84; Ahler and Swenson, 1993:135–139). It is suspected that migrations occurred prehistorically, sometimes across long distances (Toom, 1992b).

It also is assumed that all components have rather short occupations and comparable time depth. Even though this may not be true in some cases, a number of techniques are used to satisfy this condition. De Barros (1982) addressed the ways that variable site-duration affects frequency seriation. His simulation study concluded that errors in seriation ordering, using pottery types, occur under the following conditions: (1) varying rates of ceramic change; (2) transition periods, especially short ones, during the rise and decline of a type's production; (3) increasing rates of type replacement; (4) lower intervals of time between site occupation dates; and (5) short pottery-type spans in relation to the duration of site occupation. More specifically, if ceramic types are replaced rather slowly (e.g., every 75–100 years) and have relatively long life spans (e.g., 180 years) compared with site occupation spans (e.g., 10–60 years), few seriation errors occur. On the other hand, long-lived types having slow replacement rates result in seriations with low temporal resolutions (cf. Baxter, 1994:122). In addition, considerable overlap in site occupation and increased numbers of contemporary types does not result in more seriation errors, although the detection of these errors is sometimes difficult to verify. One solution that de Barros (1982:310–313) suggested, namely to seriate short-term provenience units of comparable duration (e.g., pits, houses), using temporally sensitive ceramic attributes with multivariate techniques (e.g., factor analysis), is beyond the scope of this study. The studies by C. Johnson (1977b) and Steinacher (1990) tried to minimize temporal depth by conducting intrasite analyses using discrete provenience units. The present study, by its nature and scope, must rely on traditionally defined types from a large number of sites, so the solution that de Barros recommended awaits a more exhaustive and comprehensive analysis of ceramic variability among a smaller number of Middle Missouri Plains Village sites. In addition, many sites do not have large enough samples from short-term contexts, such as pits or house floors, to perform these analyses. This problem is one of mixed materials from different time periods. One solution proposed a technique to detect mixed samples (Kohler and Blinman, 1987). This approach is thought to be inapplicable to the present study because it relies on establishing calibrated (i.e., dated) ceramic data sets for various time periods, apparently relying on "unmixed" units for establishing characteristics for each of them.

In the present study, several of the above seriation errors are minimized at sites with long periods of discontinuous occupations by dividing them into their respective components. In cases in which there is a lengthy, continuous occupation by peoples of the same cultural tradition or variant, subdivisions into shorter temporal segments are made. This is accomplished by two procedures: (1) limiting each seriation to the same tradition, variant and or phase, thereby fulfilling Dunnell's second condition; and (2) dividing sites with long and continuous occupational histories into shorter temporal units, as in the case with some Le Beau phase villages, such as Larson (39WW2), Spiry-Eklo (39WW3), Anton Rygh (39CA4), Sully (39SL4), and Swan Creek (39WW7). On occasion, this procedure is not possible because of inherent limitations in the nature of some site assemblages (e.g., Mobridge site). These examples are discussed in conjunction with each seriation. With these exceptions, all components are treated as single units with no further temporal divisions. This approach is deemed necessary because of low sample sizes within individual site provenience units, lack of uniform and meaningful provenience units, and the desire to include as many components as possible within the funding and time constraints of the study. In essence, most of the village ceramic assemblages are treated as "surface" collections; hence, the concern with the seriation assumptions of Phillips, Ford, and Griffin (1951:219–223). Additional variables contributing to potential seriation errors, such as the longevity of pottery types, varying rates of ceramic change and type replacement, and variation in the interval between village occupation, are largely uncontrolled in the current study. Instances in which these factors are particular problems are discussed so that ordination results can be evaluated.

The assumption that ceramic change is gradual over time and space was demonstrated in many archaeological contexts and in several ethnoarcheological studies (Graves, 1985:32–33). Graves also pointed out that rapid population loss and other factors might result in the disruption of traditional inter-cohort transmission of design information, resulting in dramatic ceramic change. Plog (1980:108–111) indicated that ceramic change in the American Southwest can occur rather quickly, perhaps within a period of about 75 years or less or can proceed at low rates, such as in the Valley of Oaxaca. Cleland (1972:209) also suggested that objects with short life-spans, such as pottery, change rapidly over time because of stylistic drift. Changes in the intensities of village interaction and the rates of ceramic change can vary through time, causing additional problems in interpreting a seriation or ordination along temporal grounds. Controlling for the effects vessel size, function, and form among contemporaneous prehistoric communities would help to determine the influence of these variables on style (see Graves, 1985:31). Ceramic variability within the Middle Missouri subarea is characterized by conservative potting traditions broken by a number of relatively rapid temporal changes or noncontinuous clinal variations through space. These changes generally occur at divisions between various taxonomic units at the phase or variant level, the typical subject of individual ordinations.

The requirement that the defined ceramic types, descriptive categories, or attributes be sensitive to temporal and spatial variation is self-explanatory. Types or attributes that were diagnostic space-time indicators were designated as "historical" by Rouse (1960:317). Those that are not were referred to as "descriptive" types or attributes. A summary of these two views of types appeared in Dunnell (1986:167–176). Marquardt (1978, 1979) also emphasized the search for temporally sensitive attributes before the seriation process begins. Another area of concern during the artifact classification process involves the search for types or attributes (i.e., mental templates) that conform to those of the makers of the artifacts. Dunnell (1986:176–182) summarized these efforts in terms of etic and emic approaches. Further consideration of these distributions is beyond the scope of this study other than to say that, except at the initial and most inclusive stages of classification into wares, ceramic typologies within the Middle Missouri have focused on descriptive types, with a few possible exceptions (e.g., Smith, 1977:51–52). Several researchers have commented that chronologies are more discriminating if the artifact classes, types, or attributes have short temporal spans or change relatively rapidly (Ford, 1962:43; Meighan, 1959:210). LeBlanc (1975:29) also indicated that reliance on too few pottery types does not result in the discrimination of fine time increments. In the present study, it is impossible to determine which artifact types or attributes are temporally sensitive before a formal analysis is completed. In addition, the time span of ceramic types or their rates of change in the Middle Missouri remains largely unknown because of an inadequate number of absolute dates. Only a massive dating program, much larger in scope than the present study, can begin to address these questions. These issues are discussed in greater detail in chapter 8.

There are no all-inclusive tests to determine if the established ceramic types or descriptive categories from the Middle Missouri subarea are sensitive to the spatial or temporal dimensions. Many of the types, or combined types (i.e., descriptive categories) do vary significantly through space, as measured by their relative frequencies from region to region. There also are major differences in their occurrence from variant to variant, and less so from phase to phase. What has not been accomplished is to demonstrate that these types or categories consistently vary through time within phases or variants so as to provide a means of making fine-scale temporal discriminations between individual components. Some studies, however, have isolated temporally sensitive attributes that relate to traditionally defined types (C. Johnson, 1977b:43–44; Ahler and Swenson, 1993:93–135; Johnson and Toom, 1995:263). In a sense, this study not only seeks to order components along a time scale, but it also explores the usefulness of types in making fine-scale chronological discriminations. There also is some evidence to indicate that types, whether from the Middle Missouri subarea (Steinacher, 1990) or other areas (Hegmon, 1992) reflect social interaction, historical context, symbolic, or emblematic expression. The work within the Knife region is an exception to this generalization, providing fairly precise measures of ceramic change on the attribute level while controlling for the effects of ethnic group variation (Ahler and Swenson, 1993). Several intrasite ordinations using attributes demonstrate that not only is there quantifiable ceramic change through time, but also that attributes play significant roles in the formulation of traditional types (C. Johnson et al., 1995:239–240). The results of the present study begins to evaluate more fully the ability of these established types, or their descriptive category reformulations, to help to make finer temporal divisions than previous seriations.

There is no assurance in the current study that the assumption of a unimodal type distribution through time is adhered to. The underlying premise that components can be ordered into a chronological sequence depends upon this assumption, although various internal checks are used to determine if this is indeed the case. Techniques for testing this assumption and for providing independent relative and absolute dating controls on each seriation include site stratigraphy and radiocarbon dating. Stratigraphy is discussed by a number of archaeologists as an independent technique for verifying seriations (Brainerd, 1951:305; Vis and D.R. Henning, 1969:255–257; LeBlanc, 1975:32). By including stratigraphically related components from the same site containing a long and continuous occupation, a test of the temporal ordering of components and the nature (e.g., lenticularity) of ceramic change is accomplished. Adding radiocarbon dates provides an absolute time scale to each seriation. Deetz (1968) also presented an example in which the assumption of unimodality is violated.

Most of the components used in this study have ceramic assemblages consisting of at least 50 rim sherds to ameliorate misrepresentative, unreliable, and highly erratic type frequencies inherent in small sample sizes. The use of attributes instead of types was demonstrated by LeBlanc (1975:26) to increase sample size when missing data present a problem but, as is outlined above, collecting this data is beyond the scope of the current study. Cowgill (1968:372–373) pointed out that correlation coefficients are dependent upon sample size, with smaller samples yielding lower correlations. Hatch et al. (1982) had suggested that only sample sizes in the thousands begin to reduce error or noise in frequency seriations. Several components that contain small sample sizes in the present analysis are included because they have a pre-existing suite of radiocarbon dates or are considered to be important to the overall interpretation of the study. In general, the smaller the sample size in relation to the population of rim sherds from a village, the less likely the sample reflects the actual variability in the entire site. These cases are pointed out during the analysis portion of this report.

Finally, Dunnell's condition that all components represent occupations of equal duration is related to the life spans of ceramic vessels. There are a large number of ethnoarcheological studies indicating that different sized pots are broken and enter the archeological record at different rates (David, 1972:141; David and Hennig, 1972:18–19; DeBoer, 1974; DeBoer and Lathrap, 1979; Longacre, 1985, table 13.1, 1991:7; Arnold, 1988, table 3). Breakage rates depend on how the pots are used. Those that are used and transported more often tend to break more frequently than those that are not. In general, the largest pots are broken less frequently and therefore have longer life expectancies compared with the smaller ones, on the order of 2.5–5 times (0.2–13 years). C. Johnson (1983, table 9.14) and Wilson (1977) discussed the ways pots were used among the Mandan, Hidatsa, and Arikara. If different size pots are correlated with variations in decorative style or any other variables, then the qualities of smaller pots are overrepresented in the archaeological record compared with their relative abundance within a household or village at a given point in time. The longer a site is occupied, the greater the disparity between the two figures, assuming of course that the greater rim circumference of larger pots when they are broken does not outweigh their lower breakage rates when rim sherds rather than vessel counts are used (see Ford, 1962:38).

Several examples from the Middle Missouri subarea support the idea of a relationship between length of occupation and material content. Undecorated wares, which appear to be used most often for physical utilitarian functions, tend to break at higher rates than decorated wares (Steinacher, 1990:226–231). Another example is demonstrated at the Whistling Elk site (39HU242). This village was probably occupied for a very short time as reflected in the presence of a large number of chipped stone tool preforms, unused, and fully functional stone tools made from nonlocal resources (Toom, 1983a). This pattern dramatically contrasts to almost every other village within the subarea. Another site that could represent a short occupation is the Fay Tolton site (39ST11), where a number of human skeletons and complete pots were recovered from several houses (Wood, 1976). An unusually light density of occupational debris characterizes the site.

There is virtually no way to control for the effects of occupational duration on the ceramic assemblages of Middle Missouri villages given the existing information. As noted above, villages with comparatively long occupational histories are divided into a number of shorter temporal units, although no systematic efforts to study this problem have been undertaken beyond that of Steinacher (1990); however, the relationship between the rates at which vessels are broken and discarded and style can be indirectly examined. If it is assumed that vessel size has something to do with the way pots are used, then this characteristic (as measured by orifice diameter) is easily compared with the ceramic types used in this study. This relationship is examined in chapter 4.

Theoretical Considerations

In order to place the results of the ceramic ordinations in chapter 6 of this study into their broader archeological context, it is useful to review some of the important concepts that form the theoretical basis of this study. Normative and social interaction theory provide the most useful frameworks through which to view the results of this study.

Normative theory is the oldest of the perspectives and is the basis of much of the artifact and assemblage-pattern recognition studies in archaeology so crucial in inferring social boundaries used to reconstruct culture history (Steinacher, 1990:99–100). Normative theory, as summarized by Binford (1965:203–204), is concerned with the ideational basis of human life (i.e., the normative concepts in people's minds that structure the way they behave). Formal or stylistic variation in material culture is an expression of these normative ideas. The cohesive set of shared ideas that make up culture are transmitted through learning between the generations or by diffusion between nonbreeding social units, with an inverse relationship between transmission and the social distance between the groups. Spatial discontinuities in this pattern are the result of migration and natural or psychological barriers. Cultural innovation originates at "culture centers" and spreads out, blending with surrounding cultures.

Social interaction theory, which relies on many of the same assumptions as normative theory, maintains that aspects of style are communicated from individual to individual based upon their intensity of interaction (J. N. Hill, 1985:364). Individuals or groups that interact more frequently share more aspects of style than those who do not. Stylistic elements diffuse by exposure; there are no implications that these elements are adaptive for the groups who use or adopt them. Styles remain stable or change at certain rates unless there are accidental or random errors in communication, or other factors disrupt the transmission process. In this sense, it is similar to normative theory in its emphasis on the transmittal of information through learning, borrowing, and diffusion. Unlike the normative perspective, social interaction theory elaborates on the mechanisms by which style is transmitted, leading many early proponents to reconstruct social structure from ceramic variation (Deetz, 1965; Whallon, 1968; J. N. Hill, 1970; Longacre, 1970). Some of the later analyses involving this perspective (Plog, 1976, 1980) have related similarities and differences in ceramic style to various levels of social integration through time.

A key concept involved in both theories is "social distance." In summarizing the normative theory of culture, Binford (1965:204) stated that culture is transmitted between social units through diffusion and across generations by learning that is inversely proportional to the degree of social distance between them. (A study by Roberts et al. (1995), of 47 artifact types among 31 New Guinea villages indicated that distance and language each account for slightly more than 25% of the variability in the artifacts, whereas combining the two accounts for an additional 10%.) The relationships between various measures of social distance (e.g., ceramic similarity) between villages and their locations in space might point to discontinuities because the interaction between contemporaneous communities is assumed to be inversely related to the physical distances between them. A lack of correspondence between physical and social distance, as measured by ceramics, might be interpreted to be the result of migration, varying degrees of intervillage social interaction, or some other phenomenon, assuming time is not a factor. Population movements into, out of, or within the Middle Missouri subarea during the prehistoric, protohistoric, and historic periods were discussed by Wedel (1955:77–84), Stewart (1974), Wood and Downer (1977), Ahler et al. (1991), Toom (1992b), and Ahler (1993b).

In terms of the present study, social distance between villages is measured by the degree of similarity between their rim sherd assemblages, as reflected in ceramic types.

Assemblages that are most similar are thought of as being temporally and/or socially proximate, assuming a relatively uniform degree of social interaction between villages through time and space (see Plog, 1976, 1983:126, for a discussion of factors relating to unequal rates of interaction). Close similarities may be caused by the sharing of a potting tradition by distinct and contemporaneous or nearly contemporaneous village groups, or by direct ancestral relationships between them. In this sense, a primary goal of this study of Plains Village chronological relationships is the reconstruction of culture-history, one of the three goals (along with reconstruction of past lifeways and the study of culture process) of archeology (Binford, 1968:8–16).

These chronologies are taken to the next level of abstraction by interpreting the ceramic relationships between villages in terms of ethnic origins, migrations, and interactions between peoples (see Binford, 1962), or what Hegmon (1992:518) called time-space systematics. The investigation of these similarities characterizes culture-historical archeology (Conkey, 1990:5). As Hegmon noted, this approach dominated traditional archeology and the early years of the New Archeology. Because style is treated as a passive phenomena and an integral component of material culture, a close analytical link between the objects of study or patterns of formal variation and subject (style) is maintained (Hegmon, 1992:518). Other theoretical perspectives, such as information exchange (Wobst, 1977), take a more active approach to style, relying on complex bridging arguments relating subject to object that are much more difficult to establish (Hegmon, 1992:518–519). This also includes the evolutionary approach of Dunnell (1978) and ecological theory (J. N. Hill, 1985; O'Brien and Holland, 1990; Neff, 1992).

Another important topic to consider is the framework in which ceramic variation is viewed. Formal or morphological variation in pottery or any other material class is viewed as consisting of the components of style and function. The relationship between these two dimensions is a major point of debate in archeology, resulting in a number of theoretical formulations. Early discussions make a relatively sharp division between the two, confining function to the utilitarian use of tools, such as ceramic vessels to cooking, storage, or transportation, and confining style to a residual category. Recent perspectives consider the overlap between the two concepts, preferring to view style as performing a broad array of specific social functions within the context of production and use of ceramic vessels. This discussion is of particular interest to ceramicists who perform ordinations because of the desire to determine whether the variation between ordered units is the result of some relatively broad-scale stylistic changes over time or a relationship to the way pots were used in the cooking, storage, or transportation of their contents. A relationship between utilitarian function and purely stylistic variation might result in spurious or inaccurate chronologies if these factors are not controlled or at least considered. These relationships have not been systematically investigated in the Middle Missouri subarea and are beyond the scope of this study.

Binford (1962) made one of the first attempts by an archaeologist to deal with the ways material items function within the total cultural system. In a classic discussion, he defined three kinds of artifacts that differ in the ways they were used: (1) technomic artifacts, which have their primary use in dealing directly with the physical environment; (2) sociotechnic artifacts, which serve primarily within the social subsystem of culture to articulate individuals to one another into cohesive groups; and (3) ideotechnic artifacts, which function primarily within the ideological subsystem to provide ideological rationalizations for the social system and a symbolic milieau for the enculturation of its participants. Formal or stylistic characteristics, defined as qualities that cannot be directly explained in terms of the physical aspects of artifacts or variation in the technological or social subsystems, are labeled as stylistic. Stylistic attributes are best studied when questions of ethnic origin, migration, or interaction between groups are considered. In a later article Binford (1965) made a distinction, when discussing ceramic variation, between primary functional variation (specific use) and secondary functional variation (by-product of the social context in which the vessel was made). Secondary functional variability arises from the traditional ways of doing things within a family or larger social unit, or may be an expression of between-group solidarity. Sackett (1977) viewed function as operating in all areas of the cultural system: technological, societal, and ideational. Artifact function has an active (technological) role when dealing with the environment, whereas style operates in a non-utilitarian or passive sense, reflecting a particular culture-historical context within the societal or ideational spheres of culture. Similar to Binford's concept of secondary functional variation, Sackett (1977, 1990:33) introduced the term "adjunct" form to account for variability in artifacts that are included within the cultural subsystem opposite of which the object finds its major function. In the archeological record, adjunct form is most widely manifested in decoration. This idea was reinforced with the definition of style by Davis (1983:55) as formal similarities not related to the physical or mechanical effectiveness of artifacts. Rye (1981:3) and Braun (1983:13, 1991:363) considered decoration to be a non-essential characteristic of pots that was not necessary for them to be used as tools, although the physical characteristics of pottery put constraints on the ways in which it was decorated. Ceramic variation in this "secondary," "adjunct," "non-essential," or stylistic realm is one of the key concepts underlying the present study.

A somewhat simplistic but crucial assumption is made herein that Plains Village life throughout all periods and places in the Middle Missouri subarea was relatively uniform in basic subsistence pursuits (see Wood, 1962, 1974), including the ways ceramic vessels were used and the role that style played. From this perspective, ceramic style is measured from rim sherds that vary in terms of form or shape and decoration.

With the exception of Deetz's (1965) work, efforts at defining and interpreting stylistic ceramic variability within the Middle Missouri subarea have not been very ambitious. Aside from the intersite ceramic seriations discussed above, several studies examine intrasite variation at several Plains Village communities. Steinacher (1990) explored ceramic variation at the Initial Middle Missouri Sommers site (39ST56) in an attempt to evaluate various occupation scenarios at the village. C. Johnson (1977a, 1977b) and Johnson et al. (1995) reexamined the Medicine Crow site (39BF2) that formed the basis of Deetz's work. Their goals were much less ambitious than Deetz's, focusing on arranging the various provenience units at the site into a chronological sequence. Although a temporal sequence was established, uncontrolled variation because of the occupation of the site by two or more distinct Arikara village groups was acknowledged to be a problem (C. Johnson, 1977b:47–48). It was not until sometime later (Ahler, 1992; Toom, 1995) that additional temporally sensitive data was used to question Johnson's construct of village occupation. These interpretations of the data point to an occupation of the two main site areas by contemporaneous village groups rather than a sequential use of the areas by the same group. During the historic period, the Arikara consolidated into one major village, the Leavenworth site. The site was divided into two spatially and ethnically separate communities, often designated as an upper and lower village (Bowers, 1935:5; Krause, 1972:16). A comparison of ceramic modes from these two parts of Leavenworth suggested very little difference between them (see Krause, 1972, table 5).

Absolute temporal control, in the form of a large series of radiocarbon and thermoluminescent dates, was brought to bear on the problem of ceramic variation between contemporaneous Hidatsa villages from the Knife region by Ahler and Swenson (1993, fig. 17.16). Their results indicated that there are sufficient differences between the potting traditions of the different Hidatsa subgroups to render traditional ceramic seriations misleading when interpreted as reflecting only temporal variations. In another study, Ahler (1988:108–119) demonstrated that specific ceramic attributes reflect temporal and ethnic variability among the Mandan, Hidatsa, and Arikara and their various ethnic subgroups. These attributes are used to assign specific villages to these ethnic entities. Finally, in his analysis of the settlement pattern within the Sommers site (39ST56), Steinacher (1990:220–238) indicated that there are a number of factors that contribute to ceramic variability at the site, including length of occupation.

Correspondence Analysis

Correspondence analysis is a member of a family of pattern-seeking data reduction multivariate statistical techniques. Other more familiar techniques to archeologists, such as factor analysis, principal components analysis, and multidimensional scaling, belong to this general group designed to extract a reduced number of factors, dimensions, or axes from a data matrix or matrix of similarity/dissimilarity coefficients (see Sneath and Sokal, 1973:245–250; Shennan, 1988:241–297). Implicit in the use of these techniques is the assumption that there is more than one underlying dimension or pattern of variability in the data. In the case of this study of Plains Village ceramic variation, such dimensions may be related to temporal and spatial patterned variability, or perhaps to some other factors. Multivariate techniques should not be viewed as a panacea because they mask patterns in data and do not allow the exploration of other dimensions of variability available through other techniques (Plog, 1983:131). Steinacher (1990) presented an example of the use of other techniques and alternative interpretations of ceramic variation within one Initial Middle Missouri village.

Correspondence analysis, also referred to as reciprocal analysis, was first widely applied in the field of ecology to study variation in vegetation along a number of underlying gradients, such as available moisture (M. O. Hill, 1973, 1974). In these applications, the incidence (presence/absence) or abundance of a number of plant species are recorded at a number of locations. Each location is referred to as a sample. The resulting species by sample data matrix is then input into correspondence analysis to extract underlying gradients, such as moisture, slope, plant succession, and plant communities. In this sense, it has most often been used to generate empirical generalizations of the data by induction. It is interesting to note, however, that a number of articles on correspondence analysis by ecologists also refer to seriation applications in archeology, with Kendall's (1971) work being cited most often (M. O. Hill, 1974:344, 351–354; Hill and Gauch, 1980:47; Wartenberg et al., 1987:438). Correspondence analysis was first introduced to the larger archeological community through the efforts of Bolviken et al. (1982). It has gained widespread application in Old World archeology in the 1980s, but only recently in North America (Madsen, 1988; Baxter, 1994:133–139).

Correspondence analysis is a nonparametric ordination technique developed primarily for the analysis of contingency tables, although it can be applied to both incidence and abundance data matrices (M. O. Hill, 1974:348–349; Greenacre, 1984:55–58, 308–315; ter Braak, 1985:859, 1987:96–97; Weller and Romney, 1990:72–74; Ringrose, 1992:616–617). It also has been used with continuous data (M. O. Hill, 1974:348–349; Davis, 1986:589–594). Correspondence analysis is considered to be a variant of principal components analysis based upon a chi-square distance metric (Bolviken et al., 1982:43; Gauch, 1982:148; Wartenberg et al., 1987:437), with both techniques resulting in similar solutions in many applications (M. O. Hill, 1974:340, 346 349; ter Braak, 1985:871; Ringrose, 1992:615–616). Like principal components, correspondence analysis derives a series of axes or eigenvalues from a data matrix with each axis accounting for a decreasing amount of variation in multidimensional space as additional axes are extracted. These axes explain as much variation in a data matrix as possible from a "null hypothesis" of no association between the matrix rows and columns (Baxter, 1994:114). Unlike principal components, the procedure uses a two-way weighted averaging algorithm or formula applied to a series of iterations to reach a solution (ter Braak, 1987:97–103). As Greenacre (1984:54) described it, correspondence analysis displays the rows and columns of a data matrix as points in dual low-dimensional vector spaces. In this sense, it orders or arranges a data matrix composed of both the species (or variables, ceramic types) and sample (or cases, site components) scores in terms of their similarities to other species or samples simultaneously (hence the term two-way or reciprocal analysis). It thus provides a useful way to explore the relationships between both variables and cases in a single procedure (Bolviken et al., 1982:43; Gauch, 1982:144–147; Greenacre, 1984:60–61). This feature is apparent once the actual ordinations that are the subject of this study are presented in chapter 6. Once an initial solution is found, the reordered data matrix is reentered into the algorithm until a more precise ordering is achieved. This iterative process is done a number of times until a final stable ordered matrix is achieved, indicating that the first axis is successfully extracted. Once this first axis is extracted, a second axis or dimension orthogonal or independent of the first is extracted by applying several intermediate steps to the process before the two-way weighted averaging algorithm is once again applied to the data matrix through a number of iterations. This process of orthogonalization and recalculation of the weighted species and sample scores is applied any number of times, depending on how many axes or eigenvalues are desired. These scores are standardized to a mean of zero and a variance of one (z-scores).

Correspondence analysis is based upon a chi-square metric, so low-expected cell frequencies should be avoided in any analysis (Weller and Romney, 1990:71; Baxter, 1994:113–118). There appears to be some ambiguity in the literature as to whether this applies to inferential or hypothesis testing during correspondence analysis, or whether it applies to use of the technique in a purely descriptive sense. Weller and Romney (1990:71) and Baxter (1994:113) correctly stated that inferences based upon tables with low expected cell frequencies can invalidate formal chi-square testing. Use of correspondence analysis as an exploratory, data-reduction, descriptive tool, eliminating formal testing of the null hypothesis of no association between variables and cases, could permit low-expected cell frequencies. The problem arises when low frequencies in a particular row or column unduly influence the solution of a correspondence analysis (Baxter, 1994:115). Although this is acknowledged to be a problem, an example consisting of a single infrequently occurring artifact type that Baxter (1994:113, 115, 118) used demonstrates that low frequencies sometimes have little effect, or "inertia" on an analysis.

In the present study, a number of components and pottery types are characterized by low frequencies. The approach is to include as many of them, within reason, into the analysis because (1) they are radiocarbon dated, (2) their potential interpretive value, (3) including many components can help to delineate changes in regional settlement patterns, and (4) the importance of some pottery types in temporal-spatial dynamics is unknown. A number of additional analyses not reported in this study were made eliminating infrequently occurring pottery types, resulting in little change in the overall placement of components or types. In addition, the downweighting option of the detrended correspondence analysis was chosen in several analyses, also resulting in little change in the final results.

In order to illustrate the correspondence analysis procedure, a data matrix consisting of 11 components and 12 ceramic types composing a portion of the Le Beau phase sample used in this study is passed through one iteration or step in the algorithm by manual calculations. This procedure follows the one described by ter Braak (1987:97–107). Table 2 lists a first iteration ordering of these 11 components, initially placed in numerical order by site number: Anton Rygh RI (39CA4), Anton Rygh RII–IV (39CA4), Bamble Early (39CA6), Bamble Late (39CA4), Red Horse Hawk A (39CO34), Four Bear (39DW2), Spotted Bear (39HU26), Sully Late (39SL4), Sully Middle (39SL4), Swan Creek C+D (39WW7), and Swan Creek B (39WW7). According to step 2 (ter Braak, 1987, table 7), the weighted-average site scores (*uk* in Table 2), are calculated by multiplying the frequency of each type for a given component by the numerical position of these types in Table 2 (i.e., 1 = cord-impressed, S-shaped rim through 12 = undecorated straight rim). These summed values are then divided by the sum of all types for a particular component. As an example, the *uk* for Bamble Late is computed as follows:

$$[(117 \times 1) + (27 \times 2) + (16 \times 3) + (1 \times 4) + (14 \times 5) + (17 \times 6) + (0 \times 7) + (7 \times 8) + (260 \times 9) + (106 \times 10) + (243 \times 11) + (384 \times 12)] / [(117 + 27 + 16 + 1 + 14 + 17 + 0 + 7 + 260 + 106 + 243 + 384)] = 11132/1192 = 9.34$$

An examination of the first iteration of this matrix places components in a close approximation of their final order (see chapter 6). The purpose of achieving this arrangement of values in a data matrix is to model the pattern in ecology in which successive replacements of species usually show Gaussian, unimodal, or bell-shaped distribution curves with respect to environmental gradients (Hill and Gauch, 1980:49; ter Braak, 1985:859, 1987:95–96; Wartenberg et al., 1987:434–435). The reader familiar with the literature on seriation in archeology recognizes that ceramic types or attributes are thought to rise, peak, and decline through time resembling unimodal or "battleship" curves (Brainerd, 1951:304; Robinson, 1951:293; Ford, 1962:39–40; Dunnell, 1970:309; McNutt, 1973). Several popular methods of arranging similarity matrices of site components focus on achieving a similar pattern with high values along the diagonal and corresponding lower values at off-diagonal positions (Renfrew and Sterud, 1969; Robinson, 1951; Gelfand, 1971a, 1971b).

Hill and Gauch (1980) proposed a modification of the ordination technique, detrended correspondence analysis, shortly after correspondence analysis was introduced in ecology. The modification is designed to alleviate two problems inherent in correspondence analysis or reciprocal averaging: the arch effect and the distortion of relative distances of species and samples along their axes (Hill and Gauch, 1980:47–49; Gauch, 1982:150–152; Greenacre,

TABLE 2. Two-way weighted averaged (*uk*) table of selected Le Beau phase components, first iteration of correspondence analysis based on descriptive rim sherd frequencies. Components arranged according to increasing uk. (C.I. = Cord Impressed; H.I. = Horizontal Incised; D.I. = Diagonal Incised; HR.I. = Herringbone Incised; T/F I. = Tool or Finger Impressed; UN = Undecorated; DH.I .= Diagonal or Herringbone Incised; T.I. = Tool Impressed; F.I. = Finger Impressed.)

	S-shaped/Collared/Compound rim forms						Straight/Curved/Flared/Simple rim forms						
	Exterior rim decoration						Exterior rim decoration		Lip decoration				
Component	C.I.	H.I.	D.I.	HR.I.	T/F I.	UN	DH. I.	H.I.	C.I.	T.I.	F.I.	UN	*uk*
Swan Creek B	103	28	7	4	32	0	0	27	60	134	101	15	7.02
Bamble Early	13	3	2	0	1	1	0	1	7	5	11	7	7.10
Anton Rygh RII-IV	79	22	20	3	7	3	0	18	18	76	56	95	7.51
Swan Creek C+D	256	181	47	26	55	1	0	48	403	393	580	141	8.05
Sully Middle	12	16	51	3	1	7	3	28	41	125	96	21	8.49
Anton Rygh RI	31	1	2	2	1	0	0	2	50	23	69	23	8.74
Bamble Late	117	27	16	1	14	17	0	7	260	106	243	384	9.34
Spotted Bear	20	2	4	0	0	2	0	0	319	327	106	34	9.50
Sully Late	12	0	17	4	1	0	2	1	20	71	102	44	9.66
Four Bear	22	4	24	0	2	1	0	0	126	229	393	368	10.50
Red Horse Hawk	5	0	0	0	0	0	0	0	78	58	227	166	10.82

1984:232; ter Braak, 1987:105–107). The arch, or horseshoe, effect occurs when axes extracted by correspondence analysis are dependent upon each other, resulting in a curvilinear plot of samples along two or more axes. Horseshoe patterns are commonly found in archaeological applications using multivariate data reduction techniques, resulting in curved patterns of components, samples, or cases in two dimensions (Kendall, 1971; LeBlanc, 1975:35; Drennan, 1976; Marquardt, 1979:320; Ahler and Swenson, 1993, fig. 17.2). The second problem of distance distortion is related to the arch effect. Species (or ceramic types) and samples (or components) at the ends of the extracted axes or dimensions exhibiting this horseshoe effect tend to be more compressed relative to one another compared with those nearer the center of the axes. These two problems arise because the underlying model of correspondence or reciprocal analysis differs from the mathematical properties of unimodal or Gaussian distributions encountered with real data (Gauch, 1982:150). As a result, some researchers (Hill and Gauch, 1980:47; Peet et al., 1988:926) thought that these problems were more a artifact of the ordination technique used than a real property of the data. Wartenberg et al. (1987), among others, contended that the arch effect is a real property of the data that should not be ignored. The solution that Hill and Gauch (1980:48) devised to ameliorate these inherent problems in correspondence analysis was to divide an axis into a number of segments and center the species or sample scores to a mean of zero (see also Gauch, 1982:152–157; ter Braak, 1987:105–107). This rescaling or detrending of species and sample scores between axes makes all axes orthogonal and independent of one another, removing any systematic relationships between them (Hill and Gauch, 1980:47–48; Gauch, 1982:153). One of the most popular detrended correspondence analysis computer programs is DECORANA (DEtrended CORrespondence ANAlysis) developed by M. O. Hill (1979). This program is used in all but one of the ordinations of components presented in chapter 6.

DENDROCHRONOLOGICAL DATING

Dendrochronology in the Middle Missouri subarea has provided some of the earliest dates from sites, particularly those from North Dakota (Will, 1946, 1948). Faced with an extensive salvage archeology program at numerous sites in the Dakotas in conjunction with dam building after World War II, there was a need to date these sites. Dendrochronology was one of several dating techniques incorporated into the Missouri Basin Chronology Program with the intended purpose of developing interrelated chronologies, using a variety of techniques (Stephenson, 1958). The results of this program were reported by Weakly (1971) and in the Missouri Basin Chronology Statement No. 3. Caldwell and Snyder (1983) reviewed the topic and concluded that the dendrochronological dates from the Middle Missouri subarea are unreliable. They concluded that all radiocarbon and dendrochronological dates from the Middle Missouri subarea must be questioned. This was supported by a comparison of three radiocarbon and dendrochronological dates on the same wood samples from the Sommers site, producing widely divergent dates that fall outside the temporal range of variant Sommers is assigned to. Dendrochronological dates from specific sites are discussed in chapter 6.

RADIOCARBON DATING

Broadly speaking, the purpose of the radiocarbon dating portion of this chronology program is to integrate to the maximum extent possible an accurate, high-precision calendar-based chronology with the ceramic ordination process. To achieve this, the following two specific goals in the area of radiocarbon dating were accomplished: (1) the evaluation of the relatively large number of existing radiocarbon dates for accuracy and precision, and the reduction of this array of existing dates in to a smaller set considered to be most reliable and informative about the cultural components and time period under study; and (2) the generation of new, maximally precise and accurate radiocarbon dates for as many previously undated or poorly dated components as possible.

Broad developments in three aspects of radiocarbon dating during the past decade conditioned the specific approach to these goals. First, development and routine application of the accelerator mass spectrometry (AMS) dating method makes it possible to date many components more precisely compared with conventional means (Creel and Long, 1986; Aitken, 1990:76–85). Because AMS dating uses an atom counting procedure, it is used with small samples, as little as several milligrams, within a short time span (Aitken, 1990:76–77). Conventional beta counting requires larger samples, on the order of about 10 grams. The AMS procedure facilitates the dating of small samples that would ordinarily not be suitable for conventional radiocarbon dating. This development has a direct bearing on the ability to date many components in the study area, which previously would not be accessible to radiocarbon assessment.

Second is the general understanding of the importance of focusing dating on short-lived botanical remains unequivocally associated with human activities (e.g., cultigens) as opposed to dating the often more abundant wood or wood charcoal, which is subject to a much greater possibility of discontinuity between the growth event and the cultural event under study. Error potentially assignable to "old wood" sources has been demonstrated to be substantial and confounding in several contexts in which the wood was well preserved in the environment (e.g., Schiffer, 1984, 1987:308–311; Smiley, 1985; Dean, 1991). In the present study area, old wood (wood predating the cultural event that is to be dated) undoubtedly exists in the inner rings of large timbers used as house posts, and dates on posts form a large fraction of previously existing radiocarbon dates. In addition, cultural practices compound the "old wood" problem. Cultural use of scavenged wood and river drift logs or salvaging of old house timbers would make most radiocarbon-dated samples appear to be older than the events (i.e., village occupation) with which they are associated. These practices have been documented among the Hidatsa (Wilson, 1934:359, 372–376).

It is therefore clear from cultural practices within the region, as well as from case studies outside the region, that compelling reasons exist for reevaluating existing dates that were based upon wood and for reorienting any new radiocarbon dating toward more ideal sample materials. Fortunately, the advent of routine AMS dating allows for a focus on dating materials that often occur in relatively small samples sizes in regional study sites. In our case, these newly accessible target materials include cultigens, wild plant food remains, and carbonized cooking residues occurring in small quantities on pottery vessels. Dates on maize are now well accepted when corrected through isotopic fractionation (Creel and Long, 1986). Dating of pottery residues seems practical, but it is far less established by test studies. Dating of pottery residues in the present study should therefore be considered an experimental approach.

A third advancement in radiocarbon dating that has direct bearing on this study is the development of routinely accessible computer programs that rapidly perform several very important functions, such as (1) testing for contemporaniety among a suite of dates, (2) averaging two or more dates, and (3) calibrating individual or mean dates into a calendar age by basing them upon the varying amounts of radiocarbon in the atmosphere through time. We refer in particular to components of the desktop computer program CALIB 3.0 and its successors (Stuiver and Reimer, 1993). Regarding the first point, the test of contemporaniety is used as a screening tool to eliminate from consideration suites of dates that contain too large an amount of error to accurately reflect the true age of the associated archaeological context based on a careful assessment of archaeological data independent of radiocarbon results (see Shott, 1992, for an excellent example of a systematic comparison of radiocarbon results and archaeological evidence to achieve the best possible age estimate for a site). Error assessed in this fashion includes a combination of association error (poor temporal association between the growing date of the sample and the cultural event), error introduced during laboratory processing (interlaboratory differences (International Study Group, 1982), as well as intra-laboratory error—all in addition to counting error), and error from other unknown sources. After suites of dates are screened for accuracy, the averaging routine is used to generate a mean date with the highest possible level of precision for a given cultural component.

Although it has been known for more than 30 years that differing amounts of radiocarbon in the atmosphere and oceans can affect the relationship between the radiocarbon age and the calendar age of dated materials, only recently have computer programs become available to correct for these variations. Program CALIB (Stuiver and Reimer, 1993) greatly facilitates the task of calendrically calibrating the 375 dates employed in this study. The program is based upon a recent effort to calibrate the radiocarbon time scale (Stuiver and Becker, 1993). A graphical representation of a portion of one of the calibration curves upon which this program is based is presented in Figure 5. It is observed that this decadal tree-ring curve fluctuates or "wiggles" more in some time periods than others. This has implications for the precision of corrected radiocarbon dates that are based upon the curve and can mean that the number of curve intercepts and the 1-sigma or 2-sigma ranges of dates varies depending on their position on the curve. Generally, dates that fall within the straight portions of the curve calibrate to smaller ranges than those on other more "jagged" parts.

Once a new set of screened, averaged, and calendrically calibrated radiocarbon dates are obtained for the largest possible number of components, the radiocarbon dates are integrated with ceramic ordination results in the following manner. Components with radiocarbon dates are used in conjunction with ceramic ordination to assign, within certain error parameters, many of the undated components included within the ceramic ordinations to 50 and 100 interval time periods. This is done by determining if an ordination reflects a temporal dimension or pattern by appealing to site stratigraphy, historic documentation, radiocarbon dates, and other temporal indicators. Once this

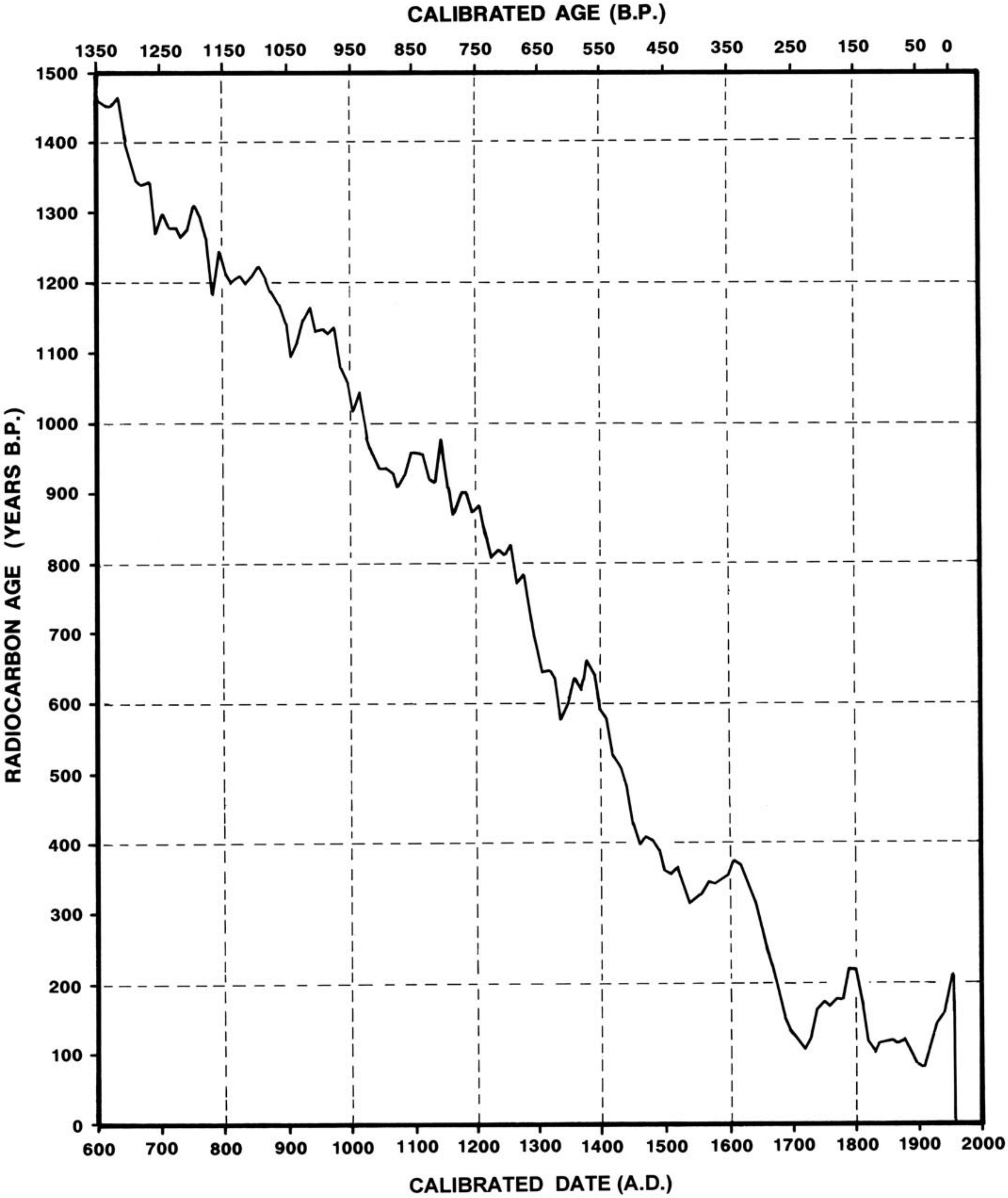

FIGURE 5. Decadal radiocarbon calibration curve (adapted from Stuiver and Becker, 1993: fig. 2a–c).

is accomplished, the radiocarbon dates associated with a number of components included within each ordination are used to estimate early and late dates of each temporal axis that is interval scaled by detrended correspondence analysis. Once this is done, assigning "absolute" dates (or more appropriately hypothesized dates) to each component is a matter of interpolating between two or more dated components in each ordination to other undated components. This technique, which is explained in more detail in chapter 6, results in an ordering of village components along an "absolute" time scale that is divided into 50- and 100-year increments. Only with a massive absolute dating program, far beyond the scope of the current study, could a more precise temporal ordering of components be achieved, assuming an appropriate amount of datable material and archeological context information is available. As a result, the temporal orderings presented in chapters 6 and 7 are considered to be hypothesized chronologies to be tested more thoroughly with additional radiocarbon dates and other independent bodies of temporally sensitive artifacts. Various levels of confidence also can be assigned to each variant or phase chronology depending on the comprehensiveness of available dates and the nature of ceramic variability within each one.

The current radiocarbon dating program is considered to be the third systematic effort to date sites of the Plains Village pattern within the Middle Missouri subarea. The first of these was the Missouri Basin Chronology Program, which was intended to develop inter-related chronologies, using a variety of techniques and data sets, including radiocarbon dating, dendrochronology, geological-climatic dating, and ceramic typology (Stephenson, 1958). The objectives were to develop a general chronology of the subarea that could be used to date subsequently excavated sites and be related to cultural developments in other parts of North America. It is particularly relevant to the current study that "the type of ceramic analyses done by Dr. A. O. Shepard in conjunction with the type of ceramic seriation that has heretofore been done in the area" was a component in the program (Stephenson, 1958:4). The ceramic aspect of the chronology program did not progress beyond the prospectus dealing with technology and how clay sources could be used to identify trade vessels (Huscher, 1958). Other portions of the chronology program yielded substantive results however, particularly in the area of radiocarbon dating. A summary of many of the radiocarbon dates from the Missouri Basin Chronology Program appears in Neuman (1967).

The second integrated dating program to be undertaken in the Middle Missouri subarea was in conjunction with the first phase of research at the Knife River Indian Villages National Historic site (Ahler and Haas, 1993). The cultural chronology that grew out of this and related analyses formed the basis of the reconstruction of Plains Village occupations in the Knife and Heart regions employed in the present study (see Ahler, 1993b). The chronology of the remaining regions within the Middle Missouri subarea (Cannonball, Grand-Moreau, Bad-Cheyenne, Big Bend, Fort Randall) is the result of the current study.

SITE STRATIGRAPHY

When a number of stratigraphically related provenience units within a particular site are grouped together into components or other cultural-temporal units, a very powerful tool is created to aid the interpretation of the results of any archeological ordination that includes these units. Interpreting the various dimensions, factors, axes, or patterns of a multivariate ordination procedure that includes some variables thought to be related to time ultimately depends upon information independent of the actual data used to construct these ordinations. Like the absolute dates provided by radiocarbon dating, stratigraphy is an interpretive tool to help in the construction of chronologies relying on ceramic ordination.

For the most part, the limited stratigraphic information available for this study seems to be an incidental byproduct of the excavation of a number of villages with relatively thick midden deposits. Even in these cases, the emphasis of the Interagency Archeological Salvage Program (IASP) program was to uncover as many houses as possible, within the existing budgetary constraints; areas between houses received far less attention It is no exaggeration to state that good stratigraphic control usually can be attained with relatively small excavations placed to maximize this information. The excavations at some of the villages in the Knife River Indian Villages National Historic Site dramatically demonstrates this point (Ahler, 1993c). It is emphasized that the stratigraphically related units sought in the current study are those that are included within the same ordination, usually confined to those components assigned to the same variant or phase. There is a wealth of stratigraphic information from many excavated sites within the Middle Missouri subarea, although it usually involves a short time period or components assigned to different variants or traditions that cannot be included within the same ordination.

Most of the stratigraphic controls for the present study are derived from villages containing relatively thick midden deposits (i.e., those occupied shortly before and during the protohistoric or Post-Contact period). The excavations at the Big Hidatsa and Lower Hidatsa sites within the Knife River Indian Villages National Historic Site is a case in point. Other villages providing some degree of stratigraphic control include a number assigned to the late Extended Coalescent variant (Swan Creek, Anton Rygh), Le Beau phase (Anton Rygh, Bamble, Larson, Spiry-Eklo, Swan Creek, Sully), Talking Crow phase (Medicine Crow), and to a lessor degree the Extended Coalescent (Walth Bay, Lower Grand), and Initial Middle Missouri (Jiggs Thompson, Pretty Head, Sommers) variants. Given the magnitude of this study and the number of components included within it, this list is relatively small and inadequate. Because there are a large number of Le Beau components that provide stratigraphic control, the ordination of this phase, along with the existing Heart River and Knife River complex sequences from the Knife and Heart regions, is firmly established. Affixing an absolute time scale to the Le Beau sequence relies on dating parameters developed largely from components occupied prior to these villages, because they were occupied most intensively after the latest feasible date for radiocarbon dating (i.e., after AD 1650).

EURO-AMERICAN TRADE MATERIALS

Artifacts of Euro-American derivation, either in their original manufactured form or modified by Native Americans, serve as a horizon marker for the beginning of the protohistoric or Post-Contact period in the Middle Missouri subarea. Some of the more common artifacts include copper, brass or iron knives; arrow points; tubes; beads; awls; fishhooks; conical tinklers; and scraps cut up from kettles and other trade items.

Glass beads also are commonly found in Post-Contact period sites. Billeck (2000) is the only one to have systematically dated sites in the Middle Missouri subarea using glass beads. His study provided an independent dating source for the post-contact sequences in this study. The actual process by which Euro-American trade items are eventually incorporated into the archaeological record is complex (Ray, 1978; Toom, 1979). Generally, sites later in time have larger numbers and more varieties of Euro-American trade items than those dating to the early part of the protohistoric period. There also are qualitative differences, as Billeck (2000) demonstrated. These trends provide ways to estimate the relative and absolute temporal placement of sites in this period. One of the major limiting factors is the field recovery techniques employed in excavations and their consistency of use, as pointed out by Billeck (2000:1) and in chapter 4. Because almost all of the sites used in this study were not screened during excavation, most of the Euro-American trade artifacts, which tend to be small, were not recovered. Only those items that were fortuitously found during excavation or were excavated with more attention to detail (e.g., human burials) remain in extant collections. Comparisons between Billeck's chronology and this study also are limited by the difference in archaeological context; this study is based upon villages, whereas Billeck's study focused on their associated cemeteries. This is not a problem when the villages were occupied for relatively short periods; however, some were occupied for long periods spanning the late prehistoric and protohistoric periods. Dates based upon beads probably tend to place these sites (i.e., the latest occupations) later than the dates derived from ceramics. Even when different components are dated in the present study, it is unclear if these occupations are defined precisely enough to allow for a one-to-one comparison with their associated cemeteries. Many of the late multi-component sites used in this study were excavated under salvage conditions that did not allow enough time for fine-scale separations of long, continuous occupations. The focus of excavations at many sites were contexts, such a houses (rather than thick middens), that could not be related stratigraphically. Still other sites either lack reports (e.g., Sully, Mobridge, Cheyenne River, Black Widow, 39ST25), do not adequately justify their separation of components (e.g., Swan Creek, Spiry-Eklo), or are reported based upon grossly inadequate field records (Larson). All of these factors add more uncertainty in the dating process. Nevertheless, comparisons are made in this report between the chronologies based upon ceramics and those based upon beads.

HISTORIC DOCUMENTATION

Historic documentation of Mandan, Hidatsa, and Arikara villages not only provides information about the tribes that occupied particular regions and specific village sites along the Missouri River in the Dakotas, but also when these villages were inhabited. This information is most complete for the eighteenth and nineteenth century Mandan and Hidatsa communities in the Knife and Heart regions, but information also is included for a number of Arikara villages in North and South Dakota.

An increasing interest in ethnohistory during the past 30 years has generated a number of summaries of the pertinent primary sources. These include Chomko (1986), Wood

(1986a:25–58; 1986b), and Thiessen (1993b), as well as the earlier studies of Wedel (1955:77–84), Hughes (1968:19–24), and Lehmer (1971:164–179, 1977a, 1977b). These compilations of European and American observations, aided by native informants, form the bulk of the historic documentation relating to the time of occupation and abandonment of specific Plains Village sites within the subarea.

ORAL TRADITIONS

Oral histories provide another source of information useful in reconstructing Mandan, Hidatsa, and Arikara origins, their cultural growth, and eventual decline. Most important for the current study is their record of where they lived during these periods and whether these locations or specific village sites can be tied to the archeological record. This historical record is critical not only as a source of independent chronological information, but also as a guide in assigning certain village components, archeological phases, complexes or other units to particular tribal entities or ethnic subdivisions within these groups. The further these oral histories are extended back in time, the more secure are the ethnic assignments of the prehistoric and post-contact villages. Making these links also is invaluable in interpreting the archeological record, a fact not lost on the adherents of the direct-historic approach to archeology on the plains (Wedel, 1938, 1940:296; Strong, 1940:353–354). Studies, such as the present one, which rely on multiple lines of archeological, historic, ethnographic, linguistic, and physical anthropological evidence in their reconstructions, follow the general methods set forth by these early pioneer archeologists more than 50 years ago and bring it full circle to these early efforts. Syms (1985) argued for a return to these various sources of information in the interpretation of the archeological record.

It becomes apparent later in chapter 6 that these various sources of interpretive information vary in detail and usefulness, depending on the tribe or ethnic group under consideration. The historic record is most detailed for the Mandan and Hidatsa, as are their oral traditions. Historical linguistics and physical anthropology are best documented for the Arikara and their ancestors. On one level, more is known about the archeology of the protohistoric and prehistoric Arikara than the Mandan and Hidatsa, although this balance has tipped in recent years as the Knife River Indian Villages National Historic Site is interpreted through the archeological, historic, and ethnographic records of the Hidatsa (Thiessen, 1993b). Much of what is known about the Mandan and Hidatsa is the result of Bowers' (1950, 1965) historical and ethnographic work. A comparable study of the Arikara has not been conducted, although Holder (1970) provided some relevant information as more continues to be made available, if only in piecemeal fashion (Parks, 1979a). Bowers keen interest in setting the prehistoric context of the Mandan and Hidatsa, so useful in recent cultural-historical reconstruction (Ahler, 1993a:34–38), has not been duplicated for the Arikara. This information may exist in the unpublished notes of Preston Holder, although efforts by this author to gain access to that source have not been productive.

HISTORICAL LINGUISTICS

Linguistic studies that outline the temporal relationships between various Northern Plains language groups (Hughes, 1968; Parks, 1979b; Hollow and Parks, 1980; Springer and Witkowski, 1982) provided useful information relating to the distributions and splitting of various Caddoan (e.g., Arikara and Pawnee) and Siouan (Mandan, Hidatsa) language groups. To the extent that such studies can date the approximate times of language group splits, the more useful this information is when combined with other studies of the affinities of certain biological populations, or ceramic relationships between villages or complexes of villages. The results of these historical linguistic studies are integrated with other temporal data in chapter 6.

CRANIOMETRIC DISTANCE

Through the efforts of Bass (1964), Jantz (1972, 1973), and a number of their students (summarized in Bass, 1981), craniometric analyses focus on morphology to infer biological distance between skeletal populations associated with certain Northern Plains Villages. Among the findings in these studies is what various investigators interpret to be temporal variability between the populations. Despite the fact that the absolute dates they employed were only estimates that were based upon very limited information (Jantz, 1972:24–25, 1973, table 1; Owsley and Jantz, 1978, table 2; Key and Jantz, 1981, table 1; Jantz and Willey, 1983, tables 1 and 2), these studies do provide relative orderings between the populations and a measure of biological distance between them that are in turn related to other factors. These results are particularly intriguing for the present study that tries to examine the flip side of the affinity question (i.e., the ceramic or inferred "social distance" between villages). Clearly, the complementary nature of these two data sets, ceramic and skeletal, and the inferred social and biological affinities are important to the overall effort to date and otherwise relate the villages and their associated remains, even though the underlying processes of ceramic and skeletal change are probably very different.

4

Data Acquisition

Table 3 lists a total of 225 site components used in this chronology of Middle Missouri Plains Village sites. The accompanying data matrices, listing the percentages and frequencies of various ceramic types, and cord-impressed decorative attributes, appear as a series of tables in Appendix A (Tables A.1–A.6). Site assemblages containing 50 rim sherds or more appear in this table, although there are a few exceptions in which smaller samples are included. Components not included in the analysis are discussed later. Also not included in the study are a number of components from the Knife and Heart regions in North Dakota; the established chronology for this region (Ahler, 1993b) is integrated into the present study. Related Mill Creek (Flanders, 1960; D. R. Henning, 1971; Anderson, 1981; Tiffany, 1982) and Lower Loup/Historic Pawnee (Grange, 1968, 1984; O'Shea, 1989) chronologies also are considered herein, although no formal re-analyses are attempted. The components in Table 3 are organized by traditionally defined taxonomic units, the variant and phase, with additional information pertaining to the degree of the fieldwork and source of the information. Variant designations follow Lehmer (1971), and taxonomic assignment is listed only in cases in which the first reporting of the site designated a phase, focus, aspect, or variant. The intensity of the field effort includes four categories: (1) surface or beach collections; (2) initial reconnaissance tests; (3) major excavations not resulting in the exposure of houses; and (4) excavations uncovering houses and the number of partial or complete houses excavated.

The source of the information listed in Table 3 deserves additional clarification. There are two major sources of actual rim sherd counts: (1) published and unpublished literature; and (2) personal inspection by the author, the latter designated as "Johnson" followed by the institution in which the collections were curated at the time they were examined. Explanations of all abbreviations appear at the end of this table. In the case of the cord-impressed motif data in Table A.6, all collections were personally examined except for Deapolis, Amahami, Rock Village, Nightwalker's Butte, and Biesterfeldt, reported in Wood (1971) and Lehmer et al. (1978). When more than one source for each component appears in Table 3, the first listed provides the actual rim sherd counts, whereas the second gives background information on the site. In some instances, the second source also provides

TABLE 3. List of Plains Village tradition components used in the ceramic ordinations by taxonomic assignment, extent of fieldwork, and source of the ceramic data. Dashes indicate not assigned or not available.

Variant/Component[1]	Taxonomic Assignment[2]	Extent of Field Work[3]	Source[4]
INITIAL MIDDLE MISSOURI			
Broken Kettle West (13PM25)	Great Oasis	1 House	Johnson, 1974
Williams (13PM50)	Great Oasis	Excavations	Williams, 1975
Larsen (13PM61)	Great Oasis	Excavations	Henning and King, 1982; Henning 1996
Cambria (21BE2)	Cambria Phase	Excavations	Johnson (MHS;UMM); Knudson,1967
Price (21BE25)	Cambria Focus	Excavations	Scullin (1979)
Great Oasis (21MU2)	Great Oasis	Excavations	Johnson (UMM); Johnson, 1969
Ferber (25CD10)	Great Oasis	Excavations	Edwards, 1993
Packer (25SM9)	Great Oasis	Excavations	Johnson (NSHS); Bozell and Rogers, 1989
Crow Creek (39BF11)	—	Test	Hanenberger, 1986; Kivett and Jensen,1976
Pretty Bull (39BF12)	— (6)	Excavations	Johnson (SDARC)
Akichita (39BF221)	—	Excavations	Johnson (SDARC); Husted, n.d.
Swanson (39BR16)	Over F.	4 Houses	Johnson (SDARC); Hurt, 1951
Jones Village (39CA3)	IMM	Tests	Johnson (SDARC); Johnson, 1986
Pease Creek (39CH5)	Great Oasis	Excavations	Johnson (NMNH)
Oldham (39CH7)	Great Oasis (6)	Excavations	Johnson (NMNH); Huscher, 1957
Hitchell (39CH45)	Great Oasis (6)	Excavations	Johnson (NMNH); Johnston, 1967
39CH205	Great Oasis	Excavations	Johnson (NMNH)
Mitchell (39DV2)	Over F./Lower James Ph.	2 Houses	Johnson (SDARC); Alex, 1981b; Meleen, 1938
Chapelle Creek C (39HU60)	Over F. (5,6)	Excavations	Brown, 1967
St. John (39HU213)	Great Oasis	Tests	Johnson (NMNH); Jensen, n.d.a
Twelve Mile Creek (39HT1)	Over F.	1 House	Johnson (SDARC); Meleen, n.d.
Dinehart (39LM33)	—	2 Houses	Johnson (SDARC)
King (39LM55)	IMM	1 House	Johnson (NMNH); Ehrenhard, 1971
Jiggs Thompson A (39LM208)	—	Tests	Caldwell & Jensen, 1969
Jiggs Thompson B (39LM208)	Grand Detour Phase	2 Houses	Caldwell & Jensen, 1969
Langdeau (39LM209)	Grand Detour Phase	5 Houses	Caldwell & Jensen, 1969
Jandreau (39LM225)	—	2 Houses	Johnson (SDARC); Jones, n.d.
Gilman (39LM226)	—	Tests	Johnson (SDARC)
Pretty Head A (39LM232)	Grand Detour Phase	1 House	Caldwell & Jensen, 1969
Pretty Head B (39LM232)	Over F.	2 Houses	Caldwell & Jensen, 1969
Heath (39LN15)	Great Oasis	1 House	Johnson (ACAL); Hannus et al., 1986
Brandon (39MH1)	Over F.	7 Houses	Johnson (SDARC); Over & Meleen, 1941
Fay Tolton (39ST11)	Anderson Phase	2 Houses	Johnson, 1976
H.P. Thomas 1 (39ST12)	IMM Variant (5,6)	Excavations	Falk, Johnson, and Richtsmeier, in prep.
Breeden A (39ST16)	Anderson Phase (6)	4 Houses	Brown, 1974
Dodd (39ST30)	Monroe/Anderson Foci (6)	11 Houses	Johnson (NMNH; SDARC); Lehmer, 1954a
Sommers (39ST56)	IMM	8 houses	Steinacher, 1990; Falk, Steinacher, and Johnson, in prep.
Cattle Oiler Early (39ST224)	IMM (2,5)	6 houses	Johnson (NSHS); Moerman & Jones, 1966
Gavins Point (39YK203)	Great Oasis	Surface	Johnson (NMNH); Brown, 1968
EXTENDED MIDDLE MISSOURI			
Havens (32EM1)	Fort Yates Phase	4 Houses	Sperry, 1968a; 1995
Tony Glas (32EM3)	—	2 Houses	Johnson, 1999; Howard, 1962a
Clarks Creek (32ME1)	Fort Yates Phase	Tests	Calabrese, 1972
White Buffalo Robe (32ME7)	Nailati Phase	1 House	Lee, 1980
Amahami (32ME8)	Nailati Phase	1 House	Lehmer et al., 1978
Bendish (32MO2)	Fort Yates Phase	2 Houses	Thiessen, 1976
Cross Ranch (32OL14)	Nailati Phase	2 Houses	Calabrese, 1972
Fire Heart Creek (32SI2)	Fort Yates Phase (6)	3 Houses	Lehmer, 1966
Paul Brave (32SI4)	Thomas Riggs Focus	3 Houses	Wood & Woolworth, 1964
Ben Standing Soldier (32SI7)	—	3 Houses	Hoffman, 1970a
South Cannonball (32SI19)	EMM Variant	7 Houses	Griffin, 1984
McKensey (39AR201)	—	1 House	Caldwell, 1966a
39AR210	—	Tests	Caldwell, 1966a
Vanderbilt Village (39CA1)	EMM	Tests, Surface	Johnson, 1986; Jensen, n.d.b
Keen Village (39CA2)	EMM	Tests, Surface	Johnson, 1986; Jensen, n.d.b
Helb (39CA208)	Fort Yates Phase	Excavations	Falk & Calabrese, 1973

Jake White Bull (39CO6)	EMM Variant	Tests/Surface	Ahler, 1977a
Travis I (39CO213)	EMM Variant (5)	Excavations	Johnson, 1982
Calamity Village (39DW231)	—	1 House	Johnson (SDARC); McGowen, 1973
Thomas Riggs (39HU1)	Thomas Riggs Focus	6 Houses	Johnson (SDARC); Kleinsasser, 1953
Sully School (39SL7)	— (5)	1 House	Johnson (SDARC); McNutt, n.d.a
C.B. Smith (39SL29)	Thomas Riggs Focus (5)	Tests	Johnson (SDARC); McNutt, 1958
Zimmerman (39SL41)	—	—	Johnson (SDARC)
Cheyenne River Early (39ST1)	— (5,6)	5 Houses	Johnson (NMNH)
Indian Creek (39ST15)	EMM Horizon (6)	Excavations	Lehmer & Jones, 1968
Blk. Widow Ridge E. (39ST203)	— (6)	2 Houses	Johnson (NMNH)
Cattle Oiler Middle (39ST224)	EMM (1,6)	1 House	Johnson (NSHS); Moerman & Jones, 1966
Extended/Terminal Middle Missouri			
32MO291	—	Excavations	Ahler et al. (2000)
Terminal Middle Missouri			
Shermer (32EM10)	TMM	4 Houses	Sperry, 1968b
Huff (32MO11)	Huff Focus	10 Houses	Wood, 1967; Ahler & Kvamme, 2000
Initial Coalescent			
Lynch (25BD1)	Anoka Focus	5 Houses	Witty, 1962
Talking Crow II (39BF3)	Campbell Creek Ph. (6)	4 Houses	Smith, 1977
Arzberger (39HU6)	—	4 Houses	Spaulding, 1956
Whistling Elk (39HU242)	—	2 Houses	Steinacher, 1983
Black Partizan B (39LM218)	Arzberger Phase (6)	2 Houses	Caldwell, 1966b
Extended Coalescent			
Redbird II (25HT2)	Redbird Focus	1 House	Wood, 1965
Elbee (32ME408)	Scattered Village	Excavations	Ahler, 1984a
No Heart Creek (39AR2)	Le Compte Focus/Phase	1 House	Hurt, 1970
39AR7	Le Compte Focus	Surface	Johnston & Hoffman, 1966
Anton Rygh RV-VII (39CA4)	Akaska Focus (6)	Excavations	Johnson (NMNH); Knudson et al., 1983
39BR10	—	Surface	Johnson (NMNH)
Locke Creek (39CA201)	—	Surface	Johnson (MT)
Demery (39CO3)	Chouteau A.	4 Houses	Woolworth & Wood, 1964
Fort Manuel (39CO5)	—	Excavations	Johnson (MWAC); Smith & Ludwickson, 1981
Leavenworth Early (39CO9)	— (6)	Excavations	Johnson (NSM); Krause, 1972
Lower Grand (39CO14)	—	5 Houses	Johnson, 1988
Bellsman Creek (39CO17)	—	Surface	Johnson (MT)
39CO18	—	Surface	Johnson (MT, NMNH)
North White Bull (39CO41/207)	—	Surface	Johnson (MT)
Potts Village (39CO19)	Chouteau A./Le Compte F.	2 Houses	Stephenson, 1971
H & H (39CO78)	—	Surface	Johnson (MT)
Travis I (39CO213)	EMM (2)	Excavations	A. Johnson, 1982
Moreau River (39DW1)	—	Tests	Johnson (NMNH); Winham, 1984
39DW217	—	Surface	Johnson (NMNH)
Fox Island (39DW230)	EC Horizon	1 House	Kotch & Starr, 1968
Molstad (39DW234)	Chouteau A./Le Compte F.	4 Houses	Hoffman, 1967
39DW253	—	Surface	Johnson (MT)
39DW254	—	Surface	Johnson (NMNH)
Scalp Creek A (39GR1)	La Roche Focus	10 Houses	Hurt, 1952
Pierre School-South (39HU10)	EC	Excavations	Johnson (ACAL)
Robinson (39HU15)	—	Surface	Johnson (NMNH); George, 1949
Chapelle Creek B (39HU60)	Chouteau Aspect (1,6)	Excavations	Brown, 1967
Little Pumpkin (39HU97)	—	Surface	Johnson, 1984b; Toom, 1992d
Little Cherry (39HU126)	EC Variant	Excavations	Kapler, 1991
Bowman (39HU204)	—	1 House	Johnson (MWAC); Roetzel & Strachan,1986a
Standing Bull (39HU214)	—	Surface/Tests	Johnson, 1984b
Fry A (39HU223)	—	1 House	Jensen, n.d.a
39HU241	—	Surface	Johnson (NMNH)
Stricker B (39LM1)	La Roche Phase	1 House	Smith, 1975
Bice (39LM31)	—	1 House	Johnson (MWAC)
Clarkstown B (39LM47)	—	Surface	Smith & Grange, 1958
Meander (39LM201)	Chouteau Aspect	Tests	Husted, 1965a
39LM222	—	3 Houses	Johnson (MWAC)
Spain A (39LM301)	Chouteau A./Shannon F.	1 House	Smith & Grange, 1958
Hosterman (39PO7)	—	5 Houses	Miller, 1964

(*continued*)

TABLE 3. (*continued*)

Variant/Component[1]	Taxonomic Assignment[2]	Extent of Field Work[3]	Source[4]
EXTENDED COALESCENT *(continued)*			
Gettysburg (39PO209)	EC Horizon	Tests	Coleman, 1968
Fairbanks (39SL2)	—	Tests	Johnson (NMNH)
Sully Early (39SL4)	— (6)	Multiple Houses	Johnson (NMNH)
Sully School (39SL7)	— (2)	1 House	Johnson (MWAC)
39SL8	—	Tests	Johnson (MWAC)
39SL12	—	Tests	Johnson (MWAC)
39SL23	—	Tests	Johnson (MWAC)
39SL24	—	1 House	Johnson (MWAC)
C.B. Smith (39SL29)	Bennett Focus (2)	1 House	McNutt, 1958
Cheyenne River Middle (39ST1)	— (2,6)	1 House	Johnson (NMNH)
Black Widow Early (39ST3)	— (6)	3 Houses	Johnson (NMNH)
Over's La Roche (39ST9)	EC Horizon	7 Houses	Hoffman, 1968
Meyer (39ST10)	—	Surface	Johnson (NMNH); Hoard, 1949
H.P. Thomas 2 (39ST12)	EC Variant (1,6)	Excavations	Falk, Johnson, and Richtsmeier, in prep.
Cooper (39ST45)	—	2 Houses	Johnson (MWAC)
Leavitt (39ST215)	EC Horizon	1 House	Lehmer & Jones, 1968
Cattle Oiler Late (39ST224)	— (1,2)	Excavations	Johnson (NSHS); Moerman & Jones, 1966
Bower's La Roche (39ST232)	EC Horizon	2 Houses	Hoffman, 1968
Swan Creek A (39WW7)	Akaska Focus (6)	Excavations	Hurt, 1957
Spiry (39WW10)	Akaska Focus	1 House	Baerreis & Dallman, 1961
Walth Bay (39WW203)	EC	7 Houses	Johnson 1988; Ahler, 1975, 1975b
39WW300	Akaska Focus	Tests	Hurt, 1957
Payne (39WW302)	Chouteau A./Akaska F.	2 Houses	Wilmeth, 1958
FELICIA PHASE			
39BR201	—	2 Houses	Weakly, 1961
Cadotte (39HE202)	Felicia Phase	Tests/Surface	Smith & Johnson, 1968
Black Partizan A (39LM218)	Felicia Focus (4)	3 Houses	Caldwell, 1966b
39LM219 A	—	1 House	Husted, 1965b
Crazy Bull (39LM220)	Chouteau Aspect	1 House	Frantz, 1962
Mc Clure (39HU7)	Felicia Phase	2 Houses	Johnson (MWAC); Johnston, 1982
TALKING CROW PHASE			
Medicine Crow 1-5 (39BF2)	Talking Crow Phase	17 Houses	Johnson & Toom, 1995
Talking Crow III (39BF3)	Talking Crow Phase (4)	9 Houses	Smith, 1977
39BF4	Ft. Thompson Focus	Excavations	Kivett & Jensen, 1976
Pretty Bull (39BF12)	— (1)	1 House	Johnson (MWAC)
Fire Cloud (39BF237)	Pahuk A./Ft. Thompson F.	Test	Karklins, 1970
Sanitarium (39BR6)	—	1 House	Kruschwitz, n.d.
39BR13	—	Tests/Surface	Johnson (NMNH); Witty, 1960
Oldham (39CH7)	— (1)	13 Houses	Johnson (NMNH); Huscher, 1957
Hitchell (39CH45)	Fort. Thompson F. (1)	2 Houses	Johnston, 1967
Iron Shooter (39HU217)	—	Tests/Surface	Johnson, 1983b; Peterson, n.d.
Amos Shields (39HU220)	—	Tests/Surface	Johnson (MWAC);Roetzel & Strachan, 1986b
Hawk (39HU238)	—	1 House	Jensen, n.d.a
Ocoma (39LM26/27)	—	10 Houses	Johnson (NSHS); Kivett, 1958
39LM34	—	Surface	Johnson (MWAC)
Peterson (39LM215)	Fort Thompson F.	1 House	Jensen, 1966
Breeden B (39ST16)	Talking Crow Ph. (1)	Excavations	Brown, 1974
Fort George Village (39ST17)	Bad River Phase	6 Houses	Hoffman, 1970b
BAD RIVER PHASE			
Pascal Creek (39AR207)	Stanley/Snake Butte F.	Tests	Johnston, 1966
Chapelle Creek A (39HU60)	Bad River Phase (1,5)	5 Houses	Brown, 1967
Coleman (39SL3)	—	1 House	Johnson (MWAC)
Little Bend (39SL13)	—	Tests	Johnson (MWAC)
Madison (39SL19)	—	Tests	Johnson (MWAC)
39SL28	—	Tests	Johnson (MWAC)
Cheyenne River Late (39ST1)	— (2,5)	2 Houses	Johnson (NMNH)

Black Widow Late (39ST3)	— (5)	1 House	Johnson (NMNH)
Dan Donavan (39ST5)	—	Surface	Johnson (NMNH)
Buffalo Pasture (39ST6)	Bad River 2	5 Houses	Lehmer & Jones, 1968; Howson, 1941
H.P. Thomas 3 (39ST12)	Bad River Phase (1,5)	5 Houses	Falk, Johnson, and Richtsmeier, in prep.
Phillips Ranch (39ST14)	Snake Butte F.	10 Houses	Lehmer, 1954a
Indian Creek A (39ST15)	Bad River 1 (2)	2 Houses	Lehmer & Jones, 1968
Gillette A (39ST23)	Stanley/Snake Butte F.	2 Houses	Brown, 1966
39ST25	—	Excavations	Johnson (NMNH)
Dodd A (39ST30)	Stanley Focus (1)	10 Houses	Lehmer, 1954a
39ST50	—	1 House	Johnson (NMNH)
39ST51	—	Surface	Johnson (NMNH)
Johnston (39ST244)	Bad River Phase 2	Surface	Lehmer & Jones, 1968
Blk. Widow Ridge L. (39ST203)	— (2)	2 Houses	Johnson (NMNH)
Le Beau Phase			
Anton Rygh RI-IV (39CA4)	— (5)	Excavations	Johnson (NMNH)
Anton Rygh Upper-Lower (39CA4)	Le Beau F., Rygh F.	8 Houses	Knudson et al., 1983
Bamble Early (39CA6)	Le Beau Focus	3 Houses	Baerreis & Dallman, 1961
Bamble Late (39CA6)	Le Beau Focus	3 Houses	Baerreis & Dallman, 1961
Nordvold I (39CO31)	—	—	Johnson (UNL); Krause, 1962
Red Horse Hawk (39CO34)	Bad River Phase	15 Houses	Hoffman, 1970b
Four Bear (39DW2)	Four Bear Focus	1 House	Hurt et al., 1962
Oahe Village (39HU2)	—	2 Houses	Johnson (SDARC)
Mush Creek (39HU5)	—	Tests	Johnson (MWAC); Bleacher, 1980
Pierre School 1987 (39HU10)	— (5)	Excavations	Johnson (SDARC; ACAL)
Pierre School 1990 (39HU10)	— (5)	Excavations	Johnson (ACAL)
39HU22	—	Tests/Surface	Johnson (NMNH)
Spotted Bear (39HU26)	Spotted Bear Focus	5 Houses	Hurt, 1954a
Steamboat Creek (39PO1)	—	Tests/Surface	Johnson (MWAC, NMNH)
Rosa A (39PO3)	Le Beau/Bad River Ph.	2 Houses	Hurt, 1974
Artichoke Creek (39SL1)	—	Surface	Johnson (NMNH)
Sully Middle (39SL4)	— (5)	Multiple Houses	Johnson (NMNH)
Sully Late (39SL4)	— (5)	Multiple Houses	Johnson (NMNH)
Mobridge (39WW1)	—	Surface	Johnson (NMNH); Parmalee, 1979
Larson 1-4 (39WW2)	Le Beau Phase	7 Houses	Falk and Johnson, in prep.
Spiry-Eklo Late-Early (39WW3)	Le Beau Focus	2 Houses	Baerreis & Dallman, 1961
Swan Creek B (39WW7)	Le Beau Focus (5)	1 House	Hurt, 1957
Swan Creek C+D (39WW7)	Le Beau Focus (5)	2 Houses	Hurt, 1957
39WW301	Akaska/Le Beau F.	Tests	Hurt, 1957
Knife River Phase			
Deapolis (32ME5)	Knife River Phase	Surface	Lehmer et al., 1978
Amahami (32ME8)	Knife River Phase	4 Houses	Lehmer et al., 1978
Rock Village (32ME15)	Knife River Phase	13 Houses	Lehmer et al., 1978
Nightwalker's Butte (32ML39)	Knife River Phase	28 Houses	Lehmer et al., 1978
Protohistoric Cheyenne			
Biesterfeldt (32RM1)	PCC	7 Houses	Wood, 1971
Late Protohistoric/historic Arikara			
Greenshield (32OL17)	—	Tests	Johnson (UMC); Nicholas & Johnson, 1986
Fire Heart Creek Late (32SI2)	— (2)	6 Houses	Lehmer, 1966
Leavenworth (39CO9)	— (5)	7 Houses	Johnson (NSM); Krause, 1972
Blue Blanket Island (39WW9)	—	1 House	Stephenson, 1969

[1] Component Abbreviations: E = Early, M = Middle, L = Late. Single occupations at multiple component sites are frequently designated by letter codes (e.g. A, B, C, D).

[2] Taxonomic Abbreviations: Variant assignments and taxonomic abbreviations follow Lehmer (1971). IMM=Initial Middle Missouri; EMM=Extended Middle Missouri; TMM=Terminal Middle Missouri; IC=Initial Coalescent; EC=Extended Coalescent; PCC=Post-Contact Coalescent. A=Aspect; F=focus; Ph=phase; H=horizon. Taxonomic assignments are from site reports. Numbers in parentheses under Taxonomic Assignment refer to additional components present at a site and included in this analysis. 1=IMM, 2=EMM, 3=TMM, 4=IC, 5=EC, 6=PCC.

[3] Extent of Field Work: Four levels of fieldwork are included. Surface are those collections from surface cutbank or beach areas. Tests are usually small, limited scale investigations. Excavations represent more extensive excavations than tests but did not result in the discovery of any houses. House excavations are denoted by the number of complete or partial houses excavated. Additional units were often excavated along with houses at the same site.

[4] Source of Data: MT=Marion Travis Collection; NMNH=National Museum of Natural History (Smithsonian Institution); NSM=Nebraska State Museum; NSHS=Nebraska State Historical Society; SDARC=South Dakota State Archaeological Research Center; MWAC=Midwest Archeological Center (National Park Service); UNL=University of Nebraska-Lincoln; MHS=Minnesota Historical Society; UMC=University of Missouri-Columbia; UMM=University of Minnesota-Minneapolis; ACAL=Augustana College Archeology Laboratory. All references to Johnson refer to Craig M. Johnson, the author of this report. Semi-colon between multiple sources indicates first source for ceramic data, second source as additional background. Dash between sources indicates use of both as sources of ceramic data.

a rim sherd count, but this information is rejected in favor of the author's personal data. Sources separated by a dash indicate that both are independent samples used in the tabulation of rim frequencies. Ceramic assemblages inspected by the author are currently curated by a number of institutions, with several housed at Marion Travis' residence in Mobridge, South Dakota. The author examined many of the ceramic assemblages during a period of almost 20 years, beginning in 1975. Since this time, most of the archeological collections curated at the Midwest Archeological Center, National Park Service in Lincoln, Nebraska, have been transferred to the South Dakota State Archaeological Research Center in Rapid City, South Dakota. There were two major periods when ceramic assemblages were examined by the author, twice in 1982 at the Midwest Archeological Center (National Park Service) and the National Museum of Natural History (Smithsonian Institution), and again in 1991 and 1992 at the National Museum of Natural History, the South Dakota State Archaeological Research Center, the University of Minnesota, and the Minnesota Historical Society. A few ceramic assemblages not included during these periods were examined at various times since 1982. The author privately funded the 1982 effort with the assistance of Carl R. Falk, whereas the Repatriation Office of the Smithsonian Institution supported the 1991 and 1992 trips. Most Coalescent tradition assemblages were examined in 1982, whereas the 1991–1992 effort focused primarily on pottery from Middle Missouri tradition components and the selection of botanical remains for the radiocarbon dating portion of the project.

There are a number of ceramic assemblages not listed in Table 3. A more complete list of Plains Village components appears in Lehmer (1971, figs. 38, 39, 76, 77, 79, 82, 111, and app. 1). Additional small, partially documented, or unlocated collections were made from a variety of survey and testing projects sponsored by the Interagency Archeological Salvage Program, the U.S. Army Corps of Engineers-Omaha District, Logan Museum-Beloit College (Bowers, 1948a), Over Museum of South Dakota (Sigstad and Sigstad, 1973) and other institutions and individuals (Petsche, 1968) . Some of these are discussed in a series of published and unpublished reports including Bowers (1930, 1948a), Howson (1941), Hughes (1955), Kuhn (1961), Howard (1962b), Hoffman (1963b, n.d.), Caldwell et al. (1964), Neuman (1964), Johnston and Hoffman (1966), Gant (1967), Lehmer and Jones (1968:75), Smith and Johnson (1968:41–43), Sigstad and Sigstad (1973), A. Johnson (1979), C. Johnson (1986), Roetzel and Strachan (1986a, 1986b), Toom (1990:138–147), Fritzen (n.d.), Hillman (n.d.), Jensen (n.d. a,b), McNutt (n.d. b–f), Reed (n.d.), Richards (n.d.). Two preliminary reports (Moerman and Jones, 1966; Jones, 1969) exist for the Cattle Oiler site (39ST224); only one is listed in Table 3. In addition, data from a recently released report on the Havens site could not be incorporated (Sperry, 1995). An older version of the report was used to compile the ceramic information from the site (Sperry, 1968a). Many of the unpublished reports are in the library at the Midwest Archeological Center, National Park Service, Lincoln, Nebraska. In addition, the Initial Middle Missouri and Initial Coalescent components from the Crow Creek site reported by Kivett and Jensen (1976) could not be used because of insufficient descriptive information and problems separating components (see introduction to Appendix A). Hanenberger's (1986) description of the Initial Middle Missouri pottery from Crow Creek is used in this analysis. The Initial Coalescent component from the Farm School site (39BF220), reported by Neuman (1961), also is eliminated because of mixing of components (Steinacher, 1983:64–66). The result is to reduce the small number of Initial Coalescent villages to five for this very important taxonomic unit. The latest Redbird components also are rejected because they contain large amounts of undecorated straight-rimmed vessels, unlike the late Extended and Post-Contact Coalescent in South Dakota (see Wood, 1965:99–103). The assemblage from the Medicine Creek site (39LM2), which contains Initial Middle Missouri, Initial Coalescent, and Extended Coalescent components (Lehmer, 1971:195), has been in the possession of Elizabeth Potter Henning since the early 1970s and could not be used despite a concerted attempt to examine it.

Plains Village components from the Knife, Heart, Garrison, and Little Missouri regions, subjects of recent reports (Woolworth, 1956; Cooper, 1958; Metcalf, 1963a, 1963b; Wheeler, 1963; Ahler, Weston et al., 1980, Ahler, Schneider et al., 1980; Ahler and Weston, 1981; Ahler and Mehrer, 1984; Kuehn et al., 1984; Ahler and Swenson, 1985), are not formally included in the present analysis, except for the Clark's Creek, Cross Ranch, White Buffalo Robe, Amahami, and Elbee sites. The Deapolis, Amahami, Rock Village, Nightwalker's Butte, Greenshield, and Biesterfeldt sites from North Dakota are included in the analysis of cord-impressed motifs. The Plains Village sites from the Knife and Heart regions, forming the basis of a recent synthesis of the Knife River Indian Villages National Historic Site (Thiessen, 1993b), also are not formally included in the present study. The cultural chronology from the area (Ahler, 1993b) is incorporated into the settlement history in chapter 7 and is relied upon to help interpret the sequences from South Dakota.

DESCRIPTIVE RIM SHERD CATEGORIES

Ceramic classification in the Middle Missouri subarea has resulted in more than 200 crosscutting and sometimes duplicate ceramic wares, types, subtypes, varieties, classes, groups, and other categories (Wheeler, 1954; Lehmer, 1971:22–23; Calabrese, 1977; C. Johnson, 1980; Butler and Hoffman, 1992). The plethora of pottery categories tends to inhibit comparisons between site assemblages, although some broader studies have been accomplished (see chapter 2). The inclusion of additional assemblages in the classification process beyond those originally used to define ceramic types has had a subtle, yet pronounced effect on the actual composition of these groups. As van der Leeuw (1991:22) asserted, the inductive definition of types changes when newly classified artifacts are included within them. The reasons for the explosive growth of ceramic wares and types remains unclear, but the shear number of excavated sites, and their geographic and temporal distributions contributed to the problem. The large number of archeologists working in the subarea, the evolving nature of ceramic classification, and the availability at any one time of only one or several ceramic assemblages during the classification process certainly aggravated the situation (C. Johnson, 1980:1–2). Despite one attempt (C. Johnson, 1980), there were no productive efforts to integrate, reconcile, or revise the ceramic classification systems used in the Middle Missouri subarea. Without a single consistent system, any intersite quantitative analyses are doomed to failure.

It is the intent herein to begin to reconcile the multitude of ceramic classification or grouping systems by reducing the myriad number of types into a smaller and more manageable number of groups, termed descriptive rim sherd categories. Because these categories are designed for use in broad cultural comparisons, they represent the efforts of a classic "lumper" as compared with a more fine-grained "splitter" approach to ceramic classification. The author uses the latter approach in intrasite ordinations (C. Johnson, 1977b; Johnson et al., 1995; Falk and Johnson, in prep.; Falk, Johnson, and Richtsmeier; in prep.), although analyses that are based upon attributes take enormous amounts of time not available for the present study. A good example of the utility of using attributes in chronological ordering is by Ahler and Swenson (1993). A recent discussion of attribute versus type approach in microseriation was presented by Duff (1996) who concluded that types can provide as accurate results as attributes. One of the results of the lumper approach is to emphasize the affinities between certain ceramic assemblages at the expense of variation between them. This approach also is deemed necessary to maximize the number of components used in the study. In short, the approach is to include as many of the radiocarbon dated components into the ceramic ordinations as possible. This is done to evaluate the relationship between ceramic variation and radiocarbon dates, and to provide data for the settlement model presented in chapter 7. Another result of the present study is to identify a small number of ceramic assemblages that can be used to address chronology problems, using more detailed attribute-based studies (see chapter 8).

The percentages and frequencies of these descriptive categories listed for each component are presented in Appendix A. The resulting five data matrices, consisting of 225 components and the frequencies of 53 descriptive rim sherd categories, are the basis of the ceramic ordinations. Examples from most of these categories are illustrated in Appendix B. The components in Appendix A are ordered by traditionally defined taxonomic units (Lehmer, 1971). The five matrices list components assigned to the following units: (1) Great Oasis phase of the Initial Middle Missouri variant; (2) Initial Middle Missouri variant; (3) Extended and Terminal Middle Missouri variants; (4) Initial Coalescent variant; and (5) Extended and Post-Contact Coalescent variants. The latter matrix is further divided into the Extended variant, four post-contact phases (Felicia, Talking Crow, Bad River, Le Beau), and the "Late Arikara" village sites. The late Arikara sites are included in the analysis of the Bad River Phase. Separate intersite seriations, based upon these variants and phases, are the focus of this report. Components assigned to some variants also are segregated by region or locality and are included within their own regional ordinations to partially control for the effects of spatial variation. Several components are included in more than one regional ordination to cross tie each one and to serve as internal checks on the orderings. An additional data matrix, listing a variety of cord-impressed motifs from 31 Post-Contact Coalescent components, also is included in the analysis (Table A.6). This matrix is based upon motif divisions within one descriptive rim sherd category (straight/curved/flared/outcurved/simple rim forms with cord-impressed lips or rim braces) included in the more inclusive intersite analysis. Methodological and other considerations inherent in the use of ceramic types in ordinations are addressed in chapter 3.

The descriptive rim sherd categories employed in this analysis are listed in a hierarchical fashion in Table B.1 by variant or phase as they appear in the data matrices. This table also lists the major corresponding previously defined types included within these descriptive categories. These categories follow the traditional and most widely accepted method for classifying ceramics from the Middle Missouri subarea (Lehmer, 1954a:3; C. Johnson, 1980:2–13). In short, pottery associated with a particular variant or phase is generally assigned to a number of wares based upon rim form. Types within each ware are defined on the presence or absence of decoration, the location of decoration, the techniques used in the decoration process, and the resulting motif or overall pattern. The result is a hierarchy with wares at the top, followed by types based upon decoration, or lack of it, and the decoration location, technique, and motif. The descriptive system used herein recognizes a number of these attributes that had been more fully discussed by C. Johnson (1980:37–42), arranged in a hierarchical system most closely corresponding to the majority of typologies used in the past by Middle Missouri archeologists. Examples included within the resulting categories are illustrated in Appendix B.

The first division in the descriptive system includes two major rim forms: straight/curved/flared/outcurved/simple (abbreviated to straight), and S-shaped/collared/compound (abbreviated to S-shaped). Two additional minor forms, rolled rims and bowls, occur in small or moderate quantities in some Initial Middle Missouri assemblages. The straight and S-shaped rim forms do not take into consideration the orientation of the rim to the plane of the lip (e.g., straight versus outflared) but rather the nature of the curved-rim surface from the vessel neck to the lip. Straight rims are those that have surfaces that do not change direction or have inflection points, as contrasted with S-shaped rims having surfaces that change direction once and sometimes twice, resembling the letter “S” on profile or cross-section (Appendix B). Braced rim forms, used as the defining attribute of Stanley Braced Rim ware (Lehmer, 1951; 1954a; Lehmer and Jones, 1968), is not recognized here but rather included within the straight rim category because of inherent inconsistencies in its definition and difficulties in separating it from closely related types (Baerreis and Dallman, 1961: 439–441). Rolled rims have no rim heights or very low ones and have round and exterior thickened bulbs of clay at their orifices. Bowl-rim or vessel forms are those that have straight or curved vessel walls up to the lip but lack a separate, definable neck or rim.

Rim sherds in each rim form are next divided by the presence or absence of decoration, and whether decoration is present on the lip/lip margins or exterior rim surfaces. No further divisions are made in the rolled or bowl forms, although some typological systems have made additional distinctions. Shoulder decoration is not considered in this system because of the fragmentary nature of the vessels and because it has not been used in the classification systems. Undecorated rim sherds are assigned to separate descriptive categories, whereas decoration technique and motif further subdivide those with lip or exterior-rim decoration. Two exceptions to this procedure deal with S-shaped rims from Extended Coalescent and Extended Middle Missouri variant contexts. These rims lacking exterior-rim decoration, with or without decorated lips, have usually been classified into one, infrequently occurring type.

Rim sherds with straight rims and decorated only on the lip, or on the interior and/or exterior lip margins, are assigned to descriptive categories based upon decoration technique and occasionally by motif as well. There are three major decorative techniques (tool impressing, cord impressing, and finger impressing), all illustrated in Appendix B. The differentiation between tool and finger impressing has, with a few exceptions (Brown 1974:16–17; Steinacher, 1990, table 14), not been made on rim sherds from Initial Middle Missouri, Extended Middle Missouri, and Initial Coalescent contexts. In these cases, tool- and finger-impressed lips on straight rims constitute a single descriptive category. Pinching, a special case of finger impressing, is consistently defined from Extended Middle Missouri assemblages and is maintained in this study. Rim sherds associated with Initial Middle Missouri components having crosshatched and incised lips also are maintained herein as a separate descriptive category. Tool impressions generally consist of short and relatively narrow diagonal or inward oriented incisions or punctates in a variety of motifs made with a bone, chipped stone, shell, or wood tool. Finger impressions are relatively broad decorations applied to the top of the lip or in an alternating pattern on the interior and exterior lip margins, creating a wavy or “pie crust” effect on the lip. Cord impressions consist of single twisted cords applied a number of times in horizontal, vertical, or diagonal motifs on vessel lips. Cord impressions also occur on the exterior rims of many of these straight-rimmed vessels but have not been considered in typological classifications. They are combined with rims with cord impressions only on the lip (or rim brace) into a single cord-impressed category. A few straight rim sherds recovered from Extended Coalescent components have cord impressions only on the rim exteriors and either undecorated lips or lips decorated with another technique. These rim sherds also are combined with the rims having cord-impressed lips because of the overall similarity of the types.

There are a relatively large number of descriptive rim sherd categories within each rim form. These categories are based solely upon exterior rim decoration technique and motif. In cases in which this portion of the vessel is decorated, other areas, such as the lip, also may be decorated but are ignored in the classification process, following the procedures used in previous typologies. The over-riding criterion in these cases is rim decoration. Straight and S-shaped rims share many common exterior rim decoration techniques and motifs. For the purposes of the present analysis, rim sherds of the same rim form (straight or S-shaped) having different decorative techniques are maintained as separate descriptive categories, although they may or may not include rims with similar motifs. These inconsistencies or exceptions, like those previously discussed, are the legacy of ceramic classification in the Middle Missouri subarea. A number of the more common decorative motifs included within the descriptive categories are illustrated in Appendix B.

A variable used in comparisons among ceramic assemblages involves the use of rim sherds versus vessel counts. Determining the minimum number of vessels within a particular provenience unit within a site, such as a house, is crucial in the study of other problems, such as site formation processes or intrasite stylistic variations. It is impossible to determine the degree to which the assemblages being studied were subjected to vessel reconstruction, although it appears that only the most obvious matches were considered during laboratory processing to be single vessels (Steinacher, 1990:120–121; C. Johnson and Toom, 1995:249). A number of ceramic assemblages (Falk and Ahler, 1988:66; Steinacher, 1990:120–121; Johnson and Toom, 1995:249; Falk and Johnson, in prep.; Falk, Johnson, and Richtsmeier, in prep.) were reduced to smaller vessel counts by systematic matching efforts of conjoined and nonconjoined rim sherds. A comparison of type percentages from the large Medicine Crow site (39BF2) assemblage before and after the matching process indicates that there is little difference between the two data sets. It might be anticipated that the smaller a particular assemblage, the greater the differences in type or descriptive category percentages between matched and unmatched collections. If this factor is combined with the probable, but unknown, bias in field selection techniques discussed below, assemblage size must be considered in the ordination process.

Determining the minimum number of vessels at a particular site is a particularly crucial problem when the assemblage consists of highly fragmented rim sherds that are decorated around the vessel circumference by regular recurring motif segments. For example, Great Oasis assemblages have relatively large quantities of rim sherds with horizontally incised or trailed lines encircling the entire vessel upon which are imposed diagonal lines, forming various triangular motifs at regular intervals. Many rim segments that are classified as horizontally incised in this study are probably from areas between these diagonal motifs. The result is to artificially inflate the number of rim sherds assigned to the horizontally incised descriptive category in highly fragmented assemblages, such as the Heath site (39LN15). Another of the many examples involves Post-Contact Coalescent assemblages containing rim sherds decorated only with finger-impressed (pinched) lips. These broad and sometimes shallow impressions often occur at fairly large intervals (4–8 centimeters). This results in the classification of small rim fragments from areas between these impressions into an undecorated category. The author cannot recall any assemblages with a particularly high number of small rim fragments. Because screens were generally not used during excavations (see the discussion below), only the larger rim sherds were recovered.

These two examples illustrate the problems in using ceramic assemblages recovered using a variety of field techniques. In the current report, it is assumed that the effects of unequal fragmentation are random and balanced out for the vast majority of the assemblages. The definition of the descriptive categories also has tried to minimize these “fragmentation effects.” For example, Post-Contact Coalescent assemblages have cord-impressed S-rims with a wide variety of motifs. All of these were combined under a single descriptive category, despite earlier attempts to subdivide them (Hurt, 1957:36–44).

Another factor that may have an effect on the vessel versus rim sherd counts is vessel size. Larger vessels generally have larger orifice circumferences, although this relationship has not been systematically studied for the entire range of variation of constricted-mouth, globular jars most commonly found in Plains Village sites in the Middle Missouri subarea. A study by Rogers and Brewster (1990) of Post-Contact period pots associated with Arikara villages demonstrated a positive curvilinear relationship between orifice diameter and volume. Larger vessels, therefore, are probably more likely to break up into a larger number of rim fragments, with all other factors, such as rim thickness, vessel use, and post-depositional factors, being equal. Vessel size and breakage rates may tend to cancel one another, with larger, thicker vessels less likely to break into more pieces after they are discarded and enter the archeological context than smaller, thinner ones.

The way vessels are used also is related to their breakage rates. A number of ethnoarcheological studies have concluded that large storage vessels are broken less often than those used for cooking or other purposes (see chapter 3). If there is another relationship between vessel size and the decorations applied to the rims, differential breakage rates and the corresponding archeological assemblages might be very different than an "in use" village assemblage. The relative frequencies of vessels of particular styles or types used at any particular time might be very different from the broken vessels left by the same village group in even relatively short periods of time, perhaps on the order of 10 years. In an ideal world, all of the "non-stylistic related" factors, such as vessel size (as measured by orifice diameter or rim thickness), might be controlled in comparisons of style from one village to the next.

Despite the fact that such an analysis is beyond the scope of the present study, data relating to variation in orifice diameter by the descriptive categories used in this study was gathered for a number of sites, presented in Table 4. This means that there is some minor variation, not only among sites but also between descriptive rim sherd categories. In general, S-shaped rims from Lower Grand, Walth Bay, and Larson are larger than their straight-rim counterparts, whereas tool-impressed straight rims are usually larger than the more highly decorated, cord-impressed or incised straight rims. Several reasons for the small size of cord-impressed, straight-rimmed vessels may relate to their use. These vessels have a higher incidence of handles, making them more suitable for carrying and suspending. These activities may require small pots. In addition, some of these vessels may be in-

TABLE 4. Mean orifice diameters (centimeters) by descriptive rim sherd category for six Plains Village components (sample size in parentheses). (IMM =Initial Middle Missouri component, EMM = Extended Middle Missouri component.)

Descriptive rim sherd	Lower Grand	Walth Bay	Larson	Medicine Crow	Cattle Oiler IMM	Cattle Oiler EMM
Coalescent Tradition						
S-shaped/Cord Impressed Rim	18.0(37)	16.3(15)	16.9(72)	—	—	—
S-shaped/Horizontal-Diagonal Rim	18.0(123)	17.3(120)	15.9(56)	—	—	—
S-shaped/Tool-Finger Impressed Rim	19.0(1)	13.8(14)	—	—	—	—
S-shaped/Undecorated	17.4(7)	16.8(4)	16.4(7)	—	—	—
S-shaped/All Categories	—	—	—	15.6(14)	—	—
Subtotal S-shaped rims	18.0(168)	16.9(153)	16.5(135)	15.6(14)	—	—
Straight/Diagonal Incised Rim	—	—	—	10.1(1)	—	—
Straight/Horizontal Incised Rim	14.5(68)	14.2(78)	17.0(32)	12.2(4)	—	—
Straight/Cord Impressed Lip	13.2(13)	10.8(8)	14.2(586)	13.3(39)	—	—
Straight/Tool Impressed Lip	16.0(48)	15.5(73)	16.7(289)	14.7(397)	—	—
Straight/Finger Impressed Lip	21.0(1)	—	17.1(737)	18.8(5)	—	—
Straight/Undecorated	16.2(14)	11.8(19)	16.7(167)	12.5(24)	—	—
Subtotal Straight rims	15.1(144)	14.3(178)	16.1(1811)	14.5(470)	—	—
Total all rims	16.7(312)	15.5(331)	16.1(1946)	14.5(484)	—	—
Middle Missouri Tradition						
S-shaped/Horizontal Cord Impressed Rim	—	—	—	—	17.2(29)	10.1(1)
S-shaped/Triangular Cord Impressed Rim	—	—	—	—	16.0(16)	—
S-shaped/Horizontal Incised Rim	—	—	—	—	18.9(8)	—
S-shaped/Triangular Incised Rim	—	—	—	—	18.0(8)	—
S-shaped/Cross Hatch Incised Rim	—	—	—	—	25.5(2)	—
S-shaped/Undecorated Rim	—	—	—	—	11.0(1)	—
Subtotal S-shaped rims	—	—	—	—	17.4(64)	10.1(1)
Straight/Tool-Finger Impressed Lip	—	—	—	—	19.3(13)	19.7(12)
Straight/Cross-Hatch Incised Lip	—	—	—	—	14.6(13)	—
Straight/Cord Impressed Lip	—	—	—	—	12.0(1)	—
Straight/Undecorated	—	—	—	—	18.5(36)	17.8(12)
Subtotal straight rims	—	—	—	—	17.8(63)	18.8(24)
Rolled Rim	—	—	—	—	14.0(4)	—
Total all rims	—	—	—	—	17.5(131)	18.4(25)

tended for burial, as it is this author's impression that the majority of vessels that accompany burials during the protohistoric period are straight rimmed and cord impressed. Because of lower sample sizes, the intertype variation in Table 4 is less conclusive among the two Middle Missouri components at Cattle Oiler, although these pots are larger than their Coalescent counterparts. Variation in size also is apparent among the four Coalescent villages of Lower Grand, Walth Bay, Larson, and Medicine Crow. The Post-Contact Coalescent assemblage from H.P. Thomas (39ST12) has a comparable overall orifice diameter of 15.8 centimeters (N = 174). A more striking difference in inferred vessel size is apparent when several Extended and Terminal Middle Missouri and Heart River phase villages are compared with those above. Orifice diameters from these former villages include Bendish (32MO11) at 25.8 centimeters (N = 28), Huff at 19.1 centimeters (N = 41), Nailati phase at 22.0 centimeters (N = 184), and Heart River phase at 21.7 centimeters (N = 244) (Wood, 1967:64–69; Thiessen, 1976, table 19; C. Johnson, 1983, table 9.13). The greater sizes of these vessels compared with their Coalescent counterparts may reflect household size or simply the degree of rim flare. It is unclear at this time what the role that overall vessel shape plays in these calculations and if the ratio of orifice and maximum vessel diameters differs between these sites (i.e., wide- versus narrow-mouthed jars). Only examinations of complete or nearly complete vessels (i.e., those for which maximum vessel diameters are known) will resolve this issue.

RADIOCARBON SAMPLES

The selection of samples to be submitted for radiocarbon dating for this study was determined by a number of explicit criteria that maximized the ability to assign absolute time scales to the ordering of components derived from the ceramic ordinations. The selection process is detailed in chapter 5. The intent was to avoid problems of cultural association, laboratory procedures, and single dates in the selection process (Thomas Thiessen, pers. comm., 1992; Toom, 1992a:121–122). It is desirable to obtain many samples of short-lived botanical remains, such as corn, squash, seeds, and ceramic vessel residues, so as to minimize the dating of aged samples, and also to allow for examination of other attributes of these samples (see chapter 5). First, a priority was placed on samples from components that were suspected of falling at either end of the temporal range within each variant and those located at the maximum geographic limits of each taxonomic unit. It was the intent to date those villages in each variant that were suspected of falling at the extreme temporal and geographic limits of these taxonomic units. Ideally, this would allow for the dating of both ends of each regional variant and would tie these into the ceramic ordinations of components so that a relatively accurate temporal sequence of a much larger number of villages could be established. As a rough guide, a list of components assigned to each variant by region (Table 5) was compiled prior to the radiocarbon sample selection process on the basis of previous ceramic ordinations and existing radiocarbon dates.

Second, archeological context is carefully considered in the sample selection process because many villages have long occupational sequences, some being inhabited by Native American village groups of different cultural traditions. To be able to relate the results of the radiocarbon dating to the ceramic sequences requires an ability to associate a particular dated sample with a specific ceramic component assemblage recovered from each site. This problem has sometimes been overlooked in past dating efforts (Thomas Thiessen, pers. comm., 1992; Toom, 1992a:121–122). The sample-selection process focuses on those sites that have a single component. When this is not possible, only samples from contexts that are assigned to a specific component are chosen for dating.

Finally, most samples are selected from components that could be included in the ceramic ordinations. In addition, samples from components that have relatively large ceramic assemblages are chosen instead of those from smaller assemblages. Furthermore, sites that have published or unpublished reports are generally favored instead of unreported ones. This is important because understanding the context of each dated sample is made clearer when a formal site report exists. These three criteria for sample selection were compromised once an examination of available short-lived botanical and ceramic vessel residue specimens proceeded. Some of the ideal village components could not be dated or subjected to multiple dates because datable material was either absent or of insufficient quantity (e.g., Arzberger, Lynch, Black Widow Ridge). At sites with multiple prehistoric and post-contact occupations, most of the botanical remains are associated with the later component. These late villages cannot be reliably dated (i.e., Cheyenne River, Dodd sites). Some multicomponent sites are so badly mixed or poorly understood so as to preclude associating some datable samples with one component or another without an intensive reanalysis of each one (e.g., Crow Creek).

TABLE 5. List of Plains Village tradition components with a potential for radiocarbon dating listed by region, variant, and estimated date based on existing radiocarbon dates and ceramic seriation.

Initial Middle Missouri	Extended Middle Missouri	Initial Coalescent	Extended Coalescent
Big Bend Region			
Early	Unknown Time	Unknown Time	Early
Sommers (ST56)*	Cattle Oiler (ST224)	Medicine Creek (LM2)	Bowers LaRoche (ST232)*
Akichita (BF221)		Useful Heart (LM6)	Overs LaRoche M/E (ST9)
Cattle Oiler E/M (ST224)			Standing Bull (HU214)
Middle		Middle	Middle
King (LM55)		Lynch M/L (25BD1)	Redbird II (25HT2)
Chapelle Creek C&D (HU60)		Crow Creek (BF11)	HU15/HU241/HU223
Langdeau (LM209)*			
Late	Late	Late	Late
Dinehart (LM33)	Durkin (ST238)	Arzberger (HU6)*	Spain (LM301)
Jandreau E/L (LM225)			Stricker B (LM1)
Jiggs Thompson (LM208)*			McClure (HU7)
Pretty Head L/M (LM232)			Scalp Creek (GR1)
Crow Creek M/L (BF11)			39BR201
HU204/LM47/LM201/LM31			
Bad-Cheyenne Region			
Early	Early		Early
Breeden A (ST16)*	Cheyenne River (ST1)		No Heart Creek (AR2)
Dodd E/L (ST30)	Thomas Riggs L/E (HU1)		Black Widow (ST3)
			Cheyenne River (ST1)
			SL24/SL8/SL7/ST10
			Middle
			Sully (SL4)
			SL23
	Late		Late
	McKensey (AR201)*		Sully (SL4)
	Indian Creek (ST15)		Gettysburg (PO209)
			ST45/SL2
	Unknown		
	Black Widow Ridge (ST203)		
Grand-Moreau Region			
	Early		Early
	Travis I (CO213)		Lower Grand (CO14)
			Potts (CO19)
			Molstad M/E (DW234)
			DW230/DW217/DW254
	Unknown Time		
	Calamity Village (DW231)		
			Middle
			Walth Bay (WW203)*
			WW10/WW302
			Late
			Hosterman (PO7)
			WW7/WW300/WW301
Cannonball Region			
	Early		
	Helb (CA208)*		
	Jake White Bull (CO6)*		
	Paul Brave E/M (SI4)		
	Middle		Middle
	Bendish (MO2)*		Demery (CO1)*
	Havens (EM1)*		
	Ben Standing Soldier L/M (SI7)		

South Cannonball (SI19)*
Fire Heart Creek (SI2)*
Tony Glas (EM3)
Late
(Terminal
Middle Missouri)
Huff (MO11)*
Shermer (EM10)

* Denotes agreement of ^{14}C and ceramic seriation dates.

E/M, M/L, E/L, M/E, L/M, L/E denote disagreement between ^{14}C and seriation dates. First letter designates radiocarbon date, last letter seriation date. E = Early, M = Middle, L = Late.

Components are listed by group according to priority. The ones at the top of each group have the largest sample sizes, are single component sites and/or have been reported.

The following sites, in the Knife-Heart and Garrison regions, are not included in this list: closely related Lower Loup sites in Nebraska; Over focus sites in southeastern South Dakota; Mill Creek sites in northwestern Iowa; the Cambria phase sites in southwestern Minnesota;, Great Oasis sites in southwestern Minnesota, northwestern Iowa, and northeastern Nebraska; and select Central Plains tradition sites in Nebraska. Sites separated by slashes (/) contain small ceramic samples.

FIELD SAMPLING STRATEGIES

Because most of the ceramic assemblages and datable material employed in this study were collected during the 1950s and 1960s, a brief discussion of field collecting strategies is in order. The major focus of most of the past research in the Middle Missouri subarea was on developing culture-historical chronologies and taxonomies (Wood, 1969). Ceramic variation and differences in house form were identified early on as key components in these efforts during the salvage period in Middle Missouri archeology (see Lehmer, 1954a:118–159). The work of Donald Lehmer and other pioneering archeologists, such as Carlyle Smith and Wesley Hurt, emphasized the primacy of ceramic and architectural variability instead of other data in their culture-historical reconstructions, and shaped the way archeologists excavated and interpreted sites for the next generation. At the time, this perspective appeared to answer all the relevant questions of the currently accepted theoretical framework. The emphasis on architecture resulted in the excavation of houses, with little or no work accomplished in other site areas. This point is particularly important for the present study, because a number of extramural contexts, such as midden deposits, can provide useful stratigraphic information crucial in the study of ceramic change without many of the post-depositional disturbances associated with activities, such as house construction on top of older cultural deposits. The utility of a small number of test excavations strategically placed within stratified deposits to develop site chronologies is demonstrated by work at the Knife River Indian Villages National Historic Site (Ahler, 1993c:73–76).

The emphasis on architecture and ceramics meant that screening of site matrix was not particularly important in the recovery of the data in question, especially considering the voluminous amounts of large pieces of pottery recovered at Plains Village sites. Excavation techniques involved shovel skimming of general site matrix and troweling features. A popularized version of these techniques appeared in Deetz (1971:57) and was evaluated by Ahler, Falk et al. (1995:30–33). Certainly, the burden of salvaging information from hundreds of sites containing large quantities of cultural materials with limited funding led to excavation techniques that would generally not be used today or in areas at the time when cultural materials were not so abundant (see Lehmer, 1971:14). There are only a few instances known to the author in which screens were employed (Kivett and Jensen, 1976:20; Owsley et al., 1977, fig. 1; Ahler, Falk et al., 1995:30), and these occurred in unique situations. The result of these field techniques was that large quantities of small chipped stone, ceramic, and bone artifacts were not recovered, in addition to botanical remains, trade artifacts, and unmodified vertebrate remains. Shortly after the Interagency Archeological Salvage Program was terminated in 1969, systematic screening was added to the repertoire of field recovery techniques in the Middle Missouri (Lehmer et al., 1978:149; Falk and Ahler, 1988:26; Ahler et al., 1991:108). In those instances in which 1/4 inch hardware cloth and 1/16 inch window screen was used, enormous and sometimes overwhelming quantities of cultural material were recovered, creating their own massive problems of sorting, processing, and data recordation. Occasionally, even small seeds were recovered using these techniques (Haberman, 1984:273). These changes in field procedures were designed to answer questions that went beyond the traditional concerns of tribal identity, taxonomic assignment, and cultural chronology, focusing on new approaches to describing and analyzing cultural materials. The Walth Bay (39WW203), Lower Grand (39CO14), and Helb (39CA208) sites served as a springboard for examining lithic raw material procurement (Ahler, 1977b), a systematic approach to stone tool function (Ahler, 1975b), and the use of unmodified vertebrate fauna to study climatic change and subsistence-settlement patterns (Falk, 1977; Semken and Falk, 1987, 1991).

At this time, it is impossible to determine how these varying field methods affected the ceramic data used in this study. There is no question that the lack of systematic screening resulted in the loss of many, if not most, artifacts from the sites. A comparison of the estimated yield of vessels greater than 0.5 inch recovered from the screened matrix of house 12 excavated during 1969 at the Lower Grand site, 0.55 vessels/square foot (2,273 vessels/4,150 square feet excavated), and all vessels from a typical unscreened SI-RBS excavation at the Medicine Crow site, 0.20 vessels/square foot (2,306 vessels/11,351 square feet excavated from 14 houses), indicates a considerable loss of data. From these figures, the average yield of ceramic vessels/house at Medicine Crow is 165, a figure much lower than the 2273 vessels recovered from house 12 at Lower Grand. It seems that on an intuitive level there would not be a systematic field selection of rim sherds assigned to a particular type or descriptive category instead of other ones, particularly when large assemblages are considered. Field selection might result in a bias in favor of one or more ceramic categories in smaller assemblages. This situation also might apply to surface or beach samples, although this does not appear to be the case with Marion Travis' collections (Ahler, 1977a:58, 62).

A comparison of smaller items, such as chipped-stone arrow points, could not be performed on these same sites, although data is available from the two separate excavation programs at the Lower Grand site (Falk and Ahler, 1988, table F.1). These are the 1962–1964 excavations by Alfred Bowers and the 1969 excavations by the University of Missouri. The earlier excavations appear to be unscreened, whereas artifacts from the latter fieldwork were recovered, using 0.25 inch and finer hardware cloth. A total of 228 arrow points were recovered from Bowers' excavations, consisting of 3.5 houses and another area equivalent in size to a house. This contrasts to a total of 1260 complete or partial points recovered from house 12 in 1969 (Stanley Ahler, pers. comm., 1993). Although precise figures cannot be calculated, it is apparent that smaller artifacts, such as projectile points, are under-represented to an even greater degree than ceramics, perhaps by a magnitude of about 20 times. Even smaller artifacts, such as trade materials (glass beads, small pieces of brass, copper, or iron) found in protohistoric contexts, are probably even more underrepresented in extant collections because of field sampling methods. A casual inspection of the number of glass beads recovered from the recent excavations at the Knife River Indian Villages National Historic Site (Ahler and Dreybred, 1993) and any Post-Contact period assemblage from non-screened excavations anywhere in the subarea illustrates this point. Finally, unscreened excavations tended to be highly selective in favor of patterned tools (C. Johnson, 1995: 267).

5

Radiocarbon Dating Results

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REVIEW OF CRITERIA FOR SAMPLE SELECTION

As a prelude to the presentation of the radiocarbon dating program results, it is worthwhile to briefly review the criteria already discussed in chapter 4 that guided site and sample selection. Because funds for radiocarbon analysis conducted as part of this program were limited, a strategic sampling and site selection process was followed in which some sites and components were given priority over others. Several general and specific criteria served to guide the selection process. These are ideal parameters, and in some cases they were changed. These modifications are explained in the discussion of specific samples and components subjected to dating.

1. Site selection focused on dating Plains Village sites and collections housed in the National Museum of Natural History (NMNH). This provided maximum information regarding sites subject to actions under the Smithsonian Institution Repatriation Program, which meant that the sites under consideration were primarily in South Dakota.

2. Sites chosen for dating were only those from which an analyzable ceramic sample also exists (generally n>50 rim sherds). This allowed maximum integration of the radiocarbon dating results with the ceramic ordination and seriation aspect of the Plains Village chronology program. Because far more components were included in the ceramic analysis than in the radiocarbon study, the radiocarbon sample selection was seen as a precision tool to be used with great selection and as a critical adjunct to the ceramic ordination program.

3. Site selection considered key components in the Cannonball region in North Dakota, but did not focus on the Heart and Knife region sites in North Dakota. Few Heart region sites have been investigated, and the chronology for sites in the Knife region is reasonably well developed through the focused chronometric and research program centered at the Knife River Indian Villages National Historic Site at the mouth of the Knife River (Ahler and Haas, 1993). The project's limited resources were best utilized by concentrating on the large series of sites and samples in the less well-dated regions of South Dakota.

4. In the interest of thoroughness, intended to complement the scope of the ceramic analysis program, priority in radiocarbon sample selection is given to

components that (1) lie near the limits of the known geographic range for a given cultural variant (e.g., Extended Middle Missouri, Initial Coalescent), and (2) are thought to lie near the respective early and late temporal extremes previously assigned to a given variant based upon all previous information and preliminary ceramic seriation results. Thus, defined variants are accepted as a midlevel organizational unit useful for both the ceramic and radiocarbon analyses. The focus is on refining the chronological limits of each unit and the potential interactions among spatially proximate components of various units. By taking all of these things into account, a list presented in Table 6 was developed as a working set of sites considered for radiocarbon sample selection. Several additional site-specific and sample-specific factors were considered:

5. In general and if available, multiple samples were run from each dated site, thereby providing internal checks on date reliability.

6. Additional attention was given to dating at a small number of sites that were qualitatively superlative in terms of the type of overall archaeological information available for further study. These included four village sites that were subjected to excavations of various scale with fine-screen artifact recovery: (1) Lower Grand (39CO14) (Falk and Ahler, 1988); (2) Walth Bay (39WW203) (Falk and Ahler, 1988); (3) Helb (39CA208) (Falk and Calabrese, 1973, Falk and Ahler, 1988); and (4) Jake White Bull (39CO6) (Ahler, 1977a). Each of these villages was subjected to previous dating programs. Additional dating allowed a check on the validity and reliability of existing date series considered acceptable (Lower Grand and Walth Bay), as well as existing radiocarbon date series that were internally inconsistent and badly in need of more complete reevaluation (Helb and Jake White Bull). Several samples were dated from each site to provide a large enough set for comparison with previously run dates.

7. Sample selection focused on short-lived organic materials, such as carbonized seeds, corn, and other food plants, grasses, and twigs and small diameter branches that occur occasionally in burned house roof-fall debris. Potentially aged material, such as wood in large posts, were completely eliminated, and charcoal potentially from interior rings in large trees was avoided if possible, in order to minimize problems with dating materials whose age is not closely tied with the time of cultural use of the dated material.

8. Relatively routine, as well as somewhat experimental AMS techniques were applied to date previously unstudied samples of very small size. This included relatively routine AMS dating of seeds and vegetal remains in good cultural association (preferably cultigens or charred wild plant food remains) and somewhat more exploratory AMS dating of carbonized organic residues adhering to pot sherds. Charred residues occurred in abundance on freshly excavated potsherds, and such residues were considered to be a potentially untapped source of firmly associated cultural material residing in the available museum collections.

9. Whenever possible, a single lab was used for radiocarbon analyses in order to reduce sources of error introduced by interlab variability.

Ahler's explicit role in the project was to provide recommendations for laboratories to conduct the dating, to be directly involved in sample selection and transmittal, and to assist in evaluation of results. Ahler's unequivocal first choice of labs for conventional radiocarbon dating was the facility run by Herbert Haas at Southern Methodist University (SMU). This choice was based upon the excellent consistency and reliability of conventional dating provided by Haas in the past, as was particularly evident in the results of the radiocarbon dating program conducted for the Knife River Indian Villages NHS project (Ahler and Haas, 1993). This choice also was based upon Haas' attention to detail, particularly in the domain of sample pretreatment, which previous work had demonstrated to be a critical step in achieving good radiocarbon-dating results.

MECHANICS OF SAMPLE SELECTION AND PROCESSING

After some discussion between Ahler and Haas, Haas agreed, despite a heavy workload, to take on the conventional dating aspects of the program at his SMU lab. After further discussion Haas agreed to carry out all pretreatment for AMS samples, with all AMS work to be done under the direction of George Bonani at ETH-Hönggerberg in Zurich, Switzerland, with Haas serving as coordinator for all AMS work done at the ETH lab under the Plains Village dating (PVD) project.

A multi-step approach was taken for the sample selection and dating process: (1) Johnson and Ahler made general sample selections based upon availability of materials and the sample and site criteria listed above; (2) Ahler examined more closely actual material remains available for dating and prepared both conventional and AMS sample materials, transmitting them to Haas; (3) Haas conducted all conventional radiocarbon work at the SMU lab; (4) Haas removed carbonized residues identified by Ahler from potsherds and conducted all pretreatment of all

TABLE 6. Intermediate working list of sites and components to be dated prior to the start of sample selection, February 1992. Status of datable materials column added after inspection of collections. (Collection location abbreviations: SDARC=South Dakota Archaeological Research Center, Rapid City; NMHN= National Museum of Natural History, Washington, D.C.; NSHS=Nebraska State Historical Society, Lincoln; MWAC=Midwest Archeological Center, NPS, Lincoln; UND=University of North Dakota, Grand Forks; UNL=University of Nebraska, Lincoln; SHSND=State Historical Society of North Dakota, Bismarck.)

Variant and relative place in variant	Site name	Site number	Collection location	Status of datable material
Initial Middle Missouri				
Early	*Jandreau	39LM225	SDARC	None exist
Early	*Sommers	39ST56	NMNH	No addtional samples known
Early	Swanson	39BR16	SDARC	None located
?	*Cattle Oiler	39ST224	NSHS	Unknown
Late	*Pretty Head B	39LM232	NMNH	None exist
?	*Dodd	39ST30	NMNH	No samples exist
Middle	*Fay Tolton	39ST11	SDARC	Unknown
Early	Jones Village	39CA3	SDARC	Abundant conventional exist
Extended Middle Missouri				
Early?	*Cattle Oiler	39ST224	NSHS	Unknown
Early?	Thomas Riggs	39HU1	SDARC	None located
?	*Cheyenne River	39ST1	NMNH	None exist
Late	McKensey	39AR201	NMNH	Unknown
?	*Calamity Village	39DW231	NMNH	Unknown
Early	Paul Brave	32SI4	SHSND	Several conventional exist
Early	*Helb	39CA208	MWAC	Abundant AMS/conventional exist
Early	*Jake White Bull	39CO6	UND	AMS samples exist
Late?	*Havens	32EM1	SHSND	Several AMS/conventional exist
Terminal Middle Missouri				
?	*Shermer	32EM10	SHSND	Several AMS samples exist
Initial Coalescent				
Early	Black Partizan B	39LM218	NMNH	Unknown-mixed components
Late	*Arzberger	39HU6	SDARC	No samples exist
?	*Lynch	25BD1	UNL	None exist
?	Useful Heart	39LM6	NMNH	Unknown-not examined
Extended Coalescent				
Early	*Over's La Roche	39ST9	NMNH	Unknown
Late	Scalp Creek	39GR7	SDARC	None located-mixed components
Late	McClure	39HU7	NMNH	Unknown-not examined
Mid/Late	*Sully	39SL4	NMNH	None exist
Early	*Lower Grand	39CO14	MWAC	Abundant AMS/conventional exist
?	*Potts	39CO19	NMNH	None exist
Middle	*Walth Bay	39WW203	MWAC	Abundant AMS/conventional exist
Late	*Hosterman	39PO7	NMNH	Abundant maize-quality doubtful
Late?	*Demery	39CO1	SHSND	One AMS/one conventional exist
Unkown				
Late	Hintz	32SN3	NMNH	Potential AMS exists

* = Sites actually selected for dating.

AMS samples (sherd residue and otherwise), forwarding pretreated materials to Georges Bonani; (5) Bonani conducted all AMS dating in the ETH-Hoenggerberg lab, forwarding all AMS results to Haas; and (6) Haas reported all conventional and AMS results to Ahler for wider project dissemination.

Initially, it was estimated that available funds and anticipated sample availability would allow for dating approximately 18 conventional samples and 23 AMS samples. Several additional samples were added to the program when we were informed by the Omaha District of the U.S. Army Corps of Engineers (USACOE) that additional financial support was available for dating samples from archaeological collections belonging to the Corps (specifically, samples from the Lower Grand, Walth Bay, Helb, and Jake White Bull site collections). The USACOE did not maintain this commitment, and the necessary financial support was provided by the Department of Anthropology at the University of North Dakota-Grand Forks (Ahler's home institution at the time). As it turned out, the actual selection of samples and the choice between conventional and AMS dating was determined not only by funding constraints but in equal measure by the availability of dateable sample materials from key sites.

By the end of the program sponsored by the Smithsonian Institution, 15 conventional samples were dated at the SMU lab and 42 samples were submitted for AMS dating. As the samples were prepared and submitted by Ahler to Haas, they were assigned sequential sample numbers for tracking purposes: PVD-1 through PVD-57 (PVD = Plains Village Dating). Because of complications stemming from Southern Methodist University's decision, midway through this project, to cease operation of Herbert Haas' radiocarbon operation, 38 rather than 42 AMS samples were actually dated at the ETH lab. In the end, 54 dates were produced on 53 samples in the original PVD series (PVD-1 through PVD-14, PVD-16 through PVD-53, with PVD-37 dated twice, and PVD-56). The sample selection process conducted specifically for the Smithsonian started early in 1992, with the last dates from this group of 57 (PVD 1-PVD 57) samples reported by the labs in February 1994. Table C.1 in Appendix C provides an inventory of information about all 57 prepared and submitted samples.

Ahler and Johnson maintained a continuing interest in developing a more complete chronology for Plains Village sites in the Dakotas, and wished to resolve certain gaps and problems in the date series available in 1994. Consequently, 19 dates were run in 1997 after the completion of the Plains Village Dating program, as reported by C. Johnson (1996) to the Smithsonian. These dates also are listed in Table C.1, Appendix C (PVD-58 through PVD-76), and are discussed here as having been developed under the PVD program. This continued dating work was supported by funding from the Department of Anthropology, University of North Dakota, Grand Forks. Additional dates were run for the Jake White Bull (39CO6), Jones Village (39CA3), Vanderbilt Village (39CA1), Shermer (32EM10), Paul Brave (32SI4), and Huff (32MO11) sites, all assigned to the Middle Missouri tradition. The continuing work was managed in the same fashion as the early part of the program. Herbert Haas conducted all conventional dating at his lab, now relocated at the Desert Research Institute in Las Vegas, Nevada (these conventional dates bear DRI lab numbers in Table C.1). Herbert conducted pretreatment of all AMS samples, with accelerator dates again produced by Georges Bonani at the ETH-Hönggerberg facility in Zurich.

Table C.1 is organized by recognized cultural variant according to Lehmer's (1971) taxonomic system. For each sample listed, the following information is given: (1) recognized cultural variant; (2) site name and number; (3) PVD number assigned to the sample; (4) institutional source of the material selected for dating; (5) field or lab catalog number(s) previously attached to the specific specimen or material used as a sample; (6) within-site provenience of the sample material; (7) material submitted for dating (e.g., charred wood, maize, charred residue); (8) more detailed information about the size of the sample and how it was selected, derived, or prepared; and (9) a brief note about why that sample or component was selected for dating.

We conclude with a few words about sample availability and some of the sites targeted for study but left undated. Based upon firsthand observations of abundant charred residues on recently excavated village pottery samples, Ahler and Johnson entered the project with the anticipation that carbonized residues on sherds would likely be the panacea for AMS radiocarbon dating of Plains Village museum collections. It was expected that residue-bearing sherds would be abundant in the old collections under consideration. With surprise and disappointment we learned that the actual availability and quality of residue-bearing sherds was very low, mostly because of the intensive scrubbing and cleaning processes that the pottery collections of this era had been subjected to. It was clear that almost all rim sherds had been routinely and intensively cleaned to enhance examination of decorative details and for illustration. In addition, some sherds were subjected to acid baths to remove carbonate deposits (Jake Hoffman, pers. comm., 1992). The few sherds that did retain residues usually had very thin, low quality deposits tightly adhering to one sherd surface. In such circumstances it was difficult to remove enough material for dating without danger of removing some of the clay matrix, as well. Most of the suitable residue deposits occurred as small remnants imbedded in decorative indentions or incisions on rim sherds, apparently small, deeply seated bodies that had accidentally escaped the intensive sherd scrubbing process.

A few site collections contained additional short-lived, AMS-datable, botanical remains in some abundance, whereas others contained nothing suitable for further radiocarbon analysis. Among the former group are Lower Grand, Walth Bay, Helb, and Jake White Bull that during excavation were all subjected to fine-screen field recovery procedures that retrieved abundant charred food remains and other datable materials. Among the latter are several SI-RBS era collections that contain little more than cleanly scrubbed sherds and occasional remnants of house posts. Table 6 also presents a listing of all site collections carefully examined or considered in the present sample selection process, giving a brief note on the suitability of the collection for further radiocarbon dating using presently available techniques. It is noted that the AMS samples submitted in this study generally consisted of a fraction of available charred seeds or maize cob and cupule fragments. In almost all cases, an equal or greater amount of AMS-datable material was retained for future study. Such was not the case for AMS sherd residue samples; virtually all available residue was removed from the sample sherds for study. Backup charred seed/cupule/cob samples can generally be assumed to exist for all dated samples listed in Table C.1; such backups are not noted in Table 6.

EVALUATION OF RESULTS OF THE RADIOCARBON DATING PROGRAM

Table C.1 presents a reference to the radiocarbon laboratory number (date number) assigned to the 74 dates that were run on the 72 samples and the conventional radiocarbon age reported by the lab (corrected for ^{13}C carbon isotope fractionation). Table 7 presents more complete information on the radiocarbon dating results, with site and site samples listed in the same order as in Table C.1. Table C.2 lists all dates, PVD or non-PVD, considered in this report (PVD dates are in bold). It also presents the carbon isotopic fractionation value or ^{13}C value reported for each sample. The chi-squared test as provided in the CALIB 3.0.3 program (Stuiver and Reimer, 1993) was used to test for sample contemporaneity among two or more samples from a single site or component, prior to calendrical calibration of radiocarbon ages. The default value for this test in CALIB is at the 0.05 level of significance and this was accepted as the standard for this study. In general, after applying the test for sample contemporaneity, a weighted mean date was developed for dates thought to be from the same population within each site or component, followed by a calendar age calibration of all averaged PVD dates or individual date (if only one was run from a site) using the decadal tree-ring data set (data set 2) curve as provided in the program CALIB 3.0.3 (Stuiver and Reimer, 1993). Single or multiple calendar age cross points or intercepts and one and two sigma calendar probability age ranges are provided in Table 7 as generated from the CALIB 3.0.3 program (Method B).

To more fully utilize and interpret the results of the present dating program, it was necessary to relate the current dating results to existing dates and date series from several of the previously dated sites. In general, the end goal is to compute, when possible, a mean for all dates considered to be reliable and valid from a particular site, and to use this mean value (if more than a single date is involved) in the interpretation of ceramic ordination studies. Because of the complexity of the decision making processes used in determining what are considered to be reliable means in some cases, it is best to proceed from this point forward with a fairly detailed discussion of the dating results and the critical evaluation of those results on a site-by-site basis. This discussion is best prefaced by making clear some assumptions and sources of information used in the evaluation of all existing dates and date series from individual sites. Several elements are particularly pertinent:

1. The construction and settlement of an earthlodge village is perceived as a planned and organized community event, requiring the combined efforts of a relatively large workforce to cut and move substantial amounts of timber and to construct houses (Wilson, 1934). It is highly likely, judging from the planned nature of most villages, that the typical village was constructed during a relatively short period (perhaps a few weeks or less) and was occupied relatively quickly by a substantial, aggregated population. When the village was abandoned, it is likely that most of the village was evacuated in a single event, and that the majority of inhabitants moved simultaneously to construct a new village at a new location. It is therefore assumed that most or all lodges within a typical village were constructed and abandoned in a synchronous manner, and are essentially contemporaneous from a radiocarbon dating point of view. There are exceptions to this, as when villages were continuously occupied during longer

TABLE 7. Radiocarbon dates from Plains Village sites, Smithsonian Institution Repatriation Office Plains Village dating program (corrections are based on CALIB 3.0.3 in Stuiver and Reamer 1993, decadal tree-ring dataset, calculation method B - probabilities).

Variant and site	PVD no.	Lab number	Age (RCYBP)	Calibration curve intercepts (A.D.)	Dates (A.D.) and relative areas under probability distribution 68.5%	P	95.4%	P
INITIAL MIDDLE MISSOURI								
Jones Village (39CA3)	71	DRI-3115	891 ± 45	1160,1173,1188	1049–1089	.29	1031–1144	.49
					1120–1139	.14	1146–1224	.45
					1151–1214	.57	1229–1244	.03
							1246–1257	.03
	72	ETH-16074	915 ± 65	1073,1077,1135,1155	1035–1101	.46	1003–1008	.01
					1113–1142	.20	1019–1225	.93
					1148–1164	.11	1225–1258	.06
					1166–1194	.18		
					1198–1207	.05		
	73	ETH-16075	945 ± 65	1042,1091,1118,1140,1150	1024–1159	.99	989–1222	.99
					1183–1185	.01	1234–1237	.00
	74	ETH-16076	980 ± 65	1027	1000–1013	.09	900–917	.02
					1016–1071	.41	997–1216	.98
					1080–1127	.35		
					1136–1154	.14		
	75	DRI-3116	881 ± 37	1163,1169,1191,1203–1205	1066–1086	.16	1036–1100	.24
					1122–1138	.12	1114–1142	.12
					1152–1218	.72	1148–1259	.64
	76	DRI-3117	898 ± 30	1159,1182,1185	1065–1087	.22	1034–1142	.52
					1122–1138	.16	1147–1217	.48
					1152–1209	.62		
Jiggs Thompson B (39LM208)	40	ETH-11041	770 ± 60	1265,1266,1277	1215–1290	1.00	1073–1077	.00
					1128–1135	.01	1154–1326	.95
							1352–1361	.01
							1366–1389	.04
Jandreau (39LM225)	51	ETH-11050	1015 ± 55	1020	983–1055	.66	897–921	.05
					1089–1121	.23	943–1160	.93
					1139–1151	.10	1173–1188	.02
Pretty Head B (39LM232)	33	SMU-2734	1002 ± 42	1022	994–1043	.60	903–909	.01
					1090–1119	.28	981–1158	.99
					1139–1151	.12	1181–1185	.00
Fay Tolton (39ST11)	13	ETH-10113	865 ± 60	1209	1068–1084	.11	1035–1142	.36
					1124–1137	.08	1148–1265	.61
					1153–1259	.81	1266–1277	.03
Sommers (39ST56)	34	SMU-2736	972 ± 73	1030,1144,1146	1001–1011	.05	899–919	.02

					1017–1156	.95	962–967	.00
							976–1223	.96
							1231–1242	.01
							1247–1257	.01
	35	ETH-11037	940 ± 60	1044,1089,1120,1139,1151	1027–1158	1.00	995–1220	1.00
							1254–1255	.00
	36	ETH-10418	1085 ± 60	984	893–927	.30	780–791	.02
					939–1020	.70	802–1040	.95
							1093–1118	.02
							1149–1150	.01
	37	ETH-10419	835 ± 60	1216	1159–1183	.19	1036–1097	.14
					1185–1265	.75	1115–1142	.07
					1267–1277	.06	1148–1288	.80
	37	ETH-11038	1065 ± 60	993	895–925	.24	982–788	.01
					940–1027	.76	809–824	.01
							826–844	.02
							866–1068	.87
							1085–1125	.07
							1137–1153	.03
Cattle Oiler (39ST224)	39	ETH-11040	690 ± 60	1292	1279–1327	.60	1223–1231	.02
					1351–1363	.11	1238–1250	.02
					1366–1390	.29	1256–1407	.96
Extended Middle Missouri								
Havens (32EM1)	48	ETH-11047	560 ± 55	1408	1325–1353	.36	1300–1375	.50
					1360–1367	.08	1376–1439	.50
					1388–1431	.56		
	49	ETH-11048	615 ± 55	1327,1350,1390	1303–1333	.37	1288–1418	1.00
					1339–1372	.42		
					1382–1399	.20		
Paul Brave (32SI4)	61	DRI-3206	755 ± 63	1280	1214–1297	1.00	1157–1329	.90
							1347–1392	.10
	62	DRI-3207	783 ± 47	1262	1221–1253	.52	1159–1180	.04
					1256–1281	.48	1186–1297	.96
	63	DRI-3208	674 ± 62	1296	1284–1327	.54	1225–1227	.00
					1351–1390	.46	1243–1246	.00
							1257–1413	.99
Vanderbilt Village (39CA1)	64	DRI-3113	673 ± 44	1296	1286–1325	.61	1265–1266	.00
					1354–1358	.06	1277–1334	.52
					1368–1388	.33	1338–1404	.48
	65	ETH-16069	745 ± 65	1281	1215–1302	.96	1159–1183	.03
					1373–1380	.04	1185–1331	.83
							1344–1394	.14
	66	ETH-16070	750 ± 65	1281	1213–1301	.98	1157–1331	.88
					1374–1378	.02	1345–1394	.12

(*continued*)

TABLE 7. (*continued*)

Variant and site	PVD no.	Lab number	Age (RCYBP)	Calibration curve intercepts (A.D.)	Dates (A.D.) and relative areas under probability distribution: 68.5%	P	95.4%	P
EXTENDED MIDDLE MISSOURI (*continued*)								
Helb (39CA208)	42	ETH-11043	515 ± 55	1423	1331–1345	.16	1303–1372	.25
					1394–1444	.84	1383–1488	.75
	43	ETH-11044	600 ± 55	1330,1346,1343	1305–1308	.04	1292–1425	1.00
					1316–1371	.68		
					1386–1408	.28		
Jake White Bull (39C06)	1	SMU-2663	747 ± 64	1281	1215–1301	.98	1159–1183	.03
					1374–1378	.02	1185–1330	.84
							1345–1394	.13
	2	ETH-10109	720 ± 60	1286	1247–1309	.76	1211–1332	.75
					1356–1383	.24	1341–1399	.25
	3	ETH-9238	975 ± 75	1029,1145,1145	1000–1013	.07	898–920	.02
					1016–1075	.39	944–952	.01
					1075–1155	.54	957–971	.01
							976–1222	.95
							1233–1239	.01
							1250–1256	.01
	58	DRI-3204	770 ± 41	1265, 1266, 1277	1222–1233	.16	1164–1167	.00
					1238–1250	.19	1193–1201	.01
					1256–1285	.64	1206–1298	.98
Calamity Village (39DW231)	4	ETH-10110	795 ± 60	1260	1164–1166	.01	1045–1046	.00
					1194–1197	.01	1047–1089	.04
					1207–1287	.98	1119–1139	.02
							1151–1302	.93
							1373–1380	.01
	5	ETH-10111	665 ± 60	1298	1287–1327	.51	1262–1411	1.00
					1350–1390	.49		
Sully School (39SL7)	52	ETH-11051	775 ± 55	1264,1270,1276	1219–1285	1.00	1075–1975	.00
							1158–1320	.98
							1370–1387	.02
	53	ETH-11052	795 ± 55	1260	1211–1283	1.00	1066–1086	.02
							1121–1138	.02
							1152–1301	.96
							1374–1376	.00
Cheyenne River (39ST1)	17	ETH-10413	675 ± 50	1295	1285–1326	.59	1264–1271	.02
					1353–1360	.08	1276–1334	.50
					1367–1388	.32	1336–1405	.48

Black Widow Ridge (39ST203)	56	ETH-11053	555 ± 55	1409	1326–1352	.34	1300–1375	.48
					1362–1366	.05	1376–1441	.52
					1389–1433	.61		
TERMINAL MIDDLE MISSOURI								
Shermer (32EM10)	46	ETH-11045	620 ± 55	1326,1352,1363,1366,1389	1301–1333	.38	1287–1416	1.00
					1341–1374	.41		
					1378–1396	.20		
	47	ETH–11046	785 ± 55	1262	1215–1284	1.00	1070–1081	.01
							1124–1136	.01
							1153–1304	.97
							1372–1383	.01
	59	DRI–3205	518 ± 51	1421	1332–1342	.12	1306–1309	.01
					1395–1442	.88	1314–1371	.23
							1385–1484	.76
	60	ETH–16394	435 ± 45	1444	1427–1494	.93	1413–1524	.81
					1603–1613	.07	1564–1575	.02
							1575–1627	.17
	60R	ETH-17511	660 ± 50	1299	1290–1326	.51	1280–1407	1.00
					1352–1363	.14		
					1366–1389	.35		
Huff (32M011)	67	DRI-3114	598 ± 39	1330, 1346, 1393	1320–1369	.70	1297–1415	1.00
					1387–1408	.30		
	68	ETH–16071	660 ± 60	1299	1289–1328	.49	1263–1273	.02
					1350–1391	.51	1275–1412	.98
	69	ETH–16072	730 ± 65	1284	1221–1253	.23	1163–1168	.01
					1256–1305	.60	1192–1203	.01
					1310–1316	.04	1206–1333	.77
					1371–1385	.12	1339–1402	.21
	70	ETH–16073	490 ± 60	1433	1333–1339	.04	1306–1310	.00
					1399–1455	.76	1314–1371	.13
					1455–1481	.20	1385–1522	.81
							1582–1625	.06
INITIAL COALESCENT								
Lynch (25BD1)	50	ETH-11049	780 ± 55	1263,1273,1275	1217–1284	1.00	1072–1078	.00
							1125–1136	.01
							1154–1305	.97
							1312–1316	.00
							1371–1385	.01
Arzberger (39HU6)	14	ETH-10114	440 ± 55	1443	1419–1497	.87	1408–1531	.76
					1514–1515	.01	1551–1634	.24
					1600–1617	.12		
	41	ETH-11042	340 ± 60	1523,1565,1578,1627	1494–1603	.81	1442–1660	1.00
					1612–1638	.19		

(continued)

TABLE 7. (*continued*)

Variant and site	PVD no.	Lab number	Age (RCYBP)	Calibration curve intercepts (A.D.)	Dates (A.D.) and relative areas under probability distribution: 68.5%	P	95.4%	P
EXTENDED COALESCENT								
Demery (39CO1)	44	SMU-2800	509 ± 47	1426	1334–1339	.06	1323–1354	.14
					1400–1444	.94	1357–1368	.02
							1388–1477	.85
	45	SMU-2789	583 ± 58	1333,1339,1400	1316–1370	.64	1295–1432	1.00
					1386–1415	.36		
Lower Grand (39CO14)	10	SMU-2689	395 ± 57	1483	1442–1522	.67	1435–1639	1.00
					1582–1625	.33		
	11	SMU-2725	326 ± 66	1529,1556,1632	1494–1603	.77	1440–1672	.97
					1613–1647	.23	1781–1799	.02
							1945–1953	.01
	12	ETH-10112	470 ± 55	1437	1410–1486	1.00	1329–1348	.04
							1392–1524	.86
							1564–1573	.01
							1575–1627	.10
	16	ETH-10412	280 ± 55	1648	1519–1595	.51	1454–1458	.00
					1622–1669	.39	1476–1682	.82
					1783–1797	.08	1737–1807	.13
					1948–1952	.03	1936–1955	.05
Potts (39CO19)	23	ETH-10120	235 ± 55	1662	1535–1536	.01	1500–1508	.01
					1637–1683	.35	1517–1597	.12
					1734–1808	.48	1620–1706	.31
					1932–1955	.16	1720–1817	.38
							1833–1879	.04
							1915–1955	.14
	24	ETH-10121	415 ± 55	1449	1436–1519	.79	1421–1533	.64
					1595–1622	.21	1542–1636	.36
Meander (39LM201)	19	ETH-10116	350 ± 55	1520,1593,1622	1490–1532	.32	1446–1649	1.00
					1547–1635	.68		
	20	ETH-10117	395 ± 55	1483	1442–1522	.68	1435–1638	1.00
					1583–1625	.32		
	21	ETH-10113	275 ± 55	1649	1520–1592	.46	1478–1684	.78
					1623–1671	.40	1734–1808	.16
					1781–1799	.11	1932–1955	.06
					1946–1953	.04		
Hosterman (39PO7)	22	ETH-10119	295 ± 55	1643	1501–1509	.05	1450–1676	.92
					1517–1598	.61	1776–1803	.06

					1619–1663	.34	1940–1955	.03
	30	SMU-2728	747 ± 62	1281	1216–1300	.99	1159–1177	.02
					1375–1376	.01	1186–1330	.85
							1346–1393	.12
	31	SMU-2731	530 ± 64	1414	1326–1352	.26	1297–1486	1.00
							1362–1366	.03
							1389–1443	.71
	32	SMU-2732	232 ± 56	1663	1638–1685	.34	1503–1505	.03
					1733–1809	.49	1518–1596	.11
					1930–1955	.17	1621–1710	.30
							1718–1819	.39
							1834–1881	.05
							1913–1955	.15
Sully (39SL4)	27	ETH-10416	365 ± 55	1494,1601,1616	1454–1457	.03	1443–1643	1.00
					1478–1529	.38		
					1556–1632	.59		
	28	ETH-10417	265 ± 55	1651	1521–1584	.35	1484–1689	.71
					1625–1675	.41	1730–1810	.21
					1777–1802	.16	1924–1955	.08
					1941–1955	.08		
	29	SMU-2726	400 ± 63	1454,1457,1478	1440–1523	.67	1428–1641	1.00
					1581–1626	.33		
Over's La Roche (39ST9)	25	ETH-10414	250 ± 50	1655	1529–1556	.14	1492–1602	.22
					1632–1679	.43	1616–1692	.35
					1763–1805	.30	1728–1812	.31
					1938–1955	.13	1922–1955	.12
	26	ETH-10415	420 ± 55	1448	1433–1518	.81	1416–1532	.67
					1596–1621	.19	1545–1635	.33
	38	ETH-11039	345 ± 60	1522,1584,1625	1493–1533	.29	1442–1656	1.00
					1542–1636	.71		
Walth Bay (39WW203)	6	SMU-2685	320 ± 63	1532,1547,1635	1495–1601	.77	1442–1671	.96
					1616–1649	.23	1781–1799	.03
							1945–1953	.01
	7	SMU-2687	321 ± 57	1531,1548,1635	1498–1513	.11	1446–1667	.99
					1615–1600	.66	1785–1795	.01
					1618–1647	.23	1952–1952	.00
	8	SMU-2677	322 ± 64	1531,1550,1634	1494–1602	.77	1441–1671	.97
					1615–1648	.23	1781–1799	.03
							1945–1953	.01
	9	SMU-2678	279 ± 46	1648	1522–1582	.47	1485–1678	.86
					1625–1688	.44	1763–1805	.10
					1784–1796	.07	1938–1955	.04
							1950–1952	.02

(*continued*)

TABLE 7. (*continued*)

Variant and site	PVD no.	Lab number	Age (RCYBP)	Calibration curve intercepts (A.D.)	Dates (A.D.) and relative areas under probability distribution: 68.5%	P	95.4%	P
POST-CONTACT COALESCENT								
Dodd (39ST30)	18	ETH-10115	160 ± 55	1683,1735,1807, 1934,1954	1671–1703	.19	1664–1893	.83
					1723–1781	.35	1908–1955	.17
					1799–1815	.09		
					1839–1877	.19		
					1917–1946	.17		
					1953–1955	.01		

periods. Separate rules for evaluating these sites are presented later.

2. Furthermore, ethnographic evidence (cf., Will, 1930; Wilson, 1934; Weitzner, 1979) and data from modern lodge reconstructions at sites, such as Fort Abraham Lincoln State Park, North Dakota (C. Erikson, pers. comm. to S. Ahler, 1988), indicate clearly that the useful life of an earthlodge is about 20 years or less, due primarily to the rotting of posts and beams that form the main structural elements in the lodge. Thus, if a village was used for more than about 20 to 30 years, there should be clear evidence of such a length of occupation in the form of lodge repairs or replacements or multiple lodge floors and architectural plans built on the same or superimposed locations. It is assumed, therefore, that architectural information can be used to assess the approximate duration of occupation of a site and, on that basis, to suggest what to expect from multiple radiocarbon dates from that site.

3. In addition, data from relatively well-dated historic and protohistoric village occupations of various durations are beginning to yield information about what to expect regarding midden accumulation rates within an earthlodge village. This in turn is used to assess the approximate duration of occupation of a prehistoric village, and thereby to predict what to expect regarding the spread of radiocarbon dates from that site. Table 8 contains data about rates of midden accumulation within three historic and protohistoric Hidatsa villages at the mouth of the Knife River in North Dakota. Data are presented for 15 individual excavation locations in these three villages, all in outside-house contexts (data are taken from excavation reports of Ahler, Weston et al., 1980; Ahler and Weston, 1981, and Ahler and Swenson, 1985, in conjunction with more refined chronological assessments for each site in Ahler and Haas, 1993). The midden accumulation rates range from 0.250 to 1.985 m per 50-year interval. The rate for Unit 4 at Big Hidatsa (1.68 m per 50 years) is obviously an outlier within that site, and rates for Sakakawea in general are substantially higher than for the other two sites. In fact it appears that the rates for deposits accumulating within the fully historic period (post–AD 1790) are substantially higher than for all deposits that have some component earlier than that in time. The overall mean of all 15 rate measurements in Table 8 is 0.827 m per 50-year interval. If the five historic period measurements from Sakakawea and the one fully historic period sample from Big Hidatsa (Unit 4) are eliminated, the nine remaining

TABLE 8. Data from test excavations in three villages regarding the rate of outside-house midden accumulation.

Village	Excavation number	Midden depth (m)	Dates (A.D.)	Years	Midden rate, m/50yr
Sakakawea	3	1.35	1800–1834	34	1.985
Sakakawea	8	1.20	1800–1834	34	1.765
Sakakawea	9	0.75	1800–1834	34	1.103
Sakakawea	11	0.60	1800–1834	34	0.882
Sakakawea	12	1.00	1800–1834	34	1.471
Sakakawea	all units	4.90		170	1.441
Big Hidatsa	1	1.70	1600–1790	190	0.447
Big Hidatsa	4	1.85	1790–1845	55	1.682
Big Hidatsa	6	1.25	1600–1745	145	0.431
Big Hidatsa	7	1.15	1600–1745	145	0.397
Big Hidatsa	8	1.05	1745–1830	85	0.618
Big Hidatsa	9	0.90	1650–1830	180	0.250
Big Hidatsa	11	0.80	1745–1845	100	0.400
Big Hidatsa	all units	8.70		900	0.483
Lower Hidatsa	1	1.10	1600–1740	140	0.393
Lower Hidatsa	3	2.40	1560–1780	220	0.545
Lower Hidatsa	4	1.80	1525–1780	255	0.353
Lower Hidatsa	all units	5.30		615	0.431
Mean of 15 units, all sites					0.827
Mean of 9 units, prehistoric and protohistoric					0.426

sample units have a mean accumulation rate of 0.426 m per 50-year interval. This is thought to be a realistic estimate of midden accumulation rates in prehistoric earthlodge village sites. Based upon this, it is assumed that an occupation of less than 50 years would yield a midden less than about 40 cm in maximum thickness in outside house locations.

It can be noted that the vast majority of known earthlodge village sites appear to lack midden deposits deeper than 30–40 cm or so, and also lack clear evidence of lodge rebuilding on the same or overlapping locations. Thus, the norm is for a village to be occupied for a half-century or less (perhaps only for a decade or two). As a result, radiocarbon dates from village sites should be evaluated in the context of what to expect in the dates relative to other information about the duration of occupation of the sites.

4. Recent work in the Knife region of North Dakota resulted in a regional chronological sequence and taxonomy, based in large measure upon radiocarbon dating and ceramic variation, in which phase units are 50, 75, or 100 years in duration. These are discrete, definable units based upon changes in ceramic attributes, lithic raw material selection and reduction patterns, settlement patterns, and lodge construction patterns. It is reasonable to expect to identify and define taxonomic systems or units of culture-historic construction in other regions in the subarea that have equal temporal precision, being no more than a century in duration.

5. When this information is combined with the observation that most earthlodge villages were occupied less than 50 years (a single component has an associated time span of 50 years or less), it is apparent that radiocarbon dates that have an associated error (sigma or standard deviation) of 100 years or more are of extremely little use for furthering our understanding of cultural chronology and change in the subarea. If the temporal measuring instrument has a built-in error of plus or minus one hundred years, then this instrument is of little value for defining and discriminating among units of study that may lie less than one hundred years apart on the time scale. Therefore, it is appropriate to, from the start, eliminate from consideration any reported radiocarbon date that has a standard deviation of 100 years or greater. By screening dates in this manner, the focus shifts to evaluation of radiocarbon dates that have the greatest potential to contribute to resolving the chronological problems in the subarea.

6. Therefore, after excluding all reported dates that have sigmas of 100 years or greater, the next step in the evaluation process involves a test of contemporaneity or an estimation of the probability that, when more than one dates exists, that all are drawn from a single population. This involves testing the variance among two or more dates relative to what their expected variance is, based upon direct archaeological evidence from a given site. It is assumed that if there is no firm archaeological evidence that a site was occupied during a long period, the expected duration of occupation of a village would be 50 years or less. As a consequence, the expectation would be that all reliable dates from the site would date what is essentially a single event (drawn from a single population), therefore passing the test of contemporaneity as discussed by Ward and Wilson (1978) and as computed in Stuiver and Reimer (1993). Acceptable evidence of long-term or multiple occupations occurs only in a few forms: (1) ceramic aggregates that contain sizable numbers of types distinctive of different cultural variants in the region; (2) evidence of superimposed houses, house floors, and/or extensive rebuilding of houses on a single location; and/ or (3) deep and extensive midden or trash accumulations of 40 cm or more in thickness and many square meters in extent. This is called primary evidence of long-term occupation (PELTO). It is therefore only in instances in which PELTO is clearly present that multiple dates from a site should not be expected to pass the test of contemporaneity.

7. If a site does not contain PELTO, and if at the same time dates from a single site having sigmas smaller than 100 years do not pass the test of contemporaneity, it is concluded, lacking clear, direct evidence for other sources of error, that the failure of the contemporaneity test indicates a problem in the reliability of the radiocarbon dates themselves. This perspective is the opposite of the more conventional approach, a willingness to do the reverse—to accept almost all dates except the wildest extremes as meaningful, and to look for some age/association problem in the dated material itself to explain internally inconsistent radiocarbon results. As Thomas Thiessen recently stated (T. Thiessen, pers. comm. to S. Ahler, 1994), there has for many years been a near-consensus among archaeologists that “every date that is produced must be used or explained in some manner”—dates simply cannot be ignored. After all, individual radiocarbon dates are too costly for them not to be used in some fashion.

The present perspective—questioning the dates themselves rather than the dated material or its association—comes from a growing body of evidence that indicates that many radiocarbon dates for Plains Village sites in the Dakotas run by many different labs (even many dates recently produced on carefully selected short-lived materials) are simply not as precise or reliable as reported error values would indicate. There is growing evidence, grounded in increasingly careful scrutiny of materials submitted for dating and better understanding of the archeological context (cf. Shott, 1992) that individual labs vary a great deal in terms of the reliability and accuracy of the dates they produce, regardless of reported error values. There is empirical evidence (e.g., Ahler and Haas, 1993) that it is not inherently difficult to repeatedly produce sets of internally and externally consistent dates for single Plains Village sites. It has been known for some time within the radiocarbon community that reported error rates from some labs are greatly underestimated because they often include only counting error but no other sources of error (see Haas, 1995). It also is clear from a growing body of archaeological evidence and by experience with different labs that some (and perhaps many) labs simply are not applying the routine analytic procedures and quality controls necessary to ensure the production of reliable dates for such sites. Knowing this, the usefulness of the results produced by various labs, based upon primary archaeological data and knowledge of the archaeological record, can be used as a beginning point in the assessment of radiocarbon dates from the study area. This is the approach that is followed here, focusing first and foremost on the results of the PVD date series.

With this background in mind, the evaluation of radiocarbon dates begins with the sites in which larger series of dates (include some PVD dates) were run, and proceeds to the less intensively dated sites about which something can be said in terms of critical evaluation. In general, the first assessments begin with large PVD date sets from individual sites that had been previously extensively dated or well dated. This permits the simultaneous evaluation of PVD dating results and the evaluation of previously run dates. In some cases, this process yields information useful for farther-reaching decisions about the reliability or validity of sets of dates from specific labs, helpful in reaching some conclusion about the advisability of using any or all dates from specific labs. This in turn affects the way previously run or existing dates from several sites that were not dated in the PVD dating program but that are used in the ceramic analysis aspects of this study are chosen for consideration.

The abbreviations associated with archeological contexts are house (H), feature (F), and excavation unit (XU) numbers. Feature number, depending on the excavator of the site, sometimes designates houses.

Sites with Complex or Extensive Date Series

Helb (39CA208) (Extended Middle Missouri)

The Helb site was selected for dating for several reasons. Foremost, it has produced a large, well-controlled excavated collection, potentially contributing a great understanding of Plains Village lifeways. An important data set, such as Helb, cannot be left undated. Equally important, the site remains the focus of much discussion and controversy regarding its age, taxonomic affiliations, and role in the dynamics of cultural interaction in the subarea.

Lehmer (1971, fig. 79) considered Helb, discovered in 1966, to be a Terminal Middle Missouri variant village, and one of the southernmost, if not the southernmost, example of such, a village in a prime location to elicit conflict with competing Extended Coalescent populations to the south. Falk and Calabrese (1973) reevaluated Helb as an Extended Middle Missouri village, apparently occupied relatively early in time, and with little evidence for later components at the site. Thiessen and Nickel (1975) assessed a large series of radiocarbon dates from the site and evaluated the radiocarbon evidence as indicating the presence of two components, one very early in the Extended Middle Missouri period (ca. AD 1000), and the second in the sixteenth century AD. More recently, Kay (1994) speculated that there were three distinct periods of use of the site by Extended Middle Missouri populations who, when using the site for more than five centuries, retained a strikingly uniform ceramic tradition. Thus the site has the possible distinction of simultaneously containing one of the earliest Extended variant components within the entire subarea, as well as documenting a late Terminal Middle Missouri population driven from the locality by expanding Extended Coalescent peoples holding territory just to the south. Regardless of how the speculative, fanciful, and imaginative arguments about the chronological significance of certain archaeological details within the site are perceived (e.g., house size [Thiessen and Nickel, 1975:309]; house pit creep rates [Kay, 1994, cited in Rosebrough, 1994:66]; house floor depths [Kay, 1994:19–20]; and pottery vessel thickness [Rosebrough, 1994:66]), it is believed that all investigators would agree that there is no primary evidence of long-term occupation (PELTO) at the Helb site. All of the speculation about time depth at Helb has its roots in a single data set that is taken at face value: the existing series of radiocarbon dates whose central tendencies alone span from AD 970 to AD 1620 (Thiessen and Nickel, 1975; Thiessen, 1977) (Table C.2). Lacking PELTO, an evaluation of the reliability of the dates produced for the Helb site is needed.

Cultigen (maize) samples from Helb are the focus of the current dating effort with one AMS sample each drawn from two trash-filled pits associated with two very similar and adjacent rectangular houses excavated in 1973 (F 417 with house 15 and F 352 with house 14). Five cupule fragments constituted one sample and a single cupule the other. Two wood charcoal samples from within each of these same pits had previously been dated (Table C.2), and collectively, these four previous dates reflect the wide range of dates available from the site as a whole. The PVD dates provide a direct check on the previously run dates from these two contexts. Lacking PELTO, it is expected that all dates from the individual labs would pass the test of contemporaneity. Several points can be made from our evaluation:

(1) The two PVD dates from F 417 and F 352, respectively (ETH-11043 and ETH-11044) pass the test of contemporaneity at the 0.05 level (T'=1.06, df=1, critical X^2=3.84). Thus, they are consistent with each other, as is expected from all archaeological data, and they appear to be reliable given the lack of PELTO for Helb.

(2) The two Radiocarbon Limited dates from Helb (RL-298 and RL-299) fail to pass the test of contemporaneity (T'=15.33, df=1, X^2=3.84). Lacking PELTO, there is therefore reason to question the reliability of these dates. There is no particularly good reason to choose one date as more accurate than the other. One perspective is simply to consider the lab error factor to be highly underestimated by the reported sigma. Using CALIB 3.0.3 (Stuiver and Reimer, 1993) it is determined that an error multiplier K value of about 2.1 must be applied to the reported dates for them to pass the test of contemporaneity. This means that when lab error and counting error are both taken into account, sigmas on the order of ±190 years are appropriate for the reported RL dates.

(3) Four of nine Nebraska Wesleyan University (NWU-39, 40, 45, and 55) dates have reported sigmas of 100 years or greater (Table C.2). Based upon assumptions made previously, these are dropped from consideration as being too imprecise for contribution to the chronological assessment of the site.

(4) The remaining five Nebraska Wesleyan University dates from the Helb site (NWU-38, 46, 52, 53, and 54) fail the test of contemporaneity (T'=35.46, df=4, critical X^2=9.49). Lacking PELTO, this series of NWU dates appears to be unreliable. Using procedures in CALIB 3.0.3, the reported sigmas must be increased by a lab error factor of approximately K=2.0, meaning sigmas on the order of 150 to 190 years rather than the reported 70 to 90 years, in order for the date series to pass the test of contemporaneity.

Other more specific evaluations of the remaining low-sigma NWU dates also can be made:

(5) The two previously run NWU dates from a single context, F 417 in H 15 (NWU-52 and NWU-46), do not pass the test of contemporaneity (T'=8.97, df=1, critical X^2=3.84). Thiessen and Nickel (1975: 308–309) noted this discrepancy and chose to speculate that the two NWU samples from the single pit are reliable but derived from carbon of different ages. The preference here is to assume, lacking PELTO, that all of the carbon from the single pit feature is effectively the same age (small twigs were selected for the NWU samples) but that lab error values (sigmas) reported for these samples are greatly underestimated. This conclusion is consistent with that reached for the NWU date series from Helb as a whole, but provides a refined assessment of this generality based upon two NWU dates from a single context. These two dates (NWU-46 and 52) are judged to be unreliable.

(6) The remaining three low-sigma NWU dates (38, 53, and 54) (Table C.2) do not pass the test of contemporaneity (T'= 21.77, df=2, critical X^2=5.99). Lacking PELTO, these three dates are considered to be unreliable, eliminating them from the analysis.

(7) In summary, lacking PELTO for Helb, the two ETH dates for Helb are viewed as the most reliable and valid radiocarbon dates for the site. The weighted average of these two dates (558 ±41 BP) is used as the basis for developing a calibrated calendar age for the site of AD 1409 (crossover point) and a 2-sigma probability range of AD 1304 to AD 1433.

Jake White Bull (39CO6) (Extended Middle Missouri)

The Jake White Bull site is an analog to Helb in many ways, originally being evaluated by Lehmer (1971:122) as one of the southernmost Terminal Middle Missouri variant sites known, then having been reevaluated as representing an early component of the Extended Middle Missouri (Ahler, 1977a). The Jake White Bull site lacks PELTO so it is expected, all else being equal, that all series of dates from the site will pass the test of contemporaneity.

In the initial testing program at the site, excavations were made near and within one house (H 4) in the north-central part of the cutbank and at the intersection of the south fortification ditch by the cutbank. Initially, the University of Georgia lab dated six radiocarbon samples from various places in both of these contexts. These six dates

(UGa-1488 through UGa-1493 in Table C.2) have a wide dispersion, some are unrealistically old, and as a group they fail the test of contemporaneity (T'= 65.82.43, df=5, critical X^2=11.07). In discussions between Stanley Ahler and Dr. Betty Brandeau of the UGa lab, Brandeau identified three dates as being unreliable (UGa-1488 through UGa-1490), with the remaining three being more reliable. As a test of this proposition, Ahler submitted a seventh sample for dating at UGa (UGa-1558) that was comprised of a composite of charcoal from the same contexts represented in the three dates identified by Brandeau as unreliable (from F 2, F 4, and F 7). This in effect was a re-date of the three unreliable samples. Based upon what Brandeau had stated, strikingly different results were expected, compatible with the three dates identified by Brandeau as being more reliable. This was precisely the result received. The re-date result (UGa-1558) was in fact much younger than previous runs on the same material, and the date was compatible with the three other UGa dates identified by Brandeau as more reliable. The test of contemporaneity on these four samples (UGa-1491, 1492, 1493, and 1558) (T'=0.90, df=3, critical X^2=7.82) shows them to be drawn from the same population with a high degree of probability. In assessing the site, Ahler (1977a) used the mean of the four dates (ca. AD 1013±43) as the best chronometric estimate of the age of the site, placing it very early in the Extended Middle Missouri sequence in the subarea.

Unfortunately, the check date run by the UGa lab (UGa-1558) has a sigma of 105 years, a value too large to be considered useful for developing a refined chronology for village sites, as discussed previously. In keeping with the general assumptions guiding this renewed evaluation, it is appropriate to eliminate this date from consideration, treating it, in essence, as a non-contributor to the dating program. When this is done, the three dates identified by the UGa lab as the most reliable (UGa-1491, 1492, and 1493) are accepted. These have a weighted average of 943±33 years BP.

In retrospect, there has always been the nagging question in Ahler's mind of why the three unreliable dates from the UGa lab were not reported as such from the outset, rather than having been identified as unreliable only after the archaeologist questioned the results. In addition, Ahler learned that the University of Georgia radiocarbon laboratory never routinely conducted pretreatment designed to extract soluble humic acids (Dennis Toom, pers. comm. to S. Ahler, 1993). Haas' experience with Plains Village samples from North Dakota indicates that humic acid extraction is sometimes a time-consuming but critical step in pretreatment, with samples often containing large amounts of soluble humates requiring many cycles of treatment in NaOH for removal. In hindsight, substantial doubt remains regarding the reliability of the UGa dates from Jake White Bull, and this is the context in which new samples from the site were chosen for dating in the PVD program.

Four samples from Jake White Bull are selected for dating in the PVD program (Table C.1). These consist of a conventional sample of wood charcoal from the midden outside of H 4 (material from the same context as UGa-1493), a conventional sample from the south fortification ditch, an AMS sample that is a composite of fragments of charred maize cupules from four subfloor pit features associated with H 4 (closely comparable to sample UGa-1558 (rejected for having a large sigma) but dating presumably better, shorter-lived materials), and an AMS sample of carbonized residues from the lip and exterior shoulder of a large Riggs ware pottery fragment from within F 3, a subfloor pit within H 4. The latter sample is best considered experimental in nature, being the first carbonized sherd residue date to be run in the PVD program. If reliable, the result from this sample should be compatible with the other three more conventional PVD sample dates.

These four dates (SMU-2663, ETH-10109, ETH-9238, and DRI-3204) pass the test of contemporaneity (T'=7.47, df=3, critical X^2=7.82), yielding a weighted average of 786±30. Even though they pass the test, the sherd residue date is at variance with the other three dates. Lacking PELTO at the site and given the experimental nature of the AMS sherd residue-dating program, the date on residue is the primary choice for possible error of unknown source. When the residue date (ETH-9328) is set aside, the remaining three PVD dates (SMU-2663, ETH-10109, DRI-3204) also pass the test for contemporaneity (T'= 0.40, df=2, critical X^2=5.99). The weighted average of these three dates is 751±33 BP, some 224 radiocarbon years more recent than the date from the carbonized sherd residue date from basically the same context. Tentatively then, the sherd residue date is omitted from consideration (ETH-9328), accepting the remaining three PVD dates as useful. A final evaluation of the sherd residue date awaits further comparisons of residue and non-residue dates from the same contexts at other sites.

The next step is to compare the newly run and acceptable PVD dates with the previously run and accepted UGa dates from Jake White Bull. The weighted means of these two sample sets (mean of three UGa dates=943±33 and of three PVD dates=751±33) do not pass the test of contemporaneity (T'= 12.18, df=1, critical X^2=3.84), suggesting that one or the other mean is not accurate. Furthermore, individual tests of contemporaneity applied to pairs of dates from essentially the same contexts indicate that one or the other date in each pair is not accurate (ETH-10109 vs. UGa-1558 yields T'=4.19, df=1, critical X^2=3.84 (even with the large sigma for the UGa date); SMU-2663 vs. UGa-1493 yields T'=3.53, df=1, critical X^2= 3.84). Given the concerns about reliability and pretreatment processes conducted by the UGa lab, as discussed in the preceding paragraph, the PVD data are considered to be the most accurate of the available dates. The weighted mean of these three dates (751±33) generates a calibrated crossover point of AD 1280 and a 2-sigma probability range of AD 1217 to AD 1297.

Lower Grand (39CO14) (Extended Coalescent)

The Lower Grand site is targeted for attention in the present program because: (1) it contains one of the larger, well-controlled, excavated samples of all sites in the subarea; (2) it lies near the northern limit of the geographic extent of Extended Coalescent components; and (3) it has previously been radiocarbon dated and assessed as being the earliest Extended variant component in the subarea, an unusual circumstance given its far upstream geographic position. It is therefore potentially a key site for understanding interactions among the Extended Middle Missouri and the Extended Coalescent variants, and it plays a potentially central role in understanding the culture history of both the Arikaras and the Mandans (Bowers, 1948a:96–99, considered Lower Grand to be a prehistoric, southern Mandan subgroup village, a serious proposition still potentially valid, yet untested).

There is evidence from fortification systems that the village area enclosed by fortification ditches expanded through time, with the ditch reexcavated to enclose a larger area later in time. In addition, there is architectural evidence in H 6 and H 17 that at least these two structures were substantially repaired by the addition of numerous small support posts during the period of their use. House 12, a much larger structure, shows less clear evidence of substantial maintenance. Middens in various parts of the site reach about 50 cm in depth, but not deeper (Falk and Ahler, 1988:30–37). Present ceramic data do not support the presence of multiple taxonomic units at the site. Thus, there is clear evidence that the village occupation was not brief, but primary evidence of long-term occupation remains equivocal. It is almost certain that the village was inhabited for more than a decade but less than 100 years; an occupation span of about 50 to 60 years is estimated for the site, with no clear evidence of this having occurred along with substantial periods of site abandonment. Thus, the radiocarbon dates from the site are expected to pass the test of contemporaneity.

Four radiocarbon dates had previously been run for the Lower Grand site (Ahler, 1975a, table 4; Falk and Ahler, 1988:64–65) (RL-300 through RL-303, Table C.2). These samples were selected to represent several contexts within the site, specifically focusing on the question of the duration of site occupation: two are from H 12, one is from H 6, and the fourth is from a midden in the northern part of the site, north of the interior fortification ditch in a part of the site that might have been used latest in time. One of these dates is eliminated from consideration (RL-301) based upon its large standard error of 120 years. The remaining three dates pass the test of contemporaneity (T'=0.87, df=2, critical X^2=5.99). There is no clear reason not to average them, and they yield a weighted mean of 560± 53 BP. This is the earliest reported date for an Extended Coalescent component in the subarea.

Four additional dates were run from Lower Grand in the PVD program (Table C.1 and Table 8). One (SMU-2689) is a conventional sample of wood charcoal from a large pit (F 59) just outside H 12, in a context comparable to F 102, another pit of great research interest. Two dates (SMU-2725 and ETH-10112) are on short-lived material from F 102, outside H 12. The final date (ETH-10412) is on maize from a pit feature (F 3) in H 11, the first dated sample from the site from excavations by Alfred Bowers. These four dates pass the test of contemporaneity (T'=6.12, df=3, critical X^2=7.82). The weighted mean of these four dates is 366±30 BP.

A span of 194 years exists between the weighted mean of the three Radiocarbon Limited dates from Lower Grand and the four PVD dates, with the RL dates being the older. The two respective weighted means do not pass the test of contemporaneity (T'=9.80, df=1, critical X^2=3.84). A more specific comparison is made by comparing the single low-sigma RL date from H 12 (RL-300) with the mean of three PVD dates from H 12 (SMU-2689, SMU-2725, ETH-10112). The two sets of dates pass the test of contemporaneity (T'=3.46, df=1, critical X^2= 3.84). Even so, there is a 186-year difference between these two values, and there is a probability of between 5% and 6% that they are drawn from the same population. Although the dates from each lab series are internally consistent (reliable), they are not comparable enough for an averaging of all dates (one set or the other is probably inaccurate). Because the RL dates from the Helb site are internally inconsistent and unreliable, greatest weight in the present context is given to the PVD dates. In addition, the PVD dates are for the most part derived from short-lived materials, whereas the RL dates are not so derived. Thus, it is concluded that the most accurate date for Lower Grand as a whole is the mean of the four dates produced in the PVD program, 366±30 BP. When calibrated, this date crosses the calibration curve at AD 1494, 1602 and 1615, and has a 2-sigma probability range of AD 1449 to AD 1635.

Two additional dates from wood charcoal became available with the completion of a report of salvage excavations at the site conducted by the U.S. Army Corps of Engineers in 1984 (Winham, 1995:187). Winham's analysis of the dates indicates a difficulty in assessing the two dates (510±90, 270±80) because of their lack of overlap. When these dates are entered in CALIB, they just barely past the test of contemporaneity (T'= 3.83, df=1, X^2=3.84). Based upon this consideration and the fact that the four PVD dates are from short-lived materials (twigs, corn), we decided not to combine the two dates reported by Winham with the four acceptable PVD dates.

Walth Bay (39WW203) (Extended Coalescent)

The Walth Bay site is selected for additional dating because it has produced a very large, well-controlled sample of archaeological material and it has previously been dated with apparently acceptable results. The site presents an interesting example of superimposed architectural features in combination with an apparent short-term occupation. The largest excavated residential unit, H 21, is highly patterned in form and was apparently briefly used. H 19, slightly smaller, was built on the same location and in the same orientation as H 21, presumably by the same group of people. Evidence suggests that H 19 was built and used immediately after the destruction of H 21. H 9 is very small and built in a shallow pit superimposed on remnants of both H 19 and H 21 (Falk and Ahler, 1988:61–63). Despite this clear sequence in house construction, there is no clear evidence that the Walth Bay site was used for a lengthy period of time. Midden deposits are generally dense but very shallow (less than 0.3 m in thickness), and there is no clear evidence in ceramic remains of substantial time passage during use of the site. Thus, there is no clear indication of PELTO, with the expectation that the radiocarbon dates from the site are drawn from a single population.

The Radiocarbon Limited lab had previously run four dates on samples from Walth Bay (Ahler, 1975a, table 4; Falk and Ahler, 1988:64–65). These were intentionally selected from widely separated locations within the site to test the possibility that measurable time depth was reflected in the samples locations. One sample (RL-304) is from H 19, the earliest of three overlapping house features, a second (RL-305) is from H 9, the latest of the three; third and fourth samples (RL-306 and RL-307) are from tests in spatially divergent parts of the village. The four dates (Table C.2) pass the test of contemporaneity (T'=1.62, df=3, critical X^2=7.82), and produce a weighted mean of 396±46 BP. At face value, there is no reason not to accept this series as reliable and accurate.

Four new dates were run on Walth Bay materials in the PVD program. The focus of this dating effort is on selected contexts associated with H 19 or undifferentiated H 19/21, primarily as a test of the reliability of dates being produced in the PVD program. Because it is believed that the period of use of these two houses was very short term, the new dates, if reliable, should cluster tightly. One sample, SMU-2685, is essentially a split sample of the same H 19 roof-fall material dated in RL-304. A second, SMU-2687, also is small twigs and branches comprising roof fall from the same burned house that was swept into an open trash pit. A third, SMU-2677, is a conventional charcoal sample from F387, a previously undated pit associated with the use of houses 19 and/or 21, and the final sample, ETH-10112, is a maize sample from the same pit context.

The PVD results are amazingly consistent internally (Table 7). Central tendencies for the two H19 short-lived, roof-fall samples differ from each other by one year. The central tendency for the conventional F387 sample differs from these two dates by one and two years, respectively. The AMS date on maize from the same pit feature is 43 years younger than the conventional charcoal date, suggesting that the corn may have grown a few years after the branches or saplings were cut to construct the roof of H19. Not surprisingly, these four dates pass the test of contemporaneity (T'=0.17, df=3, critical X^2= 7.81), having a weighted mean of 312±28 BP, clearly increasing confidence in the reliability of the dates being produced in the PVD program, whether conventional or AMS.

The remaining question then centers on a comparison of the two date series from the RL and PVD program. Comparison of the weighted means for the two sets of four dates (the mean for the RL dates is 91 years older than the mean for the PVD dates) indicates that they pass the test of contemporaneity (T'=2.37, df=1, critical X^2=3.84). A more precise comparison is made between the single RL date from H19 (RL-304, 450±90 BP) and the mean of the two PVD dates on roof fall from the same house (mean of SMU-2685 and SMU-2687, 321±42 BP). Despite the 129-year difference in these dates, they pass the test of contemporaneity (T'=1.61, df=1, critical X^2=3.84). It is of note, however, that the mean for the RL dates from Walth Bay is about 30% older than the mean of PVD series from the site. This is similar to the relationship between RL dates from Lower Grand and PVD dates from that site, although in that case the difference is greater (the RL mean is 57% older than PVD mean). Is it possible that the RL dates in general are systematically older than they should be? It is believed that this is a distinct possibility, and on that basis the mean of the PVD dates alone is used as the best estimate of the age for the Walth Bay site (mean=312±28 BP). This date calibrates to intercepts of AD 1535 and AD 1638 and a 2-sigma probability range of AD 1492 to AD 1653.

Sommers (39ST56) (Initial Middle Missouri)

The Sommers site is selected for additional study because it is a possible early example of the Initial Middle Missouri variant. It was subjected to a thorough assessment of ceramics and intrasite variability (Steinacher, 1990), and, even though extensively dated, its chronological placement has not been established through chronometric means.

The Sommers village consists of a scatter of more than 100 house depressions, some 17 or 18 of which appear to have been enclosed within a fortification system, with the others lying outside a fortification ditch. Steinacher (1990) conducted a thorough assessment of all available stratigraphic, architectural, and ceramic evidence concerning the settlement dynamics and internal chronology of the site. He concluded that there was some evidence in ceramic remains to indicate that the village was large and that it contracted in size through time, with houses within the fortified area having been used the longest. Although the evidence indicates that the village may have had a dynamic settlement history, there is nonetheless little clear evidence for long-term occupation. Although there is evidence that one of seven excavated houses may have been rebuilt, there is no evidence from midden accumulations or ceramic data that any given house unit or house area was used for a long period. There are, however, several small midden areas within the fortified portion of the site.

Among the dated samples from the site, those in XU17 and XU18 (Table C.2) are from within the fortified part of the site, whereas those from XU70 are from a house lying outside the fortified area. From the point of view of what is expected in series of radiocarbon dates from the site, it is best to study sets of dates from respective labs and respective inside-ditch and outside-ditch areas separately. Because houses within the fortification (XU17, XU18) may have been used longer, there is the possibility that dates from that part of the site may not pass the test of contemporaneity and yet may be reliable and accurate, whereas dates from XU70 outside the fortification should definitely pass the test of contemporaneity. It is with these expectations that all of the radiocarbon information from the site is evaluated.

Two samples from house posts within two structures inside the fortification ditch were dated many years ago (SI-314 and SI-315; Table C.2). These dates have sigmas of 100 years or greater, and are eliminated as not particularly useful given the arguments presented previously.

The Beta Analytic lab ran three dates on outer rings from post samples from within a single house, XU18, inside the fortification system. These three Beta dates (Beta-1901, 1902, 1903; Table C.2) pass the test of contemporaneity (T'=3.37, df=2, critical X^2=5.99), and are accepted as reliable for the moment.

Three additional Beta dates (Beta-1904, 1905, 1906) were run on outer ring wood from posts in a single house, XU70, outside the fortification that are expected to pass the test of contemporaneity. These three do not pass the test of contemporaneity (T'=26.38, df=2, critical X^2=5.99), and are therefore considered to be unreliable. They are eliminated from further consideration.

In the PVD dating program, a concerted effort was made to date short-lived materials from the Sommers site and to date previously dated contexts in order to untangle the chronometric confusion that exists for the site. Four samples were submitted, consisting of charred grass and twigs (SMU-2734), as well as maize (our PVD sample No. 37) from XU18 (which may or may not be contemporaneous), and two maize samples (ETH-11037, 10418) from a single house, XU70 (which should be contemporaneous).

Because of a mix-up in the lab, the maize sample PVD-37 from XU18 was actually AMS-dated twice, yielding dates ETH-10419 and ETH-11038. These two dates on the same material do not pass the test of contemporaneity (T'=8.32, df=1, critical X^2=3.84), and both are rejected as being unreliable. The single date from burned roof debris (SMU-2736) is therefore taken as the only reliable PVD date for this context, XU 18. When this date (972±73 BP) is compared with the mean of the three apparently acceptable Beta dates for this sample context (Beta-1901, 1902, 1903; mean of 1129±38 BP), they pass the test of contemporaneity (T'=3.26, df=1, critical X^2=3.84). Given the substantial difference in these dates (the SMU date is 157 years more recent than the mean of the Beta dates), the less than 10% chance that the dates are drawn from the same population, and the fact that the SMU date is on highly preferable short-lived grass and twig material from roof fall, whereas all of the Beta dates are on less preferable posts (possibly aged wood), it is thought that the single SMU date is probably the far more accurate assessment for the age of XU18. Our preference is to use this date alone for XU18 and not to use the Beta dates from the same context.

The two remaining PVD dates from XU70 (ETH-11037 and ETH-10418; outside the fortification) pass the test of contemporaneity (program CALIB 3.0.3 in Stuiver and Reimer, 1993; T'=2.62, df=1, critical X^2=3.84), and yield a weighted mean of 1011±45 BP as a good estimate of the age of XU70. When this mean is compared with the single acceptable date for XU 18 (SMU-2736), they pass the test of contemporaneity (T'= 0.18, df=1, critical X^2=3.84), as do all three dates when compared individually (SMU-2736, ETH-11037, and ETH-10418, T'=2.81, df=2, critical X^2=5.99). Thus, when only the most acceptable and reliable dates from the site are considered, there seems to be no evidence for long-term occupation. It is optional whether the mean of the single SMU date from XU18 averaged with the mean of the two ETH dates from XU70 (mean=999±42 BP) is accepted or the mean of all three dates outright (1001±39) is considered to be the best assessment of the age of the site. In this case the latter is chosen, yielding a calibrated calendrical age of AD 1022 and a 2-sigma probability range of AD 982 to AD 1157 for the Sommers site as a whole.

Huff (32MO11) (Terminal Middle Missouri)

Based upon the PELTO criteria discussed earlier in this chapter, this site lacks any primary evidence for long-term occupation. The presence of one square house with rounded corners and La Roche (Extended Coalescent) pottery suggested to Wood (1967:105–107, 134–136, 159) that there was possibly some interaction between the Huff villagers and contemporaneous Caddoan (Arikara) groups from South Dakota. At the present time, Huff is generally thought of as representing a single, relatively short-term occupation by Terminal Middle Missouri peoples (Stanley Ahler, pers. comm., 2000).

The Huff series of 20 dates represents one of the largest and most diverse in the Middle Missouri subarea. Working with only five of these 20 dates (SI-178, 179, 180, 182, 183) Wood (1967:114–116) rejected several of them and posited a range of AD 1400 to AD 1600 for the occupation of the site. A later effort by Ahler et al. (1996:182–183) discarded all but two dates (SI-179 and USGS-29), yielding a calibrated curve intercept of AD 1441 and a 2-sigma probability range of AD 1406 to AD 1629, very close to Wood's (1967:116) estimate for the site of AD 1400 to AD 1600. Since then, two additional groups of dates have been run for the site. The first group of four is considered to have been produced as part of this program and utilized material excavated by Wood (DRI-3114, ETH-16071, ETH-16072, ETH-16073; Table C.1). Three averaged dates result in a 2-sigma range of AD 1288 to AD 1400 for house 6. One date from house 9 yields a 2-sigma range of AD 1321 to AD 1487, a value that is incompatible with the mean for house 6. A second group of six dates was produced in conjunction with a limited geophysical and archaeological testing program undertaken at the site in 1999 (Ahler and Kvamme, 2000). Six AMS dates were obtained on maize kernels or cobs from two pit features (Ahler, 2000a, tables 4 and 5). The results of Ahler's analysis suggests that all six of these most recent dates pass the test of contemporaneity (using CALIB 4.1.2) and therefore can be averaged. Using CALIB 3.0.3 (the version used in the current study), all six dates (ETH-21581 through ETH-21586) also pass the test of contemporaneity with this version of the program (T=8.31, df=5, critical X^2=11.07). The weighted mean of BP 424±22 calibrates to an intercept of AD 1446 and a 2-sigma probability range of AD 1431 to AD 1496. Ahler and Kvamme (2000:66) noted that these results are inconsistent with even the dates run in 1996. Following Ahler (2002), we will treat the mean of the six most recently run samples as the most reliable date for the site, and will exclude all other dates from further consideration.

Other Dated Initial Middle Missouri Sites

Jones Village (39CA3) (Initial Middle Missouri)

There are ten radiocarbon dates available from this site, three from work stemming from the 1979 University of Nebraska survey of the east bank of Lake Oahe and six made available in 1997 as a follow-up to the Smithsonian-sponsored PVD program. An earlier assessment of the site (C. Johnson, 1994:156, appendix D2; 1996:173–174, appendix E) focused on the three University of Georgia dates (UGa-3359, UGa-3360, UGa-3358) available at the time this study was initiated and how they relate to the perceived site stratigraphy. At that time, there appeared to be two Middle Missouri tradition occupations at this site (Initial and Extended), each characterized by their own unique ceramic assemblages and different stratigraphic positions. It was concluded that there was PELTO at the site. Johnson (1994, 1996) assigned each of the four dates from the site to either the Initial (UGa-3357) or Extended Middle Missouri (UGa-3358, 3359, 3360) component. The test of contemporaneity for the three Extended variant dates indicated that they were drawn from different populations (T'=43.24, df=2, critical X^2=5.99). A single date (UGa-3359) was considered to be an outlier and, together with the other date from H 15, was eliminated from the study for failing to pass the test of contemporaneity for this structure (T'=26.41, df=1, critical X^2=3.84). This left a single date (UGa-3358) associated with H 10 of the proposed Extended component. This date (BP 1045± 65), had a calibrated intercept of AD 998 and a 2-sigma probability range of AD 869 to AD 1188. The single date from the Initial Middle Missouri occupation (710±65 BP) corrected to a calibration curve intercept of AD 1288 and a 2-sigma probability range of AD 1214 to AD 1405.

The second series of dates, run after the completion of the final report (Johnson, 1996), consists of three conventional and two AMS dates on wood charcoal (mixed sizes, small diameter); a sixth date was run on charred residue from a cord roughened body sherd. All samples were collected in 1979 as part of the University of Nebraska Lake Oahe survey (Falk and Pepperl, 1986). These samples were selected from provenience units (based upon a combination of depth of features and ceramic content) thought to be associated with the Initial (DRI-3115, ETH-16074, ETH-16075, ETH-16076) and Extended (DRI-3116, DRI-3117) Middle Missouri occupations. Surprisingly, all six dates form a fairly tight cluster from BP 881±37 to BP 980±65, indicating no radiocarbon support for the two-occupation hypothesis. Emergency salvage excavations conducted almost 20 years later from a different portion of the site (C. Johnson, 1997, 1998b) also provided little support for two Middle Missouri tradition occupations. Rather, a single component assigned to an Initial Middle Missouri occupation is present. There is some evidence for PELTO at the site, with two separate fillings of at least one abandoned house and extramural pit features originating at various depths. In any case, there is no direct field evidence to suggest the six most recent dates are from provenience units dating to different occupations of the sites. As a consequence, all can be assigned to the Initial variant occupation. The single sherd-residue date is excluded from the analysis, consistent with decisions to set aside such dates from other sites based upon systematic differences between residue and non-residue dates (see later discussion). The five dates (DRI-3115, ETH-16074, ETH-16075, DRI-3116, DRI-3117) pass the test of contemporaneity (T'=0.73, df=4, critical X^2=9.49), yielding a weighted average of 899± 22 BP. This calibrates to crossover dates of AD 1158 and AD 1185. The 2-sigma probability ranges from AD 1036 to AD 1216.

Fay Tolton (39ST11) (Initial Middle Missouri)

This Initial Middle Missouri village was the scene of conflict and apparently catastrophic abandonment (Wood, 1976). It is dated previously with four dates run by three labs (Table C.2). One reported date, NWU-50, has a reported sigma of 170 years and is eliminated from consideration here for reasons discussed previously. A single PVD sample was submitted from this site, primarily to run a check on the previously run and apparently consistent dates for this important site, this time using short-lived materials maximally conducive to accurate date association. Five charred chokecherry seeds were submitted, having been recovered from inside a pottery vessel near Burial 18 in H 1.

The two Wisconsin lab dates reported for the site (Wis-722 and 728) pass the test of contemporaneity (T'=0.18, df=1, critical X^2=3.84), as would be expected because they are from the same intrasite context. When considered with the other two dates from the site (M-1082 and ETH-10113), all four pass the test of contemporaneity (T'=0.51, df=3, critical X^2=7.82), and appear to be drawn from a single population. This is consistent with a lack of PELTO for the site (Wood, 1976:42–43). These four dates have a weighted mean of 885±32 BP; this calibrates to crossover dates of AD 1162, 1171, 1190 and a 2-sigma probability range of AD 1036 to AD 1258. This is taken as the best radiometrically determined age for the site (Table C.3).

Jandreau (39LM225) (Initial Middle Missouri)

A single date existed beforehand for this Initial Middle Missouri site, this being an early run SI date on a house post (SI-337) (Table C.2). This date is not considered to be useful because of its large standard error (150 years). Suitable additional datable materials are practically nonexistent for this site, so two sherd residue samples were submitted for dating in the PVD program. Because of a mix-up in the ETH lab, one sample (PVD-15) was not dated. The single date returned is 1015±55 BP; this calibrates to AD 1020 and a 2-sigma probability range of AD 897 to AD 1188. An analysis of ceramic residue and nonresidue dates from four sites (Jake White Bull, Calamity Village, Arzberger, Jones Village) presented later in this chapter indicates that residue dates may be systematically earlier than nonresidue dates. As a result, all residue dates are excluded from further consideration, including the single date from Jandreau.

Dodd (39ST30) (Initial Middle Missouri)

An attempt was made to date the Anderson focus component at this type site for the Initial Middle Missouri variant. Prior to the PVD program, a single date existed on a house post (M-843). Because of the large standard error for this date (100 years), this date was not considered to be useful in the present chronometric program. A large number of maize samples exist in the NMNH collections for the Dodd site. The proveniences of these were reviewed in detail, and a single sample was isolated as being associated within the Initial Middle Missouri component rather than the Post-Contact period component. Parts of several maize cupules were submitted as an AMS sample. The results (ETH-10115) are so recent as to suggest that the sample was actually associated with the post-contact component at the site. The radiocarbon date of 160±55 BP falls in a portion of the calibration curve where multiple crossovers occur and completely ambiguous calendrical ages are computed (AD 1683, 1735, 1807, 1934, and 1954). The 2-sigma probability dates range from AD 1671 to AD 1955.

Pretty Head B (39LM232) (Initial Middle Missouri)

PELTO exists at this site, consisting of several superimposed features, about 60 cm of midden deposit, variations in pottery content, and variation in architectural patterns. The site investigators (Caldwell and Jensen, 1969:70–71) distinguished two components, B being early and A being late, which were not thought to be separated by a great length of time. Two dates exist for this site, one each for the two Initial variant components distinguished at this location (Table C.2). These two dates are compatible with each other, but one from component A has an unacceptably large sigma (140 years; SI-166), the remaining single date from component B (SI-165; 520±80 BP) suggests a relatively late Initial Middle Missouri period of site use. Two PVD samples were submitted from component B at the site, these being from the same context, a stratigraphically deep trash filled pit (F 68) beneath a substantial midden deposit. This context was not given a specific component assignment by Caldwell and Jensen (1969:11–12), but its stratigraphic position in the deposits clearly indicates that it should date early in the period of site occupation, presumably with component B. One charred wood sample was submitted from this context, and a second sherd residue sample also was submitted, these providing some check on internal reliability. Unfortunately, the sherd sample (PVD-54) could not be pretreated at the SMU lab and was not submitted for AMS dating, leaving only a single PVD date for evaluation. The conventional date (SMU-2734) is almost 500 years earlier than the SI date from component B (SMU-2734=1002±42 and SI-165=520±80 BP). These two dates obviously do not pass the test of contemporaneity (T'= 25.31, df=1, critical X^2=3.84). If it is assumed that they should be drawn from the same population, component B at the site, then one or both are obviously in error. Subject to further evaluation if the archeological context is clarified, our choice is to accept the SMU-2734 date as the most accurate for the early component at Pretty Head. This date has a calibration curve cross-point of AD 1022 and a 2-sigma range of values from AD 903 to AD 1185.

Cattle Oiler (39ST224) (Initial Middle Missouri)

Cattle Oiler has two components (Initial Middle Missouri and Extended Middle Missouri variants), and five previous dates for the Initial variant component. Three dates have sigmas ranging from 100 to 140 years and are not considered to be useful for dating (SI-316, 317, 318; Table C.2). The remaining two dates (SI-474 and SI-475) do not pass the test of contemporaneity (T'=9.54, df=1, critical X^2=3.84). Both dates are discounted as being unreliable. This leaves no chronometric data for assessment except a single sample run in the present program (ETH-11040) on charred reeds that dates 690±60 BP. Because of the relatively late age for this date and the presence of an Extended Middle Missouri component at the site, its context and association with the Initial Middle Missouri component should be reevaluated if at all possible. This date calibrates to AD 1292 and a 2-sigma probability range of AD 1223 to AD 1407.

Jiggs Thompson B (39LM208) (Initial Middle Missouri)

There are two previous dates from the Initial variant component at this site (Table C.2), but both existing dates (I-1186, 1187) have 120-year sigmas that are considered of little value for the present chronometric analysis. A single charred maize cob sample was dated in the present program, yielding a date of 770±60 BP (ETH-11041). This calibrates to calibration curve intercepts of AD 1265, 1266, and 1277. The 2-sigma probability range is from AD 1128 to AD 1389.

Other Dated Extended Middle Missouri Sites

Havens (32EM1) (Extended Middle Missouri)

Two dates were previously run for this site, but both (M-2362 and 2363) have sigmas of 100 years (Table C.2), eliminating them from further consideration here. Two samples were submitted in the PVD program from the Havens site, these consisting of charred maize cob and cupule fragments from two separate contexts (Table C.1). The resulting dates (ETH-11047 and 11048) pass the test of contemporaneity (T'=0.44, df=1, critical X^2=3.84) and are considered to be reliable. The weighted mean of these two dates is 588±41 BP; this calibrates to calendar age of AD 1332, 1342, and 1396 with a 2-sigma range of AD 1300 to AD 1422.

Paul Brave (32SI4) (Extended Middle Missouri)

Three samples from the Extended Middle Missouri variant type site were submitted as part of the PVD program (DRI-3206, DRI-3207, DRI-3208). All samples are on unidentified wood charcoal from three separate undercut pit features. Two previous dates from the University of Michigan are eliminated because of high 1-sigma errors of 100 years. The three dates pass the test of contemoraneity (T"=1.75, df=2, critical X^2= 5.99). The weighted average of the dates is 744±35 BP. This calibrates to a crossover of AD 1282 and a 2-sigma range of AD 1214 to AD 1302.

Vanderbilt Village (39CA1) (Extended Middle Missouri)

This site lacks any indication of PELTO. There are five dates available, one of which is disregarded because it has a 1-sigma error of 105 years. The remaining dates (UGa-3355, DRI-3113, ETH-16069, ETH-16070) pass the test of contemporaneity (T'=3.54, df=3, critical X^2=7.82) with a weighted average of BP 685±30. A systematic examination of University of Georgia dates from three other sites included in this study (Sommers, Jake White Bull, Whistling Elk) indicates that the Georgia dates are unreliable for a number of reasons. With this in mind, the single Georgia date (UGa-3355) is excluded from this analysis in favor of using the three remaining dates. These three dates pass the test of contemporaneity (T'=1.19, df=2, critical X^2=5.99), yielding an average date of 710±34 BP. When this date is calibrated it gives a crossover date of AD 1288 and a 2-sigma range of AD 1257 to AD 1391.

Calamity Village (39DW231) (Extended Middle Missouri)

A single previous date exists for the Calamity Village site (SI-375; Table C.2). Having a standard error of 200 years, it is considered to be non-useful for dating. Two new samples are dated from this site, one comprised of a carbonized maize cob fragment and the second consisting of charred sherd residues (Tables C.1 and 7). The two dates (ETH-10110 and 10111) pass the test of contemporaneity (T'=2.09, df=1, critical X^2=3.84). Lacking PELTO for the Calamity Village site, it is legitimate to average the two dates for estimation of a calendrical age for the site. The weighted mean is 729±45 BP; this calibrates to a calendar age of AD 1284 and a 2-sigma probability range of AD 1215 to 1389. The sherd residue date from this site is 130 years or about 20% older than the maize date from the site. Because the sherd residue dating is taken as experimental in nature (see later discussion), the maize date might be considered to be the more accurate of the two. This date (BP 665±60) alone (ETH-10111) calibrates at AD 1298 with a 2-sigma probability range of AD 1262 to AD 1411. Although it is a single date, it is currently accepted as the most reliable date from the site.

Sully School (39SL7) (Extended Middle Missouri)

No dates had been run from the Sully School site previous to the PVD program. Two AMS samples were submitted for dating, each consisting of carbonized residues on potsherds. There is no indication of PELTO at this site, and the two dates (ETH-11051 and 11052, Tables C.1 and 7) pass the test for contemporaneity (T'=0.06, df=1, critical X^2=3.84). The weighted mean of these dates is 785±42 BP; this calibrates in calendar age to 1262. The 2-sigma probability range is from AD 1162 to AD 1293. An analysis of ceramic residue and nonresidue dates from four sites (Jake White Bull, Calamity Village, Arzberger, Jones Village) presented later in this chapter indicates that residue dates may be systematically earlier than nonresidue dates. As a result, all residue dates are excluded from further consideration, including the two from Sully School.

Cheyenne River (39ST1) (Extended Middle Missouri)

Three village components are present at this site, an Extended Middle Missouri occupation represented by rectangular houses, and Extended and Post-Contact Coalescent components with circular houses. A review of the maps, aerial photos, and notes available from this site permits the assignment of several excavated house units to the Extended Middle Missouri component. Three different labs had previously run a large series of 10 dates on samples from contexts apparently assigned to the Extended Middle Missouri variant component (Table C.2). Lacking a detailed report on the site, it is assumed that the village as a whole exhibits PELTO, but that subparts of the site assigned to discrete components based upon architectural association do not exhibit PELTO. Therefore, dates from individual components are evaluated with the expectation that they were drawn from a single population.

Three of the existing dates (M-840, I-581, and SI-119) have standard error values of 100 years or greater, and these are not considered further here for reasons stated above. The remaining seven dates are from three different house contexts, and it is of value to evaluate the samples by house context.

Two dates from two different labs (I-582 and SI-116, Table C.2) were run on post material from F 5, an Extended Middle Missouri variant house. These two dates do not pass the test of contemporaneity (T'=17.80, df=1, critical X^2=3.84), and given that these samples are from the same house context, both are dismissed as unreliable.

Four of the five remaining dates are from F 34, an Extended Middle Missouri variant house. A single PVD sample from this same house context is dated (Tables C.2 and 7), and it is of interest to evaluate the dates from this single context. Multiple PVD dates would have been submitted from this context, except that no additional short-lived materials could be located for dating. The four Smithsonian Institution lab dates from this house (SI-12, SI-17, SI-117, and S-118) technically pass the test of contemporaneity at the p=0.05 level, yet the results (T'=7.36, df=3, critical X^2=7.82) indicate that there is only about a 7% chance that the dates as reported reflect the same population. If the single additional SI lab date from this same context (SI-119), previously excluded because of its high standard error value, is re-included then the five SI dates from F 34 fail the test of contemporaneity (T'=14.24, df=4, critical X^2=9.49), this despite the high error factor associated with the fifth date. Together, these results indicate little confidence should be placed in the SI date series from F 34 as a whole, even if the four dates with smaller sigmas pass the test of contemporaneity at the p=0.05 level.

For the sake of further comparisons, the small-sigma SI dates from F 34 (SI-12, 17, 117, and 118) yield a weighted mean of 889±32 BP that is compared statistically with the single PVD date from this same feature (ETH-10413; 675±50 BP). This weighted mean and the single PVD date do not pass the test of contemporaneity (10.68, df=1, critical X^2=3.84), indicating that one or the other should be rejected, lacking PELTO from this context. Given the wide dispersion exhibited by SI lab dates that were compared, only the ETH date is accepted as the best temporal estimate for F 34 within the Cheyenne River site.

A single SI lab date exists that has not been evaluated, this being SI-15 from F24. This context cannot be confirmed to be an Extended Middle Missouri house location. Thus, its association is less that certain. Although an evaluation of SI-15 and the single PVD date, ETH-10413, indicates that they pass the test of contemporaneity (T'=2.24, df=1, critical X^2=3.84), there is a reluctance to give this date equal weight to the ETH date. The preference, given the results of overall assessment of date reliability from various labs, is to use the ETH-10413 date alone as the best estimate of age for the Extended Middle Missouri component at Cheyenne River. This date (675±50 BP) calibrates to a calendar age of AD 1295 and a 2-sigma probability range of AD 1264 to AD 1405.

Black Widow Ridge (39ST203) (Extended Middle Missouri)

Both an Extended Middle Missouri variant component and a Post-Contact Coalescent variant component are present at this site. The site is not reported, and it is assumed that the ceramic sample and dated material that are associated with the Extended Middle Missouri component lack PELTO. Two samples were selected for dating from this site, one comprised of charred maize cob fragments and the second a substantial layer of residue on the interior of a ceramic body sherd. The sample pair was selected to be a clear test comparison of short-lived food remains and what appeared to be well preserved and abundant sherd residue material. Unfortunately, the sherd residue sample could not be pretreated and submitted as originally planned, because of the unanticipated closing of the SMU lab. The charred maize cob fragment was dated, yielding a value of 555±55 BP (ETH-11053; Tables C.1 and 7). This date yields a calibrated age of AD 1409 and a 2-sigma range of dates from AD 1300 to AD 1441 as the best and only estimate for the age of this site.

Terminal Middle Missouri Sites

Shermer (32EM10) (Terminal Middle Missouri)

Two samples were submitted in the PVD program from the Shermer site. The site has not been previously dated. Excavation data from the site (Sperry, 1968b) indicate the occupation may have extended for a few or even several decades, based upon the density of storage pits within some houses, about 1.8 feet of midden in one area, and the extensive rebuilding of houses 4 and 6. The dated samples consist of fragments of charred maize cupules from two subsurface features associated with two different excavated houses at the site (Table C.1). The two dates produced (ETH-11045 and 11046) fail the test of contemporaneity (T'=3.96, df=1, critical X^2=3.84). Two additional dates from the site were obtained in an attempt to clarify its chronological position. These were run on charred wood (DRI-3205) and maize (ETH-16394). The test of contemporaneity was performed on all four dates, resulting in the rejection of the hypothesis that they date the same event (T'=22.09, df= 3, critical X^2=7.82). Because ETH-16394 was much later than the other dates, a remaining portion of the maize used for this date was re-run, producing a later date (ETRH-17511). This date can be substituted for ETH-16394 and averaged with the three other dates. These dates also fail the test of contemporaneity at the 95% level of confidence (T'=11.07, df=3, critical X^2=7.82). An internally consistent set of dates has apparently not been obtained from the site. This may be due to long-term occupation, as suggested by information from excavation.

Initial Coalescent Sites

Arzberger (39HU6) (Initial Coalescent)

The Arzberger site lacks PELTO, so it is anticipated that the dates from it will pass the test of contemporaneity. Two dates previously exist for this location (M-1126 and 1126a), each originally reported at two sigma but listed with their 1-sigma values in Table C.2. Two additional dates were run from Arzberger in the PVD program, one on charred residue on a potsherd and the second on uncharred wild sunflower seeds. One of the Michigan dates (M-1126a) is eliminated from further consideration because of a high 1-sigma error. This leaves a single Michigan date and two PVD dates to be tested for contemporaneity. The test indicated all were drawn from the same population (T'=2.91, df=2, critical X^2=5.99). The two ETH lab dates also pass the test of contemporaneity (T'=1.41, df=1, critical X^2=3.84) and yield a weighted mean of 391±42 BP. A weighted mean of the three dates was computed, yielding a date of 416±37 BP. This calibrates to calendar age of AD 1449 and a 2-sigma probability range of AD 1428 to AD 1628. It is of note that the date on the sherd residue from the Arzberger site (ETH-10114; 440±55 BP) is 100 years or 29% older than the date on short-lived food remains (ETH-11042; 340±60 BP). This general relationship pertains in several other instances in which sherd residues were AMS-dated (see the analysis later in this chapter). As a result of this analysis, all residue dates are excluded from this analysis, including the one from Arzberger. The test of contemporaneity between the two remaining dates (M-1126 and ETH-11042) passes at the 95% probability level (T'=2.62, df=1, critical X^2=3.84) with an average of 400±48 BP. Calibrating this date yields crossover points of AD 1454, 1457, 1478, and a 2-sigma range of AD 1433 to AD 1636.

Lynch (25BD1) (Initial Coalescent)

This is an Initial Coalescent variant site in Nebraska that lacks PELTO. Three dates were run previously on samples from Lynch, and two of these three are dismissed because of large standard errors (M-1127 and M-1128; Table C.2). This leaves a single previous date, M-842, 250±75 BP, for further evaluation. A single PVD date was run for the Lynch site, this being an AMS assessment on charred residue on pottery (ETH-11049; Tables C.1, C.2). This date is quite divergent from the existing Michigan lab date (the former is 780±55 BP). Considered together, these two dates fail the test of contemporaneity (T'=30.48, df=1, critical X^2=3.84). One or both of these dates is undoubtedly inaccurate. The ETH date is much closer to what are considered to be valid dates for the early part of the IC variant in the region (e.g., at Whistling Elk, Table C.2), particularly when sherd residue dates may in fact date systematically 20% to 30% too old (see the discussion at the end of this chapter). With adjustment for this systematic error in the sherd residue date, the age of Lynch might be in the range of 550 to 625 BP. This would place the site around the dates for Whistling Elk and Crow Creek (Table C.3). Thus, the ETH date is considered to be closer to an accurate estimate of the age of the Lynch site. Nonetheless, to be consistent with other decisions made on residue dates in this study, this date is excluded from any further discussion. The single Michigan date is rejected as unrealistically late, leaving the site undated.

Other Extended Coalescent Sites

Demery (39CO1) (Extended Coalescent)

The Demery site is of particular interest because it is the northernmost component of the Extended Coalescent variant, with the possible exception of the Elbee site near the mouth of the Knife River in North Dakota (Woolworth and Wood, 1964; Ahler, 1984a). The ceramic collection from this location also is of interest. Various assessments by Johnson (this report) and Woolworth and Wood (1964) judge the ceramic collections to be typical Extended Coalescent pottery. Surface collections examined by Ahler (admittedly, less intensively and with a less experienced eye) appear to have strong similarities to Extended Middle Missouri pottery, particularly in the high frequency of what appears to be Riggs ware. So, the chronological placement of the Demery site is important to the overall interpretation of cultural change in the area.

A single previous radiocarbon date exists for the site (USGS-168; Table C.2). Two conventional dates were run in the PVD program, consisting of charred wood selected for short-lived small twigs in one sample, and charred maize cobs in the other (SMU-2800 and 2789, respectively; Tables C.2 and C.3). There is no indication of PELTO at the Demery site, so all dates would be expected to pass the test of contemporaneity. The two SMU lab dates do in fact pass the test (T'=0.85, df=1, critical X^2=3.84). All three dates considered together also pass the test (program CALIB 3.0.3 in Stuiver and Reimer, 1993; T'=1.35, df=2, critical X^2=5.99). It is reasonable to compute a weighted mean for all three samples, which is 523±31 BP. This calibrates to a calendrical date of AD 1418 and a 2-sigma probability range of AD 1330 to AD 1442.

Potts Village (39CO19) (Extended Coalescent)

No dates had previously been run for the Potts site. Two AMS dates on maize were run in the PVD program (ETH-10120 and 10121; Tables C.2 and C.3). There is no indication of PELTO for the Potts site, so the expectation is that the two dates are drawn from the same population. These two dates do not pass the test of contemporaneity (program CALIB 3.0.3 in Stuiver and Reimer, 1993; T'=5.07, df=1, critical X^2=3.84). Therefore, both dates are rejected as unreliable.

Meander (39LM201) (Extended Coalescent)

There are no existing dates from the Meander site. Three AMS dates were run in the present program, two on charred maize fragments and third on a charred fruit pit (ETH-10116, 10117, and 10118, respectively; Tables C.2 and C.3). The archeological evidence from the site is too limited to fully evaluate the presence or absence of PELTO. All three dates pass the test of contemporaneity (T'=2.27, df=2, critical X^2=5.99). It is therefore reasonable to average the dates; the weighted mean of 338±33 BP calibrates to a series of four curve intercepts (AD 1524, 1564, 1575, and 1627) and a 2-sigma probability range of AD 1478 to AD 1647.

Hosterman (39PO7) (Extended Coalescent)

No dates had previously been run for the Hosterman site. Charred botanical remains, particularly maize, are abundant in the existing archaeological collections, leading to the expectation that sound dates were possible for this site. PELTO is lacking for Hosterman, with the expectation that all dates derive from a single population. Three conventional samples of charred maize cobs from a single pit feature were dated (SMU-2728, 2731, and 2732), and a single AMS date (ETH-10119) was produced on a charred maize cob fragment from a different pit feature context within the site (Table C.2, Table 7).

The three conventional samples are from successive 0.5 ft thick levels in a single, deep pit feature. They are from a large concentration of corn cobs, and likely were deposited as a single depositional event. It is expected that these three dates would cluster tightly and be drawn from the same population. This expectation is not met. These three dates (SMU-2728, 2731, 2732) fail the test of contemporaneity (T'=36.19, df=2, critical X^2=5.99), and furthermore, the trend in relative ages is directly the opposite of what would be expected based upon their relative stratigraphic position within the pit feature. Therefore, all three of these dates must be rejected as unreliable. An explanation for the variance in the dates is not readily apparent. One possibility is the presence of some form of petroleum-based contaminant in the samples, perhaps in the form of a solvent and hardener applied to the corn cobs. Such a preservative was not visible on the specimens, but use of a chemical hardener may have been deemed appropriate to stabilize the large numbers of exceptionally well-preserved cobs in the samples.

The fourth PVD program date from the site, ETH-10119, 295±55 BP, from a different context, is for the time being treated as the only reliable date from the Hosterman site. It seems inappropriate to compare this date with the other three from the site run by the SMU lab. Should other dates become available from this site, they may prove appropriate for use in tests of reliability. This date calibrates to a calendar age of AD 1643 and a 2-sigma probability range of dates from AD 1450 to AD 1676. For the time being, this is used as the best age estimate for the site although it is very late for an Extended Coalescent site if it extends into the seventeenth century.

Sully (39SL4) (Extended Coalescent)

Excavations at the Sully site, although not reported, seem to document a relatively long and continuous history of occupation by successive Extended Coalescent and Post-Contact Coalescent peoples. This is the picture gleaned through the study of site records, ceramic collections, and a partially completed manuscript on the site and other available information. Therefore, the site as a whole exhibits PELTO. It is most useful, therefore, to attempt to isolate and date discrete components at Sully, components within which it is a reasonable assumption that PELTO is lacking.

No previously run radiocarbon dates are available for the Sully site. Four samples were prepared during the PVD program, and three were dated (Table C.1). Two samples (one conventional sample of charred maize cobs and a second AMS sample of uncharred squash seeds) (SMU-2726 and ETH-10417, respectively; Table C.1) were drawn from individual cache pits in a single excavation context thought to represent a later Extended Coalescent component at the site. In terms of the ceramic ordination to be presented, these two pits fall within the "Middle" component at the site. A single AMS date (ETH-10416) was produced on charred maize from a context also assigned to this middle of three occupational periods at Sully. All three dates pass the test of contemporaneity (T'=2.85, df=2, critical X^2=5.99). The average of these three dates is 337±34 BP, computing to calibration curve intercepts of AD 1525, 1563, and 1628. The 2-sigma probability range is AD 1477 to AD 1648.

Over's La Roche (39ST9) (Extended Coalescent)

This is the final Extended Coalescent site to be considered in the discussion of PVD program results. The site investigator (Hoffman, 1968) chose to divide the several houses excavated at the site into two components, A (later) and B (earlier), both Extended Coalescent components. This distinction is based partly upon architectural evidence, partly on ceramic evidence, and partly on radiocarbon dates from the site. The site was cultivated prior to excavation, and there was no indication of PELTO from any excavated part of the site. For this study, the component separation provided by Hoffman (1968) is used, with the expectation that the radiocarbon dates within each component are drawn from a single population.

Five dates had been run previously on materials from the La Roche site. Three are associated with component B (SI-95, 104, and 169; Table C.2). The SI-169 date is removed from consideration because of the large standard deviation of 120 years, based upon reasoning discussed above. The two remaining dates from component B do not pass the test of contemporaneity (T'=3.89, df=1, critical X^2=3.84). These two dates are therefore rejected as being unreliable.

Three samples were dated from component B in the PVD program, these consisting of charred maize cupules and charred fruit pits (ETH-10414, 10415, and 11039; Tables C.1, C.2, C.3). These dates just pass the test of contemporaneity (T'=5.02, df=2, critical X^2=5.99). A weighted mean is computed for these three dates, 330±32 BP. This calibrates to AD 1528, 1558, and 1631. The 2-sigma probability range varies from AD 1485 to AD 1649. This is the best age estimate for component B at the site.

Two dates were previously run on Component A (Table C.2). These two dates (SI-97 and 106) pass the test of contemporaneity (T'=0.06, df=1, critical X^2=3.84). It is appropriate to average these two dates. Their weighted mean is 301±41 BP. This calibrates to a calendrical age of ca. AD 1641, with a 2-sigma probability range of AD 1484 to AD 1668. This is the best estimate of the calendar age of component A. It is of note that the radiocarbon dates do not reflect any measurable or significant difference in the age of component A and component B, despite the architectural differences associated with this distinction by the site investigator (Hoffman, 1968). A test of contemporaneity between all of the dates from the sites, excluding SI-169 with its 120 year 1-sigma value, supports this conclusion (T'=5.38, df=6, critical X^2=12.59). In this case, the weighted mean of the seven dates is 319±25 BP.

Sites Not Dated by the Plains Village Dating Program

The following sites were not dated by the Plains Village Dating (PVD) program sponsored by the Smithsonian Institution. These sites and their existing date data are included in this evaluation because of their usefulness in assessing the results of the ceramic ordinations that follow this presentation. They also are considered because they help to round out the dating of many components and some taxonomic units not included in the PVD program. All individual dates are listed in Table C.2 and averaged in Table C.3 (Appendix C).

Broken Kettle West (13PM25) (Initial Middle Missouri-Great Oasis)

There are nine dates available from this site, all run by the University of Wisconsin (Table C.2). The site contains a number of rectangular houses; C. Johnson (1974) reported the partial contents of one (house 4). There is no evidence for PELTO at the site, so all nine dates are assumed to be drawn from the same population. These dates fail the test of contemporaneity (T'=21.97, df=8, critical X^2=15.51). Separating the dates by structure (H 2 or H 3) and running and testing for contemporaneity fails to produce two series of dates from either one that passes this test. The final procedure that is carried out with this series of dates is to test for contemporaneity between three dates (Wis 452, 488, 499) from feature 25 within house 3. These three dates pass the test of contemporaneity (T"=1.26, df=2, critical X^2=5.99) and are accepted as the average date (912±34 BP) from the site. Calibrating this date yields correction curve intercepts of AD 1075, 1076, and 1155, and a 2-sigma probability range of AD 1031 to AD 1212 (Table C.3).

Williams (13PM50) (Initial Middle Missouri-Great Oasis)

Two dates are available from this site that lacks evidence for PELTO. When these dates are entered into the CALIB program for testing contemporaneity, they pass with an average date of 889±40 BP (T'=0.00, df=1, critical X^2=3.84). Calibrating this date produces intercepts of AD 1161, 1172, and 1189, and a 2-sigma probability range of AD 1033 to AD 1243.

Larsen (13PM61) (Initial Middle Missouri-Great Oasis)

This site has a ceramic assemblage consisting of a mixture of pottery typically found at Great Oasis and Mill Creek sites (D. R. Henning and King, 1996). It is unclear whether there are two components or a single one represented by a mixture of these ceramics. The evidence suggests that the site does not possess PELTO. As a result, all four available dates were entered into the testing portion of CALIB, passing the test of contemporaneity (T'=0.13. df=3, critical X^2=7.82). This yields an average of 727±30 BP. Entering this date into the CALIB calibrating program yields a calibrated curve intercept of AD 1285 and a 2-sigma probability range of AD 1222 to AD 1386.

Cambria (21BE2) (Initial Middle Missouri-Cambria)

The two dates available from this site have 1-sigma errors in excess of 100 years and therefore were eliminated from any further consideration.

Jones (21BE5) (Initial Middle Missouri-Cambria)

There are five dates available from this site. Three have 1-sigma errors 100 years or greater and can be eliminated from the analysis. The two dates (Beta 83242 and 113877) with 1-sigma errors less than 100 years were entered into the test for contemporaneity. The dates fail this test (T'=3.87, df=1, critical X^2=3.84) and therefore cannot be averaged.

Price (21BE25) (Initial Middle Missouri-Cambria)

There are three dates available from this site, all from a single pit feature. The site lacks evidence of PELTO. These dates pass the test of contemporaneity in the CALIB 3.0.3 program (T'=1.87, df=1, critical X^2=3.84). The average of 910±48 BP yields an intercept of AD 1156 and a 2-sigma probability range of AD 1022 to AD 1256.

Great Oasis (21MU2/17)
(Initial Middle Missouri-Great Oasis)

The two dates from this site, which is designated by two different names and site numbers, appear to be associated with its major component. This Great Oasis component appears to lack PELTO. There is evidence to suggest that the site was much less intensively occupied by Late Woodland and Cambria peoples, although no comprehensive report is available to evaluate the overall occupational history of the site (Anfinson, 1987:161–164). The two dates from the site pass the test of contemporaneity (T'=0.65, df=1, critical X^2=3.84), indicating that they can be averaged together to produce a composite date. This date (1015±47 BP) produces a calibration curve intercept of AD 1020 and a 2-sigma probability range of AD 899 to AD 1158.

Packer (25SM9) (Initial Middle Missouri-Great Oasis)

Three dates are available from a single storage pit from this site. As a result, the dates are taken as representing a short-term occupation. All other evidence from the site suggests an absence of PELTO, although there are Woodland and Central Plains tradition components present. The test for contemporaneity between the dates indicates that they can be averaged (T'=0.47, df=2, critical X^2=5.99). This date, AD 937±42, when entered into the calibration portion of CALIB yields intercepts of AD 1057, 1088, 1121, 1139, and 1151. The 2-sigma probability range is AD 1022 to AD 1208.

Crow Creek (39BF11)
(Initial Middle Missouri, Initial Coalescent)

This site contains an Initial Middle Missouri and Initial Coalesecent component. Both components lack evidence of PELTO. Three dates are available from the Initial Middle Missouri occupation. One of these dates (M-836) has a 1-sigma value of 100 years and is eliminated from further consideration. The remaining two dates pass the test of contemporaneity (T'= 0.18, df=1, critical X^2=3.84), indicating that they can be pooled together to form a composite date of 875±59 BP. Calibrating this date produces intercepts of AD 1164, 1167, 1194, 1198, and 1207, and a 2-sigma probability range of AD 1030 to AD 1276.

Two dates are associated with the Initial Coalescent occupation of the site (M-1079a, Wis-1074). When tested for contemporaneity, both dates are drawn from the same population (T'= 0.26, df=1, critical X^2=3.84). The weighted average (592±47 BP) corrects to calibration curve intercepts of AD 1331, 1343, and 1394, and a 2-sigma probability range of AD 1297 to AD 1423.

Swanson (39BR16) (Initial Middle Missouri)

By most criteria (thick middens, multiple superimposed features), this site lacks PELTO. There is some evidence to suggest that several house-building episodes occurred at the site, although the period is unknown (Hurt, 1951:3). This includes the re-use of posts from earlier houses in the construction of later ones. The 13 dates from the Swanson site represent one of the largest series available from the subarea. One date, M-839, has a 1-sigma error of 125 years and is eliminated from further consideration. When entered into CALIB's date averaging program, the remaining 12 dates fail the test of contemporaneity (T'=85.52, df=11, critical X^2=19.68). Dividing them by provenience unit (houses 1 and 2) also suggests that the dates within each of the two structures were drawn from a different population and cannot be averaged. A further subdivision is accomplished by testing for contemporaneity between dates from the same posts within H 2. Three dates each are available from post C (Wis-526, 553, 660) and post D (Wis-524, 551, 650) within H 2. The post C dates pass the test of contemporeneity (T'=2.82, df=2, critical X^2=5.99), yielding an average of 891± 34 BP, curve intercepts of AD 1160, 1173, and 1188, and a 2-sigma range of AD 1033 to AD 1256. The post D dates also pass the test of contemporaneity (T'=.04, df=3, critical X^2= 7.82). A weighted average of these dates yields a value of 1090±39 BP, that translates into a calibrated intercept of AD 984 and a 2-sigma range of AD 877 to AD 1024.

There is no overlap in the 2-sigma ranges between these two series of dates and the intercept values differ by about 200 years. This suggests that there is a strong possibility that the posts used to construct H 2 are of different ages. The present tentative interpretation is to view post D as aged wood from either a previously occupied house or from another source. Post C might represent the true age of the structure. For now, both series of dates are accepted for the village, suggesting that it was occupied on at least two occasions.

Arp (39BR101) (Initial Middle Missouri)

The two dates from this site have 1-sigma errors of 100 years or greater and are eliminated from further consideration.

Mitchell (39DV2) (Initial Middle Missouri)

This site apparently has PELTO based upon excavations in 1996 (see Winham, 1996). Parts of the village have some midden accumulation attributable to intentional banking of deposits against the sides of houses (Baerreis and Alex, 1974:144–145). There are 10 dates available from the site from varying contexts, most from H 4. It is assumed that these dates are from a single, relatively short-term event associated with the occupation of the house. Considering all dates, a run through the test of contemporaneity portion of the CALIB program fails to indicate that they were drawn from the same event (T'=23.92, df=9, critical X^2=16.92). There also is no apparent trend in the dates and their depth below the surface within H 4. There is no rationale for testing two or more dates from H 4 based upon the currently available information from the site (there is no comprehensive report of excavations at the site). The earliest and most divergent date of the series (Wis-570) is based upon willow wands, a short-lived material expected to date later than the wood charcoal dates. It was decided to arbitrarily exclude Wis-570 from consideration, realizing that this is not a completely acceptable procedure. In reality, this rejected date may be more closely tied to the occupation of the site, based as it is upon a short-lived material. The test of contemporaneity of the remaining nine dates results in accepting them as dating the same event (T'=12.39, df=8, critical X^2=15.51). The weighted average of these dates is 908±20 BP, not very different when all 10 dates were averaged (887±19 BP). When the former average is calibrated, it results in an intercept of AD 1156 with a 2-sigma probability range of AD 1036 to AD 1212.

St. John (39HU213) (Initial Middle Missouri-Great Oasis)

Only one date is available from this site (1180±60 BP). It corrects to an intercept of AD 881 and a 2-sigma probability range of AD 692 to AD 990.

Bloom (39HS1) (Initial Middle Missouri)

A single date of 1050±50 BP is available from this site. When calibrated, the date has an intercept of AD 997 and a 2-sigma probability range of AD 885 to AD 1153.

Twelve Mile Creek (39HT1) (Initial Middle Missouri)

This site apparently contains no indication of PELTO, although no formal site report exists. There are two dates available from the site that, when entered into the CALIB program's test of contemporaneity, suggests that they are drawn from separate populations (T'=9.47, df=1, critical X^2=3.84). As a result, they are eliminated from any further consideration in this study.

King (39LM55) (Initial Middle Missouri)

This site lacks any indications of PELTO. Therefore, the two dates are entered into the test of contemporaneity. As a result, both dates are accepted as being drawn from the same population (T'=0.08, df=1, critical X^2=3.84). The averaged date of 842±45 BP has an intercept of AD 1214 and a 2-sigma probability range of AD 1045 to AD 1282.

Antelope Dreamer (39LM146) (Initial Middle Missouri)

There are six dates from this site that lacks evidence for PELTO (Toom, 1990). This series of dates is rather unique for it represents the first attempt in the Middle Missouri subarea to run dates on corn and wood charcoal from the same site. All corn dates are from H 11, whereas the wood charcoal dates are from a different structure, H 15. Toom's (1990, tables 92, 93) segregation of these dates is maintained for the purposes of this report. The test of contemporaneity of the three corn dates (UCR 2308, 2309, 2310) indicates that they are dating the same event (T'=1.08, df=2, critical X^2=5.99) as does the test of the wood charcoal dates (UCR 2311, 2312, 2313) (T'=0.33, df=2, critical X^2=5.99). The average corn date of 704±31 BP calibrates to an intercept of AD 1289 and a 2-sigma range of AD 1261 to AD 1390. The weighted average of the wood charcoal dates is 827±49 BP, yielding an intercept of AD 1227 and a 2-sigma range of AD 1057 to AD 1288. A comparison between these two dated series indicates a difference of about 50 years. When all six dates are combined, they pass the test of contemoraneity (T'=5.82, df=5, X^2=11.10), yielding an average of 740±27 BP. Calibrating this date yields a 2-sigma probability average of AD 1222 to AD 1298 and a curve intercept of AD 1282, the accepted date for this site.

Langdeau (39LM209) (Initial Middle Missouri)

Based upon the description of this site by Caldwell and Jensen (1969:14–26), there is no indication of PELTO. Therefore, all three dates are considered in the test to determine if they are drawn from the same population. When this is done, all pass the test of contemporaneity (T'=2.19, df=2, critical X^2=5.99). The resulting average of 871±37 BP calibrates to curve intercepts of AD 1165, 1195, and 1208, with a 2-sigma probability range of AD 1030 to AD 1263.

Heath (39LN15) (Initial Middle Missouri-Great Oasis)

A single date (I-9499) available from the site is 940±195 BP (Winham, Lueck et al., 1992:80). Because it has a 1-sigma error greater than 100, it is eliminated from further consideration.

Over's La Roche C (39ST9) (Initial Middle Missouri)

This site, together with nearby Bower's La Roche (39ST232), is considered to be a single site complex. A major Extended Coalescent component and a smaller Initial Middle Missouri occupation are present at the site. Two of the three dates associated with the Initial variant component from the site (SI-170, 242) are excluded from further consideration because they possess 1-sigma errors of 100 years or more. This leaves a single date of 570±55 BP to date the Initial Middle Missouri component at the site. By entering this date into the CALIB 3.0.3 program, a calibration curve intercept date of AD 1406, with a 2-sigma range of AD 1299 to AD 1436, was produced. Because this sample is the most recent of all Initial Middle Missouri dates and comes from a site with an extensive Extended Coalescent component, mixture with more recent materials cannot be ruled out.

Breeden (39ST16) (Initial Middle Missouri, Post-Contact Coalescent)

This site contains PELTO in the form of Initial Middle Missouri and Post-Contact Coalescent components. All three dates are associated with the earliest or Initial variant occupation of the site. There is no indication that the Initial Middle Missouri occupation was a particularly lengthy one. Applying the test of contemporaneity to these three dates indicates that they are not drawn from the same population (T'=7.04, d.f=2, critical X^2= 5.99). As a result, the entire series is eliminated from further consideration.

Eagle Feather (39ST228) (Initial Middle Missouri)

A single date from this site, 760±40, is available and corrects to a calendrical age of AD 1279 and a 2-sigma probability of AD 1208 to AD 1378. The site also contains a dated Extended Coalescent component.

Stony Point (39ST235) (Initial Middle Missouri, Post-Contact Coalescent)

Very little is known from this unreported site except that it contains Initial Middle Missouri and Post-Contact

Coalescent components. Two dates (UCR 2314, 2315) are associated with the Initial Middle Missouri occupation that contains no indication of PELTO. A test of contemporaneity between the two dates indicates that they are drawn from the same population or date the same event (T'=3.36, df=2, critical X^2=5.99). The weighted average of the two dates is 774±42 BP, calibrating to intercepts of AD 1264, 1269, and 1276 and a 2-sigma range of AD 1163 to AD 1297. A single date (GX-13406) appears to date the Post-Contact period occupation of the site. This date (295±75 BP), when run through the CALIB program, produces a single calibration curve intercept of AD 1643 and a 2-sigma probability range of AD 1441 to AD 1955.

Clark's Creek (32ME1) (Extended Middle Missouri)

This site lacks any evidence for PELTO. There are three dates available from the site, two of which (M-2366, 2367) are rejected because of 1-sigma errors of 100 years or more. This leaves a single date of 750±50 BP that corrects to a calibration curve intercept of AD 1281 and a 2-sigma probability range of AD 1193 to AD 1389.

White Buffalo Robe (32ME7) (Extended Middle Missouri)

White Buffalo Robe contains Extended Middle Missouri and Post-Contact period, Knife River phase components. The five dates from the relatively short term Extended Middle Missouri occupation are the focus of this evaluation. These dates were included in a previous effort at averaging and calibration (Ahler and Haas, 1993, table 8.3). The dates were entered into the testing portion of the CALIB 3.0.3 program to determine if they were dating the same event. The results suggest that they are indeed drawn from the same population (T'=4.80, df=4, critical X^2=9.49) and can be averaged. The resulting weighted average of 660±28 BP corrects to a calibration curve intercept of AD 1299 and a 2-sigma probability range of AD 1285 to AD 1394.

Bendish (32MO2) (Extended Middle Missouri)

All except one of the four dates from this site were eliminated from further consideration because of 1-sigma errors equal to or greater than 100 years. The single remaining date (730±80 BP) calibrates to an intercept of AD 1284 and a 2-sigma probability range of AD 1155 to AD 1412. A somewhat different approach to dating the site was taken by Thiessen (1995:170–171).

32MO291 (Unclassified/Transitional Extended Middle Missouri–Terminal Middle Missouri)

This site has a ceramic assemblage similar to Huff and Shermer in the Heart region and Scattered Village phase sites located further north in the Knife region (Ahler and Metcalf, 2000:243–245).

Twenty-one dates are available from the site (14 AMS, 7 conventional) and, by a series of analyses, 11 of these were selected by the site investigators as best representing the period of occupation (Ahler and Metcalf, 2000:89–93, table 5.6). Further analysis indicated that these dates document perhaps intermittent occupations extending across decades, from early to late in the AD 1400s (Ahler and Metcalf, 2000:93–98). Although the 11 dates were not drawn from a single population, there is some value to averaging them to arrive at a central tendency to use in the present ceramic ordination study. The weighted average is 471±17 BP. Calibrating this average yields a crossover date of AD 1437 and a 2-sigma range of AD 1413 to AD 1451, the date that is used herein.

Cross Ranch (32OL14) (Extended Middle Missouri)

There are six dates available from this site. GX-19395 and Beta-66015 are from Milepost 28, a subarea within the site. Three (M-2368, M-2369, GX-19395) are eliminated from further consideration because of 1-sigma errors of 100 years or greater. The remaining three dates are tested for their contemporaneity at this site that lacks PELTO. The results of this test indicate that they are drawn from the same population and can be averaged (T'=3.46, df=2, critical X^2=5.99). The weighted mean of these three dates is 613±31 BP that calibrates to intercepts of AD 1328, 1350, and 1391. The 2-sigma probability range is AD 1299 to AD 1407.

Fire Heart Creek (32SI2) (Extended Middle Missouri)

The single date available from this site is one of those from the Smithsonian Institution chronology program (SI-213). When calibrated, the 720±80 BP date yields a curve intercept of AD 1286. There is a 98% chance that the 2-sigma probability places the site in the range of AD 1186 to AD 1412.

Ben Standing Soldier (32SI7) (Extended Middle Missouri)

All seven dates from this site have 1-sigma errors of 150 years and therefore are eliminated from consideration in this study.

South Cannonball (32SI19) (Extended Middle Missouri)

The occupational history of this site was reconstructed by Griffin (1984:108–111), who interpreted it to reflect a series of house rebuilding episodes and/or reoccupations in an attempt to explain the temporal variation in the radiocarbon dates. An examination of the site report indicates that there is little indication for PELTO, despite the interpretation by Griffin. The series of 14 dates from this site represents one of the largest in the Middle Missouri subarea. One of these, I-4205, is eliminated from further consideration because of a 1-sigma error of 100 years. The remaining 13 dates are evaluated in terms of their contemporaneity, resulting in accepting them as being drawn from the same population (T'=18.54, df=12, critical X^2= 21.03). The weighted mean of these dates is 655±20 BP and intercepts the calibration curve at AD 1301, 1374, and 1378. The 2-sigma probability range is AD 1289 to AD 1392. These dates are accepted as an approximate chronological placement for the site.

A somewhat different picture emerges when dates from separate houses are examined. Two dates from H 1 (I-4202, Wis-1103) were tested for contemporaneity, resulting in the conclusion that they are drawn from different populations (T'=6.18, df=1, critical X^2=3.84). Next, the two dates from H 2 are tested for contemporaneity, resulting in the conclusion that they also date different events (T'=5.56, df=1, critical X^2=3.84). Tests of contemporaneity also were conducted for the four remaining houses at the site. Houses 3 (T'=0.01, df=2, critical X^2=5.99), 4 (T'=0.30, df=2, critical X^2=5.99), 5 (T'=0.17, df =1, critical X^2=3.84) and 7 (T'=0.08, df=1, critical X^2=3.84) pass the test of contemporaneity of dates within each house. The weighted averages from these four houses exhibit about a 150-year spread from house 7 (585±51 BP), house 5 (642±58 BP), house 4 (647±43 BP) and house 3 (754±48 BP). The nine dates from these four houses, when tested for contemporaneity, results in accepting all as drawn from the same population (T'=6.67, df=8, critical X^2=15.51). The weighted average of these nine dates is 660±24 BP, only 5 years from the weighted average of the 13 dates discussed above. The approach to average the dates from houses 3, 4, 5 and 7 as outlined above, was advocated by Thiessen (1995:173).

Travis I (39CO213) (Extended Middle Missouri)

Two dates are available from this site that lacks any evidence for PELTO. Both dates are from different features but are identical in value (780±70 BP). Averaging the two dates together yields a value of 780±59 BP that corrects to calibration-curve intercepts of AD 1263, 1273, and 1275, and a 2-sigma probability range of AD 1069 to AD 1387.

Indian Creek (39ST15) (Extended Middle Missouri)

There are four dates (I-18,039, I-18,040, I-18,041, I-18,042) available from this multiple component site. The main component consists of a Post-Contact Coalescent, Bad River phase occupation. There are several houses and a fortification ditch that are attributed to a the earlier Extended Middle Missouri occupation, a component that most likely contained more houses partially obliterated by the later occupation (see Lehmer and Jones, 1968:64–66). The dates (330±80 BP from feature 43, 450±80 BP from feature 30, 300±80 BP from feature 7, 330 ±80 from feature 5) from a relatively tight cluster and are determined to be statistically the same when entered in CALIB for the test of contemporaneity (T"=1.97, df=3, X^2=7.81). This test yields an average of 351±40 BP. Calibrating this gives curve intercepts of AD 1519, 1595, and 1622 with a 2-sigma error range of AD 1452 to AD 1643. These clearly fall outside the range of dates from other Extended Middle sites (AD 1200–1400) and are earlier than the Bad River phase (AD 1650–1785). It is unclear why these dates are so late, although contamination from the later Bad River phase component cannot be eliminated. Based upon these concerns, the dates from the site are excluded from further consideration.

Ketchen (39ST223) (Extended Middle Missouri)

This site lacks PELTO and has four dates associated with it. One of these (SI-378) is excluded from further consideration because of a 1-sigma error of 140 years. The remaining three dates were input into the testing procedure of CALIB 3.0.3, resulting in accepting all of them as dating the same event (T'= 1.86, df=2, critical X^2=5.99). The weighted average of 782± 35 BP has calibration curve intercepts of AD 1263 and AD 1275, and a 2-sigma probability range of AD 1208 to AD 1292.

Durkin (39ST238) (Extended Middle Missouri)

This site also lacks any indication of PELTO. The two dates available from the site, when tested for contemporaneity, indicate that they were drawn from the same population (T'=0.03, df=1, critical X^2=3.84). The weighted average date from the site is 647±42 BP and intercepts the calibration curve at AD 1303, 1372, and 1383. The 2-sigma probability range is AD 1286 to AD 1405.

Whistling Elk (39HU242) (Initial Coalescent)

This Initial Coalescent site is one of a few villages, together with Fay Tolton (39ST11), that is characterized by a very short-term occupation (Steinacher, 1983). Whistling Elk also has a large and somewhat diverse series of dates. The seven UGa dates, when tested for contemporaneity, indicate that they cannot be accepted as dating from the same event (T'=55.52, df= 6, critical X^2=12.59). These results are similar to those arrived at by Toom (pers. comm. to C. Johnson, 1991), suggesting that all but the three University of California-Riverside (UCR) dates be excluded from further consideration. Applying the test of contemporaneity to the three UCR dates indicates that they date the same event (T'=2.44, df=2, critical X^2=5.99). The weighted mean computes to 638±40 BP, calibrating to intercepts of AD 1317, 1370, and 1386. The 2-sigma probability range is AD 1290 to AD 1405.

Elbee (32ME408) (Extended Coalescent-Related)

All indications from this site suggest that it lacks PELTO. Three dates are available from the site, all but one (SMU-797) being rejected by Ahler and Haas (1993, table 8.2). The single acceptable date (440±40 BP), when entered into CALIB 3.0.3, has a calibration curve intercept of AD 1443 and a 2-sigma range of AD 1412 to AD 1624.

Molstad (39DW234) (Extended Coalescent)

There is no evidence from this site to suggest that it was occupied for a lengthy period because it lacks PELTO. Four dates are available from the site, with one being rejected from further consideration because of a 1-sigma error of 100 years. Another (I-721) also is excluded because of possible contamination by modern organic materials (Hoffman, 1967:45). The remaining two dates were entered into the CALIB 3.0.3 program's test of contemporaneity. The results indicate that the two dates are drawn from the same population (T=0.05, df=1, critical X^2= 3.84). The resulting weighted mean of 365±45 BP calibrates to intercepts of AD 1494, 1601, and 1616. The 2-sigma probability range is AD 1448 to AD 1638.

McClure (39HU7) (Extended Coalescent)

The single date from this site is rejected from further consideration because of a 1-sigma error of 140 years.

Little Pumpkin (39HU97) (Extended Coalescent)

Three dates are available from this site that lacks PELTO. One date (SMU-2629) is eliminated from further consideration because of a 1-sigma error of 100 years. The remaining two dates pass the test of contemporaneity, indicating that they date to the same event (T'=1.30, df=1, critical X^2=3.84). The resulting weighted mean (377±44 BP) has a calibration curve intercept of AD 1490 and a 2-sigma probability range of AD 1442 to AD 1637.

Bowman (39HU204) (Extended Coalescent)

A single date from this site run on corn has a "modern" date. Because isotope fractionation was not considered when the date was run, the "modern" determination could be caused by the failure to correct for this factor. In any case, the date is eliminated from further consideration.

39SL24 (Extended Coalescent)

The single date from this site (I-614) has a RCYBP date of 240±80 BP. Entering this date into the calibration program yields a curve intercept date of AD 1660, placing it just outside the acceptable range of the Extended Coalescent variant. The date has a 2-sigma probability range of AD 1489 to AD 1955. If the date is confined to the 81% probability range within the 2-sigma error, an earlier date of AD 1489 to AD 1823 results. The earlier half of this range, up to AD 1650 is acceptable.

Eagle Feather (39ST228) (Extended Coalescent)

The Extended component at this site also containing an Initial Middle Missouri occupation is dated at 340±60 BP (UCR-2448). This translates into calibration curve intercepts of AD 1523, 1565, 1578, and 1627. The 2-sigma range is AD 1442 to AD 1660.

Bower's La Roche (39ST232) (Extended Coalescent)

There are two dates from this site. SI-214 has a 1-sigma error of 210 years, eliminating it from further consideration. The remaining date (SI-215) is 710±90 BP, well outside the range of acceptable dates for the Extended variant of the Coalescent tradition. It also is discounted in any further analysis.

Rattlesnake Keeper (39LM160) (Post-Contact Coalescent)

Three dates are available from this poorly known site that lacks PELTO. Two of the three dates (UCR-2382b,

2382) are rejected because of imprecise BP dates (i.e., <150 years). The remaining date of 210±60 BP has five calibration curve intercepts (AD 1669, 1783, 1797, 1948, and 1952), with a 2-sigma probability range of AD 1528 to AD 1955.

Ghost Lodge (39ST20) (Post-Contact Coalescent)

This site has a single date of 175±80 BP associated with it. This date calibrates to curve intercepts of AD 1678, 1765, 1775, 1805, 1939, and 1954. The 2-sigma probability dates range from AD 1531 to AD 1955.

SUMMARY OF CARBONIZED SHERD RESIDUE DATING

There were four instances in which an AMS date was run on charred organic residues scraped from the surface of a pottery sherd, and for which there is at least one companion AMS date on other material from the same or a closely equivalent within-site context. These situations allow comparison of the results of dating sherd residues with dating of more typical AMS materials, such as charred plant remains.

These instances are listed in Table 9, showing the radiocarbon age of the more typical mean AMS age (or mean age) and the AMS date on charred residues, and the difference between these values in each paired case. Although the number of examples is small, in three of four cases the dates on residues are 20% to 35% older than the companion dates on less experimental AMS material. This suggests that there may be a systematic error in the ages derived from charred residue on pottery, providing a direction for further evaluative studies.

SUMMARY OF PLAINS VILLAGE DATING PROGRAM RESULTS

It is useful to provide a summary of the results of evaluation of the dates produced in the PVD program, as well as the evaluation of previously existing dates. Table 10 gives such a summary, broken down by dating lab and showing the number of dates by lab that are rejected and accepted.

Three kinds of date rejection are listed, deriving from the evaluation process discussed herein. One (R-1) is because of overly large standard errors associated with a date, as reported from the lab. If a standard error of 100 years or greater is reported, the date is dismissed as non-useful. A second type of rejection (R-2) comes from a failure to pass the test for contemporaneity in instances in which more than one date exists from a context lacking PELTO. In this case, the date is rejected as being unreliable, on statistical grounds, in essence having substantially too small an error factor reported with the date based upon relevant archeological evidence. A third type of rejection occurs (R-3) when internal evidence within a series of dates from a single lab indicates they are drawn from the same population, passing the test for reliability, but that external evidence (often in the form of an equally or more compelling series of dates from the same context run by another lab) suggests that the dates from the first lab are inaccurate or invalid (the mean age is not an accurate estimate of actual context age). This occurs in several cases in which a series of dates from more than one lab were run on samples from the same context.

Two kinds of date acceptance occur. The first and more meaningful (A-1) is when multiple dates are run from a single context by a single lab, the context lacks PELTO, and the dates pass the test of contemporaneity. In other words, multiple dates cluster reasonably closely, as would be expected

TABLE 9. Summary comparisons of results of dating pottery sherd residues with more routine AMS dates from the same contexts. (n = number of samples.)

Site	Routine AMS date (n)	Charred sherd residue AMS date (n)	Difference: +=residue older; –=younger	Percentage difference
Jones Village	899 BP (5)	898 BP (1)	–1 year	<–1%
Jake White Bull	720 BP (3)	975 BP (1)	+255 years	+35%
Calamity Village	665 BP (1)	795 BP (1)	+130 years	+20%
Arzberger	340 BP (1)	440 BP (1)	+100 years	+29%

TABLE 10. Evaluation of radiocarbon dates produced in the Plains Village dating program and previously existing dates from the same or different sites as the Plains Village dating program. (R-1=overly large standard error; R-2=failed test of contemporaneity, R-3=dates inaccurate) (Laboratory abbreviations: Beta=Beta Analytic, ETH=ETH-Hoenggerberg, GX=Geochron, I=Isotopes Inc., M=University of Michigan, NWU=Nebraska Wesleyan University, RL=Radiocarbon Ltd., SI=Smithsonian Institution, SMU=Southern Methodist University, UCR=University of California-Riverside, UGa=University of Georgia, USGS=United States Geological Survey, Wis=University of Wisconsin.)

	Rejected dates				Accepted dates			
Dating Lab	**R-1**	**R-2**	**R-3**	**R Total**	**A-1**	**A-2**	**A Total**	**Total**
				PVD Program				
SMU/DRI	0	3	1	4	18	1	19	23
ETH	0	8	6	14	29	8	37	51
PVD subtotal	0	11	7	18	47	9	56	74
Percent subtotal	0%	15%	9%	24%	64%	12%	76%	100%
				Other Dates from PVD Sites				
SI	7	3	5	15	2	0	2	17
NWU	5	5	0	10	0	0	0	10
RL	1	2	7	10	0	0	0	10
M	5	1	0	6	3	0	3	9
UGa	1	3	3	7	0	0	0	7
Beta	0	3	3	6	0	0	0	6
I	3	1	2	6	0	0	0	6
Wis	0	0	0	0	2	0	2	2
USGS	0	0	0	0	1	0	1	1
ETH	0	0	0	0	6	0	6	6
Previous subtotal	22	18	20	60	14	0	14	74
Previous percent	32%	27%	29%	88%	12%	0%	12%	100%
				Other Dates from Non-PVD Sites				
SI	22	0	3	25	5	4	9	34
I	1	3	4	8	3	3	6	14
USGS	0	1	0	1	0	0	0	1
NWU	3	0	1	4	0	1	1	5
UGa	1	9	1	11	0	1	1	12
M	9	1	1	11	2	1	3	14
Wis	0	16	1	17	39	1	40	57
GX	0	3	0	3	0	0	0	3
UCR	0	0	0	0	11	2	13	13
SMU	1	0	0	1	8	0	8	9
Beta	0	0	0	0	0	1	1	1
ETH	0	6	0	6	8	0	8	14
DRI	0	3	1	4	3	0	3	7
Subtotal	37	42	12	95	79	14	93	188
Subtotal percent	23%	20%	7%	50%	42%	8%	50%	

based upon all archaeological evidence. The second and less meaningful acceptance situation (A-2) occurs generally when a single date is run on material from a single context, but there is no internal, statistical way of evaluating either its reliability or accuracy. It is accepted merely because there is no good reason not to. It may be unreliable or inaccurate but it will take additional radiocarbon dates or new archeological information to make such an evaluation.

Dates from Plains Village Dating Sites

Thirteen radiocarbon labs have produced dates that are evaluated in this program. The focus is of course on the SMU, ETH, and DRI lab results (i.e., PVD program dates). In the present context, the SMU and DRI dates are considered as having been produced by a single radiocarbon lab operated by H. Haas, first at Southern Methodist

University in Dallas and later at the Desert Research Institute in Las Vegas.

The PVD Program dating results are quite good, particularly in comparison to previously available dates. Eighty-three percent of the SMU/DRI dates are accepted, with 78% of the full SMU/DRI sample having passed the test of contemporaneity or reliability. Three rejected dates from a single site (Hosterman), possibly resulting from chemical contamination with preservatives, account for all except one of the rejected SMU dates. The ETH lab results are almost as good. Seventy-three percent of the 51 dates run by the ETH lab are found acceptable. Fifty-seven percent of the total ETH set passed the test of reliability. The rejected ETH dates failed the test of reliability or were run on pot residues that occur in small numbers here and there, and present no explainable pattern. Altogether, 56 of 74 dates (76%) produced in the PVD program are considered to be acceptable; 64% of the total date set is accepted after passing the test of reliability.

The evaluation of dates from nine labs and from the same sites for which PVD program dates are available does not fare as well. A total of 74 such dates are examined. Almost 30% of these (N = 22) are dismissed as non-useful because of large reported standard error values (100 years or greater). Eighteen or 24% of these failed the test of contemporaneity (reliability) in contexts where multiple dates exist. A somewhat greater number (N = 20, 27%) are rejected as being inaccurate in situations where other more acceptable dates exist. Only 14 other dates, making up 19% of this full set, are evaluated as statistically reliable and apparently accurate, as well. Overall, then, some 81% of the dates run outside this program are evaluated as unusable for one reason or another.

Although the counts by individual lab for the PVD dated sites are quite small, some apparent patterns are worth noting. A relatively large number of dates from the Smithsonian lab, the Isotopes lab, and the Michigan lab have extra-large standard errors. Half of the evaluated dates from Nebraska Wesleyan University lab also suffer from this limitation, and the other half fail the test of reliability. The majority of dates from the Radiocarbon Limited lab are determined to be reliable (internally consistent) but for various reasons appear to be inaccurate. In general, the RL dates analyzed seem to be older than they should be. All of the dates from the Beta lab and from the University of Georgia lab are evaluated as being statistically inconsistent or inconsistent with other information. These negative findings regarding Beta and UGa dates are consistent with conclusions drawn from analysis of conventional radiocarbon dates produced in the Knife River Indian Villages Program (Ahler and Haas, 1993:129). Operating outside the PVD Program, only the ETH lab produced a considerable number of internally consistent, acceptable dates (the six new dates from Huff reported in Ahler, 2000a). Although other sample sizes are extremely small, it is of note that some labs appear to produce reliable results in relatively high proportions, comparable to the ETH and SMU/DRI dating results. Among these are the Michigan dates (3 of 4 tested for reliability appear acceptable) and the Wisconsin lab (2 of 2 pass the test of reliability). Whether these patterns hold up under more extensive assessment remains to be seen.

Dates from Non–Plains Village Dating Sites

A high, but somewhat smaller rate of rejection is apparent from an examination of dates for sites not dated as part of this program. Half of the existing dates (95 out of 188) are rejected due almost entirely to either high 1-sigma errors (R-1) or lack of internal consistency (R-2). The Smithsonian Institution and Michigan dates account for almost all of the R-1 rejections, whereas the Wis and UGa labs contribute most of the R-2 dates. Almost half of the accepted dates were run by the University of Wisconsin lab that, when compared with its rejection rate, has a relatively high rate of success (40 out of 57 dates run, or 70%). The acceptance rate of the University of California-Riverside lab is a perfect 13 out of 13. The combined Southern Methodist University / Desert Research Institute lab has a high rate of acceptance, with 11 out of 16 (69%) being accepted under the A-1 criterion. The acceptance rate for labs with some of the larger numbers of dates includes: Smithsonian Institution (9 of 34, or 26%), Isotopes, Inc. (8 of 14, or 57%), University of Georgia (1 of 11, or 9%) and the University of Michigan (3 of 14, or 21%).

The PVD program is viewed as a substantial contribution to refined, revised, and reliable dating in the Middle Missouri subarea. The results present a substantial, quantum improvement in the chronometric data-base available for the region. It is anticipated that the net result will have a substantial impact on the overall interpretation of cultural dynamics in the subarea. This is consistent with the views of Shott (1992), who quite aptly noted that one's whole perspective on cultural change and cultural developments is conditioned by understanding of chronology. If major taxonomic units in the regions are viewed, perhaps incorrectly, as being coeval rather than sequential because of a cursory and uncritical evaluation of radiocarbon dates, then one's view of cultural evolution and change will likewise be profoundly affected. Such is the case in the Middle Missouri subarea, where dating results are highly critical to many aspects of higher level archaeological interpretation.

6 Ceramic Ordination Results

GREAT OASIS

The ceramic ordination of Great Oasis components is included within this study because of its suggested influential development of the Initial Middle Missouri variant. The following discussion is a brief outline of Great Oasis taxonomy, origins, and internal cultural developments.

Taxonomy

The earliest Plains villagers in the Middle Missouri subarea were those assigned to the Middle Missouri tradition. Three major taxonomic units are recognized: Initial, Extended, and Terminal variants. The present discussion focuses on the Great Oasis phase of the Initial variant. The Great Oasis phase or aspect as Tiffany (1983:96–98, 1991:187–188) referred to it, is one of a number of spatial divisions within the Initial variant that includes other phases, such as the Little Sioux and Big Sioux (Mill Creek), Cambria, Lower James, Grand Detour, and Anderson. The first three phases, along with Great Oasis, are assigned to the Eastern division of the variant, whereas the rest are included in the Western division (Henning and Henning, 1978:14; Toom, 1992a, 1992b). The Western division includes those sites located on the Missouri River that have traditionally been part of the Initial variant, whereas the Eastern division is more recently included as formal unit. It is clear that several of the Eastern division sites (Mitchell, Twelve Mill Creek, Brandon) were considered to be part of the Middle Missouri tradition from its earliest conception (Lehmer, 1954a:140–143) but were not emphasized later (Lehmer, 1971:97–98). Archaeologists working in Iowa and other parts of the Northeastern Plains expanded the Initial variant to include Mill Creek, Cambria (Tiffany, 1983), and Great Oasis (D. R. Henning, 1971; Henning and Henning, 1978). The addition of Great Oasis, Mill Creek, and Cambria sites is an extension of the Middle Missouri tradition beyond the spatial limits as Lehmer (1971) conceived it. There is some disagreement about whether the Great Oasis and Cambria phases meet the criteria for inclusion within the tradition. An extended discussion of these taxonomic divisions is presented in chapter 2 and later in this chapter.

Origins

There are two basic hypotheses that address the role Great Oasis played in the origin of the Initial Middle Missouri. The first, advocated by Johnston (1967:72), D. R. Henning (1971:126–127; 2001:225–226; E. R. P. Henning, 1981:35), Henning and Henning (1978:12–16), and Anfinson (1997:90; 1998), suggested that Great Oasis was essentially a Late Woodland manifestation that influenced or gave rise to other Initial Middle Missouri phases, such as Mill Creek. Some contemporaneous Great Oasis groups maintained their traditional Woodland lifestyles, whereas others developed into Plains villagers. Tiffany extended this model to include a sequential relationship between Great Oasis and later Cambria and Over focus villages. The second hypothesis, as outlined by Tiffany (1983:94–98), suggested that Mill Creek, Cambria, and Over were derived from a generalized Late Woodland base, including Great Oasis. Initial Middle Missouri manifestations on the Missouri River represent an in situ development from unspecified Late Woodland peoples. In contrast to these hypotheses, Toom (1992b) took a more traditional view (cf. Lehmer, 1971:97–98) that the western division of the Initial Middle Missouri was the result of a migration of eastern Initial variant communities. This topic is discussed in greater detail below.

Internal Development

Although some specialists have assigned Great Oasis to the Initial Middle Missouri (D. R. Henning, 1971; Henning and Henning, 1978; Anfinson, 1979, 1987:159–161), Tiffany (1983:96–97, 1991:188) thought it is a Late Woodland manifestation. Great Oasis is related to other Initial variant units through the Mill Creek culture, and the Cambria and Over phases. Tiffany's (1982:94) argument was that those Great Oasis peoples who changed as the result of the adoption of Mississippian ideas became Mill Creek, Cambria, and Over groups. Great Oasis groups that did not adopt Mississippian traits continued their traditional Woodland lifestyles and disappeared by AD 1100/1200, at least 100 years before Mill Creek, Cambria, and Over ceased as recognizable archeological entities. Anfinson (1987:216–217) thought that Great Oasis developed in central and northwestern Iowa and that the sites in the Prairie-Lake region represent seasonal use of the area from riverine horticultural groups based elsewhere.

Tiffany (1983:97, 1991:188) excluded Great Oasis from the Initial variant of the Middle Missouri tradition for six reasons: (1) Great Oasis sites are located in riverine and lacustrine environments; (2) Great Oasis pottery is unlike that from Initial Middle Missouri sites; (3) Great Oasis sites are unfortified; (4) Great Oasis ceramics lack S-shaped rim forms; (5) Mississippian trade goods and decorative styles occurring after AD 1000 are almost absent from Great Oasis sites; and (6) Great Oasis sites do not contain the bone tool technology found at other Middle Missouri sites. More recent discussions leave the taxonomic assignment of Great Oasis unresolved (Gregg et al., 1996:88; Anfinson, 1997:90; Lensink and Tiffany, 1999). Although it is not the purpose of this study to get into an extended discussion of cultural taxonomy, it is noted that not all Initial and Extended Middle Missouri sites are fortified (see Toom, 1992a, table 3.2, 1992b, table 3). The Great Oasis component from the Oldham site is an apparent fortified earthlodge village (Smithsonian Institution, 1954:77; Huscher, 1957). At this time, it appears that some Great Oasis groups were hunter-gatherers, whereas others, particularly those along the Missouri River, were fully horticultural. The lack of corn and other cultigens from Great Oasis sites may be more a reflection of the recovery techniques used; recent excavations have recovered corn, corn cobs, and cupules (Haberman, 1993:110; Benn, 1995; Tiffany et al., 1998:98). Given the widespread distribution of Great Oasis in a number of settings, it might be better to consider it as a horizon marked by a distinctive way of decorating pottery, rather than as a more overall encompassing lifeway.

There are several examples of continuity between Great Oasis and other Initial variant bone tool assemblages, both from multi-component sites. These are the bison scapula hoes with holes drilled through their glenoid cavities from the Hitchell (Johnston, 1967:71) and Oldham sites. The latter site is unreported, although a summary of the excavations appears in Huscher (1957). An examination by this author of the bison scapula hoes from the site indicates there are about 24 with holes drilled in the glenoid cavity, similar to those from other Initial variant components (Lehmer, 1971, fig. 55). These are undoubtedly associated with the extensive Great Oasis occupation at the site, establishing a link between Great Oasis and the Western division Initial variant villages. A similar association of these hoes and Great Oasis occurs at the Hitchell site (Johnston, 1967:69, 71). Johnston (1967:72) and D. R. Henning, (1971:127) believed that the Hitchell site represents an early developmental stage of the Middle Missouri tradition. The presence of these scapula tools also probably indicates that at least some Great Oasis peoples practiced horticulture, in agreement with Haberman (1993:110) but contrary to statements by Alex (1981a:35) and Edwards (1993:23).

The purpose of this discussion of the taxonomic placement of Great Oasis is to illustrate the point that the Great Oasis phase is poorly known, despite the volume of general overview material written about it. Of the 10 major excavated Great Oasis sites (Great Oasis, Broken Kettle West, Williams, Larsen, Ferber, Packer, Heath, Hitchell, Oldham, Gavins Point), only three are fully reported (Hitchell, Larsen, Williams). The remaining, including the type site, are in various states of completion, whereas others, such as Oldham, are virtually unknown. Without a full reporting of these and other Great Oasis sites, any definitive statements about the phase are premature and cannot be independently evaluated. Gibbon (1993:182) pointed out the lack of comprehensive reports of Great Oasis sites.

Demise

As the above summary indicates, Great Oasis is thought to have contributed to the development of the Cambria, Mill Creek, and Over complexes as a result of the adoption of Mississippian cultural traits. Other groups or bands more resistant to these influences from the east continued Woodland lifestyles (Anfinson, 1979:90) and are essentially unaccounted for in any subsequent Plains Village developments. They were possibly driven from southwestern Minnesota, along with Cambria peoples, into the Middle Missouri subarea by the Oneota expansion in AD 1200 to AD 1300 (Gibbon, 1993:182–183).

Radiocarbon Dates

The series of 21 radiocarbon dates from six Great Oasis components is plotted in Figure 6 yielding a range from about AD 950 to AD 1300 (95% level of confidence) if an apparently aberrant single date from the St. John site is excluded. All probabilities within the two sigma range of 0.10 or greater are plotted in this and other figures in this report. Probabilities less than 0.10 are not considered, in order to eliminate outlying values. Eliminating the Larsen site, interpreted as a contemporary occupation by both Great Oasis and Mill Creek (D. R. Henning, 1998) but separate occupations by Tiffany et al. (1998), yields a maximum range of about AD 950 to AD 1250. Inclusion of other Great Oasis dates not included in the present study (Henning and Henning, 1978, table 1) does little to change this range. The AD 1250 date is 150 years beyond the accepted terminal date of AD 1100 suggested by Tiffany (1983:97, 1991:188) and Tiffany et al. (1998:96) and very near the date of AD 1300 for the end of the Initial Middle Missouri. The temporal span of Great Oasis proposed by Lensink (1996) of AD 975 to AD 1050 is considerably earlier, although it is based upon only sites in Iowa. Mill Creek developments date to AD 1050 to AD 1250/1300 (Lensink, 1996). The role that Great Oasis and Mill Creek played in the development of the Initial variant of the Middle Missouri tradition becomes clearer with the ensuing discussion. At this time, it is concluded that the available evidence tends to support the hypothesis that Great Oasis was contemporaneous with other Initial Middle Missouri sites and persisted for almost the entire range of the variant. As a consequence, Great Oasis cannot be viewed as a direct development into any other Initial variant taxon at this time.

Analysis

A detrended correspondence analysis (DCA) of 12 Great Oasis components, which was based upon the frequencies of 21 descriptive rim sherd categories, was performed for this study. All default program parameters are employed, meaning that four axes are extracted and rescaled, there was no down weighting of rarely occurring rim sherd categories, and detrending is accomplished in 26 segments. These default options are used in all subsequent DCA ordinations presented in this study. The data matrix of components and rim sherd categories appears in Appendix A (Table A.1). The output of this and all subsequent DCA lists the scores each component and rim sherd category have on the four axes. The scores for the Great Oasis DCA are presented in Table 11. It is clear from Table 11 that the first axis extracted accounts for 0.327 of the variance in the data matrix or 83% of the variation extracted by all four axes ($0.327/0.396 \times 100$). The second axis accounts for 14% of the variation of the four axes.

A plot of the component and descriptive rim sherd categories on axes 1 and 2 appears in Figure 7. The axes are scaled along the scores for the components. Because the original output of these and the rim sherd categories does not include decimal points, they are added two places to the left in this figure and all subsequent analysis presented in this study. Because DCA simultaneously scores both components and ceramic descriptive categories, the descriptive rim sherd categories also are plotted in Figure 7. The axes in Figure 7 are based upon component scores; the scores of the rim sherd categories are rescaled by hand calculations to the same scale range as the components. This procedure is accomplished to aid in the interpretation of the analysis by directly relating the plot of components to the descriptive rim sherd categories that most characterize each of them. In other words, a component

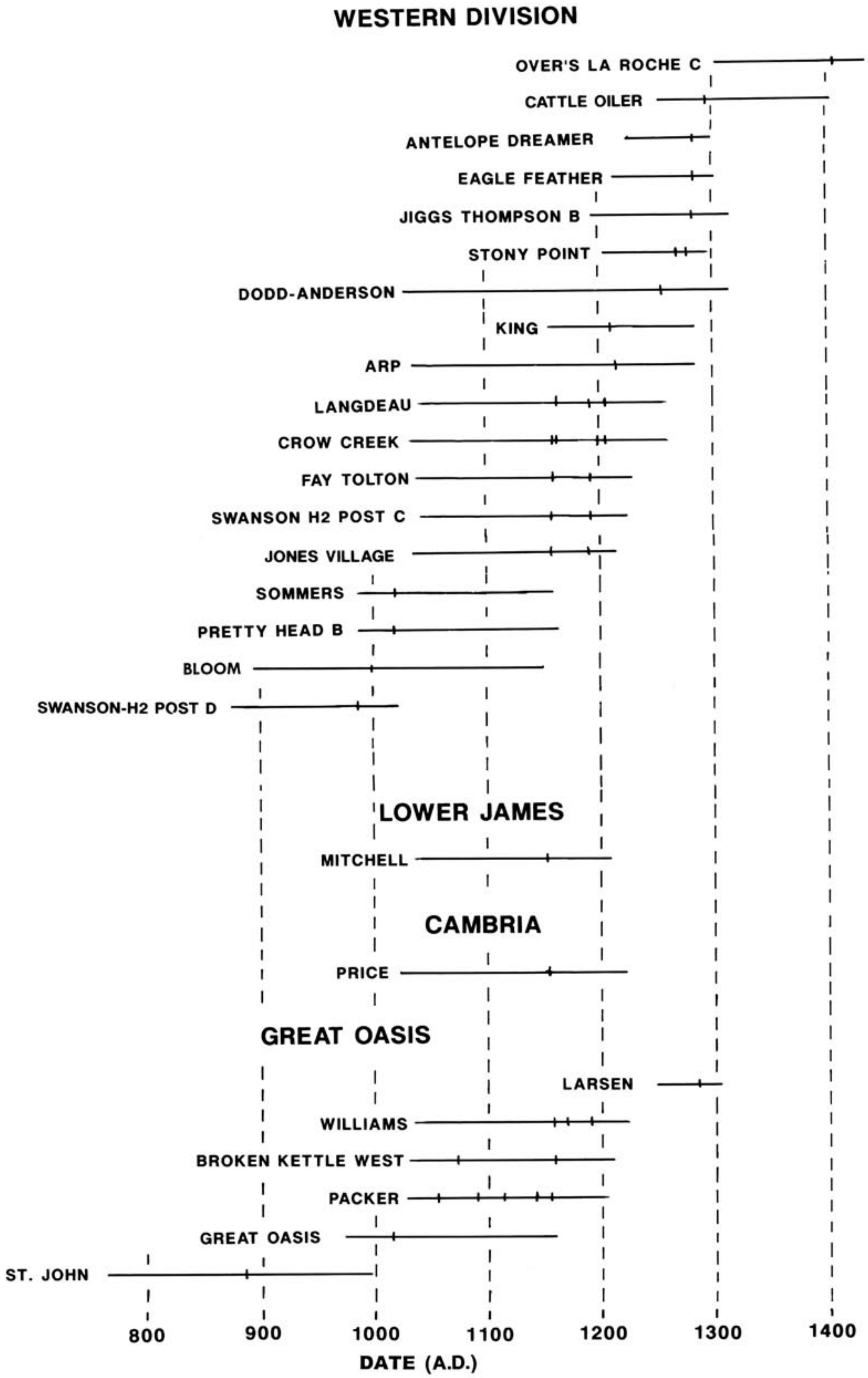

FIGURE 6. Plot of calibrated radiocarbon date ranges from Initial Middle Missouri variant components based on the decadal calibration curve (Stuiver and Becker, 1993) as implemented in CALIB 3.0.3 (Stuiver and Reamer, 1993).

TABLE 11. Site component and ceramic type scores from the detrended correspondence analysis of Great Oasis components.

Component or type	Axis 1	Axis 2	Axis 3	Axis 4
Broken Kettle West (13PM25)	1.55	0.15	0.24	0.15
Williams (13PM60)	1.20	0.35	0.35	0.26
Larsen (13PM61)	1.96	0.56	0.55	0.00
Great Oasis (21MU2)	0.17	0.17	0.41	0.02
Ferber (25CD10)	0.56	0.00	0.19	0.16
Packer (25SM9)	0.00	0.86	0.00	0.93
Heath (39LN15)	0.49	0.13	0.13	0.38
Oldham (39CH7)	0.65	0.87	0.69	0.74
Hitchell (39CH45)	0.70	0.21	0.00	0.15
39CH205	0.93	0.39	0.36	0.43
St. John (39HU213)	0.69	0.49	0.28	0.60
Gavins Point (39YK203)	0.35	0.60	0.20	0.62
Straight Triangle/Horizontal Incised	0.02	0.98	0.92	0.90
Straight Pendant Triangle/Horizontal Incised	2.05	1.17	1.41	–0.02
Straight Pendant Triangle/Diagonal Incised	1.97	–0.94	1.77	–2.49
Straight Horizontal Incised	–0.40	0.67	–1.03	0.87
Straight Tool/Finger Impressed Lip	2.03	1.01	0.25	–0.09
Straight Cross-Hatch Incised Lip	3.51	0.74	0.74	0.56
Straight Undecorated	1.20	–0.55	0.08	–0.07
Straight Chevron Incised	0.50	–0.28	1.50	–1.41
Straight Chevron Horizontal Incised	0.78	2.69	2.91	2.40
Straight Cross-Hatch, Horizontal/Diagonal Incised	1.10	–2.26	0.50	–0.23
Straight Spaced Horizontal/Diagonal Incised	–0.92	–0.64	1.69	–1.87
Straight Criss-Cross Horizontal Incised	–0.91	–1.31	1.40	–2.06
Straight Flag and Dot Horizontal Incised	2.57	0.70	–0.19	1.53
Straight Trapezoid/Horizontal Incised	2.61	0.63	0.90	0.20
Straight Triangle/Horizontal Cord Impressed	0.19	2.77	1.25	2.81
Straight Pendant Triangle/Horizontal Cord Impressed	0.73	3.00	3.07	1.91
Straight Pendant Triangle/Diagonal Cord Impressed	0.42	2.94	2.39	2.50
Straight Horizontal Cord Impressed	0.23	2.51	1.68	3.53
S-shaped Triangle/Horizontal Incised	2.88	1.16	1.35	0.67
S-shaped Horizontal Incised	0.72	2.73	3.04	2.82
S-shaped Horizontal Cord Impressed	0.73	3.00	3.07	1.91
Eigenvalues	0.327	0.054	0.013	0.002

that is plotted near a particular rim sherd category means that the component has a relatively high frequency of the rim sherd category compared with others in the analysis. A similar procedure of plotting components and artifact types is presented in Bolviken et al. (1982). An alternative procedure is to make separate plots of cases and variables, as illustrated by Warren (1991, fig. 9). Percentages are included along with frequencies in Table A.1 as an approximate measure of the relative frequency of rim sherd categories contained within each component.

Four groups of components are defined in Figure 7, corresponding to their location. One group, located along tributaries of the Big Sioux River in northwestern Iowa (Figure 2), consists of the Larsen, Broken Kettle West, and Williams sites. These components generally contain relatively large numbers of straight rims decorated with incised pendant triangle motifs, and incised flag-and-dot and trapezoids. Straight rims decorated on the lip or lip margins with tool or finger impressions, or with crosshatched incising also are relatively common. One component (Williams) has

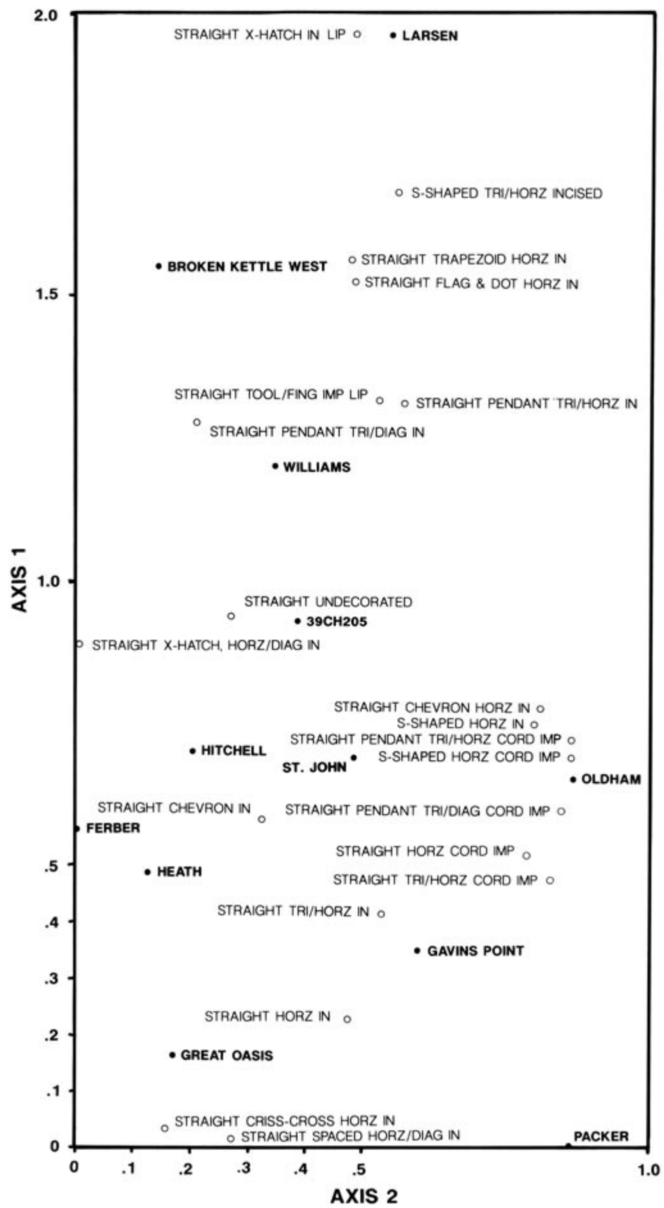

FIGURE 7. Plot of Great Oasis components and descriptive rim sherd categories on Axis 1 and Axis 2, detrended correspondence analysis ordination.

a relatively high number of S-shaped rims with horizontal and/or triangular motifs. The ceramic assemblages from these sites, although retaining the distinctive Great Oasis incised pottery, contain elements similar to Mill Creek sites, including high numbers of short curved or straight (i.e., wedge-shaped) rims reminiscent of Sanford ware and straight rims incised with pendant triangular motifs, such as Chamberlain ware. This is most apparent in the assemblage from the Larsen site, with its unusual mix of Chamberlain and Great Oasis types (Edwards, 1993:21–22; D. R. Henning and King, 1996).

A second group of components consists of four sites located along the Missouri River from the Big Bend to Fort Randall dams in southern South Dakota. From north to south these are the St. John, 39CH205, Oldham, and Hitchell sites. Pottery with incised, triangular, zigzag motifs on a horizontal field are common, as are those with a simple, incised, horizontal motif. The substantial numbers of undecorated rims from these sites tend to be the somewhat taller straight varieties, unlike their Big Sioux locality short curved (wedge-shaped) counterparts. The incised rims also are of moderate height and tend to be shorter than the decorated types from other localities. A number of minor descriptive categories also are associated with this group, almost all found at the Oldham site. These include several S-shaped types and five straight varieties decorated with cord impressions.

The third group of components includes the Great Oasis, Heath, Gavins Point, and Ferber sites. Like the previous group, they usually contain high frequencies of straight rims incised with triangular zigzag motifs on horizontal lines, incised horizontal lines, and straight undecorated rims. Two minor incised motifs occurring on straight rims occur in these assemblages, the criss-cross and spaced diagonal lines on horizontal fields. These are motifs that are most common in the Great Oasis type site assemblage. The incised criss-cross motif is similar to cord-impressed patterns found on Late Woodland pottery in Iowa (Benn, 1995, fig. 3a,b). It also is interesting to note that despite the proximity of Ferber and Gavins Point to the Big Sioux sites (Larsen, Broken Kettle West, Williams), they are most similar to the Great Oasis and Heath components, located a greater distance to the northeast.

The Packer site, located in east central Nebraska some distance from the others, has a somewhat unique ceramic assemblage. It shares with other Great Oasis sites a large number of straight rims decorated with incised lines in triangular (zigzag) pattern instead of horizontal lines. It differs from the others in its small numbers of straight undecorated rims and high frequencies of horizontally incised straight rims. The decorated rims from this site also tend to be rather high and curved compared with other Great Oasis assemblages.

A comparison of the available radiocarbon dates from six of the components included within the ceramic analysis suggests that there may be a relationship between the temporal placement of the components and their positions along axis 2. Components with low scores on axis 2 may predate those with higher values. Table C.3 (Appendix C) lists the averaged corrected radiocarbon dates for the components. The crossover points and spans of these dates for each component are included in Figure 6. Considering the Big Sioux Great Oasis sequence, Broken Kettle West has the lowest score on axis 2 and also is the earliest, at AD 1045 to AD 1146, followed by Williams (AD 1122–1221), and Larsen (AD 1242–1305) that have higher scores on this axis. There is, however, a considerable amount of overlap in the radiocarbon ranges of Broken Kettle West and Williams. If this sequence is correct, then the percentage of undecorated straight rims decreases through time, similar to the stratigraphic sequence for Sanford Plain rims at the nearby Kimball Mill Creek site (Ives, 1962, fig. 1). Straight rims with tool- or finger-impressed lips increases from Broken Kettle to Larsen, as do straight rims with horizontally incised pendant triangles. This also is true of all S-shaped rims, which tend to occur rather late, especially in sites located along the Missouri River.

There are two series of dates available from a second group of components, consisting of the Heath, Great Oasis, Gavins Point, and Packer sites. Great Oasis has a date range of AD 961 to AD 1161, whereas Packer dates to AD 1021 to AD 1201. Although there is considerable overlap, an examination of the high p values for the 68.3% probability dates (Table C.1) suggests very little overlap in the dating of the two sites. A comparison of these dates with their placement in Figure 7 suggests that like the Big Sioux sequence, scores on axis 2 decrease with increasing age. The position of ceramic types in Figure 7 and an examination of their percentages in Table A.1 suggests that straight rims decorated with triangular/horizontal or horizontal incisions increase in latter components, whereas those with pendant triangular/horizontal or criss-cross/horizontal incisions exhibit the opposite temporal trend. Straight undecorated rims decrease in popularity with increasing age, whereas the opposite is true of straight rims with tool/finger-impressed lips, similar to the Big Sioux Mill Creek sequence. Most of these trends are extended to the other two components in this group, Heath and Gavins Point, although there are some exceptions.

In summary, this analysis supports the conclusion that most of the variation in Great Oasis pottery is related to regional diversity, as Henning and Henning (1978:15) suggested. This is not unexpected, given the broad geographic spread of the sites. The greatest component of variability is along axis 1, which separates sites into four groups: Big Sioux River tributaries, Missouri River in South Dakota, southwestern Minnesota-southeastern South Dakota-northeastern Nebraska, and east-central Nebraska. Axis 2 may be related to time, but only when each group of components is considered separately; there are no strong temporal trends in the Great Oasis potting tradition that transcend its apparent spatial divisions. The Great Oasis pottery from villages in the Big Sioux locality bears strong similarities to the local Mill Creek potting tradition with its emphasis on low rims decorated on or about the lip (Sanford ware). Great Oasis sites along the Missouri River, particularly the Oldham site, with their higher percentages of cord-impressed decorations and S-shaped rim forms link them to the western Initial Middle Missouri developments.

Chapter 7 is an attempt to synthesize all of the Plains Village developmental sequences from the Middle Missouri subarea. Somewhat arbitrary time periods of 100 years duration are used for both Initial and Extended variants of the Middle Missouri tradition. These periods are as follows: period 1 (AD 1000–1100), period 2 (AD 1100–1200), period 3 (AD 1200–1300), and period 4 (AD 1300–1400). Constructing such a sequence requires assigning dates to as many components as possible. The following assignments for the five dated Great Oasis components are made according to a variety of criteria, including calibration curve intercepts, highest probability ranges, and greatest date ranges. Period 1 components include Great Oasis, Broken Kettle West, and Packer, whereas Williams is assigned to period 2. Broken Kettle West and Packer also are placed in period 2, given the uncertainty in dating. The Larsen site falls within period 3. The undated components, particularly those along the Missouri River, present a problem. Based upon their scores on axis 2, Heath and Gavins Point are tentatively assigned to periods 1 and 2, respectively. Similarly, Hitchell is provisionally assigned to period 1, and St. John and 39CH205 placed in period 2. Oldham is placed within period 3.

Craniometric Distance

Craniometric studies employing Great Oasis human skeletal remains are relatively uncommon, given the paucity of this material from excavated sites. Only one cranium, from the Oldham site, is available from the components used in this study. This excludes any comparisons of orderings that used ceramics and skeletal remains. It is useful, however, to explore the broader relationships between Great Oasis and other cultural units, presented by Key (1983:71–83, 92–98, 1994). Key's analysis included samples from the Ryan and Whitten sites in Nebraska, and Oldham and Arbor Hill in South Dakota. When the Great Oasis sample is included with other Plains Woodland components, it is most similar to the Valley focus and Devils Lake-Sourisford groups. The inclusion of the Great Oasis sample with Middle Missouri tradition components results in an affinity with Mill Creek (Broken Kettle, Kimball sites) and the Anderson phase (Fay Tolton, Breeden A) (Key, 1983, fig. 17). Inclusion of Great Oasis with Key's (1983, fig. 22) full skeletal sample indicates relationships with the Middle Woodland Keith phase, Ioway Oneota, and several Middle Missouri tradition phases (Grand Detour, Over, Fort Yates). Key's (1994, fig. 7) latest analysis of Great Oasis crania placed them nearest the Mill Creek sample. Blakeslee (1994:19) interpreted this relationship as supporting the hypothesis that Great Oasis gave rise to Mill Creek, although Key prefers to see the relationship as one of mutual interaction.

INITIAL MIDDLE MISSOURI

To understand the following discussion of the origins, development, and demise of the Initial Middle Missouri, a brief summary of the cultural taxonomy of the variant is presented. The emphasis is on the most current, but not necessarily the most widely accepted taxonomy; previous formulations were discussed in chapter 2.

Taxonomy

Tiffany (1982, 1983) proposed the latest and most comprehensive taxonomy. Expanding on Henning and Henning's (1978:14) earlier differentiation of eastern and western divisions of the Initial Middle Missouri, Tiffany proposed a Chamberlain and Mill Creek variant to replace the Initial variant. He dropped the term "variant" for the Initial Middle Missouri, preferring instead to assign these two newly defined variants to the Early Period of the Middle Missouri tradition. A developmental sequence is envisioned whereby these Early Period variants are transformed into Middle Period (i.e., Extended Middle Missouri) villages. The taxonomy of these later Middle Missouri villages is discussed in conjunction with the analysis of Extended and Terminal Middle Missouri components to be presented below. Tiffany divided the Chamberlain variant into the Anderson, Grand Detour, and Swanson phases, represented by sites in the Bad-Cheyenne, Lower Brule, and Brule Bottoms localities, respectively. Henning and Toom (2003:211) added the Sommers and Cattle Oiler phases. All of these sites are located along the Missouri River and are referred to as the western division of the Initial Middle Missouri (Henning and Henning, 1978:14; Toom, 1992a, 1992b, 1992c; Wood, 2001:186). Tiffany's Mill Creek variant included sites Henning and Henning (1978:14) placed within the eastern division of the Middle Missouri. Five local phases that overlap in time are recognized within the taxon—Lower James or Over phase in the James River locality, Brandon phase in the Sioux Falls locality, Cambria phase in the Spring Creek locality, Big Sioux phase in the Westfield or Sioux City locality, and the Little Sioux phase in the Little Sioux locality. The Big Sioux and Little Sioux phases retain their status as sole members in the Mill Creek culture. At this time, there are no serious challenges to Tiffany's taxonomy, although D. R. Henning (2001:222) included seven phases in the eastern division of the Initial Middle Missouri (Great Oasis, Big Sioux Mill Creek, Little Sioux Mill Creek, Brandon Over, Lower James Over, Cambria, Perry Creek). This does not mean there is unanimous agreement, only that other specialists consider other problems of more immediate concern.

Origins

The origins, development, and demise of the Initial variant of the Middle Missouri tradition has been a topic of great interest since the early 1950s when Hurt (1951:23, 1953:11, 56, 1954b:1–2) and Spaulding (1956:98) first discussed this topic. It was revived somewhat later with Ives' (1962:34–39) discussion of Mill Creek pottery, Brown's (1967:193) description of the Chapelle Creek site, Wood's (1967:119–122) Huff site report, Caldwell and Jensen's (1969) summary of the Grand Detour phase, and culminating in Lehmer's (1971:66, 97–98) synthesis. All of these researchers pointed out similarities in material content between Great Oasis, Mill Creek, and Cambria sites, and those in South Dakota assigned to the Over focus. The general conclusion is that the Over focus sites of Brandon, Mitchell, Twelve-Mile Creek, and Swanson developed out of the eastern complexes or that they represent a fusion of Great Oasis, Mill Creek, and Cambria with local South Dakota Woodland tradition cultures. In a recent synthesis of the Middle Missouri tradition, Wood (2001:190) theorized that the Initial variant probably developed from a rapid recombination or synthesis of preexisting Late Woodland and perhaps early Great Oasis elements from the Prairie-Plains border. There are no apparent direct relationships between the Initial Middle Missouri and the Central Plains tradition (Terry Steinacher, pers. comm., 1995).

Tiffany's (1982, 1983) summary and revision of the cultural taxonomy of the Mill Creek culture and related units of the Middle Missouri tradition once again stimulated interest in the Initial variant, its taxonomic divisions, and the relationships between these units. His views of the development of Mill Creek are summarized above in the analysis of the Great Oasis components. Citing the earlier work of Alex (1981a:39–40), Tiffany included the Initial Middle Missouri developments along the Missouri River (Chamberlain variant) as stemming out of a local, generalized, Late Woodland base. This hypothesis is similar to the earlier idea of Hurt (1951:23, 1952:32, 1953:11, 50, 56, 1954b:3), who noted similarities between Plains Village (Over focus) pottery and Late Woodland Ellis Cord-impressed and Randall Incised ceramics. Spaulding (1956:96–97), Ives (1962:36), Johnston (1967:71–72), Anderson (1969:139), Caldwell and Jensen (1969:81), Henning and Henning (1978:12, 15), and E. Johnson (1991:316) also discussed the proposition that the various phases of the Initial Middle Missouri developed from, or were influenced by, Late Woodland cultures. In Tiffany's taxonomy, the Mill Creek variant represents a development out of a Late Woodland-Great Oasis base. Peoples of the Mill Creek and Chamberlain variants were later absorbed into indigenous Missouri River groups represented by the Extended Middle Missouri variant.

More recently, Toom (1992b:137–140) reiterated the earlier hypothesis that the first Initial Middle Missouri occupations along the Missouri River were the result of a migration of Initial variant village groups from northwestern Iowa and eastern South Dakota (Mill Creek and other groups). Like others before him, Toom (1992b:141, 154) believed that these villages represent aggregations of Great Oasis and resident Woodland peoples. He believed that the process by which this happened remains elusive. The spread of these villages to the west along the James and Missouri rivers was stimulated by the Neo-Atlantic climatic episode (Caldwell and Jensen, 1969:81; Lehmer, 1970:118, 1971:105; Toom, 1992b:178–180). This migration hypothesis contrasts with Tiffany's model of simultaneous and parallel, in situ, Initial Middle Missouri developments in the west and east. The general lack of research at Late Woodland sites in the Middle Missouri subarea means that it is going to be difficult to resolve this issue. There are a few notable sites present, such as the Hitchell (39CH45), Oldham (39CH7), Scalp Creek (39GR1), and Ellis Creek (39GR2) sites. Because all of these sites are inundated, only the extant collections can be used in exploring the various hypotheses of Initial Middle Missouri origins. These collections also are limited by the general field recovery used during excavation and the mixture of materials between the components. All sites are reported except for Oldham.

An almost ignored hypothesis of Initial Middle Missouri origins was presented by Husted (1969:93–94) and briefly discussed by Lehmer (1971:99). In his report on excavations along the Bighorn River in north-central Wyoming and eastern Montana, Husted proposed that the Avonlea complex played a role in the development of the Initial variant, based upon the presence of Avonlea points at the Cattle Oiler and Breeden sites. Although the Avonlea complex is today considered to be too early for having a developmental role in the Initial Middle Missouri, Husted's hypothesis raised the issue of the relationship between Late Woodland plains complexes and the Middle Missouri tradition. More recently, Ahler, Falk et al. (1982:247–258) and Ahler (1993b:65) have renewed interest in the role Late Woodland developments played in the origins of the Middle Missouri tradition. A link is made between the Menoken (32BL2) and Jones Village (39CA3) sites, suggesting that the Initial Middle Missouri played a role in the transition from a Late Woodland to Plains Village life in North Dakota (Ahler, 1999:11.1; C. Johnson, 2007). If this is true, then the rise of a Plains Village way of life was not always one of gradual adoption of horticulture by Woodland groups but occurred rather rapidly in the opposite direction (i.e., influence of Plains villagers on Woodland peoples). More recently, Ahler (2003a:574) proposed that the Plains Village tradition in the vicinity of the Menoken site in North Dakota developed rather abruptly out of a local, indigenous, Late Woodland base through the adoption of maize/ beans/squash horticulture. This topic is discussed in more detail in the origins of the Extended Middle Missouri.

Internal Development

The internal dynamics of Initial Middle Missouri cultural development also has been a topic of debate since the 1960s. Much of this research focuses on changes in Mill Creek culture brought about by five factors or "prime movers," as Anderson (1987:528) called them: (1) Mississippian contacts; (2) contacts with Initial Middle Missouri villages in South Dakota; (3) climatic change during the Pacific episode beginning about AD 1200 making gardening more difficult, resulting in more frequent village relocation, and increasing dependence on bison; (4) the decline of Cahokia and an end to their symbiotic extractive and spiritual relationship with its most important trading partner; and (5) Oneota expansion resulting in greater competition and aggregation of Mill Creek villages. Anderson (1987:530–531) postulated that during the Neo-Atlantic climatic episode there was a budding off of villages that initially occupied somewhat marginal horticultural lands. This may be the process by which some of these village groups expanded into the South Dakota plains and eventually onto the Missouri River, as implied by the east to west migration hypothesis. Anderson (1987:529, 531) made no reference to such an expansion, preferring to view these budded Mill Creek villages as eventually consolidating back into fortified hamlets during the Pacific episode.

The migration model, as stated by Toom (1992b:155–156), may be used to account for isolated pockets of villages separated by large distances of undesirable territory by alluding to the process of "leapfrogging." This is the pattern exhibited by the lower James River villages that are intermediate in location between the Mill Creek villages and those on the Missouri River. The four villages on the lower James (Mitchell, Twelve Mile Creek, Bloom, and Goehring) may represent the remains of a single village group occupying the area for about 100 years (Alex, 1981b:182). The Lower James region was abandoned prior to AD 1300.

The settlement of the Bad-Cheyenne and Big Bend regions may have proceeded quickly, although Hurt (1953:11) seemed to favor a more gradual upriver movement of the Over focus, culminating at the Sommers site, and those of the Anderson and Monroe foci. Brown (1967:193), on the other hand, suggested at least two incursions of Initial variant peoples into the Chapelle Creek area, ending with an Over focus occupation there. Toom (1992b:150–153) thought that two to four contemporaneous village groups occupied the Big Bend region, each inhabiting a site for about 30 years. This would account for the 25 Initial variant sites in the region during 300 years and yields an average population at any given time between 500 and 1,000 individuals. The relatively brief occupation of most villages is seen as a response to warfare, competition for bottomland suitable for horticulture, timber depletion, and the meandering effects of the Missouri River on available floodplain lands. Caldwell and Jensen (1969:82–84) proposed a similar argument that two periods of intervillage conflict in the Grand Detour locality are separated by a period of peaceful coexistence. They saw the onset of the dry conditions of the Pacific I episode as bringing an end to the Grand Detour and other Initial variant villages. Griffin (1976) also suggested that timber depletion was the primary factor in village locations and movements. Watrall (1974:142) viewed the Pacific I episode as an impetus for the migration of peoples from the Cambria site to the south or southwest, where they shifted from a diffuse subsistence pattern to one based more upon focal bison hunting. As a consequence, their entire culture shifted toward a pattern strongly influenced by the Initial variant of the Middle Missouri tradition.

Demise

The ultimate disposition or fate of the villagers who participated in the cultural complex that is referred to as the Initial Middle Missouri variant is basically unknown, for all traces of them disappear from the archeological record after AD 1300. A number of authors speculated on this subject (Wood, 1967:127, 166; Lehmer, 1971:104–105; Tiffany, 1982, fig. 27, 1983, fig. 5; Toom, 1992b:140, fig. 4). Deteriorating climatic conditions associated with the Pacific climatic optimum, along with incursions of competing Initial Coalescent peoples from the Central Plains and Extended Middle Missouri groups from North Dakota were frequently given as factors in the disappearance of the Initial Middle Missouri villagers (Caldwell, 1964:3; Lehmer, 1971:100–101). The number of fortified sites of all three variants in the Big Bend and Bad-Cheyenne regions was often cited as a reflection of the level of hostile interaction involved, not to mention specific cases of violence (Lehmer, 1971:100–101; Wood, 1976; Zimmerman and Whitten, 1980; Willey, 1990; Willey and Emerson, 1993).

It is interesting to note that the end of the Initial Middle Missouri coincided with the decline of Cahokia. There is ample evidence to suggest that Initial variant peoples living along the Missouri River participated in the Cahokia trading network (Ludwickson et al., 1993). Although it is unclear what the Initial Middle Missouri villagers were trading in exchange for exotic goods from the east (Ludwickson et al., 1993:163–164), Knife River flint and bison meat and robes cannot be ruled out. The proposition that Knife River flint was part of the Mississippian trading network takes on added meaning considering its relative abundance in Initial variant sites along the Missouri River. Knife River flint from the northwest and exotic trade items from the east are almost nonexistent in Extended Middle Missouri sites in the Bad-Cheyenne and Big Bend regions, which date to AD 1200–1400 after the Cahokia florescence. The disappearance of Cambria sites in Minnesota is linked to Oneota incursions in the area from AD 1200 to AD 1300 (Gibbon, 1993:182–183, 1995a:189; Anfinson, 1997:125–126) that may have disrupted the Mississippian trade network tying the Initial Middle Missouri villages to the east. Gibbon (1991:219) suggested that the decline of the Cahokia exchange network contributed to the disappearance of Cambria.

There are some who believe the Initial Middle Missouri peoples along the Missouri River were absorbed into southern Extended Middle Missouri groups residing in the Big Bend and Bad-Cheyenne regions (i.e., Thomas Riggs phase or focus). Lehmer (1971:104–105) suggested that the latest Initial villagers, whom he assigned to the Modified Initial Middle

Missouri, borrowed traits from Extended Middle Missouri groups. These Modified variant sites are now considered to be either Initial or Extended variant villages (A. Johnson, 1977, 1979; Ludwickson et al., 1993). Perhaps as a result of the similarity in material culture between the two, it is difficult to determine what role, if any, the Initial variant played in the later developmental sequence of the Extended Middle Missouri. The Initial variant ceases to be a recognizable archeological entity after AD 1300 (cf. Wood, 2001:195).

Radiocarbon Dates

A total of 10 new radiocarbon dates from six Initial Middle Missouri components are available as part of this study. These are combined with 103 existing dates from an additional 23 components (Tables C.2 and C.3). The resulting dates appear in Table C.3. A plot of these averaged and calibrated dates is presented in Figure 6, along with Great Oasis dates. The components are segregated by division (eastern represented by the Lower James, Great Oasis, and Cambria phases, and western or Missouri River) and arranged according to date based upon the calibration curve intercepts. All ranges are in terms of the 2-sigma (95.4%) probability distribution. The plotted dates in Figure 6 include all probabilities in the 2-sigma range with values of 0.10 or higher in order to eliminate outlying values.

There are several points that emerge from the arrangement of dates in Figure 6. First, the temporal range of the Initial Middle Missouri variant falls between AD 900 to AD 1400, corresponding to the time frame of earlier investigators (Lehmer, 1971, table 2). If calibration curve intercepts are emphasized above the 95% error ranges, as Toom (1992a, table 5) suggested, then a range of AD 1000 to AD 1300 is indicated. This also is similar to the time span of AD 1030 to AD 1298 suggested by Ahler, Johnson et al. (1995, table 5) but narrower than the AD 781 to AD 1439 (2-sigma) and AD 969 to AD 1297 (1-sigma) of Eighmy and LaBelle (1996, table 2). Toom's date of AD 1000 for the beginning of the variant seems to be best grounded in the radiocarbon data presented herein because dates from four sites (Sommers, Swanson, Bloom, Pretty Head) support this conclusion. There are only several poorly dated components that support extending the variant well back into the tenth century. The termination of the Initial variant is more problematical, because there are two components that date at the end of the fifteenth century (Over's La Roche C and Cattle Oiler). Both are dated by a single sample. The most secure of the late dated components is Antelope Dreamer, which has three dates on corn. Three wood charcoal dates from the same site are almost 75 years earlier and appear to be from aged wood (Toom, 1992a, table 3). Eagle Feather, Jiggs Thompson B, and Stony Point are dated by one or two dates. These dates, plus those from Antelope Dreamer, place the end of the Initial Middle Missouri at about AD 1300.

The second conclusion drawn from Figure 6 is that most of the earliest sites among three eastern division phases (Great Oasis, Mill Creek Big Sioux, Cambria) and the western division sites date to ca. AD 1000. This may be interpreted as supporting the conclusion that the Initial Middle Missouri is essentially an in-situ development from a number of local Late Woodland/Great Oasis antecedents, as Tiffany (1982, fig. 27, 1983, fig. 5) argued. It also can support the notion, most recently espoused by Toom (1992b), that the Initial variant developed in northwestern Iowa, southwestern Minnesota, and southeastern South Dakota and rapidly spread to the west. Because the colonization of the Missouri River by the eastern division villagers is thought to have proceeded quickly, any difference in dates between the two areas could not be detected by radiocarbon dating. The radiocarbon evidence from the lower James River valley indicates that the villages located in this locality were occupied during the middle of the Initial variant sequence. This does not support Toom's (1992b:155–156) idea of "leap frogging" of Initial Middle Missouri village groups from northwestern Iowa and southwestern Minnesota to the James River valley and onto the Missouri River. Although this is certainly a possibility with later migrations, the earliest settlements along the Missouri River are by villagers with no apparent sequential relationship to those on the lower James River. Analysis of ceramic variation between these villages, to be presented below, indicates a close relationship between some of them.

A series of dendrochronological dates is available from four Initial Middle Missouri components (Appendix D). Because of recent criticisms of dendrochronological dating on the plains (Caldwell and Snyder, 1983), these dates are not used to place the components into a chronology. It is interesting to note that the dendrochronological dates from the Sommers site are about 500 years later than the radiocarbon dates. Dendrochronological dates from other Initial Middle Missouri components (H. P. Thomas, St. John, Medicine Creek) also place them within the fifteenth and sixteenth centuries, long after the radiocarbon dated termination of the variant.

Analysis

In an effort to determine if there is a relationship between the ordering of components based upon their radiocarbon determinations and their ceramic content, as measured by their relative frequencies of descriptive rim sherd types, the following analysis is presented. The results help to assess the utility of ceramic types as chronological indicators and allow various hypotheses of Initial Middle Missouri origins and culture change to be evaluated. This study involves 29 Initial Middle Missouri components, most of which are located along the Missouri River. Several eastern division sites (Mitchell, Twelve Mile Creek, Brandon, Cambria, and Price) are included because of their postulated roles in the development of the variant. Mill Creek sites are not incorporated because their ceramic assemblages are described with a different typological system (Ives, 1962) from the one employed herein. Problems with the Mill Creek radiocarbon chronology recently pointed out by Anderson (1986), Lensink (1992), and Toom (1992a:126) also put this topic beyond the scope of the present study. The currently accepted Mill Creek sequences, along with the ceramic changes that occurred through time, are related to the one developed here.

Four axes are extracted by the DCA from the original data matrix (Table A.2). A list of ceramic descriptive category and component scores on these four axes appears in Table 12. An examination of either table indicates that the eigenvalue of axis 1 (.255) is much greater than those of axes 2 (.065), 3 (.025), or 4 (.013). This indicates that of the four axes extracted, axis 1 accounts for 71% of the variation and axis 2 makes up 18%. Axes 3 and 4 account for only 11% of the remaining variation, suggesting that a two axis solution is appropriate for the Initial Middle Missouri ceramic matrix. Figure 8 is a plot of the component scores on the first two axes extracted from the DCA program. No meaningful information beyond the scores of the components on axes 1 and 2 are apparent for axes 3 and 4. These latter two axes are eliminated from further consideration. Because DCA simultaneously scores both components and ceramic descriptive categories, the descriptive categories also are plotted in Figure 8, manually rescaled from the original range of values in Table 12 to the same range of the component scores. The arrows linking components are interpreted as having a temporal stratigraphic sequence. The arrows point to the latest component.

This analysis represents one of several attempts to determine the ceramic relationships between components. In addition to the previous analyses discussed in chapter 2, several others not reported here were performed for this study. These are experimental analyses employing several multidimensional scaling solutions to Euclidean and city block matrices based upon the percentages of the same descriptive rim sherd categories presented here. The solutions result in a very similar arrangement of components as appears in Figure 8.

The placement of the ceramic descriptive categories on axes 1 and 2 are used to define the axes. The emphasis during this discussion is placed on descriptive categories that are most common because infrequently occurring types are usually unreliable indicators of any general overall differences between components. Axis 1 defines a dimension of variability that separates components with large numbers of bowls and rolled rims (Twelve Mile Creek, Mitchell, Cambria, Price) from those with relatively greater amounts of S-shaped rims with horizontal and triangular cord-impressed motifs on their exteriors (Sommers, Gilman, Dodd-Anderson, Cattle Oiler). There are some exceptions to this generalization, as an inspection of the percentages of types from each component in Table A.2 and their positions along axis 1 in Figure 8 demonstrate. Another commonly occurring type, straight rims with tool- or finger-impressed lips, tend to be most frequent in components with low scores on axis 1, such as Dinehart, Swanson, Jiggs Thompson A, Jiggs Thompson B, Pretty Head B, and Dodd-Monroe. The ceramic descriptive categories or types that are important in defining axis 1 are largely successful in separating the villages located in eastern South Dakota, southwestern Minnesota, and those farthest down the Missouri River from the components in upriver locations. There are a few notable exceptions, such as H. P. Thomas 1, Brandon, and Gilman.

The arrangement of components in Figure 8 also indicates some relationships with Great Oasis sites. The distinctiveness of Great Oasis pottery lies in its incised decorations on straight rims. An examination of Figure 8 along with the percentages in Table A.2 indicates that incising, both on straight and S-shaped rims, is most common in a series of sites in the southern Big Bend region: Pretty Bull, King, Akichita, Swanson, Jandreau, Pretty Head A, and Pretty Head B. A single site in the Fort Randall region, Pease Creek, also contains relatively high frequencies of incised pottery. These and other western Initial variant sites also contain numerous S-shaped rim sherds with short diagonal incisions just below the lip, a trait common on Great Oasis incised straight-rimmed vessels. Although the links of these components to Great Oasis are not unequivocal, any Great Oasis-western Initial Middle Missouri relationships are to be found in these and related southern sites. The relatively large number of rim sherds decorated with cord impressions and the presence of S-shaped rim sherds at Great Oasis sites along the Missouri River, such as Oldham, suggest a particularly strong link between these and Initial variant communities upriver. Great Oasis Incised pottery

TABLE 12. Site component and ceramic type scores from the detrended correspondence analysis of Initial Middle Missouri components.

Component or type	Axis 1	Axis 2	Axis 3	Axis 4
Cambria (21BE2)	0.00	0.91	0.88	0.34
Price (21BE25)	0.13	1.13	0.67	0.00
Crow Creek (39BF11)	0.28	0.67	0.44	0.60
Swanson (39BR16)	0.28	0.56	0.83	1.19
Jones Village (39CA3)	0.84	0.39	0.64	0.73
Pease Creek (39CH5)	0.45	0.75	0.93	1.17
Mitchell (39DV2)	0.26	0.27	0.36	0.76
Chapelle Creek C (39HU60)	1.04	0.39	0.95	0.77
Twelve Mile Creek (39HT1)	0.11	0.31	0.31	0.80
Dinehart (39LM33)	0.30	0.21	0.82	0.91
King (39LM55)	0.49	0.77	0.62	1.04
Jiggs Thompson A (39LM208)	0.48	0.31	0.39	0.88
Jiggs Thompson B (39LM208)	0.66	0.00	0.56	1.09
Langdeau (39LM209)	0.77	0.52	0.47	1.08
Jandreau (39LM225)	0.70	1.02	0.59	1.17
Gilman (39LM226)	1.18	0.44	0.64	1.16
Pretty Head A (39LM232)	0.12	1.32	1.00	1.14
Pretty Head B (39LM232)	0.26	0.97	0.74	0.95
Brandon (39HT1)	0.88	0.36	0.49	0.78
Fay Tolton (39ST11)	0.71	0.72	0.26	0.77
H. P. Thomas 1 (39ST12)	0.43	0.89	0.00	1.19
Breeden A (39ST16)	0.83	0.31	0.73	1.12
Sommers Inner (39ST56)	1.36	0.65	0.37	0.81
Sommers Outer (39ST56)	1.47	0.58	0.49	0.92
Cattle Oiler Early (39ST224)	1.13	0.68	0.32	0.81
Pretty Bull (39BF12)	0.47	0.62	0.75	0.60
Akichita (39BF221)	0.27	0.72	0.52	1.15
Dodd Anderson (39ST30)	1.20	0.40	0.58	1.03
Dodd Monroe (39ST30)	0.62	0.61	0.61	0.80
S-shaped Horizontal Cord Impressed	2.19	0.40	0.29	1.16
S-shaped Triangle Cord Impressed	1.32	–0.78	1.33	1.05
S-shaped Horizontal Incised	1.00	2.26	1.23	2.70
S-Shaped Triangle Incised	1.10	0.61	–0.47	1.42
S-shaped Cross-Hatch Incised	2.29	0.01	1.95	1.12
S-shaped Tool/Finger Impressed, Undecorated	–0.92	1.38	–1.61	3.80
Straight Tool/Finger Impressed Lip	–0.08	0.16	1.07	1.31
Straight Cross-Hatch Incised Lip	0.68	0.37	0.55	–0.47
Straight Cord Impressed Lip	1.47	–2.87	1.08	1.91
Straight Undecorated	0.85	1.09	–0.32	0.06
Rolled Rim	–1.73	2.48	2.32	–0.52
Straight Horizontal Cord Impressed	1.95	–0.30	3.07	0.60
Straight Triangle Cord Impressed	1.73	1.40	3.12	2.74
Straight Horizontal Incised	0.33	0.19	2.64	0.08
Straight Tri Incised	0.38	0.20	1.70	–0.03
Straight Cross-Hatch Incised	0.71	2.18	0.71	–2.40
Bowls	–1.22	–1.70	–1.24	1.09
Eigenvalues	0.255	0.065	0.025	0.013

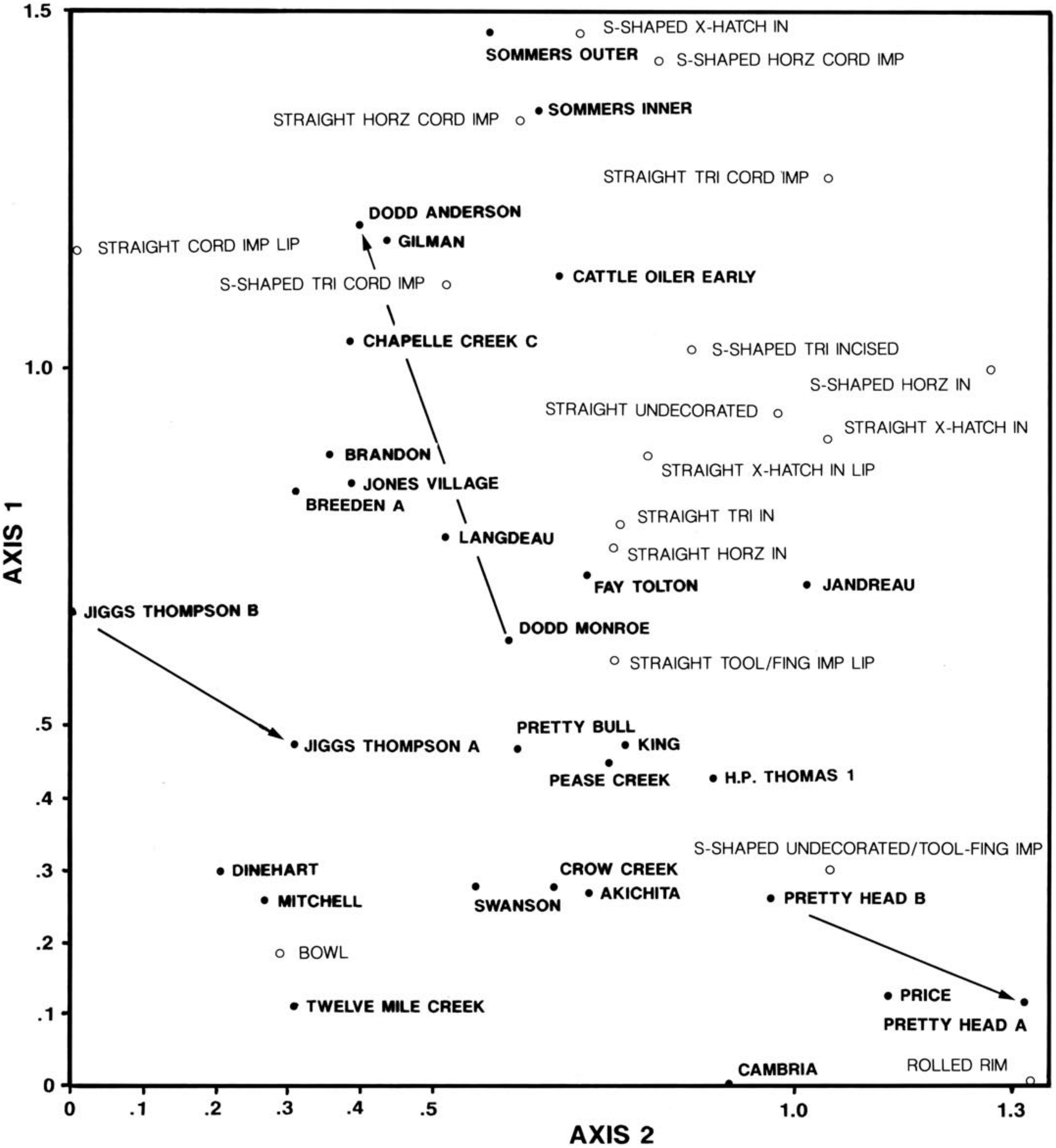

FIGURE 8. Plot of Initial Middle Missouri variant components and descriptive rim sherd categories on Axis 1 and Axis 2, detrended correspondence analysis ordination.

also is characterized by short diagonal incisions below the lip. These carry over into the western Initial variant villages on numerous S-shaped rims. Great Oasis villages located on the Missouri River, such as Hitchell and Oldham, also are linked to upriver Initial Middle Missouri communities through their similar bone tools (e.g., scapula hoes with drilled glenoid cavities).

Axis 2 also is defined by the components with large quantities of rolled rims (Price, Cambria, Pretty Head A, Pretty Head B) versus those with greater numbers of bowls, such as Twelve Mile Creek, Mitchell, Pretty Head A, Pretty Head B. Other types also play important roles in the variation along axis 2, such as horizontally incised S-shaped rims, and straight undecorated types. Other less frequently occurring types (incised straight and S-shaped rims) also play a role in defining axis 2. Components containing high relative frequencies of the horizontally incised S-shaped rim sherds include Pretty Head A, Pretty Head, B and Jandreau. Straight undecorated rim sherds are most abundant in H. P. Thomas 1, Price, Fay Tolton, and Crow Creek.

Considered together, both axes also tend to separate components with cord-impressed decoration (upper left hand corner of Figure 8) from those high in rim sherds with incised decoration (lower right hand corner of Figure 8). This may ultimately relate to the origins of the Initial Middle Missouri in the sense that rim incising is most common in Great Oasis and Mill Creek, whereas cord impressing is more popular in certain Late Woodland ceramics, such as Loseke Creek and Missouri Bluffs.

The plot of components on axes 1 or 2, considered together or separately, fails to correspond to their associated radiocarbon dates and site stratigraphy. Four sites (Sommers, Jiggs Thompson, Pretty Head, and Dodd) have some evidence of multiple Initial variant occupations. A fifth site, Jones Village, has stratigraphic evidence for multiple (or a continuous long term) Initial variant occupations. At the time of the analysis, the data from the 1997 and 1998 Jones Village excavations were not available. A tabulation of the pottery types from these excavations yields approximately the same percentages as those appearing in this study (C. Johnson, 2007). The ordering along axis 2 of the five components described by Caldwell and Jensen (1969)—Jiggs Thompson A and B, Pretty Head A and B, and Langdeau—agrees with internal site stratigraphy if Jiggs Thompson B is considered to be the earliest component and Pretty Head A the latest. This reverses the order of Jiggs Thompson and Pretty Head sites from Caldwell and Jensen's (1969:74–75, 78) sequence but retains the internal order of components A and B within each site.

Relying partially on their own analysis and Lehmer's (1954a:124) developmental sequence at the Dodd site, Caldwell and Jensen (1969:74–75) suggested that there is a temporal change in pottery in the Lower Brule locality that is similar to the Dodd site. S-shaped rims from all four sites (Dodd, Jiggs Thompson, Pretty Head, and Langdeau) are thought to change from an emphasis on incised decoration, highest at Pretty Head, to cord impressions that reaches a maximum in JiggsX Thompson A. Similar percentages as those in Caldwell and Jensen (1969, table 49) are generated from Table A.2, although if the calculations are based upon the total ceramic assemblages from each component and not just the S-shaped rims, the differences are much less dramatic and frequently reversed. This accounts for the reversed positions of Jiggs Thompson and Pretty Head in Figure 8 from the sequence proposed by Caldwell and Jensen (1969:74–75, 78).

A consideration of the available radiocarbon dates from the Lower Brule locality (Table C.3) does little to clarify either Caldwell or Jensen's sequence or the ordination in Figure 8. There is no agreement with the dates assigned to each component (Caldwell and Jensen, 1969:72–73; Thiessen, 1977:67–68) and their internal ordering, or to the temporal placement between sites. This situation is not particularly surprising, considering the fact that only one date for each site has not been excluded for one reason or another. The average of dates from the Langdeau site does support its temporal placement as intermediate between Jiggs Thompson and Pretty Head, however. A single date (PVD 33) is from Feature 67, a pit that appears to be from an early context at Pretty Head (see Caldwell and Jensen, 1969, fig. 6). Relying upon the radiocarbon data, it is suggested that the early component at Pretty Head, along with Jandreau, represent an eleventh century Initial variant occupation of the Lower Brule locality. The next site to be established is Langdeau some 100 to 200 years later, closely followed by the occupation of Jiggs Thompson in the thirteenth century. Jiggs Thompson brought a close to the Initial Middle Missouri presence in the locale.

Referring to the positions of components on axis 2 in Figure 8, this postulated sequence means that components with higher scores generally are the earliest, whereas those with lower values date late in the sequence. This order is similar to Caldwell and Jensen's (1969, fig. 23) but results in the reversing of components within Pretty Head and Jiggs Thompson. At this point, there is no satisfactory resolution to this dilemma. The contradiction may result from an inadequate dating, problems with internal site stratigraphic reconstructions, occupations by two or more separate bands, or spurious relationships between ceramic variation and date of site occupation. The seriations by Falk and Johnson (in prep.) and Falk, Johnson, and Richtsmeier (in prep.) add little to clarify the chronological ordering of Initial Middle Missouri sites.

Another site that contains evidence of time depth is Sommers. A recent analysis of the ceramic assemblage from the site indicates that there was a contraction of the site into a terminal fortified village (Steinacher, 1990). The earliest Sommers component is labeled outer (houses outside the fortification ditch), whereas the latest is designated as Sommers Inner in Figure 8. The available radiocarbon dates do not agree with this outer to inner sequence, possibly because of a suspected temporal depth of only about 100 years for the village (Toom, 1992a:124). Although the ceramic trend within Sommers is for S-shaped cord impressed to decline with time, as it is within and between Jiggs Thompson and Pretty Head, this suggested trend cannot be extended to all or even most of the other Initial variant components. The similarity of pottery from the two Sommers contexts indicates either a relatively short period of occupation or that ceramic change at the time of occupation was not great.

The last available stratigraphic sequence occurs at the Dodd site (Lehmer, 1954a). Excavations revealed a series of superimposed, rectangular, Initial Middle Missouri houses that are assigned to an early Monroe component and a later Anderson occupation. Relying on a number of paired superimposed houses, Lehmer (1954a:73–83) defined two architectural types and a series of seemingly impressive artifact differences to justify his identification of components. Although the differences in architecture may be more imaginary than real, the current study accepts Lehmer's components at face value. A reevaluation of the occupational history of this site needs to be performed, however. An examination of Table A.2 indicates that there are ceramic differences between the components, based upon a recent examination of the ceramic assemblage by the author. For this study, Lehmer's (1954a:80) associated provenience units are used to assign rim sherds to their respective components. The results, although different in frequency, point to an increase in cord-impressed S-rims through time. This trend, originally noted by Lehmer (1954a, table 1) and elaborated on by Caldwell and Jensen (1969:74–75), is the opposite of what occurs at Sommers, Jiggs Thompson, and Pretty Head. There is a single radiocarbon date from the Anderson component at the Dodd site, indicating it may date to the fourteenth century. A sample of corn from Dodd, suspected of being associated with the Initial variant occupation of the site was dated for this study. The results suggest an association with the post-contact occupation, although it was found in the fill of Feature 17, an Initial Middle Missouri house.

A closer examination of the radiocarbon dates associated with each site or component suggests that there is no overall relationship between the dates and their associated components on axes 1 or 2. Referring to Figure 8, three sites with the largest, and presumably most secure, series of dates (Sommers, Swanson, and Mitchell) all date to the eleventh century yet have different scores on axis 1 and/or axis 2. Swanson also may have been reoccupied during the twelfth century. If other components are considered, the situation becomes even more confused.

Perhaps the most parsimonious explanation for the relationship between the placement of components in Figure 8 and their associated radiocarbon dates is to interpret some villages within certain localities as sequential developments from earlier ones, whereas others represent different groups or bands of Initial Middle Missouri villages new to each locale. Each local sequence has its own trajectory of ceramic change. The pattern seems to best fit the migration model in which a small number of village groups settled along the Missouri River trench in South Dakota, each taking up residence in their own locality, as Toom (1992b:153) suggested. The Sommers and Swanson sites best exemplify these early residents, both having numerous dates averaging ca. AD 1000 to AD 1100. These villages are located in different localities, some 40 air miles [64 km] from each other. Other localities might have been colonized at the same time or shortly thereafter. Because there are fewer dates from these villages, any firm statements about their periods of occupancy are somewhat premature. These early villages may include Breeden in the lower Bad-Cheyenne region, the earliest occupation at Pretty Head and Jandreau, both in the Lower Brule locality, and Cattle Oiler and Chapelle Creek. Cattle Oiler and Chapelle Creek are near Sommers, whereas Pretty Head and Jandreau are in the same locality. Swanson appears to be an early village in the lower Big Bend region.

As the Chapelle Creek villagers abandoned their community, they may have moved to the site of Cattle Oiler. It appears that the occupants of Cattle Oiler settled at the Sommers site. Sommers represents a larger site that was occupied for a longer period of time. Eventually its occupants fortified the site and later abandoned the village. All three sites have similar ceramic assemblages, with Cattle Oiler dating somewhat earlier than Sommers. The trend within this locality is for pottery to become dominated by more S-shaped rims with horizontal cord impressions with time.

The Swanson, Crow Creek, Pretty Bull, Akitchita, and King sites form a group of villages very similar in ceramic content. Apparently these sites represent a single group of villagers who occupied the same locale for about 225 years, from ca. AD 1000 to AD 1225. The order of occupation, from earliest to latest, is as follows: Swanson-Crow Creek-Akitchita-Pretty Bull-King. Brown (1967:193) included Dinehart and Medicine Creek, but not Pretty Bull, in this group as representatives of a westward movement of Over focus peoples from the James River and Big Sioux River valleys. Although Brown's conclusion about the cultural similarity of these sites is supported by the present analysis, he did not have most of the radiocarbon dates at his disposal. These dates suggest that the sites form a local developmental sequence.

Jones Village represents a third locality occupied by Initial Middle Missouri peoples. Established in the twelfth century, these people probably emigrated from well-established villages to the south (e.g., Breeden, Langdeau, Dodd) or southeast (e.g., Brandon). There are no known Late Woodland ancestors in north-central South Dakota, and it is difficult to imagine a Sommers ceramic assemblage with so many similarities to those far to the south developing out of an indigenous Late Woodland base. In fact, Jones Villages was probably the impetus for the development of Plains villagers out of Late Woodland incipient horticulturists occupying villages like Menoken, ultimately giving rise to the Extended Middle Missouri.

Brown's (1967:193) comments concerning the origin of the western Initial Middle Missouri from the fully developed eastern Plains villagers do raise another question. Do the western division villages represent a transplantation of eastern village culture and, if so, from what source? An examination of the dates from the Mitchell and Twelve Mile Creek sites does not unequivocally support the idea of intrusions from east to west. A single date of AD 1022 from Twelve Mile Creek cannot be relied upon and a series of nine averaged dates from Mitchell (AD 1043–1201) places it coeval with or after the earliest Missouri River villages. A series of dates from Mill Creek sites in the Little Sioux locality were averaged and calibrated for this study. Although some of the dated series do not pass the test of contemporaneity, they indicate that three of the four major sites (Wittrock, Phipps, Brewster) were first occupied early in the eleventh century (see Lensink, 1996). This is comparable to the early Missouri River villages of Sommers and Jandreau. Similarly, several early Great Oasis sites (Great Oasis, Broken Kettle West) also were probably occupied early in the eleventh century. Wittrock and Phipps were possibly occupied for a relatively long period of time, perhaps on the order of 200 years. Given the depth of their middens, comparable to some of the lengthy occupations at the Knife River Indian Villages National Historic Site (see Ahler, 1993c:89), such great time depth would not be unexpected. The averaged and calibrated radiocarbon dates from the upper zones of Wittrock and Phipps place them into the fourteenth century, somewhat later than most of the western Initial Middle Missouri sites.

The earlier review of Initial Middle Missouri origins along the Missouri River presented the in situ Woodland hypothesis most recently proposed by Tiffany (1983:94–98) and the westward migration proposition advocated by Toom (1992b:141). Both derive the Initial Middle Missouri out of a Late Woodland and/or Great Oasis base. Tiffany's in situ scheme is not supported by the available evidence, as Toom (1992b) aptly demonstrated, but neither is Toom's, based upon the available radiocarbon data. In addition, there is not a clear continuity in pottery from Late Woodland/Great Oasis and the early Initial Middle Missouri assemblages. There are some similarities, particularly between the incised straight rims (Great Oasis incised, Chamberlain types) and finger/tool-impressed straight rims, but other ceramic assemblages, such as Sommers with its high numbers of cord-impressed S-shaped rims, represent a greater break from the Great Oasis potting tradition. Rather, the Sommers pottery appears to have greater affinities to other Late Woodland pottery (Loseke ware, Faye Cord-Impressed, Ellis Cord-Impressed) characterized by cord-impressed decoration (see Hurt, 1952; Kivett, 1952; Benn, 1990:139–141; 1995, figs. 2, 3, 5, 9). These Woodland, cord-impressed rims, however, are straight in form rather than the ubiquitous S-shaped varieties encountered at Sommers and other Initial Middle Missouri sites on the Missouri River. Benn (1990:140) also noted rim form, appendage, and vessel form similarities between Loseke ware and Plains Village pottery. The Brandon site in the Big Sioux River drainage system, with its relatively large frequencies of S-shaped, cord-impressed rim sherds, has strong ceramic similarities with Sommers. No radiocarbon dates are available from Brandon. Finally, if the western Initial Middle Missouri is an in situ development from a local Late Woodland base, more ceramic homogeneity might be expected in the variant than is presently the case.

The origins of the western Initial Middle Missouri might be very difficult to resolve, particularly if the entire range of western and eastern division phases developed within a short period of time in response to the Neo-Atlantic episode, as Lehmer (1970:118, 1971:105) and Toom (1992b) suggested. If the Late Woodland/Great Oasis origin of the Initial Middle Missouri remains a viable hypothesis, then additional research into Great Oasis must be initiated. This includes completing site reports on extant collections. The Oldham site is singled out as a particularly important Great Oasis village, for it has a large artifact assemblage and evidence of agricultural implements (bison scapula hoes with holes in the glenoid cavities) that clearly link it with the mainstream Initial Middle Missouri villages further upriver.

Estimates of the periods during which each of the Initial Middle Missouri components were occupied can be made. Many of them are radiocarbon dated, and these dates are used to place them in chronological order. Other components are dated by their positions within each local ceramic ordination. As with the previous analysis of Great Oasis components, these placements are made in 100 year time periods (e.g., AD 1000–1100, 1100–1200). Calibration-curve intercepts and the probability ranges of dates are considered in these assignments. Because the overall goal of this exercise is to develop a chronology of all Plains Village manifestations within the Middle Missouri subarea, the time periods corresponding to centuries are maintained. The rationale for this decision is more apparent when the Extended and Terminal Middle Missouri developmental sequence is considered later.

Components are assigned to the following time periods on the basis of radiocarbon dates and their placement within seven local ceramic sequences (Cambria, Big Sioux, Lower James, Swanson, Lower Brule, Sommers, Bad-Cheyenne) as depicted in Figure 8. Period 1 (AD 1000–1100) components include Jandreau, Pretty Head A/B, Sommers Inner/Sommers Outer, Chapelle Creek C, Cattle Oiler Early, and possibly Brandon. The occupations at Swanson, Crow Creek, Mitchell, and Price extend into Period 2 (AD 1100–1200). Villages placed within period 2 are Jones Village, Akichita, Langdeau, Dodd (Anderson/Monroe components), and Fay Tolton. Langdeau was established at the end of this period and continued into period 3 (AD 1200–1300). Other period 3 villages include Pease Creek, King, Pretty Bull, Jiggs Thompson A/B, Antelope Dreamer, and Stony Point. Two components, Gilman and Dinehart, could not be assigned to a time period.

The rationale for assigning the undated components on the basis of their placement in Figure 8 is as follows. Akichita and Pretty Bull have close ceramic affinities to another period 2 component, Crow Creek. Although Pease Creek is some distance to the south of other Swanson locality sites, its affinity to King suggests a period 3 assignment. The Dodd components, by virtue of their position in Figure 8 along a line between Breeden A and Fay Tolton, indicate a possible occupation in the twelfth century. Brandon, with its distinct ceramic assemblage consisting of large numbers of S-shaped rims decorated with cord impressions links it to the Sommers site, suggesting a period 1 assignment. Chapelle Creek stands at the early end of a sequence beginning with Cattle Oiler and ending with Sommers.

Craniometric Distance

There are several craniometric analyses employing a few individuals recovered from Initial Middle Missouri contexts (Jantz, 1976; Owsley, Morey, and Turner, 1981; Jantz and Willey, 1983). These studies frequently combine individuals from Initial, Extended, and Terminal Middle Missouri variant sites, as well as the Heart River complex, into a generalized "Mandan" group. The results support the conclusion that most Initial variant individuals are similar to the pooled "Mandan" sample. The one exception is the study by Owsley, Morey, and Turner (1981), in which he concluded that the Mill Creek individuals from the Big Sioux phase Broken Kettle site have an affinity with the Initial Coalescent peoples of Crow Creek.

Key (1983) presented the most comprehensive study of Plains Indian craniometric relationships. In his analysis, Key grouped individuals according to generally accepted taxonomic units rather than larger and sometimes misleading units, such as "Mandan." In reference to the Initial Middle Missouri, he employed the following taxonomic units and sites: Anderson phase (Fay Tolton, Breeden A), Grand Detour phase (Langdeau, Dinehart, Medicine Creek), Over focus (Mitchell, Bloom, Twelve Mill Creek), Mill Creek (Broken Kettle, Kimball), and Upper Big Sioux (Brandon). Great Oasis, consisting of individuals from the Ryan, Whitten, Arbor Hill, and Oldham sites, is included within the Late Woodland period. Craniometric or biological distance between these taxonomic units and a large number of other Woodland and Plains Village populations is accomplished with principal coordinate/principal components analysis, representing a departure from most previous approaches that rely on discriminant analysis.

Although it is difficult to relate Key's results to the present analysis because different sites are used, a comparison of the two is nonetheless instructive. Referring to a plot of sites on principal coordinates I and II (Key, 1983, fig. 17), there is a similar pattern of relationships compared with Figure 8 of this study. The plot of taxonomic units on principal coordinate I, from the Over focus at one extreme, to the Grand Detour, Anderson, and Upper Big Sioux unit at the other end, maintains the order of components present along axis 1 in Figure 8. It also is interesting to note that individuals from Great Oasis contexts are most similar to those of the Anderson phase, whereas the Mill Creek individuals share an affinity with the Over focus on principal coordinate I. A more recent analysis by Key (1994:185) suggested craniometric affinities between the Anderson phase, and Truman and Sonota Woodland peoples. This suggests a possible origin of some Initial Middle Missouri groups in indigenous Middle Missouri Woodland populations. The Grand Detour individuals are somewhat divergent from Key's Woodland groups; they are closest to the Mill Creek and Great Oasis samples.

An analyses by Glenn (1974:58–59) included Cambria materials from several mounds in Big Stone County, Minnesota. These sites have been reassigned recently to the Cambria-related Big Stone phase (Anfinson, 1997:108). Glenn's (1974, figs. 6.5–6.7) study suggested an affinity between these "Cambria" individuals and the Dakotid A sample, consisting of individuals from Mobridge, South Dakota (cemeteries 2 and 3). This latter sample is referred to as Mandan and Arikara. If it is from the Mobridge site (39WW1), it is probably protohistoric Arikara in origin. Whatever the case, there is a relationship between the Cambria and Dakotid A groups when compared with Oneota and other Plains Indian samples.

EXTENDED AND TERMINAL MIDDLE MISSOURI

A brief history of research on the Extended and Terminal variants of the Middle Missouri tradition is presented in chapter 2. In order to understand the following discussion, a consideration of the culture taxonomy of these two units is required.

Taxonomy

There are two taxonomic systems developed for the Extended and Terminal variants of the Middle Missouri tradition. The traditional view, most recently espoused in its fullest form by Tiffany (1983), recognized three variants—Northern Extended, South Extended, and Terminal. The Southern variant consists of a single phase, Thomas Riggs, the equivalent of Hurt's (1953, chart III) Thomas Riggs focus. This unit includes some of most southerly of Extended villages in the Bad-Cheyenne region. Some earlier descriptions of the Thomas Riggs focus (Wood and Woolworth, 1964:63; Lehmer and Caldwell, 1966:515; Wood, 1967:122–123) included all Extended Middle Missouri sites within this taxon. The Northern Extended variant is made up of three phases, Clark's Creek, Fort Yates, and Nailati. Nailati is considered a developmental outgrowth of the Clark's Creek and Fort Yates phases. The Fort Yates phase, first defined by Lehmer (1966:54, 56), is the taxonomic equivalent of the Fort Yates focus (Hurt, 1953, chart III), whereas the other two phases were formulated by Calabrese (1972:71). These phases include sites in the Cannonball, Knife, and Heart regions. The Northern and Southern Extended variants are ancestral to the Terminal variant, represented by the Huff phase or focus (Hurt, 1953, chart III; Wood, 1967:131–137).

Ahler (1993b) constructed a new cultural taxonomy for all Plains Village developments in the Cannonball, Heart, Knife, and Garrison regions. Although his system is most elaborate for the latter two regions, the scene of much recent work, he discussed the Middle Missouri tradition or complex as he calls it. The Middle Missouri complex is made up of the Clark's Creek, Fort Yates, and Huff phases. The Fort Yates phase is seen as ancestral to the Huff phase. Ahler placed the Nailati phase within the Painted Woods complex, one of several phases included within it. A further discussion of the Painted Woods complex and all later taxonomic units are outlined later in the analysis of Coalescent tradition.

The Terminal Middle Missouri is thought to be a direct developmental outgrowth of the Extended Middle Missouri. The Terminal variant, in turn, is ancestral to the Heart River phase, considered by most subarea specialists as representing the ancestral Mandan immediately prior to direct European and American contact. These three units are thought to represent an unbroken Mandan cultural continuum extending from the historically documented villages in the Heart region back to about AD 1000 (Lehmer, 1966:59; Wood, 1986a:7). The Hidatsa cultural sequence is outlined later.

Origins

Just as the final disposition of the Initial Middle Missouri villagers is unclear, the origin of the Extended variant is equally obscure. To some degree this is because of the existence of three Mandan groups (Bowers, 1948a:19–20, 1950:17–20), whose prehistoric and protohistoric villages cannot be identified with any degree of confidence. One account, according to Mandan oral tradition, is that the Heart River is their traditional homeland (Bowers, 1948a:20; Hurt, 1953:21–22; Wood, 1986a:13). According to Bowers, this myth was recorded a century before by Maxmillian in 1832 to 1834. Another account has a Mandan group originating at the mouth of the Mississippi River, making their way up the Mississippi, and traveling southwest to the Pipestone quarries (Bowers, 1948a:20–24). From this point, the Awigaxa Mandan split into two groups, one moving northward along the Red and Cheyenne rivers to Devils Lake and then westward to the Missouri River. The other Awigaxa in southwestern Minnesota traveled west to the White River, in the vicinity of the Arikara. Some of these Awigaxa then went west to the Black Hills and, upon returning to the Missouri, discovered that two other Mandan groups, the Nuptadi and Nuitadi, had divided into two linguistic groups. The latter two groups moved up the Missouri to the Heart River, where they joined the other Mandan. Other Awigaxa continued to live at the Cheyenne, Moreau, and Grand Rivers to the south. They resided for some time at the mouth of the Grand, where they were forced to the Rocky Mountains by a flood. Upon returning to the Missouri River, they found the area occupied by other (Coalescent?) people. They then moved to a location between the Knife and Heart rivers and joined with the Heart River Mandan at Fort Clark after the first smallpox epidemic.

Ahler's (1993b:100) interpretation of Mandan culture history is similar to Bowers. Ahler recognized a Northern and Southern group of Mandan, corresponding to Extended Middle Missouri villages in North and South Dakota. Later, about AD 1500, four groups are recognized—the Northern (Nuitadi, Nuptadi) and Southern (Istopa, Awigaxa) Mandan. Shortly thereafter, they began their merger into a single Mandan entity known archeologically as the Heart River complex (Ahler, 1993b, fig. 25.3).

Historical linguistic studies of the Siouan language (Hollow and Parks, 1980, table 3; Springer and Witkowski, 1982, fig. 2; Syms, 1985, fig. 8) suggest some general relationships between groups but none that are particularly useful for this study. According to these sources, the proto-western Mandan, Hidatsa, and Crow split from the remaining Siouan or Oneota groups (proto-central, proto-eastern) at 500 BC to AD 300. Depending on the study, the Mandan diverged from the Hidatsa/Crow between AD 100 and 500. The Crow are thought to have split from the Hidatsa at about AD 1200. A study by Wood and Downer (1977) indicated a Crow-Hidatsa linguistic split ca. AD 1500.

The Mandan origin myth that places them at the pipestone quarry in southwestern Minnesota could be the inspiration for a number culture-historical reconstructions. Lehmer (1971:100) stated that the Initial and Extended variants of the Middle Missouri tradition originated in the same or similar complex(es) in southern Minnesota and northern Iowa. One group, later recognized as peoples of the Initial variant, moved west to the Big Bend and Bad Cheyenne regions. Extended Middle Missouri peoples migrated to the northwest, following the glacial lakes in the eastern Dakotas, to a place 40 miles [64 km] west of Bismarck and then onto the Missouri River. The Extended villages in the Bad-Cheyenne region represent a downriver movement of peoples from their heartland in North Dakota. Alex (1981b:185) proposed a very similar origin for the Extended Middle Missouri, and even identified at least one site in northeastern South Dakota (Hartford Beach) as a possible village site along the migration route. Several collections examined by the author from sites on the Islands in Lake Traverse (Jensen, Jackson, Carlson islands) contain small amounts of cord-impressed and undecorated pottery resembling Extended Middle Missouri types. Spaulding (1956:103–104) noted similarities in pottery and village fortifications between the Terminal Middle Missouri Huff site and Aztalan, suggesting a link between these sites that he believed were contemporaries. Wood (1962:37) noted the possibility of Mississippian influence on the Extended and Terminal Middle Missouri. These relationships and other considerations led earlier investigators to postulate an origin of the Extended variant in the Initial Middle Missouri (Hurt, 1954a, chart III, 1957, chart I; Wood, 1967:127–128, 130–131), an interpretation that fell into disfavor with the publication of Lehmer's (1971) synthesis. Finally, Wood (2001:192) thought that there is a close relationship between the Initial and Extended variants, indicating an origin out of a common ancestor.

With the earlier espoused view of a sequential relationship between the Initial and Extended Middle Missouri variants (Wood, 1967:127–131) challenged by radiocarbon dates suggesting considerable temporal overlap between the two (Lehmer, 1971:99), the search for the archeological precursors of the Extended variant turned to other sources. Because of the concentration of Extended sites in North Dakota, it is believed to have originated there (Lehmer, 1971:99). Until recently, very little progress has been made on this problem. The information that became available with research in conjunction with the KNRI (Lovick and Ahler, 1982:56; Ahler, 1993b, fig. 25.3) and with work at Cross Ranch (Ahler, Falk et al., 1982:247–258) suggested that the origins of the Middle Missouri complex (i.e., Extended Middle Missouri) might be found in indigenous Late Woodland manifestations. Ahler (1993b:65), limiting his discussion to the Heart, Knife, and Garrison regions, identified the Charred Body complex as the most likely source of the Middle Missouri complex in those three regions. Two sites are placed within the Charred Body complex, Flaming Arrow and Menoken, although others may be present on Cross Ranch. The Charred Body complex is poorly known because the two key sites assigned to it have not been fully reported. The

Cross Ranch Late Woodland sites have arrow points that are variants of Prairie Side-Notched (AD 700–1300) forms defined by Kehoe (1966) blending into specimens found at Extended Middle Missouri sites (Ahler, Falk et al., 1982:247–258). Flaming Arrow is thought to be an example of one developmental line, along with the Schultz site (Wood, 1963), of the Awatixa Hidatsa tradition centered in the Knife region. The Menoken site (Hoffman, 1983) in the Heart region, along with several early Extended Middle Missouri in the Cannonball region, contributed to the formation of the Northern Mandan cultural tradition. Fieldwork at Menoken in 1998 indicated similarities to contemporaneous Initial Middle Missouri sites, particularly Jones Village (39CA3) (Ahler, 1999:10.7). Jones Village is somewhat earlier than Menoken and represents the earliest known Plains Village site north of the Cheyenne River. Dated at about AD 1100, it represents the northern frontier of horticulture in the Middle Missouri subarea and was probably influential in the transformation of local Late Woodland groups, such as those occupying Menoken, into the Plains Village communities of the Extended Middle Missouri. There are a number of characteristics that link Jones Village with Menoken in addition to the presence of houses and fortification ditches, such as the high reliance on Knife River flint, bipolar flaking, and some ceramics (Ahler, 1999:11.1–11.2; pers. comm., 1999, 2007). Bowers (1948a:131) attributed some linear mounds in the Knife region to the Hidatsa on the basis of informant interviews.

Internal Development

There are several interrelated hypotheses proposed to account for the movements of Extended Middle Missouri peoples through time. The earliest and most environmentally deterministic model ties most of the population movements of all but the latest villages within the Middle Missouri subarea to climatic episodes (Lehmer, 1970, 1971:105). These episodes affected the distribution of bison, timber, and horticulture, causing displacement in the villagers who relied on these resources.

The appearance of the first Extended Middle Missouri villages about AD 1100, believed to be limited to the Cannonball and Knife-Heart regions (Lehmer, 1970, figs. 1, 2), is not correlated with the onset of any climatic episode. Shortly thereafter, Extended groups pushed to the south and established a number of outpost settlements in the Bad-Cheyenne region. In the process, they displaced resident Initial Middle Missouri peoples into the Big Bend region. Before the Initial villagers retreated, the Bad-Cheyenne served as the setting for violent confrontations between the two groups, exemplified by the Fay Tolton site (Lehmer, 1971:100–101; Wood, 1976). The onset of the cool, dry Pacific I episode at AD 1250, coincided with the abandonment of the southern range of the Extended Middle Missouri. Unknown to Lehmer, the Initial Coalescent intrusion into the Middle Missouri subarea at AD 1300 closely corresponded to this climatic period. According to Lehmer, the Pacific I period marked the presence of the 200 year "gap" in the Extended Middle Missouri occupation of the Bad-Cheyenne from AD 1250 to AD 1450 (Lehmer, 1966:59–60, 1971:104–105; Thiessen, 1977:67). With ameliorating climatic conditions brought on by the Pacific II episode at AD 1450, some Extended Middle Missouri villagers reestablished themselves in the Bad-Cheyenne region. By AD 1550, the Neo-Boreal caused cooler summers, making agriculture difficult. This development, together with pressure from expanding Extended Coalescent peoples (Lehmer, 1971:126–127), again forced Extended Middle Missouri villagers to retreat to their traditional homeland in North Dakota. Along the way they temporarily settled in the Grand-Moreau region. They finally consolidated with the Extended Middle Missouri groups, who stayed in North Dakota, into the large fortified towns of the Terminal Middle Missouri. The Terminal Middle Missouri villages were occupied until the onset of the Post-Contact period beginning at AD 1675 (Lehmer, 1970:125).

Demise

The Terminal Middle Missouri represents the final stage of the Middle Missouri tradition. The sites of this variant are thought to represent a consolidation of what was until then a series of autonomous Extended Middle Missouri villages. The Terminal variant is thought of as a transitional stage between the fully prehistoric Extended variant and the later post-contact Heart River phase, the latter representing the protohistoric ancestral communities of the Mandan and some Hidatsa (Lehmer, 1971:163–164, 203–205). Common traits that link the Terminal variant and Heart River phase are villages with open plazas and pottery with similar paste and design characteristics (Lehmer, 1971:164). The transition from rectangular to round houses in the Knife and Heart regions remains obscure, mainly because of the limited excavations conducted at Heart River phase sites. A single square house at the Terminal Middle Missouri Huff site (Wood, 1967:158–159; Lehmer, 1971:128), interpreted as borrowing from the Extended Coalescent, was cited as an example of this architectural transition. Only at sites that date relatively late (e.g., Amahami and Rock Village) have circular houses been exposed (Hartle, 1960; Lehmer et al., 1978). Lehmer et al. (1973:166) implied that the transition from rectangular to round houses occurred at the Bagnell site, dated at about AD 1570 to AD 1630. Ahler (1993b:81, 85–86) was skeptical that round houses were present at Bagnell and believed that the earliest of these structures in the Knife region were associated with the Hensler phase (AD 1525–1600). Recent work at the Double Ditch site has indicated that rectangular houses may have been present in the earliest parts of the village (Ahler, 2003b:2).

Radiocarbon Dates

Figure 9 is a plot of averaged and calibrated radiocarbon dates extracted from Table C.3. The 2-sigma (95.4%) range of each site takes into consideration all individual probabilities of 0.10 or greater. Components are divided into three areas representing southern (Bad-Cheyenne and Big Bend regions), middle (Grand-Moreau and Cannonball regions), and northern (Knife and Heart regions) areas. There are several aspects of Figure 9 that can be summarized. First, the temporal span of the Extended Middle Missouri variant, based solely upon 2-sigma errors, ranges from ca. AD 1150 to AD 1450. If all sites with single dates are eliminated from consideration, the range of calibration curve intercepts falls within the relatively narrow time frame of AD 1200 to AD 400. This is similar to the span of AD 1217 to AD 1404 of Ahler, Johnson, Haas, and Bonani (1995, table 5) but dramatically different from some prior estimates of AD 1050/1100 to AD 1550 or more (Lehmer, 1971, table 2; Thiessen, 1977, table 5; Toom, 1992b, table 1; Eighmy and LaBelle, 1996, table 2). Most of this difference is because of the elimination of many dates, compared with past efforts that have used most of them. Incorporating the Terminal Middle Missouri Huff site extends the sequence to ca. AD 1500. A starting date for the Extended Middle Missouri of AD 1200 eliminates all but about 100 years of overlap between it and the end of the Initial Middle Missouri, creating the possibility of a sequential rather than coeval relationship between the two variants (Ahler, Johnson et al., 1995:26).

A second topic to be addressed is the proposed temporal gaps in the Extended Middle Missouri sequences in the Bad-Cheyenne and Cannonball regions (Lehmer, 1966:59–60; 1971:104–105; Thiessen, 1977:67). To briefly summarize these earlier observations, there is an apparent occupational hiatus in the Bad-Cheyenne and Cannonball regions from about AD 1250 to AD 1450. The Bad-Cheyenne sequence also takes into consideration three Initial Middle

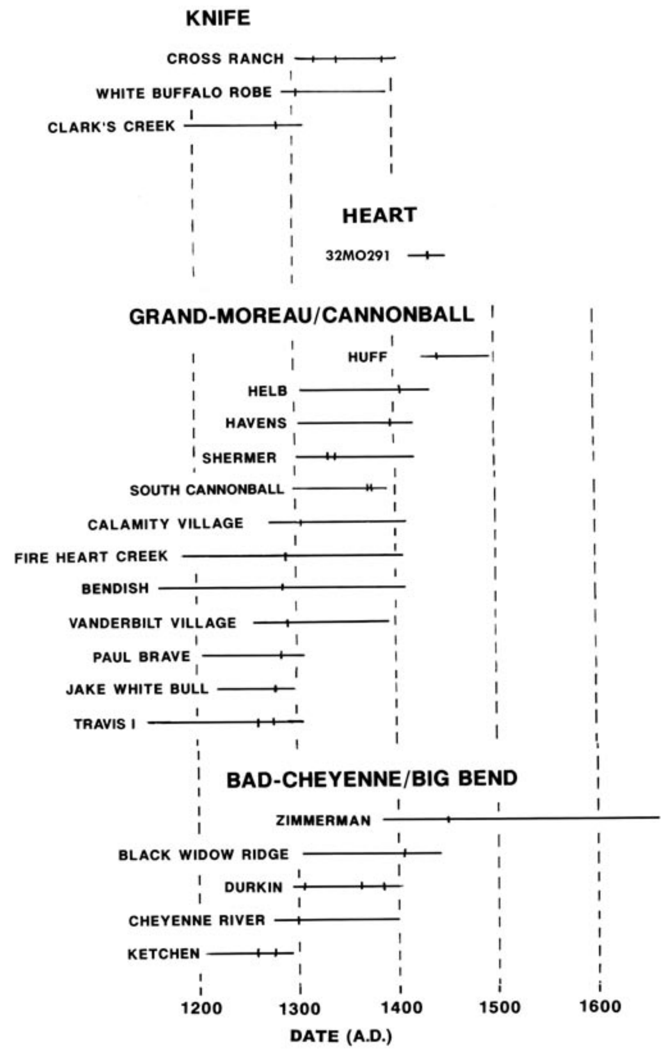

FIGURE 9. Plot of calibrated radiocarbon date ranges from Extended and Terminal Middle Missouri variant components based on the decadal calibration curve (Stuiver and Becker, 1993) as implemented in CALIB 3.0.3 (Stuiver and Reamer, 1993).

Missouri sites (Breeden, Fay Tolton, Dodd). Although the plots of dates in Figures 6 and 9 are not set up for such a comparison, a brief review of the data is useful in evaluating these interpretations. Referring to the Bad-Cheyenne/Big Bend sequence in Figure 9, two Big Bend components (Ketchen and Durkin) are eliminated from consideration. This leaves four components that do not exhibit a particularly pronounced gap. Incorporating the two Initial variant components from Figure 6, Dodd and Fay Tolton, does nothing to change this conclusion. This difference in conclusions is largely the result of how the radiocarbon dates are calibrated and which ones are considered. Three of the seven sites (Breeden, McKensey, Thomas Riggs) are eliminated from this analysis, whereas selected dates from other sites accepted by previous researchers are discounted for a variety of reasons. The PVD date from Black Widow Ridge was not available to past researchers. The available evidence suggests that the Bad-Cheyenne occupational hiatus may be more imaginary than real, although it should be noted that there is still an inadequate number of dates from the region to evaluate this hypothesis.

The occupational gap from about AD 1250 to AD 1450 in the Cannonball region (Thiessen, 1977:67) is not supported by the radiocarbon data (Figure 9) if two Grand-Moreau villages, Travis I and Calamity Village, are eliminated from consideration. Once again, the difference is attributed to the calibration programs used and the particular dates that are considered. For example, three series of dates are either eliminated (Ben Standing Soldier) or greatly modified by selecting some dates instead of others (Helb, Bendish). Additional dates unavailable to earlier archeologists (Havens, South Cannonball, Helb, Vanderbilt Village) significantly alter the data upon which to construct the Cannonball sequence.

Analysis

The initial detrended correspondence analysis begins with all 29 Extended and Terminal variant components. The data matrix of ceramic descriptive category frequencies appears in Table A.3. Percentage calculations also are provided in this table to aid in the interpretation of the results. An examination of Table 13 indicates that the first axis accounts for 58% of the variation extracted by the four axes, whereas axis 2 accounts for 27% of the variance. Less than 15% of the remaining variation is accounted for by the last two axes, suggesting that a two axes solution is appropriate.

A plot of the component scores on axis 1 and 2 in Figure 10 indicates that the two Terminal variant sites (Huff, Shermer) and two late components (White Buffalo Robe, Amahami) are clearly separated from all of the Extended Middle Missouri components. An examination of Table 13 and Figure 10 indicates that Huff, Shermer, White Buffalo Robe, and Amahami have relatively high values of four ceramic types (straight filleted rims, straight tool-impressed rims, undecorated or tool/ finger-impressed S-rims, cord-impressed S-rims) compared with the others. The other 25 components have relatively high frequencies of the other eight descriptive categories. Because this first analysis tends to isolate White Buffalo Robe, Amahami, Huff, and Shermer from the other sites as outliers and thus compresses the variability of the remaining ones, no additional interpretations are offered at this time. It is noted, however, that axis 1 in Figure 10 cannot be interpreted strictly in terms of time, for averaged and calibrated crossover dates from the Shermer (AD 1262, 1326, 1352, 1363, 1366, 1389) and White Buffalo Robe (AD 1299) sites are not much different from the other Extended variant sites and clearly not as late as the Huff series (AD 1441) (Table C.3).

The second correspondence analysis eliminates from further consideration the four outlying components (White Buffalo Robe, Amahami, Huff, Shermer) so that smaller increments of ceramic variability emerge among the remaining Extended variant villages. The results of this analysis are presented in Table 14. A plot of components and ceramic types on axes 1 and 2 appears in Figure 11. The first eigenvalue extracted accounts for 68% of the four, whereas 19% of the variability is explained by the second axis. Axes 2 and 3 account for 13% of the variation.

A further examination of Figure 11 indicates that axis 1 separates the southern Thomas Riggs phase villages from the northern Fort Yates, Clark's Creek, and Nailati phase components. The Extended component at Cattle Oiler, located in the Big Bend region, is one exception, being placed closest to the Fort Yates villages. Travis I, in the Grand-Moreau region, is displaced towards the Thomas Riggs sites to the south. The southern Extended variant villages generally tend to have higher relative frequencies of straight rims decorated on the lips with tool or finger impressions, straight and S-shaped rims with fillets, and S-shaped rims with horizontal incising. The Cheyenne River site is the only one with relatively high numbers of filleted S-shaped rims. Two relatively popular types, straight undecorated rims and straight rims with pinched lips, are most common among northern sites, as the plot of descriptive categories in Figure 11 demonstrates. S-shaped rims decorated by cord impressions also are most common in the northern Extended Middle Missouri ceramic assemblages, particularly those from the Knife region, such as Clark's Creek and Cross Ranch. These differences clearly demonstrate that traditionally formulated ceramic types, which are reflected in the descriptive categories used in this study, are able to discriminate between spatially distinct groups of villages. The difference in the quantity of S-shaped rims between the north and south persists into the Extended variant of the Coalescent tradition in South Dakota and the Heart River complex in North Dakota.

An examination of the available radiocarbon dates from the villages used in this analysis suggests that there are no clear temporal trends in ceramic variation (Figure 9).

TABLE 13. Site component and ceramic type scores from the detrended correspondence analysis of Extended/Terminal Middle Missouri components.

Component or type	Axis 1	Axis 2	Axis 3	Axis 4
Havens (32EM1)	0.31	0.23	0.76	0.23
Tony Glas (32EM3)	0.33	0.06	0.67	0.25
Shermer (32EM10)	1.70	1.07	1.14	0.24
Clark's Creek (32EM1)	0.41	0.62	0.29	0.24
White Buffalo Robe (32EM7)	1.16	0.39	0.41	0.12
Amahami (32ME8)	1.49	0.34	0.32	0.20
Bendish (32MO2)	0.25	0.11	0.76	0.56
Huff (32MO11)	1.76	0.44	0.00	0.33
Cross Ranch (32OL14)	0.66	0.33	0.46	0.43
Fire Heart Creek (32SI2)	0.14	0.16	0.90	0.40
Paul Brave (32SI4)	0.21	0.00	0.65	0.38
Ben Standing Soldier (32SI7)	0.27	0.33	0.61	0.30
South Cannonball (32SI19)	0.15	0.20	0.76	0.58
McKensey (39AR201)	0.20	0.73	0.33	0.37
39AR210	0.22	1.00	0.39	0.42
Helb (39CA208)	0.01	0.60	0.58	0.47
Jake White Bull (39CO6)	0.02	0.44	0.66	0.53
Travis I (39CO213)	0.40	0.79	0.71	0.23
Calamity Village (39DW231)	0.20	0.40	0.87	0.41
Thomas Riggs (39HU1)	0.05	0.97	0.40	0.27
Sully School (39SL7)	0.21	0.81	0.66	0.57
C. B. Smith B (39SL29)	0.08	1.12	0.45	0.00
Zimmerman (39SL41)	0.25	0.93	0.49	0.40
Cheyenne River Early (39ST1)	0.34	1.13	0.59	0.68
Indian Creek (39ST15)	0.01	0.91	0.46	0.38
Black Widow Ridge (39ST203)	0.11	0.98	0.52	0.40
Cattle Oiler Middle (39ST224)	0.04	0.48	0.70	0.48
Vanderbilt (39CA1)	0.28	0.33	0.81	0.50
Keene Village (39CA2)	0.00	0.37	0.73	0.51
S-shaped Cord Impressed	1.95	0.00	–0.49	0.04
S-shaped Horizontal Incised	1.10	1.48	1.01	1.33
S-shaped Cross-Hatch Incised	–0.40	–0.77	1.38	1.31
S-shaped Filleted	0.17	4.15	–1.28	5.00
S-shaped Tool/Finger Impressed, Undecorated	1.00	0.99	2.20	0.36
Straight Horizontal Incised	–0.38	–0.16	1.76	1.06
Straight Cross-Hatch Incised	–0.31	–1.96	0.23	–1.83
Straight Tool/Finger Impressed	1.46	2.02	2.42	–1.99
Straight Filleted	2.55	1.74	1.65	1.49
Straight Pinched Lip	0.88	–0.97	1.40	–1.57
Straight Tool/Finger Impressed Lip	–0.19	1.22	0.14	0.16
Straight Undecorated	–0.08	–0.35	1.30	1.02
Eigenvalues	0.301	0.137	0.050	0.028

The ceramic variability within the Fort Yates and Thomas Riggs phases is relatively minor and does not lend itself to the ordering of units along a temporal dimension. To date the sites, the radiocarbon data form the main body of information with the ceramic ordination taking a subordinate role. The earliest dated components in the Grand-Moreau and Cannonball regions are Jake White Bull, Paul Brave, Travis I, and possibly Bendish, all falling within the thirteenth century. Tony Glas is tentatively assigned to this time period, based upon ceramic affinities with Paul Brave. Clark's Creek also is tentatively assigned to this period, although there is only one date from it. The temporal positions of Clark's Creek, Steifel, and PG are discussed elsewhere (Ahler, 1993b:76–78). Thomas Riggs is tentatively assigned to this period based upon its ceramic differences with two later sites, Black Widow Ridge and Cheyenne River. Three dates from the Ketchen site place it within the thirteenth century, although its ceramic assemblage is too

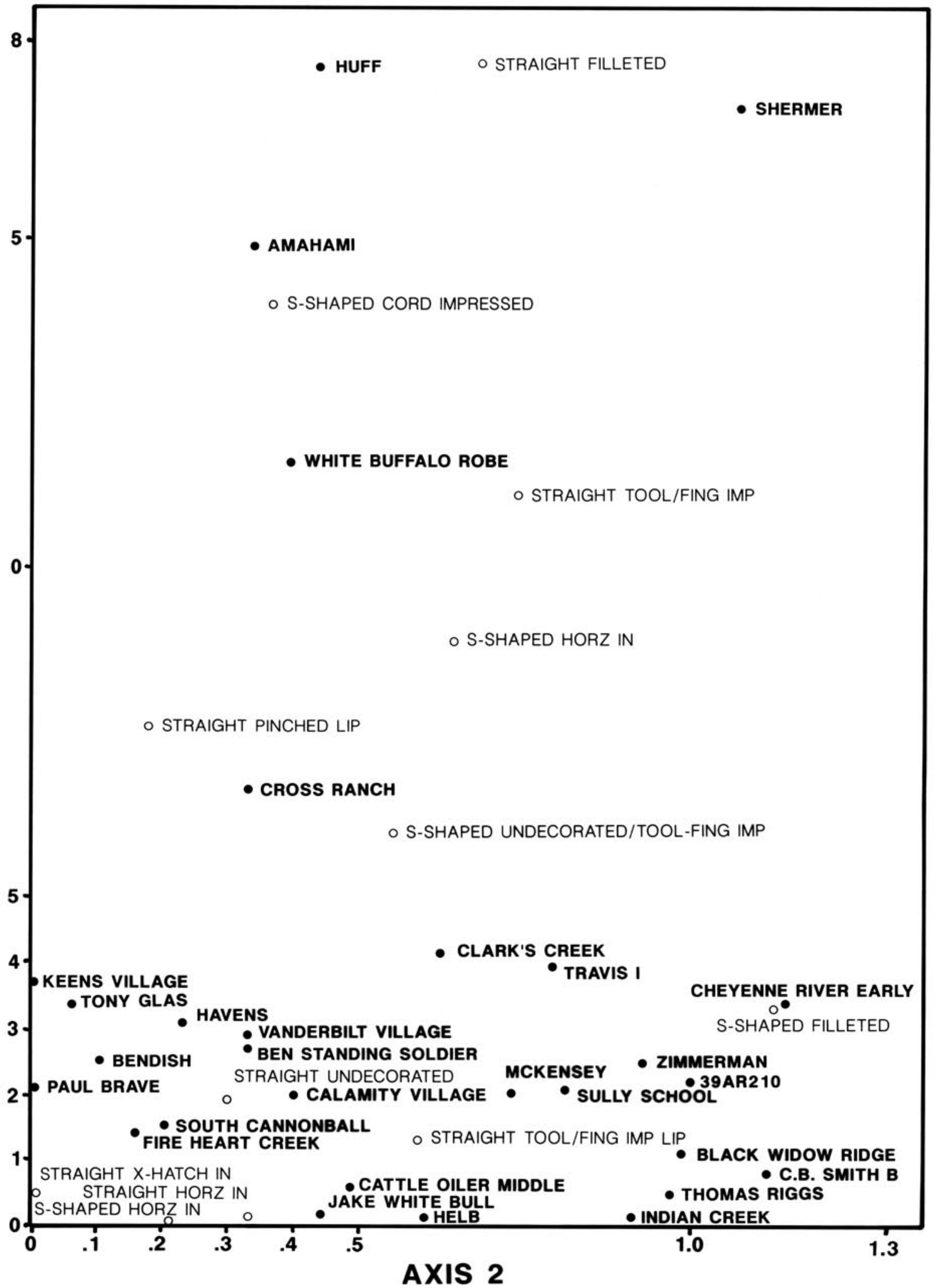

FIGURE 10. Plot of Extended and Terminal Middle Missouri variant components and descriptive rim sherd categories on Axis 1 and Axis 2, detrended correspondence analysis ordination.

TABLE 14. Site component and ceramic type scores from the detrended correspondence analysis of Extended Middle Missouri components.

Component or type	Axis 1	Axis 2	Axis 3	Axis 4
Havens (32EM1)	0.17	0.53	0.22	0.14
Tony Glas (32EM3)	0.00	0.64	0.23	0.16
Clark's Creek (32ME1)	0.53	0.23	0.53	0.29
Bendish (32MO2)	0.07	0.79	0.32	0.16
Cross Ranch (32OL14)	0.24	0.53	0.57	0.37
Fire Heart Creek (32SI2)	0.12	0.80	0.00	0.23
Paul Brave (32SI4)	0.00	0.68	0.66	0.00
Ben Standing Soldier (32SI7)	0.28	0.60	0.31	0.17
South Cannonball (32SI19)	0.20	0.78	0.42	0.03
McKensey (39AR201)	0.69	0.39	0.47	0.34
39AR210	0.99	0.48	0.39	0.42
Vanderbilt (39CA1)	0.24	0.79	0.16	0.52
Keene Village (39CA2)	0.38	0.75	0.35	0.07
Helb (39CA208)	0.60	0.59	0.30	0.21
Jake White Bull (39CO6)	0.45	0.68	0.43	0.24
Travis I (39CO213)	0.72	0.39	0.20	0.37
Calamity Village (39DW231)	0.36	0.71	0.05	0.29
Thomas Riggs (39HU1)	0.97	0.35	0.33	0.17
Sully School (39SL7)	0.82	0.74	0.31	0.53
C. B. Smith B (39SL29)	1.06	0.00	0.19	0.18
Zimmerman (39SL41)	0.90	0.51	0.31	0.24
Cheyenne River Early (39ST1)	1.10	0.86	0.29	0.00
Indian Creek (39ST15)	0.91	0.48	0.25	0.15
Black Widow Ridge (39ST203)	0.98	0.54	0.21	0.14
Cattle Oiler Middle (39ST224)	0.48	0.67	0.20	0.10
S-shaped Cord Impressed	–0.32	–0.20	1.49	0.90
S-shaped Horizontal Incised	1.56	1.64	0.66	2.24
S-shaped Cross-Hatch Incised	–0.51	1.70	2.42	2.37
S-shaped Filleted	3.51	5.64	0.68	–1.00
S-shaped Tool/Finger Impressed, Undecorated	0.32	1.58	–1.87	3.06
Straight Horizontal Incised	0.07	1.60	–1.28	0.99
Straight Cross-Hatch Incised	–1.48	0.14	4.08	–3.66
Straight Tool/Finger Impressed	1.64	–1.82	–1.10	–0.32
Straight Filleted	2.19	2.38	0.38	–2.00
Straight Pinched Lip	–1.38	0.75	–2.69	1.05
Straight Tool/Finger Impressed Lip	1.20	0.11	0.29	0.25
Straight Undecorated	–0.29	1.33	0.24	–0.23
Eigenvalues	0.166	0.046	0.022	0.011

small to allow it to be included within the present ceramic ordination. Two villages in the Cannonball region, South Cannonball and Havens, are similar in ceramic content and have dates placing them in the fourteenth century. Helb is another fourteenth-century village. It has two PVD dates associated with it, with all others being rejected for various reasons. Kay (1994) thought that this village was occupied on three separate times. The dates from Shermer place it in the fourteenth century, contemporaneous with the late Extended Middle Missouri villages of South Cannonball, Havens, and Helb. Helb dates to the last half of the fifteenth century. Shermer is dated somewhat earlier than Huff, which agrees with the ceramic differences between them (Stanley Ahler, pers. comm., 1997).

To summarize, the available radiocarbon and ceramic data suggest that there may be at least three regional temporal sequences, each corresponding to the Bad-Cheyenne, Cannonball/upper Grand-Moreau, and Knife regions. Each is characterized by its own trajectory of ceramic change, meaning that there is no overall trend through time in the Extended Middle Missouri potting tradition. The commonly cited change from straight rims (Riggs ware) to

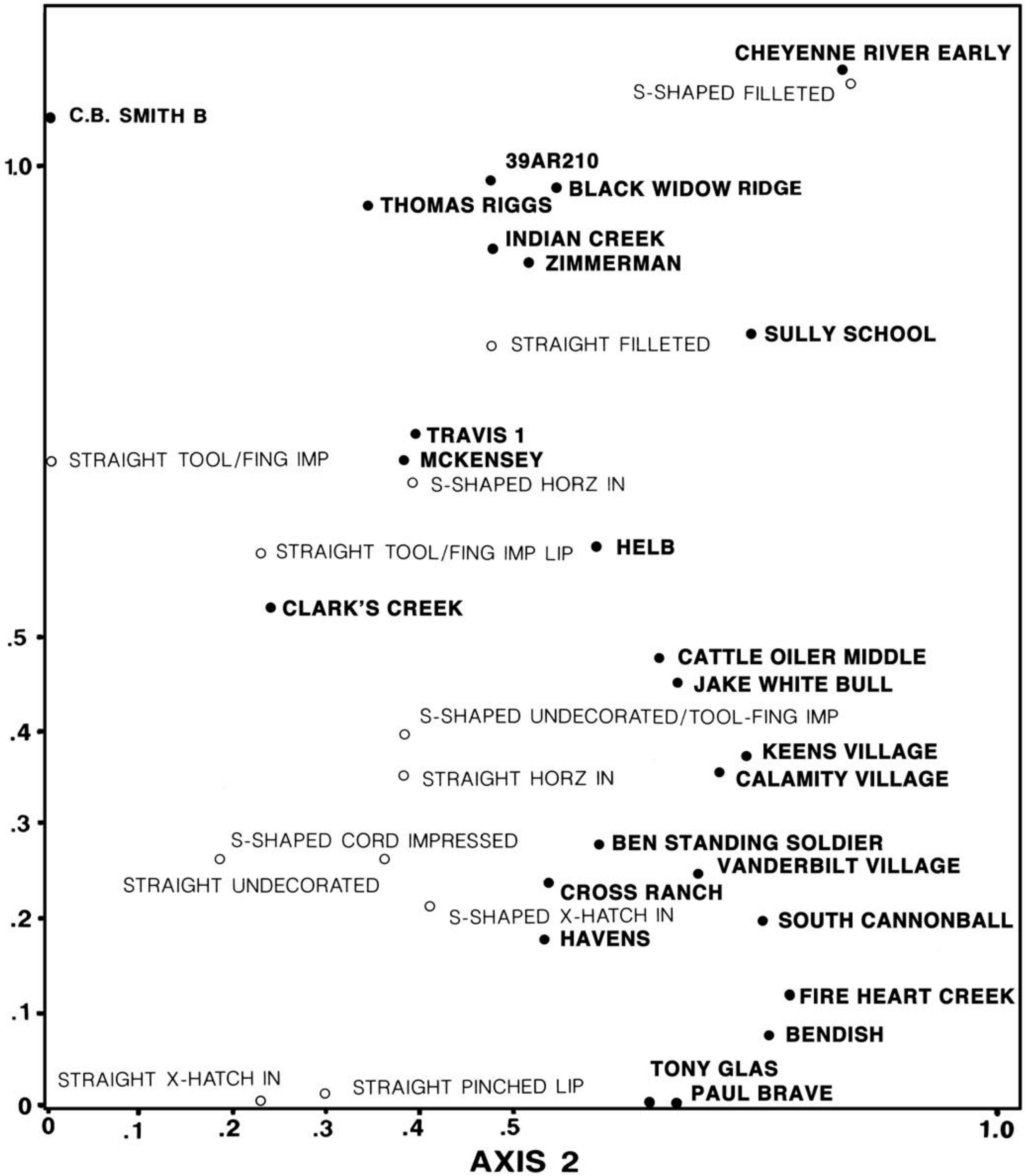

FIGURE 11. Plot of Extended Middle Missouri variant components and descriptive rim sherd categories on Axis 1 and Axis 2, detrended correspondence analysis ordination.

S-shaped (Fort Yates ware) forms is based almost entirely upon comparisons between Extended variant sites and a single Terminal Middle Missouri village, the Huff site. Other sites that are assigned to the Terminal variant by Lehmer (1971, fig. 79), including Tony Glas, Helb, and Jake White Bull, have typical Extended variant ceramic assemblages that differ substantially from Huff. This means that the Terminal Middle Missouri, as originally conceived (Lehmer, 1971:120–124) is so heterogeneous in terms of dating parameters and material content as to render this taxonomic unit of limited value. There is little doubt that some Terminal variant communities, such as Huff and Shermer, represent the final stage of the Middle Missouri tradition, but other sites do not.

Incongruities between the location of several sites and the nature of their ceramic assemblages raises particular interpretive questions. For example, Cattle Oiler has affinities with a number of Cannonball villages yet is located in the Big Bend region. Although the information is far from clear, this may indicate a movement of Cattle Oiler villagers to the south, bringing with them their regional potting tradition. Several southern villages, Sully School and 39AR210, contain relatively large numbers of horizontally incised, S-shaped rims compared with other Extended Middle Missouri sites. The reasons for this are unclear, although it is possible that these villages represent a transitional Initial/Extended Middle Missouri stage, or that they had incorporated refugee Initial Middle Missouri peoples. Some Initial variant sites, such as Akitchita, Swanson, Pascal Creek, Chapelle Creek, Jandreau, Pretty Head, and Fay Tolton, contain relatively large frequencies of incised, S-shaped rims. It is clear from this discussion that the current approach to ceramic variability, although "coarse-grained," provides information useful in selecting sites for more detailed analysis. It is this information that is useful in guiding future research efforts (see chapter 8).

For the purposes of the occupational history of the Middle Missouri presented in chapter 7, the following components are assigned to the 100-year periods. The earliest of these are put into period 3 (AD 1200–1300), including Jake White Bull, Travis I, and Ketchen. Clark's Creek and Thomas Riggs may have been occupied during this period, although they are dated by only one accepted radiocarbon date. Indian Creek also is placed in this time period by virtue of its ceramic affinities to other sites of this period. Cattle Oiler also appears to date to this period because of its ceramic relationships with Jake White Bull and Calamity Village. About the same number of Extended Middle Missouri communities were occupied during period 4 (AD 1300–1400). Among the sites established during this time are Havens, White Buffalo Robe, Cross Ranch, Steifel, PG, South Cannonball, Bendish, Vanderbilt, Helb, Cheyenne River, and Durkin. Except for Durkin and Cheyenne River, all of these sites are located in North Dakota or northern South Dakota. Villages tentatively assigned to this period include Tony Glas and Black Widow Ridge. The Terminal Middle Missouri village of Shermer is assigned to this period, whereas the Huff site is placed in period 5 (AD 1400–1500). The temporal positions of the remaining villages, including Sully School, Calamity Village, Fire Heart Creek, Ben Standing Soldier, Keens Village, McKensey, Zimmerman, C. B. Smith, and 39AR210 remain undetermined.

Craniometric Distance

Because of the paucity of human crania from Extended and Terminal Middle Missouri sites, little can be said concerning craniometric distances between individuals from particular villages assigned to these taxonomic units. The only one who dealt with specific villages or groups of taxonomically related sites at the phase level was Key (1983, figs. 17, 19, 22). The sites in this analysis include Huff, Thomas Riggs, C. B. Smith, and Havens. A single crania is represented from each site. Key's analysis indicates that there is a substantial amount of variation present, with Huff and Havens being most dissimilar. The Thomas Riggs phase villages of Thomas Riggs and C. B. Smith fall between Huff and Havens. These results tend to support the findings of the ceramic ordination that there is definable ceramic variability between the sites but is inconclusive concerning the temporal relationships between the villages.

In a more general sense, the Thomas Riggs and Huff sites have affinities to the Truman (Sonota) and Arvilla Woodland complexes, respectively (Key, 1983, fig. 17). The Havens site is related to the Grand Detour phase. Thomas Riggs and C. B. Smith also are related to crania from the Deapolis site (Key, 1983, fig. 19). Key's (1983, fig. 22) full sample analysis indicated that Thomas Riggs and C. B. Smith are similar to post-contact Le Beau phase villages, with Havens maintaining its ties to the Grand Detour and Over phases. Huff diverged from the other samples in this analysis, with no clear craniometric affinities. In another study (Owsley, Morey, and Turner, 1981, table 6), the crania from Thomas Riggs and Havens classify as Mandan (combined Terminal Middle Missouri and Heart River complex samples) rather than other reference samples from the Crow Creek (Initial Coalescent), Anton Rygh, and Mobridge (Le Beau phase) sites.

INITIAL COALESCENT

The Initial variant of the Coalescent tradition is one of the most important cultural developments in understanding the dynamics of the Plains Village pattern. A number of factors, such as low site density, unrecognized sites, mixture of components, lack of excavations, and a substandard site report in one case, have conspired to make the Initial Coalescent one of the least understood of all taxonomic units. The lack of basic knowledge of it is perhaps only rivaled by the Heart River phase.

Taxonomy

Fox (1980) and Steinacher (1983:48–53) presented the most recent reviews of the Initial Coalescent, although neither proposed any modifications to the existing taxonomic structure of the variant. The following summary is based largely upon a distillation of statements compiled by Steinacher (1983, attachment 3). There is no summary of the Initial Coalescent that attempts to reconcile the various taxonomic assignments of sites. Perhaps this is symptomatic of the state of knowledge of the variant. As a result, the taxonomy that has developed reflects the views of numerous researchers, with no clear and widely accepted scheme. There are currently three recognized phases or foci: Arzberger, Campbell Creek, and Anoka. Taking the spatial dimension as the main determinant of phase affiliation, the Talking Crow, Crow Creek, Black Partizan, and Farm School components are assigned to the Campbell Creek focus (Neuman, 1961:199; Witty, 1962:181). Lynch and other nearby sites in Nebraska might be best grouped into an Anoka phase (Lehmer, 1971:114–115; Smith, 1977:156). The Arzberger site, along with Black Partizan, are assigned to the Arzberger phase (Caldwell, 1966b:85). Kivett and Jensen (1976:78), and Smith (1977:156) recognized Arzberger 1 and Arzberger 2 as subphases of the Arzberger phase. The latest taxonomy created by Ludwickson et al. (1987:161–168) included a "Basal Coalescent," comprised of the Itskari (Loup River) and St. Helena phases, which precedes and is presumably ancestral to the Initial Coalescent.

Origins

The earliest statement about Initial Coalescent origins focuses on an Upper Republican progenitor (Strong, 1940:382–383). Spaulding (1956:76–79) and others reinforced the Initial Coalescent-Central Plains tradition link of focusing on an Upper Republican origin either by diffusion or direct migration because of drought (Lehmer, 1954a:148–150; see Steinacher, 1983:51–52, 135–142, for a summary of these statements). Today, the most widely accepted view is that the Initial Coalescent represents a blending of Central Plains and Middle Missouri tradition traits (Lehmer, 1954a:148–154, 1971:115, 125–126; Smith, 1963:489; Caldwell, 1966b:84; Lehmer and Caldwell, 1966:514; Caldwell and D. R. Henning, 1978:133). This blending took place when Central Plains tradition groups, such as Upper Republican, Loup River (Itskari), and/or St. Helena, either migrated into South Dakota and interacted with indigenous Middle Missouri peoples or participated in trade or other activities that fostered the dissemination of cultural traits characteristic of the Coalescent tradition (Strong, 1940:382; Lehmer, 1954a:146–147; 1970:125; 1971:115, 125; Wedel, 1961:183; Ludwickson, 1975:114–121; Caldwell and D. R. Henning, 1978:129). Blakeslee (1978:139–143) and Spaulding (1956:89–90) also thought that Mississippian or Oneota influences played a role in the formation of the Initial Coalescent. The migration of populations from the Central Plains subarea into the Middle Missouri, according to the traditional hypothesis, occurred during a period of drought (Lehmer, 1954a:148–150; Wedel, 1961:182–184; Caldwell, 1966b:77–81).

This contrasts to a more recent study suggesting there is little evidence of a fusion of Central Plains and Middle Missouri cultural traits, the defining characteristic of the Initial Coalescent (Steinacher, 1983:93–95, 1990:22–23). Steinacher also found no evidence for a direct migration of currently recognized Central Plains groups. Rather, it appears as though the strong similarities between Initial Coalescent and certain Central Plains phases (Smoky Hill, Nebraska, Loup River) may be through an indirect process. The link between them may be through sites traditionally assigned to the Anoka focus. Others concerned with the cultural developments in the Central Plains subarea of the Plains suggested a developmental sequence from the Nebraska phase to the St. Helena phase, which turns into the Initial Coalescent (ancestral Arikara) (Blakeslee, 1988:6–8; O'Brien, 1994:214). Ludwickson et al. (1987:218) implied that the Initial Coalescent had its beginnings in the Basal Coalescent, the taxonomic unit that includes the St. Helena and Itskari phases. The most recent statement on this problem suggested one possible scenario or model that links the Central Plains tradition with the Itskari phase via the Initial and Extended Coalescent (Billeck et al., 1995:31). The preponderance of linguistic, archeological, and craniometric evidence suggests that the Pawnee and Arikara are descendent from Central Plains tradition ancestors (Billeck et al., 1995:32).

Blakeslee (1981b) and Wood (1993d) discussed the mechanics by which the Coalescent tradition developed and spread. Blakeslee thought that the Calumet ceremony was largely responsible for the cultural interaction that led to the Coalescent. Wood, on the other hand, contended that the Hako, a Pawnee version of the Calumet, provided a mechanism for the spread of Caddoan (Arikara) cultural elements throughout the Northern and Central Plains. The Hako is a mechanism facilitating interband and intertribal trade of goods and exchange of ideas.

Internal Development

Upon their arrival on the Missouri River, Initial Coalescent peoples appear to have interacted with resident Initial and Extended Middle Missouri villagers (Lehmer, 1971:124–126, figs. 71–73). The main theme of this interaction involved violence between Initial Coalescent and Middle Missouri populations (Caldwell, 1964:2–3, 1966b:85; Lehmer, 1971:125–126; Kivett and Jensen, 1976:67). The numerous villages with elaborate fortification systems are thought to be a response to this competition. The reason for this conflict is unclear, although an increase in population pressure and competition for resources, such as horticultural bottomland and timber, cannot be ruled out (see Caldwell, 1964:3). There also is the possibility that cultural factors played a part, because the Initial Coalescent and Middle Missouri are from different ancestral stocks (i.e., Caddoan vs. Siouan speakers). Some of this interaction might be of a nonviolent nature, probably a necessary prerequisite for the kinds of borrowing envisioned in Lehmer's concept of the Coalescent tradition. It also is suggested that internecine Initial Coalescent violence was a major factor in these people's lives (Zimmerman and Whitten, 1980; Zimmerman and Bradley, 1993). The massacre of at least 486 Initial Coalescent individuals at the Crow Creek site is cited as evidence for this, although it is more likely these people met their fate at the hands of Initial Middle Missouri villagers. In the final analysis, the answer to this question remains unresolved until the dating of more individual Initial Coalescent and Middle Missouri villages is completed.

Demise

There is almost unanimous agreement that the Initial Coalescent is ancestral to the Extended Coalescent and later protohistoric Arikara (Strong, 1940:382; Lehmer, 1954a:159, 1971:115, 120, 127; Spaulding, 1956:109; Caldwell and D. R. Henning, 1978:133; Ludwickson, 1979:57; Zimmerman and Bradley, 1993:224). Some ceramic discontinuities between the two variants indicate that the relationship between them may not have been one of simple replacement (C. Johnson, 1998a:308). It also is hypothesized that the Initial Coalescent is ancestral to the protohistoric Pawnee (Lower Loup), a band of which (Skiri) is closely related the Arikara (Strong, 1940:382; Spaulding, 1956:86, 109; Deetz, 1965:14, 22–23; Caldwell, 1966b:85; Zimmerman and Bradley, 1993:225). As a result, Initial Coalescent peoples are antecedents of later Extended and Post-Contact variant groups that ultimately lead to the historically documented Arikara and possibly some Pawnee.

Radiocarbon Dates

There are 20 radiocarbon dates available from four Initial Coalescent components (Table C.2). These are averaged and calibrated, eliminating all but the three UCR dates from the Whistling Elk and Arzberger sites. The seven UGa dates from Whistling Elk are excluded on the basis of advice from Dennis Toom (pers. comm., 1992). A plot of the averaged and calibrated dates from these four sites is presented in Figure 12 along with those from other Coalescent tradition variants. The ranges of these dates and all others in this figure are based upon the 2-sigma (95.4%) probabilities. Only individual probabilities within the 2-sigma range of 0.10 or greater are considered in Figure 12 to eliminate outliers or dates with very low probabilities. Taking the ranges of these dates as a starting point, the Initial Coalescent is placed in a time frame between about AD 1200 and AD 1600, a span of 400 years. Eliminating the date from the Lynch site yields a range similar to the AD 1302 to AD 1598 figure of Ahler, Johnson et al. (1995, table 5). If Whistling Elk is used as the earliest village and the lowest probability span (.42) from Arzberger is eliminated, a range acceptable to Toom (1992a, table 1) of about AD 1300 to AD 1500 results. Eliminating Arzberger from the dating yields a much earlier span of AD 1300 to AD 1400 for the variant (Ahler, Johnson et al., 1995, fig. 11). Although accepting the crossover point for Lynch does little to modify this occupational span, accepting the full range of Lynch raises the distinct possibility that the Initial Coalescent begins as early as AD 1200. Despite the fact that the Lynch site is included in most discussions of the Initial Coalescent, a systematic reanalysis of the site is needed to evaluate its relationship to the Missouri River villages. It is possible that, upon reexamination, it might not be included within the Initial Coalescent. The single date from carbonized residue on

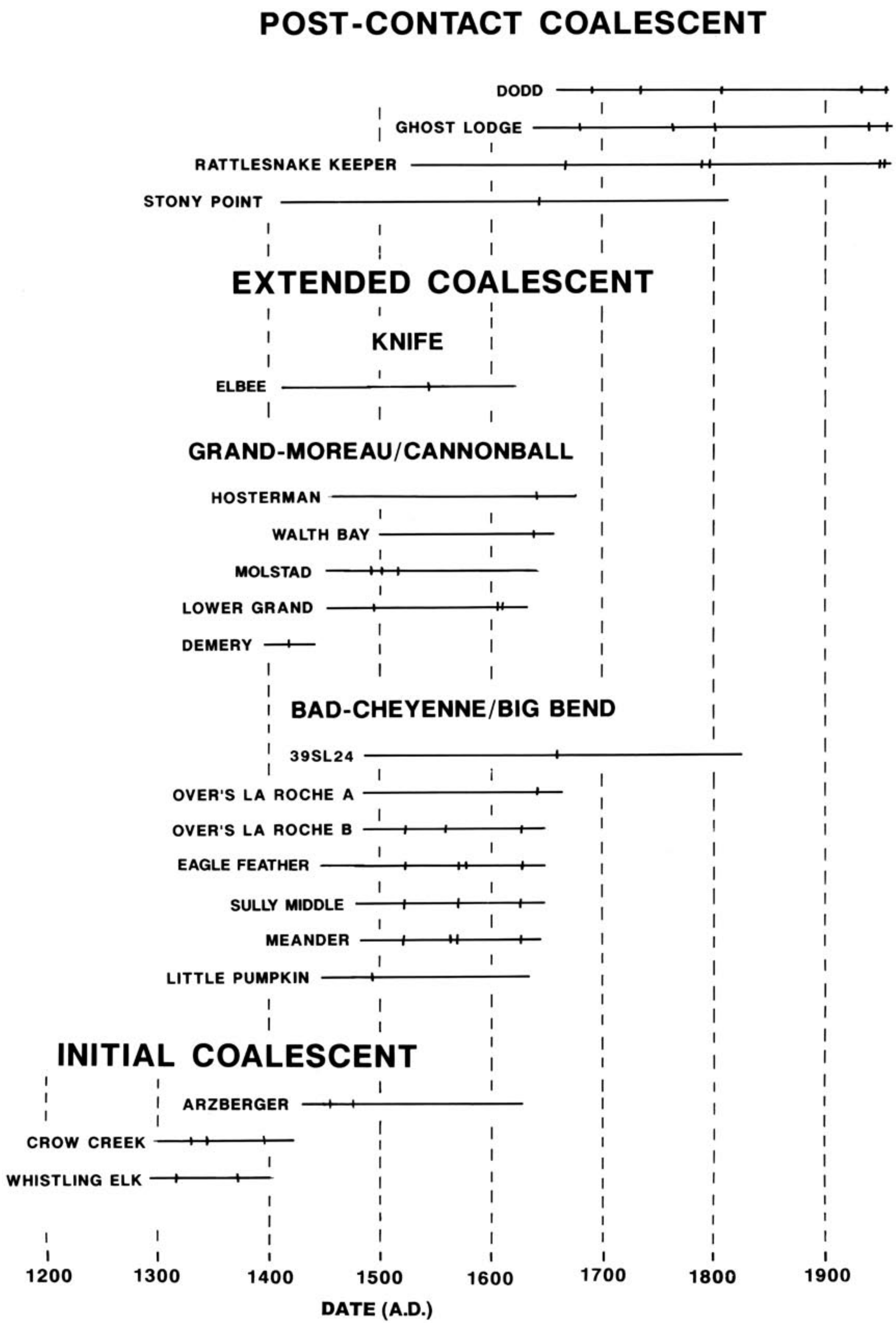

FIGURE 12. Plot of calibrated radiocarbon date ranges from Coalescent tradition components based on the decadal calibration curve (Stuiver and Becker, 1993) as implemented in CALIB 3.0.3 (Stuiver and Reamer, 1993).

a pot used to date Lynch also may be too early by about 100 to 200 years, given the present uncertainty of residue dates (see Table 9 in this report). Finally, Figure 12 indicates a relatively continuous series of dates, although this might change, depending on the actual crossover point of the Whistling Elk series. The early date from Whistling Elk is supported by the presence of several feet of eolian (loess) deposits on top of the paleosol containing cultural material (see Toom, 1992c:326–329). A similar loess deposit capping the Initial variant occupation at Crow Creek also supports an early placement in the Initial Coalescent chronological sequence.

Analysis

The data matrix of five Initial Coalescent components and 12 pottery types used in the following correspondence analysis is listed in Table A.4. Unlike all other ordinations presented in this study, this one does not allow the DECORANA program (M. O. Hill, 1979) to extract a second eigenvalue on the Initial Coalescent sample because it has a value of zero. In its place, the DECORANA procedure in CANOCO (ter Braak, 1989) is employed, courtesy of Robert E. Warren of the Illinois State Museum. This program extracts two eigenvalues, with values of .21 and .00. The second eigenvalue was retained since it provides some meaningful information. Table 15 lists the component and ceramic type scores output from the program. These are plotted along axis 1 in Figure 13.

A comparison of the ordering of components in Figure 13 with their radiocarbon dates indicates that axis 1 is considered a temporal dimension. Whistling Elk is the earliest dated site and falls at one end of Figure 13. Ceramic and radiocarbon evidence indicates that Arzberger is the latest site in the Initial Coalescent sequence. For the purposes of this study, it is assumed that the ordering of the South Dakota components in Figure 13 represents a temporal dimension. Components that are early (high scores on axis 1) possess a relatively large number of rim sherds with finger-impressed straight rims and straight rims that lack decoration. S-shaped rims are most common in late Initial Coalescent sites, such as Arzberger. Axis 2 is largely responsible for separating Whistling Elk from the other four sites. One pottery type, straight finger-impressed rims, is responsible for this difference. This pottery type may be most typical of the earliest Initial Coalescent ceramic assemblages.

If a date of ca. AD 1350 for the occupation of Whistling Elk is accepted along with an estimate of AD 1450 for the Arzberger site, it is a matter of interpolating between the two to assign Black Partizan, Lynch, and Talking Crow the time periods used in chapter 7. Talking Crow then falls within Period 4 (AD 1300–1400) with Black Partizan, and Lynch assigned to Period 5 (AD 1400–1500). Crow Creek, dated by two radiocarbon dates, falls within Period 4. Arzberger, given its large 2-sigma error, is placed somewhere in the Period 5 or early Period 6 range. Whistling Elk is placed in Period 4 (AD 1300–1400).

TABLE 15. Site component and ceramic type scores from the detrended correspondence analysis of Initial Coalescent components.

Component or type	Axis 1	Axis 2
Lynch (25BD1)	0.57	0.57
Talking Crow II (39BF3)	1.30	0.67
Azberger (39HU6)	0.00	0.67
Whistling Elk (29HU242)	1.46	0.00
Black Partizan B (39LM218)	0.74	0.70
S-shaped Diagonal Incised	–1.35	1.03
S-shaped Horizontal Incised	–0.08	–0.12
S-shaped Cross-Hatch Incised	–1.97	0.32
S-shaped Cord Impressed	0.44	0.32
S-shaped Finger Impressed	–1.77	–0.43
S-shaped Tool Impressed	0.18	–1.51
S-shaped Undecorated	–0.47	0.32
Straight Finger Impressed	2.54	–1.09
Straight Horizontal Incised	0.20	0.83
Straight Diagonal Incised	0.44	0.32
Straight Tool/Finger Impressed Lip	0.54	0.41
Straight Undecorated	1.69	1.92
Eigenvalues	0.211	0.000

Craniometric Distance

Ever since a large number of individuals associated with the Initial Coalescent occupation at the Crow Creek site was excavated, there has been an intense interest in this variant of the Coalescent tradition. Except for the individuals from Crow Creek and a single human crania recovered from the Lynch site (Key, 1983, table 1; Willey and Emerson, 1993), no other Initial variant site has yielded human skeletal remains useful in the study of craniometric relationships. When this fact is coupled with the inability to use the Crow Creek ceramic sample in this study, there is virtually no basis for comparing the results of biological (craniometric) and social (ceramic) distance. Some of the results of craniometric studies are summarized, however.

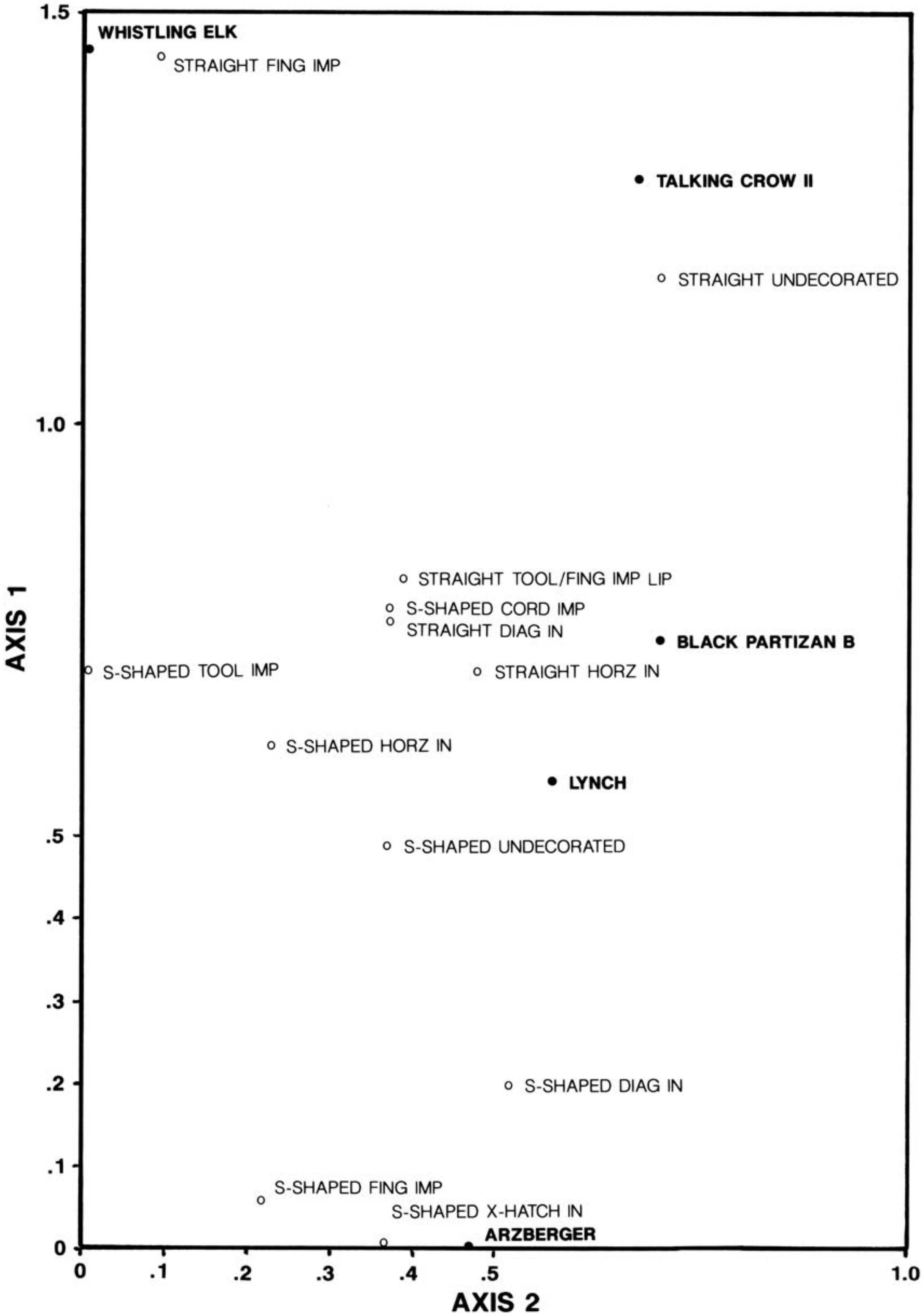

FIGURE 13. Plot of Initial Coalescent variant components and descriptive rim sherd categories on Axis 1 and Axis 2, detrended correspondence analysis ordination.

The two major studies of Initial Coalescent craniometric variation compare the sample from Crow Creek to sites assigned to the St. Helena phase, Le Beau phase (protohistoric Arikara), Ponca, Pawnee, and Mandan (Willey, 1990; Willey and Emerson 1993). Both analyses find the crania from Crow Creek to be most similar to those from two St. Helena sites (25DK9, 25DK13) and secondarily to the Le Beau phase sites of Mobridge, Larson, and Anton Rygh (Willey, 1990, figs. 5, 6; Willey and Emerson, 1993, fig. 17). Key (1983, figs. 21–23) compared the single Anoka focus crania from the Lynch site to others from the Central and Northern Plains. His study indicated that the Lynch site crania is most similar to those of the Central Plains tradition (Nebraska, Loup River, St. Helena phases), lending some support to the Willey and Emerson studies. This indicates an early position for Lynch, perhaps contemporaneous with Whistling Elk. The studies by Key and Willey suggest that the Initial Coalescent may have its origins in the Central Plains tradition and is ancestral to later Arikara populations of the Le Beau phase. Key (1983:92) and Willey and Emerson (1993:265), however, thought that the link between the Initial Coalescent and St. Helena represented an interaction or gene flow between contemporaneous groups, rather than an ancestral one. On the other hand, St. Helena and the Initial Coalescent may be related through a common ancestor, as Billeck et al. (1995:25) suggested. The Crow Creek individuals also may be related to other Arikara groups, such as those assigned to the Bad River and Talking Crow phases, although there are no formal analyses of these relationships. Key's (1983, fig. 21) study also indicated that the crania from the Le Beau, Bad River, and Talking Crow phases are similar.

EXTENDED COALESCENT

More sites than any other variant represent the Extended variant of the Coalescent tradition. There are about 175 Extended Coalescent villages (Lehmer, 1971, fig. 77), a number that has grown somewhat as a result of subsequent archeological surveys (Falk, 1983; Falk and Pepperl, 1986). Despite the abundance of these sites, it remains one of the more poorly dated variants in the subarea, as the following discussion demonstrates.

Taxonomy

The cultural taxonomy of the Extended Coalescent or Chouteau aspect, its previous designation, is not well developed compared with other Middle Missouri Plains Village variants. Hoffman (1967:58–59) and Lehmer (1971:120) provided brief summaries. Six foci are defined, based upon the geographic location of sites. From south to north these are the Redbird, Shannon, La Roche, Bennett, Akaska, and Le Compte foci. An additional entry to this list, the Felicia focus or phase, was suggested by Caldwell (1966a:80) and by Smith and Johnson (1968:49) and included components in the lower Big Bend region that are intermediate in time between the prehistoric Shannon focus and the protohistoric Talking Crow phase. The Redbird focus (Wood, 1965) included prehistoric and protohistoric Ponca villages located near the confluence of Ponca Creek and the Niobrara River in northeastern Nebraska. Shannon focus sites are located in the lower Big Bend region and predate Felicia phase communities (Smith and Grange, 1958:125; Smith and Johnson, 1968:49). Villages of the La Roche focus (Hurt, 1952:34–35; Stephenson, 1954) include those concentrated in the Big Bend and Fort Randall regions, although it has more recently been expanded to include the majority of Extended variant sites (Lehmer, 1971:120). Bennett focus sites are located in the Bad-Cheyenne region (Hoard, 1949; Stephenson, 1954), whereas those of the Akaska focus are somewhat farther upriver in the Grand-Moreau region (Hurt, 1957:26–27; Wilmeth, 1958:12–15). Perhaps the most distinctive Extended Coalescent taxon is the Le Compte focus (Johnston and Hoffman, 1966), characterized by villages having houses both within and outside bastion fortification systems. These villages are on the west (right) bank of the Missouri river in the Bad-Cheyenne and Grand-Moreau regions. Hurt (1970:206) believed that different settlement patterns associated with some of the Extended Coalescent taxonomic units may be the result of varying economic activities reflecting seasonality.

Origins

It is not an overstatement to say that, almost without exception, researchers who discussed the origins of the Extended Coalescent emphasized a beginning in the preceding Initial Coalescent (Strong, 1940:382; Spaulding, 1956:109; Lehmer, 1971:115, 120, 127; Caldwell and D. R. Henning, 1978:133; Ludwickson, 1979:57; Zimmerman and Bradley, 1993:224). Given the general lack of knowledge of the Initial Coalescent, the certainty with which this hypothesized relationship is proposed is somewhat surprising. There are some ceramic discontinuities between the Initial and Extended variants that remain unexplained (C. Johnson, 1998a:308). Of the four dated Initial variant villages, only Arzberger falls within the temporal span of the earliest Extended Coalescent sites if the apparent aberrant dates from two sites (Bower's La Roche, McClure) are rejected. The strongest link between Initial and Extended Coalescent potting traditions also involves the Arzberger site. The other dated Initial Coalescent site in this study, Whistling Elk, has a ceramic assemblage with closer ties to the Central Plains tradition. The Crow Creek ceramic assemblage is inadequately described and therefore cannot be evaluated (Appendix A).

Although little is known about most of the remaining Initial Coalescent sites, there is the possibility that the Extended Coalescent evolved from Arzberger or perhaps a few other late Initial Coalescent villages. In addition to other similarities, early Extended variant Le Compte focus villages have bastion fortifications similar to Initial Coalescent sites. Clearly, the dynamics of the Initial to Extended Coalescent transition remains uncertain. A recent attempt by Zimmerman and Bradley (1993) to make such a link proposed that a dispersal of populations from the Initial to Extended Coalescent was in response to internecine warfare. To briefly summarize their argument, competition between Initial Coalescent villages for arable, floodplain bottomland resulted in a shift away from large fortified villages of this variant to the smaller and more scattered hamlets of the Extended Coalescent. It is suggested that a number of northern Extended variant peoples, as represented by the Akaska focus, owed a portion of their cultural heritage to the Terminal Middle Missouri or Huff focus (Wilmeth, 1958:12–13; Woolworth and Wood, 1964:131, 134; Lehmer, 1971:127–128;). This relationship to cultural developments in North Dakota, most apparent in pottery, played a prominent role in the successor to the Akaska focus, the protohistoric Le Beau phase.

Internal Development

Given the widespread and relatively dense distribution of Extended Coalescent sites along the Missouri River throughout most of South Dakota, it is generally believed that these peoples rapidly expanded in population, surpassing preceding periods (Lehmer, 1971:115). It also is postulated that Extended Coalescent peoples were rather mobile, their villages characterized by scattered, lightly constructed houses with thin accumulations of refuse, sometimes in the Missouri breaks area (Brown, 1967:203; Hoffman, 1968:78; Lehmer, 1971:115–116). Lehmer (1970:128, 1971:128) believed this settlement pattern was in response to the Neo-Boreal climatic episode when summer temperatures cooled and made horticulture more difficult. It also was a time of relative tranquility or "pax La Roche," when most Extended variant villages were unfortified (Caldwell, 1964; Lehmer, 1971:126). The exception to this is a number of Extended Coalescent villages concentrated in the Grand-Moreau region, many of which are assigned to the Le Compte focus (Johnston and Hoffman, 1966; Hoffman, 1967:62–63; Lehmer, 1971:126). It is believed that these villagers, with their expansion into northern South Dakota, came into conflict with resident Extended and Terminal Middle Missouri peoples (Lehmer, 1971:126–127). The inference is that the Extended Coalescent developed in the Big Bend region from its Initial variant base and spread up and downriver (see also Wilmeth, 1958:14; Lehmer, 1971:126). LeCompte focus communities, because of their close similarities, are thought to represent the remains of a single tribe or subtribal (band) entity (Johnston and Hoffman, 1966:63; Stephenson, 1971:85–86).

Demise

The Extended variant of the Coalescent tradition is ancestral to three protohistoric or Post-Contact Coalescent phases: Felicia, Bad River, and Le Beau (Hurt, 1957, chart I; Smith, 1960, 1963, 1977:155–156; Smith and Johnson, 1968:49; Lehmer, 1971:163). The transition between the Extended and Post-Contact Coalescent variants, at least in terms of ceramics, is best demonstrated in the Big Bend region (Smith, 1960, 1963, 1977, fig. 29). Smith's work indicated a gradual change from Extended Coalescent to the Felicia phase. Felicia phase pottery, in turn, gradually develops into the Talking Crow phase ceramic tradition.

The transition from the Extended to the Post-Contact Coalescent is more abrupt in the Bad-Cheyenne and Grand-Moreau regions, contrary to Lehmer's (1965:K123) opinion. Major ceramic changes occur from one variant to another, perhaps because this prehistoric to protohistoric transition period is only known from a number of poorly understood complex and multi-component stratified villages, such as Anton Rygh, Bamble, Spiry-Eklo, Larson, Swan Creek, Sully, Oahe Village, and Pierre School. This is probably a factor in Lehmer's (1965:E8–E9) recommendation that additional research be conducted on this problem. Baerreis and Dallman (1961:180) first noted the break in the continuity between pottery of the Extended Coalescent and the later Le Beau phase. A similar discontinuity is recognized between the Extended Coalescent and Bad River phase (Lehmer and Jones, 1968:81; Stephenson, 1971:92). An earlier statement by Lehmer (1954a:124, 159) stressed the continuity between the two. Lehmer and Jones (1968:81) attributed the discontinuity to an occupational hiatus in the

Bad-Cheyenne region. This topic is addressed in the analysis presented below.

Despite some of the questions raised in linking the prehistoric Extended Coalescent to the protohistoric or post-contact developments in South Dakota, it is with the Extended variant that many researchers first began to make ethnic identifications. The most popular hypothesis is that the Extended Coalescent, through the intervening Post-Contact variant, represents the ancestral Arikara (Hurt, 1957:29, 1970:207). Meleen (1948:31) and Hoffman (1967:63–64, 1968:75) attributed Extended Coalescent villages not only to the Arikara but some, particularly those farthest to the south, to the Pawnee. Lehmer (1965: K107–K108) also stated that the similarity in cultural traits between the late Extended Coalescent in the Big Bend and lower Ft. Randall regions, and the Redbird and Lower Loup phases of the Central Plains of Nebraska indicates a spread of the Coalescent tradition to the south during this period. Wood (1965:125), who linked the Redbird focus to the La Roche focus of the Chouteau Aspect (i.e., Extended Coalescent), also supported this proposition. The Redbird focus was thought to be ancestral Ponca (Jantz, 1974; Wood, 1965:127). Bowers (1948a:23–24, 96–99) thought that sites assigned to his Lower Grand focus, including a number of Extended Coalescent villages in the Grand-Moreau region, represent the former communities of the Awigaxa band of the Mandan. C. Johnson (1988:98–100), summarized Bowers' arguments. On the other hand, Ludwickson (1978:105) believed that the Lower Loup phase developed locally in Nebraska out of the Loup River phase. The link between the Arikara and Pawnee may be through the St. Helena phase, which is similar to the Loup River phase and had a role in Coalescent developments in South Dakota. Grange (1979:146–147) held a similar view of Lower Loup-Pawnee origins. Hurt (1952:35) and Stephenson (1971:92) asserted that it is premature to assign ethnic identities to villages of the Extended Coalescent.

Radiocarbon Dates

Sixteen Extended Coalescent components are dated (Table C.2). Of these, 12 are organized in Figure 12 into northern (Grand Moreau-Cannonball) and southern (Bad-Cheyenne and Big Bend) groups. Elbee, a site of uncertain taxonomic assignment, is represented from the Knife region. Potts, Bowman, and McClure are eliminated from further consideration because of failing the test of contemporaneity or other problems (see chapter 5). The remaining components form a fairly tight cluster between AD 1450 and AD 1650, except for the Demery site, which is placed between about AD 1400 to AD 1450. The beginning date of AD 1450 is 150 years later than the Initial Coalescent sites of Whistling Elk and Crow Creek but contemporaneous with the early range of dates from the Arzberger site. The AD 1650 date for the termination of the Extended Coalescent provides a beginning date for Post-Contact variant in all regions, a date supported by Toom (1992b, table 1). It also is 50 years later than the most recently proposed date for the Post-Contact period in the Knife and Heart regions (Ahler, 1993b:89) and 25 years earlier than Lehmer's (1971:33) date for the onset of this period. A range of AD 1415 to AD 1640 increases the span of the Extended Coalescent to 225 years (Ahler, Johnson et al., 1995, table 5).

Both the northern and southern date series form a relatively continuous set of occupations, exhibiting no clear gaps in their respective sequences. The northern sequence appears to be the earliest, marked by the early fifteenth-century occupation at Demery. It also is apparent from these dates that the sixteenth and early seventeenth centuries was a time of instability in the correction curve, as the multiple crossovers of the majority of calibrated dates attest. This is somewhat discouraging, for it makes any fine-scale radiocarbon distinctions between these components difficult, if not impossible, to attain.

Analysis

The analysis of ceramic variability within the Extended Coalescent begins with a consideration of all components assigned to this taxon. The DCA involves 72 Extended Coalescent and Felicia phase components in addition to three Le Beau occupations. The early Le Beau phase components (Swan Creek B, Anton Rygh Upper, 39WW301) are included to provide a link between this analysis and the one employing a larger Le Beau sample, to be presented later. This study is the first time that sharing components that lie on the suspected temporal limits of two ceramic ordinations is accomplished. This is particularly important because it provides a cross check of two independent analyses. Additional examples of this procedure are presented later in this study. The Elbee site, which is not assigned to a specific taxonomic unit (Ahler, 1984a), is included in the present analysis to determine its ceramic relationships to other Extended Coalescent sites.

The results of the DCA of these components is presented in Table 16. It is apparent from the eigenvalues that axes 1 and 2 account for most of the variation in the data. Eigenvalues dramatically decline from axis 2 (.148)

TABLE 16. Site component and ceramic type scores from the detrended correspondence analysis of Extended Coalescent components.

Component or type	Axis 1	Axis 2	Axis 3	Axis 4
Redbird II (25HT2)	0.58	1.13	0.70	0.92
Elbee (32ME408)	1.24	0.90	0.90	0.80
No Heart Creek (39AR2)	0.22	0.70	1.12	0.49
39AR7	0.09	0.80	0.97	0.72
Anton Rygh RV-VII (39CA4)	1.56	0.81	0.98	0.66
Anton Rygh Upper (39CA4)	2.05	0.89	0.91	0.71
Anton Rygh Middle (39CA4)	1.82	0.77	1.00	0.68
Anton Rygh Lower (39CA4)	1.79	0.61	1.15	0.64
39BR10	0.93	1.68	0.16	1.31
Locke Creek (39CA201)	0.98	0.64	1.19	0.59
Demery (39CO1)	0.69	0.96	0.79	0.89
Fort Manuel (39CO5)	0.70	1.37	0.42	1.13
Leavenworth Early (39CO9)	1.70	0.56	1.16	0.66
Lower Grand (39CO14)	1.42	0.23	1.55	0.34
Bellsman Creek (39CO17)	0.77	0.24	1.59	0.16
39CO18	0.61	0.38	1.42	0.34
Potts (39CO19)	0.38	0.37	1.43	0.35
North White Bull (39CO41/207)	1.00	0.05	1.73	0.26
H & H (39CO78)	1.28	0.61	1.05	0.78
Travis I (39CO213)	0.73	0.26	1.58	0.19
Moreau River (39DW1)	1.09	0.66	1.15	0.63
39DW217	1.14	0.00	1.80	0.13
Fox Island (39DW230)	0.53	0.49	1.30	0.46
Molstad (39DW234)	0.23	0.49	1.29	0.45
39DW253	0.49	0.51	1.41	0.00
39DW254	1.23	0.31	1.40	0.54
Scalp Creek A (39GR1)	0.67	1.60	0.20	1.26
Mc Clure (39HU7)	1.03	1.74	0.22	1.08
Pierre School South (39HU10)	1.05	1.51	0.29	1.11
Robinson (39HU15)	0.71	1.19	0.61	0.95
Chapelle Creek B (39HU60)	0.47	1.26	0.61	0.84
Little Pumpkin (39HU97)	0.62	1.01	0.79	0.77
Little Cherry (39HU126)	0.91	1.23	0.76	0.39
Bowman (39HU204)	0.63	1.48	0.39	1.06
Standing Bull (39HU214)	0.36	0.80	0.97	0.68
Fry A (39HU223)	0.72	1.02	0.87	0.39
39HU241	1.06	1.38	0.54	0.69
Stricker B (39LM1)	0.75	1.69	0.18	1.31
Bice (39LM31)	0.78	1.52	0.32	1.19
Clarkstown B (39LM47)	0.52	1.52	0.29	1.22
Meander (39LM201)	0.82	1.68	0.32	0.94
39LM222	0.45	1.05	0.75	0.87
Spain A (39LM301)	0.53	1.31	0.48	1.12
Hosterman (39PO7)	1.03	1.03	0.83	0.66
Gettysburg (39PO209)	0.57	1.24	0.53	1.03
Fairbanks (39SL2)	1.63	1.06	0.88	0.38
Sully Early (39SL4)	0.65	0.99	0.88	0.62
Sully School (39SL7)	0.32	1.05	0.74	0.86
39SL8	0.39	0.92	0.94	0.61
39SL12	0.39	0.76	1.11	0.47
39SL23	0.54	1.26	0.60	0.88
39SL24	0.14	0.67	1.14	0.45
C. B. Smith (39SL29)	0.00	0.54	1.25	0.36
Cheyenne River Middle (39ST1)	0.35	0.70	1.10	0.51
Black Widow Early (39ST3)	0.20	0.65	1.15	0.46
Over's La Roche (39ST9)	0.21	0.84	0.95	0.65
Meyer (39ST10)	0.28	0.81	0.97	0.65

(*continued*)

TABLE 16. (*continued*)

Component or type	Axis 1	Axis 2	Axis 3	Axis 4
H. P. Thomas 2 (39ST12)	0.22	0.99	0.79	0.77
Cooper (39ST45)	0.54	1.30	0.50	0.98
Leavitt (39ST215)	0.01	0.66	1.09	0.57
Cattle Oiler Late (39ST224)	0.38	0.91	0.93	0.69
Bower's La Roche (39ST232)	0.21	0.82	1.03	0.50
Swan Creek A (39WW7)	0.96	0.94	0.87	0.75
Spiry (39WW10)	1.23	0.47	1.36	0.42
Walth Bay (39WW203)	1.11	0.65	1.22	0.40
39WW300	1.32	1.13	0.69	0.97
Payne (39WW302)	0.86	0.61	1.21	0.46
Two Teeth (39BF204)	1.11	1.95	0.00	1.32
39BR201	1.11	1.77	0.19	1.01
Cadotte (39HE202)	1.10	1.99	0.01	1.16
Black Partizan A (39LM218)	0.94	1.78	0.09	1.34
39LM219 A	1.12	1.64	0.32	0.78
Crazy Bull (39LM220)	1.26	1.73	0.17	1.04
Swan Creek B (39WW7)	1.92	1.12	0.63	0.89
39WW301	1.72	1.06	0.68	0.89
S-shaped Cord Impressed	2.61	0.45	0.94	1.04
S-shaped Horizontal Incised	1.68	–0.65	2.47	–0.14
S-shaped Diagonal Incised	1.36	0.61	1.77	–1.51
S-shaped Herring Bone Incised	1.07	3.03	–0.40	1.29
S-shaped Tool/Fing Impressed	2.12	0.71	1.17	–0.41
S-shaped Undecorated	1.16	0.04	1.29	0.68
Straight Diagonal/Herring Bone Incised	–0.53	1.27	0.09	2.30
Straight Horizontal Incised	–0.20	0.42	1.35	0.35
Straight Cord Impressed Lip	2.93	0.72	1.24	0.67
Straight Tool Impressed Lip	0.85	1.98	–0.21	1.66
Straight Fing Impressed Lip	2.67	1.67	0.09	0.93
Straight Undecorated	1.99	0.93	1.25	0.65
Eigenvalues	0.347	0.148	0.032	0.023

to axis 3 (.032). The scores of the components and descriptive rim sherd categories on all four axes also appear in this table.

A plot of the component scores on the first two axes is presented in Figure 14. The main feature of this figure is that the southern components, those located in the Bad-Cheyenne and Big Bend regions (lower right), are segregated from those to the north in the Grand-Moreau and Cannonball regions (upper left). The southern components also appear to be more homogeneous and less spread out in two-dimensional space than those to the north, particularly in the early part of the southern sequence. The three Le Beau phase components have high scores on axis 1 and presumably fall at the late end of the northern Extended Coalescent sequence. Similarly, a number of early post-contact Felicia phase components (Two Teeth, Cadotte, Black Partizan A, Crazy Bull, Mc Clure, 39BR201, 39LM219 A) have high scores on axis 2, serving to mark the end of the southern Extended Coalescent sequence. In terms of descriptive rim sherd categories, the northern components tend to have higher relative frequencies of S-shaped rims and smaller numbers of straight rims with tool-impressed lips or horizontal rim incisions compared with their southern counterparts. The single exception to this is S-shaped rims with herringbone motifs, designs most commonly associated with the Felicia phase. It is noted that a previous principal components analysis of a slightly smaller number of components, relying on type percentages, results in an almost identical plot of site component scores (C. Johnson, 1984a). Because there is a clear distinction in ceramic variation between the southern and northern components, it was decided to perform two separate analyses corresponding to these divisions. Therefore, no further discussion of Figure 14 is warranted at this time.

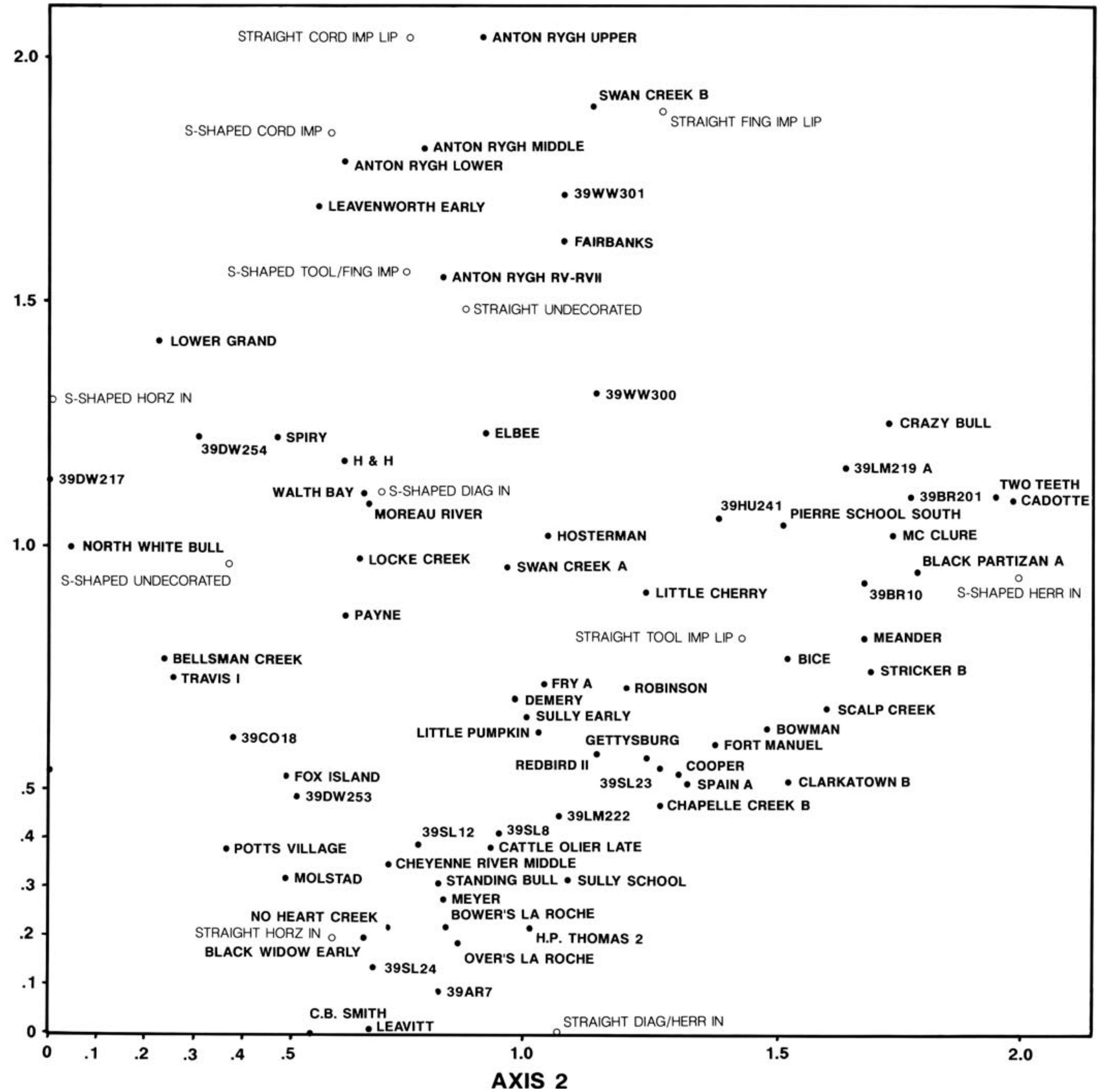

FIGURE 14. Plot of Extended Coalescent variant components and descriptive rim sherd categories on Axis 1 and Axis 2, detrended correspondence analysis ordination.

Southern Extended Coalescent

Table 17 presents the results of a DCA of 44 southern Extended variant components. The first axis extracted accounts for 77% of the variance of the four axes, followed by smaller amounts related to axis 2 (13%), 3 (6%), and 4 (5%). Component scores on the first two axes are plotted in Figure 15. The trend in this figure is for components with low scores on both axes to cluster together and then spread out and become more variable with higher

TABLE 17. Site component and ceramic type scores from the detrended correspondence analysis of southern Extended Coalescent components.

Component or type	Axis 1	Axis 2	Axis 3	Axis 4
Redbird II (25HT2)	0.70	0.77	0.12	0.22
No Heart Creek (39AR2)	0.24	0.26	0.72	0.59
39AR7	0.25	0.35	0.50	0.23
39BR10	1.30	0.90	0.16	0.21
Scalp Creek A (39GR1)	1.04	0.86	0.34	0.48
Mc Clure (39HU7)	1.42	0.70	0.46	0.65
Pierre School South (39HU10)	1.34	0.17	0.83	0.00
Robinson (39HU15)	0.78	0.52	0.50	0.49
Chapelle Creek B (39HU60)	0.79	0.37	0.64	0.46
Little Pumpkin (39HU97)	0.69	0.47	0.59	0.45
Little Cherry (39HU126)	0.93	0.49	0.74	0.97
Bowman (39HU204)	1.00	0.62	0.44	0.45
Standing Bull (39HU214)	0.33	0.41	0.53	0.51
Fry A (39HU223)	0.73	0.32	0.92	1.03
39HU241	1.26	0.00	1.01	0.32
Stricker B (39LM1)	1.20	0.93	0.19	0.46
Bice (39LM31)	1.06	0.97	0.11	0.35
Clarkstown B (39LM47)	0.93	0.79	0.32	0.43
Meander (39LM201)	1.27	0.70	0.44	0.83
39LM222	0.58	0.61	0.37	0.39
Spain A (39LM301)	0.81	0.73	0.36	0.39
Sully Early (39SL4)	0.66	0.36	0.66	0.62
Sully School (39SL7)	0.50	0.54	0.46	0.44
39SL8	0.47	0.40	0.59	0.58
39SL12	0.43	0.21	0.69	0.50
39SL23	0.76	0.56	0.47	0.61
39SL24	0.17	0.22	0.72	0.55
C. B. Smith (39SL29)	0.00	0.11	0.80	0.55
Cheyenne River Middle (39ST1)	0.32	0.29	0.71	0.55
Black Widow Early (39ST3)	0.20	0.24	0.73	0.56
Over's La Roche (39ST9)	0.32	0.32	0.66	0.43
Meyer (39ST10)	0.32	0.35	0.62	0.51
H. P. Thomas 2 (39ST12)	0.39	0.43	0.60	0.51
Cooper (39ST45)	0.77	0.72	0.42	0.53
Leavitt (39ST215)	0.11	0.19	0.72	0.42
Cattle Oiler Late (39ST224)	0.47	0.52	0.33	0.30
Bower's La Roche (39ST232)	0.34	0.24	0.72	0.57
Two Teeth (39BF204)	1.61	0.85	0.26	0.45
39BR201	1.54	1.25	0.00	0.63
Cadotte (39HE202)	1.68	0.62	0.54	0.65
Black Partizan A (39LM218)	1.32	1.05	0.14	0.56
39LM219 A	1.41	0.42	0.85	0.75
Crazy Bull (39LM220)	1.59	0.26	0.88	0.39
Anton Rygh V	2.05	0.89	0.91	0.71
S-shaped Cord Impressed	0.12	1.41	–2.06	0.84
S-shaped Horizontal Incised	0.18	0.56	0.68	0.99
S-shaped Diagonal Incised	0.81	–0.55	2.12	2.39
S-shaped Herring Bone Incised	2.71	0.82	–0.03	1.21
S-shaped Tool/Fing Impressed	2.35	3.97	–2.33	–0.06
S-shaped Undecorated	0.73	–0.10	1.71	1.81
Straight Diagonal/Herring Bone Incised	–0.43	0.63	–0.15	–1.85
Straight Horizontal Incised	–0.17	0.03	0.81	0.45
Straight Cord Impressed Lip	1.16	–0.78	1.65	1.74
Straight Tool Impressed Lip	1.34	1.19	0.13	0.46
Straight Fing Impressed Lip	2.73	–1.83	2.46	–1.47
Straight Undecorated	1.45	1.67	–1.68	–0.94
Eigenvalues	0.362	0.059	0.028	0.023

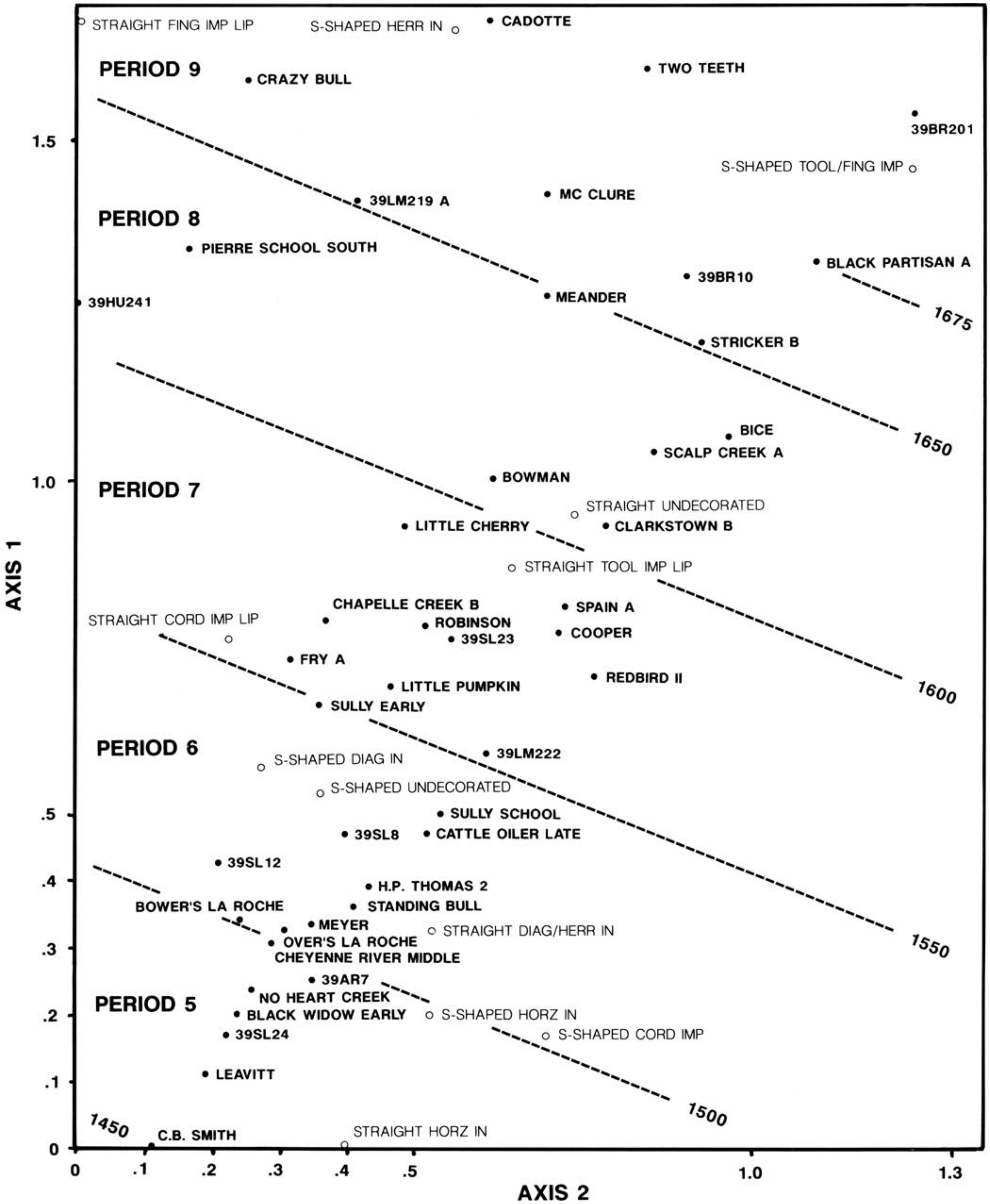

FIGURE 15. Plot of southern Extended Coalescent variant components and descriptive rim sherd categories on Axis 1 and Axis 2, detrended correspondence analysis ordination.

scores, particularly along axis 1. This indicates that with time, Extended Coalescent pottery became more variable on those characteristics (rim form and decoration) used in this study. The latest components, those assigned to the Felicia phase (Two Teeth, Cadotte, Black Partizan A, Crazy Bull, Mc Clure, 39BR201, 39LM219 A), have high scores on axis 1. This end of axis 1 may be taken as late in the sequence. Presumably, the components with low scores on axis 1 date to the early part of the southern Extended Coalescent sequence. According to the plot of descriptive rim sherd categories, also included in Figure 15, these "early" components are characterized by straight rims decorated on their rim exteriors by horizontal incising. Other ceramic types are plotted at this end, although they occur in relatively small quantities. Components with moderate scores on both axes have relatively large numbers of straight-rimmed vessels with tool-impressed lips, whereas those with higher scores on axis 1 and/or 2 contain large quantities of S-shaped rims decorated on their rim exteriors by herringbone motifs. Other ceramic categories or types are plotted at the extreme high ends of both axes, although they occur in relatively small quantities and should not be considered diagnostic of these components. The results of this analysis are similar to previous ceramic seriations (Smith, 1960, 1963; Hoffman, 1963a, 1967, 1968; Brown, 1967; C. Johnson, 1983, 1988).

Five components included in the DCA have radiocarbon dates (Over's La Roche, Sully Middle, Little Pumpkin, Meander, 39SL24). Most of these have averaged and calibrated dates falling within the period characterized by a fluctuating atmospheric radiocarbon, creating "wiggles" in the calibration curve. These result in multiple curve intercepts and relatively wide date ranges. All Extended Coalescent components, except Demery, date from about AD 1450 to AD 1650. Unless the various calibration-curve intercepts of these components are selectively chosen, the dates are of little value in determining if the arrangement of components along axis 1 and/or 2 is temporal in nature. They do, however, provide beginning and ending dates for the southern Extended Coalescent occupational sequence.

There is one case, the Sully site, in which internal stratigraphy appears to support the temporal ordering of components along axis 1. Three components, composed of somewhat arbitrarily defined groups of provenience units, are present at the site. These components are based upon a separate intrasite DCA of ceramic types, not presented here, supported by stratigraphic relationships. The earliest component from the site, designated as Sully Early, has a mid-range score on axis 1. The other two components from the site, Sully Middle and Sully Late, are included in the Post-Contact period Le Beau ordination presented later. The early end of the Le Beau sequence is included in the previously discussed ordination of all Extended Coalescent components (see Figure 14). The Le Beau ordination places the two late Sully components after the early one in that sequence. By extension, it can be inferred from Figure 14 that axis 1 is the approximate equivalent of axis 1 in Figure 15. This suggests that axis 1 in Figure 15 is temporal in nature. As appealing as this argument is, it is not a completely satisfying solution because the mid-point of Sully Middle is placed at about AD 1650 to AD 1675 in the Le Beau phase ordination to follow (Figure 17), whereas the two radiocarbon dates associated with the latest prehistoric component at the site are at least 50 years earlier as a group (Table C.1).

This does not resolve the problem of determining if actual component scores along axis 1 are related to an absolute time scale because there is no particular agreement between their positions on this axis and their radiocarbon dates. This may be caused, in part, by the instability of the calibration curve between AD 1450 and AD 1650, as previously noted. Another factor that might contribute to the uncertainty of assigning more precise dates to the other undated southern Extended components concerns the length of time involved and the rate of ceramic change. It is possible that a span of 200 years, from AD 1450 to AD 1650, is not long enough for ceramics change to allow for an accurate seriation. Data from the Knife region, however, suggest that pottery can change during a similar period of time (Ahler and Swenson, 1993). Middle Missouri ceramic variation, presented in this report, indicates that more time is needed for potting traditions to undergo detectable change, particularly during the prehistoric period. Data from the Middle Missouri tradition and from the Knife region also suggest that ethnic group affiliation played a significant part in ceramic variation and that differences because of this factor may be difficult, if not impossible, to separate from other sources without the necessary chronological controls.

Despite these problems, it is assumed that ceramic variation along axis 1 does relate, at least partially, to temporal change. It also is assumed that the order of components on this axis represents their approximate temporal placement. The radiocarbon dates of six components, Little Pumpkin, Eagle Feather, Sully, Meander, Over's La Roche, and 39SL24 (Figure 12) suggest a time span of AD 1450 to AD 1650. If the earliest date of AD 1450 is assigned to the component with the lowest scores on axis 1 (C. B. Smith) and AD 1650 to the highest dated Extended Coalescent component score (Meander), temporal divisions within this sequence become apparent.

Anticipating the synthesis in chapter 7, temporal divisions are made in Figure 15 along a diagonal line from lower left to upper in 50-year increments. The orientation of an imaginary diagonal line through the middle of the plotted components is placed in a somewhat arbitrary fashion. The mathematical procedure for establishing 50-year intervals is relatively simple and applies to other ordinations in this study. Perpendicular lines to the diagonal line from C. B. Smith and Meander are drawn to establish the AD 1450 and AD 1650 beginning and end points. The distance between these points on the diagonal is determined. A proportion is then set up between these two points and their time span. A second proportion is established, with 50 years as a given, and the actual distance that this represents in Figure 15 as the unknown value. Cross-multiplying between the two known values in this equation gives a value, which is divided by 200 years, yielding a distance value in Figure 15 spanned by 50 years. This value is then measured from the AD 1450 starting point to establish the AD 1500, 1550, and 1600 points. These 50-year intervals are assigned to Period 5 (AD 1450 to 1500), Period 6 (AD 1500 to 1550), Period 7 (AD 1550 to 1600), Period 8 (AD 1600 to 1650), and Period 9 (AD 1650 to 1700). A date of about AD 1675 also is established for Black Partizan A by a process of interpolation of its distance from the AD 1650 date. Rounding this up to AD 1675 provides a beginning point for the Talking Crow phase, using Black Partizan A as a starting point in its temporal sequence. The results of this analysis are presented below.

The cultural dynamics of the southern Extended Coalescent communities are presented in chapter 7, although a brief summary is presented here. The earliest villages were established in the Little Bend area of the Bad-Cheyenne region. Ceramic assemblages during the period from AD 1450 to AD 1500 are characteristically homogeneous, with high percentages of horizontally incised straight rims. In Period 6 (AD 1500 to 1550), villages were established in the Big Bend region, most notably at Bower's La Roche and Over's La Roche. In period 7 (AD 1550 to 1600), related Redbird communities were occupied along the Niobrara River valley in northeastern Nebraska. The spread of Extended Coalescent communities further south into the lower Big Bend and Fort Randall regions, as epitomized by the communities of Spain A, Fry A, and 39LM22, also occurred in Period 7. This pattern continued into Period 8 (AD 1600 to 1650). It is from these villages that the protohistoric Felicia phase is believed to have developed in the Lower Brule locality, eventually giving rise to the Talking Crow phase. Period 8 also coincides with early Lower Loup villages (O'Shea, 1989). Ceramic assemblages of these late southernmost Extended Coalescent components are characterized by high relative frequencies of straight-rimmed vessels decorated only by tool impressions applied to their lips or lip margins. This forms a relatively smooth continuity in potting traditions with the later Felicia and Talking Crow phases and also with the early portion of the Lower Loup phase. This link indicates a possible origin for at least some of the Lower Loup phase in South Dakota because a credible Nebraska precursor of the protohistoric Pawnee has not been identified. Another alternative to this late Extended Coalescent-Lower Loup link is that there was some mutual interaction between the Arikara and Pawnee, with no clear lines of Lower Loup origins. There is evidence that there was a great deal of movement of the Arikara from South Dakota to Nebraska and back during the historic period (Wedel, 1955:77–84; Wood, 1955), and that movements of this kind probably occurred during the prehistoric period.

Historical linguistics of the Caddoan speakers indicates a split between the Arikara and Pawnee between AD 1450 and AD 1650 (Hughes, 1968:74–85; Parks, 1979b:204–208). This places a separation between the two Caddoan speakers during the time when Extended Coalescent peoples dominated the southern portion of the Middle Missouri subarea. This information, when combined with the ceramic affinities between the late Extended Coalescent and early Lower Loup villages, provides some basis for arguing that some protohistoric Pawnee had their origins in the Extended variant villages. It is not particularly surprising to discover that there are early historic accounts of Pawnee in South Dakota (Parks, 1979a:217, 220). Roper (1993:149) suggested that the Pawnee may have had their origins in earlier Initial Coalescent developments.

Oral traditions present a different version of Arikara-Pawnee relationships. These traditions, as summarized by Hughes (1968:53–54) and Roper (1993:38–41), indicate that the Arikara and the Skiri band of Pawnee once formed a single tribe living on the Platte and Loup rivers in Nebraska after migrating there from the south or east. The Arikara then split off from the Skiri and moved up the Missouri River to occupy their villages in South Dakota. There is no mention of a Pawnee presence in South Dakota or a migration of them into Nebraska from the north. This seems to present a problem for archaeological interpretation that is not easily resolved at this time.

Northern Extended Coalescent

The results of the ordination of 32 northern Extended variant components is presented in Table 18. The eigenvalues

TABLE 18. Site component and ceramic type scores from the detrended correspondence analysis of northern Extended Coalescent components.

Component or type	Axis 1	Axis 2	Axis 3	Axis 4
Elbee (32ME408)	1.00	0.77	0.38	0.19
Anton Rygh RV-VII (39CA4)	1.26	0.71	0.47	0.35
Anton Rygh Upper (39CA4)	1.80	0.69	0.44	0.29
Anton Rygh Middle (39CA4)	1.52	0.62	0.38	0.17
Anton Rygh Lower (39CA4)	1.45	0.43	0.12	0.02
Locke Creek (39CA201)	0.64	0.54	0.23	0.52
Demery (39CO1)	0.44	0.97	0.57	0.37
Fort Manuel (39CO5)	0.56	1.27	0.70	0.42
Leavenworth Early (39CO9)	1.27	0.56	0.36	0.15
Lower Grand (39CO14)	0.91	0.24	0.20	0.48
Bellsman Creek (39CO17)	0.32	0.31	0.25	0.67
39CO18	0.23	0.41	0.21	0.46
Potts (39CO19)	0.05	0.35	0.03	0.25
North White Bull (39CO41/207)	0.44	0.10	0.06	0.63
H & H (39CO78)	0.88	0.64	0.37	0.00
Travis I (39CO213)	0.30	0.31	0.19	0.63
Moreau River (39DW1)	0.75	0.52	0.18	0.46
39DW217	0.60	0.00	0.00	0.54
Fox Island (39DW230)	0.17	0.54	0.33	0.49
Molstad (39DW234)	0.00	0.61	0.36	0.40
39DW253	0.19	0.63	0.53	0.75
39DW254	0.74	0.35	0.19	0.31
Hosterman (39PO7)	0.73	1.14	1.03	0.96
Gettysburg (39PO209)	0.39	1.22	0.74	0.46
Fairbanks (39SL2)	1.40	0.99	0.79	0.81
Swan Creek A (39WW7)	0.67	0.91	0.66	0.61
Spiry (39WW10)	0.83	0.43	0.34	0.63
Walth Bay (39WW203)	0.74	0.62	0.49	0.75
39WW300	1.04	1.00	0.64	0.57
Payne (39WW302)	0.48	0.67	0.52	0.71
Swan Creek B (39WW7)	1.71	0.93	0.67	0.38
39WW301	1.48	0.93	0.68	0.33
S-shaped Cord Impressed	2.16	0.43	0.10	–1.39
S-shaped Horizontal Incised	0.86	–0.64	–0.30	0.96
S-shaped Diagonal Incised	1.01	1.18	1.92	2.52
S-shaped Herring Bone Incised	1.34	1.52	1.59	1.56
S-shaped Tool/Finger Impressed	1.87	–0.04	0.35	2.26
S-shaped Undecorated	0.05	1.49	1.87	1.25
Straight Diagonal/Herring Bone Incised	–0.98	3.50	4.18	2.70
Straight Horizontal Incised	–0.45	0.47	0.11	0.05
Straight Cord Impressed Lip	2.62	0.45	0.41	0.19
Straight Tool Impressed Lip	0.80	1.88	1.22	0.61
Straight Finger Impressed Lip	2.73	1.43	1.46	1.17
Straight Undecorated	1.87	–0.17	–1.75	0.08
Eigenvalues	0.347	0.148	0.032	0.023

indicate that axis 1 accounts for most of the variability of all four axes in the data (63%), whereas axis 2 is responsible for 27% of the variation. The remaining two axis are less important and cannot be interpreted, therefore deserving no addition attention.

A plot of component scores along axes 1 and 2 appears in Figure 16. Like the analysis of the combined sample of northern and southern Extended Coalescent, the present one includes three Post-Contact Coalescent Le Beau phase components, Swan Creek B, Anton Rygh Upper, and 39WW301. On the basis of their positions at the top of this figure (high scores on axis 1), this end is interpreted to be late in the sequence, whereas those with low scores are early. This also is supported by the stratigraphy at the

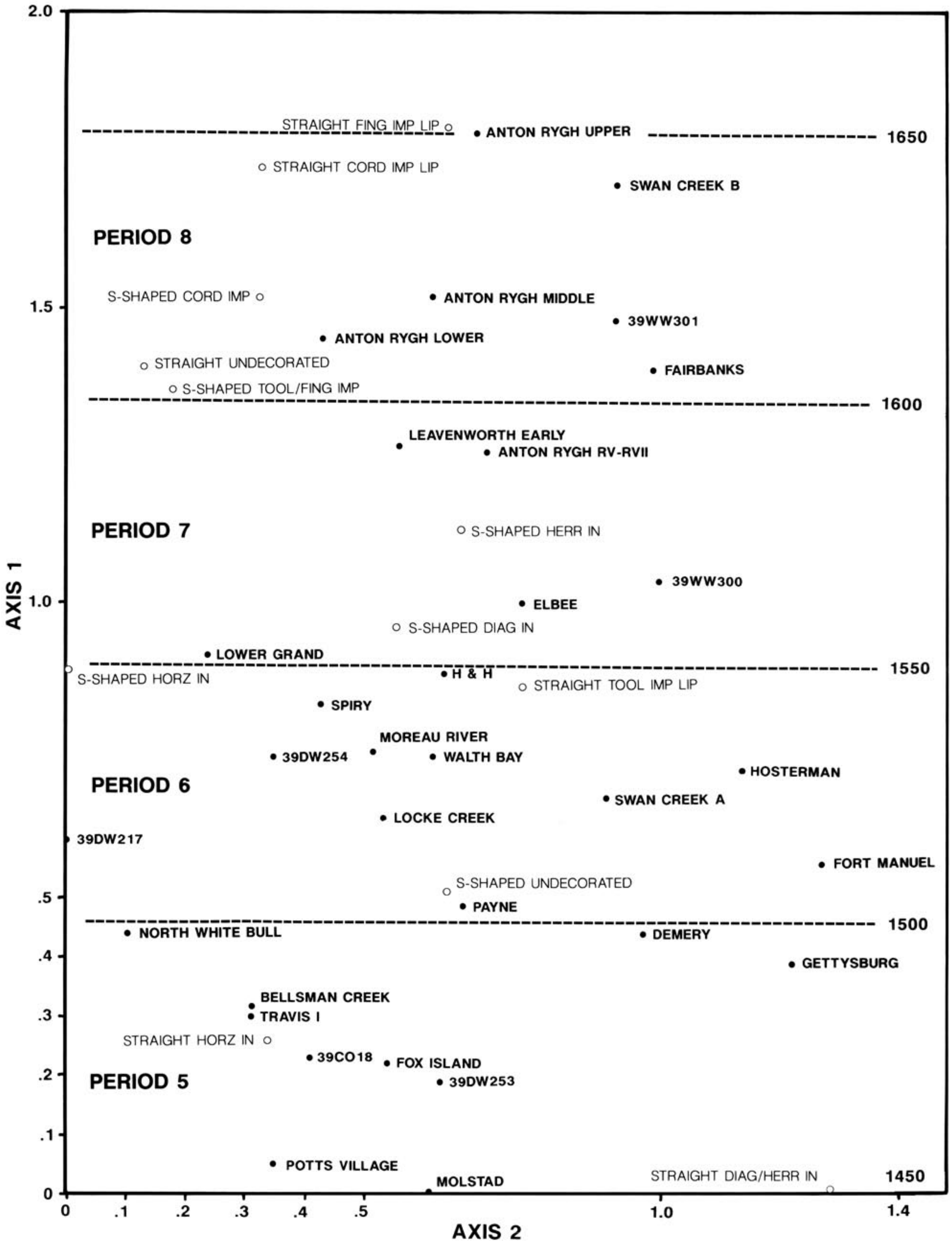

FIGURE 16. Plot of northern Extended Coalescent variant components and descriptive rim sherd categories on Axis 1 and Axis 2, detrended correspondence analysis ordination.

Anton Rygh site, which is in order from Lower, Middle, and Upper components along axis 1. Their scores on axis 2 also increase from lower to upper, although it should be remembered that axis 1 accounts for about two times the variation of axis 2. If the two axes were rescaled to reflect this difference, it would become apparent that most of the variation between these three components would be along axis 1 and not on axis 2. The interpretation that axis 1 relates to a temporal dimension does not agree, however, with the scores of six components that have radiocarbon dates (Potts, Molstad, Demery, Walth Bay, Hosterman, Lower Grand). Demery is the earliest of the dated sites, followed by Lower Grand and Molstad. The latest dated sites are Walth Bay, Elbee, and Hosterman. Stephenson (1971:85) noted the close ceramic relationship between Potts and Molstad. The results of this study are very similar to the ceramic seriations of Hoffman (1963a, 1967, 1968), Grange (1981), and C. Johnson (1988). Grange's study, however, assigned dates that are 100 to 150 years later than Figure 16. The other studies do not assign dates to specific sites.

The discrepancies between the scores on axis 1 and radiocarbon dates may be caused by a number of factors. One is the instability of the calibration curve from about AD 1500 to AD 1650, resulting in numerous curve intercepts and wide ranges for a series of dates that may otherwise be rather precise. Another reason that may make it difficult to interpret the placement of components in Figure 16 is ceramic variation because of ethnic affiliation. It was suggested that the pottery from the Demery and Lower Grand sites is somewhat different than most other Extended Coalescent communities (Woolworth and Wood, 1964:129; C. Johnson, 1988:98–100). Bowers (1948a:97–98) concluded that ancestral Mandan, rather than Arikara, occupied Lower Grand. The traditional view is that the prehistoric ancestors of the Arikara occupied Extended Coalescent villages. An ethnic group different from those in Extended villages to the south in South Dakota also might have occupied the Elbee site, although its dated range falls near the other Extended variant sites. Figure 16 indicates that Elbee is similar in ceramic content to Walth Bay, Anton Rygh V–VII, and H & H. Several additional components, Molstad and Lower Grand, have dates that do not correspond to their scores on axis 1.

Despite these problems, the most parsimonious interpretation of Figure 16 is that components with low scores on Axis 1 are earlier than those with higher values. Those with high scores (Anton Rygh, Swan Creek) form a direct continuity with the Post-Contact period Le Beau phase villages. The opposite end of the sequence is assumed to be the beginning of the northern Extended Coalescent. Its beginning is established at AD 1450, just after the occupation of the Demery site at AD 1400 to AD 1450. Additional support for the AD 1450 start of the sequence comes from the Knife River region, where the Scattered Village phase (AD 1400–1450) is defined. This phase has some intriguing similarities to Extended Coalescent pottery and settlement patterns (see Ahler, 1993b:80–82). The Scattered Village phase was established when there was an expansion of Extended Coalescent peoples into north-central South Dakota, represented by the Demery site and early villages of the Le Compte phase (Molstad and Potts). An AD 1450 date may be somewhat too late for some of the early Extended Coalescent sites, but at this point it is the only date supported by the radiocarbon evidence. At the other end of the time scale, Anton Rygh Upper is assigned a date of AD 1650, corresponding to the end of the range of radiocarbon dated Extended Coalescent components and the beginning of the Post-Contact period in South Dakota. Interpolating between the AD 1450 and AD 1650 dates over their difference of 200 years yields the 50-year intervals depicted in Figure 16.

Establishing a beginning date of AD 1450 for the northern Extended Coalescent sequence is at odds with the radiocarbon dates from the Demery site, which place it in a rather narrow time span of AD 1392 to AD 1442 (Table C.3). According to its placement in Figure 16, Demery falls about 50 to 100 years later than its radiocarbon dates indicate. It is difficult to reconcile these differences, other than to appeal to some sort of ceramic variation, perhaps ethnic in origin, not related to temporal position. At this time, the radiocarbon dates from Demery are accepted as valid for that site only, preferring to begin the northern Extended Coalescent sequence at the same time as the southern Extended Coalescent occupation (i.e., AD 1450). There are two reasons for this decision. First, all other radiocarbon dates place the beginning of the Extended Coalescent at AD 1450. Second, the ceramic assemblages from the earliest northern and southern sites in the lower left-hand corner of the combined Extended Coalescent ordination in Figure 14 (e.g., C. B. Smith, Leavitt, Black Widow Early, Potts, Molstad) are placed near one another. This suggests a common origin for the sites, probably from an Initial Coalescent base in the Big Bend region. From that point forward, the pottery from the southern and northern areas diverged, following their own somewhat different trajectories of ceramic change.

The late portion of the northern Extended Coalescent sequence is verified by reference to the taxonomy established for the Knife and Heart regions (Ahler, 1993a). In this summary, the Hensler phase (AD 1525–1600) of the Heart River complex is characterized by cord-impressed, S-shaped rim sherds (Le Beau ware) that constitute about 75% of the pottery from these components. The Heart River complex represents the florescence of Mandan culture in the Heart region, influencing the neighboring Hidatsa to the north. The Heart River complex also is thought to have influenced the Arikara to the south in the Grand-Moreau region. This is apparent in the relatively high percentages of S-shaped, cord-impressed pottery among some components, in the range of 20% to almost 30%. This includes those components in Figure 16 with high scores on axis 1 (e.g., Leavenworth Early, 39WW301, Swan Creek B, Anton Rygh components). Even those that are earlier in the sequence (e.g., Lower Grand, 39DW217, 39DW254) have high relative numbers of shallow, S-shaped rims, predominantly of the incised variety. The ending date of AD 1600 for the Hensler phase corresponds to Leavenworth Early and the establishment of Anton Rygh.

This strong Heart River complex influence may be the reason for Bowers' (1948a:35) contention that the Mandan inhabited the Anton Rygh site. Subsequent craniometric analyses of skeletal remains from the cemetery associated with the Anton Rygh village clearly established it as an Arikara site (Lin, 1973, 1978). Later Le Beau phase components at the Swan Creek and Four Bear sites contain crania that classify as both Arikara and Mandan (Owsley, Slutsky, Guagliardo, and Deitrick, 1981:39–41), so the issue of a Mandan presence in late Coalescent tradition sites in South Dakota is not resolved. Blakeslee's (1981a:104) contention that there is no ceramic evidence for a Mandan presence in Coalescent villages in South Dakota is not entirely accurate. Although it may be impossible to determine if Mandan individuals lived in some Post-Contact and late Extended Coalescent sites in north-central South Dakota, a clear Mandan (i.e., Heart River complex) ceramic influence seems to be present.

The plot of types in Figure 16 indicates ceramic variation along axis 1. Ceramic assemblages high in straight rims with horizontally incised rim exteriors characterize components with low scores. Villages with moderate scores on axis 1 have higher relative frequencies than others, whereas those at the upper end have high quantities of undecorated straight rims or those decorated on the lip with finger or cord impressions. Vessels with cord-impressed, S-shaped rims also reach their greatest popularity among components with high scores.

Referring to the scores of the descriptive rim sherd categories plotted in Figure 16, components with low scores on axis 1 generally contain high relative frequencies of horizontally incised, S-shaped rims, whereas those with higher scores contain larger amounts of straight rims with tool-impressed lips. The trend for vessels decorated only on the lips with tool impressions to increase through time also occurred among the southern Extended Coalescent villages (Figure 15).

Craniometric Distance

Biological relationships between Extended Coalescent components, either singly or in groups, were explored by Key (1983, figs. 21–23). Three foci or phases were employed in his study: Le Compte (Hosterman site), Akaska (Walth Bay, Lower Grand sites), and La Roche (Anton Rygh, Nordvold 2 and 3, Fairbanks, Sully A and D, Ziltener, Mobridge F1, Mobridge cemetery 1). Although some of the samples included within his La Roche phase are small and better assigned to the Akaska phase (Anton Rygh, Nordvold 2 and 3, Mobridge), the results of his analysis are nonetheless informative. The crania from the Le Compte and Akaska phases are similar and tend to date earlier than those from the La Roche phase. These relationships are somewhat obscured, however, by the inclusion of a number of Central Plains tradition sites in the analysis that tends to compress the variability of the Extended and Post-Contact Coalescent samples. Despite this problem, the biological relationships between the three Extended Coalescent phases is similar to the temporal ordering proposed in this study. It also is interesting to note that the protohistoric Pawnee Lower Loup phase crania have strong affinities to the Akaska and Le Compte phases, and secondarily to the Talking Crow, Bad River, and Le Beau phase samples (Key, 1983, figs. 21–23). In contrast, the ceramic evidence presented herein suggests a relationship between the La Roche and Lower Loup phases. Finally, Jantz (1993, table 2) suggested that there is a close craniometric relationship between the Arikara and the Pawnee.

POST-CONTACT COALESCENT

Taxonomy

Until the 1990s, the most commonly accepted Post-Contact Coalescent taxonomy was summarized in Lehmer (1971:33, 163, 176–177, 201–206). Although the traditionally accepted taxonomy for the protohistoric period in South Dakota remains largely intact, such is not the case for North Dakota. This is due entirely to recent research within the Knife River Indian Villages National Historic Site (Thiessen, 1993b). The following brief review of the Post-Contact Coalescent taxonomy focuses on the South Dakota cultural sequence, thought to represent the protohistoric Arikara, and then on the North Dakota cultural manifestations, representing ancestral Mandan and Hidatsa.

Plains Village Post-Contact Coalescent sites in South Dakota are assigned to the Felicia, Talking Crow, Bad River, and Le- Beau phases. Sites of the Felicia phase or focus are located in the lower Big Bend region and represent a transitional stage between the earlier prehistoric Extended Coalescent and the later protohistoric Talking Crow phase (Caldwell, 1966b:80; Smith and Johnson, 1968:49). Lehmer (1971:201) assigned a date of AD 1675 to AD 1700 to the Felicia phase. Villages of the Talking Crow phase are centered in the lower Big Bend region. Several others were located to the north in the Bad-Cheyenne region (Lehmer, 1971, fig. 82), although these sites have never been independently verified as Talking Crow components. Two additional major Talking Crow sites are near the southern limits of the Middle Missouri subarea in the Fort Randall region (Hitchell and Oldham). The Talking Crow phase is thought to date from AD 1700 to AD 1750 (Lehmer, 1971:202) or from AD 1725 to AD 1780 (Smith, 1977:151).

The Bad River phase, perhaps the most thoroughly reported of all the South Dakota, post-contact, taxonomic units, is centered in the Bad-Cheyenne region (Lehmer, 1971, fig. 82). Several sites also are found nearby, in the upper Big Bend region, and it is suggested that sites far to the north in the Grand-Moreau region (Nordvold, Red Horse Hawk) be included in the phase (Hoffman and Brown, 1967:334). An initial summary of the phase appears in Hoffman and Brown (1967). Shortly thereafter, Lehmer and Jones (1968:97–100) expanded it to include two subphases, Bad River 1 (AD 1675–1740) and Bad River 2 (AD 1740–1795). It is suggested that several historically documented sites (Greenshield, Leavenworth) be assigned to their own separate subphases (Hoffman and Brown, 1967:333; Lehmer and Jones, 1968:99; Lehmer, 1971:176). A somewhat more recent synopsis of the Bad River phase appears in Lehmer (1971:202).

The Le Beau phase, first identified as a focus from excavations at the Swan Creek site (Hurt, 1957:27–30), is best known from villages in the Grand-Moreau region. Several large villages are located to the south in the Bad-Cheyenne region (Sully, Oahe Village). The Amos Shields site (39HU220) is the southernmost of these sites (Lehmer, 1971, fig. 82), although the results of the current study indicates it is best placed within the Talking Crow phase. The Le Beau phase is dated at AD 1675 to AD 1780 (Lehmer, 1971:202).

The traditionally accepted taxonomy of the Post-Contact Coalescent in North Dakota was first synthesized by Lehmer (1971:203–206) and later expanded by Lehmer et al. (1978:422–435) and Wood (1986a:7–24). This taxonomy recognizes two phases, Heart River (AD 1675–1780) and Knife River (AD 1780–1845), each of which is divided into two subphases. Many of the villages assigned to the two tentatively defined Heart River subphases are identified as Mandan (Heart River 1) and Hidatsa (Heart River 2). The Mandan communities are concentrated in the Heart Region, whereas those of the Hidatsa are found in the Knife region to the north. Wood (1986a:13) was less certain of the tribal affiliations of many of the villages in the Knife region and therefore did not divide the Heart River phase into subphases. He also started the phase at about AD 1450, some 225 years before the AD 1675 date of Lehmer. The successor to the Heart River phase is the Knife River phase, divided into two subphases based upon ethnicity, Knife River 1 (Mandan) and Knife River 2 (Hidatsa). The Knife River phase villages, along with the latest remnants of the Arikara at three sites (Greenshield, Leavenworth, Fort Clark), represent the last vestiges of Plains Village Native Americans in the Middle Missouri subarea. This period, dating from AD 1780 to AD 1862, is referred to as the Disorganized Coalescent (Lehmer, 1971:205–206). This variant is no longer considered to be a viable taxonomic unit by Middle Missouri specialists (Hoffman, 1977:21).

This traditional taxonomy contrasts sharply with the most recent one developed by Ahler (1993b). Ahler rejected Lehmer's Middle Missouri and Coalescent traditions as useful constructs for interpreting the culture history in the Cannonball, Heart, Knife, and Garrison regions. Ahler's contention was that these two taxonomic units, although possibly useful for the Plains Village sequences in South Dakota, for which they were originally designed (Lehmer, 1954a:139–154), cannot be extended to North Dakota. Ahler's (1993b:61–62) integrative device was the complex, a provisional unit designed to be used until horizons, variants, or other terms are defined in the Willey and Phillips (1958) system. These complexes are groups of components that share a common, dominant, stylistic trait or groups of nondominant, stylistic, cultural traits. Of the five complexes defined by Ahler, two are relevant to the Post-Contact period: Heart River (AD 1450–1785) and Knife River (AD 1600–1886). The Heart River complex is centered in the Heart region, with some presence in the Knife region, whereas the Knife River complex is largely confined to the Knife and Garrison regions. The Knife River complex is made up of four sequential phases: Willows (AD 1600–1700), Minnetaree (AD 1700–1785), Roadmaker (AD 1785–1830), and Four Bears (AD 1830–1886). The Willows and Minnataree phases are attributed to the Hidatsa, whereas the Roadmaker and Four Bears phases, dominated by the Hidatsa, also are the product of the Mandan and Arikara. All subsequent discussions in this study employ the taxonomy developed by Ahler. Because there are so few systematic excavations at Heart River complex sites, it cannot be divided into phases at this time.

Ahler (1993b:63–64, 99–102) also introduced the concept of ethnic tradition, an attempt to reconstruct the development of the Mandan and Hidatsa by meshing their archeological, historic, and ethnographic records. The result is a tree diagram of the various subgroups of these tribes and subtribes that trace their migrations, separations, and merging over time and space. Three groups of Hidatsa (Awatixa, Awaxawi, Hidatsa-proper) and four of Mandan (Nuptadi, Nuitadi, Istopa, Awigaxa) are traced in the archeological record back to about AD 1400 or AD 1500 (Ahler, 1993b, fig. 25.3). These groups crosscut archeologically defined regions, complexes, and phases.

Origins

The origins of the various Post-Contact period phases derive from numerous sources, both with long-standing histories in the Middle Missouri subarea and those with more recent backgrounds. The Knife River complex is an outgrowth of the Heart River complex, which in turn is derived from the Middle Missouri and Painted Woods complexes (Figure 4; Ahler, 1993b, fig. 25.2). More specifically, the Hensler phase precedes the Willows phase, the earliest of the post-contact units in the Knife region, whereas the Heart River complex is derived from the Huff phase. Ancestral Mandan who can trace their lineage back to ca. AD 1000 to AD 1200 and the beginnings of the Middle Missouri tradition occupied most Heart River complex villages. Lehmer (1971:163) maintained that his Heart River phase, composed of Post-Contact period Mandan and Hidatsa communities, was a direct outgrowth of the Terminal Middle Missouri. One group of Hidatsa, the Awatixa, also appears to be long-term Missouri River residents, able to trace their beginnings back to the Late Woodland Charred Body complex at about AD 1000. Two Hidatsa groups, the Awaxawi and Hidatsa-proper, are relatively recent migrants to the Heart, Knife, and Garrison regions, having arrived about AD 1600 from areas in eastern North Dakota and elsewhere.

The Post-Contact Coalescent phases in South Dakota (Felicia, Talking Crow, Bad River, and Le Beau) are thought to be derived from the Extended Coalescent (Hurt, 1957, chart 1; Smith, 1960, 1963, 1977:155–156; Smith and Johnson, 1968:49; Lehmer, 1971:163). The previous discussion of the demise of the Extended Coalescent indicated that the transition between the prehistoric and protohistoric, particularly in terms of pottery, is most clear in the Big Bend region. This transformation is not as evident in the Bad-Cheyenne and Grand-Moreau regions, although there are few alternatives to an Extended Coalescent origin. Lehmer (1971:163–164) suggested that the uniformity of Post-Contact period material culture indicates convergence because of trait selections from a number of sources, including the Middle Missouri tradition (Lehmer, 1971:163–164). This represents a period of "coalescence" that led some subarea specialists to recognize the Coalescent as a process that occurred a number of times throughout the Middle Missouri subarea rather than a tradition (Lovick and Ahler, 1982:64; Ahler, 1993a:38).

Internal Development

Probably more than any other time in the culture history of the Middle Missouri subarea, the Post-Contact period represents a dynamic time of major cultural changes. The impetus for a series of sweeping changes in Native American life was the growing intensity of the fur trade and contact with Euro-Americans. The nature of these interactions and the resultant changes have been discussed by many researchers but are beyond the scope of this study. Knowledge of this period is greatly enhanced by the written documents of various explorers and traders who visited the Mandan, Hidatsa, and Arikara villages with increasing frequency about the time of the Lewis and Clark expedition of AD 1804 to AD 1806 (Bass et al., 1971:22–29; Meyer, 1977; Wood and Thiessen, editors, 1985:18–47; Chomko, 1986; Thiessen, 1993a; Wood, 1993a). For the purposes of this brief discussion, the focus is on the technological and social changes.

Ahler and Dreybred (1993), Ahler and Swenson (1993), Ahler and Toom (1993), and Weston and Ahler (1993) documented the earliest changes in material culture at the Knife River Indian Villages National Historic site. Beginning about AD 1600, trade goods, consisting of small amounts of metal and glass artifacts, begin to appear in Hidatsa artifact assemblages. These artifacts slowly increase through time, resulting in a series of changes in lithic technologies, an increase in metal-modified and expedient bone tools, and a decline in bone awls. Other Native American technologies, such as ground stone tools and ceramic manufacture, were not affected by the introduction of Euro-American artifacts until very late in the contact period.

Baerreis and Dallman (1961), Toom (1979, 1995), and Rogers (1990, 1993), among others, discussed the technological changes among the protohistoric Arikara in South Dakota. In addition to observing evidence for increasing modification of bone tools by metal implements at the Spiry-Eklo site, Baerreis and Dallman (1961:195–196) also noted an increase in the relative number of some types of skin-dressing tools and bone tools (hoes, bone knife handles, shaft straighteners). Toom (1979, 1995) documented the replacement of stone tools with metal ones at three post-contact sites in South Dakota (Medicine Crow, Larson, Leavenworth). He also suggested that metal artifacts were extensively recycled among Plains villagers and therefore are underrepresented in the archeological record compared with their use at these and other villages.

Although the introduction of Euro-American trade items no doubt had an impact on the social structure of the Plains villagers (O'Shea, 1981, 1984), the greatest impact probably occurred when a series of epidemic diseases swept through their villages. The earliest documented epidemic, a major outbreak of smallpox, occurred in AD 1780 to AD 1781. It is suspected that other epidemics preceded this one, perhaps as early as the sixteenth or seventeenth centuries (Ramenosky, 1987:134; Trimble, 1989, table 3; 1993, table 15.4). Ahler (1993d:43–51) suggested a series of related population declines among the Hidatsa. The earliest decline attributable to disease is thought to have occurred between AD 1525 and AD 1600, long before direct contact with Europeans. Although there is no comparable archeological data that can unequivocally demonstrate a similar population decline among the Mandan and Arikara, a massive population collapse occurred in AD 1780–1781 (Lehmer, 1971:172, 174). Earlier epidemics also probably reduced Mandan and Arikara populations. The people who survived these epidemics consolidated their villages. Along with increasing pressure from nomadic groups, such as the Dakota, the Mandan, Hidatsa, and Arikara eventually formed one remnant village, Like-a-Fishhook at Fort Berthold, in the Garrison region (Smith, 1972). This ended a 250-year period, since AD 1600, of increasingly larger and fewer villages occupied for long periods by less mobile populations. These changes were the direct result of their middleman trading status, epidemic diseases, and conflict with some nomadic peoples.

A number of postulated changes in other aspects of Plains Village social structure took place during this period. Deetz (1965:30–37) proposed a link between modifications in social structure and other cultural changes. He suggested that four factors (increased mobility and trade, rapid population reductions, and conflict with the Dakota) were responsible for a shift towards a generational kinship system and away from a matricentered type. A recent report of the investigations at the Medicine Crow site, the same one that Deetz used to support his hypothesis of Arikara social change, questioned the foundation of his archaeological data (Toom, 1995:365–368). Hoffman (1977) used historic and archeological sources to reconstruct Arikara (i.e., Bad River phase) social organization, characterized by exogamous matriclans and village endogamy. Because of similar forces first proposed by Deetz (1965:30–37), Hoffman argued that the Arikara developed a weakly structured unilineal-bilineal descent system. Finally, an analysis of the grave inclusions from the Larson site (39WW2) led O'Shea (1981:46–48, 1984) to postulate three social ranks: (1) adult males with large quantities of socio-technic artifacts; (2) adult males with task-oriented artifacts, adult females and sub-adults with large amounts of trade items; and (3) a majority of individuals with few associated artifacts. There is little evidence for kin-based organization at Larson. Social ranking at the site also was supported by Bass and Rucker (1976), and among the historically documented Arikara (Holder, 1958).

Demise

The last Plains Village earthlodge village in the Middle Missouri subarea was established at Like-a-Fishhook in AD 1845 (Smith, 1972). This site contains the remnants of the Mandan, Hidatsa, and Arikara, greatly reduced in numbers by epidemic diseases and other forces beyond their control. At a somewhat earlier time, the Mandan maintained independent communities at Fort Clark (1822–1837) and Deapolis (ca. AD 1787–1856) (Wood, 1986a:16). Prior to their consolidation with the Mandan and Arikara, the Hidatsa lived at the Amahami (ca. AD 1787–1834), Sakakawea (ca. AD 1787–1834), and Big Hidatsa (ca. AD 1780–1845) sites (Wood, 1986a:16; Ahler, 1993b:97–101). The latest Arikara villages were at the Star (AD 1861–1862), Fort Clark (AD 1838–1861), Leavenworth (ca. AD 1798–1832), and Greenshield (ca. AD 1795–1798) sites (Metcalf, 1963a:66; Krause, 1972:15; Wood, 1986a:21; Ahler, 2003c).

Radiocarbon and Dendrochronological Dates

Four Post-Contact Coalescent sites, all with single radiocarbon dates, are included in Figure 12. Most have large ranges, on the order of about 300 years, reflecting the instability of the calibration curve during this period. Although these dates cannot be used to order the sites with any degree of certainty, two indicate an initial date of about AD 1650 for the Post-Contact period in the Big Bend and Bad-Cheyenne regions. This agrees with the terminal date for the Extended Coalescent, as discussed above, and suggests that the AD 1600 date for the onset of the Post-Contact period in the Knife region may not be applicable to the southern regions of the Middle Missouri, as Ahler and Toom (1995:377) had implied. O'Shea (1989) also used the AD 1600 date for the onset of the protohistoric Lower Loup phase. A recent analysis of Lower Loup ceramic formula dating indicates that this protohistoric Pawnee phase also began in AD 1650 (Steve Holen, pers. comm., 1995), lending support to the beginning date of AD 1650 for the post-contact sequence in South Dakota. Billeck (2000) also began his Euro-American bead chronology, which focused on sites in South Dakota, at AD 1650.

There appears to be some conflicting evidence for this AD 1650 date in the form of Euro-American glass trade beads found in some burials at the Sully site (Owsley, 1992:77). Anticipating the results of the Le Beau phase ceramic ordination, the early half of the Sully village sequence predates AD 1650. If some of the cemetery areas are associated with the first half of village occupation, the appearance of Euro-American trade items also would seem to predate AD 1650, supporting an earlier date proposed by Ahler and Dreybred (1993:290), and Ahler and Toom (1995:377). Of course, it is entirely possible that the three Sully cemetery areas containing the small number of burials that include trade beads could be associated with the last half of village occupation. It also is possible that a few late burials were interred in various cemetery areas, giving the appearance that other burials from these areas are post-contact in age.

A series of dendrochronological dates are available from 10 Talking Crow, Le Beau phase, and Heart River complex components (Appendix D). Most of those from South Dakota are from Talking Crow phase villages (Medicine Crow, Oacoma, Talking Crow, Fort George Village); one series of dates is from Four Bear, a Le Beau phase site. All dates from these sites fall between ca. AD 1675 to AD 1775. These are within the suspected temporal range of these phases. In addition, the two dates from two Medicine Crow components (Medicine Crow 1, Medicine Crow 4) agree with the internal ceramic seriation at the site (Johnson et al., 1995). The dendrochronological dates from the Heart River complex sites also fall within its suspected temporal limits (see Ahler, 1993b:68–69).

Analysis

The following investigation of ceramic variability of the Post-Contact period follows traditionally accepted taxonomic divisions, presenting three DCA of components assigned to the Le Beau, Bad River, and Talking Crow phases. Ahler (1993b) established a chronology of post-contact components in the Knife and Heart regions, formerly assigned to the Heart and Knife River phases. Because of the limited radiocarbon and dendrochronological dates, independent temporal measures, such as Euro-American trade items and metal modified bone tools, are incorporated into this discussion. A final analysis focuses on microceramic variation of a single class of ceramic rim sherds, those with cord-impressed lips or rim braces. This provides additional information to evaluate the three phase ordinations in addition to suggesting some possible ceramic correlates of ethnicity.

Le Beau Phase

The DCA of the Le Beau phase involves 29 components. For the first time in this study, there are a number of villages having stratigraphic sequences that can be used as independent measures in evaluating the chronology established by ceramic ordination—Anton Rygh, Larson, Bamble, Spiry-Eklo, Swan Creek, and Sully. Also, three components assigned to the Extended Coalescent (Anton Rygh Upper, Swan Creek B, 39WW301) are included to serve as a link between the two.

The analysis is based upon the frequencies of descriptive rim sherd categories appearing in Table A.5. The results of the DCA are presented in Table 19. Axis 1 accounts for 61% of the variance extracted by the four axes from the original data matrix of 12 descriptive rim sherd categories. The variance drops to less than half of this for axis 2 and considerably less for the two remaining axes. This indicates that a two axis solution adequately reflects the variation between components and ceramic types. It is noted that a principal components analysis of a similar data set, employing percentages of types instead of frequencies, results in a similar solution and plot of component factor scores (Falk and Johnson, in prep).

A plot of component scores on axes 1 and 2 is presented in Figure 17. The rescaled scores of the descriptive rim sherd categories also are depicted in this figure. Arrows, pointing from earliest to latest occupation link the components from the six sites that have stratigraphic information. The stratigraphic evidence is consistent with the interpretation that axis 1 is temporal in nature and that

TABLE 19. Site component and ceramic type scores from the detrended correspondence analysis of Le Beau phase components.

Component or type	Axis 1	Axis 2	Axis 3	Axis 4
Anton Rygh RI (39CA4)	0.89	0.38	0.22	0.33
Anton Rygh RII-IV (39CA4)	1.12	0.48	0.28	0.23
Anton Rygh Upper (39CA4)	1.24	0.50	0.41	0.02
Bamble Late (39CA6)	0.49	0.12	0.45	0.08
Bamble Early (39CA6)	1.10	0.29	0.22	0.24
Nordvold I (39CO31)	0.10	0.00	0.69	0.07
Red Horse Hawk (39CO34)	0.38	0.10	0.57	0.33
Four Bear (39DW2)	0.32	0.24	0.62	0.36
Oahe Village (39HU2)	0.46	0.76	0.36	0.23
Mush Creek (39HU5)	0.43	0.85	0.51	0.57
Pierre School 1987 (39HU10)	0.23	0.77	0.42	0.12
Pierre School 1990 (39HU10)	0.50	0.72	0.91	0.19
39HU22	0.00	0.51	0.74	0.30
Spotted Bear (39HU26)	0.49	1.06	0.25	0.19
Steamboat Creek (39PO1)	0.97	0.44	0.33	0.48
Rosa A (39PO3)	0.74	0.36	0.42	0.35
Artichoke Creek (39SL1)	0.43	0.11	0.55	0.27
Sully Middle (39SL4)	0.93	0.92	0.69	0.38
Sully Late (39SL4)	0.61	0.56	0.58	0.64
Mobridge (39WW1)	0.96	0.58	0.51	0.00
Larson 3-4 (39WW2)	0.85	0.30	0.26	0.49
Larson 2 (39WW2)	0.94	0.28	0.12	0.50
Larson 1 (39WW2)	1.03	0.34	0.00	0.43
Spiry-Eklo Late (39WW3)	0.37	0.17	0.52	0.17
Spiry-Eklo Middle (39WW3)	0.60	0.22	0.29	0.23
Spiry-Eklo Early (39WW3)	0.75	0.29	0.34	0.24
Swan Creek C+D (39WW7)	1.04	0.57	0.27	0.36
Swan Creek B (39WW7)	1.15	0.67	0.07	0.42
39WW301	1.28	0.80	0.30	0.35
S-shaped Cord Impressed	2.08	0.02	–0.57	0.33
S-shaped Horizontal Incised	2.52	0.54	1.16	–0.36
S-shaped Diagonal Incised	1.84	1.14	1.24	0.71
S-shaped Herring Bone Incised	1.80	1.30	1.58	4.83
S-shaped Tool/Finger Impressed	1.75	–0.55	–3.81	1.94
S-shaped Undecorated	0.71	–0.24	0.60	–0.28
Straight Diagonal/Herring Bone Incised	0.72	3.35	6.79	2.80
Straight Horizontal Incised	2.73	1.27	1.98	–2.38
Straight Cord Impressed Lip	0.77	0.83	–0.18	–0.66
Straight Tool Impressed Lip	0.01	1.88	0.59	0.79
Straight Finger Impressed Lip	1.14	0.06	0.32	1.03
Straight Undecorated	–0.75	–0.81	1.29	–0.30
Eigenvalues	0.133	0.054	0.023	0.007

there is a direct or positive relationship between scores and age (i.e., as scores increase the age of the components increase). Although this also is true of axis 2, there is greater spread of scores on axis 1. In addition, since axis 1 accounts for more than twice the variance of axis 2, this spread in scores is even greater. If the component scores are rescaled to match the eigenvalues, axis 1 would more than double in length compared with axis 2. Axis 2, on the other hand, is interpreted as having a strong spatial referent. Most of the southern Le Beau components—those in the Bad-Cheyenne and Big Bend regions (i.e., Sully, Pierre School, Oahe Village, Spotted Bear, Mush Creek)—have high scores, whereas those to the north in the Grand-Moreau region have low scores. The southern components have scores higher than 39HU22 on axis 2 and lower scores than Sully Middle on axis 1. Thus, DCA is able to isolate sources of ceramic variability relating to time and space.

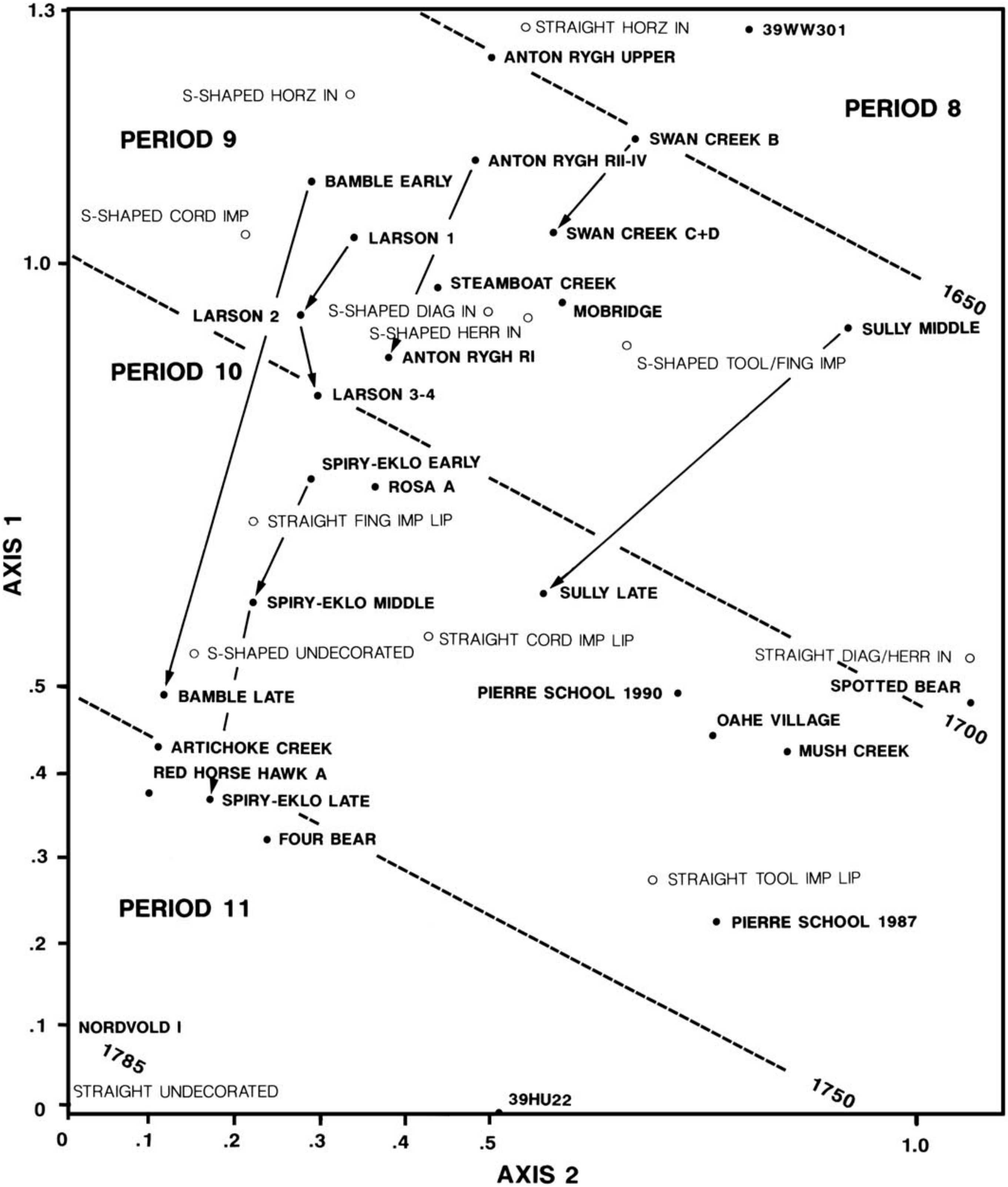

FIGURE 17. Plot of Post-Contact Coalescent Le Beau phase components and descriptive rim sherd categories on Axis 1 and Axis 2, detrended correspondence analysis ordination.

An examination of the positions of the ceramic types in Figure 17, in conjunction with the percentages of these in the data matrix in Table A.5, indicates the ones that vary through space and time. Late components tend to have ceramic assemblages dominated either by straight undecorated rims (northern villages) or straight rims with tool-impressed lips (southern villages). Early northern Le Beau phase components have relatively high quantities of S-shaped rims decorated with cord impressions or horizontal incisions. Straight rims, also horizontally incised, most frequently occur in early components, linking them with the late end of the Extended Coalescent chronology. The difference between the northern and southern Le Beau villages is almost entirely attributable to a number of S-shaped rim types, most common in the northern components. These trends are, for the most part, mirrored in the late villages from the Knife region (Breakey and Ahler, 1985, table 19; Ahler and Swenson, 1993, figs. 17.7b, 17.10, 17.16). At these sites, there is a progressive decline in S-shaped rim sherds, which are replaced by vessels with rim bracing (i.e., straight rims). Rims decorated with finger impressions, tool impressions, or those that are undecorated, increased in popularity through time, at the expense of those decorated with cord impressions. These common trends indicate that the villages in the Grand-Moreau, Knife, and Heart regions generally follow the same trajectories of ceramic change during the Post-Contact period.

A temporal scale is added to Figure 17 by drawing an imaginary diagonal line from near 39WW301 to a point between Nordvold I and 39HU22. This diagonal follows the direction of the stratigraphic sequences of the Anton Rygh, Larson, Bamble, Spiry-Eklo, Swan Creek, and Sully sites. An initial date for the Le Beau phase of AD 1650 is assigned on the basis of the previous analysis of Extended Coalescent components. The beginning of the Le Beau phase marked the point when Mandan influence, as epitomized by the Hensler phase of the Heart River complex, began to wane in the Knife and Grand-Moreau regions. Le Beau phase villagers then began to develop their own truly independent culture coinciding with increasing involvement in the fur trade. A terminal date of AD 1785 is selected because it is shortly after the smallpox epidemic of 1780–1781 and coincides with Ahler's (1993b:89–95) division between the Minnetaree and Roadmaker phases. Nordvold I is assumed to be the last Le Beau phase village and is assigned the date of AD 1785. By this measure, the last two components of the Swan Creek site are dated between AD 1650 and AD 1675. This is significant because it may mark the time when Euro-Americans first entered the area. Jantz and Owsley (1994) identified one individual from the Swan Creek site as non-Indian. The association of this individual or any of the remaining burials with Swan Creek B or C/D components is unclear. Jantz and Owsley (1994:199) cited a number of accounts of Euro-American presence in the Middle Missouri subarea in the early eighteenth century.

A somewhat different dating scheme could associate the AD 1785 terminal date to the abandonment of five villages (Bamble, Spiry-Eklo, Red Horse Hawk, Artichoke Creek, Four Bear) depicted in Figure 17. This argument coincides to the historical accounts of the smallpox epidemic of AD 1780 to 1781 and the resulting depopulation. This would place site 39HU22 and Nordvold I in the historic period (post AD 1804), however, although they were not historically documented at this time. In addition, the analysis of microstylistic, cord-impressed motifs, presented later in Figure 22, suggests little continuity between the Le Beau phase and the historically documented Arikara Leavenworth site. This indicates that the Le Beau phase may have contributed few if any people to the Leavenworth village, perhaps because of a major population decline prior to the epidemic of AD 1780 to 1781. It is believed that the Le Beau phase villagers, for whatever reason (e.g., epidemics, conflict with nomadic groups), suffered a major population decline at about AD 1750 to AD 1752 (see also Trimble, 1989:50, 1993, table 15.4).

It also is interesting that the two series of units from Anton Rygh (Lower-Middle-Upper and RI–RVII) date to somewhat different times. RI-RVII, excavated into a midden (Strong, 1940:378; Hughes, 1955:9–13) spans the entire length of occupation. The Lower-Middle-Upper sequence is developed from another portion of the site excavated by Bowers (Knudson et al., 1983, table 8) and dates to the middle of the former units. This suggests that not all parts of the village were occupied during the same period, similar to the pattern at Big Hidatsa (see Ahler and Swenson, 1985:262–269). In this context, dating another Le Beau Phase site, Oahe Village, is difficult without a more detailed analysis of the site. This analysis treats the entire large assemblage from the site as a single component. Given the thickness of the extensive midden deposits at the site, it could have been occupied for a length of time comparable to some of the other Le Beau phase villages, or at least 100 years. It is impossible to determine if the position of Oahe Village in Figure 17 represents its mid-point date or some other figure without a knowledge of where excavations took place. Given its late position and assumed long time span, however, it most likely was occupied for at least 100 years, if not considerably longer. Taking its position in Figure 17 as a midpoint, the date of occupation is estimated to be from AD 1650 to AD 1750.

A similar line of reasoning could be applied to the Mobridge site, which is important mainly because of the numerous human remains excavated from its associated cemetery (Palkovich, 1981). The ceramic assemblage from Mobridge consists of three separate surface collections, probably representing considerable time depth because many Le Beau phase sites have relatively thick midden deposits. Most of the pottery from the village consists of types associated with Post-Contact period Le Beau phase sites; a small amount is assigned to a late Extended Coalescent occupation. Bowers (1948a:35) also suggested that there is a prehistoric and protohistoric component present. He thought that the prehistoric occupation resembled the lower and middle levels at Anton Rygh, and the Davis (Lower Grand) site. This would place the earliest component at the Mobridge site at about AD 1550 to AD 1600. Lehmer (1971, fig. 82) recognized a single component at the site dating to the Post-Contact period. It is assumed that the position of the site in Figure 17 probably represents a good portion of its time span, skewed towards the late end by the surface context of the ceramic sample. By this line of reasoning, an estimate of the temporal span of the site is from AD 1625 to AD 1700. It also should be noted that this temporal ordering depicted in Figure 17 is similar to the one developed by Hurt (1957, chart 1), and by Falk, Johnson et al. (in prep.). The dates from these two studies tend to be 25 to 75 years later than those in Figure 17.

Another source useful in dating is the relative quantities of Euro-American metal trade items and various Native American bone tools thought to be temporal indicators. Figure 18 plots the ratio of trimmed scapula hoes, bone knife handles, bone awls, and metal items to rim sherds. This information is extracted from Table 20, which also lists Bad River and Talking Crow phase components to be discussed later. Because volumes of excavated matrix are not available from the various components as they are from other sites (see Ahler and Dreybred, 1993), the number of hoes, knife handles, awls, and metal items has to be standardized to some other measure of occupational duration or intensity. Toom (1979:164–175) suggested that one good measure of this is the total number of ceramic sherds recovered from a component. For this study, rim sherds are chosen because they can be assigned to specific components. Body sherds that usually cannot be attributable to particular post-contact components are not used. The order of components in Figure 18 follows the inferred temporal order from the ceramic ordination, from Anton Rygh Lower at the left to Red Horse Hawk at the right. The full Anton Rygh sequence is included in the figure despite the fact the two earliest components, Anton Rygh

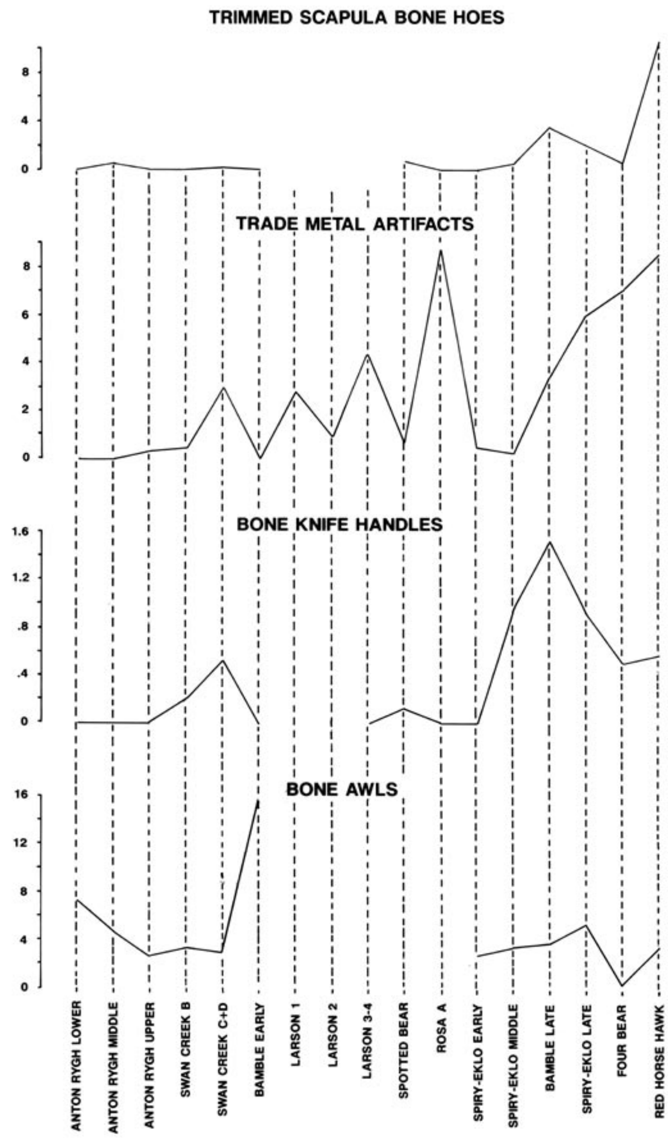

FIGURE 18. Plot of the relative amounts of metal modified bison scapula hoes, bone knife handles, bone awls, and trade metal artifacts, Post-Contact Coalescent Le Beau phase.

Lower and Anton Rygh Middle, are thought to predate the Le Beau phase. Some components are excluded because of lack of data.

If the use of Euro-American metal items increases through time, then the expectation is for an increase in these materials, as well as Native American bone tools modified by or for use with these new artifacts. Trimmed scapula hoes (those with the glenoid cavity completely removed) are believed to be modified by metal tools. These are expected to increase through time. Figure 18 indicates that these hoes increase through time, but only at the end

TABLE 20. Frequencies of temporally sensitive post-contact period artifacts and their ratios to ceramic vessels. Dashes for artifacts indicate no data available.

	Frequencies					Artifact class/ceramic vessels × 100			
Phase/Component	Trade metal	Bone knife handles	Trimmed scapula bone hoes	Bone awls	Ceramic vessels	Trade metal	Bone knife handles	Trimmed scapula bone hoes	Bone awls
Bad River Phase									
Dodd A	32	—	—	—	582	5.50	—	—	—
Indian Creek	25	—	—	—	451	5.54	—	—	—
Phillips Ranch	75	7	103	31	1491	5.03	0.47	6.91	2.08
Buffalo Pasture	101	37	51	26	2001	1.30	1.85	2.55	1.30
Le Beau Phase									
Anton Rygh Lower	0	0	0	30	408	0.0	0.0	0.0	7.35
Anton Rygh Middle	2	0	1	95	1995	0.05	0.0	0.50	4.76
Anton Rygh Upper	1	0	0	77	2820	0.25	0.0	0.0	2.73
Swan Creek B	2	1	0	17	511	0.39	0.20	0.0	3.33
Swan Creek C+D	62	11	3	67	2131	2.91	0.52	0.14	3.14
Bamble Early	0	0	0	8	51	0.0	0.0	0.0	15.69
Bamble Late	40	18	43	45	1192	3.36	1.51	3.61	3.78
Larson 1	10	—	—	—	373	2.68	—	—	—
Larson 2	7	—	—	—	747	0.93	—	—	—
Larson 3-4	122	—	—	—	2824	0.21	—	—	—
Spotted Bear	5	1	6	56	814	0.61	0.12	0.74	6.88
Rosa A	107	—	—	—	1231	8.69	—	—	—
Spiry-Eklo Early	4	0	0	27	952	0.42	0.0	0.0	2.84
Spiry-Eklo Middle	1	20	3	22	639	0.15	0.94	0.47	3.44
Spiry-Eklo Late	140	22	45	49	2368	5.91	0.93	1.90	5.51
Four Bear	81	6	6	7	1169	6.93	0.51	0.51	0.60
Red Horse Hawk	45	3	56	20	534	8.43	0.56	10.49	3.76
Talking Crow Phase									
Hitchell	3	—	—	—	79	3.80	—	—	—
Oacoma	—	6	—	64	3042	—	0.20	—	2.10
Talking Crow III	27	0	1	10	692	3.90	0.0	0.14	1.45
Fort George Village	34	3	95	10	275	11.93	1.05	33.33	3.51
Medicine Crow 1	9	2	9	4	111	8.11	1.80	8.10	3.60
Medicine Crow 2	89	13	27	11	461	19.31	2.82	5.86	2.39
Medicine Crow 3	43	5	36	6	555	7.75	11.62	6.49	1.08
Medicine Crow 4	38	9	19	5	442	8.60	2.04	4.30	1.13
Medicine Crow 5	7	0	2	0	88	7.95	0.0	2.27	0.0

of the Le Beau sequence. The change is most dramatic at Red Horse Hawk, although there is another peak at Bamble Late. Bamble Late is dated at about AD 1750.

Bone knife handles, most frequently fashioned by making thin slots in bison ribs for hafting metal cutting tools, also are expected to increase through time. There are two peaks in Figure 18, a minor one at about AD 1675 (Swan Creek C+D) and a major increase at ca. AD 1750 (Bamble Late). For some unknown reason, there is a drop from Bamble Late to Red Horse Hawk. It should be noted that the temporal difference between these two late components is relatively small. Because the ordination of components along the temporal dimension makes no claims of differentiating between components separated by less than 25 years, the order of these components could very well be reversed in reality. The main point is the increased use of these tools during the latter half of the Le Beau sequence at about AD 1725 (Spiry-Eklo Middle).

Bone awls are an excellent temporal indicator during the Post-Contact period (Weston, 1986, 1993; Weston and Ahler, 1993). It is thought that as metal replacement awls entered the Native American tool technological system, they replaced their bone counterparts. Therefore, bone awls are expected to decline through time. This appears to be partially true for the Le Beau phase. The relative number of bone awls declines from Anton Rygh Lower to

Bamble Early. There is an increase from Spiry-Eklo Early to Spiry-Eklo Late, then a decrease to Four Bear and Red Horse Hawk. Again, there is little temporal difference between the late components, so any trends in this part of the sequence should be interpreted with caution. The early end of the sequence indicates that awls decline to a relatively low level at about the time of the last two occupations of Swan Creek (i.e., AD 1650–1675). This closely corresponds to the period of maximum decline of these tools in the Knife region during the early Willows phase (AD 1600–1650) (Weston and Ahler, 1993, table 20.3).

Euro-American metal trade artifacts, both identifiable tools and scrap pieces, exhibit a somewhat uneven trend in Figure 18. These artifacts first appear in the Anton Rygh Upper and Swan Creek B components, dated at AD 1650. Until the late end of the Le Beau sequence their presence is uneven, showing a regular series of increases and decreases. Beginning with the last occupation at Bamble at about AD 1725, there is a dramatic increase in these items. This corresponds to a similar increase at about the same time in the Knife region (Ahler and Dreybred, 1993, figs. 21.2–21.5).

In summary, the temporal ordering established by the ceramic ordination is somewhat supported by these four temporally sensitive artifact classes. Metal trade items started to have an impact on native bone technologies at about AD 1650, with a major change occurring at ca. AD 1725. This late change confirms the placement of components at the late end of the Le Beau sequence. These changes also occur in the Knife region, further substantiating the temporal order established by the ceramic ordination.

Yet another source of information comes from a study by Billeck (2000) of 26 protohistoric and historic Arikara sites. The source of most of beads used in this study comes from burials, many in cemeteries physically separate from their associated villages. The discussion of Euro-American trade materials in chapter 3 points out the inherent difficulties of making comparisons between chronologies based upon the following factors: (1) two types of material classes (pottery vs. beads); (2) different methods of recovery and documentation (cemetery/burials vs. villages); and (3) lack of any direct spatial or stratigraphic association between cemetery and village that would be helpful in establishing chronological relationships at sites with relatively long periods of continuous occupation. The result is less confidence when making these comparisons than in other situations.

Billeck examined 10 sites assigned to the Le Beau phase that also are the focus of this chronology and assigned them absolute dates within a 25- or 50-year span, each having an uncertainty of 25 years on either end: Sully (1675–1700), Larson (1700–1725), Mobridge (1725–1750), Swan Creek (1675–1700), Rosa (1700–1725), Four Bear (1700–1725), Indian School (1725–1775), Nordvold (1750–1775), Red Horse Hawk (1750–1775), and Spiry-Eklo (1750–1775). The core date range for the Sully and Spiry-Eklo sites corresponds to the end of their occupations established in the present study. Billeck's core date for the Larson and Swan Creek sites are 25 years later than what is proposed here. The date that Billeck assigns to the Rosa, Indian (Pierre) School, and Red Horse Hawk are in agreement with the ones proposed in this study. Two sites, Four Bear and Nordvold, are placed from about 10 to 30 years later in this study compared with Billeck's chronology. There is at least a 50-year difference between the two dating techniques at the Mobridge site. It is difficult to explain this difference without reference to the nature of the ceramic assemblage from the village portion of the site used in the ceramic study (all from the surface), the disturbance to the site prior to the collection of the pottery, the probable long period of continuous occupation, and the lack of any systematic excavations in the village. Cases in which the trade-bead chronology places sites either at the end (Sully, Spiry-Eklo) or somewhat later (Larson, Swan Creek) than the ceramic chronology may be caused by the fact that the burials from the cemeteries containing most of the beads also could date to the end of these long and continuously occupied sites. Although the ceramic chronology for the Le Beau phase partitions each of these site into "components," these components are difficult to relate to the cemeteries. The bead chronology may in fact be dating the later occupations of each site, something that the ceramic chronology cannot do with as much precision. If Billeck's 25-year range is added onto either end of the span of each site core date, then the only differences between the two dating schemes for the 10 sites is in the placement of Mobridge and Four Bear.

Craniometric Distance

A number of large human skeletal samples were excavated from the cemeteries associated with Le Beau phase sites, including Larson, Mobridge, Sully, Anton Rygh, and Swan Creek. The recently investigated Pierre School site apparently contained a large population buried within the village, although many were probably not excavated. Smaller numbers of crania are available from Oahe Village, Steamboat Creek, Nordvold I, and Four Bear. This wealth of data have been incorporated into numerous craniometric studies (see Bass, 1981, for a partial list). Many of these analyses also employ the crania from the historically documented

Arikara community of Leavenworth. Depending on the study and sex of the individuals, the interpreted chronological relationships between these populations tend to differ somewhat between studies (Jantz, 1973; Jantz et al., 1981; Key and Jantz, 1981; Owsley, Slutzky, Guagliardo, and Deitrick, 1981; Willey, 1990; Willey and Emerson, 1993). In Jantz's (1973, figs. 2, 3) study, the following craniometric order, from earliest to latest, is suggested: Mobridge-Anton Rygh-Sully-Larson-Leavenworth (males on CVI). The relationship among females on CVII is the same except for the reversal of Anton Rygh and Mobridge. This is almost the same as the results obtained by Jantz et al. (1981, fig. 1) for both males and females on CVIII: Mobridge-Anton Rygh-Sully-Larson-Leavenworth. Key and Jantz (1981, fig. 2) suggested the following relationships, from early to late, are indicative of temporal ordering: Anton Rygh-Sully-Mobridge-Larson-Leavenworth. The analyses by Willey (1990, fig. 3), and Willey and Emerson (1993, fig.17) are identical, resulting in the following orderings of males and females on CVI: Mobridge-Anton Rygh-Larson-Sully-Leavenworth. Finally, Owsley, Slutzky, Guagliardo, and Deitrick (1981, figs. 1, 2) incorporated a larger number of sites to derive the following order of males: Mobridge-Anton Rygh-Swan Creek-Larson-Oahe Village-Four Bear-Leavenworth (fig. 1). The relationships among females (fig. 2) is somewhat different: Mobridge-Anton Rygh-Oahe Village-Swan Creek-Larson-Leavenworth-Four Bear.

Several conclusions can be drawn from these studies. Mobridge and Anton Rygh are early in the sequence, switching places depending on the study. The Larson site is near the late end of the chronological sequence, having an affinity to Leavenworth. The Sully site usually falls between these temporal extremes. Other sites, such as Swan Creek, Four Bear, and Oahe Village, occupy intermediate to late chronological positions.

A somewhat different study by McWilliams (1982) used discrete nonmetric cranial attributes, rather than the more traditionally accepted measurement data. Although this study is more difficult to interpret because it consists of a matrix of divergences or distances, it nonetheless has certain relationships that can be summarized. Based upon their relationships with the Leavenworth site, Anton Rygh and Sully are most dissimilar, whereas Larson and Mobridge bear stronger affinities to the historic Arikara village. This indicates that the former two sites are earlier than the latter ones. This temporal ordering is in partial agreement with the ceramic ordination presented in this study. Furthermore, Mobridge has strong affinities to the Crow Creek site.

In addition to these analyses, significant variation is noted within the Mobridge and Sully cemeteries. These differences are thought to reflect the time the individuals were interred. The four burial areas at Sully are assigned to different time periods based upon the amount of Euro-American trade goods (Owsley and Jantz, 1978). Burial areas D and E are earlier than areas A and B. At the Mobridge site, cemeteries 1 and 3 are similar in time compared with the later cemetery 2 (Owsley, 1981; Owsley et al., 1982). The site was possibly occupied from AD 1625 to AD 1700. The archeology of the Sully village indicates that there are three to four periods of house building or superpositioning (Smithsonian Institution, 1958:54–55, 1960:60–71). The present study suggests a continuous occupation of the village divided, for the purpose of analysis, into three arbitrary time periods from ca. AD 1550 to AD 1725.

A comparison of the craniometric studies and the ceramic ordination indicates that both agree with the early position of Anton Rygh. The Mobridge site is placed at the end of the Anton Rygh occupation and contemporaneous with the middle component at Sully in this study. Euro-American glass trade beads are absent from two of the three Mobridge site cemeteries (Owsley, 1992:77), suggesting that a portion of the Mobridge village is earlier than the temporal parameters established in this report, or that a different trade dynamic and/or burial pattern is operating at various villages and time periods. In the present study, Sully Middle/Sully Late and Larson are essentially contemporaneous, which agrees with the craniometric studies. Swan Creek is placed between Anton Rygh and Larson in the ceramic ordination, somewhat out of order with the craniometric results. Oahe Village occupies a position after Larson in the ceramic ordination, agreeing with its order on craniometrics. Key (1983, figs. 21–23) indicated that geographic location is an important factor in the biological relationships between Le Beau phase populations. In his analysis, the following order of sites is apparent: Le Beau 1 (Sully B and E, Oahe Village)-Le Beau 2 (Four Bear, Steamboat Creek, Swan Creek)-Le Beau 3 (Nordvold I, Larson, Mobridge F2). The reader familiar with the location of these sites will notice a south-to-north trend in which Le Beau 1 includes the most southerly sites and Le Beau 3 those farthest to the north.

Bad River Phase

Twenty-four components assigned to the Bad River phase are included in this study. Two Le Beau phase components most similar in ceramic content to the Bad River phase—Oahe Village and Pierre School-1987—also are incorporated in order to formally tie the ordinations of these two phases together. Fort George Village is not included in this DCA because it is considered to be an outlier on axis 2 as another analysis (unreported) indicates. This village is included in the analysis of the Talking Crow phase, to be discussed below. The four axes extracted, along with the pottery type and component scores, are presented in Table 21. The first two axes account for 88% of the variation of all four factors. The eigenvalues significantly decline after the second axis is extracted, suggesting that a two dimensional solution to reducing the data matrix (Table A.5) is appropriate.

A plot of the component scores, along with those of each of the 12 descriptive rim sherd categories, appears in Figure 19. Like previous analyses in this study, the pottery type scores are rescaled to fit the range of the site component values. There are four major ceramic descriptive categories represented at Bad River sites—undecorated straight rims and those decorated on the lip (or rim brace) with tool, finger, or cord impressions. A smaller number of S-shaped or collared rims decorated with cord impressions also are present. It is apparent from the position of these five type scores that components with scores high on axis 1 and low on axis 2 generally contain relatively large relative frequencies of straight rims with finger-impressed lips (Dodd A, H. P. Thomas 3, Pascal Creek). Straight rims

TABLE 21. Site component and ceramic type scores from the detrended correspondence analysis of Bad River phase components.

Component or type	Axis 1	Axis 2	Axis 3	Axis 4
Greenshield (32OL17)	0.00	0.68	0.49	0.50
Fire Heart Creek (32SI2)	0.01	0.37	0.53	0.50
Pascal Creek (39AR207)	0.65	0.00	0.00	0.00
Leavenworth Late (39CO9)	0.04	0.42	0.48	0.47
Oahe Village (39HU2)	0.65	0.54	0.44	0.44
Pierre School 1987 (39HU10)	0.48	0.80	0.24	0.23
Chapelle Creek A (39HU60)	0.21	0.38	0.27	0.24
Coleman (39SL3)	0.69	0.53	0.30	0.28
Little Bend (39SL13)	0.41	0.55	0.32	0.32
Madison (39SL19)	0.57	0.22	0.49	0.47
39SL28	0.34	0.15	0.19	0.19
Cheyenne River Late (39ST1)	0.58	0.33	0.51	0.49
Black Widow Late (39ST3)	0.52	0.16	0.14	0.12
Dan Donavan (39ST5)	0.39	0.42	0.54	0.53
Buffalo Pasture (39ST6)	0.35	0.33	0.02	0.00
H. P. Thomas 3 (39ST12)	0.56	0.07	0.38	0.39
Phillips Ranch (39ST14)	0.52	0.49	0.24	0.22
Indian Creek A (39ST15)	0.68	0.81	0.38	0.35
Gillette A (39ST23)	0.29	0.44	0.65	0.60
39ST25	0.60	0.19	0.35	0.34
Dodd A (39ST30)	1.04	0.13	0.42	0.42
39ST50	0.18	0.41	0.69	0.67
39ST51	0.72	0.16	0.15	0.13
Black Widow Ridge (39ST203)	0.78	0.09	0.25	0.30
Johnston (39ST244)	0.59	0.44	0.01	0.01
Blue Blanket Island (39WW9)	0.37	0.19	0.40	0.39
S-shaped Cord Impressed	–0.51	0.00	2.67	2.46
S-shaped Horizontal Incised	1.06	2.18	0.42	0.73
S-shaped Diagonal Incised	1.37	–0.38	–0.24	0.66
S-shaped Herring Bone Incised	1.28	1.49	3.14	5.11
S-shaped Tool/Finger Impressed	–2.59	2.12	–2.54	–2.20
S-shaped Undecorated	0.07	2.11	0.07	1.80
Straight Diagonal/Herring Bone Incised	3.04	10.20	1.71	–5.34
Straight Horizontal Incised	–0.15	5.59	–0.72	–0.14
Straight Cord Impressed Lip	–0.32	0.54	0.89	0.87
Straight Tool Impressed Lip	1.39	1.66	0.49	0.45
Straight Finger Impressed Lip	1.63	–0.86	0.43	0.46
Straight Undecorated	–0.06	0.07	–1.05	–1.10
Eigenvalues	0.069	0.027	0.009	0.004

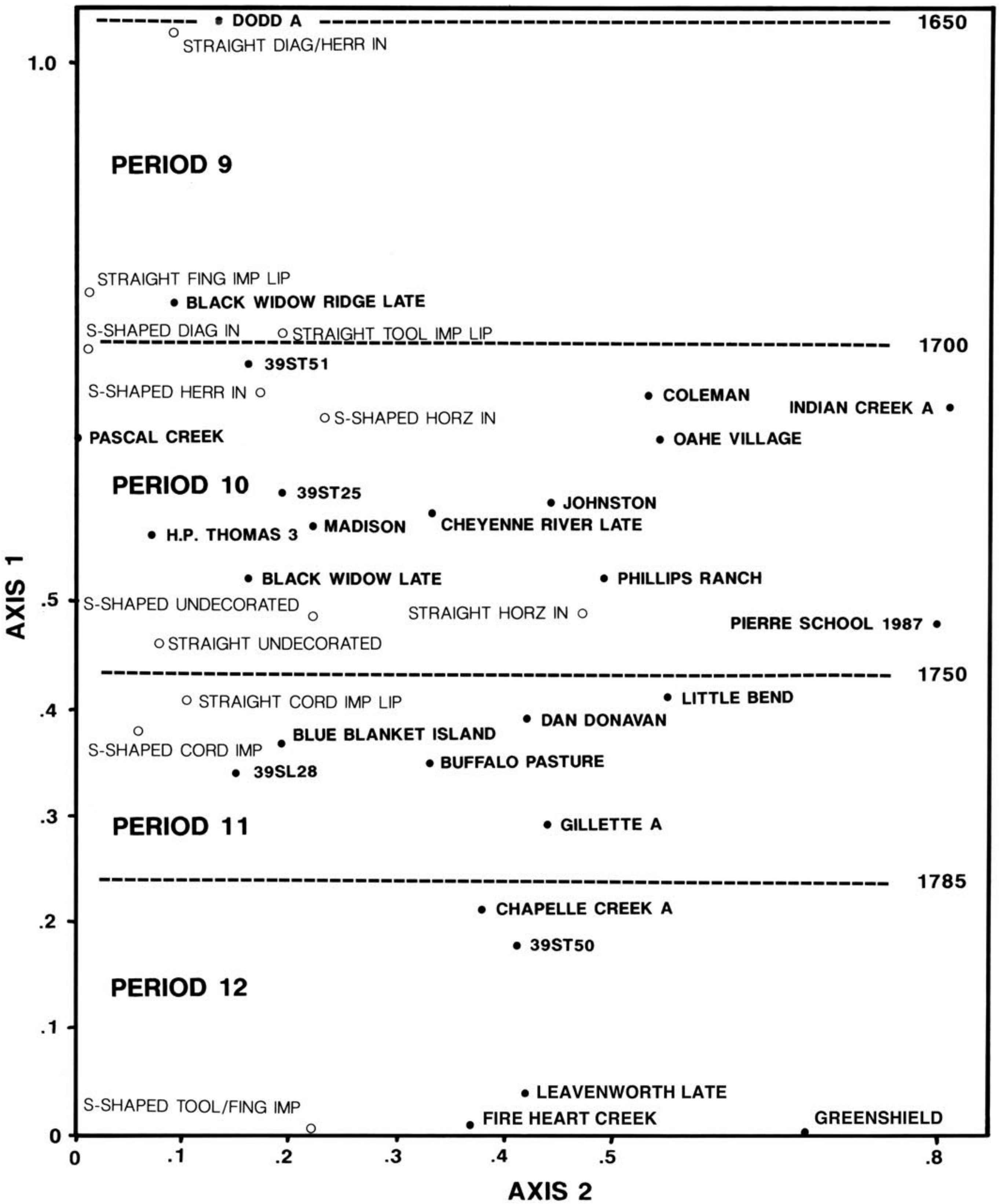

FIGURE 19. Plot of Post-Contact Coalescent Bad River phase components and descriptive rim sherd categories on Axis 1 and Axis 2, detrended correspondence analysis ordination.

with tool-impressed lips are most common in the ceramic assemblages of components with high scores on axis 2, such as Coleman, Pierre School–1987 (a.k.a. Pierre Learning Center), Oahe Village, and Indian Creek A. As component scores drop on axis 1 and rise on axis 2, ceramic assemblages contain relatively larger amounts of straight undecorated rims and rims with cord-impressed lips. Villages with low scores on axis 1 contain the highest relative frequencies of S-shaped rims with cord-impressed rim exteriors.

These ceramic changes, interpreted as temporal in nature, tend to contrast with those in the post-contact villages of the Grand-Moreau, Knife, and Heart regions, suggesting that the Bad River phase has its own independent trajectory of ceramic change. The modest increase in S-shaped (collared) rims, most of which are cord impressed, parallels the dramatic rise in collared vessels (Webster Collared Braced) in post-AD 1750 Pawnee/Lower Loup sites in Nebraska, such as Linwood, Bellwood, Palmer, Horse Creek, Hill, Kansas Monument, and Blue Springs (Grange, 1968, figs. 8 and 10). The introduction of large amounts of braced-rim pottery (i.e., Stanley ware) during the Bad River phase also contrasts sharply with the preceding Extended Coalescent ceramics in the Bad-Cheyenne region. Small amounts of pottery with L- and T-shaped lips (Appendix B, Figure B.16n,o) appearing in Extended Coalescent villages may be the precursors to Stanley ware. Two other origins for the Bad River phase include the Talking Crow phase, as suggested by Smith (1977:156), and certain southern Le Beau phase villages, such as Sully. The late component at Sully has some ceramic affinities to another large village established about AD 1700—Oahe Village (see Figure 17). Taking this argument one step further, the appearance of a large number of Bad River phase communities about AD 1700 may represent formerly autonomous village groups that split off from Sully during its waning years.

The interpretation of axes 1 and 2 can be understood by reference to the position of a number of components with extreme values on each axis and by relating them to the positions of two Le Beau phase components included in Figure 17. Axis 2 seems to be partially related to a division between sites on the west and east banks of the Missouri River. Most of the sites with extreme values on axis 2 (Pierre School-1987, Little Bend, Coleman, Oahe Village) are located on the east bank, whereas those with lower values tend to be located on the west side. This may relate to some ill-defined ethnic differences that some authors describe as the left (east) and right (west) bank Arikara (Hoffman, 1977:21–22). These ceramic differences are accentuated when Bad River villages, concentrated on the right bank, are compared with those on the opposite or left bank (Le Beau phase) in the Bad-Cheyenne region.

Axis 1 is interpreted to be temporal in nature based upon the following argument. Two historically documented villages, Leavenworth and Greenshield, have low scores on axis 1. Leavenworth was occupied by the Arikara between ca. AD 1798 and AD 1832, whereas Greenshield is dated immediately prior to Leavenworth at ca. AD 1795 to AD 1798 (Krause, 1972:14–15; Wood, 1986a:21). The interpretation of the placement of Greenshield in Figure 19 is complicated by the fact that both the Arikara and Mandan occupied the village. It is impossible to determine from the limited excavations at Greenshield if the Mandan and Arikara occupations can be identified from the archeological record. Suffice it to say that the ceramic assemblage from the site falls within the range of variation of a number of late Bad River phase villages occupied by the Arikara. The two Le Beau phase components included in this analysis, Oahe Village and Pierre School-1987, are arranged in their correct temporal order on axis 1 if Oahe Village is considered the older of the two. This ordering between the two also agrees with their relative temporal position among the remaining Le Beau phase components depicted in Figure 17.

These same arguments are used to establish an "absolute" time scale for axis 1. Focusing on the late end of the Bad River sequence, Leavenworth is assigned a date of occupation at AD 1815, an average of its assumed beginning and ending dates of AD 1798 and AD 1832. Oahe Village serves as the other "anchor" component in the sequence because it has a relatively large ceramic assemblage and is included in the previous Le Beau ordination. The Le Beau sequence dates Oahe Village to about AD 1715. If these dates are assigned to the components in the Bad River ordination, it is only a matter of interpolating between the two to make 50-year intervals in the sequence. These 50-year intervals are depicted in Figure 19. Extending the dating back to Dodd A places this component at about AD 1650, or the beginning of the Post-Contact period. This lends added support to the dating of both the Le Beau and Bad River phase sequences. The time periods also are indicated in Figure 19, including period 12 (AD 1785–1830) that corresponds to Ahler's (1993b:92–95) Roadmaker phase. As a consequence, period 11, like the Le Beau phase sequence, is only 35 years in duration.

The results of several previous chronologies of Bad River phase components are briefly compared with the ordering presented in this analysis. The division of the Bad River phase sequence into two subphases by Lehmer and Jones (1968:95–100), Bad River 1 (AD 1675–1740) and

Bad River 2 (AD 1740–1795), is based upon several "temporally sensitive" indicators, such as presence or absence of horse bones, firearms, and fortifications. For comparative purposes, the following sites included in the present analysis are assigned to the two subphases by Lehmer and Jones (1968, fig. 21). Dodd A, Black Widow Ridge Late, Coleman, Pascal Creek, Indian Creek A, Little Bend, Dan Donavan, and 39SL28 are included in Bad River 1. Bad River 2 sites include Johnston, 39ST25, 39ST50, Cheyenne River Late, H. P. Thomas 3, Madison, Phillips Ranch, Buffalo Pasture, Gillette A, and Chapelle Creek A. Although the temporal divisions and placement of components in Figure 19 do not agree with these subphases of the Bad River phase, there is a tendency for Bad River 1 components, such as Dodd A, Black Widow Ridge Late, Coleman, Pascal Creek, and Indian Creek A, to be early in the sequence and Bad River 2 sites like Buffalo Pasture, Gillette A, Chapelle Creek A, and 39ST50 to be late. The seriation by Hoffman (1970b:290–311, 1972) orders a small number of components along a dimension similar to the nontemporal axis 2 in this report. The temporal ordering in Figure 19 also conflicts with the results of Grange (1981, figs. 5, 7) but is in general agreement with Falk et al. (in prep. a). Finally, Krause's (1967, fig. 27) ordering agrees with Figure 19, particularly if his Dodd–Phillips Ranch–Buffalo Pasture sequence is separated from the 39ST203–39ST25–39ST12 one.

Perhaps because so many Bad River phase villages were occupied so late in time, their abandoned remains were documented by a number of early explorers. Unlike references to other villages in South Dakota that are of a general nature, these historic accounts can sometimes be used to identify specific archeological sites. This information is used as an independent means of evaluating the Bad River phase chronology. The following references to these historic accounts are largely drawn from Chomko's (1986) historical reconstruction of the Middle Missouri subarea. Two introductory points need to be made. First, the following summary deals only with those late villages attributable to the Arikara, most located in South Dakota. Ahler (1993b) and Wood (1993b) incorporate information on the Mandan and Hidatsa villages into their syntheses. Second, the lack of references to villages of the Talking Crow and Le Beau phases generally supports the chronologies of these two taxa because early explorers apparently recorded only recently abandoned and highly visible sites. The Le Beau phase chronology indicates that most of these villages were abandoned by about AD 1750, about 50 years before the major exploratory period began with the Lewis and Clark expedition of AD 1804 to AD 1806. Similarly, the chronology of the Talking Crow phase presented later suggests that most of these villages also were abandoned by AD 1750.

In their journey up the Missouri River in AD 1804, Lewis and Clark documented a series of occupied and recently abandoned Arikara villages, some noted by earlier explorers and those who followed the expedition. Two fortified villages below the confluence of the Cheyenne and Missouri rivers (Chomko, 1986, fig. 27a,b) may refer to Gillette A, 39ST25, or 39ST50. The former two sites date late in the Bad River sequence, whereas 39ST50 is early. Lewis and Clark's description of one of the villages most closely corresponds to 39ST50, conflicting with its early chronological position in the ceramic sequence. A number of other sites occupied immediately below the mouth of the Cheyenne River include the late villages of Little Bend and 39SL28 (see Chomko, 1986:69–72, 78, 80). The Cheyenne River site also is a possibility, although it dates to the middle of the Bad River sequence at about AD 1725. Upriver from these villages is the island community of Lahoo-catt, a site that apparently was never located by the Smithsonian Institution but which may appear in early U.S. Department of Agriculture aerial photographs. Two Arikara villages on the right bank below the Moreau River were occupied in AD 1803 and AD 1804 (Chomko, 1986:79–80). There are no known late Arikara communities in the area, although a much earlier Extended Coalescent site (39DW217) is present. Another possibility is Swan Creek, although it is placed in the Le Beau sequence at about AD 1650 to AD 1675 and is on the left bank of the Missouri. Blue Blanket Island, also documented by the Lewis and Clark expedition (Chomko, 1986:78–79), is placed relatively late in the Bad River ceramic ordination.

Continuing on their journey upriver, Lewis and Clark recorded the presence of a third Arikara island community on Ashley Island (Chomko, 1986:81–82). It was destroyed by the Missouri River or inundated by Lake Oahe before archeologists could locate it. Immediately upriver from this site are the Grand River villages of the Arikara, also known as the Leavenworth site. This is the major Arikara village occupied during the early historic period. They were living at the two villages when Lewis and Clark traveled upriver in AD 1804, when John Bradbury and Henry Brackenridge passed by in AD 1811, when the villagers battled with General William Ashley and Colonel Leavenworth in AD 1823, and when George Catlin saw them in AD 1832. Prince Maximillian and Karl Bodmer documented their abandoned villages in AD 1833 (Wedel, 1955:80–81; Krause, 1972:15; Chomko, 1986:81–82, 86–89). The early historic component at Leavenworth, along with Greenshield and Fire Heart Creek, are placed at the end of the Bad River phase ceramic sequence. Fire Heart Creek may be one of the Arikara hunting camps noted by the Lewis and Clark expedition (Chomko, 1986:81–82). A few years earlier, between AD 1795 and AD 1798, the Arikara were living at the Greenshield site far to the north in the Knife region (Chomko, 1986:72–78). In summary, the Bad River phase chronology, with a few possible exceptions, seems to agree with the historic documentation.

An examination of the relative number of Euro-American metal artifacts and bone tools thought to be affected by the introduction of metal tools is useful in evaluating the proposed temporal ordering of Bad River phase villages. Unfortunately, only two components (Phillips Ranch and Buffalo Pasture) have data sufficiently complete to allow for a temporal comparison of these artifacts. Therefore, a plot of these artifacts is not made. Table 20 lists the relative numbers of bone awls, bone knife handles, trimmed scapula bone hoes, and Euro-American trade metal for each of these sites. Metal artifact counts also are available from Dodd A and Indian Creek. This table indicates that the quantity of metal artifacts is stable among the four components. From Phillips Ranch to Buffalo Pasture, the relative numbers of awls decrease, whereas bone knife handles and trimmed scapula hoes increase. This is expected if the temporal ordering between these two sites is correct. That is, bone awls were probably replaced by metal equivalents through time (cf. Weston, 1986, 1993; Weston and Ahler, 1993). Similarly, increased availability of metal tools would promote the modification of bone knife handles to accept metal blades. An increase in metal through time is expected to result in more metal-modified or trimmed-scapula hoes.

A chronology by Billeck (2000) of sites based upon glass trade beads provided a source of directly comparable results. Ten Bad River phase sites are included in his study of 26 protohistoric and historic sites. Billeck examined 11 Bad River phase sites and assigned them absolute dates within a 25- or 50-year span and an uncertainty of 25 years on either end: Leavitt (1750–1800), Cheyenne River (1750–1775), Dodd (1725–1750), 39ST25 (1725–1750), Buffalo Pasture (1725–1750), Indian Creek (1725–1775), Black Widow (1725–1775), Stony Point (1750–1775), Phillips Ranch (1750–1775), Pascal Creek (1750–1775), and Leavenworth (1800–1832). Two of these sites, Leavitt and Stony Point, lack sufficiently large ceramic assemblages to be included in the ceramic chronology. There are only three sites (Black Widow, Leavenworth, and 39ST25) that are placed at about the same time in the ceramic and bead chronologies. The bead chronology places the remaining sites either earlier by about 25 years (Buffalo Pasture) or later by about 25 years (Indian Creek, Cheyenne River, Dodd, Phillips Ranch, Pascal Creek) compared with the ceramic chronology. Using the 25-year uncertainty factor in Billeck's dates brings the two chronologies into agreement. This is little consolation, however, because a 75- or 100-year spread in a date for any particular site based upon trade beads is not particularly informative, considering the entire protohistoric period lasted for less than 150 years. Taken together with the Le Beau phase chronology, there seems to be a systematic error in one or both of the bead and ceramic chronologies that places many sites dated by beads about 25 years later than dates derived by pottery. This difference might be due to the nature of the long continuous occupations and physical separation of cemeteries and villages at the Le Beau sites but does not appear to be the case with the relatively short-lived Bad River phase villages. In addition, the bead chronology could be dating the latest part of some villages with relatively long occupations compared with the ceramic chronology.

Craniometric Distance

The only study to deal with craniometric relationships of the Bad River phase is by Key (1983, figs. 21–23). In this analysis, crania are assigned to two Bad River taxa: Bad River 1 (Indian Creek, Dodd, Black Widow Ridge) and Bad River 2 (Cheyenne River, Leavitt, Buffalo Pasture, Stony Point) based upon the chronology established by Lehmer and Jones (1968:97–98). All of these sites are included in the present ceramic analysis, except for Leavitt and Stony Point.

The placement of these sites in the ceramic ordination depicted in Figure 19 generally agrees with the order established by Lehmer and Jones (1968:97–98). An examination by Key (1983, figs. 22, 23) indicated that the skeletal samples from Bad River 1 and Bad River 2 were in their correct order, particularly in reference to the earlier Le Compte and Akaska phase sites. The order of Bad River 1 and 2 in Key's figure 21, however, is reversed. Several analyses incorporate Bad River phase crania in their studies of broader craniometric relationships. Jantz et al. (1981, fig. 1) and Jantz and Owsley (1982, fig. 17) indicated that the Buffalo Pasture and Leavitt crania are most similar in morphology to those from the Sully site. This tends to support the conclusion of the present study of a relationship, perhaps an ancestral one, between Sully and at least some Bad River phase villages. Jantz (1972, fig. 2) indicated that the crania from the Bad River phase Cheyenne River site (39ST1) differed from the Le Beau phase sites of Larson, Anton Rygh, Mobridge and Sully, as well as from Leavenworth. This suggests that the Le Beau and Bad River phases may reflect some underlying Arikara ethnic (e.g., band) differences as others have suggested (Hoffman, 1977:21–22). It also indicates that at least one Bad River village (Cheyenne River) is dissimilar from Sully and Leavenworth. The results of the ceramic ordination indicate that the Sully village may have played a developmental role in the formation of the Bad River phase that in turn contributed people to the Leavenworth village (see the following section on ceramic microstylistic variation). Another interpretation of late Arikara population dynamics emerged from a recent craniometric analysis by Byrd and Jantz (1994), who suggested that most of the crania from the Leavenworth site have a greater affinity to Le Beau rather than Bad River populations. This is at odds with the ceramic data that link Leavenworth to the Bad River rather than the Le Beau phase. Perhaps one explanation for this divergence is that the dynamics of gene flow is different from the transmission of ceramic design elements.

Finally, the mortality figures presented by Owsley (1992, fig. 2) for the Mobridge, Sully, Larson, Cheyenne River/Four Bear/ Leavitt, and Leavenworth sites generally support the chronology of the villages proposed herein, if it is assumed that mortality generally increases through time. That is, Sully is generally the earliest of the sites and also has the lowest percentage of preadult mortality, followed by Mobridge, Larson, the pooled sample from Cheyenne River, Four Bear, and Leavitt. The mortality figure for Leavenworth is somewhat of an anomaly, falling as it does between Sully and Mobridge.

Talking Crow Phase

The DCA of the Talking Crow phase involves 19 components, including one assigned to the Felicia phase. This latter component, Black Partizan A, being included with other Felicia phase villages in the previous analysis of southern Extended Coalescent, serves to link the Talking Crow and Extended Coalescent ordinations.

The results of the DCA are presented in Table 22. The eigenvalues indicate that the first axis accounts for most of the variation in the data matrix. Axes 3 and 4 constitute only 7% of the variation of the four dimensions. A plot of the component and type scores on axes 1 and 2 appears in Figure 20. It is difficult to attach any meaning to the positions of many of the descriptive categories in this figure because ceramic assemblages from Talking Crow villages are dominated by three ceramic types (undecorated straight rims or straight rims with tool- or cord-impressed lips/rim braces). This is particularly true of axis 2, which accounts for little variation and is defined by ceramic types that occur infrequently. One descriptive category that occurs with some frequency, undecorated straight rims, plays a defining role in axis 2. Components with low scores on axis 2, such as Hawk, Oldham, Iron Shooter, and Breeden B, contain relatively high amounts of straight undecorated rims, whereas those with higher scores possess smaller amounts. Axis 2, then, is interpreted to represent variation largely because of the frequency of straight, undecorated rim sherds.

Axis 1 is interpreted as representing a temporal dimension. This is based upon the presence in the analysis of five cultural-temporal units from the Medicine Crow site and one Felicia phase component. Black Partizan A, like all components assigned to the Felicia phase, is thought to span the time period between the fully prehistoric Extended Coalescent in the Big Bend region and the protohistoric Talking Crow phase. This component has a low value on axis 1, indicating that it marks the early end of the Talking Crow temporal sequence. The Felicia-early Talking Crow phase link is established by the presence in moderate quantities of S-shaped rim sherds decorated by incisions and tool impressions (Iona S-rim and Cadotte Collared pottery types). A comparison of the ordering of components in Figure 20 to a previous analysis of Talking Crow phase ceramic variability (Johnson and Toom, 1995, fig. 11.5) indicates a similarity in the two temporal orderings. There also is a spatial component to Axis 1, in which the sites that have low scores are located farthest to the south, whereas those with higher scores tend to be farther upriver. This interpretation means that through time, there was a trend for Talking Crow phase villages to be located farther to the north. This could be part of a larger trend whereby Talking Crow phase villagers moved upriver to contribute to the growth of the Bad River phase (see Smith, 1963:495; 1977:156; Grange, 1981:54).

Five analytical units (Medicine Crow 1–5) are defined for the Talking Crow phase occupations at the Medicine Crow site (C. Johnson et al., 1995). These are interpreted as reflecting an underlying temporal sequence on the basis of site stratigraphy by this author, with Medicine Crow being the earliest and Medicine Crow 5 the latest. These units are placed in their correct order in Figure 20 if those with lower scores on axis 1 are earliest in the sequence. One of the reasons for lack of a clearer separation between some of the Medicine Crow temporal units is that the original intrasite ceramic ordination focused on attributes rather than types (C. Johnson, 1977a, 1977b; C. Johnson et al., 1995).

TABLE 22. Site component and ceramic type scores from the detrended correspondence analysis of Talking Crow phase components.

Component or type	Axis 1	Axis 2	Axis 3	Axis 4
Medicine Crow 5 (39BF2)	0.43	0.25	0.00	0.00
Medicine Crow 4 (39BF2)	0.42	0.32	0.06	0.07
Medicine Crow 3 (39BF2)	0.42	0.27	0.13	0.14
Medicine Crow 2 (39BF2)	0.25	0.34	0.17	0.16
Medicine Crow 1 (39BF2)	0.21	0.43	0.17	0.16
Talking Crow III (39BF3)	0.41	0.32	0.26	0.27
39BF4	0.20	0.35	0.34	0.29
Pretty Bull (39BF12)	0.41	0.41	0.34	0.26
Fire Cloud (39BF237)	0.23	0.58	0.23	0.28
Santarium (39BR6)	0.21	0.44	0.17	0.13
39BR13	0.23	0.40	0.21	0.20
Oldham (39CH7)	0.02	0.15	0.25	0.26
Hitchell (39CH5)	0.00	0.38	0.18	0.12
Iron Shooter (39HU217)	0.31	0.28	0.14	0.17
Amos Shields (39HU220)	0.67	0.31	0.06	0.09
Hawk (39HU238)	0.43	0.00	0.08	0.15
Oacoma (39LM26/27)	0.07	0.30	0.24	0.21
39LM34	0.18	0.37	0.19	0.17
Peterson (39LM215)	0.41	0.26	0.23	0.20
Black Partizan A (39LM218)	0.03	0.55	0.28	0.30
Breeden B (39ST16)	0.55	0.27	0.21	0.21
Fort George Village (39ST17)	0.80	0.30	0.16	0.06
S-shaped Cord Impressed	2.38	2.04	2.64	0.30
S-shaped Horizontal Incised	-0.21	2.21	0.44	0.84
S-shaped Diagonal Incised	-1.53	-0.91	0.56	0.30
S-shaped Herring Bone Incised	-1.33	1.37	0.40	0.30
S-shaped Tool/Finger Impressed	-2.16	-1.04	-0.20	-0.21
S-shaped Undecorated	-1.32	-1.97	-0.45	0.12
Straight Diagonal/Herring Bone Incised	-0.05	-0.32	0.84	0.59
Straight Horizontal Incised	0.53	2.32	1.27	2.61
Straight Cord Impressed Lip	1.99	0.00	-1.31	-1.20
Straight Tool Impressed Lip	0.21	0.46	0.16	0.12
Straight Finger Impressed Lip	1.61	0.58	2.87	2.36
Straight Undecorated	0.61	-1.05	0.74	1.05
Eigenvalues	0.131	0.021	0.008	0.003

Toom (1995:364–365), and Ahler and Toom (1995:377) reached very different conclusions concerning the meaning of ceramic variability within Medicine Crow. They believed that much of the ceramic variation at the site reflected differences related to its occupation by two contemporaneous village or social groups largely corresponding to site areas A (Medicine Crow 3–5) and C (Medicine Crow 1–2). This interpretation is supported by a lack of agreement between the quantity of trade-metal and metal-modified bone tools in the postulated temporal positions of Medicine Crow 1–5 (Bleed et al., 1995:332–342). Although the ultimate sources of ceramic variability within Medicine Crow and the Talking Crow phase can probably not be resolved without additional excavations, this author assumes that much, if not most, of the variation along axis 1 in Figure 20 represents time. Temporally sensitive artifacts from extant SI-RBS collections, such as trade metal and metal-modified bone tools, are considered to be poor indicators of the time during which these villages were occupied, particularly for short periods of time and in sites dating before about AD 1725 (see also Hoffman, 1972:31–32). It is only after this date that relatively rapid increases in the numbers of these artifacts permit their use as adjuncts in dating sites where fine-scale field recovery techniques were used (see Ahler and Dreybred, 1993, figs. 21.2–21.4, 21.14).

Axis 2 in Figure 20 appears to represent another source of variability in the data, perhaps relating to social differences between contemporaneous village groups. If axis 1 is considered to be temporal in nature, then the

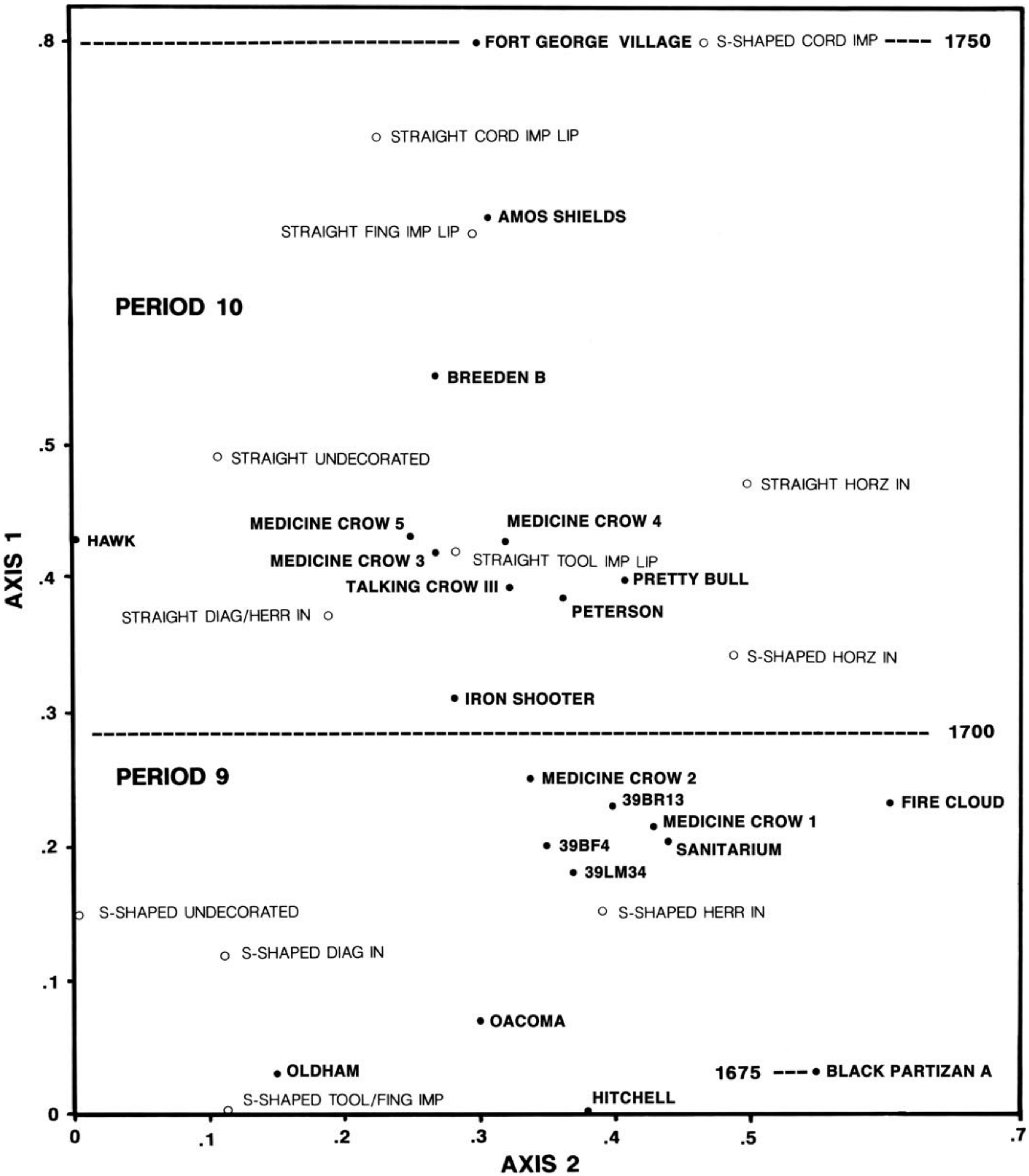

FIGURE 20. Plot of Post-Contact Coalescent Talking Crow phase components and descriptive rim sherd categories on Axis 1 and Axis 2, detrended correspondence analysis ordination.

differences between components along axis 2 are mostly between those villages within the same locality. For example, Hitchell and Oldham are located very near one another along the Missouri River but differ along axis 2. Black Partizan and Oacoma are, of course, farther to the north in Big Bend region. The second group of components, composed of 39LM34, 39BF4, Sanitarium, Fire Cloud, and 39BR13, are located at the southern border of the Big Bend region. The one exception is Medicine Crow, located somewhat to the north. The third group of components (Pretty Bull, Peterson, Hawk, Talking Crow III, Medicine Crow 3–5, and perhaps Iron Shooter) tend to be concentrated farther upriver at the cul-de-sac, or Grand Detour, of the Missouri River. A fourth group is composed of the northernmost villages (Breeden B, Amos Shields, Fort George Village) but is not believed to represent a few closely interacting communities.

An absolute time scale is estimated for the Talking Crow sequence. Black Partizan A is thought to date about AD 1675, based upon its position among the southern Extended Coalescent sites (see Figure 15). Fort George Village is assumed to date the end of the Talking Crow phase at AD 1750. This estimate is close to the AD 1730 date Hoffman (1972:30–32) assigned to the site. Hoffman, among others, assigned Fort George Village to the Bad River phase. In this context, several additional correspondence analyses of the Bad River phase components discussed earlier indicated that Fort George Village is an outlier. The unreported results of these analyses suggest dates ranging from AD 1700 to AD 1750. Interpolating in 50-year segments between the beginning and end dates of AD 1675 and AD 1750 in Figure 20 yields the intervals depicted. This places the major occupation of the Medicine Crow site between AD 1700 and AD 1725, about 25 years earlier than suggested by Toom (1995:364) and before major increases in trade materials begin to enter the subarea.

Hitchell and Oldham represent the earliest major Talking Crow villages in the Fort Randall region, and Oacoma in the lower Big Bend to the north about AD 1675. Given the proximity of the Hitchell and Oldham sites, they probably represent a single village group occupying the same locality either at the same or slightly different times. Oacoma might represent a transitional community relocated to the north. These villagers may have moved upriver to establish their villages at a later date or could have joined some of their Lower Loup relatives living along the tributaries of the Platte River in east-central Nebraska. Contemporary Pawnee villages occupied by the Skidi band include Burkett, Wright, Phil Cuba, Larson, Monroe, and Gray/Wolfe/Schuyler (see O'Shea, 1989, table 2). At a somewhat later date, a group of villages in the lower Big Bend region, including Sanitarium, 39BF4, 39BR13, and 39LM34, were occupied. These also probably represent one or perhaps two village groups occupying the same locality at any given time. They may be the descendants of the various Felicia phase villagers or perhaps derived from the Oldham, Hitchell, or Oacoma sites. The Medicine Crow site was first occupied somewhat farther to the north at this time. Communities in the middle of the Talking Crow sequence (AD 1700–1725) include Medicine Crow, Talking Crow, Peterson, Pretty Bull, Hawk, and Iron Shooter. The northernmost sites (Amos Shields, Fort George Village, Breeden B) represent the end of the Talking Crow phase. Fort George Village may represent the remnants of a number of Talking Crow phase groups who decided to consolidate and fortify their community against incursions by such nomadic groups as the Dakota. Earlier fortified Talking Crow villages include Iron Shooter and possibly Oldham (Smithsonian Institution, 1954:77, 1956, pl. 1). It should be apparent to the knowledgeable reader that the temporal sequence developed in this study has a strong spatial component because components that are latest in the proposed chronology also tend to be farther upriver. This conclusion supports the general upriver movement of the Arikara as suggested by Wedel (1955:77–81), Hoffman (1972:24), Smith (1977:56), and Grange (1981:54).

The fortified villages represent a departure from the unfortified and rambling nature of other Talking Crow communities. The fortifications were probably constructed in response to Dakota incursions from the east in the first half of the eighteenth century (see Holder, 1951:97–102, 1970:97–105). The upstream villages of Breeden, Iron Shooter, Amos Shields, and Fort George Village also may represent refugees from the more southeastern communities (see Brown, 1974:53). It is likely that Fort George Village was absorbed into the late Bad River phase community of Chapelle Creek, as the analysis of microstylistic ceramic variation indicates (see below). Late Bad River phase communities, such as Buffalo Pasture, may have in turn, absorbed Breeden.

Lehmer (1965:K121, 1971:202) suggested that the protohistoric Arikara and Pawnee occupied Talking Crow phase villages. Although most appear to have been occupied by the ancestral Arikara, some sites, such as Oacoma, are linked to the Lower Loup focus or phase on the basis of ceramic similarities (Kivett, 1958:136–137; Lehmer, 1971:202). Blakeslee (1994:17) speculated that the Skiri band of Pawnee occupied Oacoma sometime between AD 1722 and AD 1750. Its position in Figure 20 suggests an earlier date of about AD 1675. The Lower Loup phase represents the protohistoric Pawnee of Nebraska. On the basis of this analysis, the Oldham and Hitchell sites also might be included in the Lower Loup phase. Their location near the northern border of Nebraska seems to lend credence to this proposition, although more detailed comparative studies of these sites and other Lower Loup villages in Nebraska need to be done. Close interactions between these southern Talking Crow villagers and their Lower Loup counterparts in Nebraska also might account for the perceived, but never quantified, similarities in material culture. There also is some evidence to suggest that the Omaha and Ponca were living at the mouth of the White River in South Dakota during the Post-Contact period (Wood, 1965:128). Although there are no known post-contact sites there, there are Talking Crow phase sites nearby. The Post-Contact period was a time of great restlessness, with villagers moving relatively great distances in many directions (see Wedel, 1955:77–84; Wood, 1955). Nonetheless, the hypothesis that some of the southernmost early Talking Crow villagers joined the protohistoric Pawnee in Nebraska cannot be ruled out at this time. Some Arikara, possibly from Bad River phase villages, also lived among the Ponca in northeastern Nebraska (Jantz, 1974). Relationships between the Arikara and Pawnee are apparent in the lithic assemblages from the Oldham site, which contains stone materials from Nebraska (C. Johnson, 1984b:299–300).

It is instructive to examine the distribution of Euro-american metal-trade artifacts and metal-modified bone tools among the Talking Crow phase components. Figure 21 plots three types of bone tools either modified by or for hafting metal artifacts (trimmed scapula hoes, bone knife handles) or thought to directly replaced by metal equivalents (bone awls). The data that forms the basis of Figure 21 are presented in Table 20 (see Le Beau phase). Figure 21 indicates that there are no clear trends in the data. Trimmed scapula hoes should increase through time if the use of metal tools to modify these artifacts conforms to expectations. There is an increase at the end of the sequence that is particularly pronounced at Fort George Village. Metal artifacts exhibit a rather uneven trend, peaking at Medicine Crow 2 and leveling off for a time, then increasing slightly at the end of the sequence. Bone knife handles, made to accommodate metal blades, remain constant except during a period of increase at Medicine Crow 3. Bone awls, probably replaced by metal equivalents through time, decrease through time only to peak at the terminal Fort George Village.

There are several possible explanations for these inconsistent patterns. First, the chronology developed for the Talking Crow phase is incorrect. Second, expectations about the effects of Euro-American metal tools on Native American technologies is incorrect, at least for the Talking Crow phase. Third, there is a field-sampling bias that results in the gross underrepresentation of small metal items in the collections and that this bias is not consistent from site to site. Fourth, there is so little time depth among most of the Talking Crow components, approximately 50 years, that any changes in native technologies is not apparent. All Talking Crow sites were occupied before the major influx of trade artifacts began about AD 1725. This author favors the latter three explanations, although this issue will probably never be resolved with data from extant collections.

Billeck (2000) based his chronology of 26 protohistoric and historic sites upon Euro-American trade beads. His chronology assigned dates to three Talking Crow phase sites, Oacoma (AD 1675–1700), Breeden (AD 1660/1665–1710/1715), and Ft. George (AD 1675–1700). The date for Oacoma corresponds to its chronological position assigned in this study; however, Breeden has a ceramic date of about AD 1725, whereas Ft. George is placed at AD 1750. This trend reverses that found in the Le Beau and Bad River phase sites, where there was a tendency for sites dated by pottery to be earlier than those dated by trade beads.

Craniometric Distance

A small sample of Talking Crow phase crania from the Talking Crow and Oacoma sites was included in Key's (1983, figs. 21–23) study of Plains Indian craniometrics. His analysis suggested affinities to the Bad River 1 (Indian Creek, Dodd, Black Widow Ridge), Historic Arikara (Fort Clark, Leavenworth), Bad River 2 (Cheyenne River, Leavitt, Buffalo Pasture, Stony Point), and Historic Pawnee (Genoa, Linwood A, Hill/Pike, Palmer, Woodcliff burial). Although Key's findings are not useful in evaluating the relationships between Talking Crow phase sites, they do suggest strong affinities to other protohistoric Arikara and Pawnee populations.

POST-CONTACT MICROSTYLISTIC VARIATION

Another way to evaluate the ceramic relationships between the Post-Contact period sites is through an analysis of microstylistic variability of one particular descriptive category, e.g., straight rim sherds decorated with cord impressions on their lips or rim braces. This category includes the types Stanley Cord Impressed, Talking Crow

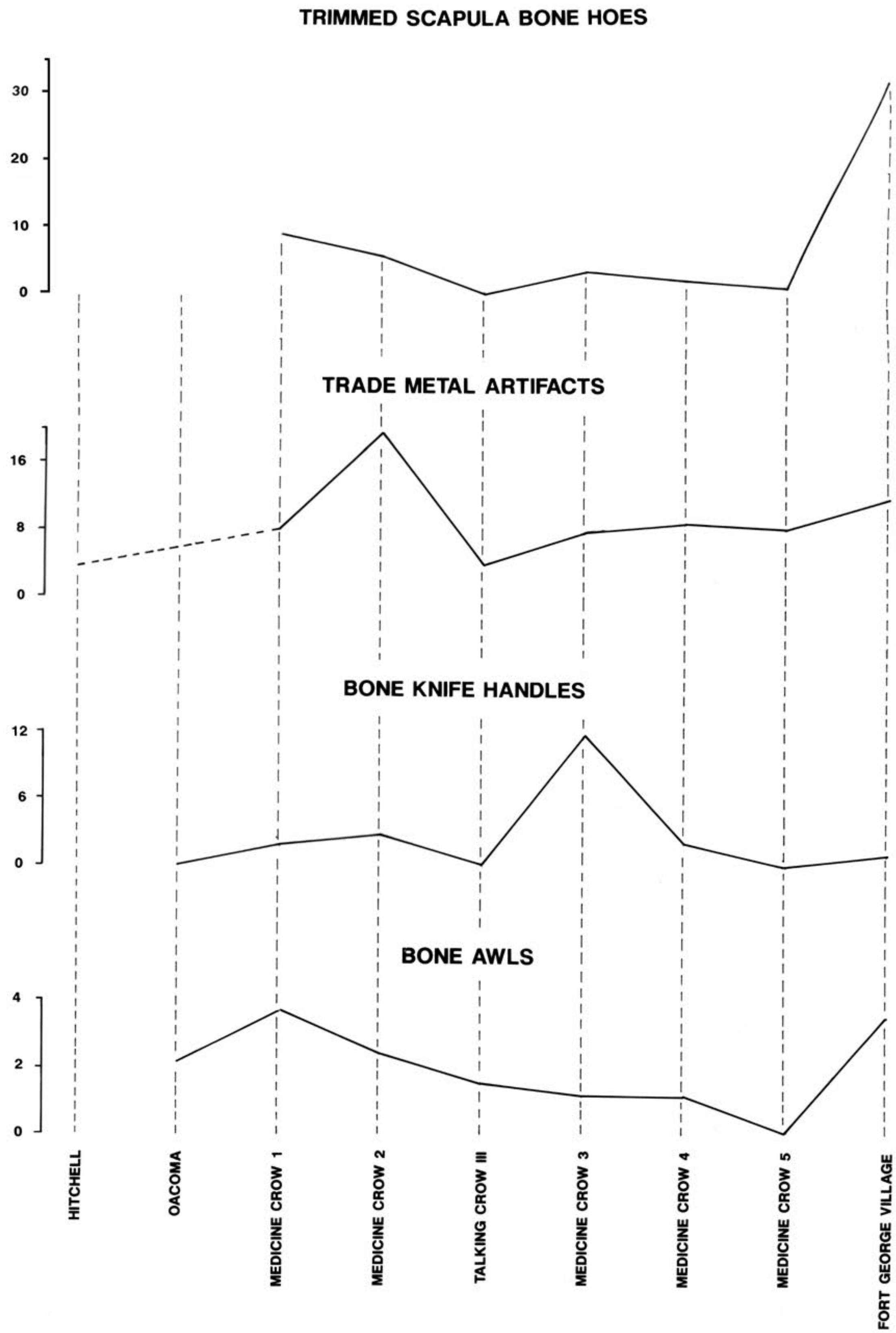

FIGURE 21. Plot of the relative amounts of metal modified bison scapula hoes, bone knife handles, bone awls, and trade metal artifacts, Post-Contact Coalescent Talking Crow phase.

Cord Impressed, Le Beau Cord Impressed: Variety A, Steamboat Cord Wrapped Rod, and Knife River Cord Impressed (Appendix B). These types are decorated with a wide variety of motifs. This analysis is viewed as an alternative and complement to the previous three DCA of Le Beau, Bad River, and Talking Crow components employing ceramic types. It focuses on the motifs, patterns, or orientations of cord impressions at the area around the lip on straight or braced rim types. This consideration of microstylistics includes five components not used in previous analyses: Deapolis, Amahami, Rock Village, Nightwalker's Butte, and Biesterfedlt. Lehmer et al. (1978) reported data from the four former sites, whereas information from Biesterfeldt appeared in Wood (1971, tables 1, 2). This author, during the tabulation of typological information, collected data from the remaining sites. The inspiration for this analysis came from the data presented in Hoffman (1970b, table 1), Wood (1971, tables 1, 2), and Lehmer et al. (1978, table 9.1). The data matrix used for the present study appears in Appendix A (Table A.6) and consists of 16 motifs on the lip or rim brace, and the rim interior among 31 sites. Intrasite and phase-level divisions are not maintained in this analysis.

Like previous DCA employed in this study, four axes were extracted from the data matrix (Table 23). Axis 1 accounts for almost 76% of the variation of the four axes, whereas axis 2 consists of 15%. The eigenvalues of axes 3 and 4 exhibit a dramatic decrease, indicating that a two axis solution to the data matrix is appropriate. A plot of component and rescaled ceramic motif scores appears in Figure 22. The values of the plotted data appear in Table 23. The axes in this figure have not been rescaled to reflect the differential values of the eigenvalues. The positions of three of the most commonly occurring motifs and three less frequent ones are used to help interpret this figure. Axis 1 defines variation along the three most popular motifs. At the low end of this scale are sites with a series of parallel horizontal lines on the lip or rim brace and an undecorated rim interior (Table A.6). This is by far the most commonly occurring motif. Villages with moderate scores on axis 1 usually contain the highest numbers of rim sherds with right diagonals on their lip or rim braces (i.e., cord impressions starting from the lower left and oriented to the upper right as viewed from the rim exterior) and undecorated on their rim interiors. Villages with relatively scores high on axis 1 and low on axis 2 contain relatively large numbers of rim sherds with left diagonals on their lips or rim braces (i.e., cord impressions starting from the lower right and moving to the upper left) and undecorated rim interiors.

Axis 2 contrasts the three most popular motifs, all with low scores, to three minor motifs that have relatively high values on this axis. Sites with relatively high numbers of rim sherds with parallel horizontal cord impressions on their lips or rim braces, and diagonal or vertical impressions on their interiors (as viewed from the rim interior) have high scores on axis 2. These motifs also vary along axis 1. The third motif, characterized by rim sherds with impressions oriented at a right angle to the lip or rim brace axis and undecorated rim interiors, also has relatively high scores on axis 2. Villages with relatively large numbers of these rim sherds also have high scores on axis 1.

It also is instructive to examine the placement of individual components in Figure 22 as they relate to taxonomic divisions and previous ordinations presented in this study. All of the late villages from the Knife and Garrison regions in North Dakota (Rock Village, Deapolis, Nightwalker's Butte, Amahami, Greenshield) have scores high on axis 1 and low on axis 2. Leavenworth also has a high value on axis 1 and a moderate score on axis 2. It is aligned with Bad River phase sites near the confluence of the Missouri and Cheyenne Rivers, suggesting it drew its people from these sites and not the Le Beau phase communities to the north. Leavenworth's ceramic affinity to some of the North Dakota sites also may reflect interaction with the Mandan in the Knife region when the Arikara occupied the Greenshield site. It is possible that the Le Beau phase Arikara suffered a major population decline about 30 years before their more southerly Bad River phase kinsmen. This might account for the under-representation of classic Le Beau phase cord-impressed motifs in the Leavenworth ceramic assemblage.

It also is interesting to note that the Leavenworth ceramic assemblage is very heterogeneous (Table A.6), probably reflecting its status as a composite village of a number of Arikara bands or village groups (see Hoffman, 1977:24; Chomko, 1986:78; Byrd and Jantz, 1994:206). Parks (1979a, 2001) discussed the complexity of Arikara social diversity that is not always apparent in the archeological record. From his own ethnographic work and others before him, he listed from seven to 12 bands or villages of Arikara. Unfortunately, only two bands are linked with any specificity to archeological sites. One is the village of Lahoo-catt, recorded by Lewis and Clark in 1804 as being deserted for five years (Chomko, 1986:78). The other is the village near the modern town of Fort Pierre, visited by the La Verendrys in 1743.

At the opposite end of Figure 22 from the Bad River phase sites are two late Le Beau phase villages from the Grand River locality, Red Horse Hawk and Nordvold I,

TABLE 23. Site component and ceramic type scores from the detrended correspondence analysis of Post-Contact period cord impressed motifs. (LL–UR=Cord impressions oriented from the lower left to upper right. LR–UL=Cord impressions oriented from the lower right to upper left.)

Component or type	Axis 1	Axis 2	Axis 3	Axis 4
Deapolis (32ME5)	1.33	0.28	0.77	0.26
Amahami (32ME8)	1.59	0.71	0.75	0.51
Rock Village (32ME15)	1.46	0.00	0.97	0.00
Nightwalker's Butte (32ML39)	1.42	0.62	0.60	0.20
Greenshield (32OL17)	1.26	0.71	0.45	0.12
Biesterfeldt (32RM1)	0.55	0.89	0.79	0.68
Medicine Crow (39BF2)	0.20	0.96	0.36	0.87
Anton Rygh (39CA4)	0.08	1.15	0.08	1.05
Leavenworth Late (39CO9)	1.89	1.01	0.49	0.68
Nordvold I (39CO31)	0.47	1.76	1.08	0.61
Red Horse Hawk (39CO34)	0.09	1.94	0.87	0.73
Oahe Village (39HU2)	0.21	0.83	0.32	0.86
Mush Creek (39HU5)	0.12	1.12	0.00	1.02
Pierre School (39HU10)	0.08	0.90	0.28	0.89
Chapelle Creek A (39HU60)	0.28	1.10	0.76	0.59
Steamboat Creek (39PO1)	0.53	1.12	0.05	1.02
Rosa A (39PO3)	0.56	1.32	0.16	1.20
Coleman (39SL3)	0.64	1.02	0.56	0.80
Sully (39SL4)	0.42	0.93	0.36	0.89
Cheyenne River Late (39ST1)	1.31	1.24	0.35	1.30
Black Widow Late (39ST3)	1.43	1.00	0.63	0.97
Buffalo Pasture (39ST6)	0.59	0.98	0.75	0.73
H. P. Thomas 3 (39ST12)	1.35	1.13	0.61	1.16
Phillips Ranch (39ST14)	0.32	1.28	0.59	0.85
Fort George Village (39ST17)	0.10	1.08	0.06	1.01
39ST25	1.12	1.01	0.49	0.73
Dodd A (39ST30)	0.13	1.33	0.80	0.67
39ST50	1.22	1.14	0.83	1.07
Black Widow Ridge Late (39ST203)	0.97	0.80	0.85	0.78
Mobridge (39WW1)	0.00	1.22	0.43	0.96
Larson (39WW2)	0.00	1.33	0.39	0.89
Horizontal Exterior/Undecorated Interior	–0.12	1.02	0.12	1.04
Horizontal Exterior/LL–UR Interior	–0.23	2.87	2.23	0.04
Horizontal Exterior/Horizontal Interior	1.12	2.01	–1.81	1.78
Vertical Exterior/Undecorated Interior	2.12	1.69	0.30	2.34
Vertical Exterior/Horizontal Interior	2.63	2.12	0.15	2.87
LL–UR Exterior/Undecorated Interior	1.05	0.55	1.21	0.19
LL–UR Exterior/LL–UR Interior	0.28	3.13	2.14	1.10
LL–UR Exterior/Horizontal Interior	2.66	1.97	0.82	1.26
LR–UL Exterior/Undecorated Interior	1.61	–0.33	1.12	–0.09
LR–UL Exterior/LL–UR Interior	2.28	2.14	0.50	2.07
LR–UL Exterior/Horizontal Interior	2.98	0.78	0.12	–1.62
Undecorated Exterior/LL–UR Interior	0.61	2.31	–0.53	1.47
Undecorated Exterior/Horizontal Interior	1.00	1.94	–0.67	1.02
Chevron Exterior/Undecorated Interior	2.41	2.00	0.29	2.07
Vertical-Horizontal Exterior/Undecorated Interior	1.45	2.36	0.02	3.42
LL–UR, Horizontal Exterior/Undecorated Interior	0.75	1.69	3.08	1.42
Eigenvalues	0.444	0.086	0.035	0.020

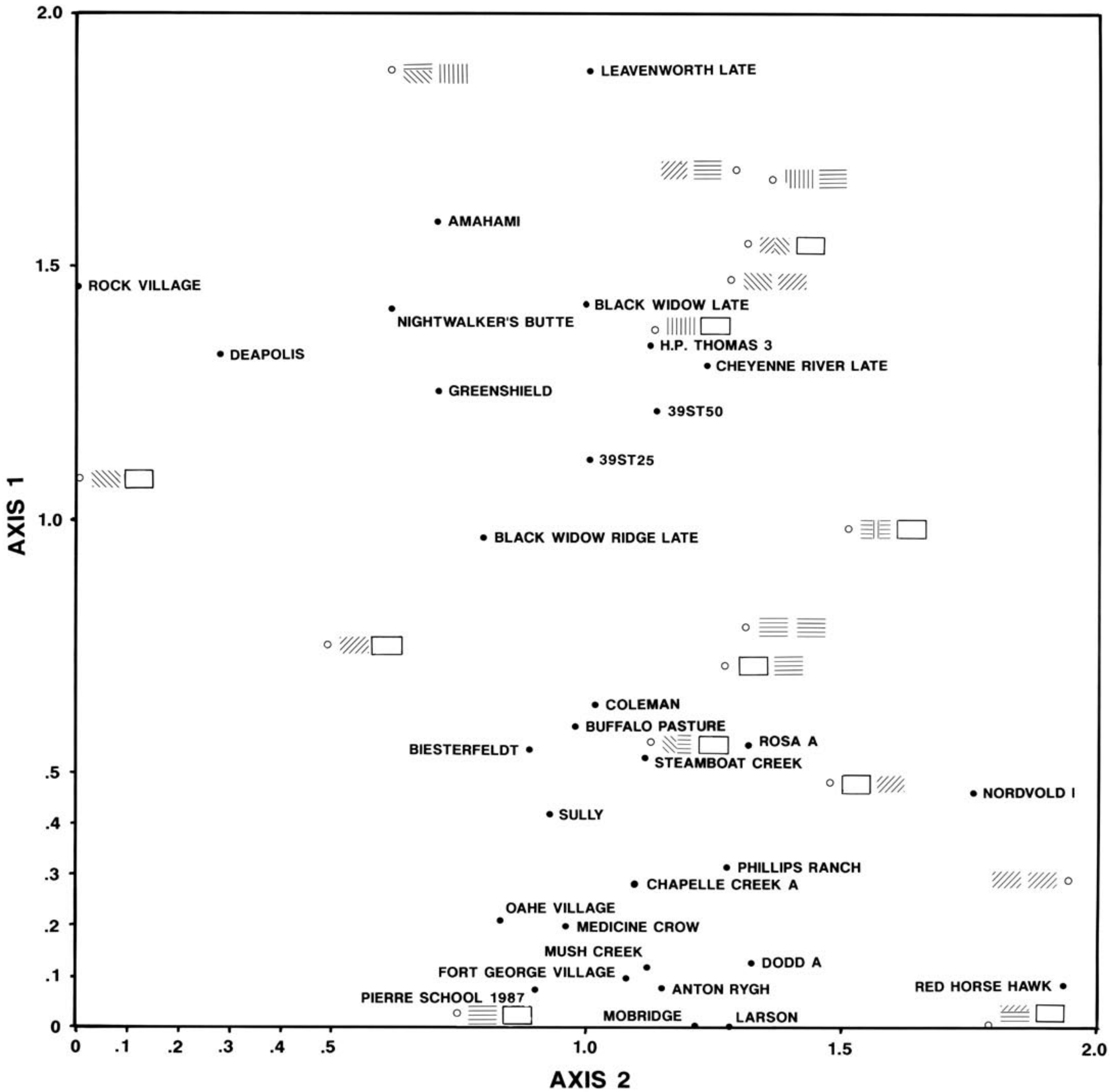

FIGURE 22. Plot of Post-Contact Coalescent components and rim sherd cord impressed motifs on Axis 1 and Axis 2, detrended correspondence analysis ordination. Each motif consists of two parts, a rim exterior (left) and a rim interior (right).

possibly representing sites occupied by the same band or village group at different times. Six Bad River villages represent a third group of components, all located on the west bank of the Missouri River near its confluence with the Cheyenne (Black Widow Ridge, Black Widow, Cheyenne River, H. P. Thomas, 39ST25, 39ST50). These may be the remains of several bands that occupied the locality for approximately 100 years. The positions of components in Figures 19 and 22 indicate that these groups include Black Widow Ridge, Black Widow, and 39ST25 on the one hand,

and Cheyenne River and 39ST50 on the other. The status of H. P. Thomas is unknown, although it may represent a consolidation of several bands given its village plan consisting of two adjacent and separate groups of houses.

About half of the components included in this analysis consist of a group with low scores on axis 1 and moderate scores on axis 2. On closer examination, it is possible to make a division in this group. One group corresponds to three Bad River communities at the southern reaches of the Bad-Cheyenne region near the present-day Oahe Dam (Dodd A, Phillips Ranch, Buffalo Pasture) and two up- and downriver sites (Coleman, Chapelle Creek). The former three villages may represent a single band or village group who occupied the area through time (see Figure 19), whereas Chapelle Creek appears to be related to Fort George Village. The latter site probably represents remnants of the last Talking Crow phase communities. Fort George is paired with Medicine Crow on the basis of microstylistics, supporting the interpretation that the former village is related to the Talking Crow and not the Bad River phase communities. Both Fort George Village and Medicine Crow date to about AD 1750. Most of the Le Beau phase villages in Figure 22, although closely related to some Bad River communities, are segregated from most of them. Most of the southern Le Beau sites (Pierre School-1987, Oahe Village, Sully, Steamboat Creek, Rosa A) tend to higher scores on axis 1 and lower ones on axis 2 compared with their northern counterparts (Larson, Mobridge, Anton Rygh). The position of Biesterfedlt, interpreted to be a protohistoric Cheyenne village (Wood, 1971), has its closest affinities to several Bad River phase sites (Buffalo Pasture, Coleman) and one Le Beau community (Sully) in the Bad-Cheyenne region.

DATING THE PLAINS VILLAGE PATTERN VARIANTS

It is useful to summarize the results of the radiocarbon dating portion of this study by determining the temporal span of the six major taxonomic units (i.e., variants) and compare these dates with those from previous chronologies. Table 24 compares the chronology developed in this study with those of Lehmer (1971, table 2), Ahler (1993b), and Toom (1996, table 8). The temporal ranges from the present study are from a visual inspection of Figures 6, 9, and 12. Only sites located within the restricted limits of the Middle Missouri subarea (i.e. on the Missouri River) as defined by Lehmer (1971, fig. 21) are included for comparative purposes.

The range for the Initial variant of the Middle Missouri tradition is derived from Figure 6 of this study by restricting it to the concentration of dates and eliminating two outliers (Swanson H2 Post D and Over's La Roche C) and considering only the calibration curve intercept of Cattle Oiler rather than its full range. Over's La Roche C is based upon a single date, whereas the earliest date from Swanson has a range 100 years earlier than the nearest two dates from Pretty Head and Sommers. Likewise, the range for the Extended Middle Missouri eliminated some of the date ranges for Travis I (two averaged dates), Bendish (one date), and Fire Heart Creek (one date) (Figure 9). At the late end of the Extended sequence, the calibration curve intercepts for four of the latest sites (Black Widow Ridge, Vanderbilt Village, Havens, and Helb) were taken as an approximate end date for the variant. If the full range of these dates are considered, the variant may extend up to AD 1425. The single date from the Zimmerman site is

TABLE 24. Comparison of Middle Missouri subarea Plains Village chronologies (years AD).*

Tradition	Variant	Lehmer (1971)	Ahler (1993b)	Toom (1996)	Johnson (this study)
Middle Missouri	Initial	900–1400	—	1000–1300	1000–1300
	Extended	1100–1500	1000–1400	1100–1500	1200–1400
	Terminal	1500–1675	1300–1500	1500–1650	1400–1500
Coalescent	Initial	1400–1500	—	1300–1500	1300–1500
	Extended	1550–1675	—	1500–1650	1400/1450–1650
	Post-Contact	1675–1862	1600–1886	1650–1886	1650–1886

* Ahler's chronology does not address the Initial Middle Missouri, Initial Coalescent, and the Extended Coalescent because it is based mostly on North Dakota sites and does not use Lehmer's taxonomy. The date range for the Extended Middle Missouri correlates with his Fort Yates, Clark's Creek, and Nailati phases. The Terminal Middle Missouri correlates with his Huff phase. The Post-Contact Coalescent correlates with his Knife River complex.

considered to be an outlier and is eliminated from further consideration.

Only two sites from the Terminal Middle Missouri (Huff and Shermer) are dated (Figure 9). The problems interpreting the dates from Shermer are discussed earlier in this chapter. The Huff series is clearly the more reliable of the two at this time. A start date of AD 1400 is given for the Terminal variant because it is not completely clear where Shermer dates. The range of AD 1400 to AD 1500 may be the most acceptable because the ceramic assemblage from Shermer places it somewhat earlier than Huff (S. Ahler, pers. comm., 1997), but probably not as many as 100 years. In addition, the relatively small number of Terminal sites at eight (Lehmer, 1971, fig. 79 minus the now-recognized Extended Middle Missouri sites of Tony Glas, Jake White Bull, and Helb) may not support a temporal span of more than 100 years for the variant. Furthermore, if the Terminal variant developed out of the Extended variant, then a beginning date of AD 1400 for the former is most likely.

Dating the Initial variant of the Coalescent tradition is problematical considering the relative small number of sites along the Missouri River (those in Lehmer, 1971, fig. 76, plus 39HU61, 39HU207, 39HU229, 39HU242), only three of which are dated (Figure 12). The dates from Crow Creek and Whistling Elk place the earliest Initial sites at AD 1300 to AD 1400. Unfortunately, the latest part of the Initial variant is dated only by Arzberger, which has a large date range of 200 years. It is assumed that the end of the Initial Coalescent is at about AD 1500, somewhat later than the calibration curve intercepts of its three averaged dates. Given the relatively small number of sites assigned to this variant (14), a span much larger than 200 years may not be supported. This is particularly true because the succeeding Extended Coalescent only lasts for approximately 200 years but is characterized by many more, but smaller, sites.

Dating the Extended Coalescent also is somewhat problematic given the fact that the calibration curve is not as straight as it is in earlier periods. This causes multiple curve crossover points, when dates are calibrated (Figure 12). The date ranges of most Extended sites begin at about AD 1450 and running until about AD 1650, a 200-year span that is clearly not particularly useful for dating any particular site. Taken together, however, they provide a reasonable range of AD 1450 to AD 1650. The only except to this generalization is the Demery site, which has a reasonably tight range of AD 1400 to AD 1450 based upon three averaged dates. To take this uncertainty into consideration, a starting date of AD 1400/1450 for the variant is accepted at this time.

Referring to Figure 24, it is apparent that the range of AD 900 to AD 1400 for the Initial Middle Missouri is now narrowed to AD 1000 to AD 1300 by eliminating 100 years on either end of Lehmer's chronology. This range agrees with Toom's chronology but is somewhat different than the AD 969 to AD 1297 (PR 68) range of Eighmy and LaBelle (1996, table 2) or the AD 950 to AD 1350 range of Winham and Lueck (1994, table 7.3). It is close to the AD 1030 to AD 1298 range of Ahler, Johnson et al. (1995, table 5). Similarly, the Extended variant of the Middle Missouri tradition has been narrowed by 100 years on either end of the ranges of Lehmer and Toom (AD 1100–1500) and by 200 years at the early end of Ahler's chronology (AD 1000–1400). The range of AD 1200 to AD 1400 accepted in the current study is almost 175 years less than the AD 1075 to AD 1443 (PR 68) range of Eighmy and LaBelle (1996, table 2) and a full 300 years narrower than the range of AD 1000 to AD 1500 of Winham and Lueck (1994, table 7.4). Ahler, Johnson et al. (1995, table 5) date the variant at AD 1217 to AD 1404. Regardless of whether the start of the Terminal Middle Missouri is placed at about AD 1300 or AD 1400, it is clear that the variant starts and ends much sooner than the AD 1500 to AD 1675 date originally proposed by Lehmer (and accepted by Winham and Lueck, 1994, table 7.6). Lehmer's time span for the variant is now filled in by the Heart River complex or phase dated at AD 1450/1500 to AD 1780 (Ahler, 1993b:69), a much longer-lived taxonomic unit, particularly in the Heart region. Clearly, Lehmer was not aware of the great time depth of these Heart River Mandan villages.

The chronology of the Coalescent tradition also has undergone some dramatic changes. Most archaeologists now accept the Initial Coalescent as beginning at AD 1300 and ending about AD 1500 (Winham and Lueck, 1994, table 7.5; Toom, 1996), 100 years earlier than Lehmer's start date. Ahler, Johnson et al. (1995, table 5) dated the variant at AD 1302 to AD 1598, extending the terminal date beyond other schemes by 50 to 100 years. In the present study, the Extended variant (AD 1400/1450–1650) begins 100 to 150 years earlier than Lehmer's chronology (AD 1550–1675) and ends 25 years earlier, but is close to the AD 1415 to AD 1640 date of Ahler, Johnson et al. (1995b, table 5). There is less of a contrast with Toom's dates (AD 1500–1650), but a substantial one with Winham and Lueck's (1994, table 7.5) chronology of AD 1550 to AD 1675. The time span of the post-contact variant of the Coalescent tradition (AD 1650–1886) is lengthened about 25 years on either end of Lehmer's range of AD 1675 to AD 1862.

Given the revised chronology developed in this study, it is instructive to briefly examine what this means to the interpretation of Plains Village culture change and dynamics in the Middle Missouri subarea. Lehmer (1971:97–100) viewed the Middle Missouri tradition as beginning at different locations along the Missouri River, each represented by a different variant, the Initial in the south and the Extended in the north. The large overlap in dates indicates a nondevelopmental sequence from the Initial to the Extended Middle Missouri. The current chronology of each variant indicates that there is only about 100 years of overlap between the two and that the Initial Middle Missouri preceded the Extended by 200 years. This occurred not only in south central South Dakota (Big Bend and Bad-Cheyenne regions) but also in the north in the Cannonball region, as represented by Initial variant site of Jones Village (39CA3). The Plains Village pattern in the north, from the Cannonball region and upriver, very likely developed by the spread of horticulture from the large and probably influential Jones Village site to local Late Woodland groups possessing typical Plains Village traits, such as earth lodges surrounded by fortifications (C. Johnson, 2007). The Menoken site is one of these incipient Plains Village sites that lacked horticulture. With the addition of horticulture and continuing contact with peoples from Jones Village, these Late Woodland groups developed into the Extended Middle Missouri at the beginning of the thirteenth century. The people of Jones Village may have directly contributed to the developing Extended variant by abandoning their village and adopting a lifestyle typical of the Extended Middle Missouri. This interpretation of a local Late Woodland origin for the Extended Middle Missouri is at odds with the traditionally accepted view that Extended Middle Missouri peoples migrated to the north part of the Middle Missouri subarea from the southeast, carrying with them a full-blown Plains Village way of life (see Lehmer, 1971:100). If this is true, the Extended Middle Missouri is a direct development out of the Initial Middle Missouri. The evidence seems to support the hypothesis that the Terminal variant of the Middle Missouri tradition developed out of the Extended variant (Lehmer, 1971:24), although the fourteenth century dates from Shermer suggest that the two were partially contemporaneous.

The chronology of the Coalescent tradition indicates that the Initial and Extended variants were contemporaneous for 50 to 100 years. There is little evidence to indicate that the Extended Coalescent did not develop directly out of the Initial variant; however, it was far from a simple situation of replacement, as they appear to have coexisted for some time. There also is evidence to indicate that the conflict centered in the Big Bend region was not between the Initial and Extended variant villagers, as Lehmer suggested (1971:99–105), but between Initial Coalescent and Initial Middle Missouri peoples during a very short time at the turn of the fourteenth century. This evidence comes from the near total absence of Extended Middle Missouri sites in the region and the replacement of Initial Middle Missouri villagers with immigrants from the Central Plains (i.e., Initial Coalescent). Although there may be up to 100 years of temporal overlap between the Terminal Middle Missouri and Extended Coalescent variants in the Cannonball region in the fifteenth century, most of the latter sites are later in time making conflict between the two highly unlikely, contrary to what Lehmer (1971:127) believed. The reassignment of the three southernmost Terminal sites (Helb, Jake White Bull, and Tony Glas) to the earlier Extended Middle Missouri also means that the distance between the closest Extended Coalescent (Demery) and Terminal Middle Missouri (North Cannonball) sites is about 35 miles [56 km], also making a conflict situation unlikely.

7

Settlement History

The occupational history of the Middle Missouri subarea is reconstructed herein. The history covers a series of 13 time periods, ranging from AD 1000 to AD 1886, mainly in 50- and 100-year increments. This culture history of the Mandan, Hidatsa, and Arikara, and their prehistoric and protohistoric ancestors, focuses on individual sites placed within these somewhat arbitrary time periods. The rationale is to depict those portions of the Missouri River that the Plains villagers occupied and how the numbers and locations of their villages changed through time. This approach differs from past attempts in its specificity of time periods and the large number of sites assigned to these intervals. It should be noted that this occupational reconstruction is simply that—a hypothetical construct of the history of the Plains villagers along the Missouri River in the Dakotas. Villages assigned to any particular time period may change with future research, as can the periods themselves. Other investigators may, upon an examination of the data presented in this study, come to different conclusions about the temporal positions of these villages and the interactions between them. The information that forms the basis of this culture history is derived from chapter 6 and Ahler's (1993b) cultural taxonomy for the Knife, Heart, and Garrison regions in North Dakota.

The emphasis of this study is on developing a cultural sequence largely organized in 50- and 100-year time blocks for sites in South Dakota; the periods cross-cut those established by Ahler (1993b), except for the last three. This is justified because the focus of the present study is on sites in other regions. The emphasis of this study also is on Plains Village settlements located on the Missouri River, although off-river developments in other Plains subareas also are considered. This settlement history is based upon much less precise data compared with that of the Knife region. Lacking additional information and the need to formulate periods of equal duration for the purposes of tracing changes in village numbers, the use of arbitrary time intervals is fully justified. Limiting the time periods to 50- and 100-year intervals also facilitates comparison of site distributions through time.

When considering the following reconstruction, it should be kept in mind that many components could not be employed for lack of suitable data or simply because they were not excavated. Based upon the number of sites listed in

Lehmer (1971, figs. 38, 39, 76, 77, 79, 82, 111), the percentage of sites used in this analysis ranges from lows of 31% and 41% for the Initial and Extended variants of the Coalescent tradition, to 57%, 63%, and 90% for the Initial Middle Missouri, Extended Middle Missouri, and Post-Contact Coalescent, respectively. The percentage of Initial Coalescent components is based upon an expanded list of sites added by a recent shoreline survey in the Big Bend region (Falk, editor, 1983). These figures do not include a small number of components included within the ceramic ordinations but later excluded from temporal assignment because of a lack of supporting information. In addition, the components used in the research do not constitute a random sample of each variant or phase, although it is difficult to point to any systematic bias that would select proportionately more components from one period rather than another. Finally, levels of confidence are assigned to each region, variant, or phase chronology presented in chapter 6, depending on the number and consistency of chronological indicators for any region, phase, or variant. From highest to lowest confidence levels these are the Knife region, Le Beau phase, Bad River phase, Extended Coalescent variant, Initial Coalescent variant, Talking Crow phase, Initial Middle Missouri variant, Extended/Terminal Middle Missouri variants, and Great Oasis phase.

Period 1 (AD 1000–1100)

The first villages to be occupied along the Missouri River occurred at six localities (Figure 23). A number of additional areas in southeastern South Dakota, northwestern Iowa, and southwestern Minnesota were also the sites of Initial Middle Missouri settlements. The success of the Initial Middle Missouri peoples in establishing villages across a broad expanse of the Middle Missouri and Northeastern Plains subareas is usually attributed to the relatively warm and moist conditions of the Neo-Atlantic climatic episode. These conditions are thought to have promoted the expansion of maize horticulture from the Eastern Woodlands out onto the Plains. These and other transformations were widespread, occurring throughout the northeastern Woodlands and Plains (Gibbon, 1993:182). At the present time, the origins of the Initial Middle Missouri are unclear. The location of sites in Figure 23 suggests that it occurred simultaneously in a number of localities. This does not mean that the villages depicted in this figure arose from indigenous sources. It simply suggests that they are the first locations of these settlements.

There are two models to account for the Initial Middle Missouri villages along the Missouri River (see chapter 6). One model suggests that these peoples arose from indigenous Woodland groups, whereas the other model contends that they migrated from Initial variant settlements in Northeastern Plains (see chapter 6). The available radiocarbon dates cannot be used to resolve this issue because a number of sites in both the Middle Missouri and Northeastern Plains subareas date to the beginning of Period 1. The migration hypothesis seems to account for the appearance of the Initial Middle Missouri villages, particularly when viewed in light of the absence of any suitable Late Woodland precursors within the Big Bend region. It does not appear to be substantiated in several areas, however. First, at least one site in the Lower James region (Mitchell) dates somewhat later in Period 1 than the earliest Missouri River villages (Swanson, Sommers). This appears to at least partially negate Toom's (1992b) idea of a migration from east to west with stops at intermediate locations, such as on the James River. Second, the ceramic assemblage from the Sommers site appears to have a Late Woodland origin, as evident in its high numbers of cord-impressed rim sherds. Cord-impressed decoration is a very minor component in the eastern Initial Middle Missouri villages, except for the Brandon site. It appears that sites such as Sommers, Dodd (Anderson component), Langdeau, Cattle Oiler, Brandon, and Breeden may have developed out of an amalgamation of Woodland peoples from the Northern Plains who had a tradition of cord impressing their pots. Perhaps the most likely origin of this is in the Late Woodland, cord-impressed, ceramic horizon that spread throughout the Northeastern Plains beginning about AD 700 to AD 800 (Benn, 1990:139–141). Loseke ware and the types included within it (Feye Cord-Impressed, Ellis Cord-Impressed, Missouri Bluffs Cord-Impressed) have been found in a number of Late Woodland assemblages in the Northeastern Plains (Benn, 1990:114). Other western Initial Middle Missouri sites, such as Swanson, Jandreau, Pretty Head, and Akichita, have closer ties to the Initial variant complexes in the Northeastern Plains, such as Great Oasis and Mill Creek with their higher incidence of incised pottery. Both the cord/cord-wrapped tool impressed and incised (Great Oasis) Late Woodland potting traditions also have short diagonal incisions or tool impressions immediately below the lip, framing the upper border of the rim decoration. These elements are carried into the western Initial Middle Missouri ceramic assemblages, particularly on decorated S-shaped rim sherds. In short, the western Initial Middle Missouri sites appear to have derived from several separate Late Woodland sources. These origins, in addition to Mississippian influences, seem to account for the more easterly Initial Middle

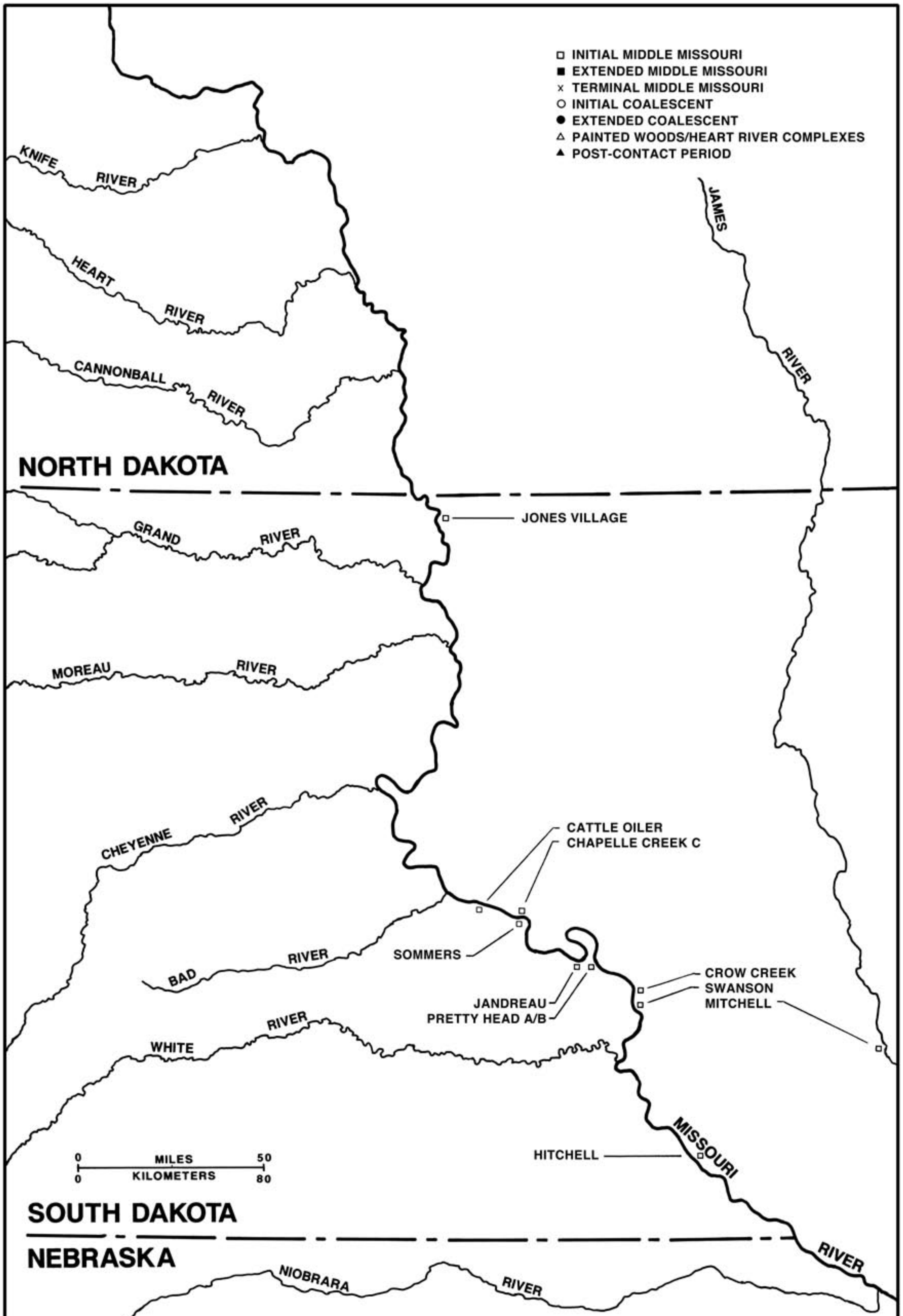

FIGURE 23. Distribution of Plains Village components within the Middle Missouri subarea during Period 1 (AD 1000–1100).

Missouri developments, including the Lower James, Mill Creek, and Cambria phases.

In Figure 23, there are five localities along the Missouri River with Initial Middle Missouri communities. Hitchell represents an early Great Oasis presence in the Fort Randall region. It is closely linked to later Great Oasis sites along the river, such as St. John and 39CH205, and Great Oasis sites in the Northeastern Plains. Like other Great Oasis sites, it is suspected of having originated from an indigenous Late Woodland base. Other early Great Oasis sites of this period include the Great Oasis site in southwestern Minnesota, Heath in southeastern South Dakota, and Broken Kettle West in northwestern Iowa. At the end of period 1, Great Oasis peoples made incursions into central Nebraska, as far west as the Packer site. Three Mill Creek sites (Brewster, Wittrock, and Phipps) were established in the Little Sioux locality at this time. The Cambria phase sites of Cambria and Price also may have been occupied as early as Period 1, although they were most likely established during the following period.

Another Initial variant village, Swanson, was established in the lower Big Bend region early in this period. It has some ceramic affinities with villages along the lower James River (Mitchell, Twelve Mile Creek), suggesting either an origin there, a moderate amount of interaction with these peoples, or a related ancestral base. Swanson marks the beginning of a 200-year Initial Middle Missouri presence in this locality. Swanson is fortified, although it is difficult to identify any hostile group because the only other contemporaneous sites in the region are assigned to the same variant. Nomadic groups, who often leave little archeological evidence of their presence, cannot be ruled out as a reason for constructing village fortifications. If the hypothesis is correct that the early Initial variant villages along the Missouri River drew their populations from a number of Late Woodland/Initial Middle Missouri sources, it would seem that conflicts also could have arisen from Plains Village peoples of different cultural heritages. Another source of conflict could have been from local Woodland or related groups (Great Oasis), although the suspected low numbers of these peoples suggests that this is unlikely. Extended Middle Missouri sites were nonexistent in the Big Bend region at that time, ruling them out as a source of aggression. The Crow Creek site may have been occupied at the end of this period, perhaps representing a resettled Swanson village group.

Sites in the Lower Brule locality (Jandreau and Pretty Head) established an Initial variant presence there that lasted 300 years (Figure 24d). A single village band perhaps occupied the locality during this period, accounting for the modest number of sites there. Pretty Head B and its later component, Pretty Head A, have ceramic assemblages linking them to two Cambria phase sites, Cambria and Price. It is unclear what this relationship entails because the dating of all these components is imprecise and the nature of the rolled rims that links the sites is different from Pretty Head and Cambria. The Cambria phase peoples may have migrated to the Missouri River in Period 1 to sites such as Pretty Head, or they may have had just shared common traits with the early western Initial variant peoples. A westward movement of Cambria peoples at this time seems too early, especially in light of an Oneota expansion into the eastern plains by AD 1200 to AD 1300 that is commonly cited as a reason for the disappearance of Cambria (see Gibbon, 1993:182). An even less likely scenario envisions some form of interaction between the Pretty Head peoples and contemporaneous Cambria villages to the east. Jandreau may represent the same villagers as Pretty Head at a somewhat earlier or later date.

Chapelle Creek and Cattle Oiler represent the first villages to be established in the middle reaches of the Big Bend region (Figure 24b). Shortly afterward, Sommers was occupied either by the people from Chapelle Creek, and/or Cattle Oiler, or another band. Sommers is an unusually large site composed of almost 100 houses within and outside of a fortification ditch, indicating a consolidation of peoples for mutual defense (Figure 24a). Steinacher's (1990) work suggested that several groups occupied the village. The evidence also indicates that the site was initially unfortified. Somewhat later but still within Period 1, a fortification ditch and palisade were constructed around a series of houses at the north end of the site. It is possible that the Sommers villagers protected themselves against other Initial Middle Missouri communities, perhaps the fortified Pretty Head or Swanson sites some distance away. Conflict of this sort was probably rooted in the origins of these village groups who, although they share the same archeological cultural tradition, were nonetheless derived from different Woodland sources. The fate of the Sommers villagers is unknown, although they have close ceramic links to the later Anderson component at the Dodd site.

Finally, Jones Village was established late in this period or in the succeeding one in the south Cannonball region, 100 miles [160 km] north of the nearest Initial Middle Missouri villages to the south (Figure 24f). Although the occupational history of Jones Village is not fully understood, emergency salvage excavations in 1997 and 1998 suggested that what little remains of the site was from either a continuous long-term occupation or at least two separate Initial variant components (C. Johnson, 1997, 1998b, 2007).

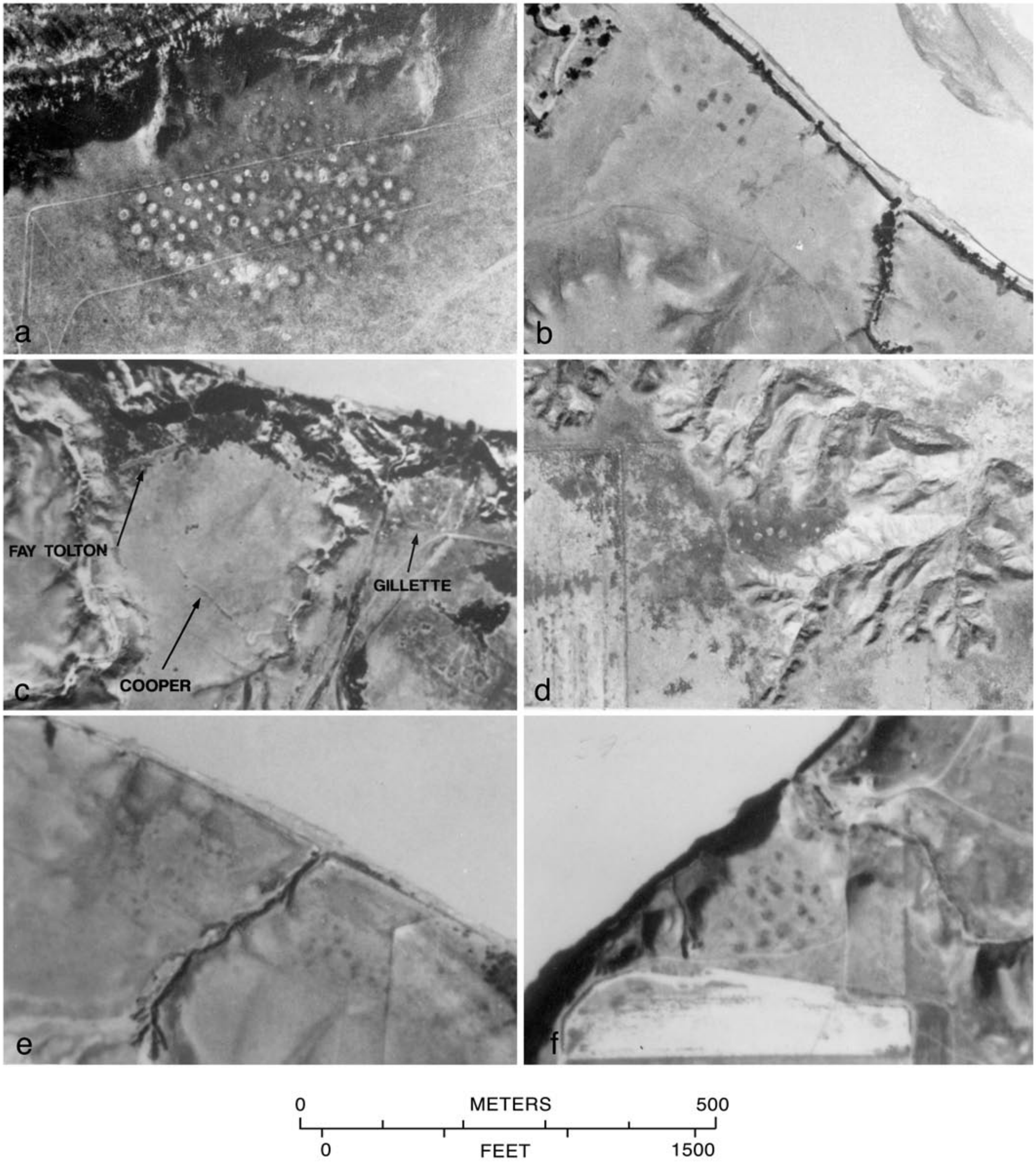

FIGURE 24. Aerial photographs of Initial Middle Missouri (IMM) sites: a, Sommers; b, Cattle Oiler (Extended Middle Missouri [EMM] Ketchen site is in lower right corner); c, Fay Tolton (arrow points to fortification ditch, village partially slumped into Missouri River); d, Jiggs Thompson (fortification ditch runs vertically west of last houses); e, Dodd (area to west has IMM and Post-Contact occupations, area to east contains Post-Contact component); f, Jones Village (site extends beyond image southwest ~200 feet, most house depressions obscured by cultivation).

The presence of a small amount of pottery typically associated with the Extended Middle Missouri may represent a reoccupation of the site in the thirteenth or fourteenth centuries, although an early developing Extended variant potting tradition cannot be ruled out at this time. The village plan of the site, with its irregular arrangement of houses, is suggestive of an Initial variant occupation. Extended Middle Missouri communities generally have houses loosely arranged in rows. A fortification ditch also surrounds a portion of the village. It is clear that an early Initial Middle Missouri presence in north-central South Dakota not only has taxonomic implications but also raises questions about the origins of the variant and its influence on surrounding Late Woodland peoples (see chapter 6). One of the more intriguing aspects of the site is its almost exclusive use of Knife River flint for making chipped-stone tools. This exceeds later Extended Middle Missouri communities in the region. It is suggested that the occupants of Jones Village, being relatively close to the Knife River Flint quarries, perhaps facilitated the procurement and distribution of Knife River Flint to the more southern Initial variant villages (C. Johnson, 1997, 1998b, 2007).

Period 2 (ad 1100–1200)

Period 2 is viewed as a continuation of the Middle Missouri tradition occupations in the localities established in Period 1. Jones Village was occupied sometime during this period (Figure 25), perhaps influencing Late Woodland peoples like those at Menoken to later accept horticulture and a full Plains Village way of life. The upper Big Bend locale, once settled by the Sommers, Cattle Oiler, and Chapelle Creek villages, was abandoned. The Great Oasis descendants of Hitchell may have occupied site 39CH205. It could have been fortified with a ditch and bastion system, although this is not clear. Other contemporaneous Great Oasis communities include Broken Kettle West, Williams, and Gavins Point to the east, and Packer to the south in east-central Nebraska. The Brewster Mill Creek site continued to be occupied, and Chan-Ya-Ta was established in the Little Sioux locality. The Mitchell site, perhaps occupied continuously for more than 100 years, represents the Plains Village presence along the lower James River. The Cambria phase, as represented by the Cambria and Price sites, represents a short-lived and geographically constricted Plains Village presence in southwestern Minnesota.

During this period, a second short-term occupation of the Swanson site may have taken place. This conclusion is based upon the two series of dates from the site (see the discussion of the site in chapter 3). Crow Creek and Akichita are the most obvious successors to the Swanson site in the lower Big Bend locality. It is possible that Crow Creek and Akichita represented the villages of a few contemporary bands or more likely a single group occupying successive locations. The descendants of this band occupied the King site during the next time period. Akichita was the only fortified site among this group. Once again, it is impossible to determine the source of the threat that would have caused the Akichita villagers to fortify their community. Also present is a single Great Oasis site, St. John, that apparently represents a transient community. The only other village in the area, Langdeau, is an Initial variant site located a short distance upriver. Like Akichita, it too was fortified.

The community of Langdeau represents the descendants of the earlier Lower Brule locality villages of Jandreau and Pretty Head. Ceramic relationships suggest links with the Brandon site in southeastern South Dakota, and the community of Fay Tolton. The occupants of Brandon may have migrated to the Lower Brule locale during this period, accounting for the similarity between assemblages. The link with Fay Tolton suggests some form of interaction with or a migration of Langdeau peoples upriver into the Bad-Cheyenne region. It is more likely that the Langdeau villagers abandoned their community and occupied the nearby site of Jiggs Thompson in the next time period.

Two Anderson phase villages were established in the Bad-Cheyenne region during this period, Fay Tolton and Dodd (Figure 24c,e). Based upon the similarity of their ceramic assemblages, these two communities probably represent one or possibly two bands of people. Both sites were fortified. Fay Tolton was the setting for a particularly violent confrontation between its occupants and some other group (Lehmer, 1971:100–101; Wood, 1976; Hollimon and Owsley, 1994). Although it is proposed that the individuals responsible for the attack were Extended Middle Missouri peoples, there are no contemporaneous Extended variant villages in the area. This may be a reflection of sampling, because not all Extended Middle Missouri sites are dated. The nearest Extended villages in time and space are Cheyenne River and Sully School, both placed in the Bad-Cheyenne region during the following period (ad 1200–1300). There is some overlap in the lower range of the radiocarbon dates from these sites and the upper range from Fay Tolton. Another alternative is to attribute the attackers to another Initial Middle Missouri village, or to a nomadic group.

Another source of the Plains villagers could have been from indigenous Late Woodland groups occupying the Knife and Heart regions. The Flaming Arrow and Menoken sites, assigned to the Charred Body complex, are thought

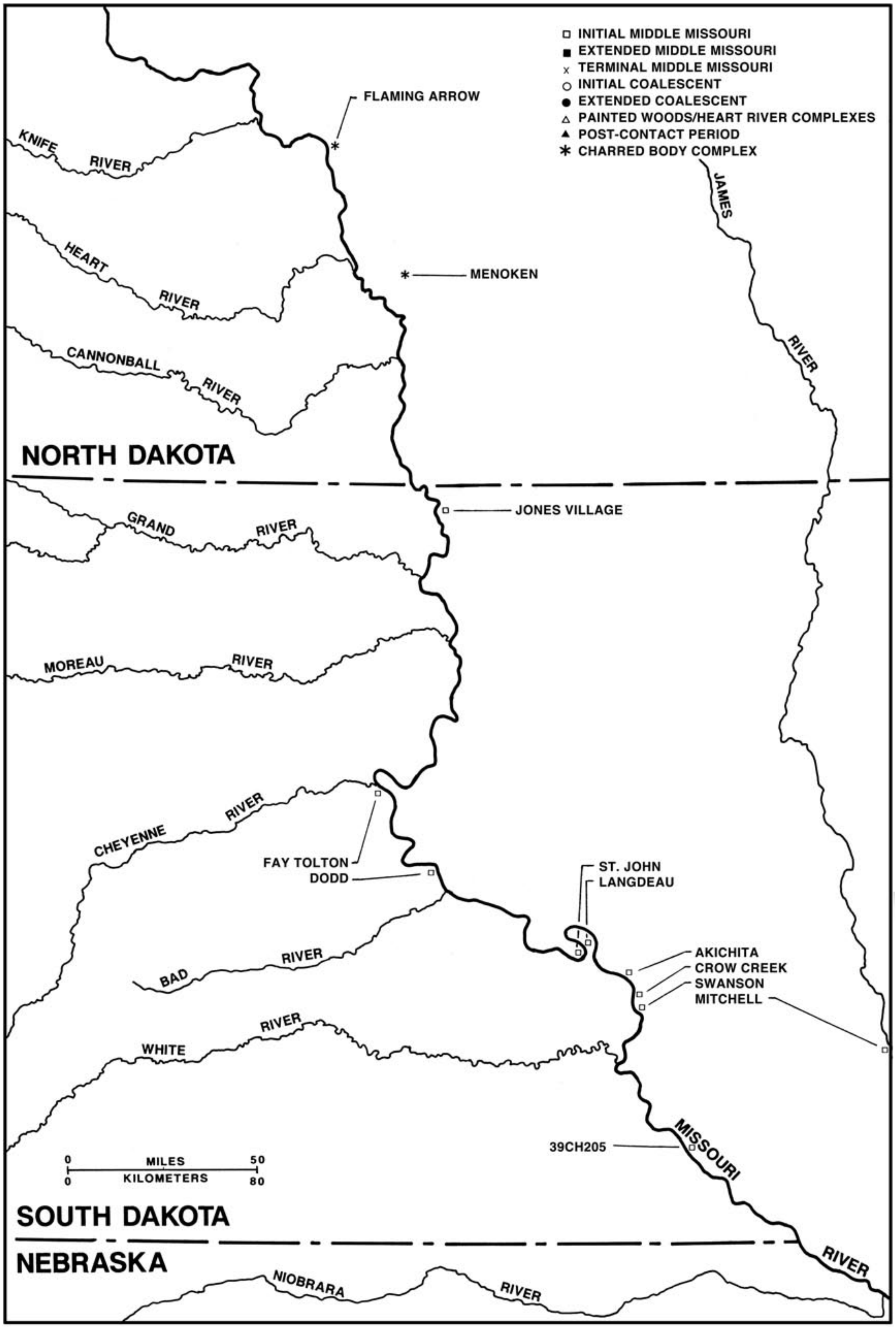

FIGURE 25. Distribution of Plains Village components within the Middle Missouri subarea during Period 2 (AD 1100–1200).

to represent a transition between the Late Woodland and Plains Village peoples in the Knife and Heart regions. There is evidence, in the form of some shared ceramic traits, a very high reliance on Knife River flint, and bipolar flaking technology, to indicate a relationship between Menoken and Jones Village (Ahler et al., 2003a; Ahler, 2007). The presence of such a large and well-developed Initial variant community like Jones Village, in proximity to Late Woodland sites like Menoken, could have been the impetus for a shift to Plains Village life. In turn, Menoken, Flaming Arrow, and other related sites probably developed into the Middle Missouri complex (Clark's Creek and Fort Yates phases) in North Dakota in the next period.

Period 3 (AD 1200–1300)

This period marks the beginning of the Extended Middle Missouri presence in the Middle Missouri subarea (Figure 26). Three Fort Yates communities in north central South Dakota and south-central North Dakota (Paul Brave, Jake White Bull, Travis I) are the earliest Extended variant villages in the Cannonball and Grand-Moreau regions (Figure 27c,e). Vanderbilt (Figure 27d), Havens, and possibly Tony Glas (Figure 28f) were occupied somewhat later. Tony Glas and Jake White Bull were fortified. There are no nearby contemporaneous villages of another taxonomic unit that would pose a threat to these three communities; nomadic groups cannot be excluded at this time. One of the far-flung, Extended variant outposts during this period is Grandmother's Lodge in the Garrison region. Farther down river in the Knife region are the Steifel, Clark's Creek, and PG villages, assigned to the Clark's Creek phase (Figure 27a). The origins of the early Fort Yates villages remain a question to be resolved by future research. One interpretation suggested that the Extended Middle Missouri originated from the Initial Middle Missouri (Ahler, Johnson et al., 1995:26). A somewhat alternative view of the origins of these villages is presented by Ahler (1993b), who suggested they originated from the Late Woodland Charred Body complex, perhaps influenced in turn by the large Initial Middle Missouri community of Jones Village. The evaluation of either hypothesis rests on additional radiocarbon dates and a systematic comparison of Initial and Extended Middle Missouri ceramic technology.

An incursion of Extended Middle Missouri villagers into the Bad-Cheyenne and Big Bend regions from the north occurred during this period. Two villages assigned to the Thomas Riggs phase were occupied at this time—Ketchen and Cheyenne River (Figures 24b, 28d). One additional site, Thomas Riggs (Figure 28b) may have been established at this time, although its temporal placement is not secure. Other villages were probably occupied during this period in these regions, for not all sites could be dated or included in the analysis presented in chapter 6.

It is difficult to establish any clear ties between the Fort Yates and Thomas Riggs phases other than in general terms. Although both phases share the same Extended Middle Missouri potting tradition, they differ in the specific proportions of ceramic types present. This is probably attributable to the great geographic distance involved between the phases, resulting in stylistic drift through time. Cattle Oiler may represent an intrusive village group from the Cannonball region. Its ceramic assemblage more closely resembles some Fort Yates villages rather than the local Thomas Riggs communities (Figure 11). If other Thomas Riggs communities were visited when they were first established, their ceramic assemblages might reveal greater similarity to their suspected ancestral villages to the north. The McKensey site (Figure 28c), not dated with any degree of precision, is perhaps one of these early, shortly occupied villages. With time and isolation from their northern Fort Yates kinsmen, the Thomas Riggs peoples developed their own unique potting tradition.

A few of the Thomas Riggs phase villages were fortified with ditches and palisades (Figure 28b). This is the first time in Middle Missouri prehistory where there is clear evidence for the juxtaposition of villages of different cultural variants. Both the Bad-Cheyenne and Big Bend regions contain contemporaneous Initial and Extended Middle Missouri. This situation could have resulted in hostilities, for the Bad-Cheyenne region seems to have been abandoned by the Initial Middle Missouri villagers shortly thereafter, as Lehmer (1971:101) suggested. It should be noted that this interpretation is tentative because communities of both variants were fortified in this and previous periods, in the absence of nearby contemporaneous villages of different taxonomic status (e.g., Sommers, Dodd, Jake White Bull, Calamity Village).

The Initial Middle Missouri villages of this period represent a continuity of occupations in the Big Bend region that had begun almost 200 years before. Jiggs Thompson (Figure 24d) and Langdeau appear to be the descendants of the Period 1 and 2 villagers who inhabited Pretty Head and Jandreau. The King and Pretty Bull sites are the terminal Swanson phase villages with ties to the Period 2 communities of Crow Creek, Akichita, and Swanson. In northwestern Iowa, Initial Middle Missouri villages continued their presence with the occupation of Larsen and site 13OB3. The Oldham site may represent the last Great Oasis village occupied along the Missouri River.

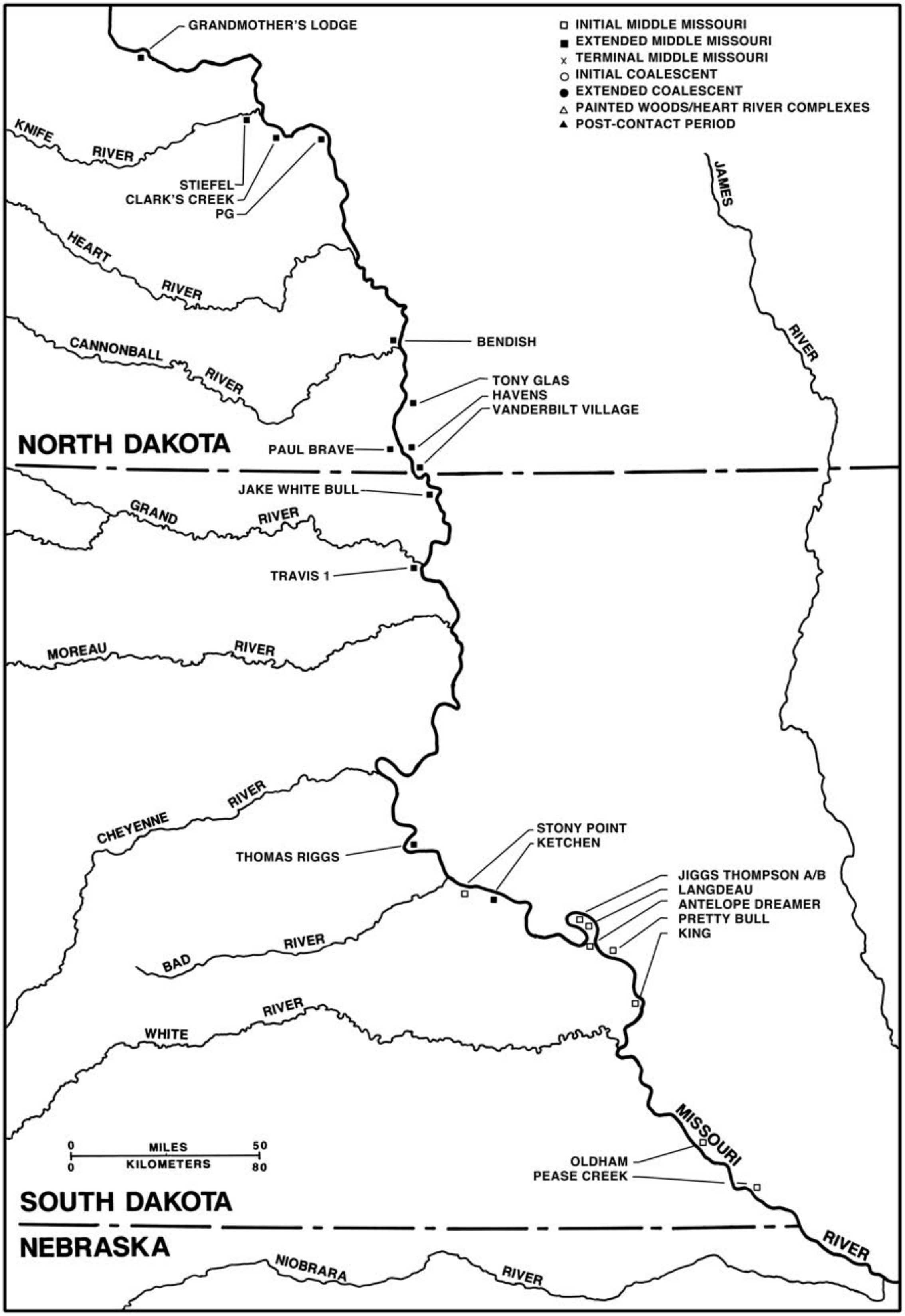

FIGURE 26. Distribution of Plains Village components within the Middle Missouri subarea during Period 3 (AD 1200–1300).

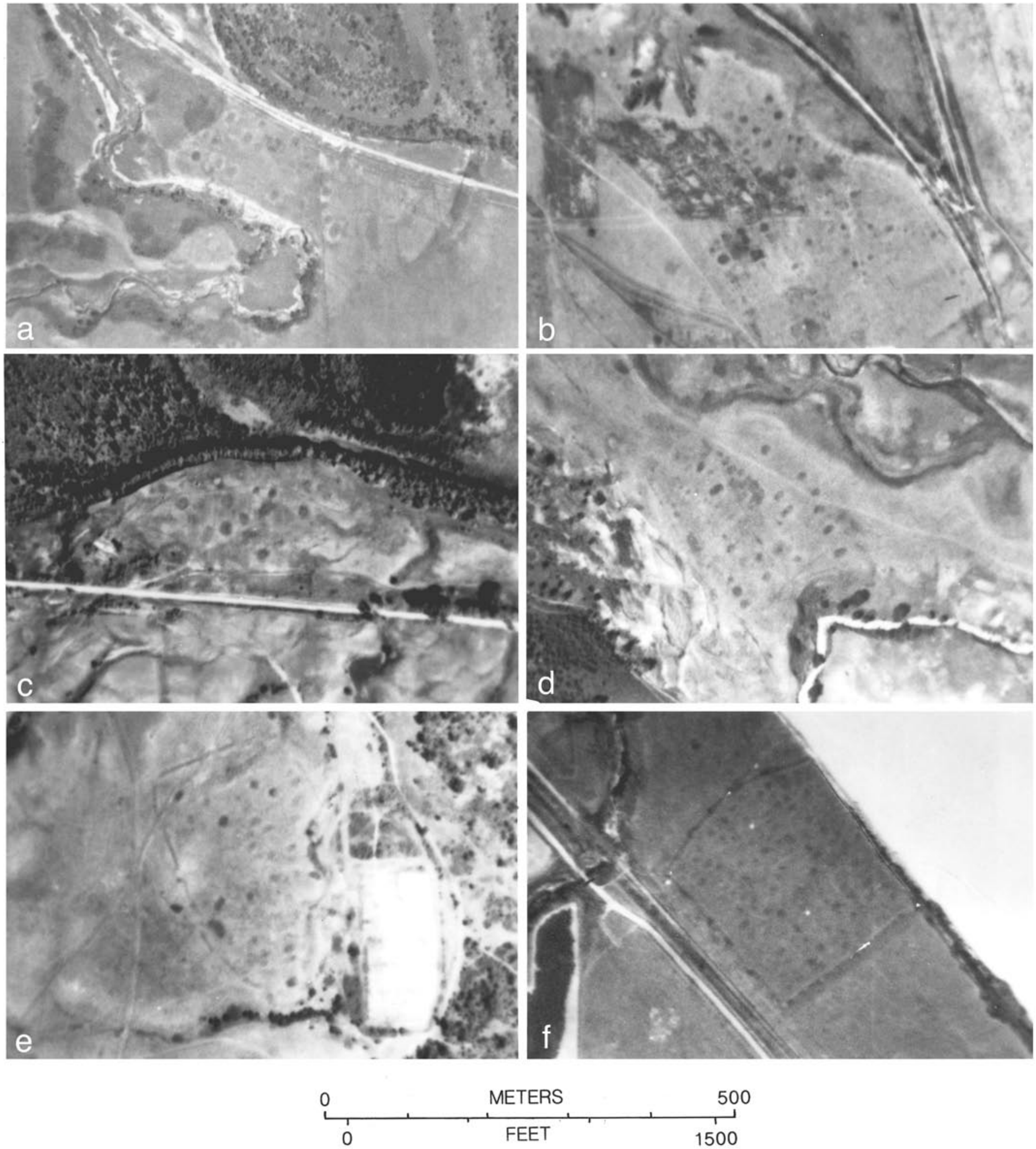

FIGURE 27. Aerial photographs of Extended and Terminal Middle Missouri sites: a, Clark's Creek; b, South Cannonball; c, Paul Brave; d, Vanderbilt Village; e, Jake White Bull; f, Huff.

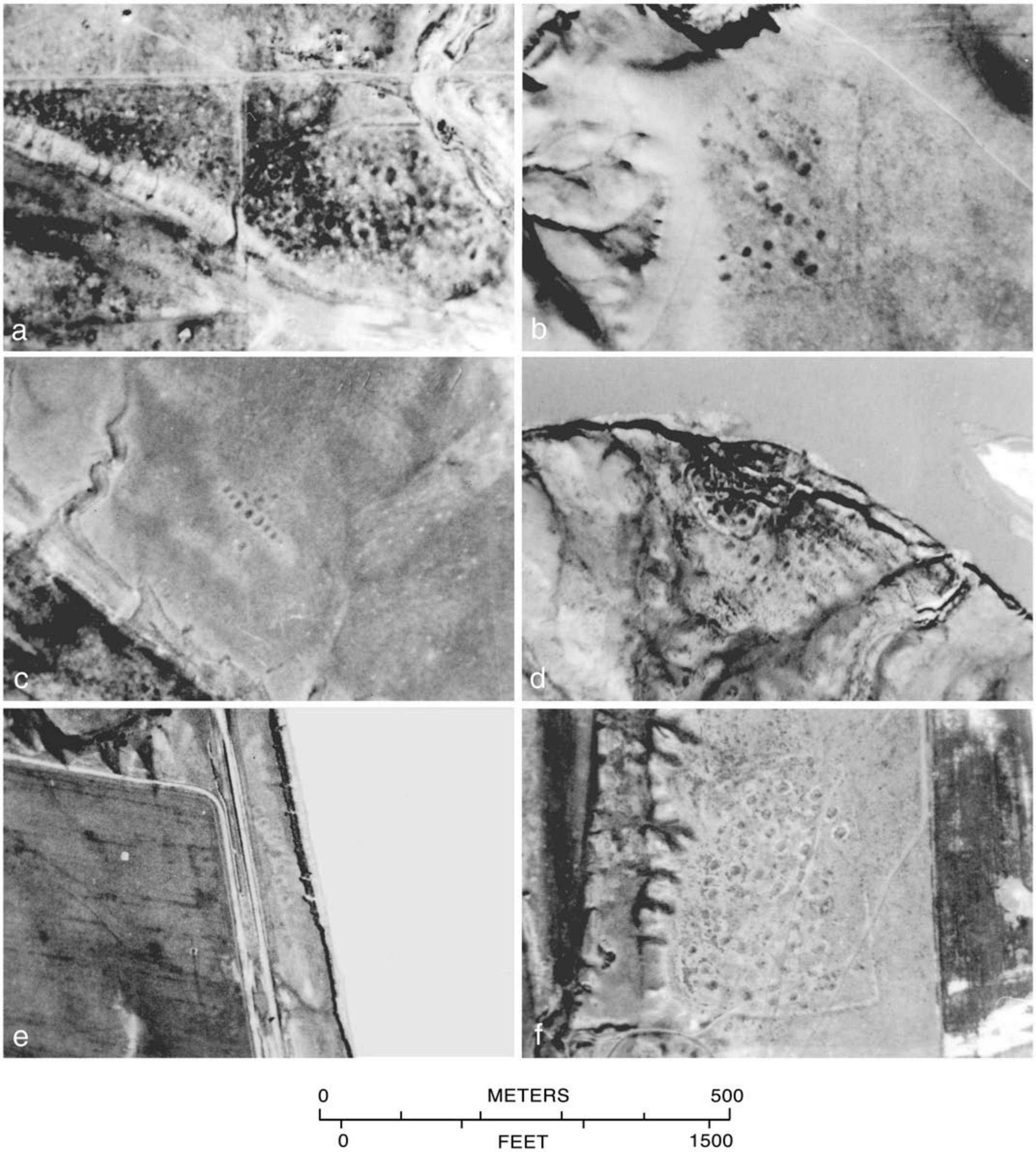

FIGURE 28. Aerial photographs of Extended Middle Missouri (EMM) sites: a, Sully School; b, Thomas Riggs; c, McKensey; d, Cheyenne River (EMM houses visible southeast of fortified Post-Contact village, which is partially slumped into Missouri River; EMM component also present in northeastern portion of site); e, Cross Ranch (partially destroyed by road and railroad); f, Tony Glas.

Period 4 (AD 1300–1400)

During this period, Helb was the only Fort Yates phase community in the south Cannonball region (Figure 29). Calamity Village, a heavily fortified site, was located farther to the south in the upper Grand-Moreau region. Other sites were certainly present during this period, although it is impossible at this time to determine which ones they were. Farther upstream at the confluence of the Cannonball and Missouri Rivers, the South Cannonball site was established (Figure 27b). Its ceramic content indicates close ties to Bendish, suggesting that the same band possibly occupied both villages sequentially. Similarly, Havens and Vanderbilt could be the product of the same village group at different times, as indicated by their ceramic similarities and spatial proximity.

The Shermer site also was occupied during this period. It represents the earliest known Terminal Middle Missouri site. There is some evidence that Shermer could be later because it has only two acceptable radiocarbon dates and its ceramic assemblage places it slightly earlier than Huff, a well-dated, fifteenth-century, Terminal variant village. If Shermer was occupied during the fourteenth century, it would be contemporaneous with a number of Extended Middle Missouri villages. This would mean that the Terminal variant existed for at least 200 years, from AD 1300 to AD 1500.

Upstream in the Knife region, the Nailati phase developed out of its local Period 3 antecedent, the Clark's Creek phase. All of the Nailati communities were unfortified. Of these sites, Cross Ranch (Figure 28e) is most closely related to the Fort Yates villages on the basis of ceramic content. Amahami, and to a lesser extent White Buffalo Robe, have ceramic affinities to the later Period 5 site of Huff. There was a rapid increase in the number of people occupying the region from AD 1350 to AD 1450 (Ahler, 1993d, fig. 24.3), possibly resulting from the influx of Extended Middle Missouri peoples who abandoned large portions of South Dakota.

The Bad-Cheyenne region was possibly occupied by remnants of Extended Middle Missouri villages, such as Black Widow Ridge and Cheyenne River (Figure 28d), although the dating of this site remains very uncertain. By this time, there were no Initial Middle Missouri villages remaining in the Big Bend region. Their occupants may have been absorbed into some of the local Extended variant villages, such as Durkin. It also is possible that the relationship between the Initial and Extended variants of the Middle Missouri tradition is sequential rather coeval. The results of this study indicate that the Initial variant is dated at AD 1000 to AD 1300, whereas the Extended Middle Missouri spans the period between AD 1200 and AD 1400. A number of problems need to be studied before this hypothesis is accepted or rejected. The last of the eastern Initial Middle Missouri peoples occupied the Wittrock and Phipps sites in the Little Sioux locality.

The probable cause of the abandonment of the Big Bend region by Middle Missouri tradition peoples was an influx of Initial Coalescent peoples into the Big Bend region from the Central Plains of Nebraska. At least one Initial Coalescent site, Lynch, is identified from the Niobrara river drainage in Nebraska, with the possibility of there being other sites in the area (Terry Steinacher, pers. comm., 1995). The St. Helena phase also is suggested as a possible point of origin (Blakeslee, 1988:6–8; Willey, 1990, figs. 5, 6; Willey and Emerson, 1993, fig. 17). An additional link is made between the Initial Coalescent and Loup River/Itskari Group A sites (Steinacher and Carlson, 1998:258–259). All Initial Coalescent villages in South Dakota were fortified with a ditch and palisade system characterized by protruding bastions spaced at regular intervals around the village perimeter.

During this period hostilities reached their zenith with the massacre of almost 600 Initial Coalescent occupants of Crow Creek (Figure 32a). There are no known contemporaneous villages in the area assigned to the Middle Missouri tradition that could have posed a threat to the residents of Crow Creek. Because a number of Initial Middle Missouri sites are not included in this chronology, this conclusion must be considered tentative. Another hypothesis that may explain this violence is that Initial Coalescent communities competing for horticultural floodplain land caused it (Zimmerman and Bradley, 1993). Two other villages occupied during this period, Whistling Elk and Talking Crow, may have been competitors of Crow Creek. Whistling Elk might be the best candidate in such a scenario, for it was occupied for only a short time and shows signs of a rapid abandonment. Despite these interesting pieces of information, it is suggested that only several Coalescent villages were ever occupied at the same time, assuming that the 13 known villages are relatively evenly spread during the variant's 200- to 300-year existence. It is probable that the village of Talking Crow represents the ancestors or descendants of Crow Creek, although this remains unclear because the latter site could not be included in the ceramic analysis. In any event, the Talking Crow/Crow Creek peoples persisted in the region, possibly establishing a new village at the Black Partizan site in the next time period.

Period 5 (AD 1400–1500)

Six large Painted Woods/Heart River phase complex villages and five smaller ones date to this period. All are

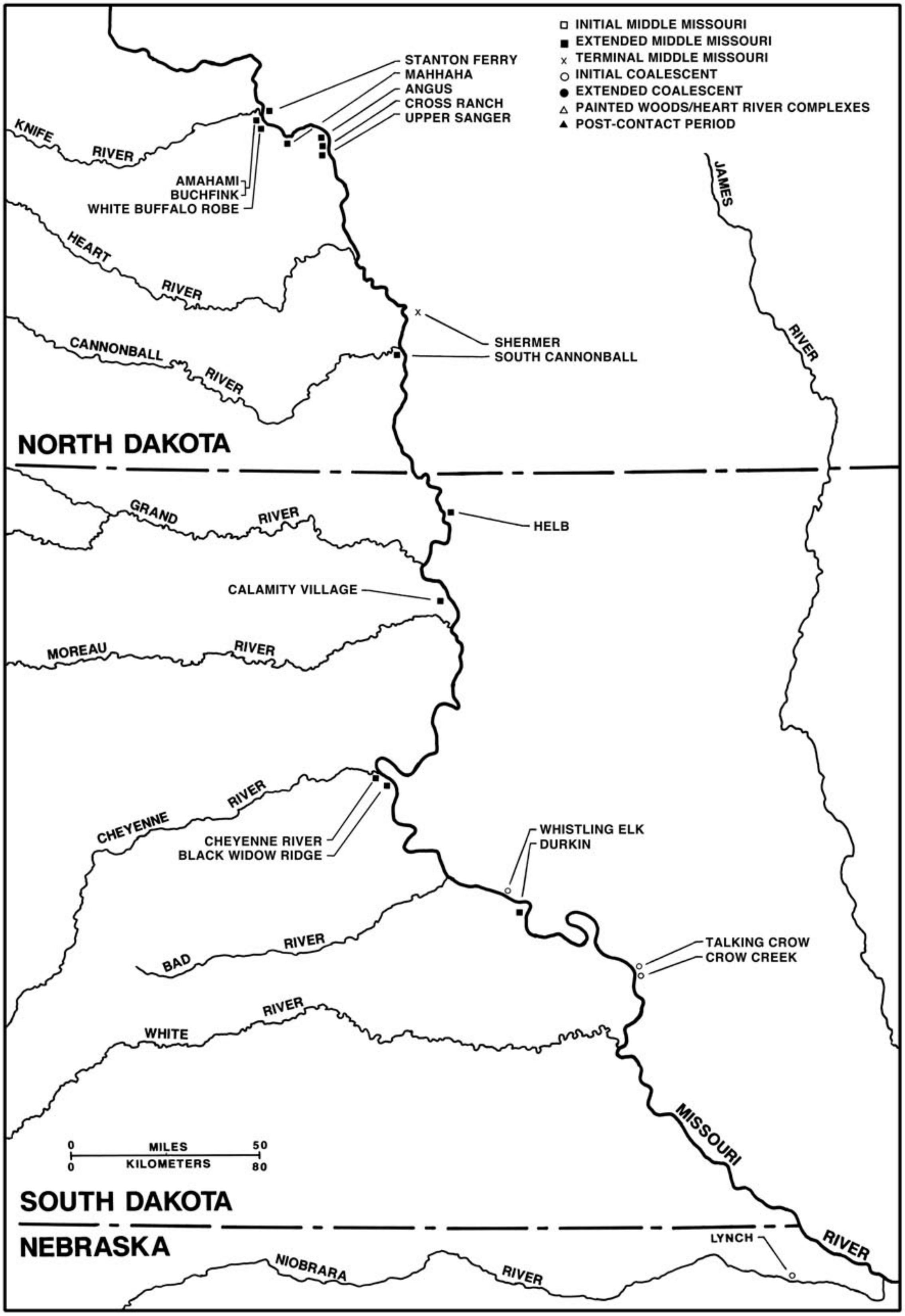

FIGURE 29. Distribution of Plains Village components within the Middle Missouri subarea during Period 4 (AD 1300–1400).

located in the Knife region (Figure 30). These include the Scattered Village phase components of Pretty Point, Upper Sanger, Mandan Lake, Mahhaha, Lyman Aldren, Big Hidatsa, Poly, Scovill, Forkorner, Hump, and Youess, dated at AD 1400 to AD 1450. Other components of the Mandan Lake and Mahhaha sites are assigned to the Mandan Lake phase, dated at AD 1450 to AD 1525 (Figure 31d). The Mandan Lake phase is a direct outgrowth of the Scattered Village phase (AD 1400–1450). There was a population increase during the early Scattered Village complex (AD 1400–1450), possibly related to a migration of peoples into the region (Ahler, 1993d:47, 50). One source of the increase in population, as well as architectural changes, could be the emerging Extended Coalescent villages in the Grand-Moreau region. The ceramic assemblages of the Scattered Village phase seem to derive elements borrowed from a variety of far flung sources, including the Extended Coalescent. This was followed by a sudden population collapse from AD 1450 to AD 1525 in the Knife region, perhaps because of epidemic diseases, out-migration, and warfare related to climatic change and decreasing agricultural production (Ahler, 1993d:50). It is believed that the transition from rectangular to round houses in the Knife region also took place during this period.

Huff was once thought to have been inhabited between AD 1400 and AD 1600 (Wood, 1967:116, 166) with Shermer occupied somewhat earlier (Sperry, 1968b:84). Their temporal positions are now relatively secure at AD 1300 to AD 1400. Because there are so few dates from other Terminal Middle Missouri villages, it is unclear if they fall within this time period. Terminal variant sites like Huff may represent a transition between the Extended Middle Missouri and the Heart River complex, based upon the assumption that the latter complex began about 275 years earlier than the date originally proposed by Lehmer (1971:163, 203). Such a lengthy duration for the Heart River complex was proposed by Ahler (1993b) and supported by recent work at On-A-Slant Village (Ahler, 1997:8) and by thick midden deposits at sites, such as Double Ditch (Will and Spinden, 1906). Direct evidence for a starting date in the fifteenth century for the Heart River complex is not available at this time. Communities like Huff may be composed of a number of formerly autonomous Extended Middle Missouri villages, for there are many more houses enclosed within its fortified perimeter than Extended variant villages. The large population at Huff also may be due, in part, to a general population increase among the Northern Plains villagers, similar to the one from the Knife Region during the late fourteenth and early fifteenth centuries (Ahler, 1993d, fig. 24.3). A less likely possibility is that Terminal variant villages, such as Huff, are contemporaneous with Extended Middle Missouri communities in the Cannonball region, each representing different Mandan bands.

Two Initial Coalescent villages were occupied during this period, Arzberger and Black Partizan (Figure 32b). Given Black Partizan's ceramic affinities to the earlier Initial Coalescent sites, it was probably occupied early in the period. Arzberger was established late in Period 5 and perhaps persisted into Period 6 (AD 1500–1550). It represents the descendants of Black Partizan or perhaps other contemporaneous villages. Given the low number of Initial Coalescent villages in the Big Bend and the combined time span of them of about 200 years, it could be expected that only several were occupied at the same time. By this time, the Initial Coalescent villagers were in sole possession of the Big Bend region.

During the first half of this period, a single Extended Coalescent village was established in the lower Cannonball region. The Demery site is not only the earliest but also the northern-most Extended variant village in the Middle Missouri subarea (Figure 33b). It was established at the time, or shortly after, the Extended Middle Missouri peoples vacated the area. If this is the case, the conflict between Extended Coalescent and Middle Missouri peoples that Lehmer (1971:126–127) and Kay (1994:1, 30; 1995) envisioned for the region probably did not occur. Although conflict between them in the Cannonball and upper Grand-Moreau regions may no longer be a plausible scenario, a different kind of interaction is possible. The incorporation of Extended Middle Missouri ceramic elements into the Demery site pottery indicates that borrowing may have occurred and that the interaction between the two was peaceful instead of violent.

The origin of Demery is problematical. Although the general consensus is that the Extended Coalescent was a sequential development out of the Initial Coalescent, the dates suggest a period of overlap of perhaps 50 to 100 years between the latest Initial Coalescent of Arzberger and Demery, the earliest Extended Coalescent site. There also is a rather significant difference between the ceramic assemblages of the two variants, suggesting that some changes occurred. In addition, it is difficult to account for the distance of almost 100 miles [160 km] between the last Initial variant sites and the earliest Extended villages. Thus, the only alternative at this point is to suggest that the Initial and Extended variants of the Coalescent tradition were partially contemporaneous. Through some village migration or budding process, some of the descendants of the late Initial Coalescent communities established themselves far to the north at the Extended Coalescent Demery site.

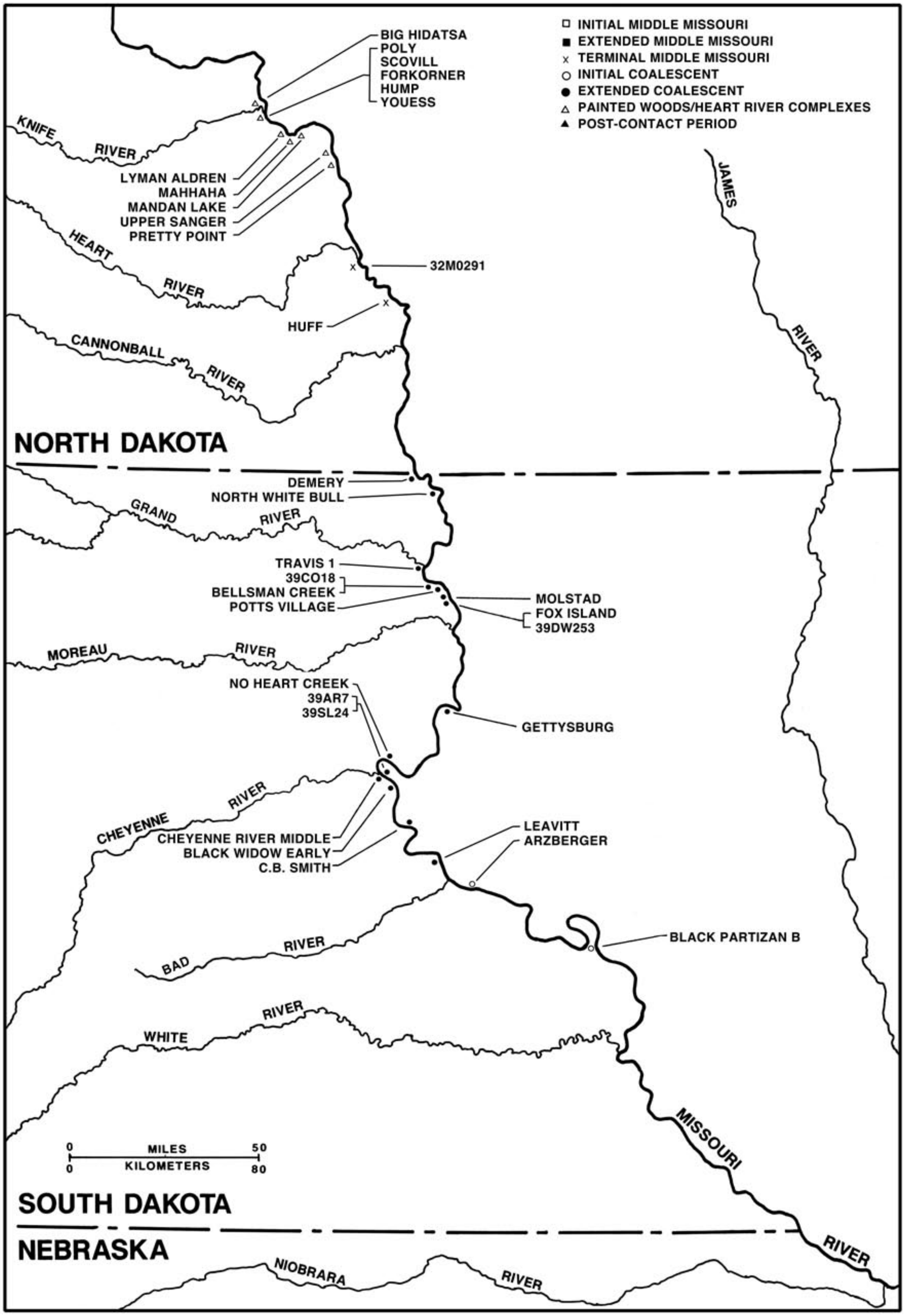

FIGURE 30. Distribution of Plains Village components within the Middle Missouri subarea during Period 5 (AD 1400–1500).

FIGURE 31. Aerial photographs of Heart River, Painted Woods, and Knife River complex sites: a, Big Hidatsa (Hidatsa-proper village); b, Lower Hidatsa (Awatixa Hidatsa village); c, Sakakawea (Awatixa Hidatsa village); d, Mandan Lake (Awatixa Hidatsa village); e, Molander (Awatixa Hidatsa village); f, Fort Clark (Nuitadi/Istopa Mandan and Arikara village).

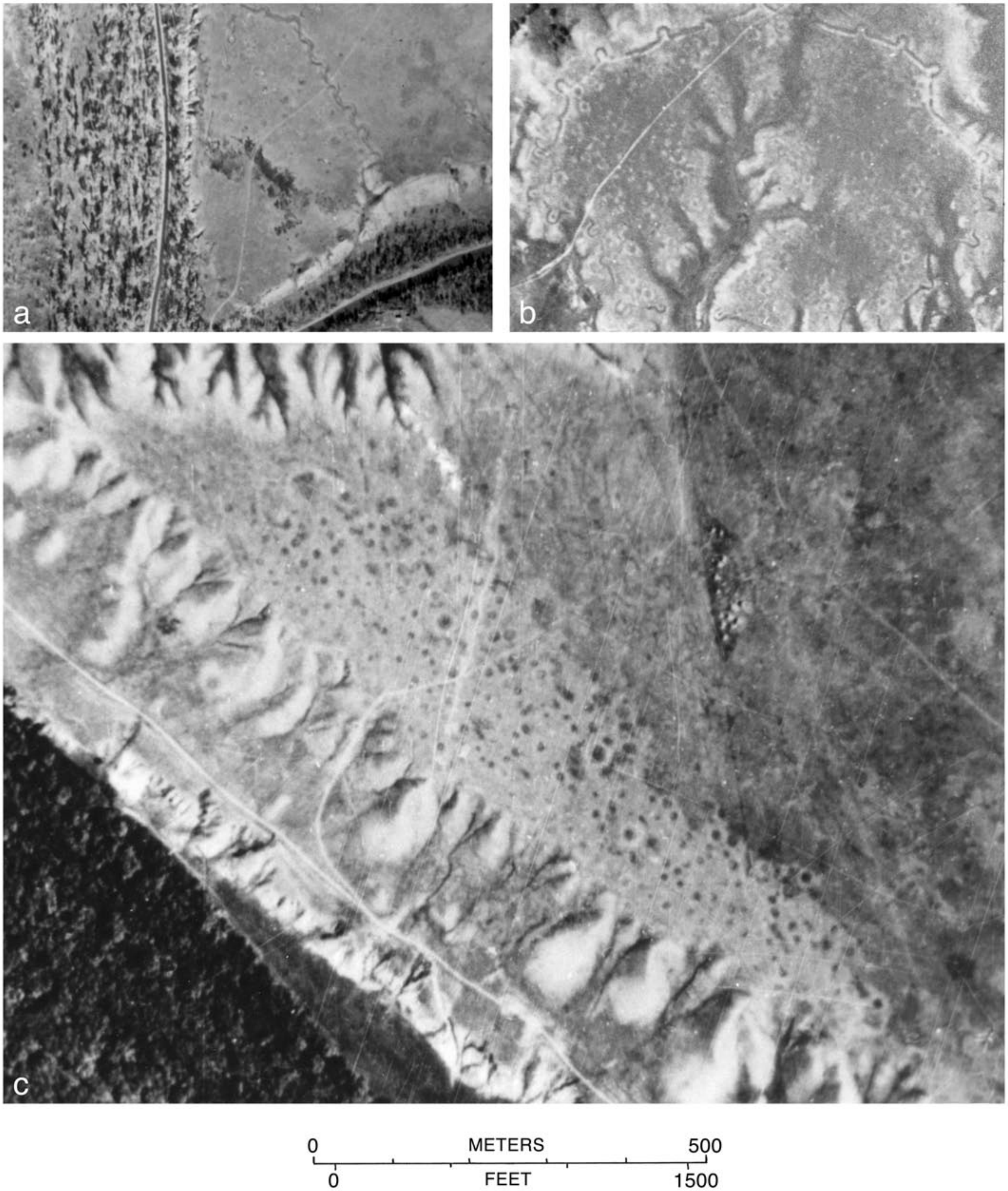

FIGURE 32. Aerial photographs of Initial, Extended, and Post-Contact Coalescent sites: a, Crow Creek (contains Initial Middle Missouri and Initial Coalescent components); b, Arzberger (fortification ditch surrounds entire village; on southeast side, it runs between bluff draws); c, Sully (contains Extended and Post-Contact components).

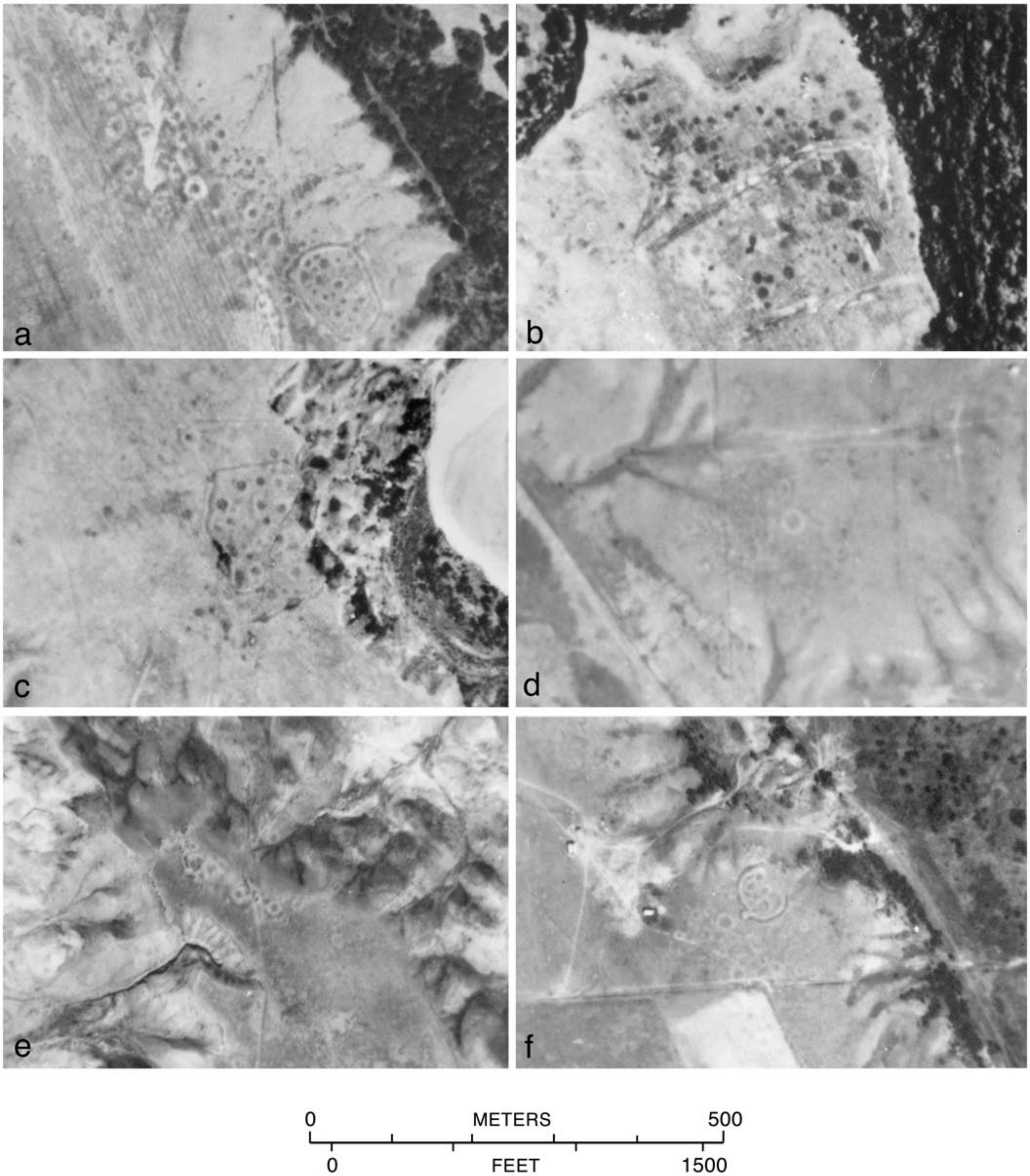

FIGURE 33. Aerial photographs of Extended Coalescent sites: a, Potts; b, Demery; c, Lower Grand; d, Walth Bay; e, Meyer; f, Molstad.

During the last half of this period, there was a expansion of Extended Coalescent peoples in the Grand-Moreau region. The most likely origin is to the south from the Initial Coalescent villages in the Big Bend region, although the inhabitants of the Demery site also may have been a source for some of these Extended variant villages. Only a few of the 14 Extended variant villages of this period were fortified; three are assigned to the Le Compte phase (Potts, Molstad, No Heart Creek). These communities were fortified with round bastion ditches and palisade systems, which encircled only some of the houses (Figure 33a,f). The bastion fortification systems were similar to Initial Coalescent communities, except that they contain only a few, irregularly spaced bastions. There were no villages of different cultural traditions that could pose a threat, although Lehmer (1971:126) believed that Extended Middle Missouri peoples in the region may be responsible. The results of this study indicate that Extended Middle Missouri peoples abandoned the Grand-Moreau region about 50 years prior to the establishment of these Extended Coalescent villages. Another alternative is to suggest that the Le Compte populations fortified their villages against other Extended Coalescent villages or nomadic groups.

The Little Bend locality was another locus of early Extended Coalescent settlement. The Cheyenne River site probably was occupied shortly after it had been abandoned by Extended Middle Missouri peoples (Figure 28d). The ceramic assemblages of the Little Bend villages and those to the south, such as C. B. Smith and Leavitt, are remarkably homogeneous, more so than their northern counterparts, suggesting a high degree of cultural interaction or a relatively small number of contemporaneous village groups or bands. Ancestral villages probably included the late Initial Coalescent communities of Period 5, such as Arzberger, or less likely, Black Partizan.

Period 6 (AD 1500–1550)

The dominant cultural configurations during this period are the Painted Woods/Heart River complexes in the Knife and Heart regions of North Dakota and the Extended Coalescent of South Dakota. The northern villages include those assigned to the Mandan Lake (Mandan Lake, Mahhaha sites) and Hensler (Smith Farm, Lower Sanger, Hensler, Alderin Creek, White Buffalo Robe, Lower Hidatsa sites) phases, dated at AD 1450–1525 and AD 1525–1600, respectively (Figures 30, 34, 36). All villages were unfortified, except for Lower Sanger, Alderin Creek, and Smith Farm. The Hensler phase marks the time of maximum cultural influence of the ancestral Mandan (Heart River complex) communities in the Heart region. These influences, as indicated by pots decorated with cord impressions, were present in the Knife region and also far to the south, among the Extended Coalescent communities in the Grand-Moreau region. One likely source of Mandan influence was the Double Ditch site, an incredibly large and rich site marked by two visible concentric fortification ditches and very thick middens (Figure 35e). It was probably continuously occupied for several hundred years, comparable in time to some of the other long-lived villages in the Middle Missouri subarea, such as Big Hidatsa and Anton Rygh.

The Extended Coalescent villages are concentrated in three areas: Grand-Moreau, Bad-Cheyenne, and the central Big Bend regions. Bower's La Roche, Over's La Roche, Cattle Oiler, and Standing Bull probably represent the direct descendants of local Initial Coalescent communities, such as Arzberger and Black Partizan. Arzberger was possibly occupied into the early part of this period. Nine villages in the Grand-Moreau region were occupied, marking stability in population compared with the previous period. Swan Creek was established at this time and was probably continuously occupied for at least 125 years, into the early Post Contact period. Only a few villages, all in the Grand-Moreau region, were fortified: Moreau River and Walth Bay (Figure 33d). Walth Bay is unusual for a Middle Missouri subarea village, for it had a stockade without an accompanying ditch. It is a community of 30 houses that had at least three short-term occupational episodes. The majority of Extended Coalescent sites were rambling, unfortified villages marking a period relatively free of conflict, or a "pax La Roche," as Caldwell (1964:3) described it.

Extended Coalescent villages in the Bad-Cheyenne region continued to be occupied, particularly in the Little Bend Locality. Ceramic assemblages became somewhat more heterogeneous during this period as populations began to grow and diversify. A second village, in addition to Swan Creek, began to dominate the Extended Coalescent landscape at this time. This is the Sully site, the largest village in the Middle Missouri subarea (Figure 32c). It contains about 200 visible house depressions, although the actual number of houses that were eventually constructed during a series of three to four rebuilding cycles may easily triple this figure. Sully was occupied from about AD 1550 to AD 1700/1725, making it the longest, continuously occupied Plains Village site known in South Dakota. Sully was never fortified and probably represents, particularly in its later stages, an amalgamation of a number of formerly autonomous Extended Coalescent villages in the area. Its

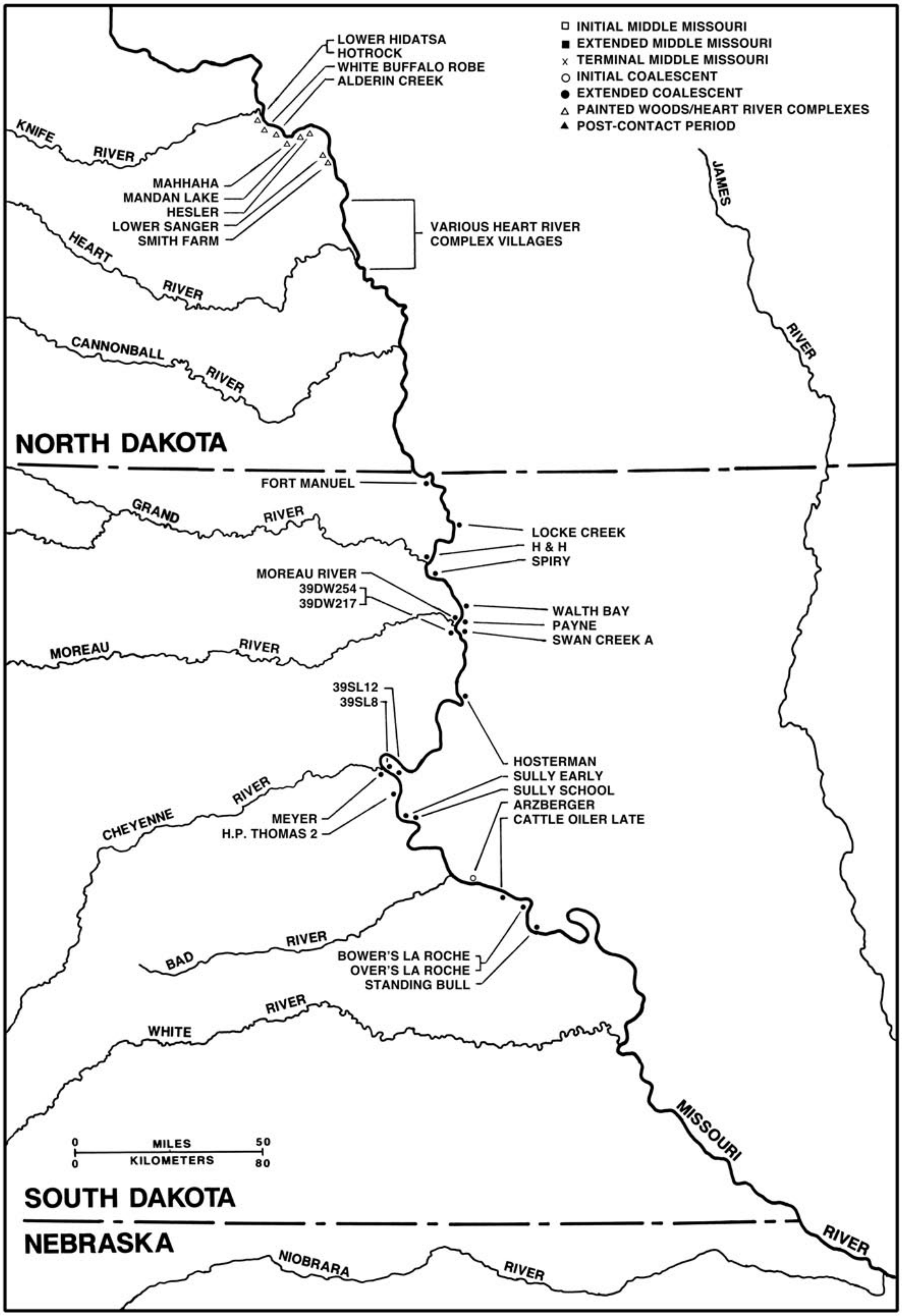

FIGURE 34. Distribution of Plains Village components within the Middle Missouri subarea during Period 6 (AD 1500–1550).

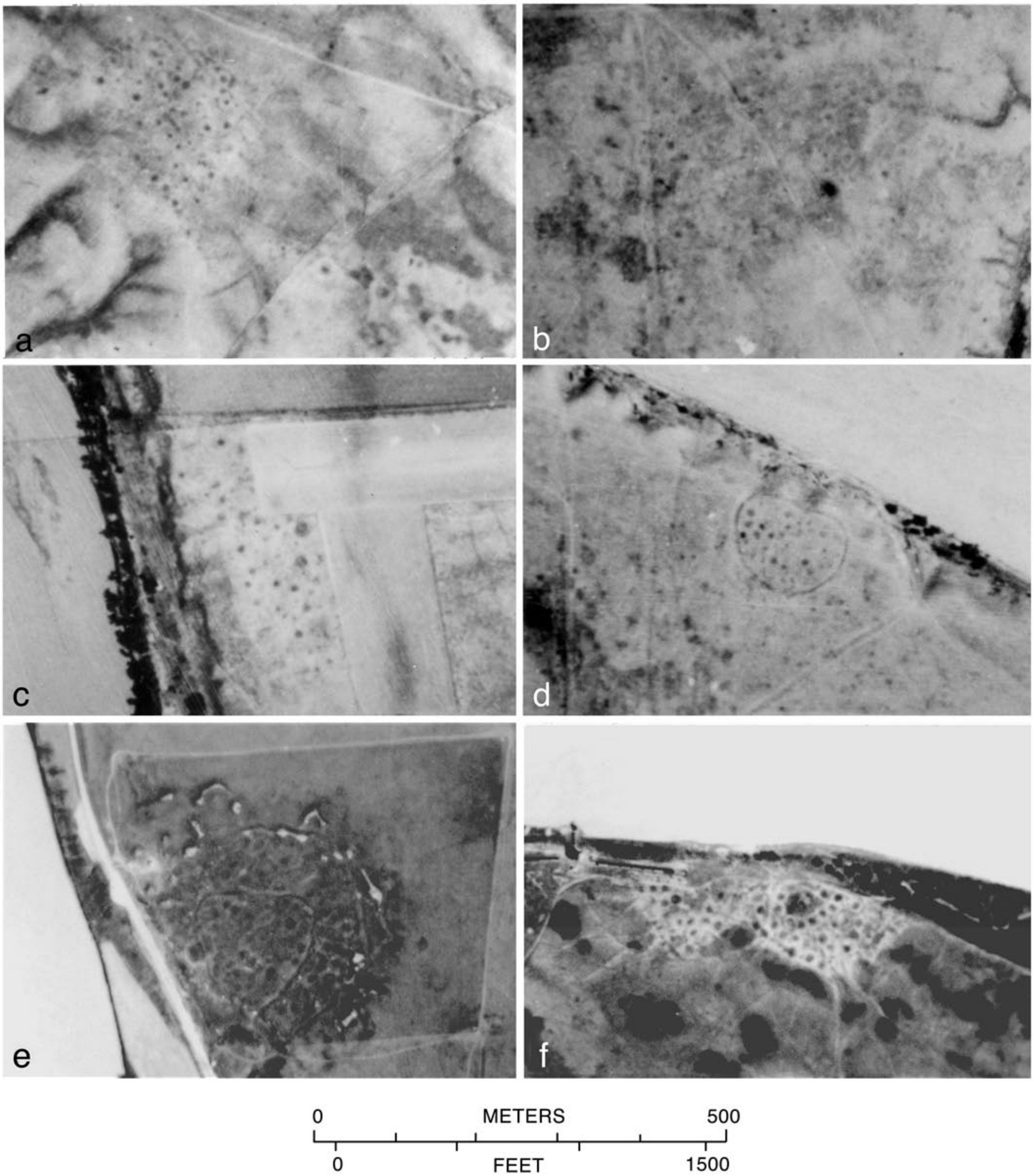

FIGURE 35. Aerial photographs of Talking Crow phase, Heart River, and Knife River complex sites: a, Medicine Crow; b, Peterson; c, Amos Shields; d, Fort George Village; e, Double Ditch (fence of park surrounds site, light linear areas are middens); f, Deapolis (Nuptadi/Nuitadi Mandan village).

village plan resembles many of the rambling Extended Coalescent communities from which it drew its population, unlike many of the smaller and more compact sites of its time. Bowers (1930:3) postulated that Sully was occupied by four separate groups of Arikara who spoke mutually unintelligible languages. The reason they consolidated into one village was for mutual defense. Bowers (1930) based his opinion on historical and archeological evidence.

Not all Extended Coalescent villages are located on the edge of the first upper terrace overlooking the Missouri River floodplain. Some, such as Meyer (Figure 33e), are located well into the breaks or hills separating the last terrace from the surrounding uplands. These may represent special-purpose observational sites (Lehmer, 1970:128).

Period 7 (AD 1550–1600)

During this period, the Heart River complex Hensler phase villages of Hensler, Lower Sanger, Smith Farm, Alderin Creek, White Buffalo Robe, Lower Hidatsa, and Hotrok dominated cultural developments in the Knife region (Figure 36). The Heart region experienced a florescence of ancestral Mandan villages during the Hensler phase, strongly influencing the Knife region. One of these, On-A-Slant (32MO26), was established midway through the period and was continuously occupied until 1785 (Ahler, 1997:8). The Elbee site, also in the Knife region, represents a somewhat different cultural tradition. The ceramics from this site link it to the Extended Coalescent sites in South Dakota, such as Walth Bay, H & H, 39WW300, and the early component at Anton Rygh. The presence of Elbee far to the north of the Extended Coalescent homeland has not been explained.

Farther to the south in the Grand-Moreau and Bad-Cheyenne regions, there was a reduction in the number of Extended villages, which was particularly evident in the Grand-Moreau and Bad-Cheyenne regions. Late Extended Coalescent peoples in Grand-Moreau and Bad-Cheyenne regions probably consolidated into regional centers, such as the Swan Creek, Anton Rygh, and Sully sites. Ramenofsky's (1987:124, 133) research also supported a population decline at this time, which he attributed to the introduction of European pathogens. Trimble (1989, 1993) listed additional epidemics at about this time. A similar population decline and reorganization began 50 years earlier in the Knife region and continued into later periods (Ahler, 1993d:43–44, 50). Other reasons for these apparent population reductions and consolidations might include mutual defense or deteriorating conditions associated with the Neo-Boreal or Little Ice Age (Lehmer, 1970).

The occupational history of the Sully site is relevant in this regard. An intrasite ceramic analysis of the site indicates that it was continuously occupied since it was established late in Period 6 and expanded in size from west to east. In light of its unusual size and at least three house rebuilding episodes throughout much of the site, Sully represents a very large population, compared with many of the small Extended Coalescent hamlets (Figure 32c). It probably represents an agglomeration of a number of formerly semiautonomous villages that banded together for mutual defense or as a result of epidemic diseases. This may account for the reduction in the number of sites in the region during Period 8. Although Sully was unfortified, it may have contained a large enough population to thwart any external threats. The fortified Cooper site may represent a different response to conflict. Cooper is something of an enigma because it was fortified by a ditch with bastions at regular intervals (Figure 24c). It resembles the fortifications of earlier Initial Coalescent and Le Compte phase sites, although it seems to lack houses outside of this feature. It could represent the descendants of Le Compte phase villagers or possibly a remnant Initial Coalescent group. Although its ceramic assemblage links it to the Extended Coalescent, it is possible that there is another unrecognized and partially buried (early Initial Coalescent) component at the site associated with the fortification ditch.

Another important community, Anton Rygh, was established at this time (Figure 37a). Anton Rygh and Swan Creek (Figure 37f) were the dominant communities in the Grand-Moreau region for at least 100 to 125 years, until about AD 1675 to AD 1700 when other villages eclipsed them. Both exhibit ceramic influences from the Heart River Mandan, and it is not inconceivable that interaction between the Mandan and Arikara took place on a regular basis. This Heart River complex influence had led a number of investigators to conclude that ancestral Mandan occupied Anton Rygh. Craniometric analyses of the human skeletal remains from the site have confirmed an Arikara affiliation (Lin, 1973, 1978). The Lower Grand site, occupied early in this period, has a rather unusual fortification system consisting of a rectangular, not round, ditch that was expanded to include several houses on its northern periphery (Figure 33c).

Five villages (Little Pumpkin, Little Cherry, Chapelle Creek, Fry, 39LM222) continued the Extended Coalescent presence in the Big Bend region. All were unfortified and ancestral to two clusters of Period 8 sites in the upper and lower Big Bend localities. Several outlying villages, Spain and Redbird II, extend the range of the Extended variant far to the south into the lower Big Bend region

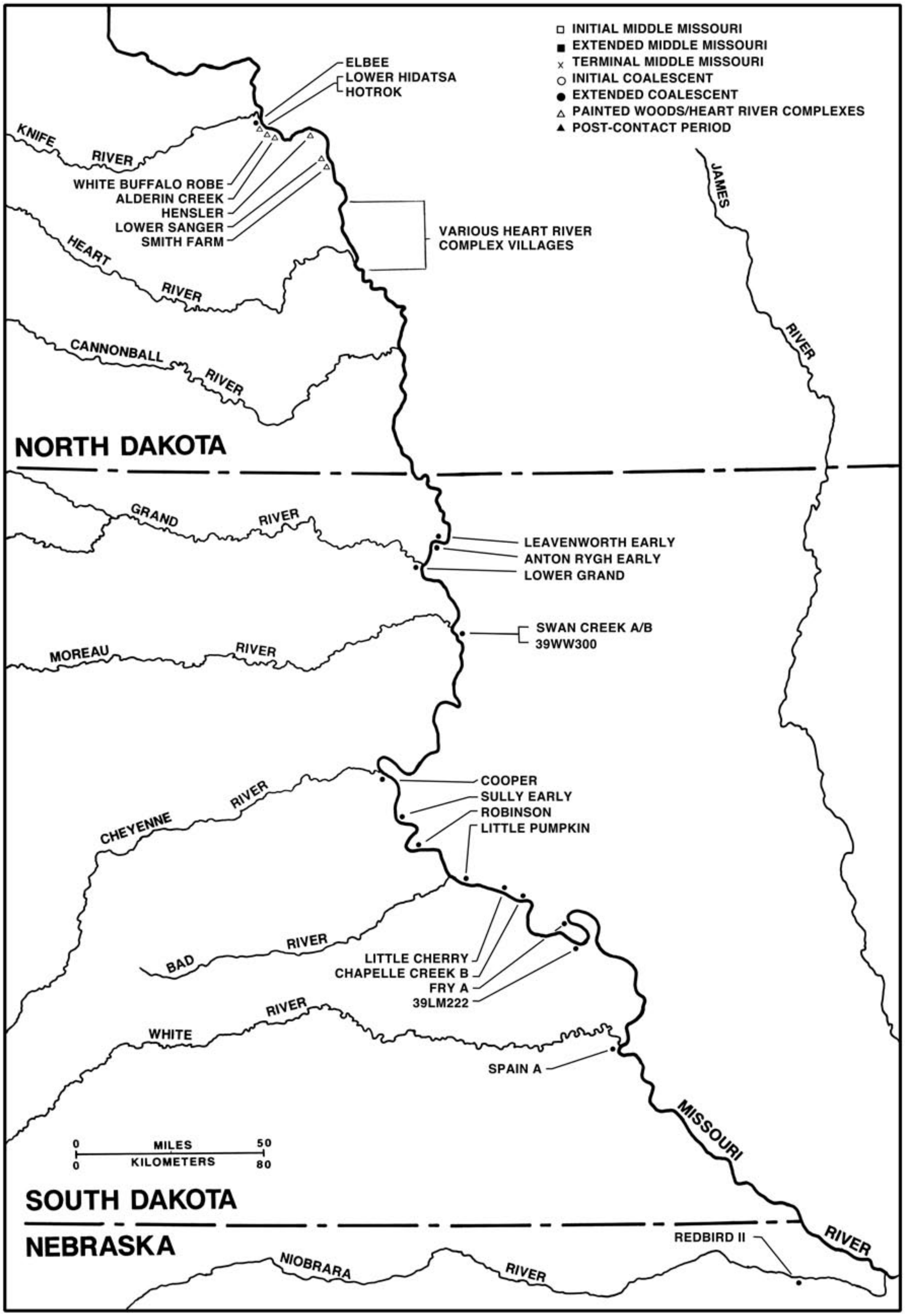

FIGURE 36. Distribution of Plains Village components within the Middle Missouri subarea during Period 7 (AD 1550–1600).

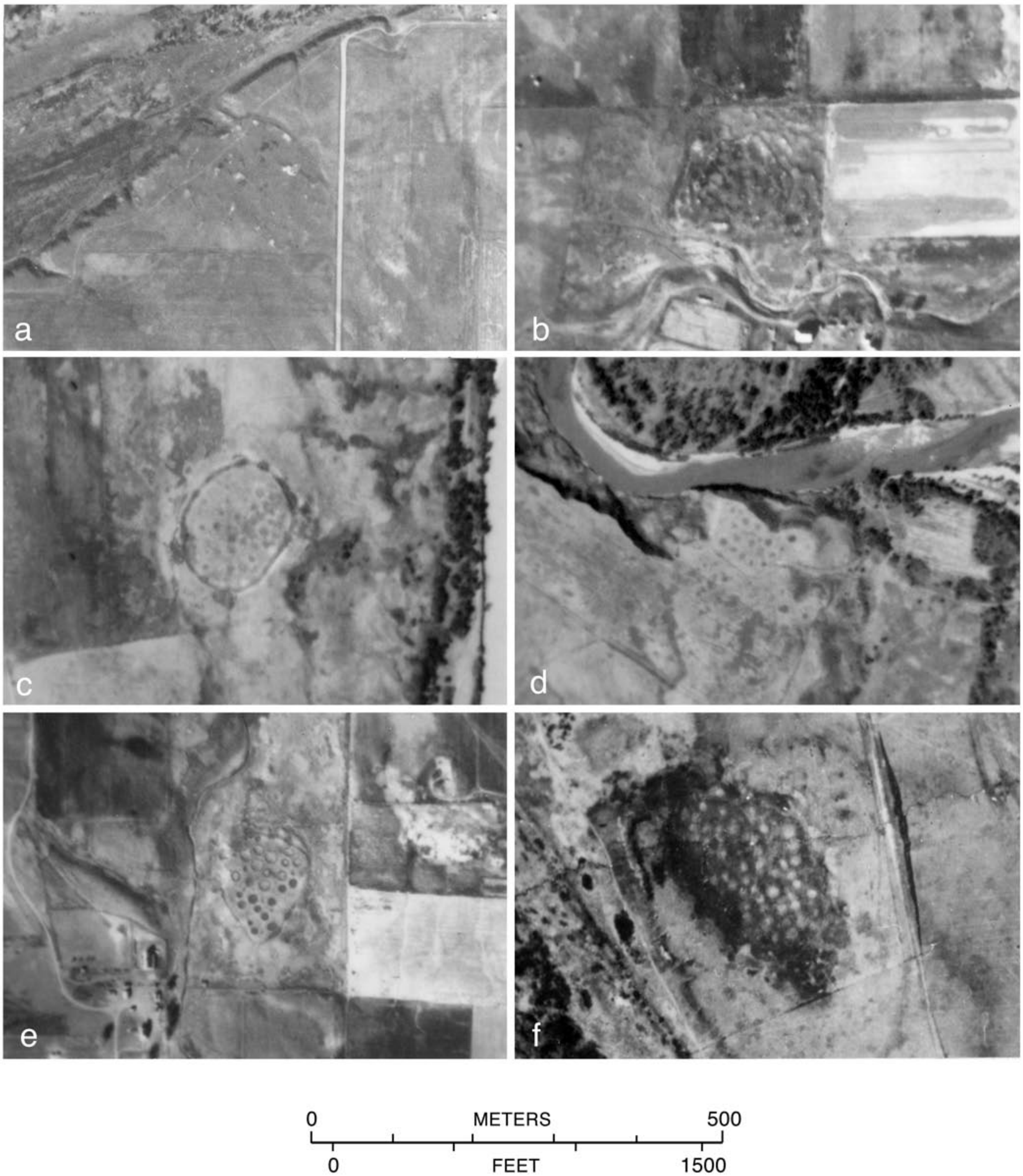

FIGURE 37. Aerial photographs of late Extended and Post-Contact Coalescent sites: a, Anton Rygh; b, Bamble (linear mounded areas are middens); c, Nordvold I; d, Red Horse Hawk; e, Larson; f, Swan Creek (Swan Creek and Anton Rygh contain Extended and Post-Contact Coalescent components).

and the Central Plains subarea of Nebraska. Along with the Elbee site in the Knife region, this marks the time of greatest geographic range of the Extended variant of the Coalescent tradition.

Period 8 (AD 1600–1650)

Very small amounts of Euro-American trade artifacts (metal, glass beads) began to appear in the Middle Missouri subarea at the Knife region villages, marking the beginning of the Post- Contact period. The evidence for these artifacts is less clear in South Dakota, where the Extended Coalescent was drawing to a close. The absence of these items, except perhaps at the Hosterman site of the previous period, may be a function of the "coarse" recovery techniques used to excavate these South Dakota sites. In any case, the present reconstruction does not recognize the presence of Euro-American trade artifacts in Coalescent sites in South Dakota until about AD 1650.

Five Knife region villages (Big Hidatsa, Lower Hidatsa, Lower Hidatsa West, Hotrok, Mahhaha) were occupied during this period (Figure 38). All have been assigned to the Willows phase (AD 1600–1700) and were unfortified. This period marks the first time of moderately intense occupations at Big Hidatsa and Lower Hidatsa, two villages that later became more prominent (Figure 31a,b). Big Hidatsa was continuously occupied by the Hidatsa-proper into Period 13 (AD 1830–1886) for about 200 years. The Awatixa Hidatsa occupied Lower Hidatsa from Period 6 (AD 1500–1550) until Period 11 (AD 1750–1785), also for about 200 years. Period 8 also was a time of a dramatic population decline in these villages, which was probably attributable to Euro-American–derived epidemic diseases. The Willows phase also marked the appearance of the Hidatsa-proper in the archeological record, an end to Mandan influence in the Knife region, and the recognition of the Hidatsa peoples as a single tribal entity.

Anton Rygh, Swan Creek, and Sully continued to be the dominant communities in South Dakota. The Mobridge site, just south of Anton Rygh, was first occupied in this period. Small satellite sites, such as 39WW301, which was associated with Swan Creek, also were established. A small group of communities farther to the south in the Big Bend region continued the traditional Extended Coalescent lifestyles in two localities. Pierre School South, Bowman, and 39HU241 were established in the upper Big Bend, whereas the three villages of Bice, Clarkstown, and Meander occupied the area near the mouth of the White River. These Big Bend villages laid the foundation for the protohistoric Felicia phase.

Period 9 (AD 1650–1700)

During this period, Euro-American trade artifacts spread throughout the entire Middle Missouri subarea. As a result, all villages occupied from this time until the period of direct and sustained Euro-American contact have been assigned to the Post-Contact or Protohistoric period. Cultural developments in the Knife region are the same as in Period 9 because the Willows phase spans both Periods 8 and 9. There was a moderate increase in population during this time among the Hidatsa in the Knife region and a large growth among the Arikara in South Dakota (see Ahler, 1993b:88; Owsley, 1992:83). In the Grand-Moreau region, the long standing villages of Anton Rygh and Swan Creek remained occupied (Figure 39). Three other Le Beau phase villages were established during this period: Bamble, Larson, and Steamboat Creek (Figure 37b,e). All have thick midden deposits, suggesting relatively intense and/or long-term occupations. There also is evidence to suggest that different parts of Anton Rygh, Swan Creek, and Larson were occupied at partially overlapping but somewhat different times. The Larson site appears to have contracted through time, as indicated by its double fortification ditch on its north end (Figure 37e). The actual time span of the Mobridge site is unknown because the ceramic assemblage could not be segregated into components. Given the thickness of deposits at the site, it appears to have been occupied throughout several periods, probably back into the previous 50-year interval. All of the Le Beau phase communities were fortified, some with multiple ditches erected during different times. These villages perhaps competed as middlemen in the lucrative trade for Euro-American goods and fur pelts brought in by various nomadic peoples (see Lehmer, 1971:164–172). Another source of conflict could have been incursions by the nomadic Dakota, who were increasing their presence on the Great Plains as a result of their quest for bison, increasing trade opportunities, and conflicts with the Ojibway in Minnesota. A reduction in the exploitation of nonlocal, chipped-stone resources, with a concomitant increase in local lithic materials at the Anton Rygh and Larson sites, was perhaps a reflection of the reduced mobility of these villagers caused by hostilities from nomadic groups (C. Johnson, 1984b:299). Increased sedentism resulting from more trade opportunities cannot be ruled out. Whatever the case, it is unusual that the villages to the north, in the Knife region, and those to the south, in the Bad-Cheyenne and Big Bend regions, remained largely unfortified.

The Sully site maintained its dominance in the Bad-Cheyenne region during the early Protohistoric period

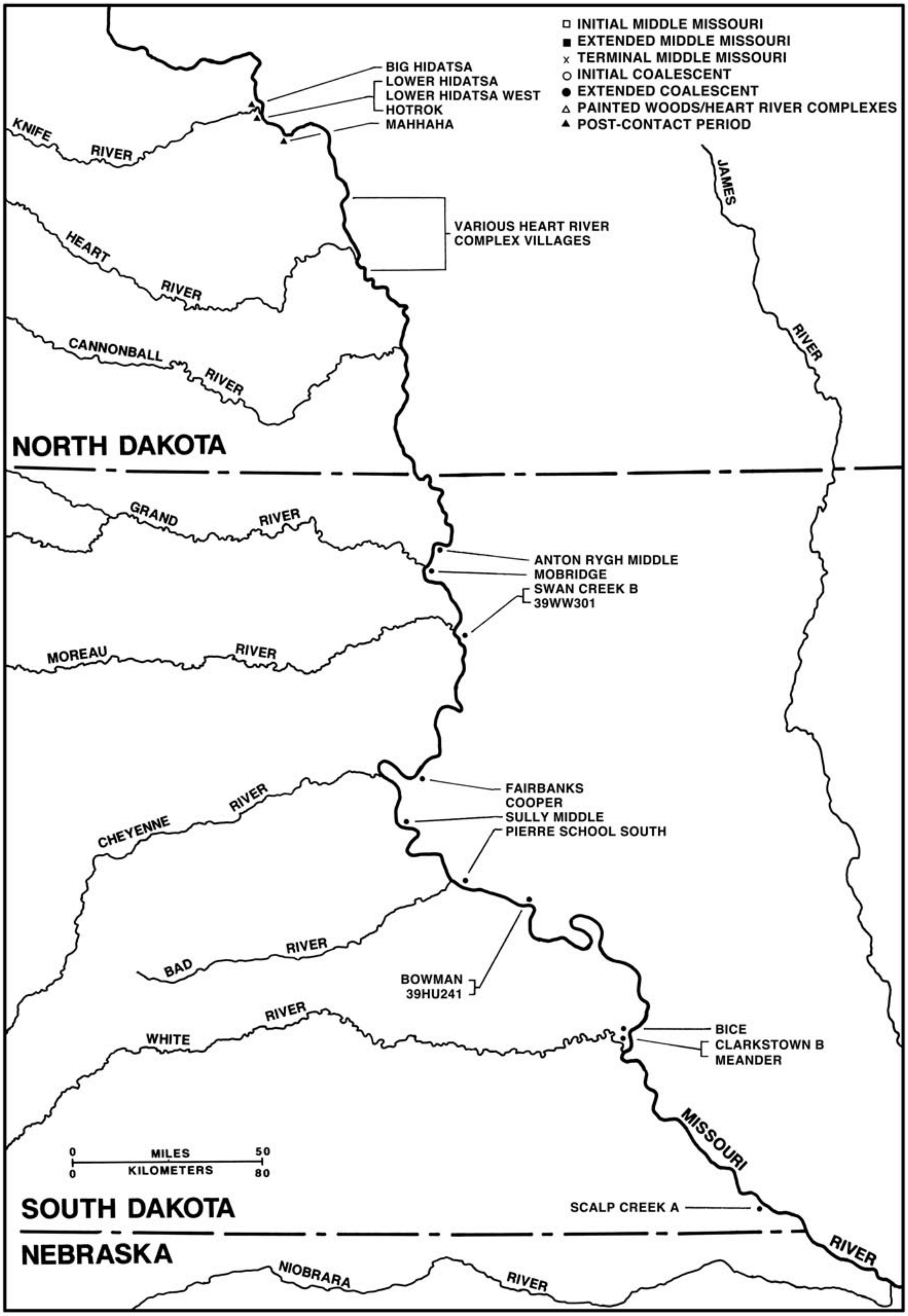

FIGURE 38. Distribution of Plains Village components within the Middle Missouri subarea during Period 8 (AD 1600–1650).

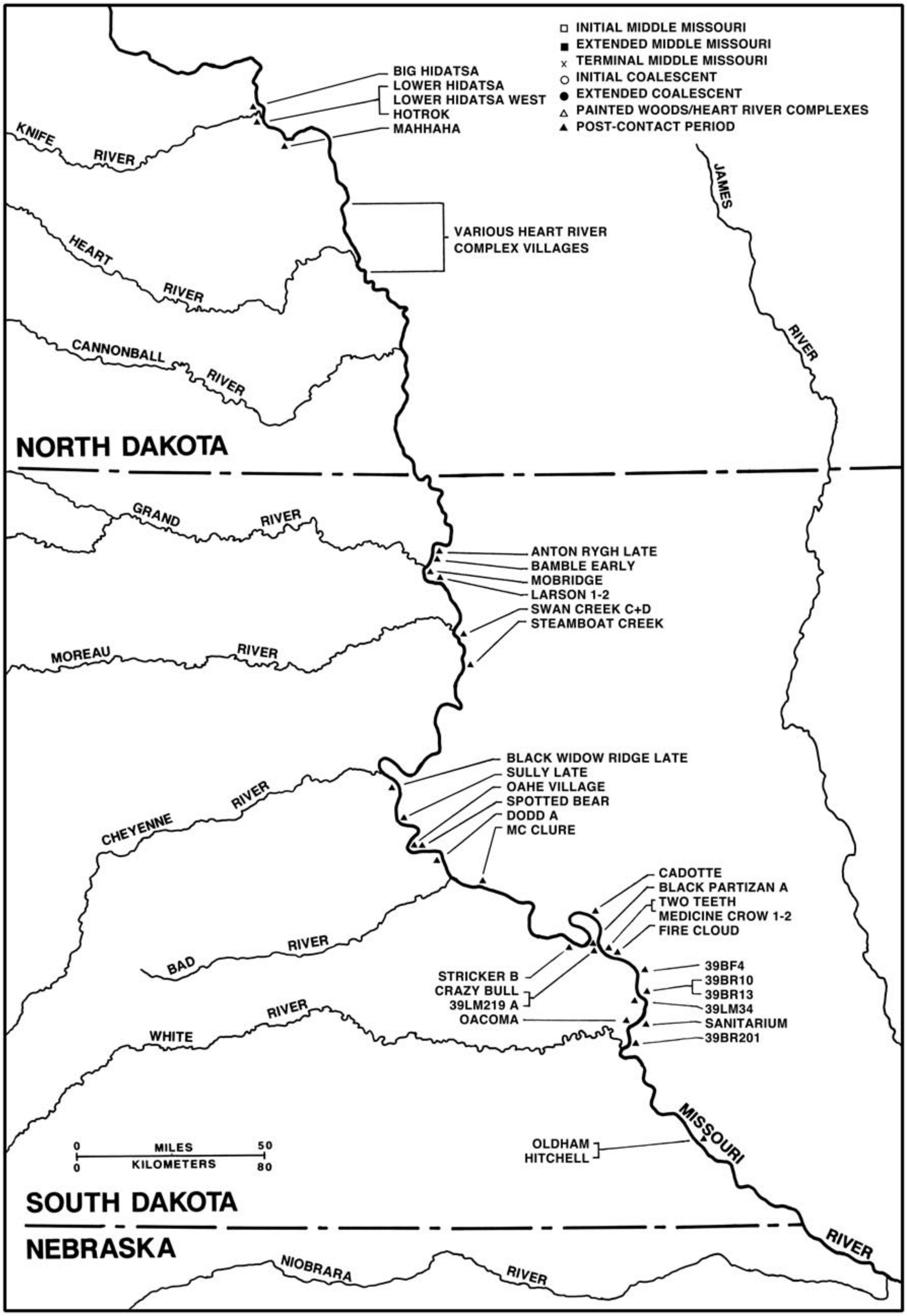

FIGURE 39. Distribution of Plains Village components within the Middle Missouri subarea during Period 9 (AD 1650–1700).

(Figure 32c). This period witnessed the establishment of four additional villages in the region, namely, Black Widow Ridge (Figure 40c), Dodd, Spotted Bear, and Oahe Village. The information suggests that Dodd, Spotted Bear, and Oahe Village have ceramic affinities with Sully. Dodd (Figure 24e) and Oahe Village (Figure 40d) were probably occupied at the onset of Period 9, whereas Spotted Bear and Black Widow Ridge were established at the end of the period. Lacking any suitable precursors to Dodd, Oahe Village, and Spotted Bear, it is suggested that they represent former Sully residents who established (or reestablished) their own semi-autonomous communities. The occupants of Black Widow Ridge may have come from Sully, but more likely were descendants of early Bad River phase communities such as Dodd. The reasons for this postulated budding process from Sully are unknown. Four possible scenarios relate to reaching the carrying capacity of the Fielder Bottoms where Sully is located, an overwhelming desire to re-establish independent villages, the desire to participate more fully in the growing fur trade, and/or a cessation of hostilities. The middle reaches of the Big Bend region witnessed a short-lived but distinctive cultural development in the Felicia phase. Although somewhat diverse in their ceramic assemblages, all sites assigned to the phase share common elements that set them apart from the earlier Extended Coalescent communities. This commonality was probably engendered by their physical proximity to one another; most sites (Cadotte, Two Teeth, Black Partizan, Crazy Bull, 39LM219) are located at or near the neck of the cul-de-sac in the Big Bend region. Not all of the villages were occupied during the entire 50 years of Period 9, for they have relatively light debris densities and lack superimposed houses. Later in this period, the Felicia phase villages developed into the communities of the Talking Crow phase, such as Medicine Crow and Fire Cloud. Additional descendent Talking Crow communities of the Felicia phase or other late Extended Coalescent peoples occupied areas near the White River and farther to the south on top of earlier Great Oasis occupations (Oldham, Hitchell). This is the most likely time of a relationship between the Arikara and Pawnee, for there are a number of early Skidi Pawnee villages occupied at this time, such as Burkett, Wright, Phil Cuba, Larson, and Monroe (O'Shea, 1989, table 2). The next period witnessed the abandonment of the Talking Crow villages in the southern reaches of the Big Bend region, leaving only those near the cul-de-sac to continue the Plains Village presence at the southern-most periphery of the Middle Missouri subarea.

Period 10 (AD 1700–1750)

Three villages (Big Hidatsa, Lower Hidatsa, Mahhaha) that were occupied in the previous period continued into Period 10 (Figure 41). All were unfortified. Two fortified sites, Molander and Nightwalker's Butte, were established during this time. All five sites are included within the Minnetaree phase (AD 1700–1785). One site, Nightwalker's Butte, probably represents a dissident Hidatsa group. The Awatixa Hidatsa occupied the Lower Hidatsa site, whereas Big Hidatsa continued to be a Hidatsa-proper community. The Awaxawi Hidatsa lived at Molander for at least part of this period (Figure 31e). It was during this time that the various subgroups of Hidatsa grew in number and consolidated their common identity as Hidatsas. It also was a period of increasing direct and indirect Euro-American contact, epitomized by the explorations of the La Verendreys, who visited the Mandan and Hidatsa in the Knife and Heart region, and the Arikara in the lower Bad-Cheyenne region, beginning in AD 1738. Near the end of this period, the horse and gun frontiers met at the Middle Missouri subarea (Thiessen, 1993a:34), intensifying the middleman trading status of the Mandan, Hidatsa, and Arikara and the flow of Euro-American trade goods and furs. Increasing conflicts between the Hidatsa and nomadic groups, such as the Dakota, appear to be reflected in a decline in the exploitation of bison and nonlocal chipped-stone resources (Ahler and Toom, 1993:230–231; Ahler et al., 1993:270). A somewhat similar lithic exploitation pattern occurred in the previous period in the Grand-Moreau region at the Anton Rygh and Larson sites.

This period was a time of population decline of Le Beau peoples and an increase in Bad River populations. The number of Talking Crow phase peoples apparently remained the same from the previous period. A total of at least 24 villages were occupied, but most likely not at the same time. If other sites not included in the ceramic ordination fall within this period, the total could approach the 40 villages mentioned by Etienne Veniard de Bourgmount in AD 1714 (Chomko, 1986:64; Norall, 1988:110) and the 32 Arikara communities noted by Truteau in AD 1795 (Nasatir, 1952:299). The Le Beau phase villages of Mobridge and Anton Rygh were abandoned during this period, ending the lengthy occupation of the latter site. In their place, Spiry-Eklo was established. It is unclear if this community represents the descendants of Anton Rygh and/or Mobridge. Spiry-Eklo could represent a reestablished Larson population, driven from its village by a violent confrontation, for it is near this site and immediately

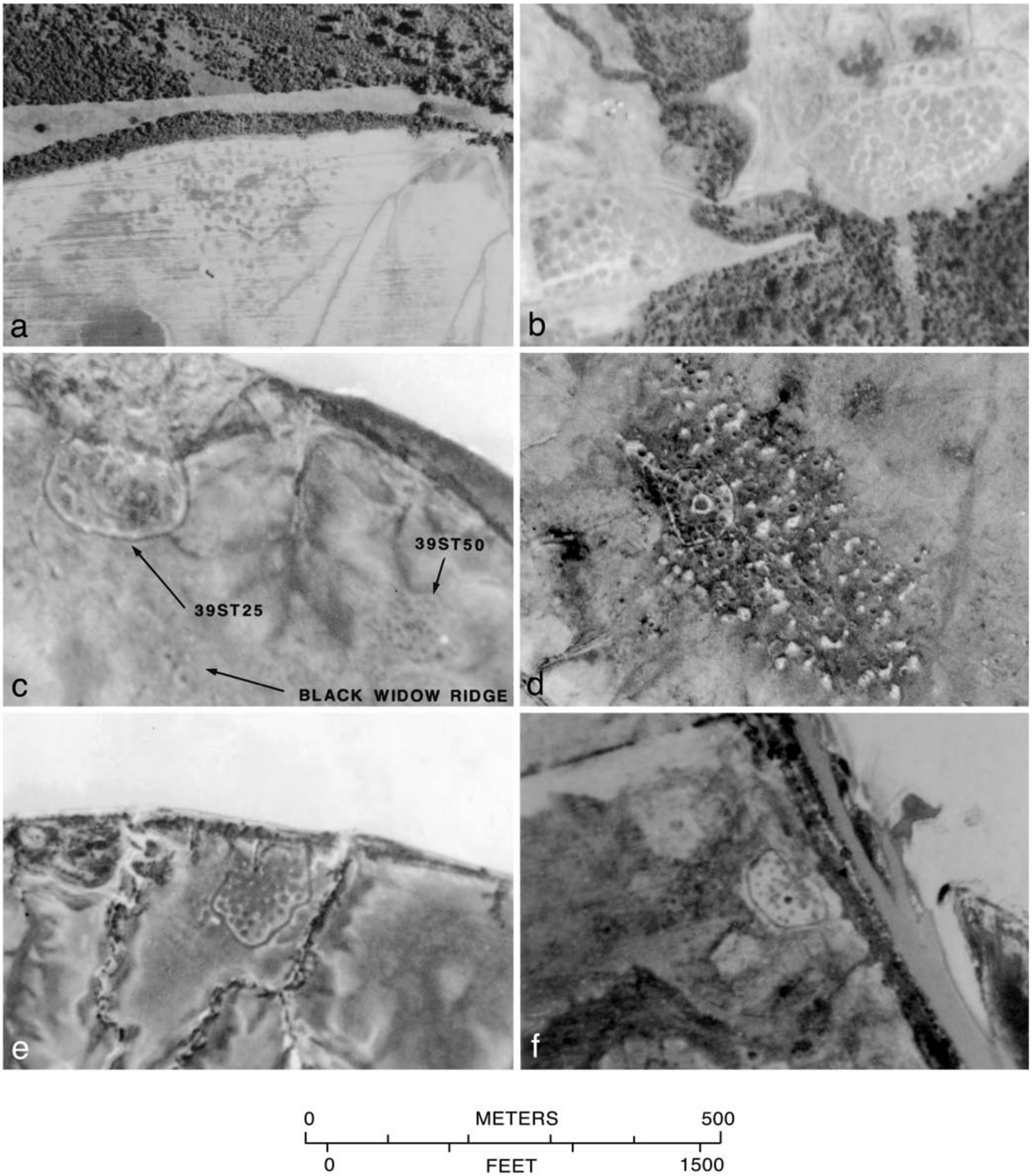

FIGURE 40. Aerial photographs of post-contact period sites: a, Greenshield (occupied by Mandan and Arikara); b, Leavenworth (portion of western village not in image); c, 39ST25 (fortified village partially slumped in Missouri River) and 39ST50 (some houses of Black Widow Ridge site in lower left of image); d, Oahe Village (middens appear as light areas); e, Buffalo Pasture; f, Phillips Ranch.

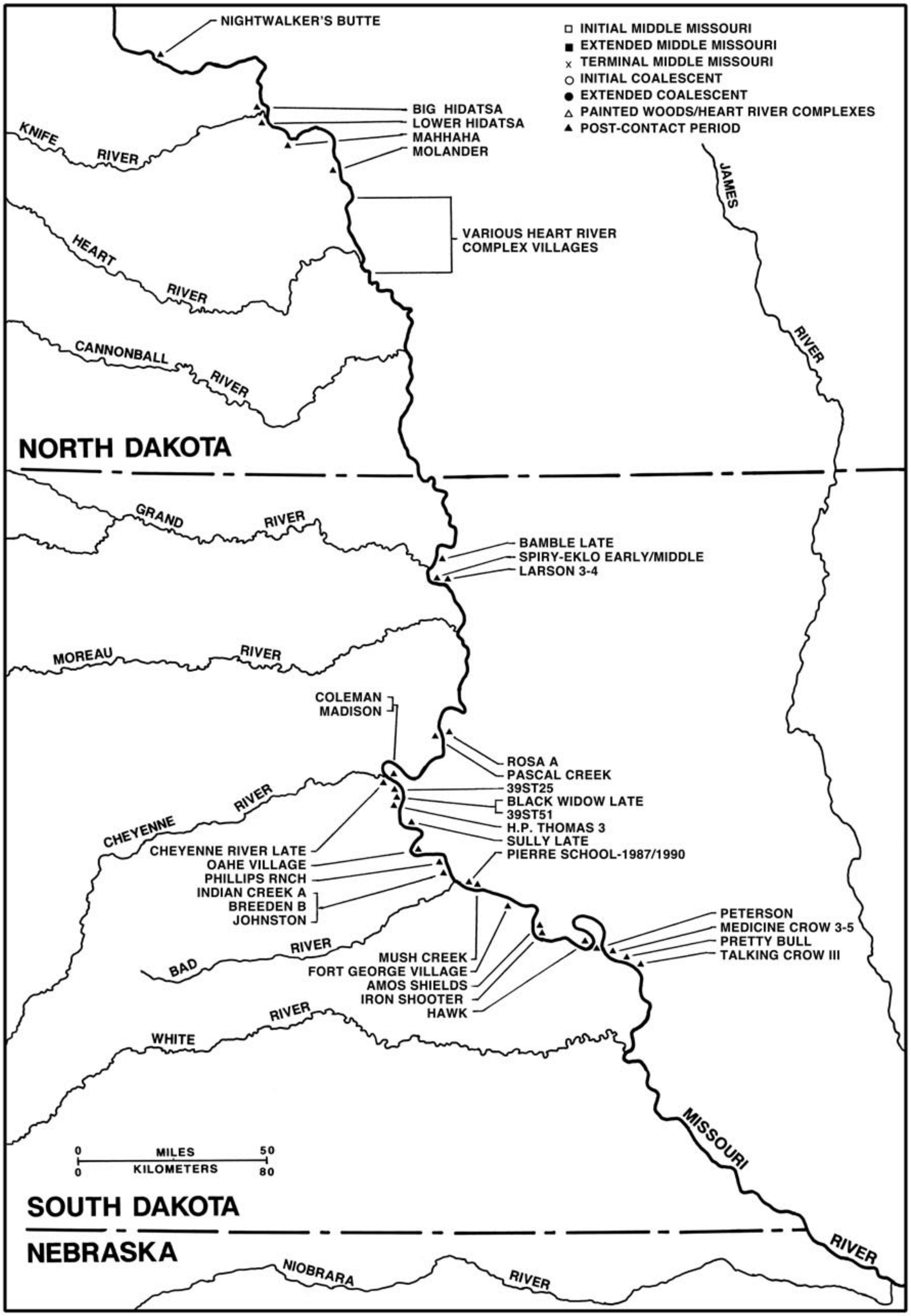

FIGURE 41. Distribution of Plains Village components within the Middle Missouri subarea during Period 10 (AD 1700–1750).

post-dates it. Cord-impressed microstylistics indicates that Larson, Anton Rygh, and Mobridge are very similar. They may have been occupied sequentially by the same village group or interacted to a high degree. The fortifications around these villages attest to continuing conflict with unknown groups in the locality, violence that appears to extend back almost 200 years with the establishment of Anton Rygh. Larson and Bamble were abandoned by the end of Period 10, only to be succeeded by the late component at Spiry-Eklo and Red Horse Hawk.

The Bad River and Le Beau phase villages in the Bad-Cheyenne and upper Big Bend regions also represent population maximums not seen since the establishment of early Extended Coalescent communities in Periods 6 and 7 (AD 1500–1600). Unlike most of these earlier sites, a substantial number of these late villages such as 39ST25, Oahe Village, and Phillips Ranch were fortified (Figure 40c,d,f). A number of them also appear to have been occupied for a relatively short period, perhaps about 20 years, as indicated by their thin sheets of refuse and lack of superimposed structures. Two exceptions were Oahe Village and Sully. The former site has a relatively thick refuse deposit and a small central portion of houses surrounded by a fortification ditch (Figure 40d). It may have been occupied for at least 75 years, beginning in the previous period. The Sully site, containing a large number of superimposed houses, was abandoned during the first half of this period (Figure 32c). Its population may have been reduced by epidemic diseases and/or dispersed to establish the nearby villages of the period. Coleman, Phillips Ranch, Oahe Village, and/or Pierre School may be likely budded villages with Sully site origins. Phillips Ranch or Buffalo Pasture, both fortified and dated about 1750, may be the villages that Francios Le Chevalier, one of La Verendrey's sons, visited in 1743 (see Chomko, 1986:65). It also is likely that there was a population decline near the end of this period, for only half the villages were occupied during the succeeding period. A likely cause of this depopulation is epidemic diseases introduced directly or indirectly by Euro-Americans.

This period also marks the florescence of the Talking Crow phase, for more than half of the large villages were occupied at this time. Only two of these communities, Fort George Village and Iron Shooter, were fortified, suggesting that the Talking Crow peoples established more intergroup relationships with outsiders than many of their Bad River and Le Beau phase contemporaries to the north. The Medicine Crow village was probably inhabited during much of this period, for it contains instances of two and possibly three episodes of house rebuilding (Figure 35a). The equally large Peterson site could be the antecedents or descendants of Medicine Crow (Figure 35b). Amos Shields and Fort George Village date to the end of the period (Figure 35c,d). Fort George may represent the remnants of a number of Talking Crow communities decimated by Euro-American–derived epidemic diseases, for only a few villages were inhabited in the following period. The Amos Shields and Breeden sites are other late Talking Crow communities located upriver from the majority of these villages (Figure 35c).

Period 11 (AD 1750–1785)

The villages occupied during this time in the Knife region are unchanged from the earlier period because both Periods 10 and 11 encompass the Minnetaree phase (Figure 42). The event that is used to terminate this period is the devastating smallpox epidemic of 1780–1781, which decimated the Mandan, Hidatsa, and Arikara. The Hidatsa occupied a number of fortified villages in the period after the epidemic, and the Heart River Mandan abandoned their communities for ones farther to the north. During Period 11, three villages were occupied in the Grand-Moreau region (Red Horse Hawk, Spiry-Eklo, Blue Blanket Island). Spiry-Elko was finally abandoned during this period, after a relatively short existence of about 50 years. Red Horse Hawk was abandoned at the beginning of this period, along with Four Bear and Artichoke Creek. The reasons for this are unknown, although it may have been attributable to the smallpox and measles epidemics in 1734–1735 and 1750–1752 (Trimble, 1989:50, 1993, table 15.4). It is possible that these four villages mark the beginning of the 1780–1781 epidemic and that the dating parameters used in chapter 6 are somewhat in error. The Red Horse Hawk site is similar in typological and microstylistic ceramic content to Nordvold I. On this basis, Nordvold I represents the logical choice for a relocated Red Horse Hawk population (Figure 37c,d).

The Bad-Cheyenne region contained seven villages during this period. All but one, Buffalo Pasture, was unfortified, and most were Bad River phase settlements. Buffalo Pasture has ceramic affinities to Coleman and may represent the descendants of that community (Figure 40e). Blue Blanket Island, a fortified island site located far to the north in the Grand-Moreau region, is linked by ceramics to the Bad River phase villages rather than the local Le Beau phase communities. It probably represents a small group of people who decided to abandon the Bad-Cheyenne region and move to the north. This site, in addition to a number around the confluence of the Cheyenne and Missouri Rivers, were documented about AD 1800 by

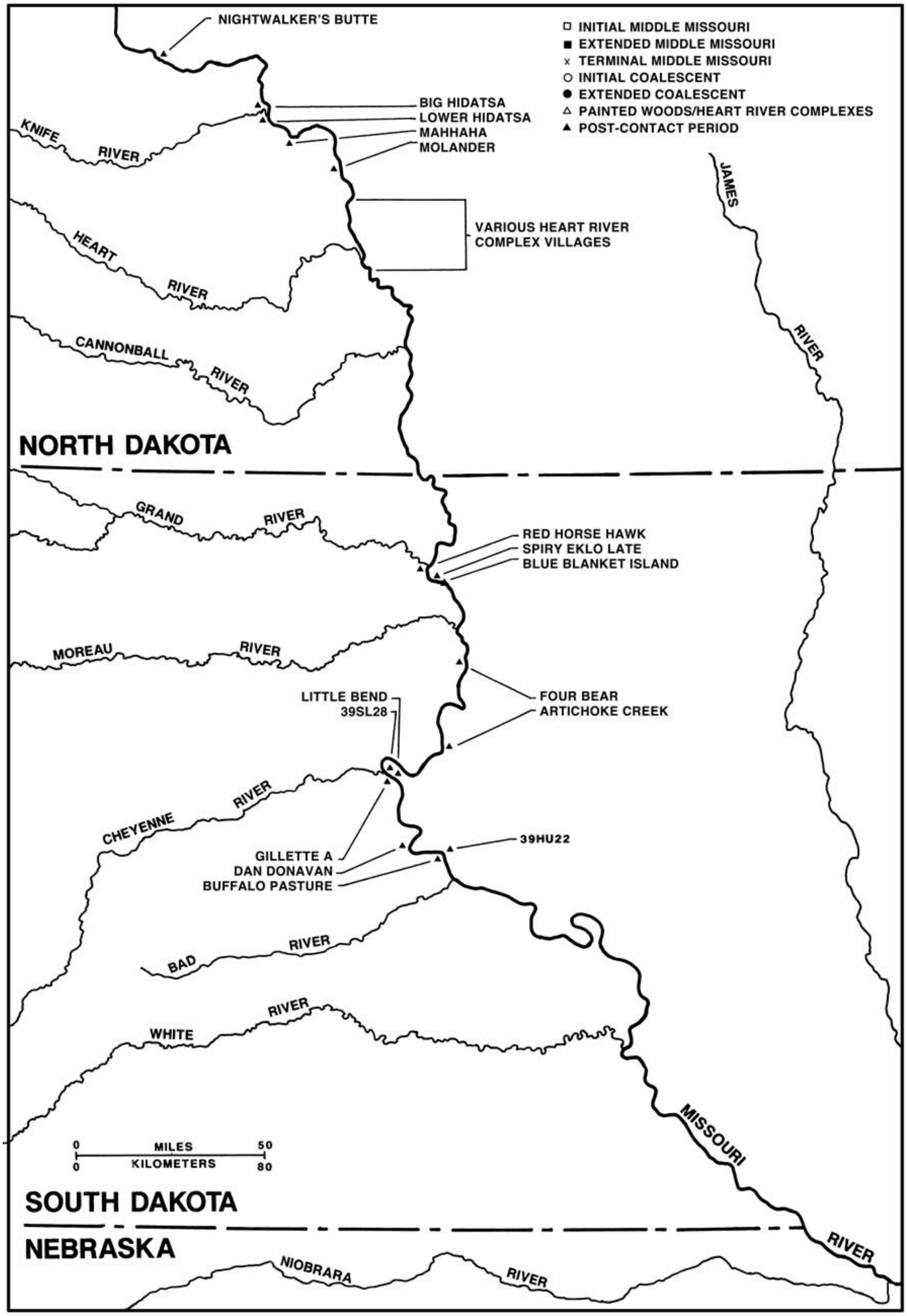

FIGURE 42. Distribution of Plains Village components within the Middle Missouri subarea during Period 11 (AD 1750–1785).

a number of Euro-American explorers, including Lewis and Clark (Chomko, 1986; Lehmer and Jones, 1968:92–94). Gillette (Figure 24c) is another late site in the region. The 11 sites occupied in South Dakota during this period are similar to the ones documented by Lewis and Clark in 1804 (Lehmer and Jones, 1968:94).

Another site that has microstylistic ceramic affinities to the Bad-Cheyenne sites, particularly Buffalo Pasture, Sully, and Coleman, is Biesterfeldt. This is a postulated protohistoric Cheyenne village located on the Sheyenne River in eastern North Dakota. It was probably occupied at about AD 1725. This date is somewhat at variance with the dating of Buffalo Pasture (AD 1750–1785) but closer to Coleman (AD 1700–1750). Biesterfeldt's ceramic microstylistics also links it with the Rosa site (AD 1700–1750) and the earlier Steamboat Creek site (AD 1650–1700). Biesterfeldt's ties to the Bad-Cheyenne villages make the case for a southern origin of the peoples who occupied it rather than a northern orientation as Wood (1971:51–68) suggested. During the early part of the following period, one village (39ST50) remained in the Bad-Cheyenne region.

Probably more than any other protohistoric group of peoples in the Middle Missouri subarea, those belonging to the Talking Crow phase suffered the greatest depopulation during this period. Of the nine communities inhabited in the previous period, none remained. Some could have withdrawn upriver and consolidated with Bad River peoples. It is more likely that the remnant Talking Crow villagers lived together in one or a few villages that have been identified as part of the Bad River phase, as their material culture (i.e., pottery) was gradually becoming more like the Bad River peoples of the previous period. Hoffman and Brown (1967:334) discussed the general northward movement of the protohistoric Arikara. This depopulation could have been the result of Euro-American–introduced contagious diseases before the 1780–1781 smallpox epidemic.

Period 12 (AD 1785–1830)

This period, corresponding to the Roadmaker phase, can best be described as a time of reorganization following the smallpox epidemic of 1780–1781. The Mandan, Hidatsa, and Arikara, who were decimated by this event, consolidated, relocated, and fortified their villages (Figure 43). The Mandan abandoned the Heart region and moved to the Knife region, establishing three independent villages at Fort Clark, Deapolis, and Black Cat (Figures 31f, 35f). All except Black Cat were occupied into the following time period. They sought mutual protection with the more numerous Hidatsa. At this time, their material culture was virtually indistinguishable from that of the Hidatsa, who become the dominant group of the region during the Roadmaker phase. This also was a time when direct and sustained Euro-American contact was established. Alexander Henry the Younger (Gough, editor, 1988), and David Thompson (Tyrrell, 1916) documented life in the Mandan and Hidatsa villages.

More than any other event, the Lewis and Clark expedition of 1804–1806 opened the Missouri River to many explorers, adventurers, and thrill seekers who soon followed. This expedition documented many of the Mandan, Hidatsa, and Arikara villages occupied at the time, as well as a number of abandoned ancestral ones (Chomko, 1986; Moulton, 1983; Thwaites, editor, 1969). The expedition also collected valuable information on the lifestyles of the Plains Indians. As a result of these and other contacts with Euro-Americans, the native technologies of the Missouri River villagers, particularly in the areas of bone and chipped-stone tools, were greatly transformed. A reduction in these tools was not matched by ground-stone artifacts and ceramic pots, which continued to be made and used in large quantities because they lacked suitable Euro-American replacements.

Early in this period, about AD 1795 to AD 1798, the Arikara occupied the Greenshield site in the Knife region (Figure 40a). All of their villages, including Chapelle Creek and 39ST50 (Figure 40c), in South Dakota were probably abandoned and consolidated at this northerly location. After leaving Greenshield, the Arikara lived at the Leavenworth site from about AD 1798 to AD 1832 (Figure 40b). Other communities, including Ashley Island and Lahoo-catt, were probably established at this time. Neither site was ever located by archeologists because of their floodplain settings. Fire Heart Creek may represent one of the Arikara hunting camps documented by the Lewis and Clark expedition in 1804. The Arikara abandoned Leavenworth in 1823, when they came under siege by the U.S. Army led by Colonel Henry Leavenworth. They returned shortly thereafter, only to abandon it finally in 1832. From there, the Arikara left the Missouri River, spending the next five years leading a nomadic life and living with their Skidi Pawnee kinsmen on the Platte River in Nebraska. In 1838 they established themselves at Fort Clark, abandoned a year earlier by the Mandan.

Before the beginning of this period, the Hidatsa communities of Molander, Mahhaha, and Nightwalker's Butte were abandoned. Four main Hidatsa villages were occupied during this time. These include Big Hidatsa, established several hundred years before, and the newly formed villages of White Buffalo Robe, Buckfink, Sakakawea, and

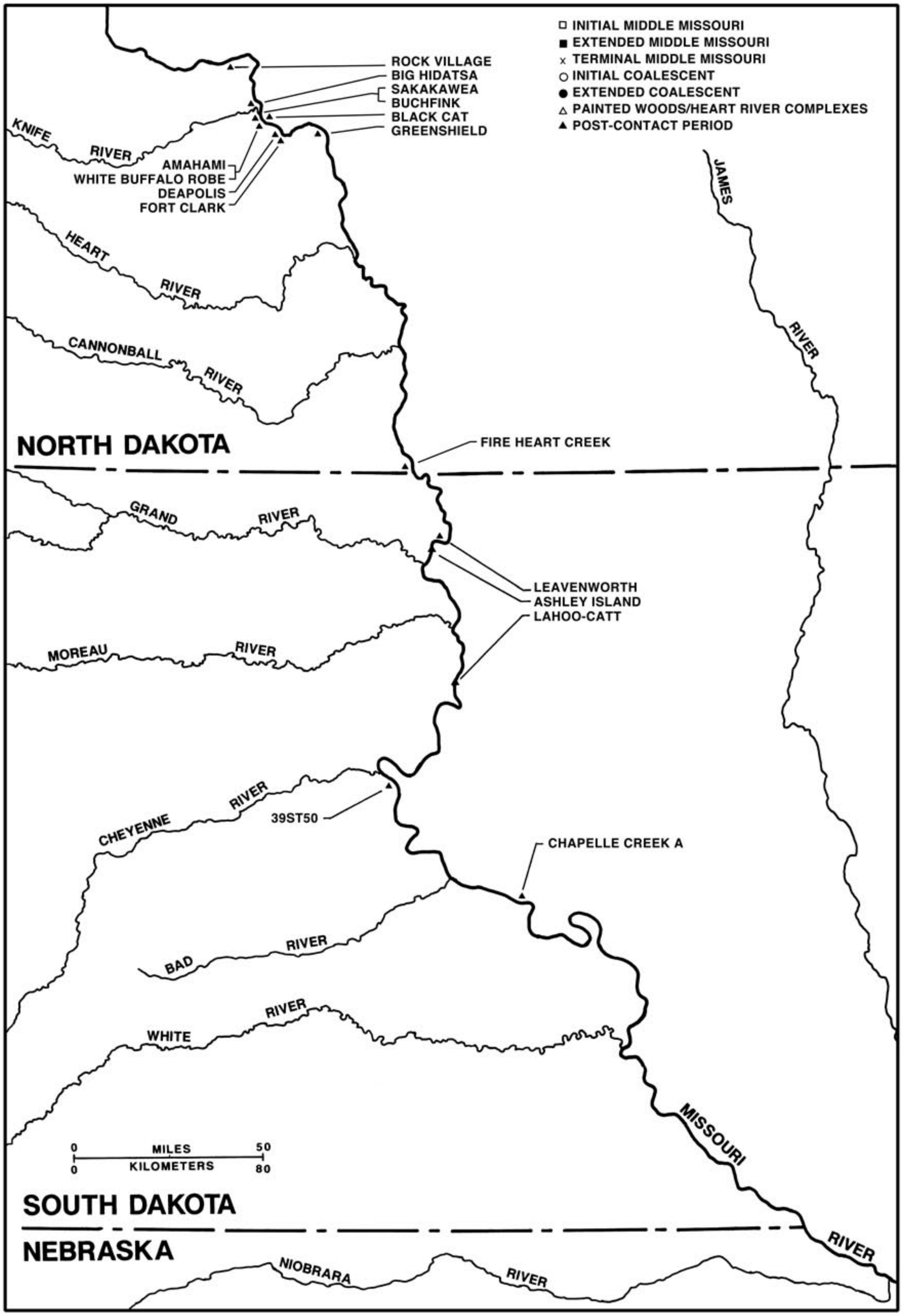

FIGURE 43. Distribution of Plains Village components within the Middle Missouri subarea during Period 12 (AD 1785–1830).

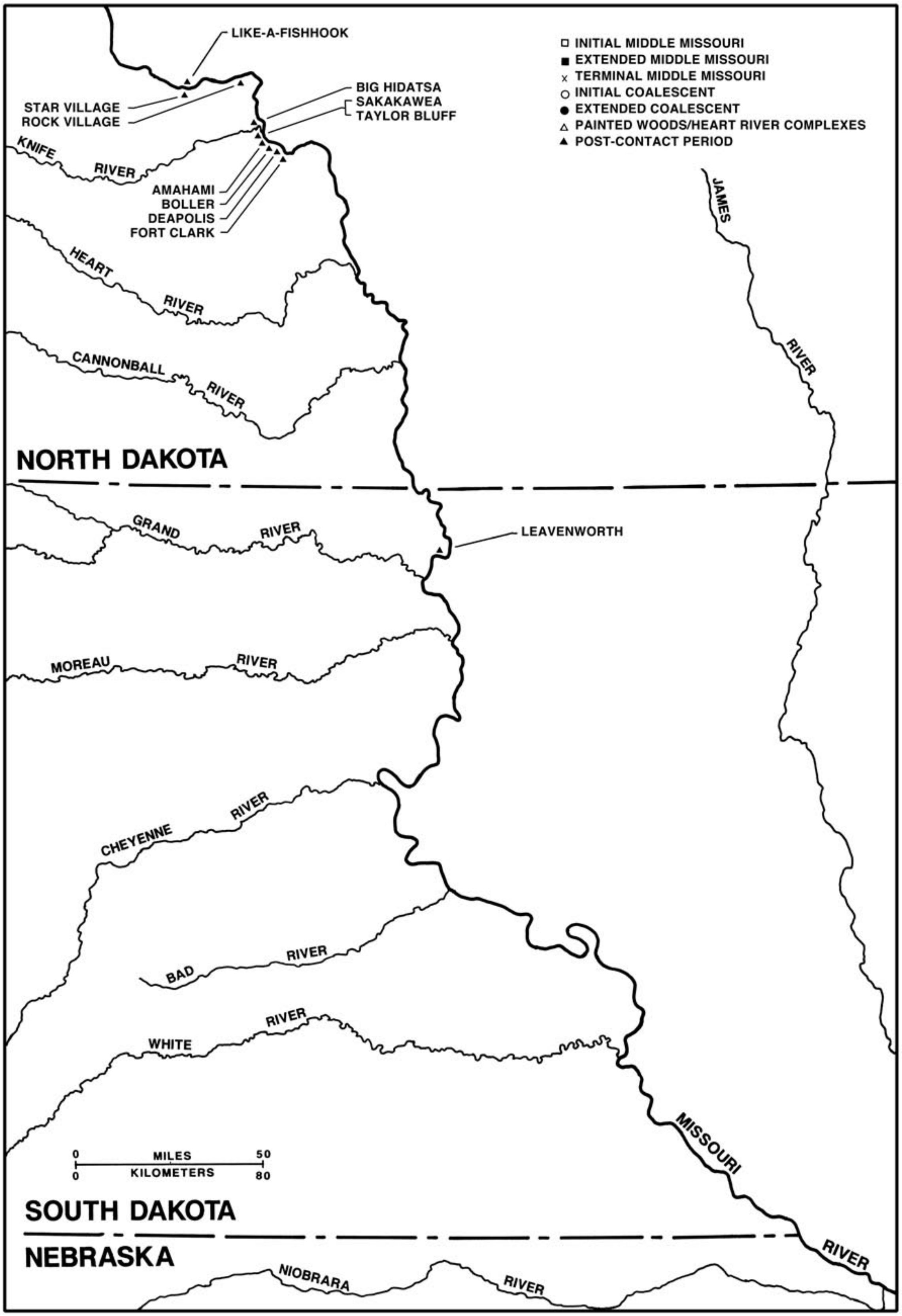

FIGURE 44. Distribution of Plains Village components within the Middle Missouri subarea during Period 13 (AD 1830–1886).

Rock Village (Figure 31c). Although there was a consolidation of Hidatsa villages during this period, there also is evidence to suggest that they maintained their three subgroup identities. The end of this period was marked by the establishment of American Fur Company trading posts on the upper Missouri, making direct trade with the Native Americans in the area a reality (Thiessen, 1993a:39–41).

Period 13 (AD 1830–1886)

This period corresponds to the Four Bears phase defined for the Knife region. Except for the Leavenworth site, occupied only during the first few years of this period, the entire length of the Missouri River in South Dakota was abandoned by the Arikara (Figure 44). Rock Village, Big Hidatsa, Amahami, and Sakakawea remained as Hidatsa communities, whereas the Taylor Bluff site was established by an unknown subgroup of Hidatsa. Two previously occupied villages, Deapolis and Fort Clark, continued to be inhabited at this time (Wood, 1993c). A third Mandan village, Boller, also was established. The 1837 smallpox epidemic further reduced the Mandan, Hidatsa, and Arikara populations by as much as 50% to 85% (Trimble, 1994:83–84). The American Fur Company built posts on the upper Missouri shortly before the beginning of this period, increasing the flow of trade goods to the Native Americans in the area (Thiessen, 1993a:39–41). This had a dramatic effect on chipped-stone technologies, reducing or eliminating many traditional tool forms. Bone and ground stone tools continued much as in the past, particularly early in this period. During the first years of this period, various European explorers documented Plains Village life ways through their writings and drawings, including Catlin (1965), and Maximillian and Bodmer (Thomas and Ronnefeldt, 1976; Thwaites, 1966).

Period 13 also was a time of chaos and reorganization of Mandan, Hidatsa, and Arikara villages as the result of epidemic diseases and intense military pressure from nomadic Plains Indians. The Mandan occupied Fort Clark until 1837, when they probably joined others at Deapolis, which had been settled about 1787. By 1856, they joined other Mandan and Hidatsa who established Like-a-Fishhook Village at Fort Berthold in 1845. The Amahami and Sakakawea sites burned in 1834, their Hidatsa residents relocating to other villages, perhaps Big Hidatsa and Like-a-Fishhook. Big Hidatsa was abandoned about 1845, and its residents moved to Like-a-Fishhook. After living at Fort Clark from 1838 to 1861, the Arikara established their last independent community, Star Village, in 1861. It was abandoned one year later in favor of residence with the remaining Mandan and Hidatsa at Like-a-Fishhook. The consolidated village of the three affiliated tribes was abandoned in 1886, bringing to a close a 900-year legacy of Plains Village life on the Northern Plains.

8 Future Research

Perhaps the most important lesson that can be learned from this study is that additional research needs to be done before a high degree of confidence is given to the chronological placement of many Middle Missouri Plains Village sites. This study began with a belief that many components could be placed within absolute chronological sequences by radiocarbon dating of short-lived materials linked to ceramic ordinations. The reality of limited amounts of short-lived datable samples from most sites, many unreliable preexisting dates, radiocarbon calibration curve "wiggles," and ceramic variation caused by factors other than time, leads to some uncertainty in the dating process. In this sense, this study can be viewed as another tool to select additional samples for radiocarbon dating and to suggest refinements in ceramic ordination and other dating techniques by focusing on particular sites or methods of analysis. The chronologies can serve as hypothetical reconstructions, requiring additional analyses to test the proposed relationships between villages. The results of this study also may be used in selected studies of culture process, particularly for those sites that are most firmly dated. Some future studies of this kind and other research topics are presented later in this chapter. The following discussion briefly reviews certain chronological issues for each taxonomic unit, what can be done to resolve these problems, how their resolution can aid in the study of culture process, and other topics for future research. The emphasis is on work in South Dakota and southern North Dakota. Ahler and Thiessen (1993) discussed research topics from the perspective of Hidatsa archeology.

CHRONOLOGICAL ISSUES

Great Oasis

The results of the analysis of Great Oasis components defined for the first time the relationships between 12 ceramic assemblages. There is a strong spatial component in the variation of Great Oasis pottery, first suggested by Henning and Henning (1978:15). This study quantifies these differences and indicates that there also may be temporal variation that partially crosscuts these spatial variations. The evidence for this is not clear, however, because half of the components lack radiocarbon dates. This is particularly true for the Missouri River sites (e.g., Hitchell and Oldham). Lacking dates from these sites, the Great Oasis chronology must be considered tentative in nature. Radiocarbon dates support a time span of 300 years, between AD 950 and AD 1250. Additional dates should be run on samples from sites that have relatively large assemblages. These samples will have to come from extant collections; selected small-scale excavations at other sites also is needed to secure additional samples, preferably from short-lived botanical remains. Substantial progress in establishing a Great Oasis chronology has been made by Lensink and Tiffany (1999).

Future research on Great Oasis chronology can focus on a variety of topics. First and foremost is the need to complete site reports on a number of Great Oasis components. Most of the Great Oasis components (i.e., Broken Kettle West, Great Oasis, Oldham) are not fully reported, leaving other archeologists in a position of not being able to make independent evaluations of the plethora of material written on the topic. Gibbon (1993:182) made a similar call for the completion of reports of Initial Middle Missouri sites in Minnesota. With new methods and perspectives of analysis of ceramics, lithics, and faunal materials, extant collections from many Plains Village sites can be used to frame regional questions within problem-oriented archeology that would facilitate the completion of these reports. Important multicomponent sites, such as Oldham, cannot be dated without knowing the context from which radiocarbon samples were drawn. This is part and parcel of the dating of any multicomponent Plains Village site, an all to familiar situation in Middle Missouri archaeology. A full reporting of all excavated Plains Village sites is an important first step in using these sites to build chronologies.

Locating and excavating additional Great Oasis sites will not only facilitate the development of regional chronologies, but it may provide the data to define subgroups of Great Oasis peoples and to reconstruct the movements and interactions of various village groups. Large-scale excavations at the Cowen site in northwestern Iowa (Anderson, 1995) will provide valuable insights into these and other problems. The analysis of ceramics employing an attribute approach is a necessary prerequisite, along with absolute dating techniques, to answering these temporally related questions (see Edwards, 1993). In this regard, relatively large ceramic assemblages may be required, perhaps on the order of 50 or more vessels from each site.

Initial Middle Missouri

The available radiocarbon dates support an interval of 300 years for the Initial Middle Missouri, between AD 1000 and AD 1300. This eliminates 200 years from the span of the variant (AD 900–1400) as proposed by Lehmer (1971, table 2). The present study indicates that much of the ceramic variation between Initial Middle Missouri villages is the product of differences between contemporaneous social groups or bands. This variability probably reflects the multiple Late Woodland origins of these villagers. Consistent ceramic change through time occurred independently within four or five localities and the trajectory of this variation seems to be different for each one. This means that to develop a chronology for the Initial Middle Missouri sites on the Missouri River, independent temporal sequences for each locality must be developed. This makes chronology building for the Initial variant particularly difficult, for many more components need to be dated by absolute techniques compared with other taxonomic units. Ceramic ordination can be used to supplement the absolute dating of components.

The first step, then, in refining the chronology developed in this report is to date select villages within each of the four regions or localities along the Missouri River (Bad-Cheyenne, upper Big Bend, Lower Brule, lower Big Bend). Two undated AMS samples selected for inclusion in the present program, from the Jandreau (39LM225) (PVD-15) and Pretty Head (39LM232) (PVD-54) sites, should be considered in any future dating effort. Other sites, such as those assigned to the Lower James, Cambria, Brandon, and Mill Creek phases, also need to be radiocarbon dated. Because many of these sites are unreported or inadequately described, site reports that would put any dates in context also are a priority. The paucity of short-lived datable materials expected from most of these sites necessitates consideration of radiocarbon dating other materials (i.e., house posts). Another option would be to secure additional botanical remains from sites not presently inundated. Almost all of these sites are located in the Big Bend reservoir. Small test excavations of features to collect these samples are the preferred method. Features could be located by geophysical techniques and cored prior to excavation. This procedure was successful in dating the Huff site (Ahler and Kvamme, 2000). If formal excavations prove to be too costly or time consuming, coring to recover a smaller sample might be an option.

Ceramic variation with the aid of attribute analysis should be defined for each locality. The key problem in this context is to determine whether the villages within each locality represent one or more bands. Detailed attribute analyses might be helpful in defining unique village patterns important in discriminating between sites occupied by different contemporaneous groups. One possible starting point is to define different decoration techniques applied to the lip and lip margins of straight rims, techniques that have largely been lumped together as tool/finger impressions in this and other studies. The form and orientation of short, diagonal, tool impressions above and/or below the main decorative pattern on S-shaped rims also might provide ways of discriminating between sites. These decorations immediately below the lip also could provide temporal information. For example, is this technique derived from Great Oasis where it is very common on decorated straight rims? In this case, the earliest sites might be expected to contain a higher number of this decoration because they would be closest in time to the Great Oasis sites. Ceramic variation attributable to other sources, such as the individual or household, is part of isolating village differences over time. Steinacher (1990) addressed some of these issues at the Sommers site (39ST56).

A second problem that needs consideration is the stratigraphic sequence at a number of sites, including Dodd, Pretty Head, and Jiggs Thompson. The field notes and ceramic artifacts from these sites need to be reexamined more closely to determine if their proposed occupational histories are justified. The apparent lack of thick middens at these sites indicates that there might not be enough temporal variation to detect changes in material culture. Other excavated sites that have substantial time depth, such as Mitchell (Baerreis and Alex, 1974), need to be analyzed from the perspective of ceramic change through time. Because most of the previous excavations at Plains Village sites have focused on the exposure of houses, other site areas were essentially ignored. This includes relatively thick middens at sites such as Sommers that might provide the stratigraphic information necessary to clarify the occupational histories at each site. Many Initial Middle Missouri sites are located outside of the Missouri River valley or have not been totally inundated by the main-stem reservoirs (Alex, 1981a; A. Johnson, 1993; Toom and Picha, 1984). This is particularly true of the Big Bend reservoir where some sites, such as Sommers, remain essentially unaffected by the operation of the dam, whereas others are being destroyed.

The third area of future research involves additional excavations at the Jones Village site (39CA3), which was mostly destroyed by the tailwaters of the Oahe reservoir and by vandals. Because its geographic location was far removed from most Initial variant sites and because of its early chronological position, this site appears to represent the northern frontier of Plains Village life. Extended Middle Missouri villages in the Cannonball region date somewhat later, and nearby contemporaneous Late Woodland sites, such as Menoken, have many Plains Village characteristics. Architectural details at Jones Village, which are poorly known, need to be explored and related to excavated houses at Menoken. Jones Village also could be an outpost village that played an important link in procuring, processing, and transporting Knife River flint from North Dakota to the southern Initial variant communities in the Big Bend and Bad-Cheyenne regions. If this is the case, southern Initial Middle Missouri sites occupied before and after Jones Village should contain significantly less Knife River Flint than those occupied at the same time. The relationship of Jones Village to other nearby and somewhat later Extended Middle villages, such as Jake White Bull and Paul Brave, needs to be clarified (see C. Johnson, 1986:1D13; Kay, 1994:27).

Finally, the relationship between the Initial and Extended Middle Missouri variants needs to be more fully evaluated. At this time, villages of both variants overlapped for 100 years during the thirteenth century. On this basis, Ahler, Johnson et al. (1995:26) suggested that the Initial Middle Missouri variant was mostly ancestral to the Extended variant, which differed from Lehmer's (1971:99) idea of independent developments. Dates from the Initial variant Jones Village site (39CA3) place it at AD 1036 to AD 1216, making it the earliest Plains Village settlement north of the Cheyenne River. Although there are some minor ceramic similarities between Jones Village and slightly later Extended variant sites such as Jake White Bull (39CO6), the relationships are still unclear. It is possible that the inhabitants of Jones Village introduced horticulture to Woodland groups in the Cannonball, Heart, and Knife regions, transforming some of the indigenous Late Woodland groups into Extended Middle Missouri Plains villagers. Additional radiocarbon dates, coupled with an intensive analysis of ceramic assemblages from Late Woodland and Plains Villages sites occupied during this period, are needed. The high amounts of incising indicate that ceramic assemblages from some Extended Middle Missouri sites, such as Sully School, have ties to Initial variant villages. A common ceramic attribute recording system must be used for assemblages of both variants. The present study, although based upon real typological differences, tends to obscure any common aspects between the two variants because they are part of separate analyses. The focus might be on straight or curved rim forms from sites of both variants that overlap in time in the thirteenth century. This question is essentially a reevaluation of Lehmer's (1971:104) Modified Initial Middle Missouri taxon, which was supported by Ehrenhard (1971:73–74) but challenged by A. Johnson (1977).

Extended and Terminal Middle Missouri

This analysis indicates that the Extended variant of the Middle Missouri tradition dates to a rather narrow range, from AD 1200 to AD 1400. This interval of time eliminates 100 to 150 years on either side of the previously accepted range for the variant of AD 1100 to AD 1550 (see Lehmer, 1971, table 2). Because of the problems with the dates from the Terminal Middle Missouri Shermer site and the lack of dates from other villages, the time span for this variant is unknown. It is clear that additional samples of short-lived material need to be dated from as many Terminal variant sites as possible. Many of these sites have not been inundated, so additional short-lived botanical remains can be excavated from features. The preferred method is to first locate features with geophysical techniques and then core the area prior to excavation. This procedure was successful in dating the Huff site (Ahler and Kvamme, 2000). If formal excavations prove to be too costly or time consuming, coring to recover a smaller sample might be an option. The Terminal Middle Missouri is believed to date somewhere between AD 1300 and AD 1500, with a range of AD 1400 to AD 1500 most likely. The ordination of Extended and Terminal Middle Missouri sites indicates that the latter villages have ceramic assemblages that differ substantially from the former ones. The radiocarbon data also suggest that the existing dating parameters of the Terminal variant, based almost exclusively upon the series of Huff site dates, may be no longer viable.

The results of the ordination of Extended variant villages indicate that gross geographic differences between sites (i.e., Fort Yates versus Thomas Riggs phases) is reflected in the variation of traditionally formulated types. The situation is much less clear when these pottery types are related to the available radiocarbon dates. What emerges is an apparent pattern that is somewhat similar to the Initial Middle Missouri wherein groups of sites within regions or localities seem to have their own trajectories of ceramic change. The trends are unclear at the moment because of either the absence of or the small number of dates from key components. Defining ceramic change through time as a method of dating larger numbers of components also seems to be limited by the homogeneity of Extended Middle Missouri ceramic assemblages, at least as this variation is reflected in traditionally formulated types. It is only during the Terminal Middle Missouri that dramatic changes, such as the increase in Fort Yates and Le Beau wares, takes place. A solution may be to explore ceramic variability at the attribute scale.

Another variable is rim form. At the present time, rim form is divided into two basic types, S-shaped and straight. There is a type of rim form, most commonly assigned to Riggs ware, which appears to be intermediate between the two main rim-form classes. That is, it is slightly to moderately convex from lip to neck, as viewed from the exterior, but it lacks the well-defined separation into two parts that characterizes Fort Yates ware. Might this represent a transitional form between the two wares that would allow for finer chronological distinctions in a potting tradition which, on its surface, is characterized by a great amount of homogeneity? Other attributes, such as vessel thickness (Rosebrough, 1994, 1995), need to be evaluated for their temporal implications.

The only solution to these chronology questions involves additional radiocarbon dates linked to a re-analysis of ceramic assemblages, using an attribute approach. Significant variation in Extended and Terminal Middle Missouri pottery is masked by the typological approach. As an example, the type Riggs Decorated Lip includes vessels decorated on the lip with finger impressions and an array of different shaped tool impressions. Differences of this kind need to be examined to determine the causes of ceramic variability within and between these villages. A brief examination of the pottery from several well-dated villages that are at both ends of a local temporal sequence is one starting point. Because of the paucity of short-lived datable materials expected from most of these sites, radiocarbon dating of other materials (i.e., house posts) might be considered as an option for sites such as McKensey, Thomas Riggs, Ketchen, and Cheyenne River (see Weakly, 1971, table 12). The best option would be to secure additional botanical remains from sites not presently inundated. A few sites in the Big Bend reservoir and others in the upper Oahe reservoir are either actively eroding or are not being affected by bankline erosion. Test excavations of features to collect these samples are the preferred method. Features could be located by geophysical techniques and then cored prior to excavation as was done at the Huff and Double Ditch sites (Ahler and Kvamme, 2000; Kvamme and Ahler, 2007). If formal excavations prove to be too costly or time consuming, coring to recover a smaller sample might be an option.

Like the Initial Middle Missouri, the description and analysis of the excavations and material content from certain sites with large extant collections needs to be completed. This list includes Ben Standing Soldier (39SI7), Calamity Village (39DW231), and a series of closely related sites in the

Bad-Cheyenne region (Black Widow Ridge, Zimmerman, Sully School). An attribute analysis of pottery from the latter three sites, including Thomas Riggs and Indian Creek, would provide not only additional data to evaluate the nature of ceramic temporal change but also might establish relationships between villages useful in determining the number of village bands present at any one time in the region.

Lacking any clear relationship between ceramic variation and radiocarbon dates, it is crucial to continue the radiocarbon dating program initiated in this study. Additional AMS dates should be run on cultigen samples from the Helb site (39CA208), particularly from loci within the middle house rows that are posited to be early within the village sequence. This would help to determine the duration of site occupation, a topic that has become somewhat controversial in the past few years.

Additional excavations at Extended and Terminal Middle Missouri villages should focus on midden deposits at sites of long occupation. A series of virtually unknown Extended and Terminal variant sites in the upper Cannonball region could be tested (Lehmer, 1971, figs. 39, 79), as they are not immediately threatened by erosion from the Oahe reservoir. The focus should be on collecting adequate ceramic and radiocarbon samples to permit their placement in the overall chronology developed for this study. This program could be patterned after the Lehmer and Wood excavations of the late 1960s in the upper Knife-Heart region. Less ambitious efforts could focus on the recovery of datable organics by means of coring or augering.

Additional analysis of the existing collections and further field investigations at the Flaming Arrow and Menoken sites need to be undertaken to understand their place in the origins of the Hidatsa and Extended Middle Missouri (Ahler and Thiessen, 1993:122). Excavations at the Initial Middle Missouri site of Jones Village need to determine if the architecture is similar to Flaming Arrow and Menoken or more like traditional variant houses to the south.

Initial Coalescent

The results of this analysis indicate that the Initial Coalescent dates between AD 1300 and AD 1500, earlier than Lehmer's range (1971, table 2) of AD 1400 to AD 1550 but in agreement with Toom (1996, table 8). Considering the ceramic ordination along with radiocarbon dates, there is general agreement between the two, with Whistling Elk and Arzberger placed at different ends of the Initial variant sequence.

Test excavations at the Arzberger site are needed to recover wood charcoal or short-lived botanical remains for radiocarbon and possibly thermoluminescent dating. This site is important in the transition from the Initial to the Extended Coalescent, and a set of dates would help to date this site that is at or near the end of the Initial Coalescent. Other less familiar and unexcavated Initial Coalescent sites also need to be dated, particularly if they have ceramic assemblages exhibiting a blending of Initial and Extended Coalescent attributes that indicate a temporal placement between either end of the Initial Coalescent sequence. Establishing a terminal date for the Initial variant and assessing its role in the formation of the Extended Coalescent continue to be critical avenues of research.

Another goal for future researchers interested in the Initial Coalescent is to reexamine all of the pottery from these sites. This may seem like a monumental task, but the limited number of components involved is well within the time frame of any moderate research effort. This analysis should be based upon attributes that permit a more precise delineation of the similarities and differences involved at the intrasite and intersite level. As with all attribute-based re-analyses of pottery suggested in this chapter, the assemblages should be laid out at the same time to facilitate the selection of significant temporal or spatial attributes.

By necessity, the Crow Creek ceramic assemblage has to be segregated into its two constitute components, if possible (Initial Middle Missouri, Initial Coalescent). This might be approached by examining contained contexts, such as pits, assigned with some degree of assurance to either component. Ideally, a revised report about the site should be written to make up for the deficiencies of the first one by Kivett and Jensen (1976). Although this may seem unrealistic, Crow Creek is one of the most significant sites in Middle Missouri prehistory by virtue of having been the scene of a large-scale massacre of Initial Coalescent peoples. A full understanding of this massacre cannot be accomplished without a reconsideration of the material remains from the village.

Related Central Plains tradition assemblages, such as those from select St. Helena, Loup River (Itskari), Smoky Hill, Nebraska, Solomon River, and Upper Republican phase sites, should be considered in any comparative analysis involving the Initial Coalescent (see Steinacher, 1983). A select number of Initial Middle Missouri components also should be examined because there are strong intervariant similarities between some types characterized by tool/finger impressions on straight rims. This ceramic study must be accompanied by additional radiocarbon dates from Initial Coalescent components. Of particular concern are those that remain undated or poorly dated, such as Talking Crow II, Black Partizan, and Crow Creek. All three have multiple components, so datable samples should be carefully selected from contained pit contexts. Additional datable samples need to be excavated from the Arzberger site to more fully establish its temporal position.

Despite the construction of the Fort Randall and Big Bend dams, many Initial Coalescent sites have not been inundated. Crow Creek, Talking Crow, and Arzberger remain essentially intact. Others such as Medicine Creek (39LM1), Arch (39HU229), and Granny Two Hearts (39HU61) are being affected by the waters of the Big Bend reservoir or by cultivation (Steinacher and Toom, 1984, table 11). Because so few Initial Coalescent sites remain accessible to archeological research, a testing program focusing on the recovery of pottery and radiocarbon samples from these poorly known sites should be initiated. Because the village plans of many of these sites are unknown, geophysical mapping would prove useful in developing maps and locating features to excavate as they have at the Whistling Elk and Double Ditch sites (Toom and Kvamme, 2002; Kvamme, 2003a, 2003b; Kvamme and Ahler, 2007). Additional samples of short-lived material for dating could be excavated by a small program focusing on features. The preferred method is to locate features with geophysics and then core the area prior to excavation. This procedure was successful in dating the Huff site (Ahler and Kvamme, 2000).

Extended Coalescent

This study suggests that the Extended variant of the Coalescent tradition is dated at AD 1450 to AD 1650, or 25 to 100 years earlier than the previous estimate of AD 1550 to AD 1675 (Lehmer, 1971, table 2). The analysis of Extended Coalescent pottery and radiocarbon dates results in a chronology that is dependent on only a few dated sites at one end of the sequence and a number of early Post-Contact period villages on the other. Most Extended variant sites fall within the period of unstable amounts of atmospheric radiocarbon, so most dates are not particularly useful in refining the chronology. Only certain early sites, such as Demery or Molstad, or those with well-controlled excavations, such as Walth Bay and Lower Grand, can be used to clarify the chronology of these sites. Molstad is a particularly good site since it is early, it has a large ceramic sample, and several areas of the site in feature 7 in the bastion still contain large amounts of charcoal (Hoffman 1967: figure 11). Given that most sites were occupied within a period of 150 years, ordinations relying on ceramic types may not be particularly useful in refining the chronologies. Assumptions about the direction and rate of ceramic change are made across several regions and over the duration of the variant for this study in what is a very homogeneous potting tradition. The variation in pottery interpreted to be temporal in nature may reflect other nontemporal sources yet to be identified.

The emphasis of any future radiocarbon dating program should focus on those sites that are suspected of having been occupied during two periods of stable atmospheric radiocarbon: AD 1400 to AD 1500 and AD 1625 to AD 1650. Because these are relatively narrow time periods, high precision dating should be considered an option. Test excavations at several suspected early Extended Coalescent villages that are not inundated, such as Molstad, Demery, Fox Island, or Meyer, are needed to recover datable material. Geophysics could be used to locate, core, and excavate features, similar to the program at the Huff and Double Ditch sites (Ahler and Kvamme, 2000; Kvamme and Ahler, 2007). A single ceramic sherd residue AMS sample identified but not run from the Sully site (39SL4) (PVD-55) might be considered as it would provide additional information, along with three undated samples from other sites (PVD-15, 54, 57), on the suspected differences between sherd residue dates and botanical/wood charcoal dates. The three sherd residue dates obtained on other sites for the present study indicate that they may be as much as several hundred years older than dates from conventional materials.

The development of the Post-Contact Coalescent Le Beau phase from its suspected origins in the Grand-Moreau Extended Coalescent villages needs to be investigated. The key to investigating this problem appears to reside in the Anton Rygh site, which was occupied for about 200 years. Linking its earliest occupational strata with certain Extended variant sites such as Spiry and possibly Lower Grand might provide the transition needed to link the prehistoric and protohistoric periods in the region. In this regard, site reports from the Lower Grand site and Strong's excavations at Anton Rygh would be useful. A re-analysis of the ceramic collection from Bower's work at Anton Rygh also is needed. Such a study also could be helpful in relating the human skeletal remains from the site's cemetery to the village. The transition between the Extended and Post-Contact Coalescent farther to the south in the Bad-Cheyenne region can perhaps be best approached through an analysis of the Sully site. The partial report of the excavations at this important site should be completed, particularly to put the human remains from its associated cemetery in their archeological context (see Lippincott, 2000). Additional radiocarbon dates need to be run on samples associated with the earliest occupations at the Anton Rygh and Sully sites to establish the link between the Extended and Post-Contact Coalescent occupations in the Grand Moreau and Bad-Cheyenne regions. These samples might be collected through test excavations when the level of Lake Oahe drops enough to expose the sites.

Further test excavations at Extended Coalescent sites would be confined to the Big Bend reservoir and the tailwaters of the Fort Randall and Oahe dams where shoreline erosion of numerous village sites is occurring. Stratified sites spanning the prehistoric and protohistoric periods, such as Anton Rygh, Swan Creek, Sully, and Oahe Village, are priorities if the waters of the Oahe reservoir drop low enough to expose them. Other sites in the Heart and Knife regions that also span this period deserve additional work, particularly the Double Ditch site (Ahler and Thiessen, 1993:123). Efforts might be directed at collecting adequate ceramic and radiocarbon samples to test the chronology developed in this study. The focus should be on sites with significant time depth and in those areas containing middens. The current low water level of Lake Oahe provides a unique opportunity to excavate stratified midden deposits at Le Beau phase sites such as Larson, Anton Rygh, Swan Creek, and Sully. There are several extant collections from sites with moderate midden deposits, such as Walth Bay and Potts. An investigation of the ceramic changes within these middens indicates very little change in traditionally formulated types. Perhaps an attribute analysis of pottery would reveal some temporal changes within these sites that is related to broader variations within the Extended Coalescent potting tradition. It is more likely that these and most other Extended Coalescent sites were not occupied long enough for any significant or detectable ceramic change to take place.

Post-Contact Coalescent

This variant dates between AD 1650 and AD 1886, which is very close to the AD 1675 to AD 1882 span proposed by Lehmer (1971, table 2). The initial date for the Post-Contact period in North Dakota may be as early as AD 1600 (Ahler, 1993b:89; Ahler and Drybred, 1993:290). The success of the ceramic ordinations of Post-Contact Coalescent components from South Dakota varies according to phase. There is a relatively high degree of confidence in the ordering of the Le Beau phase villages, mostly because of the presence of a number of sites containing long stratigraphic sequences. The absolute dates assigned to the Le Beau components are somewhat more in doubt, as there is no direct way to date them except by reference to earlier Extended Coalescent villages and sites in the Knife region. The discovery that many Heart River complex sites were continuously occupied throughout a long period suggests that the same is true for some of the Le Beau phase villages. In this sense, some of the individual time spans for the Le Beau sites are probably understated. Despite these problems, an approximation of the absolute dates of these sites is achieved. A systematic effort to analyze Euro-American trade materials from cemetery contexts can only add to the refinement of the current chronology of sites. The chronology developed for the Bad River phase is somewhat more uncertain as there are no sites containing stratigraphically related units. They are dated by reference to the Leavenworth site and to several villages included in the Le Beau chronology. The Talking Crow phase sequence is the most tenuous of all three Post-Contact Coalescent chronologies. Although the internal stratigraphy of the Medicine Crow site strongly supports the interpretation of the Talking Crow sequence, the phase's suspected duration of 50 years may not be long enough to permit enough ceramic change to confidently order components. This time span also may be too short to permit dating by other artifacts such as Euro-American trade items and metal-modified bone tools. The chronological sequence for the Knife region, however, is relatively secure, as it was based upon an integrated research strategy that focused on absolute dating, internal site stratigraphy, historic documentation, Euro-American trade artifacts, and ceramic variation (see Ahler 1993b).

An examination of Euro-American trade materials and native bone-tool technologies in the Le Beau, Bad River, and Talking Crow phases indicates that these materials do not support the chronological sequences developed herein. The reasons for this are unclear, although the extant collections of Euro-American trade items are probably badly skewed by field collections techniques that failed to recover most of the smaller artifacts. There is some correspondence between chronology and these artifacts when the latest part of each sequence is considered (i.e., AD 1750–1832). It appears that the quantity of Euro-American trade materials sufficient to affect native technologies was accessible only late in this period. There also is a possibility that the chronologies for all three phases may be incorrect or that other sources of variation are complicating the matter. Ahler (1992) suggested that other factors besides time, such as social/ethnic (subtribal) differences, played an important role in ceramic variability. He also suggested that the ceramic seriation approach, which plays such an important role in this report, may not be valid. Much of the data useful in evaluating this proposition, or for that matter the ordinations presented in this study, are not currently available in extant collections. This information is, for the most part, either destroyed, residing under the surfaces of main-stem reservoirs, or is being eroded by those bodies of water.

Future chronology research with extant collections might focus on a reexamination of metal-modified bone tools and on ways to make quantitative comparisons within and between sites based upon these artifacts. These tools are emphasized because they are relatively large and probably did not escape detection to the extent that other, smaller artifacts did. It is difficult at this time to see any merit in devoting much effort to trade artifacts in these extant collections given the nature of field techniques used in their recovery. The use of trade artifacts in this context must begin to focus on samples unbiased by field recovery techniques. This means that if any progress is to be made on this front, additional test excavations, using fine mesh screens at select sites, many of which are found along the eroding banks of the Big Bend reservoir, must be initiated. A small sample currently exists from the 1987 excavations at the Pierre School site (39HU10). The utility of using trade artifacts from extant collections in any but the most basic of analyses also must be reconsidered (see Orser, 1984; Rogers, 1990, 1993; Toom, 1979).

Another topic of interest is to explore the rates of midden accumulations in the Le Beau phase villages. This would help to estimate the time depth of these and other Arikara villages in South Dakota. Figures from the Knife River Indian Villages National Historic Site indicate that an average of 42.6 centimeters of fill develops during a period of 50 years (Table 8; Ahler, Johnson et al., 1995, table 1). The results of the present analysis indicate that this figure may be too low for the Le Beau phase villages. This conclusion of course depends on the dating parameters established for these sites, which are less precise than those of the Knife River villages. The following preliminary temporal spans and midden depths are available: Sully (4–5 feet between AD 1575–1710), Swan Creek (6–7 feet between AD 1575–1675), Anton Rygh (6 feet from AD 1590–1690), Larson (4–5 feet from AD 1680–1700), Bamble (4–5 feet from AD 1675–1740), and Spiry-Eklo (4 feet from AD 1710–1750). Taking the lower of the depth measurements and converting to centimeters, these figures are as follows: Sully (45 cm/50 years), Swan Creek (91 cm/50 years), Anton Rygh (91 cm/50 years), Bamble (94 cm/50 years), Spiry-Eklo (152 cm/50 years), and Larson (304 cm/50 years). These figures fall within the range of variation of the Knife River villages, except for the Larson site. These stratified sites that were occupied for a long time hold the key to developing regional chronologies. The currently inundated sites of Anton Rygh, Spiry-Eklo, Swan Creek, and Oahe Village should be a focus of this work in the future, should the waters of Lake Oahe recede. Excavations are most productive in village midden areas rather than within houses, as the phase I program within the Knife River Indian Villages National Historic Site aptly demonstrates (Ahler and Thiessen, 1993:123).

Attribute studies involving ceramic rim sherds might refine the regional chronologies and begin to isolate the characteristics of pots that reflect ethnic differences, much as Ahler (1988:108–119) and Ahler and Swenson (1993) have done. This may aid in estimating the number of village groups or bands responsible for the archeological sites that they left behind. Links also may be established between certain villages that were occupied by the same village group over time. The Talking Crow phase components may be the best candidates for such a study for they contain large numbers of straight rims with decorated lips from three spatially distinct groups (Oldham-Oacoma-Hitchell, Medicine Crow-Peterson-Talking Crow-Pretty, Bull-Peterson, Breeden-Amos Shields-Fort George Village-Iron Shooter). Also of interest is the status of Fort George Village. Does it represent the remnants of the Talking Crow villagers reduced in numbers by infectious diseases and hostilities with the Dakota as is suggested in this report? Or is it an outlying Bad River phase village as is commonly believed? This analysis also should include certain early protohistoric Pawnee villages in order to evaluate the hypothesis of a link between the Arikara and the Skidi Pawnee so often times cited in the literature. Other Post-Contact period villages assigned to the Le Beau and Bad River phases also may be included in an examination of Arikara ethnic divisions. Identifying villages occupied by the same bands may permit the tracing of these groups through time, resulting in refined chronologies. An evaluation of the hypothesis that the Sully site was occupied by numerous bands of Arikara might be possible if the complex site stratigraphy is clarified. Once this is done, the fate of the Sully site villagers might be illuminated. Earlier in this report, it was suggested that Sully budded off into a number of daughter villages attributable to Oahe Village (39HU2) and some Bad River phase communities.

Like the other variants discussed in this chapter, a number of Post-Contact period sites remain fully or partially unreported. The larger site collections include Anton Rygh, Oahe Village, Mush Creek, Sully, Coleman, Madison, Cheyenne River, Black Widow, Black Widow Ridge, 39ST25, 39ST50, Oldham, and Oacoma. A concerted effort should be made to complete the reports on these sites, particularly Sully, which is almost finished (see Lippincott, 2000). An effort should be made to examine ceramic variation within some of these sites for temporal trends, similar to the intrasite chronology constructed for the Sully site (39SL4). A similar approach could be used at Oahe Village (39HU2) because houses within and outside the fortification system were apparently excavated. Perhaps more significant is that the site contains a large number of thick middens. Because of time limitations and an assessment that the ceramic assemblage looked “late,” no attempt was made to subdivide the pottery from this site into separate provenience units for this report. The current low water level of Lake Oahe provides an opportunity to excavate stratified midden deposits at Le Beau phase sites in the upper Oahe (e.g., Larson, Anton Rygh, Swan Creek, Sully) with a goal of refining the chronology of the Extended Coalescent and Post-Contact periods in South Dakota. Before any work is done, an assessment of the damage to these sites by Lake Oahe needs to be considered.

An evaluation of the usefulness of the collections at the Logan Museum at Beloit College in Beloit, Wisconsin, needs to be done. Anyone who has read Bower’s (1948a) doctoral dissertation can appreciate the fact that there is a great potential resource in the numerous collections from sites he excavated from 1929 to 1933. This includes artifacts and human skeletal remains from some very important sites, such as Greenshield (Bowers, 1930), occupied by the Mandan and Arikara in the late eighteenth century (Wood, 1986a:21–23). Most of the human remains from Greenshield were examined by personnel from the Smithsonian Institution (Douglas Owsley, pers. comm., 1995). Bowers also excavated a number of sites that contain components from virtually all of the currently identified taxonomic units in North and South Dakota. The first step would be to evaluate the research potential of the collections and field documentation for answering some basic culture-historical questions. Many of these collections have apparently been split up and dispersed to locations such as the Illinois State Museum and others yet to be identified (S. Ahler, pers. comm., 1992; Ahler and Thiessen, 1993:123). A concerted effort also should be made to locate an unpublished manuscript authored by Bowers (1948b) detailing these excavations. This manuscript is often cited in Bowers (1948a), who was unable to locate the manuscript (S. Ahler, pers. comm., 1992). Other collections from the Knife and Heart regions need to be analyzed (Ahler and Thiessen, 1993:123).

Similarly, the extant collections and field notes from W. H. Over’s work in South Dakota (Sigstad and Sigstad, 1973) need to be evaluated for their research potential. In some cases, intrasite analyses of villages that were occupied during a long period, such as Oahe Village (39HU2), might help to develop internal site chronologies. The collections from Slant (32MO26), Double Ditch (32BL8) and other sites excavated by Will and Spinden (1906), Will and Hecker (1944), and Strong (1940) need to be evaluated for their research potential. The usefulness of the Leavenworth site collection needs to be reconsidered, especially in light of an evaluation by Toom (1978). At the time the author inspected the ceramic assemblage in 1982, many of the catalog numbers on the rim sherds were illegible. This prevented a consideration of internal ceramic variation, such as might occur between the upper and lower villages. An effort must be made to reassign as many artifacts to their original catalog numbers as possible. This would improve the research potential of artifacts from a site that has played such an important role in Arikara culture history.

Additional test excavations could be initiated at a number of sites, most of which are located in the Big Bend region. The Post-Contact Coalescent sites in this reservoir constitute almost all of the protohistoric villages in South Dakota that have not been inundated by reservoir waters. Exceptions include a few sites in the upper Fort Randall reservoir (e.g., Talking Crow) and the Mobridge site. The latter village is located above the waters of the Oahe reservoir in the Grand-Moreau region. Future work at this site, which is on private land, may be warranted because it has a large human skeletal population from its associated cemetery but lacks systematic village excavations; however, previous extensive vandalism would make conventional excavation techniques unproductive. As one Middle Missouri archeologist once commented, perhaps the best approach would be to mechanically scrape off the disturbed overburden to reveal undisturbed features, such as pits, for excavation. As with all more recent excavations, recovery techniques at all Post-Contact period sites must include provisions for the recovery of very small items, such as trade beads and metal artifacts, that are grossly underrepresented in extant collections. Recovery of these items would be useful in constructing more accurate chronologies that were based upon the quantities of these items, similar to efforts at the Knife River Indian Villages National Historic site (Ahler and Dreybred, 1993). In this context, a number of Le Beau phase villages that were continuously occupied for a long time need to be targeted, should they become exposed by dropping reservoir levels. These sites, located in the tailwaters of Lake Oahe, and perhaps a few Talking Crow phase sites to the south in the Big Bend reservoir, hold the key to developing chronologies independent of ceramic materials (Ahler and Thiessen, 1993:124).

WOODLAND TO PLAINS VILLAGE TRANSITION

The cultural transformation that led from Late Woodland to Plains Village life is unclear at this time. Although the shift from mobile hunter-gatherers to more sedentary life occurred throughout the upper Midwest and Plains about AD 1000, the mechanism(s) that brought it about or the attendant cultural changes remain to be explored. One of the problems is that research at Woodland sites in the Middle Missouri subarea was overshadowed by an emphasis on the many highly visible and artifact-rich Plains Village sites. More often than not, when archeologists worked on Woodland sites it was at those containing mounds or occupations discovered while excavating Plains Village components. Important sites with Late Woodland (or very early Plains Village) components, such as Hitchell (39CH45), Oldham (39CH7), Scalp Creek (39GR1), and Ellis Creek (39GR2), have been virtually ignored, perhaps because they are located southeast of the Middle Missouri subarea as defined by Lehmer (1971:61–62). With the construction of the Missouri River reservoirs, many Woodland sites were either destroyed or inundated. The low density of Late Woodland sites in many parts of the Middle Missouri led some to argue for a migration of Plains villagers from the east (Toom, 1992b:137–140), although there could be a bias in favor of investigating earlier Middle Woodland sites (see Toom, 1996, table 7). This migration hypothesis is reinforced by the similarities, ceramic and otherwise, between the Plains Village sites on the Missouri River and those in the Northeastern Plains. Work at the Cross Ranch in North Dakota has documented a significant Late Woodland presence along the Missouri River (Ahler et al., 1981, 1982). These sites predate the expanding Plains Village northern frontier, as represented by the Jones Village site (AD 1100–1200), by about 100 years and lack any evidence of Plains Village ceramic traits (C. Johnson, 2007). The Late Woodland to Plains Village transition appears to have been smoother farther to the south in the Fort Randall region, where sites, such as Scalp Creek, Ellis Creek, and particularly Oldham and Hitchell, exhibit a series of Late Woodland and Plains Village characteristics. These sites lie under the waters of Lake Francis Case. Research with the Oldham collection might be particularly important, as the Great Oasis component may be a fortified earthlodge village (see Smithsonian Institution, 1954:77; Huscher, 1957; Thiessen, 1999:98). Great Oasis sites (AD 950–1100), located in the Northeastern Plains, also contain a mixture of Late Woodland and Plains Village traits, pointing to their transitional taxonomic position in Great Plains prehistory (Lensink and Tiffany, 1999).

The Woodland to Plains Village transition also can be explored farther upriver in North Dakota. Most promising are Late Woodland sites, such as Menoken and Flaming Arrow, that have characteristics of both traditions. The role that the Initial Middle Missouri Jones Village (39CA3) played in transition is particularly important. It is proposed by this author that this transition occurred at least 100 years later in North Dakota compared with southern South Dakota. Furthermore, the impetus to a semi-sedentary lifestyle occurred in the north through the influence of the occupants of Jones Village, who disseminated horticulture to regional Late Woodland peoples. Efforts to complete the report from the 1997–1998 excavations at Jones Village must continue, focusing on its relationships to Late Woodland and early Extended Middle Missouri developments in the area.

SUBSISTENCE-SETTLEMENT SYSTEMS

Research in this realm involves a series of interrelated topics involving the seasonal subsistence activities of the Plains villagers and how these might be manifested in the archaeological record. The ethnographic evidence suggests that the highly visible earthlodge villages that have been the focus of most of the work within the Middle Missouri subarea represent just one aspect of these peoples' overall settlement system (Hurt, 1969; Wood, 1974). Other less visible sites, such as campsites, bison kills, winter villages, and quarry areas, are either poorly known or selectively reported (see Cooper, 1958). Site complexes such as the Knife River Flint quarries that were used for a long period of time, including into the Late Prehistoric period, have been the subject of recent work (Ahler, 1986). The historic record also identifies winter villages located on the wooded and protected floodplain or low terraces of the Missouri River, although few if any have been located, much less excavated (Smith and Grange, 1958; Ahler, 1993b:93). Understanding how villages or base camps in locations away from the Missouri River fit into the overall settlement system also is a fruitful avenue of future research (Alex, 1981a; A. Johnson, 1993).

Bison kills that are attributed to Plains Village peoples are almost unknown. One of these sites is 32SH7, which is located in the breaks of the Missouri Coteau near the headwaters of the Sheyenne and James Rivers (Larson, 1976). The site, attributed to the Post-Contact Coalescent, is within a long draw. The Bundlemaker Site (323OL159) is a bison kill and campsite that was occupied mostly by earlier Archaic and Woodland peoples (Ahler et al., 1981:31–82). It is in the Missouri breaks and may represent an analogy to the many Plains Village bison kills that must surely be located along the entire course of the Missouri River in the Dakotas. The large amounts of bison bone, together with the types of elements present, excavated from villages along the Missouri River, suggest that some bison were procured locally (see Schubert and Cruz-Uribe, 1997:126; Warren, 1986, table 26; Wood, 1967:183–187). Bison kills could be present in the coulees of the breaks zone bordering the Missouri River, which have been made more visible by the erosion action of the main-stem reservoirs. Areas where float bison were taken from the Missouri River (Chomko, 1976:40–41; White, 1954:165) would probably not be represented in the archeological record.

The transition from a Late Woodland hunter-gatherer way of life to a Plains Village economy based upon hunting, gathering, and horticulture also is an important research issue. It is clear that all peoples of the Middle Missouri subarea, Woodland and Plains Village alike, placed a strong emphasis on bison hunting. Did the adoption of horticulture and a more settled way of life really change the way bison were exploited? It appears that the earlier Middle Missouri tradition relied more on a diverse group of cultigens (e.g., sumpweed, corn, and sunflower) and weedy plants and grasses, compared with the later Coalescent and historic pattern that was based upon corn, beans, and squash (see Nickel, 1974:54, 1977:57). This might indicate that horticulture among the earliest Plains villagers was not fully developed, at least as it is known from the historic period. Rather, the emphasis might be on the hunting of bison, supplemented by hunting smaller animals, fishing, collecting wild plants, and horticulture. This hypothesis appears to conflict with the currently accepted hypothesis of the dual nature (bison hunting and horticulture) of Plains Village economies (Wood, 1974; Lehmer and Wood, 1977:85; Toom, 1992b). Compared with Plains Woodland peoples, a larger and greater variety of tools were made from bison by the Plains villagers. There was also a change, however, in the location, season, method of butchering and transport, and emphasis on bison flesh and bone compared with the earlier Woodland pattern? Bozell and Rogers (1989:15) addressed this issue in the context of Great Oasis subsistence, noting that the retention of a Woodland reliance on fish, birds, and small mammals at the Broken Kettle West Great Oasis village may be a carry-over from earlier times. Was there also a change in the exploitation of bison by Initial Coalescent peoples as they settled in the Middle Missouri subarea from the Central Plains of Nebraska? Central Plains tradition economies were much less reliant on bison compared with the Initial Coalescent (Bozell, 1995:158–159). Did this also involve a change in other aspects of bison exploitation, or was it merely a matter of emphasis? Finally, given the different origins of Middle Missouri (i.e., Woodland tradition) and Coalescent (i.e., Central Plains tradition) tradition peoples and the differences in their ancestral economies, did the two exploit bison in different or similar ways? Or did the Middle Missouri subarea exert the kind of influence on all Plains Village people living there that would make all economies fairly uniform and repetitive from one village to another as Wood (1974) has suggested?

Factors influencing the location of villages along the Missouri River are an integral part of the study of settlement patterns. A prerequisite for any serious analysis of these variables is temporal control, and this study represents an attempt to develop some basic temporal parameters. Several key variables, which in turn affect the availability of life-sustaining resources, are thought to influence the location of Plains Village communities along the Missouri River. One is the size and stability of the Missouri River floodplain. Generally, large floodplains provide more land for agriculture and timber resources. The width of the Missouri River floodplain in the Dakotas varies substantially, with relatively narrow areas in the Fort Randall and upper Bad-Cheyenne regions to wider stretches in the Cannonball, Heart, and Knife regions. Griffin (1976, 1977) suggested that wood for house construction and fuel is a critical determinant in village location. Studies of this problem have focused on the identification of wood charcoal (Zalucka, 1983) and temporal changes in wood species used for house posts (Weakly, 1971:40–42). The availability of timber resources depends on floodplain forest ecology and growth, competition between villages, exploitation during previous periods, and the amount of driftwood present within a particular area. The effects of village competition and the availability of tillable bottomland was discussed by Zimmerman and Bradley (1973), whereas variations in temperature and precipitation were the topics of Richtsmeier's (1980) study.

Stability of the Missouri River channel also appears to have been a factor in village location. Areas where relatively low levels of meandering and channel cutting have taken place also were highly desirable for establishing and maintaining villages. These areas included the inside bends of the river, below confluences, and in places where the Missouri River channel was relatively straight. It is a well-known fact that rivers and streams erode or cut land on the outside of their bends and deposit sediment on their insides. Within the floodplain, this process of meandering progresses downstream. As the floodplain widens, the meandering becomes more dramatic, creating large loops and oxbows. It is in those areas where the river floodplain changes direction because of the presence of higher terraces or uplands that a relatively stable environment exists. In these cases, the floodplain on the inside bend is generally free from the eroding effects of river meandering. Other areas where floodplain stability is relatively high occurs immediately downstream of tributaries, especially those entering with high sediment loads. Of course, confluences provide other attractions to humans, including alternative (e.g., more pure) sources of water, travel routes, higher environmental diversities, and greater quantities of plant and animal resources. A brief inspection of the U.S. Army Corps of Engineers 1949 Missouri River series maps (Gavins Point near Yankton, South Dakota, to Stanton, North Dakota) indicates that the inside bends of the river generally had more sites occupied for longer continuous periods of time (as measured by midden deposits) than villages in other areas. For example, most of the villages in South Dakota thought to be continuously occupied throughout a long period, on the order of 50 years or more, are located on the inside bends of the valley (Oahe Village, Sully, Swan Creek, Spiry-Eklo, Mobridge, Larson, Anton Rygh). Some of these are in areas with relatively narrow floodplains (Swan Creek), whereas others, such as Sully, also are located at confluences and where there is a relatively wide floodplain. In some favorable areas, such as the Little Bend locality at the mouth of the Cheyenne River, there are many villages. A number of these are located on the outer bend of the channel, suggesting that there may be other factors involved in site location. Some of these may include movements of bison and other animals, or conflict or competition with other village and/or nomadic peoples. The outside river bends also may be more conducive in collecting float bison during the spring ice breakup. It is not unreasonable to suggest that villages were located in areas of favorable bison procurement, much as linear Plains Woodland mounds are thought to be linked to those locations (Ahler and Thiessen, 1993:120). Yet another factor in site location is the availability of intermediate terraces. The Fort Randall and upper Bad-Cheyenne regions are good examples, with their relatively narrow terraces and low densities of villages.

Combining these factors with the available chronologies has the potential to provide new insights into Plains Village settlement system dynamics. For example, the Four Bear and Steamboat Creek sites are across the Missouri River from one another in an area characterized by a relatively straight channel and narrow floodplain. From the previous discussion, this area is thought to have a relatively low potential for containing contemporaneous villages. The chronology established in this study places these sites in different time periods (Figure 17). This indicates that at the time each village was occupied, the channel of the Missouri River was most likely along or near the opposite bank of the river, providing floodplain land for agriculture and wood. The unpredictable nature of the meandering Missouri River also may be a factor how long a village was occupied. Vanderbilt Village, which was apparently occupied for a short period compared with other Extended Middle Missouri communities in the lower Cannonball region, also is located along the Missouri River in an area characterized by a wide floodplain and extensive meandering. It is not unreasonable to suggest that an unexpected flood or erosion of the nearby floodplain either destroyed their agricultural crop or cut the village off from easily accessible bottomland.

A more complete study of settlement and demographics of the Plains villagers also must include the time of occupation and community plan of each village. An examination of the publications, field notes, and related documentation of unreported sites would be required for such an analysis. Population surrogates similar to those used by Ramenofsky (1987:114–124) may prove useful in estimating village size. Since the sample of excavated sites used in the present analysis is nonrandom, this bias must be considered (see also Ramenofsky, 1987:135). If it is assumed that there is no systematic bias in excavating sites of different ages within the same variant, then one technique would be to distribute all undated components of the same variant in proportion to the dated ones assigned to each time period. Village size, structure, and duration also would need to be considered, a particularly difficult question to answer at sites with long and complex occupational histories (see Ahler et al., 2003). Determining the number of inhabitants based upon the number of houses present is one way to measure village demographics. These estimates can be made for many sites from surface features, whereas estimates of other buried sites, such as Whistling Elk, will need to be determined, using various remote sensing or geophysical techniques (see Toom and Kvamme, 2002; Kvamme, 2003a, 2003b). Duration of village occupation can be measured by the depth of middens and by the presence or absence of house superpositioning. One goal would be a reconstruction of settlement change similar to that produced for the Knife region (Ahler, 1993d). The ultimate objective would be to understand the evolution of Plains Village settlement systems within the Middle Missouri subarea.

Falk (1977) raised a number of other issues concerning subsistence-settlement systems in his review of past research on unmodified vertebrate materials from the Middle Missouri subarea. One of these is the dietary contribution of various species. The evidence from the subarea indicates that bison contributed almost all of the meat to the diets of the Plains Villages (Gilbert, 1969; Chomko, 1976, table 18; Falk, 1977:155; Ahler et al., 1993:270). A recent study of stable isotopes from the human skeletal remains from the Sully site by Tuross and Fogel (1994) indicated that bison meat played the predominate role in the diets of these people. This finding indicates that the traditional view of the dual bison-horticulture economy (Lehmer and Wood, 1977:85), with the implication that each played significant roles in subsistence, may be an over-generalization. The evidence, at least in this case, points to a subsistence mode based predominately on bison. Maize, beans, squash, and other plants and animals provided a dietary supplement. The reliance on bison might be most apparent in early Middle Missouri tradition sites, which had recently emerged from a Late Woodland bison-based economy. Several studies have focused on other supplementary resources, such as wild plants (Nickel, 1974, 1977), fish (Peterson, 1980), and domestic dogs (Snyder, 1991, 1995). Nickel (1974:54–55, 1977:57), relied on original data and information from Benn (1974) and contrasted plant utilization at Middle Missouri and Coalescent tradition sites. Middle Missouri tradition peoples relied more on weeds, grasses, and sunflower than the later Coalescent tradition groups who made more extensive use of corn. This pattern appears to be supported from the preliminary information from the 1997 and 1998 excavations at Jones Village (39CA3), an Initial Middle Missouri community located on the east bank of the Missouri River near the North Dakota-South Dakota border.

The presence of an adequate population of bison in the Middle Missouri appears to have led to relatively large human aggregates during the late prehistoric period compared with smaller numbers of both in the Central Plains (Bozell, 1995:159). Further research in this area needs to be undertaken to determine if the results of this research cross-cuts temporal, geographic, and ethnic boundaries. Other issues for which faunal remains are best suited, such as seasonality of site occupation (Peterson, 1980), relationships between animal and human populations, climatic change, and the identification of different canid species (Morey, 1986), have yet to reach their full potential (see Falk, 1977:155, 158–159). Additional faunal samples from well-controlled excavations, employing fine-scale recovery techniques, are particularly important in addressing these and other questions, as demonstrated by Semken and Falk (1987, 1991).

Several studies have linked settlement changes in the Middle Missouri with climatic episodes. Lehmer (1970) presented a rather strong environmental deterministic argument linking all known cultural variants to climatic episodes. With the revision of the radiocarbon chronology presented in this report, these climatic-cultural correlations need to be seriously reconsidered. Toom (1992b, 1992c) presented a thorough reevaluation of the development of semi-sedentary village life in the Middle Missouri subarea as it relates to the Neo-Atlantic climatic episode. The results of this study support earlier findings suggesting that the development of horticulture within the subarea broadened the subsistence base of the villagers to a tripartite system of bison hunting, horticulture, and broad-spectrum hunting and gathering. In light of findings of the dominant role that bison played in some Coalescent variant economies (Tuross and Fogel, 1994), the contributions of these three subsistence pursuits needs to be explored throughout time and throughout the expanse of the Middle Missouri subarea.

Several lines of evidence point to increasing sedentism during the Post-Contact period. There is a temporal decline in the exploitation of nonlocal materials for manufacturing chipped- stone tools linked to increased sedentism during the Post-Contact period in north-central South Dakota (C. Johnson, 1984b:299; Ahler and Toom, 1993:230–231). Use of large canids, even those used as beasts-of-burden, for food significantly increased from the Initial Middle Missouri to the Post-Contact Coalescent variant. This is attributed to the disruptions of traditional food sources (e.g., bison) caused by increased competition by nomadic groups such as the Sioux, increased fur trade, and epidemic diseases (Ahler et al., 1993:270; Synder, 1995:190–192, 246, 250–251). Lehmer (1952b:54) also noted a dramatic decrease in the relative amount of animal bone from the Initial Middle Missouri to the Post-Contact Coalescent variants. It is suggested that because of their participation as middlemen in the Euro-American–Native American trading system and restriction of traditional hunting territories by hostile nomads, the Middle Missouri villagers of protohistoric and historic periods were more sedentary than their prehistoric counterparts, relying on trade with nomadic hunters for meat. Ahler (2002:18.4) suggested that areas densely occupied by humans for long periods of time may have been avoided by bison herds, resulting in an increasing reliance on other animals. These hypotheses can be tested with data from additional sites, particularly those for which reliable data is available.

LITHIC TECHNOLOGY

Almost all of what is known about chipped- and ground-stone technologies within the Middle Missouri subarea is based upon very select samples of patterned stone tools. Chipped-stone debitage of any kind is essentially absent from most collections because systematic screening of soil matrix was a late addition to field techniques in the subarea (see chapter 4). There is a need to acquire small samples of tools and debris from well-controlled test excavations from a select number of sites, using small-screen mesh sizes. The data could be used to address a series of questions involving lithic economies (the system of procurement, manufacture, use, maintenance, rejuvenation, recycling, and discard of stone tools) that cannot be answered with most of the available data.

How do chipped-stone reduction technologies differ for sites that vary through time and across the landscape? Some of these patterns, particularly those between the Middle Missouri and Coalescent traditions, were outlined by Ahler (1977b), and C. Johnson (1984b). Is this pattern maintained for a large sample of sites? The evidence suggests that Extended Middle Missouri sites below the Grand River, such as Calamity Village, Thomas Riggs, Zimmerman, and Sully School, contain relatively small quantities of Knife River flint, which contrasts with the high reliance at Extended variant sites in the Cannonball region (C. Johnson, 1984b:299; 1999:70). What are the differences in the way this material was reduced at these sites. Another similar comparison can be made between the southern Extended Middle Missouri sites and Initial Middle Missouri villages even farther down river that contain moderate amounts. Are the differences in the use of Knife River flint between Initial and Extended Middle Missouri villages below the Grand River sites the result of different trade patterns? For example, it is thought that Initial variant groups along the Missouri River participated to a greater degree in the Mississippian trade network than did those of the Extended variant (Ludwickson et al., 1993). Knife River flint might have been involved in this trade network, much as it had done during the Middle Woodland period (see Clark, 1984). Heavy reliance on this material continued into the Late Woodland period in central North Dakota at sites such as Menoken (Ahler et al., 2003). Do the different quantities of Knife River flint and other stone materials reflect variations in embedded strategies of lithic procurement linked to hunting territories, as is demonstrated among Pawnee bands (see Holen, 1991), or were other factors, such as conflict, involved (see C. Johnson, 1984b:298–299)? The presence of Initial Middle Missouri sites in southwestern South Dakota indicates a large range for these people, perhaps linked to chipped-stone resources (see A. Johnson, 1993). How does a site such as Jones Village (39CA3), which has a very high use of Knife River flint (C. Johnson, 1984b:296), compare with other nearby Extended Middle communities, such as Vanderbilt Village (39CA1), Keen Village (39CA2), and Jake White Bull (39CO9)? What role, if any, did the people at Jones Village have in the distribution of Knife River flint to Initial Middle Missouri villagers downriver? Does the heavy reliance on Knife River flint and bipolar reduction at Jones Village indicate that the village had its roots in local Late Woodland developments with similar patterns, or were the occupants of Jones Village immigrants from some other area? The large size of Jones Village and its well-developed Plains Village material culture points to a beginning elsewhere, probably in the Initial Middle Missouri core area to the south. Additional research into the use of Knife River flint from the perspective of the Knife region was discussed by Ahler and Thiessen (1993:121).

Other questions that can be answered by more complete lithic samples include the kinds of reduction technologies carried on at various sites and how these relate to proximity to raw materials. What were the specific quarry sources of flakable stone materials and how did the presence of these materials relate to mobility and culture-historical affiliation (Hoard et al., 1993)? Did availability and quality of raw materials have any consequences for lithic reduction? For example, how did flint-knapping of Knife River flint in Initial Middle Missouri sites in the Big Bend region, which were farther from the source area of the material, compared with that of more northerly Extended Middle Missouri villages? Can these results be integrated with data from the Knife River flint quarries that suggest there was a heterogeneous or mixed reduction strategy during the late prehistoric period (Ahler and Vannest, 1984:194)? How was Bijou Hills silicified sediment or Ogallala orthoquartzite (Church, 1994), which is relatively coarse in texture, being worked by Middle Missouri and later Coalescent peoples in the Big Bend and Fort Randall regions? Did the reduction of materials, such as cherts, jaspers, and solid quartzites, differ from region to region or between villages on opposite sides of the Missouri River? It appears that most of these materials are found in pebble and cobble form in local terrace gravels in the Big Bend and lower Bad-Cheyenne regions, whereas they are considered to be nonlocal materials farther to the north in the Grand-Moreau region (C. Johnson, 1984b:293). The southern villagers appear to have reduced the local pebbles and cobbles on-site or at nearby locations, whereas the northern peoples did much of their initial lithic reduction away from the villages. Will this hypothesis hold up when flaking debris is considered from a larger number of sites?

Can the presence of varying quantities of nonlocal chipped stone be used for studying the settlement systems of Plains villagers? For example, the very large quantities of Flattop chalcedony (Toom, 1983a) found at the Whistling Elk site (39HU242) indicate a recent movement to the Big Bend region with little time to establish a local chipped-stone procurement system focusing more on locally derived materials. The fact that many preform, newly made, and in-use tools were recovered from the site also indicates that it was abandoned quickly with the intent of being reoccupied. Can the relative numbers of local compared with nonlocal materials be an indication of the length of village occupation, or are there other factors involved? Another example is the temporal decline in the exploitation of nonlocal materials for manufacturing chipped-stone tools linked to increased sedentism during the Post-Contact period in north-central South Dakota (C. Johnson, 1984b:299). As this seems to indicate, the restriction in Arikara territory noted by Parks (2001:365) for the nineteenth century may well have begun much earlier.

Finally, did peoples who lived at villages assigned to the different cultural variants reduce like raw materials in the same manner or were there real differences? Chipped-stone debris collected with fine-scale recovery techniques is needed to answer these questions. Extant collections recovered with these techniques include the Jones Village (39CA3), Jake White Bull (39CO6), Helb (39CA208), Walth Bay (39WW203), and Lower Grand (39CO14) sites in South Dakota and the KNRI sites in the Knife region (Ahler, 1977a; Falk and Ahler, 1988; C. Johnson, 1997, 1998b). Additional samples from other sites are needed for comparative studies.

CERAMIC TECHNOLOGY

The preceding discussion outlines various problems that can be addressed with more intensive analyses of ceramics. These deal with issues of chronology, exploring temporal and genetic links between villages, and intrasite ceramic variation. This last issue is an important one, because understanding the variability within a village is important to delineating differences between sites (Steinacher, 1990; Ahler, 1992; Toom, 1994; Ahler and Toom, 1995:376–377). Such an understanding is lacking in virtually all of the excavated Plains Village sites. Attribute-based ceramic studies are promising in the sense that they take a multidimensional perspective of ceramic change applicable throughout the Middle Missouri subarea. The potential impact of these and other studies on the established culture history of the Mandan and Arikara could be as important as its impact on the culture history of the Hidatsa (Ahler and Thiessen, 1993:119–120). As previously noted, there is a need to define ceramic change within all of the taxonomic units. This can be done by building several key local chronologies through additional radiocarbon dating and stratigraphic studies of extant ceramic collections or assemblages from middens that need to be excavated. The areas that hold the most promise are those that have not been inundated, including the Big Bend, Grand-Moreau, Cannonball, Heart, and Knife regions. Ahler (2001) derived a number of important conclusions from a study of ceramic collections from sites in North Dakota that were particularly important in chronology building.

Another aspect of ceramic variation within the Middle Missouri subarea that has not received very much attention is vessel use. Although some studies exist (Rogers and Brewster, 1990; Rosebrough, 1994, 1995; Falk and Johnson, in prep.), additional research is needed, especially as pottery is the most consistently collected material from these sites. The relationship of ceramic style and use needs to be systematically explored, for the way vessels are used effects their breakage rates and consequently their representation in the archeological record. Finally, various physical techniques are beginning to show promise for the identification of clay resources (Dunn et al., 1999; Speakman et al., 1999), particularly in areas where inundation has been minimal or absent.

BONE TOOL TECHNOLOGY

Studies of bone-tool variation through time and space also are important. These can be patterned after the work of Baerreis and Dallman (1961), Weston (1986, 1993), and Ahler and Weston (1993). Although there are a number of large-scale intersite ceramic and lithic studies, there is no comparable one involving bone tools. A number of topics could be explored, including changes in bone-tool technology between variants through time or during the introduction and spread of Euro-American metal tools used to manufacture and replace native tools made of bone. The target sites for the latter topic would be those assigned to the Post-Contact period, including extant collections and those from sites currently exposed in the reservoir cutbanks in the Big Bend region. Stratified sites occupied for a long time, such as the Le Beau phase sites of Anton Rygh, Spiry-Eklo, Swan Creek, and Sully, are particularly important. A study of bone-tool manufacture and expedient bone tools is also needed. Given the fact that bone debris and other fragments were not collected by the Interagency Archeological Salvage Program, such a study might be best employed with materials from screened site matrix.

CULTURAL INTERACTION

Cultural interactions can occur on a variety of levels and within different contexts. The most visible of these is between a village and some outside aggressor(s), manifested in the fortification systems that encircled many sites (Lehmer, 1971:100–105). Although numerous researchers have discussed the topic of conflict (Caldwell, 1964; Willey and Emerson, 1993; Zimmerman and Bradley, 1993; Hollimon and Owsley, 1994; Kay, 1994, 1995; Owsley, 1994), there have been few systematic efforts in the Northern Plains to incorporate the results into broader anthropological theory, except by Robarchek (1994). Perhaps this is because the proper chronological controls are lacking that would allow for the determination of "contemporaneous" villages or sites. In this context, a serious effort to understand the meaning of ethnicity within the Middle Missouri should be undertaken from an anthropological perspective (Gibbon, 1995b). One manifestation of ethnicity and the maintenance of ethnic boundaries is the fortified village. Other indicators of boundary maintenance conditions may lie in stylistic studies of pottery and other artifact classes (Wobst, 1977). Relating warfare to resource unpredictability and socialization of fear also may be a fruitful avenue of research (see Lekson, 2002). Another promising area involves the integration of several independent lines of artifactual and ecofactual materials. For example, reductions through time in bison and nonlocal chipped-stone resources in the Knife and Heart regions suggest a restriction in residential mobility thought to be related to pressure by other groups, such as the Dakota (Ahler and Toom, 1993:230–231; Ahler et al., 1993:270; Ahler, 1997:432). A similar pattern in lithic exploitation occurred in the Grand-Moreau region at the Anton Rygh and Larson sites, albeit at a somewhat earlier date (C. Johnson, 1984b:299). Some progress has been made therefore but needs to be integrated with a consideration of village location, demographics, available resources, and temporal considerations.

Until this study was completed, the general consensus held that village fortifications in the Middle Missouri were directly attributable to conflict between village communities assigned to different archeological taxonomic units. The results of this analysis suggest that in many cases, particularly those involving villages that were prehistoric in age, there were no apparent contemporaneous nearby villages of different variants that posed a threat to other communities. Assuming that other more distant villages or nomadic groups did not threaten the fortified villages, it is entirely possible that communities of the same taxonomic unit (i.e., variant) were in conflict with each other. Although the internecine warfare suggested for the Initial Coalescent by Zimmerman and Bradley (1993) is not supported herein, their idea of conflict between villages assigned to the same taxonomic class has merit when applied to the broader trends of Middle Missouri prehistory. This certainly has implications for understanding the causes of conflict and the meaning of taxonomic units. That is, the taxonomic units that have been established for the Middle Missouri subarea may have little meaning beyond a shared technology within a very limited realm of material culture. How many examples can be pointed to in the modern world in which people still maintain their ethnic divisions and hatreds despite sharing some broad aspects of material culture? In essence, when archeological taxonomic units are established they serve to unite sites assigned to the same unit and to divide those of different units. These units then serve as a basis for interpreting the archeological record, extending their significance to a broad range of human behaviors, such as conflict, when in reality they may be nothing more than the remnants of a limited shared technology that happen to survive in the ground.

Conflict between Plains villagers and nomadic groups also must be considered. There are a number of examples in which this is the most likely scenario. Jones Village (39CA3) is the earliest known Plains Village site north of the Cheyenne River; at least a portion of the site is surrounded by a fortification ditch (C. Johnson, 1998b). There are no other contemporaneous Plains Village communities for at least 80 miles [129 km]; therefore, it is likely that unidentified neighboring Late Woodland groups threatened Jones Village. A similar threat was probably the reason for the elaborate fortification system at the slightly later Late Woodland Menoken (32BL2) site, 75 miles [121 km] north of Jones Village. Conflict between Plains villagers intensified during the protohistoric and early historic periods when the nomadic Sioux or Dakota threatened a number of Bad River and Le Beau phase communities along the Missouri River in South Dakota. This pattern could have developed about 500 years earlier with Plains Village–Late Woodland ancestral Dakota warfare in Minnesota at Cambria phase sites (see E. Johnson, 1991:315). One problem with exploring Late Woodland–Plains Village interaction along the Missouri River is determining the scope of the Woodland presence. Although large and relatively visible Plains Village communities were located during early work along the Missouri River by researchers such as W. H. Over (Sigstad and Sigstad, 1973), Alfred Bowers (1948a), and the Smithsonian Institution Interagency Archeological Salvage Program (Thiessen, 1999), many smaller and less visible Woodland sites were not located. Many, if not most, of these Woodland sites have since been destroyed by the impounded waters of reservoirs. Work in other relatively pristine settings, such as Cross Ranch, has revealed numerous Woodland sites (Ahler et al., 1981, 1982). With a refined chronology, changes in intergroup relationships, as measured by such things as the presence or absence of fortification systems will be put on a more firm footing. Houses exhibiting burned floors might be another indicator of violence, particularly if there is a strong relationship between the presence of fortification systems and burning. Remote sensing has been particularly useful in identifying the presence of fortification systems and burned house floors at villages that have been partially or wholly buried by various natural or cultural processes (Kvamme, 2003a, 2003b; Kvamme and Ahler, 2007).

Lehmer (1971) discussed other examples of influence. One particularly interesting one involves the similarities among Initial Middle Missouri, Extended Middle Missouri, and Initial Coalescent pottery. Detailed attribute studies of rim sherds from a select number of sites is needed. This would most likely involve extant collections as it would take excavations to provide additional large ceramic assemblages. Other studies of interaction could proceed in the traditional areas of trade shell and catlinite present in extant collections (Wood, 1980; Ludwickson et al., 1993). Additional small-scale excavations would provide little more data than is currently available.

EURO-AMERICAN TRADE IMPACTS ON NATIVE TOOL TECHNOLOGIES

Euro-American trade materials, such as brass, copper, iron, and glass beads, are greatly underrepresented in almost all extant collections. When metal items occur, they tend to be the larger artifacts; metal manufacturing debris is virtually absent. The presence of these materials, aside from their enormous value for dating and other problems (see Toom, 1979), can be used in conjunction with a study of their incorporation within and impacts on native bone, stone, and ceramic tool technologies through time (Ahler and Toom, 1993; Hudson, 1993). Although some limited information can be gleaned from extant collections, any real progress to be made in this area must rely on trade metal and glass artifacts collected through fine-scale field recovery techniques (see Ahler and Thiessen, 1993:119). These items also would provide an independent method of dating Post-Contact period sites when other techniques are inappropriate. To study this problem, the immediate goal is to conduct limited excavations at a number of protohistoric sites included in this study. Most of these are in the Big Bend region.

SUBTRIBAL ETHNIC IDENTITIES

Most of the Plains Village sites in South Dakota were probably occupied by the ancestors of the Mandan and Arikara. Some of these villages may have been associated with the Cheyenne and Pawnee (Wood, 1971:60–68; Blakeslee, 1994:17). The Pawnee, or more specifically the Skidi band, may have lived in a few villages along the Missouri River in South Dakota from perhaps AD 1500 to AD 1781. It is unclear if any of these suspected Pawnee occupations were in the same or separate villages as their close relatives the Arikara. Perhaps future ceramic studies could make these distinctions, as has been done in studies linking chipped-stone, raw-material exploitation with Pawnee band hunting ranges (Holen, 1991). The future research directions summarized above also suggest that finer ethnic distinctions on the subtribal or band (village) level may be possible, as has been made for the Mandan and Hidatsa (Ahler, 1993b). This has implications for interpreting the sources of ceramic variability (Ahler, 1992), perhaps leading to chronological refinements. There is historic documentation for seven to 17 Arikara bands (Parks, 1979a; 2001, table 1), although the detailed historic and ethnographic evidence that proved useful in assigning particular villages to the Mandan and Hidatsa subgroups (see Ahler, 1993b) is apparently lacking for the Arikara. Bowers (1930:3) based his opinion that the Sully site (39SL4) was occupied by four Arikara bands upon historic and archeological considerations. This division could be manifest in the four cemetery areas at the site rather than a difference in the time of burial as Owsley and Jantz (1978) suggested. There is archeological evidence, in the form of ceramic and human cranial variation, to suggest there were at least three and probably more Arikara subtribes or bands perhaps corresponding to the Le Beau, Bad River, and Talking Crow phases. Further divisions must await additional detailed analyses. A craniometric study of individuals from the Leavenworth site, a historic Arikara community, suggests that at least two groups with Bad River and Le Beau phase affinities occupied the site (Byrd and Jantz, 1994:206). Only after a complete review and reporting of the available information on the Arikara, including any unpublished notes of Preston Holder, will it be possible to more fully evaluate the ethnic divisions within a people who once dominated the late prehistoric and protohistoric landscape along the Missouri River valley in South Dakota.

HUMAN SKELETAL REMAINS

Perhaps the greatest impact that this study may have on future research is to provide physical anthropologists with an archeological context for their human skeletal remains. The need for a refined chronology of certain villages and their associated cemeteries has been recognized since the earliest systematic studies of skeletal remains (Bass, 1964; Jantz, 1972, 1973). The dates that have been used for these sites throughout the years are impressionistic (Jantz and Owsley, 1985; Owsley and Jantz, 1985; Owsley, 1992). With a more recent diversification of these studies away from craniometrics and into the fields of human demography, paleopathology, and subsistence (Bass, 1981; Owsley and Jantz, 1994), the need for chronological control is even greater today. Any conclusions about culture change and biological processes are only as good as the temporal control upon which they are based. Fortunately for these studies, the Le Beau chronology has good stratigraphic controls, making it the best developed of all of the ones reported in this study. Le Beau villages with large associated cemetery populations include Sully, Mobridge, Larson, Anton Rygh, and Swan Creek.

An integrated approach is needed to link the results of the present analysis with changes in the skeletal biology among the Plains villagers. This study has begun this process, but more remains to be done. One approach would be to relate any human remains found in seriated village contexts, particularly those for which craniometric data is available, to the larger population of individuals buried in associated village cemeteries. This would provide a temporal tie not only between village and cemetery contexts, but it also would help to order cemetery areas in terms of an absolute time scale. The best candidates for this approach would be a number of Post-Contact period sites that contain large excavated cemetery populations, such as Anton Rygh, Larson, Swan Creek, and Sully.

A concerted effort to describe and analyze the burial inclusions from a number of large post-contact cemeteries needs to be undertaken. Most of the work on this topic has been either incomplete, superficial, or on a synthetic level (Bass and Rucker, 1976; O'Shea, 1981, 1984). Once this goal is accomplished, inter-cemetery studies can begin. Another aspect of mortuary analysis needs to address the types of grave inclusions and how they relate to general village debris. During a brief examination by the author of the grave inclusions from the cemetery associated with the Larson site (39WW2), it became apparent that there is a dramatic contrast between what has been buried with individuals versus the artifacts recovered from the village. Exploring this topic also would help to evaluate the relative utility of dating Post-Contact period villages and cemeteries with trade artifacts of Euro-American origin.

MITIGATION OF CONTINUING SITE DESTRUCTION

Since the four main-stem Missouri River reservoirs within the Middle Missouri subarea were constructed, the effects on cultural resources have been steady and unrelenting. Those sites that were submerged fairly quickly and were not subject to the wave action of the reservoirs have perhaps escaped much of the destruction. More than one-half (31) of the 54 sites illustrated in chapter 8 have been inundated or are being destroyed by shoreline erosion. For the sites in the Big Bend region and in the tailwaters of Lake Oahe, the effects have been far greater (see Toom, 1996:75–76; C. Johnson, 1997, 1998b). Recognizing this problem, the National Park Service funded a Landmark theme study of the Middle Missouri (Winham, Wood et al., 1992b). In a study by Ebert et al. (1989), which was a continuation of the efforts by Falk and Ahler (1988); Kay (1994), and Speakman and Johnson (2006), the destructive forces of reservoirs on Plains Village archaeological sites were documented. Recent work at the Jones Village site (39CA3) site indicated that since 1979, when the University of Nebraska worked there (Falk and Pepperl, 1986:2B680–2B703), about 50 meters of the site have eroded into Lake Oahe (Speakman and Johnson, 2006; see also Ebert et al., 1989, figs. 6, 7). Excluding 11 out of 20 years between 1979 and 1998 when the reservoir level was low enough (1611 feet) not to greatly affect the site, the erosion rate was approximately five to seven meters per year. The rate of erosion at the Helb site (39CA208), based upon the difference between the shoreline between 7/16/69 and 8/2/72, was about six meters per year (Falk and Calabrese, 1973, fig. 2; Falk and Ahler, 1988, fig. A.1). Walth Bay (39WW203) had greater or lesser rates of erosion depending upon location along the cutbank (Falk and Ahler, 1988, fig. 14). These figures compare with a recent EDM measured rate of 1.95 meters per year for the Molstad (39DW234) and Jake White Bull (39CO6) sites, two villages located along the banks of Lake Oahe (Ebert et al., 1989, table 12). The erosion rates of three other sites within various Missouri River reservoirs ranged from 1.16 to 3.19 meters per year. Perhaps the most disturbing information comes from the predicted site extinction dates for sites 39LM224 (3/1/94), 39DW234 (5/24/2019), and 39CO6 (4/8/2009). These sites may have been temporarily spared the ultimate fate by a series of low reservoir levels beginning in 1998, levels that have exposed previously inundated sites. Although several attempts at shoreline stabilization have been made, the results have been mixed. Prevention of further erosion hopefully will preserve what little is left of these sites, allowing future fieldwork on a number of chronological problems.

Given the ongoing and projected future erosion of sites by the reservoirs, the reluctance of the United States Army Corps of Engineers to establish a comprehensive and effective stabilization program, and the difficulty of preventing vandalism, perhaps the only long-term viable solution is to continue to monitor the shoreline for sites and to conduct limited problem-oriented test excavations along the banks at selected sites. The approach to this field work should stress bankline profiling to place the sites within their geomorphic contexts, collection of datable radiocarbon samples, determining site limits and structure by remote sensing (see Weymouth, 1976; Weymouth and Nickel, 1977; Wood et al., 1984; Nickel, 1993; Toom and Kvamme, 2002; Kvamme, 2003a, 2003b; Kvamme and Alher, 2007), and limited excavations to collect artifactual and ecofactual data pertinent to the topics discussed in this chapter (see also Kay, 1994:24–26). These excavations should use waterscreening through 1/16 inch mesh and include flotation of matrix samples. A research design needs to be developed that integrates a variety of sources of information so that sites, both Plains Village and pre-Plains Village, are ranked in terms of their ability to answer various research questions. This would be a multiyear project during the lifespan of the reservoirs. During periods of low water, sites that are currently submerged could be incorporated into the research design.

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Missouri, graciously loaned to me his set of aerial photographs from a portion of the Middle Missouri subarea, copies of which appear in chapter seven. He also sent to me ceramic photographs from the upper Knife-Heart region that appear in Figure B-23. I thank Bill Billeck and LuAnn Hudson for transporting these photographs from Columbia, Missouri, to my home and back again.

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Appendix A: Ceramic Data Matrices

This appendix presents six multiple-page data matrix tables used in each of the ceramic ordinations of components included within this study. There is one table each for components assigned to the Great Oasis phase (Table A.1), Initial Middle Missouri variant (Table A.2), Extended and Terminal Middle Missouri variants (Table A.3), Initial Coalescent (Table A.4), and Extended and Post-Contact Coalescent variants (Table A.5). The latter table is subdivided into the taxonomic units employed in each of the four ordinations of the Extended Coalescent variant and into the Talking Crow, Bad River, and Le Beau phases. Components assigned to the Felicia phase and the Late Arikara are combined with the Extended Coalescent variant and Bad River phase ordinations, respectively. The sixth and last data matrix (Table A.6) combines a number of Post-Contact Coalescent components for a specialized study of cord-impressed motifs on straight or curved rim sherds. The other data matrices list components by percentages and frequencies of descriptive rim sherd categories. These categories or classes of rim sherds, which are based upon rim form and decoration, are discussed in greater detail in chapter 4.

All of the figures in these data matrices are derived from sources listed in Table 3 (see chapter 4). Segregation of ceramics from multicomponent sites is based on associations of particular ceramic types with certain archeological contexts or is based solely on types from distinctly different potting traditions (e.g., Extended Middle Missouri, Extended Coalescent). This author used the latter method of component separation most frequently for the collections that were personally examined.

During the course of compiling these data matrices, estimates of the actual frequencies of the descriptive rim sherd categories for the following components were made in order to include them in the study. The alternative would have been to either exclude them or to reexamine the actual collections. The latter alternative was judged to be unacceptable because all of the estimates involved multicomponent villages. A personal examination of the collections with the intent

TABLE A.1. Data matrix of ceramic rim sherd descriptive categories by component, Initial Middle Missouri variant (Great Oasis).

Component	Straight/Curved/Flared/Outcurved/Simple rim forms decorated on the exterior rim: Decorated on the exterior rim: Tri/Horz incised		Pendant tri/horz incised		Pendant tri/dia incised		Horz incised		Decorated on the lip: Tool/Finger impressed		Cross-hatch incised		Undecorated	
Broken Kettle West (13PM25)	13.8	16	2.6	3	5.2	6	1.7	2	9.5	11	8.6	10	38.8	45
Williams (13PM50)	15.9	10	15.9	10	0.0	0	9.5	6	11.1	7	1.6	1	38.1	24
Larsen (13PM61)	3.3	9	31.4	87	5.4	15	1.8	5	18.8	52	12.6	35	20.9	58
Great Oasis (21MU2)	29.4	209	6.5	46	1.3	9	22.5	160	1.4	10	0.0	0	18.7	133
Ferber (25CD10)	27.3	12	0.0	0	2.3	1	13.6	6	0.0	0	0.0	0	47.7	21
Packer (25SM9)	36.1	78	0.0	0	0.5	1	44.9	97	3.2	7	0.0	0	4.6	10
Heath (39LN15)	29.9	67	0.4	1	0.0	0	20.5	46	0.4	1	0.0	0	45.5	102
Oldham (39CH7)	31.4	222	9.5	67	1.3	9	13.2	93	6.1	43	0.0	0	22.0	156
Hitchell (39CH45)	20.4	33	4.3	7	5.6	9	22.8	37	9.3	15	0.0	0	35.2	57
39CH205	17.5	11	6.3	4	0.0	0	9.5	6	12.7	8	0.0	0	46.0	29
St. John (39HU213)	19.0	8	0.0	0	2.4	1	19.0	8	9.5	4	0.0	0	38.1	16
Gavins Point (39YK203)	32.1	25	2.6	2	0.0	0	26.9	21	6.4	5	0.0	0	23.1	18

Component	Straight/Curved/Flared/Outcurved/Simple rim forms decorated on the exterior rim: Chevron incised		Horizontal incised		Chevron horz/dia incised		Cross-hatch horz/dia incised		Spaced criss-cross horz incised		Flag and dot horz incised		Trapezoid horz incised	
Broken Kettle West (13PM25)	0.0	0	0.0	0	0.9	1	0.9	1	0.9	1	10.3	12	6.9	8
Williams (13PM50)	1.6	1	0.0	0	0.0	0	0.0	0	0.0	0	6.3	4	0.0	0
Larsen (13PM61)	0.0	0	0.0	0	0.7	2	0.0	0	0.0	0	2.2	6	0.0	0
Great Oasis (21MU2)	0.3	2	0.0	0	0.8	6	4.2	30	14.7	105	0.0	0	0.1	1
Ferber (25CD10)	0.0	0	0.0	0	0.0	0	0.0	0	6.8	3	2.3	1	0.0	0
Packer (25SM9)	0.0	0	0.0	0	0.0	0	0.5	1	0.9	2	1.4	3	0.0	0
Heath (39LN15)	0.0	0	0.0	0	1.8	4	0.0	0	1.3	3	0.0	0	0.0	0
Oldham (39CH7)	0.0	0	2.0	14	0.0	0	0.0	0	0.4	3	0.0	0	0.0	0
Hitchell (39CH45)	0.0	0	0.0	0	0.0	0	0.0	0	2.5	4	0.0	0	0.0	0
39CH205	0.0	0	1.6	1	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
St. John (39HU213)	0.0	0	2.4	1	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
Gavins Point (39YK203)	0.0	0	0.0	0	0.0	0	0.0	0	2.6	2	0.0	0	0.0	0

Component	Straight/Curved/Flared/Outcurved/Simple rim forms decorated on the exterior rim: Tri/Horz cord impressed		Pendant tri/horz cord impressed		Pendant tri/dia cord impressed		Horizontal impressed		S-Shaped/Collared/Compound rim forms decorated on the exterior rim: Tri/Horz incised		Horz incised		Horz cord impressed		Sample size
Broken Kettle West (13PM25)	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	116
Williams (13PM50)	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	63
Larsen (13PM61)	0.4	1	0.0	0	0.0	0	0.0	0	2.5	7	0.0	0	0.0	0	277
Great Oasis (21MU2)	0.0	0	0.0	0	0.0	0	0.0	0	0.1	1	0.0	0	0.0	0	712
Ferber (25CD10)	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	44
Packer (25SM9)	4.6	10	0.0	0	0.5	1	2.8	6	0.0	0	0.0	0	0.0	0	216
Heath (39LN15)	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	224
Oldham (39CH7)	3.2	23	4.4	31	1.0	7	2.4	17	0.3	2	2.5	18	0.3	2	707
Hitchell (39CH45)	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	162
39CH205	3.2	2	0.0	0	0.0	0	3.2	2	0.0	0	0.0	0	0.0	0	63
St. John (39HU213)	0.0	0	0.0	0	0.0	0	4.8	2	0.0	0	4.8	2	0.0	0	72
Gavins Point (39YK203)	6.4	5	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	78

TABLE A.2. Data matrix of ceramic rim sherd descriptive categories by component, Middle Missouri tradition (Initial variant).

	Straight/Curved/Flared/Outcurved/Simple rim forms										
	Decorated on the lip										
Component	**Tool/Finger impressed**		**Cross-hatch incised**		**Cord impressed**		**Undecorated**		**Rolled rim**		**Sample size**
Cambria (21BE2)	31.6	301	10.1	96	0.3	3	29.4	280	19.8	189	952
Price (21BE25)	21.1	12	10.5	6	0.0	0	40.4	23	19.3	11	57
Crow Creek: Crow Cr. (39BF11)	23.8	74	8.4	26	0.0	0	36.0	112	6.1	19	311
Pretty Bull (39BF12)	29.0	31	1.9	2	0.0	0	32.7	35	0.0	0	107
Akichita (39BF221)	33.6	223	5.9	39	0.0	0	20.1	133	3.3	22	663
Swanson (39BR16)	49.2	388	2.5	20	0.1	1	14.1	111	2.0	16	789
Jones Village (39CA3)	29.4	10	26.5	9	2.9	1	5.9	2	2.9	1	34
Pease Creek (39CH5)	40.0	30	1.3	1	0.0	0	14.7	11	4.0	3	75
Mitchell (39DV2)	38.9	686	8.2	145	0.0	0	27.0	476	0.0	0	1765
Chapelle Creek C (39HU60)	20.8	224	9.7	105	0.0	0	15.8	171	0.0	0	1085
Twelve Mile Creek (39HT1)	33.8	421	5.6	70	0.1	1	26.3	328	4.0	50	1245
Dinehart (39LM33)	54.7	234	4.2	18	0.0	0	16.8	72	0.7	3	428
King (39LM55)	42.9	15	0.0	0	0.0	0	31.4	11	0.0	0	35
Jiggs Thompson A (39LM208)	45.4	30	1.5	1	1.5	1	30.3	20	0.0	0	66
Jiggs Thompson B (39LM208)	38.2	58	2.6	4	9.9	15	15.1	23	1.3	2	152
Langdeau (39LM209)	31.9	148	0.0	0	0.9	4	22.6	105	1.5	7	464
Jandreau (39LM225)	24.9	90	0.0	0	0.0	0	32.6	118	1.1	4	362
Gilman (39LM226)	27.9	19	0.0	0	0.0	0	10.9	7	0.0	0	64
Pretty Head A (39LM232)	20.5	9	2.3	1	0.0	0	13.6	6	18.2	8	44
Pretty Head B (39LM232)	36.1	30	2.4	2	0.0	0	22.9	19	10.8	9	83
Brandon (39MH1)	23.0	79	15.1	52	0.3	1	17.2	59	0.0	0	344
Fay Tolton (39ST11)	23.8	5	4.8	1	0.0	0	38.1	8	0.0	0	21
H. P. Thomas 1 (39ST12)	26.6	17	1.6	1	0.0	0	42.8	27	0.0	0	64
Breeden A (39ST16)	38.9	311	3.5	28	1.1	9	9.1	73	0.5	4	799
Dodd: Anderson (39ST30)	30.2	48	4.4	7	1.3	2	13.2	21	0.0	0	159
Dodd: Monroe (39ST30)	40.4	19	8.5	4	0.0	0	31.9	15	0.0	0	47
Sommers: Inner (39ST56)	8.8	36	5.6	23	0.0	0	27.5	113	0.2	1	411
Sommers: Outer (39ST56)	7.8	81	2.2	23	0.3	3	22.5	234	1.5	16	1041
Cattle Oiler: Early (39ST224)	11.4	132	5.9	68	0.3	4	33.2	385	0.8	9	1161

	S-shaped/Collared/Compound Rim Forms											
	Decorated on the exterior rim											
Component	**Horizontal cord impressed**		**Tri cord impressed**		**Horizontal incised**		**Triangular incised**		**Cross-hatch incised**		**Undecorated or tool/ finger impressed lip**	
Cambria (21BE2)	0.0	0	2.0	19	0.1	1	0.2	2	0.2	2	0.7	7
Price (21BE25)	0.0	0	1.8	1	0.0	0	0.0	0	0.0	0	0.0	0
Crow Creek: Crow Cr. (39BF11)	1.9	6	0.0	0	8.0	25	0.6	2	0.0	0	0.0	0
Pretty Bull (39BF12)	0.0	0	0.0	0	4.7	5	4.7	5	0.0	0	0.9	1
Akichita (39BF221)	3.0	20	0.2	1	16.0	106	2.9	19	0.0	0	4.4	29
Swanson (39BR16)	2.3	18	1.4	11	11.4	90	3.2	25	0.1	1	1.6	13
Jones Village (39CA3)	26.5	9	0.0	0	2.9	1	2.9	1	0.0	0	0.0	0
Pease Creek (39CH5)	6.7	5	1.3	1	14.7	11	2.7	2	2.7	2	0.0	0
Mitchell (39DV2)	3.2	58	0.8	14	1.4	24	2.6	46	0.6	11	0.8	14
Chapelle Creek C (39HU60)	18.4	200	3.6	39	2.9	31	2.0	22	9.4	102	0.5	5
Twelve Mile Creek (39HT1)	2.2	27	2.6	32	1.4	17	2.7	34	0.1	1	3.0	37
Dinehart (39LM33)	1.9	8	9.8	42	0.5	2	2.1	9	0.2	1	0.0	0
King (39LM55)	2.9	1	0.0	0	14.3	5	2.9	1	0.0	0	0.0	0
Jiggs Thompson A (39LM208)	12.1	8	1.5	1	0.0	0	1.5	1	0.0	0	0.0	0
Jiggs Thompson B (39LM208)	16.4	25	4.6	7	2.0	3	4.6	7	0.0	0	0.0	0

(*continued*)

TABLE A.2. (*continued*)

	S-shaped/Collared/Compound Rim Forms											
	Decorated on the exterior rim											
Component	**Horizontal cord impressed**		**Tri cord impressed**		**Horizontal incised**		**Triangular incised**		**Cross-hatch incised**		**Undecorated or tool/ finger impressed**	
Langdeau (39LM209)	23.9	111	3.7	17	8.6	40	2.2	10	0.0	0	0.4	2
Jandreau (39LM225)	8.0	29	0.0	0	24.6	89	1.9	7	0.8	3	0.6	3
Gilman (39LM226)	39.1	25	6.2	4	6.2	4	3.1	2	3.1	2	0.0	0
Pretty Head A (39LM232)	0.0	0	0.0	0	31.8	14	4.5	2	0.0	0	0.0	0
Pretty Head B (39LM232)	3.6	3	0.0	0	15.7	13	4.8	4	0.0	0	0.0	0
Brandon (39MH1)	23.5	81	5.5	19	4.1	14	2.3	8	0.0	0	0.0	0
Fay Tolton (39ST11)	4.8	1	0.0	0	4.8	1	19.0	4	0.0	0	0.0	0
H. P. Thomas 1 (39ST12)	4.7	3	0.0	0	6.2	4	4.7	3	0.0	0	14.1	9
Breeden A (39ST16)	23.7	189	8.5	68	5.5	44	3.9	31	0.5	4	0.0	0
Dodd: Anderson (39ST30)	43.4	69	1.3	2	3.1	5	0.0	0	1.3	2	0.0	0
Dodd: Monroe (39ST30)	8.5	4	0.0	0	6.4	3	0.0	0	0.0	0	0.0	0
Sommers: Inner (39ST56)	40.6	167	1.0	4	5.1	21	1.2	5	4.6	19	0.5	2
Sommers: Outer (39ST56)	47.6	496	1.7	18	3.7	39	1.1	11	6.1	64	0.3	3
Cattle Oiler: Early (39ST224)	25.8	299	4.6	53	6.4	74	7.1	82	2.4	28	0.5	6

	Straight/Curved/Flared/Outcurved Simple rim forms decorated on the exterior rim											
Component	**Impressed**		**Horizontal cord impressed**		**Tri cord incised**		**Triangular incised**		**Incised**		**Cross-hatch bowls**	
Cambria (21BE2)	0.0	0	0.3	3	2.3	22	1.8	17	0.6	6	0.4	4
Price (21BE25)	0.0	0	0.0	0	0.0	0	0.0	0	7.0	4	0.0	0
Crow Creek: Crow Cr. (39BF11)	0.0	0	0.0	0	2.3	7	3.5	11	0.3	1	9.0	28
Pretty Bull (39BF12)	0.9	1	0.0	0	7.5	8	16.8	18	0.9	1	0.0	0
Akichita (39BF221)	0.2	1	0.0	0	1.2	8	2.3	15	0.2	1	6.9	46
Swanson (39BR16)	0.8	6	2.0	16	3.3	26	2.2	17	0.0	0	3.8	30
Jones Village (39CA3)	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
Pease Creek (39CH5)	0.0	0	1.3	1	4.0	3	6.7	5	0.0	0	0.0	0
Mitchell (39DV2)	0.0	0	0.0	0	1.9	34	2.9	51	0.3	5	11.4	201
Chapelle Creek C (39HU60)	4.9	53	1.0	11	5.5	60	5.6	61	0.0	0	0.1	1
Twelve Mile Creek (39HT1)	0.0	0	0.0	0	1.0	12	3.5	43	0.0	0	13.8	172
Dinehart (39LM33)	0.5	2	0.0	0	4.9	21	0.5	2	0.0	0	3.3	14
King (39LM55)	0.0	0	0.0	0	0.0	0	5.7	2	0.0	0	0.0	0
Jiggs Thompson A (39LM208)	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	6.1	4
Jiggs Thompson B (39LM208)	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	5.3	8
Langdeau (39LM209)	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	4.3	20
Jandreau (39LM225)	0.0	0	0.3	1	1.7	6	2.5	9	0.0	0	1.1	4
Gilman (39LM226)	0.0	0	0.0	0	1.6	1	0.0	0	0.0	0	0.0	0
Pretty Head A (39LM232)	0.0	0	0.0	0	0.0	0	4.5	2	0.0	0	4.5	2
Pretty Head B (39LM232)	0.0	0	0.0	0	0.0	0	0.0	0	1.2	1	2.4	2
Brandon (39MH1)	2.3	8	0.6	2	0.0	0	0.0	0	0.9	3	5.2	18
Fay Tolton (39ST11)	0.0	0	0.0	0	4.8	1	0.0	0	0.0	0	0.0	0
H. P. Thomas 1 (39ST12)	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
Breeden A (39ST16)	1.0	8	1.0	8	0.9	7	0.0	0	0.0	0	1.9	15
Dodd: Anderson (39ST30)	1.2	3	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
Dodd: Monroe (39ST30)	4.3	2	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
Sommers: Inner (39ST56)	0.7	3	0.7	3	0.0	0	1.0	4	1.5	6	1.0	4
Sommers: Outer (39ST56)	0.9	9	1.5	16	0.4	4	1.7	18	0.0	0	0.6	6
Cattle Oiler: Early (39ST224)	0.4	5	0.0	0	0.4	5	0.3	4	0.3	4	0.3	3

TABLE A.3. Data matrix of ceramic descriptive rim sherd categories by component, Middle Missouri tradition (Extended and terminal variants).

	S-shaped/Collared/Compound rim forms										
	Decorated on the exterior rim										
Component	Cord impressed		Horizontal incised		Cross-hatch incised		Filleted		Undecorated or tool/ finger impressed lip		Sample size
Havens (32EM1)	13.5	171	0.4	5	1.0	12	0.0	0	0.0	0	1266
Tony Glas (32EM3)	16.4	91	0.2	1	0.2	1	0.0	0	0.2	1	556
Shermer (32EM10)	27.6	441	4.2	67	0.0	0	0.0	0	6.8	108	1597
Clark's Creek (32ME1)	24.7	24	0.0	0	0.0	0	0.0	0	0.0	0	97
White Buffalo Robe (32EM7)	42.7	102	9.2	22	0.0	0	0.0	0	1.3	3	239
Amahami (32ME8)	53.3	96	20.0	36	0.0	0	0.0	0	3.3	6	180
Bendish (32MO2)	14.9	50	0.3	1	0.3	1	0.0	0	1.8	6	336
Huff (32MO11)	68.7	643	1.5	14	0.0	0	0.0	0	0.1	1	936
Cross Ranch (32OL14)	31.0	149	3.5	17	0.0	0	0.0	0	1.9	9	481
Fire Heart Creek (32SI2)	5.2	41	1.5	12	1.5	12	0.0	0	1.4	11	794
Paul Brave (32SI4)	15.7	136	0.0	0	3.5	30	0.0	0	0.0	0	867
Ben Standing Soldier (32SI7)	12.9	118	0.3	3	0.5	5	0.0	0	3.1	28	912
South Cannonball (32SI19)	10.2	284	0.3	8	1.4	40	0.0	0	0.2	6	2796
McKensey (39AR201)	14.3	9	4.8	3	0.0	0	0.0	0	0.0	0	63
39AR210	7.1	7	11.2	11	0.0	0	0.0	0	1.0	1	98
Vanderbilt Village (39CA1)	11.9	12	2.0	2	2.0	2	0.0	0	9.9	10	101
Keens Village (39CA2)	2.7	2	4.1	3	0.0	0	0.0	0	1.4	1	73
Helb (39CA208)	4.3	31	3.5	25	0.6	4	0.0	0	0.6	4	725
Jake White Bull (39CO6)	5.6	65	2.8	33	3.9	46	0.0	0	1.2	14	1165
Travis I (39CO213)	10.6	7	7.6	5	0.0	0	0.0	0	3.0	2	66
Calamity Village (39DW231)	5.2	17	5.8	19	0.0	0	0.0	0	2.1	7	326
Thomas Riggs (39HU1)	3.3	25	2.9	22	0.1	1	0.0	0	0.8	6	757
Sully School (39SL7)	3.7	16	13.9	60	2.1	9	0.0	0	3.0	13	433
C. B. Smith B (39SL29)	4.2	2	0.0	0	0.0	0	0.0	0	0.0	0	48
Zimmerman (39SL41)	7.8	29	3.2	12	0.8	3	0.8	3	2.7	10	372
Cheyenne River (39ST1)	3.8	34	4.8	43	0.7	6	6.4	57	0.7	6	891
Indian Creek (39ST15)	1.4	2	1.4	2	0.0	0	0.0	0	1.4	2	148
Black Widow Ridge (39ST203)	1.0	4	2.8	11	0.0	0	1.0	4	1.5	6	394
Cattle Oiler Middle (39ST224)	4.3	5	0.9	1	0.0	0	0.0	0	0.0	0	117

	Straight/Curved/Flared/Outcurved/Simple rim forms													
	Decorated on the exterior rim						Decorated on the lip							
Component	Horizontal incised		Cross-hatch incised		Tool/Finger impressed		Filleted		Pinched		Tool/Finger impressed		Undecorated	
Havens (32EM1)	0.0	0	1.6	20	5.5	69	0.0	0	7.3	92	29.9	379	40.9	518
Tony Glas (32EM3)	0.7	4	2.7	15	0.2	1	0.4	2	11.0	61	28.6	159	39.6	220
Shermer (32EM10)	0.1	2	0.0	0	19.7	314	30.5	487	0.1	1	3.4	55	7.6	122
Clark's Creek (32ME1)	0.0	0	0.0	0	3.1	3	0.0	0	0.0	0	51.5	50	20.6	20
White Buffalo Robe (32EM7)	0.0	0	0.0	0	5.0	12	4.2	10	8.8	21	16.3	39	12.6	30
Amahami (32EM8)	0.0	0	0.0	0	1.1	2	3.9	7	11.1	20	3.3	6	3.9	7
Bendish (32MO2)	0.6	2	0.3	1	0.0	0	0.3	1	3.0	10	25.3	85	53.3	179
Huff (32MO11)	0.0	0	0.0	0	0.0	0	16.8	157	0.0	0	10.8	101	2.1	20
Cross Ranch (32OL14)	0.0	0	0.0	0	1.0	5	2.1	10	1.0	5	26.8	129	32.6	157
Fire Heart Creek (32SI2)	0.9	7	0.0	0	1.5	12	0.0	0	10.1	80	30.2	240	47.7	379
Paul Brave (32SI4)	0.7	6	6.2	54	0.0	0	0.0	0	3.0	26	27.3	237	43.6	378
Ben Standing Soldier (32SI7)	0.4	4	3.1	28	0.0	0	2.0	18	5.8	53	40.4	368	31.5	287

(*continued*)

TABLE A.3. (*continued*)

	Straight/Curved/Flared/Outcurved/Simple rim forms													
	Decorated on the exterior rim						Decorated on the lip							
Component	Horizontal incised		Cross-hatch incised		Tool/Finger impressed		Filleted		Pinched		Tool/Finger impressed		Undecorated	
South Cannonball (32SI19)	0.0	0	1.2	34	0.8	22	1.5	43	0.9	26	31.0	866	52.5	1467
McKensey (39AR201)	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	60.3	38	20.6	13
39AR210	0.0	0	0.0	0	0.0	0	3.1	3	0.0	0	66.3	65	11.2	11
Vanderbilt Village (39CA1)	0.0	0	0.0	0	0.0	0	0.0	0	3.0	3	31.7	32	39.6	40
Keens Village (39CA2)	0.0	0	2.7	2	0.0	0	0.0	0	1.4	1	42.5	31	45.2	33
Helb (39CA208)	0.1	1	0.1	1	0.3	2	0.3	2	1.1	8	55.3	401	33.9	246
Jake Whirte Bull (39CO6)	0.5	6	1.0	12	0.3	3	0.0	0	0.2	2	46.8	545	37.7	439
Travis I (39CO213)	0.0	0	0.0	0	9.1	6	1.5	1	1.5	1	43.9	29	22.7	15
Calamity Village (39DW231)	1.2	4	0.0	0	3.7	12	0.3	1	6.1	20	34.4	112	41.1	134
Thomas Riggs (39HU1)	0.3	2	1.2	9	2.0	15	2.9	22	0.1	1	74.0	560	12.4	94
Sully School (39SL7)	2.3	10	0.0	0	0.5	2	2.8	12	0.2	1	50.6	219	21.0	91
C. B. Smith (39SL29)	0.0	0	0.0	0	10.4	5	0.0	0	0.0	0	77.1	37	8.3	4
Zimmerman (39SL41)	0.5	2	0.0	0	2.2	8	5.4	20	0.0	0	61.0	227	15.6	58
Cheyenne River (39ST1)	0.0	0	0.1	1	6.2	55	8.3	74	0.0	0	48.8	435	20.2	180
Indian Creek (39ST15)	0.0	0	0.0	0	0.0	0	4.1	6	0.7	1	72.3	107	18.9	28
Black Widow Ridge (39ST203)	0.0	0	0.0	0	1.8	7	5.6	22	1.5	6	67.8	267	17.0	67
Cattle Oiler Middle (39ST224)	2.6	3	0.0	0	0.9	1	1.7	2	2.6	3	47.9	56	39.3	46

TABLE A.4. Data matrix of ceramic descriptive rim sherd categories by component, Coalescent tradition (Initial variant).

	S-shaped/Collared/Compound rim forms													
	Decorated on the exterior rim													
Component	Diagonal incised		Horizontal incised		Cross-hatch incised		Cord impressed		Finger impressed		Tool impressed		Undecorated ext. rim	
Lynch (25BD1)	0.6	5	14.6	130	0.3	3	1.9	17	0.2	2	0.3	3	1.3	12
Talking Crow II (39BF3)	1.3	4	0.6	2	0.0	0	0.0	0	0.0	0	0.9	3	0.0	0
Arzberger (39HU6)	5.8	44	8.0	61	7.6	58	0.7	5	2.8	21	0.4	3	1.3	10
Whistling Elk (39HU242)	0.0	0	0.0	0	0.0	0	0.0	0	1.4	1	1.4	1	0.0	0
Black Partizan B (39LM218)	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0

	Straight/Curved/Flared/Outcurved/Simple rim forms										
	Decorated on the exterior rim						Decorated on the lip				
Component	Finger impressed		Horizontal incised		Diagonal incised		Tool/Finger impressed		Undecorated		Sample size
Lynch (25BD1)	0.8	7	8.3	74	0.1	1	57.9	515	13.6	121	890
Talking Crow II (39BF3)	21.3	68	10.6	34	0.0	0	30.3	97	35.0	112	320
Arzberger (39HU6)	0.5	4	14.5	110	0.3	2	54.6	415	3.6	27	760
Whistling Elk (39HU242)	40.3	29	9.7	7	0.0	0	27.8	20	19.4	14	72
Black Partizan B (39LM218)	5.0	18	12.9	46	0.0	0	61.6	220	20.4	73	357

TABLE A.5. Data matrix of ceramic rim sherd types by component, Coalescent tradition (Extended and Post-Contact variants).

	S-shaped/Collared/Compound rim forms												
	Decorated on the exterior rim												
Variant-Phase/Component	Cord impressed		Horizontal incised		Diagonal incised		Herringbone incised		Tool/Finger impressed		Undecorated		Sample size
Extended Coalescent													
Redbird II (25HT2)	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	72
Elbee (32ME408)	7.9	3	5.3	2	0.0	0	0.0	0	0.0	0	0.0	0	38
No Heart Creek (39AR2)	0.0	0	6.8	50	4.9	36	2.7	20	0.0	0	0.0	0	732
39AR7	0.0	0	0.0	0	1.7	2	0.8	1	0.0	0	0.0	0	119
Anton Rygh RV-VII (39CA4)	17.3	22	12.6	16	5.5	7	0.8	1	2.4	3	1.6	2	127
Anton Rygh Middle (39CA4)	23.2	462	10.4	207	3.0	60	2.3	45	1.1	21	1.1	21	1995
Anton Rygh Lower (39CA4)	27.2	111	15.4	63	2.2	9	1.5	6	0.0	0	0.0	0	408
39BR10	0.0	0	0.0	0	2.1	2	5.3	5	1.1	1	1.1	1	95
Locke Creek (39CA201)	0.0	0	26.7	24	2.2	2	0.0	0	0.0	0	0.0	0	90
Demery (39CO1)	5.8	79	11.4	155	0.9	12	0.0	0	0.2	3	1.3	18	1359
Fort Manuel (39CO5)	2.6	3	2.6	3	1.8	2	0.0	0	0.0	0	0.0	0	114
Leavenworth Early (39CO9)	26.3	25	21.1	20	4.2	4	0.0	0	0.0	0	5.3	5	95
Lower Grand (39CO14)	15.3	421	41.7	1152	5.7	156	0.3	8	0.7	20	1.6	45	2760
Bellsman Creek (39CO17)	0.0	0	35.1	27	9.1	7	0.0	0	0.0	0	1.3	1	77
39CO18	1.6	3	24.3	46	4.2	8	0.5	1	0.0	0	1.1	2	189
Potts Village (39CO19)	0.8	13	16.0	274	1.0	17	0.0	0	0.0	0	0.6	10	1717
North White Bull (39CO41/207)	0.0	0	48.2	82	0.0	0	0.0	0	0.6	1	5.3	9	170
H & H (39CO78)	28.3	70	17.8	44	0.0	0	0.8	2	0.0	0	4.5	11	247
Travis I (39CO213)	0.0	0	31.1	23	8.1	6	0.0	0	0.0	0	1.4	1	74
Moreau River (39DW1)	5.3	5	26.6	25	1.1	1	0.0	0	2.1	2	0.0	0	94
39DW217	8.3	4	47.9	23	4.2	2	0.0	0	2.1	1	0.0	0	48
Fox Island (39DW230)	0.0	0	22.6	28	2.4	3	1.6	2	0.0	0	3.2	4	44
Molstad (39DW234)	1.2	11	12.0	107	3.4	30	0.0	0	0.0	0	1.6	14	889
39DW253	0.0	0	9.6	13	23.0	31	0.0	0	0.0	0	0.0	0	135
39DW254	15.9	7	36.4	16	0.0	0	0.0	0	0.0	0	4.6	2	44
Scalp Creek A (39GR1)	0.0	0	2.1	3	5.6	8	2.8	4	0.0	0	0.0	0	142
McClure (39HU7)	0.0	0	3.9	15	8.9	34	15.3	58	0.5	2	0.5	2	380
Pierre School-South (39HU10)	0.0	0	1.3	2	2.6	4	3.3	5	0.0	0	0.0	0	151
Robinson (39HU15)	1.6	1	1.6	1	1.6	1	1.6	1	0.0	0	1.6	1	62
Chapelle Creek B (39HU60)	0.0	0	0.0	0	6.8	3	9.1	4	0.0	0	0.0	0	44
Little Pumpkin (39HU97)	0.0	0	8.6	10	2.6	3	1.7	2	1.7	2	0.9	1	116
Little Cherry (39HU126)	0.0	0	0.0	0	31.1	19	0.0	0	0.0	0	0.0	0	61
Bowman (39HU204)	0.0	0	1.3	2	3.1	5	9.4	15	0.0	0	0.0	0	159
Standing Bull (39HU214)	3.3	5	6.7	10	0.7	1	1.3	2	0.0	0	0.7	1	150
Fry A (39HU223)	0.0	0	0.0	0	25.0	15	0.0	0	0.0	0	8.3	5	60
39HU241	0.0	0	0.0	0	13.1	13	7.1	7	0.0	0	0.0	0	99
Stricker B (39LM1)	0.0	0	4.7	14	1.3	4	11.4	34	0.0	0	0.0	0	299
39LM31	0.0	0	0.7	1	2.7	4	2.1	3	0.7	1	0.0	0	146
Clarkstown B (39LM47)	0.0	0	0.0	0	1.1	1	5.5	5	0.0	0	0.0	0	91
Meander (39LM201)	0.0	0	1.1	1	11.7	11	19.1	18	0.0	0	2.1	2	94
39LM222	0.0	0	1.7	4	0.8	2	0.4	1	0.0	0	1.7	4	239
Spain A (39LM301)	0.0	0	6.2	77	1.4	17	4.2	52	0.0	0	0.7	9	1241
Hosterman (39PO7)	2.4	62	14.1	372	13.0	343	4.7	124	0.0	0	5.2	138	2631
Gettysburg (39PO209)	0.0	0	3.7	32	0.9	6	0.0	0	0.6	5	2.5	22	863
Fairbanks (39SL2)	14.5	9	3.2	3	25.8	16	1.6	1	1.6	1	0.0	0	62
Sully Early (39SL4)	0.9	4	6.3	29	8.0	37	4.3	20	0.4	2	0.6	3	462
Sully School (39SL7)	0.0	0	2.1	3	0.0	0	1.4	2	0.0	0	0.0	0	145
39SL8	0.0	0	4.3	4	5.4	5	4.3	4	0.0	0	0.0	0	93
39SL12	0.0	0	7.8	4	3.9	2	7.8	4	0.0	0	0.0	0	51
39SL23	2.3	2	2.3	2	5.8	5	8.1	7	0.0	0	0.0	0	86
39SL24	0.0	0	2.6	3	5.2	6	0.9	1	0.0	0	0.0	0	116
C.B. Smith (39SL29)	0.5	1	1.6	3	0.0	0	0.0	0	0.0	0	0.0	0	186

(*continued*)

TABLE A.5. (*continued*)

	S-shaped/Collared/Compound rim forms												
	Decorated on the exterior rim												
Variant-Phase/Component	Cord impressed		Horizontal incised		Diagonal incised		Herringbone incised		Tool/Finger impressed		Undecorated		Sample size
EXTENDED COALESCENT (*continued*)													
Cheyenne River Middle (39ST1)	0.0	0	6.8	47	4.9	34	0.1	1	0.7	5	2.6	18	694
Black Widow Early (39ST3)	0.0	0	4.7	26	5.7	31	0.2	1	0.0	0	1.1	6	548
Over's La Roche (39ST9)	0.0	0	1.8	13	3.8	28	0.4	3	0.1	1	0.1	1	739
Meyer (39ST10)	1.5	6	4.1	16	2.3	9	0.5	2	0.0	0	0.5	2	390
H. P. Thomas 2 (39ST12)	0.0	0	0.0	0	2.8	2	0.0	0	0.0	0	0.0	0	72
Cooper (39ST45)	0.0	0	1.2	1	4.9	4	0.0	0	1.2	1	0.0	0	82
Leavitt (39ST215)	0.0	0	1.1	2	2.2	4	0.0	0	0.0	0	1.1	2	184
Cattle Oiler Late (39ST224	0.0	0	0.0	0	2.6	2	1.3	1	0.0	0	0.0	0	78
Bower's La Roche (39ST232)	0.0	0	2.0	6	9.1	27	5.4	16	0.0	0	1.0	3	296
Swan Creek A (39WW7)	3.8	12	19.2	61	4.7	15	2.8	9	0.9	3	1.9	6	317
Spiry (39WW10)	9.0	53	28.5	168	9.3	55	1.5	9	3.9	23	0.5	3	589
Walth Bay (39WW203)	5.1	101	25.6	507	11.2	222	3.8	75	1.5	30	2.7	54	1977
39WW300	9.5	27	22.9	65	4.6	13	2.5	7	0.0	0	0.0	0	284
Payne (39WW302)	1.0	2	22.3	45	6.9	14	1.5	3	2.5	5	6.9	14	202
FELICIA PHASE													
Two Teeth (39BF204)	0.0	0	0.3	5	4.3	78	15.5	279	0.2	4	0.9	17	1805
39BR201	0.0	0	0.0	0	11.0	20	11.0	20	9.9	18	0.0	0	181
Cadotte (39HE202)	0.0	0	0.0	0	9.9	15	21.2	32	0.0	0	1.3	2	151
Black Partisan A (39LM218)	0.9	3	3.0	10	2.7	9	8.6	29	0.9	3	1.5	5	337
39LM219 A	0.0	0	1.1	1	23.4	22	5.3	5	0.0	0	0.0	0	94
Crazy Bull (39LM220)	0.0	0	0.0	0	11.8	21	8.4	15	0.0	0	2.2	4	178
TALKING CROW PHASE													
Medicine Crow 5 (39BF2)	0.0	1	0.0	0	1.1	1	0.0	0	0.0	0	1.1	1	88
Medicine Crow 4 (39BF2)	0.0	0	0.0	0	0.2	1	0.2	1	0.0	0	0.4	2	442
Medicine Crow 3 (39BF2)	0.2	1	0.0	0	0.4	2	0.2	1	0.4	2	1.4	8	555
Medicine Crow 2 (39BF2)	0.2	1	0.0	0	0.0	0	0.9	4	0.0	0	1.3	6	461
Medicine Crow 1 (39BF2)	0.0	0	0.0	0	0.9	1	0.0	0	0.0	0	1.8	2	111
Talking Crow III (39BF3)	0.0	0	0.0	0	0.3	3	0.0	0	0.0	0	0.0	0	692
39BF4	0.0	0	0.0	0	2.8	3	2.8	3	0.0	0	0.0	0	109
Pretty Bull (39BF12)	2.5	4	0.0	0	0.6	1	0.0	0	0.0	0	0.0	0	163
Fire Cloud (39BF237)	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	59
Sanitarium (39BR6)	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	78
39BR13	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	71
Oldham (39CH7)	0.0	0	0.2	2	4.9	46	3.3	31	1.9	18	3.5	33	936
Hitchell (39CH45)	0.0	0	0.0	0	5.1	4	3.8	3	2.5	2	0.0	0	79
Iron Shooter (39HU217)	0.0	0	2.3	4	0.0	0	2.3	4	1.1	2	0.0	0	175
Amos Shields (39HU220)	0.0	0	0.0	0	0.0	0	0.9	1	0.0	0	0.0	0	105
Hawk (39HU238)	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	4.3	3	70
Oacoma (39LM26/27)	0.0	1	0.7	21	4.7	144	3.0	91	1.2	36	1.0	30	3042
39LM34	0.0	0	0.0	0	0.0	0	0.0	0	3.4	3	0.0	0	88
Peterson (39LM215)	0.0	0	0.0	0	3.2	3	0.0	0	0.0	0	0.0	0	93
Breeden B (39ST16)	0.0	0	0.9	2	2.2	5	4.3	10	0.0	0	0.0	0	230
Fort George Village (39ST17)	3.9	11	1.1	3	1.8	5	0.7	2	0.0	0	0.0	0	285
BAD RIVER PHASE													
Fire Heart Creek (32SI2)	8.0	4	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	50
Pascal Creek (39AR207)	1.9	1	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	54
Chapelle Creek A (39HU60)	5.3	14	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	265
Coleman (39SL3)	1.4	4	0.0	0	0.0	0	0.0	0	0.0	0	0.4	1	276
Little Bend (39SL13)	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	1.4	1	74
Madison (39SL19)	6.0	7	0.0	0	0.0	0	0.0	0	0.9	1	0.0	0	117
39SL28	2.6	2	0.0	0	2.6	2	0.0	0	0.0	0	0.0	0	76
Cheyenne River Late (39ST1)	3.9	38	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	976

Black Widow Late (39ST3)	0.8	5	0.0	0	0.0	0	0.0	0	0.8	5	0.0	0	660
Dan Donavan (39ST5)	7.7	13	0.0	0	0.0	0	1.2	2	0.0	0	0.0	0	169
Buffalo Pasture (39ST6)	3.5	71	0.0	0	0.8	17	0.1	1	0.3	6	0.1	3	2001
H. P. Thomas 3 (39ST12)	3.7	15	0.0	0	0.2	1	0.0	0	0.0	0	0.7	3	409
Phillips Ranch (39ST14)	1.2	18	0.0	0	0.1	2	0.0	0	0.1	1	0.0	0	1491
Indian Creek A (39ST15)	0.0	0	0.2	1	0.0	0	0.0	0	0.0	0	0.2	1	451
Gillette A (39ST23)	14.6	12	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	82
39ST25	2.4	8	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	340
Dodd A (39ST30)	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	582
39ST50	2.9	3	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	105
39ST51	2.2	1	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	46
Black Widow Ridge (39ST203)	0.8	3	0.0	0	3.3	13	0.0	0	0.0	0	1.3	5	394
Johnston (39ST244)	0.0	0	0.0	0	0.0	0	0.0	0	3.6	2	0.0	0	55
Blue Blanket Island (39WW9)	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	35
LE BEAU PHASE													
Anton Rygh RI (39CA4)	15.2	31	0.5	1	1.0	2	1.0	2	0.5	1	0.0	0	204
Anton Rygh RII-IV(39CA4)	19.0	79	5.3	22	4.8	20	0.7	3	1.7	7	0.7	3	416
Anton Rygh Upper (39CA4)	18.3	516	8.0	225	3.2	90	0.6	18	0.6	18	0.2	6	2820
Bamble Late (39CA6)	9.8	117	2.3	27	1.3	16	0.1	1	1.2	14	1.4	17	1192
Bamble Early (39CA6)	25.5	13	5.9	3	3.9	2	0.0	0	2.0	1	2.0	1	51
Nordvold I (39CO31)	0.6	2	0.0	0	0.0	0	0.0	0	0.0	0	0.6	2	350
Red Horse Hawk A (39CO34)	0.9	5	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	534
Four Bear (39DW2)	1.9	22	0.3	4	2.1	24	0.0	0	0.2	2	0.1	1	1169
Oahe Village (39HU2)	2.3	88	0.2	7	0.8	31	0.3	10	0.1	4	0.5	18	3757
Mush Creek (39HU5)	6.7	61	0.2	2	1.1	10	1.4	13	0.1	1	0.3	3	916
Pierre School-1987 (39HU10)	1.2	10	0.0	0	0.0	0	0.0	0	1.4	12	0.6	5	850
Pierre School-1990 (39HU10)	1.1	4	0.3	1	0.0	0	1.7	6	0.3	1	0.6	2	353
39HU22	0.5	2	0.0	0	0.8	3	0.5	2	0.0	0	1.6	6	384
Spotted Bear (39HU26)	2.5	20	0.2	2	0.5	4	0.0	0	0.0	0	0.2	2	814
Steamboat Creek (39PO1)	11.3	134	1.2	14	2.7	32	2.4	28	1.1	13	1.1	13	1191
Rosa A (39PO3)	6.1	75	3.2	39	2.9	36	0.8	10	1.3	16	1.5	19	1231
Artichoke Creek (39SL1)	1.6	1	1.6	1	0.0	0	0.0	0	0.0	0	0.0	0	63
Sully Late (39SL4)	4.4	12	0.0	0	6.2	17	1.5	4	0.4	1	0.0	0	274
Sully Middle (39SL4)	3.0	12	4.0	16	12.6	51	0.7	3	0.2	1	1.7	7	404
Mobridge (39WW1)	6.3	104	4.8	79	1.7	28	0.6	10	0.5	8	0.5	9	1641
Larson 3-4 (39WW2)	5.5	156	1.4	40	1.8	51	0.7	20	2.8	79	1.3	36	2824
Larson 2 (39WW2)	10.8	81	1.9	14	2.7	20	1.2	9	5.5	41	0.4	3	747
Larson 1 (39WW2)	14.2	53	3.5	13	3.5	13	0.0	0	7.0	26	1.3	5	373
Spiry-Eklo Late (39WW3)	5.2	124	1.2	29	0.7	17	0.0	1	0.8	19	0.7	17	2368
Spiry-Eklo Middle (39WW3)	6.7	43	1.6	10	0.9	6	0.0	0	3.0	19	0.9	6	639
Spiry-Eklo Early (39WW3)	8.9	85	2.1	20	1.3	12	0.1	1	2.0	19	1.3	12	952
Swan Creek C+D (39WW7)	12.0	256	8.5	181	2.2	47	1.2	26	2.6	55	0.1	1	2131
Swan Creek B (39WW7)	20.2	103	5.5	28	1.4	7	0.8	4	6.3	32	0.0	0	511
39WW301	22.0	41	9.7	18	2.7	5	1.6	3	3.2	6	0.0	0	186
LATE ARIKARA													
Greenshield (32OL17)	6.0	5	0.0	0	0.0	0	0.0	0	0.0	0	8.4	7	83
Leavenworth Late (39CO9)	2.7	46	0.1	2	0.2	3	0.1	1	1.1	19	0.3	5	1723

	Straight/Curved/Flared/Outcurved/Simple rim forms											
	Decorated on the exterior rim				Decorated on the lip							
Variant-Phase/Component	**Diagonal/Herring-bone incised**		**Horizontal incised**		**Cord impressed**		**Tool impressed**		**Finger impressed**		**Undecorated**	
EXTENDED COALESCENT												
Redbird II (25HT2)	0.0	0	43.1	31	0.0	0	40.3	29	0.0	0	16.7	12
Elbee (32ME408)	0.0	0	31.6	12	21.1	8	26.3	10	2.6	1	5.3	2
No Heart Creek (39AR2)	0.7	5	67.5	494	0.0	0	17.2	126	0.0	0	0.1	1
39AR7	8.4	10	67.2	80	0.0	0	16.8	20	0.0	0	5.0	6
Anton Rygh RV-VII (39CA4)	0.0	0	15.7	20	9.4	12	21.3	27	7.9	10	5.5	7
Anton Rygh Middle (39CA4)	0.0	0	15.2	303	14.9	297	10.8	216	12.0	240	6.2	123

(*continued*)

TABLE A.5. (*continued*)

	Straight/Curved/Flared/Outcurved/Simple rim forms											
	Decorated on the exterior rim				Decorated on the lip							
Variant-Phase/Component	Diagonal/Herring-bone incised		Horizontal incised		Cord impressed		Tool impressed		Finger impressed		Undecorated	
EXTENDED COALESCENT (*continued*)												
Anton Rygh Lower (39CA4)	0.0	0	16.2	66	11.0	45	8.1	33	7.4	30	11.0	45
39BR10	4.2	4	9.5	9	0.0	0	62.1	59	5.3	5	9.5	9
Locke Creek (39CA201)	0.0	0	28.9	26	5.6	5	28.9	26	0.0	0	7.8	7
Demery (39CO1)	1.1	15	35.8	486	0.2	3	41.4	563	0.0	0	1.8	25
Fort Manuel (39CO5)	0.0	0	27.2	31	0.0	0	60.5	69	0.0	0	5.3	6
Leavenworth Early (39CO9)	0.0	0	8.4	8	10.5	10	20.0	19	0.0	0	4.2	4
Lower Grand (39CO14)	0.4	11	15.8	437	2.4	65	13.6	374	0.1	4	2.4	67
Bellsman Creek (39CO17)	0.0	0	41.6	32	0.0	0	11.7	9	0.0	0	1.3	1
39CO18	0.5	1	51.9	98	0.5	1	11.6	22	0.5	1	3.2	6
Potts Village (39CO19)	0.0	0	68.6	1178	1.7	30	5.7	98	0.0	0	5.6	97
39CO41/207	0.6	1	31.8	54	1.2	2	8.8	15	0.0	0	3.5	6
H & H (39CO78)	0.0	0	24.3	60	0.8	2	23.1	57	0.0	0	0.4	1
Travis I (39CO213)	1.4	1	44.6	33	0.0	0	8.1	6	0.0	0	5.4	4
Moreau River (39DW1)	0.0	0	24.5	23	1.1	1	28.7	27	1.1	1	9.6	9
39DW217	0.0	0	31.2	15	0.0	0	4.2	2	0.0	0	2.1	1
Fox Island (39DW230)	0.8	1	50.8	63	0.0	0	16.9	21	0.0	0	1.6	2
Molstad (39DW234)	3.9	35	64.1	570	1.1	10	9.7	86	0.0	0	2.9	26
39DW253	0.0	0	55.6	75	0.0	0	8.9	12	0.0	0	3.0	4
39DW254	0.0	0	22.7	10	0.0	0	18.2	8	0.0	0	2.3	1
Scalp Creek A (39GR1)	4.9	7	15.5	22	0.0	0	69.0	98	0.0	0	0.0	0
Mc Clure (39HU7)	0.5	2	6.8	26	1.3	5	55.5	211	5.3	20	1.3	5
Pierre School-South (39HU10)	3.3	5	20.5	31	0.0	0	44.4	67	23.2	35	1.3	2
Robinson (39HU15)	0.0	0	37.1	23	4.8	3	43.5	27	3.2	2	3.2	2
Chapelle Creek B (39HU60)	4.5	2	43.2	19	0.0	0	31.8	14	4.6	2	0.0	0
Little Pumpkin (39HU97)	0.0	0	42.2	49	0.0	0	36.2	42	5.2	6	0.9	1
Little Cherry (39HU126)	0.0	0	16.4	10	0.0	0	45.9	28	0.0	0	6.6	4
Bowman (39HU204)	1.9	3	30.8	49	0.0	0	47.8	76	3.8	6	1.9	3
Standing Bull (39HU214)	0.0	0	60.0	90	0.0	0	26.0	39	0.7	1	0.7	1
Fry A (39HU223)	0.0	0	28.3	17	0.0	0	36.7	22	0.0	0	1.7	1
39HU241	0.0	0	26.3	26	0.0	0	30.3	30	21.2	21	2.0	2
Stricker B (39LM1)	4.0	12	13.4	40	0.0	0	62.2	186	0.0	0	3.0	9
39LM31	1.4	2	19.2	28	0.0	0	63.0	92	0.0	0	10.3	15
Clarkstown B (39LM47)	3.3	3	29.7	27	0.0	0	59.3	54	0.0	0	1.1	1
Meander (39LM201)	0.0	0	16.0	15	0.0	0	47.9	45	0.0	0	2.1	2
39LM222	0.0	0	48.5	116	0.0	0	38.9	93	0.0	0	7.9	19
Spain A (39LM301)	6.6	82	29.4	365	0.0	0	50.4	625	0.0	0	1.1	14
Hosterman (39PO7)	4.3	112	15.1	396	1.1	30	32.8	864	5.4	142	1.8	48
Gettysburg (39PO209)	0.0	0	35.7	308	0.0	0	53.5	462	1.7	15	1.5	13
Fairbanks (39SL2)	0.0	0	3.2	2	4.8	3	25.8	16	8.1	5	11.3	7
Sully Early (39SL4)	0.0	0	42.9	198	2.4	11	28.8	133	3.2	15	2.2	10
Sully School (39SL7)	0.0	0	55.2	80	0.0	0	38.6	56	0.0	0	2.8	4
39SL8	0.0	0	55.9	52	1.1	1	25.8	24	0.0	0	3.2	3
39SL12	0.0	0	64.7	33	0.0	0	9.8	5	2.0	2	3.9	2
39SL23	2.3	2	38.4	33	1.2	1	39.5	34	0.0	0	0.0	0
39SL24	0.0	0	74.1	86	0.0	0	15.5	18	0.0	0	1.7	2
C. B. Smith (39SL29)	0.0	0	89.2	166	0.0	0	8.6	16	0.0	0	0.0	0
Cheyenne River Middle (39ST1)	0.4	3	60.8	422	0.0	0	20.0	139	1.7	12	1.9	13
Black Widow Early (39ST3)	0.9	5	69.0	378	0.2	1	16.6	91	0.2	1	1.5	8
Over's La Roche (39ST9)	2.8	21	64.3	475	0.0	0	23.7	175	1.6	12	1.4	10
Meyer (39ST10)	0.3	1	63.1	246	0.3	1	25.9	101	1.0	4	0.5	2
H. P. Thomas 2 (39ST12)	0.0	0	61.1	44	0.0	0	36.1	26	0.0	0	0.0	0
Cooper (39ST45)	0.0	0	35.4	29	0.0	0	56.1	46	0.0	0	1.2	1
Leavitt (39ST215)	3.8	7	77.2	142	0.0	0	14.1	26	0.5	1	0.0	0
Cattle Oiler Late (39ST224)	1.3	1	57.7	45	0.0	0	24.4	19	0.0	0	12.8	10

Bower's La Roche (39ST232)	4.7	14	62.5	185	0.0	0	14.2	42	0.0	0	1.0	3
Swan Creek A (39WW7)	0.0	0	22.7	72	2.8	9	40.1	127	0.9	3	0.0	0
Spiry (39WW10)	0.0	0	23.1	136	4.1	24	16.5	97	0.5	3	3.1	18
Walth Bay (39WW203)	0.6	12	21.4	404	1.1	22	22.5	444	0.1	2	5.3	104
39WW300	0.0	0	0.0	0	1.1	3	54.2	154	0.0	0	5.3	15
Payne (39WW302)	0.0	0	31.2	63	1.0	2	24.3	49	0.0	0	2.5	5
Felicia Phase												
Two Teeth (39BF204)	0.1	1	0.8	14	0.3	6	64.3	1161	7.1	128	6.2	112
39BR201	0.0	0	0.0	0	0.0	0	63.0	114	0.0	0	5.0	9
Cadotte (39HE202)	0.0	0	1.3	2	0.0	0	57.0	86	9.3	14	0.0	0
Black Partisan A (39LM218)	0.0	0	5.0	17	0.6	2	73.0	246	0.0	0	3.9	13
39LM219 A	0.0	0	1.1	1	0.0	0	58.5	55	10.6	10	0.0	0
Crazy Bull (39LM220)	1.1	2	3.4	6	1.1	2	52.2	93	19.7	35	0.0	0
Talking Crow Phase												
Medicine Crow 5 (39BF2)	1.1	1	0.0	0	13.6	12	77.3	68	0.0	0	5.7	5
Medicine Crow 4 (39BF2)	0.4	2	0.9	4	10.9	48	80.1	354	0.7	3	6.1	27
Medicine Crow 3 (39BF2)	0.0	0	1.3	7	10.1	56	75.5	419	2.2	12	8.5	47
Medicine Crow 2 (39BF2)	0.2	1	0.4	2	2.6	12	88.1	406	0.4	2	5.9	27
Medicine Crow 1 (39BF2)	0.0	0	1.8	2	1.8	2	92.8	103	0.9	1	0.0	0
Talking Crow III (39BF3)	0.4	3	2.5	17	6.2	43	77.0	532	3.8	26	9.8	68
39BF4	0.0	0	0.0	0	0.0	0	83.5	91	4.6	5	6.4	7
Pretty Bull (39BF12)	1.2	2	1.2	2	4.3	7	80.4	131	4.9	8	4.9	8
Fire Cloud (39BF237)	0.0	0	6.8	4	0.0	0	93.2	55	0.0	0	0.0	0
Sanitarium (39BR6)	0.0	0	0.0	0	0.0	0	98.7	77	0.0	0	1.2	1
39BR13	0.0	0	1.4	1	0.0	0	93.0	66	0.0	0	5.6	4
Oldham (39CH7)	0.2	2	0.7	7	0.0	0	73.5	688	0.5	5	11.1	104
Hitchell (39CH45)	0.0	0	0.0	0	0.0	0	87.3	69	0.0	0	0.0	0
Iron Shooter (39HU217)	1.7	3	0.6	1	7.4	13	72.6	127	0.0	0	12.0	21
Amos Shields (39HU220)	0.0	0	2.9	3	21.0	22	62.9	66	4.8	5	7.6	8
Hawk (39HU238)	0.0	0	0.0	0	11.4	8	64.3	45	0.0	0	20.0	14
Oacoma (39LM26/27)	0.6	17	0.5	15	0.3	8	81.3	2473	0.7	20	6.1	186
39LM34	0.0	0	1.1	1	1.1	1	89.8	79	1.1	1	3.4	3
Peterson (39LM215)	0.0	0	0.0	0	8.6	8	75.3	70	5.4	5	7.5	7
Breeden B (39ST16)	0.4	1	1.3	3	17.0	39	55.7	128	7.4	17	10.9	25
Fort George Village (39ST17)	0.0	0	0.0	0	23.5	67	54.0	154	7.4	21	7.7	22
Bad River Phase												
Fire Heart Creek (32SI2)	0.0	0	0.0	0	54.0	27	8.0	4	8.0	4	22.0	11
Pascal Creek (39AR207)	0.0	0	1.9	1	14.8	8	7.4	4	38.9	21	35.2	19
Chapelle Creek A (39HU60)	0.0	0	0.0	0	38.1	101	15.1	40	10.9	29	30.6	81
Coleman (39SL3)	0.0	0	0.0	0	21.7	60	29.3	81	17.8	49	17.8	49
Little Bend (39SL13)	0.0	0	0.0	0	40.5	30	24.3	18	13.5	10	20.3	15
Madison (39SL19)	0.0	0	0.0	0	31.6	37	17.1	20	30.8	36	13.7	16
39SL28	0.0	0	0.0	0	35.5	27	7.9	6	21.1	16	30.3	23
Cheyenne River Late (39ST1)	0.0	0	0.0	0	36.0	351	21.4	209	26.1	255	12.6	123
Black Widow Late (39ST3)	0.0	0	0.0	0	27.9	184	13.3	88	28.9	191	28.3	187
Dan Donavan (39ST5)	0.0	0	0.0	0	36.1	61	20.1	34	16.6	28	18.3	31
Buffalo Pasture (39ST6)	0.0	0	0.0	0	24.1	482	17.0	341	14.3	286	39.7	794
H. P. Thomas 3 (39ST12)	0.0	0	0.0	0	32.8	134	9.8	40	34.2	140	18.6	76
Phillips Ranch (39ST14)	0.0	0	0.0	0	30.7	457	27.1	404	16.2	242	24.6	367
Indian Creek A (39ST15)	0.2	1	0.4	2	30.6	138	41.7	188	12.6	57	14.0	63
Gillette A (39ST23)	0.0	0	0.0	0	34.1	28	20.7	17	12.2	10	18.3	15
39ST25	0.0	0	0.0	0	31.5	107	16.5	56	30.6	104	19.1	65
Dodd A (39ST30)	0.0	0	0.0	0	20.3	118	25.4	148	46.6	271	7.7	45
39ST50	0.0	0	0.0	0	63.8	67	11.4	12	15.2	16	6.7	7
39ST51	0.0	0	0.0	0	17.4	8	19.6	9	32.6	15	28.3	13
Black Widow Ridge (39ST203)	0.0	0	0.0	0	23.1	91	15.5	61	37.3	147	18.8	74
Johnston (39ST244)	0.0	0	0.0	0	18.2	10	27.3	15	23.6	13	27.3	15
Blue Blanket Island (39WW9)	0.0	0	0.0	0	48.6	17	8.6	3	25.7	9	17.1	6
Le Beau Phase												
Anton Rygh RI (39CA4)	0.0	0	1.0	2	24.5	50	11.3	23	33.8	69	11.3	23
Anton Rygh RII-IV(39CA4)	0.0	0	4.3	18	18.3	76	13.5	56	22.8	95	8.9	37
Anton Rygh Upper (39CA4)	0.0	0	9.4	264	19.0	537	10.3	291	21.3	600	9.0	255

(*continued*)

TABLE A.5. (*continued*)

	Straight/Curved/Flared/Outcurved/Simple rim forms											
	Decorated on the exterior rim				Decorated on the lip							
Variant-Phase/Component	Diagonal/Herring-bone incised		Horizontal incised		Cord impressed		Tool impressed		Finger impressed		Undecorated	
Le Beau Phase (*continued*)												
Bamble Late (39CA6)	0.0	0	0.6	7	21.8	260	8.9	106	20.4	243	32.2	384
Bamble Early (39CA6)	0.0	0	2.0	1	13.7	7	9.8	5	21.6	11	13.7	7
Nordvold I (39CO31)	0.0	0	0.0	0	18.6	65	10.6	37	24.6	86	45.1	158
Red Horse Hawk A (39CO34)	0.0	0	0.0	0	14.6	78	10.9	58	42.5	227	31.1	166
Four Bear (39DW2)	0.0	0	0.0	0	10.8	126	19.6	229	33.6	393	31.5	368
Oahe Village (39HU2)	0.0	0	0.0	0	30.7	1155	30.8	1157	19.8	744	13.1	492
Mush Creek (39HU5)	0.1	1	0.5	5	9.0	82	44.3	406	22.6	207	13.6	125
Pierre School-1987 (39HU10)	0.0	0	0.6	5	30.2	257	36.7	312	7.8	66	21.5	183
Pierre School-1990 (39HU10)	3.7	13	8.8	31	17.0	60	26.3	93	17.8	63	22.4	79
39HU22	0.0	0	0.0	0	8.1	31	37.0	142	13.5	52	38.0	136
Spotted Bear (39HU26)	0.0	0	0.0	0	39.2	319	40.2	327	13.0	106	4.2	34
Steamboat Creek (39PO1)	0.2	2	2.9	35	16.9	201	13.1	156	38.6	460	8.6	103
Rosa A (39PO3)	0.0	0	1.4	17	17.2	218	14.1	174	33.7	415	17.2	212
Artichoke Creek (39SL1)	0.0	0	0.0	0	17.5	11	9.5	6	39.7	25	30.2	19
Sully Late (39SL4)	0.7	2	0.4	1	7.3	20	25.9	71	37.2	102	16.1	44
Sully Middle (39SL4)	0.7	3	6.9	28	10.1	41	30.9	125	23.8	96	5.2	21
Mobridge (39WW1)	0.1	1	10.1	166	23.7	389	15.2	250	24.7	406	11.6	191
Larson 3-4 (39WW2)	0.0	0	0.9	25	17.5	495	10.4	294	45.8	1294	11.8	333
Larson 2 (39WW2)	0.0	0	1.1	8	17.1	128	9.4	70	37.9	283	12.0	90
Larson 1 (39WW2)	0.0	0	0.5	2	19.0	71	11.3	42	30.8	115	8.8	33
Spiry-Eklo Late (39WW3)	0.0	0	0.1	2	19.2	454	13.3	316	25.8	610	32.9	779
Spiry-Eklo Middle (39WW3)	0.0	0	0.0	0	24.1	154	10.3	66	29.3	187	23.2	148
Spiry-Eklo Early (39WW3)	0.0	0	2.3	22	20.3	193	11.2	107	31.9	304	18.6	177
Swan Creek C+D (39WW7)	0.0	0	2.3	48	18.9	403	18.4	393	27.2	580	6.6	141
Swan Creek B (39WW7)	0.0	0	5.3	27	11.7	60	26.2	134	19.8	101	2.9	15
39WW301	0.0	0	8.1	15	6.5	12	29.6	55	15.6	29	1.1	2
Late Arikara												
Greenshield (32OL17)	0.0	0	0.0	0	51.8	43	13.3	11	1.2	1	19.3	16
Leavenworth Late (39CO9)	0.0	0	0.2	2	59.9	1032	8.4	144	10.2	176	17.0	293

of assigning the rim sherds to specific components would have involved a lengthy process of intrasite analysis and reconstruction clearly beyond the time or monetary constraints of this project. The other alternative would have been to exclude the collections from consideration. This also was an unacceptable alternative because all represent relatively large assemblages from important sites. Therefore, estimates were made of specific rim sherd categories. These were made primarily because the typological system developed for Talking Crow ware by Smith (1951, 1977) was incompatible with the division of straight or curved rim sherds into the three component decorative classes or descriptive categories (tool impressed, finger impressed, undecorated lips) used in the current study.

SULLY (39SL4)

A formal intrasite ordination was undertaken in order to begin to define the occupation sequence at the Sully site (39SL4), a sprawling village of more than 200 houses occupied during Extended and Post-Contact Coalescent times (Figure 32c; Lehmer, 1971, fig. 6). The site is important because of its time depth and also because it has an associated cemetery, which consists of four spatially separate areas. These areas have been thought to reflect different periods of internment (Owsley and Jantz, 1978). Establishing an absolute temporal sequence for the Sully village greatly helps the interpretation of the cemetery remains, in addition to clarifying the chronology of the

TABLE A.6. Data matrix of ceramic rim sherd cord impressed motif categories on straight or braced rim forms, Post-Contact Coalescent variant. Right diagonal runs from lower left to upper right; left diagonal runs from lower right to upper left.

	Horizontals on lip or rim brace, decorated on the interior rim						Verticals on lip or rim brace, decorated on the interior rim				
Component	Undecorated		Right diagonal		Horizontal		Undecorated		Horizontal		Sample size
Deapolis (32ME5)	17.0	16	0.0	0	0.0	0	4.3	4	0.0	0	94
Amahami (32ME8)	6.3	11	0.0	0	1.7	3	5.7	10	0.0	0	174
Rock Village (32ME15)	7.6	10	0.0	0	0.8	1	0.0	0	0.0	0	132
Nightwalker's Butte (32ML39)	18.6	34	0.0	0	3.3	6	2.2	4	0.0	0	183
Greenshield (320L17)	40.0	18	0.0	0	0.0	0	2.2	1	0.0	0	45
Biesterfeldt (32RM1)	45.7	59	6.2	8	0.8	1	3.9	5	0.0	0	129
Medicine Crow (39BF2)	73.2	109	4.0	6	0.0	0	2.0	3	0.0	0	149
Anton Rygh (39CA4)	82.7	91	0.0	0	0.9	1	0.0	0	0.0	0	110
Leavenworth Late (39CO9)	7.4	74	0.8	8	3.0	30	11.0	110	5.6	56	1003
Nordvold I (39CO31)	21.5	14	30.8	20	1.5	1	1.5	1	0.0	0	65
Red Horse Hawk (39CO34)	39.1	18	32.6	15	6.5	3	0.0	0	0.0	0	46
Oahe Village (39HU2)	77.8	926	0.0	0	0.0	0	1.7	20	0.0	0	1190
Mush Creek (39HU5)	84.0	63	1.3	1	8.0	6	1.3	1	0.0	0	75
Pierre School (39HU10)	84.5	185	0.0	0	0.0	0	0.0	0	0.0	0	219
Chapelle Creek A (39HU60)	48.4	31	17.2	11	1.6	1	0.0	0	0.0	0	46
Streamboat Creek (39PO1)	52.9	72	1.5	2	15.4	21	0.0	0	0.0	0	136
Rosa A (39PO3)	51.4	38	2.7	2	10.8	8	5.4	4	0.0	0	74
Coleman (39SL3)	39.7	23	5.2	3	5.2	3	5.2	3	0.0	0	58
Sully (39SL4)	60.4	191	1.3	4	3.2	10	6.0	19	0.0	0	316
Cheyenne River Late (39ST1)	27.1	92	1.8	6	4.7	16	14.7	50	10.6	36	340
Black Widow Late (39ST3)	15.4	12	2.6	2	2.6	2	11.5	9	1.3	1	78
Buffalo Pasture (39ST6)	41.2	134	8.0	26	1.2	4	2.8	9	1.5	5	325
H. P. Thomas 3 (39ST12)	16.4	19	2.6	3	2.6	3	12.1	14	6.0	7	116
Phillips Ranch (39ST14)	52.8	227	11.6	50	1.9	8	0.5	2	0.0	0	430
Fort George Village (39ST17)	70.8	34	2.1	1	8.3	4	0.0	0	0.0	0	48
39ST25	26.3	20	3.9	3	5.3	4	9.2	7	1.3	1	76
Dodd A (39ST30)	55.0	66	20.0	24	0.0	0	0.0	0	0.0	0	120
39ST50	13.8	9	4.6	3	3.1	2	12.3	8	3.1	2	65
Black Widow Ridge (39ST203)	26.0	25	0.0	0	0.0	0	3.1	3	0.0	0	96
Mobridge (39WW1)	80.2	105	8.4	11	0.0	0	0.0	0	1.5	2	131
Larson (39WW2)	70.1	744	13.0	138	2.4	26	0.0	0	0.1	1	1062

	Right diagonals on the lip or rim brace, decorated on the interior rim						Left diagonals on the lip or rim brace, decorated on the interior rim					
Component	Undecorated		Right diagonal		Horizontal		Undecorated		Right diagonal		Horizontal	
Deapolis (32ME5)	9.6	9	0.0	0	1.1	1	57.4	54	1.1	1	4.3	4
Amahami (32ME8)	19.5	34	0.0	0	18.4	32	37.9	66	0.0	0	2.3	4
Rock Village (32ME15)	14.4	19	0.0	0	0.8	1	71.2	94	0.0	0	4.5	6
Nightwalker's Butte (32ML39)	20.2	37	0.0	0	6.0	11	30.6	56	1.1	2	14.8	27
Greenshield (320L17)	8.9	4	0.0	0	4.4	2	20.9	9	0.0	0	24.4	11
Biesterfeldt (32RM1)	20.9	27	0.8	1	0.0	0	17.1	22	0.0	0	0.0	0
Medicine Crow (39BF2)	4.0	6	0.0	0	0.0	0	11.4	17	0.0	0	0.0	0
Anton Rygh (39CA4)	2.7	3	0.0	0	2.7	3	0.0	0	0.0	0	0.0	0
Leavenworth Late (39CO9)	5.7	57	0.6	0	5.7	57	23.1	232	6.3	63	15.1	152
Nordvold I (39CO31)	18.5	12	3.1	2	6.2	4	3.1	2	1.5	1	0.0	0
Red Horse Hawk (39CO34)	2.2	1	6.5	3	2.2	1	0.0	0	0.0	0	0.0	0
Oahe Village (39HU2)	6.8	81	0.0	0	0.0	0	12.4	147	0.0	0	0.0	0
Mush Creek (39HU5)	0.0	0	0.0	0	0.0	0	1.3	1	0.0	0	2.7	2
Pierre School (39HU10)	10.0	22	0.0	0	0.0	0	5.5	12	0.0	0	0.0	0
Chapelle Creek A (39HU60)	9.4	6	0.0	0	0.0	0	15.6	10	0.0	0	0.0	0

(*continued*)

TABLE A.6. (*continued*)

	Right diagonals on the lip or rim brace, decorated on the interior rim						Left diagonals on the lip or rim brace, decorated on the interior rim					
Component	**Undecorated**		**Right diagonal**		**Horizontal**		**Undecorated**		**Right diagonal**		**Horizontal**	
Streamboat Creek (39PO1)	5.9	8	0.7	1	0.0	0	12.5	17	1.5	2	0.0	0
Rosa A (39PO3)	10.8	8	1.4	1	0.0	0	2.7	2	1.4	1	0.0	0
Coleman (39SL3)	20.7	12	1.7	1	0.0	0	12.1	7	3.4	2	0.0	0
Sully (39SL4)	15.5	49	0.0	0	0.0	0	9.5	30	0.0	0	0.0	0
Cheyenne River Late (39ST1)	4.1	14	0.6	2	0.0	0	15.3	52	6.8	23	3.5	12
Black Widow Late (39ST3)	7.7	6	0.0	0	7.7	6	26.9	21	2.6	2	2.6	2
Buffalo Pasture (39ST6)	15.4	50	1.2	4	0.6	2	17.2	56	0.9	3	0.0	0
H.P. Thomas 3 (39ST12)	8.6	10	0.9	1	1.7	2	19.8	23	3.4	4	1.7	2
Phillips Ranch (39ST14)	4.9	21	3.0	13	0.7	3	8.6	37	3.3	14	0.5	2
Fort George Village (39ST17)	2.1	1	0.0	0	0.0	0	4.2	2	0.0	0	0.0	0
39ST25	3.9	3	2.6	2	1.3	1	23.7	18	3.9	3	6.6	5
Dodd A (39ST30)	5.0	6	3.3	4	0.0	0	10.0	12	0.8	1	0.0	0
39ST50	7.7	5	0.0	0	0.0	0	18.5	12	4.6	3	0.0	0
Black Widow Ridge (39ST203)	30.2	29	2.1	2	0.0	0	22.9	22	1.0	1	0.0	0
Mobridge (39WW1)	3.1	4	0.8	1	0.0	0	0.8	1	0.0	0	0.0	0
Larson (39WW2)	3.0	32	0.3	3	0.0	0	0.8	9	0.3	3	0.1	1

	Undecorated on lip or rim brace, decorated on the interior rim				Undecorated on the interior rim, decorated on the lip or rim brace					
Component	**Right diagonal**		**Horizontal**		**Opposed diagonal**		**Vertical and horizontal**		**Diagonal and horizontal**	
Deapolis (32ME5)	0.0	0	5.3	5	0.0	0	0.0	0	0.0	0
Amahami (32ME8)	0.0	0	8.0	14	0.0	0	0.0	0	0.0	0
Rock Village (32ME15)	0.0	0	0.8	1	0.0	0	0.0	0	0.0	0
Nightwalker's Butte (32ML39)	0.0	0	3.3	6	0.0	0	0.0	0	0.0	0
Greenshield (320L17)	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
Biesterfeldt (32RM1)	0.0	0	0.0	0	0.0	0	0.0	0	4.7	6
Medicine Crow (39BF2)	1.3	2	0.7	1	0.7	1	0.0	0	0.7	1
Anton Rygh (39CA4)	4.5	5	4.5	5	0.0	0	0.0	0	0.0	0
Leavenworth Late (39CO9)	0.6	6	1.2	12	4.4	44	0.2	2	0.0	0
Nordvold I (39CO31)	6.2	4	1.5	1	0.0	0	0.0	0	0.0	0
Red Horse Hawk (39CO34)	0.0	0	3.1	2	0.0	0	0.0	0	0.0	0
Oahe Village (39HU2)	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
Mush Creek (39HU5)	0.0	0	1.3	1	0.0	0	0.0	0	0.0	0
Pierre School (39HU10)	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
Chapelle Creek A (39HU60)	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
Streamboat Creek (39PO1)	0.0	0	4.4	6	2.2	3	1.5	2	0.7	1
Rosa A (39PO3)	1.4	1	2.7	2	4.1	3	4.1	3	1.4	1
Coleman (39SL3)	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
Sully (39SL4)	0.9	3	0.6	2	0.0	0	0.0	0	0.3	1
Cheyenne River Late (39ST1)	0.6	2	0.0	0	1.8	6	2.4	8	0.3	1
Black Widow Late (39ST3)	0.0	0	1.3	1	3.8	3	5.1	4	1.3	1
Buffalo Pasture (39ST6)	0.3	1	0.3	1	0.3	1	0.6	2	2.5	8
H.P. Thomas 3 (39ST12)	0.9	1	0.0	0	3.4	4	4.3	5	2.6	3
Phillips Ranch (39ST14)	0.2	1	0.0	0	1.4	6	1.2	5	0.0	0
Fort George Village (39ST17)	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
39ST25	1.3	1	1.3	1	0.0	0	0.0	0	0.0	0
Dodd A (39ST30)	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0
39ST50	0.0	0	1.5	1	3.1	2	0.0	0	7.7	5
Black Widow Ridge (39ST203)	0.0	0	0.0	0	4.2	4	6.3	6	4.2	4
Mobridge (39WW1)	0.8	1	0.8	1	0.0	0	0.0	0	3.1	4
Larson (39WW2)	0.9	10	3.1	33	0.1	1	0.0	0	0.6	6

Extended and Post-Contact Coalescent occupations in the Bad-Cheyenne region.

A portion of a partially completed manuscript of the Sully site excavations was given to the author by Dr. Charles Orser of the Midwestern Archeological Research Center, Illinois State University, about a year prior to the death of Dr. Robert Stephenson, who excavated the site. The description of the excavations indicates that there are three and possibly four episodes of house superpositioning at the site. These may or may not be related to the four burial areas within the site's cemetery (Owsley and Jantz, 1978). Given the complexity of the village occupation and the mixing of materials that occurs when houses and pit features are excavated into earlier cultural materials, only pits or groups of pits associated with specific houses were included in a ceramic intrasite ordination. This resulted in eliminating much of the ceramic assemblage from the analysis because it was from uncontained (non-pit) contexts. Other pits or groups of pits were eliminated because of small sample sizes. This left 15 pits or pit clusters associated with 14 houses.

The ordination of these pits using DECORANA and the same descriptive rim sherd categories (percentages in this case) as in the larger intersite analyses resulted in an ordering that generally conformed to site stratigraphy and is interpreted to reflect the passage of time. The results suggest that there are no well-defined components or occupational episodes at the site; all evidence points to a continuous and relatively unbroken occupation of the site starting at it's western end and progressing, in a general fashion, to the east. For the purposes of the larger analysis, however, the occupation of the site was divided into three periods at minor "gaps" in the sequence: (1) an Early period represented by F 109 pits (early), F 122 pits, F 28 pits, F 203 pits, F 101 C1, 3 (late); (2) a Middle period including F 113 pits (early), F 206 C7, F202 C2–7, F 206 C5, 6, 10, 11, F 102 pits, F 206 C8, 9 (late); and (3) a Late period made up of F 214 pits (early), F 208 C1, 2, 5, F 211 pits, F103 C1 (late). These three "periods" at Sully (Early, Middle, and Late) were used in the larger intersite ordinations appearing in the main body of this report. Sully Early was included in the analysis of Extended Coalescent components, whereas the Middle and Late periods were incorporated into the ordination of Le Beau phase villages.

DODD (39ST30)

The Initial Middle Missouri rim sherds from this site were inspected by the author and classified into the Anderson and Dodd components. The classification is based on the provenience assignments listed by Lehmer (1954a:80).

TALKING CROW (39BF2)

Estimates of the frequencies within each of the descriptive categories for this site are based on the data presented by Smith (1977:49–81). This involves only a small portion of the Talking Crow and Campbell Creek phase assemblages from the site—those few relatively unmixed or "pure" provenience units from the site. The Talking Crow phase units include mound 2, 0–12 inches, Mound 1, F21 and F25, and Mound 1, Zone III (Smith, 1977, fig. 27). The following provenience units are assigned to the Initial Coalescent (Campbell Creek phase) occupation of the site: House 1, F16; House 2, F31; House 4, early pits, H8 pits; Mound I, F18, F20; Mound 2, Cut 2 (18–20 inches). All pottery types associated only with the Initial Coalescent component (Campbell Creek, Arzberger) are eliminated from the Talking Crow phase calculations. Smith's (1977:55–71) type descriptions from the site were sufficiently detailed to assign the rim sherds of particular rim form and decorative variants to the descriptive rim sherd groups used in the current analysis. The proportions of these variants within each of Smith's types for the entire site are used to make estimates of the frequencies of these decorative variants for the particular provenience units used when combined with the reconstructed frequencies of his types (Smith, 1977, tables 28, 29).

BLACK PARTIZAN (38LM218)

This multicomponent Initial and Post-Contact Coalescent site was reported by Caldwell (1966b). The pottery from the site is described as a single group, although much of it is assigned to types that can be placed within one component or another. Provenience units assigned to the Initial Coalescent component are XU-4, XU-5 through XU-9, XU-11 through XU-15, and Test 1 through Test 3. Contexts included within the Felicia phase include XU-1, XU-2, and XU-10. Proportions of the decorative variants corresponding to the descriptive types used in the current study are calculated for the entire assemblage and are used to estimate the number of descriptive categories for the Initial Coalescent and Felicia phase components, which are based upon type frequencies within provenience units supplied by Caldwell (1966b:28–53, 91).

CROW CREEK (39BF11)

The ceramic assemblage from this important multiple component Initial Middle Missouri and Initial Coalescent site as reported by Kivett and Jensen (1976:38–46) could not be included in this study for several reasons, although Hanenberger's (1986) description of later excavations within the Initial Middle occupation is used. The problems with the Kivett and Jensen report are numerous and extend beyond their description of the ceramic assemblage. In terms of the ceramic rim sherds, their descriptions were very brief, dated, vague, and inadequate, making any transformations into other typological systems impossible. Second, their descriptions of the Campbell Creek types were not consistent with those from other Initial Coalescent sites and appear to be of questionable quality. For example, Campbell Creek Plain, Campbell Creek Cord Roughened, and Campbell Creek Indented were described as almost always being decorated with tool impressions on the lips or lip/rim margins; only a few undecorated examples exist. From the descriptions of these types from two other Initial Coalescent sites (Talking Crow and Black Partizan), the Crow Creek types appear to be very unusual. The percentages of decorated (usually tool impressed lips or lip margins) versus undecorated lips are significantly lower at Talking Crow and Black Partizan: Campbell Creek Plain (62% to 81% undecorated) and Campbell Creek Cord Roughened/Cord Marked (49% to 64%). There also are some more minor discrepancies in Kivett and Jensen's descriptions of Campbell Creek Collared, Campbell Creek Indented, and Talking Crow Straight Rim types. Another possible explanation of these discrepancies is that a substantial number of rim sherds from both components at Crow Creek were included in the descriptions of types that which were supposed to be associated with one component or the other.

One possible solution to this problem involves a reanalysis of the ceramic assemblage from Crow Creek, perhaps eventually culminating in a revised site report. A brief examination of the ceramic assemblage and site records curated at the South Dakota Archaeological Research Center suggests that one possible approach to a reanalysis is to segregate rim sherds by discrete provenience unit (e.g. pits, houses), perform an internal ceramic ordination and combine those units thought to be related to the same occupational period or component. One starting point might be a consideration of pit features that Kivett and Jensen (1976, table 1) assigned to the two components. They did not consider many of these units when they tabulated ceramics by component (houses) (Kivett and Jensen, 1976, tables 2–5), yet the units probably contain some relatively unmixed deposits crucial in defining the complex occupational history of the site.

BAMBLE (39CA6), SPIRY (39WW3), AND SPIRY-EKLO (39WW10)

These three sites were included in a report of sites from the Mobridge area by Baerreis and Dallman (1961). The Bamble site consists of two Post-Contact Coalescent components, whereas the Spiry-Eklo site is divided into three protohistoric occupations. The Spiry site is a single component Extended Coalescent village. The problem with estimating the frequencies of descriptive rim sherd categories from these sites is twofold. First, there was no breakdown of the decorative variants of S-shaped rim sherds by component, although these were described for each site as a whole. Second, they used Smith's (1951) typology of Talking Crow ware. Frequency estimates of the S-shaped rims in each of the Bamble and Spiry-Eklo components was made by taking the decorative motifs (e.g., horizontal lines, diagonal lines) and decorative techniques (e.g., cord impressed, incised, tool impressed), combining them in their logical groups, and translating these to the component level using the data presented in Baerreis and Dallman (1961:190, 195, 445–446, 476–477, tables 50, 51). In actuality, the reconstruction of decorative motifs and techniques involves only a relatively small number of incised rims, because all other S-shaped, rim sherd, descriptive categories (e.g., cord impressed, tool/finger impressed) are based only on decorative technique.

Assigning the numbers of Talking Crow brushed, Talking Crow indented, and Talking Crow straight-rim sherds to the descriptive categories used in this study and their components at Bamble, Spiry, and Spiry-Eklo is approached in a manner similar to the Talking Crow site discussed above. That is, the relative proportions of undecorated, tool-impressed, and finger-impressed lips (or rim braces) on these types is calculated for each site assemblage based on the descriptions of each Talking Crow type. In the case of Spiry-Eklo, these estimates are taken from the nearby and closely related Bamble site because there are no type descriptions from the former site. Once these proportions are calculated, they are extended to each component using the data in Baerreis and Dallman (1961, tables 50, 51).

ANTON RYGH (39CA4)

Two sets of "components," or provenience units, were developed for this site. One was divided into Upper, Middle, and Lower (Knudson et al. 1983, table 8). In this case, work unit H-1958 is divided into groups of arbitrary levels as follows: 0 to 15 and 12 to 17 inches (Upper), 24 to 29 and 36 to 41 inches (Middle), and 48 to 53 and 60 to 65 inches (Lower). The other group of components from Anton Rygh is developed from the ceramic assemblage excavated by Strong (1940:378). His work at the site consisted of a 10-foot square unit excavated in one-foot levels to a depth of seven feet (Hughes, 1955). The pottery from the excavations, examined by the author in 1982 at the Smithsonian Institution, is placed in descriptive ceramic types. After an examination of the percentage distributions of these types by one-foot levels, they are combined into grouped levels as follows: RI (0–1 foot), RII–IV (2–4 feet), and RV–VII (5–7 feet).

39WW300, 39WW301, ROSA (39PO3)

A breakdown of the motifs found on S-shaped rims with incised rim exteriors is not given for these sites. Estimates of these are based on the proportions of horizontal-, diagonal-, and herringbone-shaped, incised rims from the nearby and closely related Swan Creek site (Hurt, 1957:41–42).

Appendix B: Cross Reference of Descriptive Rim Sherd Categories and Ceramic Types

This appendix provides information helpful in cross referencing the descriptive rim sherd categories used in this report with the traditionally accepted ceramic types included within these classes. It consists of Table B.1, which links the ceramic types defined for the Middle Missouri subarea, the Northeastern Plains and the descriptive rim sherd categories used in this study. The appendix also includes illustrations of most of the descriptive categories. The figure numbers for figures that appear in Appendix B (Figures B.1–B.24) are given in parentheses after their respective rim sherd categories. The descriptive categories in this table are arranged hierarchically by variables in a fashion most congruent with past ceramic typologies. These variables, or characteristics, listed in descending order, are rim form, area of decoration (or lack of it), decoration technique, and decoration motif.

Not all ceramic types used by researchers in the Middle Missouri subarea are included within this table; only those that have been most frequently employed are included. A more complete listing of ceramic types, organized in a similar hierarchical fashion as in Table B.1, appeared in Johnson (1980). In addition, several of the ceramic types included within this appendix, most notably those defined from the Knife and Heart regions (i.e., Knife River ware, Deapolis Collared) are usually not included in the analysis because a chronology currently exists for components located from there (Ahler, 1993b). Many recently defined types from sites in these two regions are not included in this appendix, largely because the present analysis focuses on sites to the south. Some ceramic types

TABLE B.1. Correlation of descriptive rim sherd categories and defined ceramic types, Middle Missouri subarea (numbers and letters in parentheses refer to figures in Appendix B).

Initial Middle Missouri (except Great Oasis, Mill Creek)

- S-shaped/Collared Rim Form
  - Decorated on the Exterior Rim
    - Horizontal Cord Impressed (Fig. B.2e–i)
      - Foreman Cord Impressed (Lehmer, 1951:8–10; Hurt, 1951:44–45)(Fig. B.2e–i)
        - Foreman Horizontal Cord Impressed (Caldwell and Jensen, 1969:39)(Fig. B.2f–i)
      - Marken Horizontal Cord Impressed (Caldwell and Jensen, 1969:40)(Fig. B.2e)
        - Judson Composite: Judson Variety (Knudson, 1967:257–258)
    - Triangular Cord Impressed (Fig. B.2c)
      - Foreman Cord Impressed Triangle (Lehmer, 1951:8–10; Hurt, 1951:45; Caldwell and Jensen, 1969:39)(Fig. B.2c)
      - Marken Cord Impressed Triangle (Caldwell and Jensen, 1969:40)
      - Judson Composite: Judson Variety (Knudson, 1967:257–258)(Fig. B.7e,g)
    - Horizontal Incised (Figs. B.1f,g; B.2j–o)
      - Foreman Incised (Lehmer, 1951:10; Hurt, 1954b)(Figs. B.1f,g; B.2j–o)
      - Foreman Horizontal Incised (Caldwell and Jensen, 1969:39)(Figs. B.1f,g; B.2j,k,m,n)
      - Marken Horizontal Incised (Caldwell and Jensen, 1969:40)(Fig. B.2l–o)
    - Triangular Incised (Fig. B.1h–o)
      - Foreman Incised Triangle (Lehmer, 1951:8–10; Hurt, 1951:43–44)(Fig. B.1h–o)
      - Foreman Incised Triangle (Caldwell and Jensen, 1969:39)(Fig. B.1h–j,m–o)
      - Marken Incised Triangle (Calwell and Jensen, 1969:40–41)(Fig. B.1k,l)
    - Cross-Hatched Incised (Fig. B.1a–e)
      - Foreman Incised (Lehmer, 1951:10)(Fig. B.1a–e)
      - Foreman Incised Crosshatch (Caldwell and Jensen, 1969:39)(Fig. B.1c–e)
      - Marken Incised Crosshatch (Caldwell and Jensen, 1969:41)(Fig. B.1a,b)
  - Undecorated Exterior Rim or Tool/Finger Impressed (Fig. B.2d)
      - Foreman Plain (Lehmer, 1951:8–10; Hurt, 1954b; Caldwell and Jensen, 1969:39)(Fig. B.2d)
      - Marken Plain (Caldwell and Jensen, 1969:39)
      - Stuart Tool Impressed (Caldwell and Jensen, 1969:43–44)(Fig. B.6a–b)
      - Judson Composite: South Bend Variety (Knudson, 1967:257–259)
      - Judson Composite: Lincoln Variety (Knudson, 1967:257–259)
- Straight/Curved Rim Form
  - Decorated on the Rim Exterior
    - Horizontal Cord Impressed (Fig. B.3k,l)
      - Chamberlain Cord Impressed (Hurt, 1954b)(Fig. B.3k,l)
      - Anderson High Rim (Lehmer, 1951:11–12)(Fig. B.3d–m)
      - Chamberlain Horizontal Cord Impressed (Caldwell and Jensen, 1969:43)(Fig. B.3k,l)
    - Triangular Cord Impressed (Fig. B.3m)
      - Chamberlain Cord Impressed Triangle (Hurt, 1951:46–47)(Fig. B.3m)
    - Horizontal Incised (Fig. B.3d,e)
      - Chamberlain Horizontal Incised (Caldwell and Jensen, 1069:43)(Fig. B.3d,e)
      - Linden Everted Rim: Cottonwood Variety (Knudson, 1967:263–266)
    - Triangular Incised (Fig. B.3f–j)
      - Chamberlain Incised Triangle (Hurt, 1951:45–46; Caldwell and Jensen, 1969:43)(Fig. B.3f–j)
      - Linden Everted Rim: Cottonwood Variety (Knudson, 1967:263–266)
    - Cross-Hatched Incised (Fig. B.3a–c)
      - Anderson High Rim (Lehmer, 1951:11–12)
      - Chamberlain Incised Crosshatch (Caldwell and Jensen, 1969:43)(Fig. B.3a–c)
  - Decorated on the Lip
    - Tool/Finger Impressed (Figs. B.4a–g, B.5a–o)
      - Anderson High Rim, Anderson Low Rim (Lehmer, 1951:11–12)(Figs. B.4a–o, B.5a–o)
      - Kimball Modified Lip, Mitchell Modified Lip (Hurt, 1951:49)(Fig. B.5a–o)
      - Anderson Tool Impressed (Caldwell and Jensen, 1969:42)(Figs. B.4e,g; B.5a–o)
      - Anderson Incised Herringbone (Caldwell and Jensen, 1969:42)
      - Linden Everted Rim: Nicollet Variety (Knudson, 1967:261–262)(Figs. B.7a–c, h–k; B.8a–c)
      - Stuart Tool Impressed (Caldwell and Jensen, 1969:43–44)
    - Cross-Hatch Incised (Fig. B.4a–c,f)
      - Anderson High Rim, Anderson Low Rim (Lehmer, 1951:11–12)(Fig. B.4a–c,f)
      - Mitchell Modified Lip (Hurt, 1954b)(Fig. B.4e,f)
      - Anderson Incised Crosshatch (Calwell and Jensen, 1969:42) (Fig. B.4a–c,f)
      - Linden Everted Rim: Nicollet Variety (Knudson, 1967:261–262)(Fig. B.8d,f)

Cord Impressed (Fig. B.4h,i)
Anderson Cord Impressed (Caldwell and Jensen, 1969:42)(Fig. B.4h,i)
Linden Everted Rim: Nicollet Variety (Knudson, 1967:261–262)
Undecorated (Fig. B.4j–o)
Anderson High Rim, Anderson Low Rim (Lehmer, 1951:11–12)(Fig. B.4j–o)
Maxon Flared-rim (Hurt, 1951b:48–49) (Fig. B.4j–o)
Anderson Plain (Calwell and Jensen, 1969:42)(Fig. B.4j–o)
Linden Everted: Linden Variety (Knudson, 1967:260–261)(Fig. B.8g,i)
Tschetter Plain (Alex, 1981b:58–59)
Stuart Plain (Caldwell and Jensen, 1969:43–44)
Rolled Rim (Figs. B.6c,f–i; B.8h,j,k)
Mitchell Broad Trailed (Hurt, 1954b)(Fig. B.6f,h,i)
Mitchell Rolled Rim (Caldwell and Jensen, 1969:44–45)(Fig. B.6c,f–j)
Powell Plain (Knudson, 1967:255–256)(Fig. B.8h,k)
Ramey Broad Trailed (Knudson, 1967:255–256)(Fig. B.8j)
Bowls (Fig. B.6d,e)
Twelve Mile Incurved Rim, Twelve Mile Red Filmed (Hurt, 1954b)
Ethan Ware, Dimock Ware (Alex, 1981b:59–60)

GREAT OASIS
S-shaped/Collared Rim Form
Decorated on the Exterior Rim
Triangular and Horizontal Incised
No Defined Types
Horizontal Incised
No Defined Types
Horizontal Cord Impressed
No Defined Types
Straight/Curved Rim Form
Decorated on the Exterior Rim
Triangular and Horizontal Cord Impressed
No Defined Types
Pendant Triangular Diagonal Cord Impressed (Fig. B.8o)
No Defined Types
Horizontal Cord Impressed
No Defined Types
Triangular and Horizontal Incised (Figs. B.8l–n, B.9i)
Groups A-2, A-5 (E. Johnson, 1969)
Group 5 (Johnston, 1967:42–44)
Great Oasis High Rim (Triangle) (Henning and Henning, 1978:18)
Pendant Triangular/Horizontal Incised (Fig. B.9c,e,f)
Groups B-2, B-4, B-5 (E. Johnson, 1969)
Group 6 (Johnston, 1967:44–45)
Great Oasis High Rim (Pendant Triangle) (Henning and Henning, 1978:18)
Pendant Triangular/Diagonal Incised (Fig. B.9d,o)
Groups B-1, B-3 (E. Johnson, 1969)
Group 6 (Johnston, 1967:44–45)
Great Oasis High Rim (Pendant Triangle) (Henning and Henning, 1978:18)
Horizontal Incised (Fig. B.9g,h)
Group F-1 (E. Johnson, 1969)
Group 4 (Johnston, 1967:41–42)
Chevron Incised
Group I-1 (E. Johnson, 1969)
Chevron and Horizontal Incised (Fig. B.9j,k)
No Defined Types
X-Hatch, Horizontal and Diagonal Incised
Groups E-1, E-2 (E. Johnson, 1969)
Straight/Curved Rim Form
Decorated on the Exterior Rim
Spaced Horizontal and Diagonal Incised
Group C (E. Johnson, 1969)
Great Oasis High Rim (Oblique Lines) (Henning and Henning, 1978:22)
Decorated on the Exterior Rim
Criss-Cross Horizontal Incised (Fig. B.9m,n)

(*continued*)

TABLE B.1. (*continued*)

Great Oasis (*continued*)
- Group A-1 (E. Johnson, 1969)
- Group 5 (Johnston, 1967:42–44)
- Great Oasis High Rim (Diamond) (Henning and Henning, 1978:18)

Flag and Dot and Horizontal Incised (Fig. B.9a,b)
- Great Oasis High Rim (Flag and Dot) (Henning and Henning, 1978:22)

Trapezoid and Horizontal Incised
- Groups D-2, D-3 (E. Johnson, 1969)
- Great Oasis High Rim (Trapezoid) (Henning and Henning, 1978:18, 22)

Decorated on the Lip (Fig. B.10e,g,h)
- Tool/Finger Impressed
  - Group 7 (Johnston, 1967:45–46)
  - Group 9 (Johnston, 1967:47–48)
  - Great Oasis High Rim Plain (Henning and Henning, 1978:18)
  - Great Oasis Wedge Lip (Tool Impressed Lip) (Henning and Henning, 1978:24)
- Cross-Hatch Incised
  - Great Oasis Wedge Lip (Crosshatched Lip, Crosshatched/Tool Impressed Lip) (Henning and Henning, 1978:24)

Undecorated (Fig. B.10a–d,f)
- Group 7 (Johnston, 1967:45–46)
- Great Oasis High Rim Plain (Henning and Henning, 1978:18)
- Great Oasis Wedge Lip (Plain) (Henning and Henning, 1978:24)

Extended and Terminal Middle Missouri

S-shaped/Collared Rim Form
- Decorated on the Exterior Rim
  - Cord Impressed (Figs. B.10l–o; B.11n,o)
    - Fort Yates Cord-Impressed (Hewes, 1949:65–66)(Figs. B.10l–o; B.11n,o); TMM, EMM
    - Fort Yates Cord Impressed Rim (Wood and Woolworth, 1964:20–21)(Figs. B.10l–o; B.11n,o); TMM, EMM
    - Le Beau Cord Impressed (Wood, 1967:67–68); see entry in Coalescent Tradition; TMM
  - Horizontal Incised (Fig. B.10i,j)
    - Fort Yates Incised (Lehmer, 1966:29–31)(Fig. B.10i,j); TMM-EMM
    - Le Beau Trailed (Calabrese, 1972:19)
  - Cross-Hatch Incised (Fig. B.10k)
    - Fort Yates Cross-Hatched Rim (Wood and Woolworth, 1964:21)(Fig. B.10k); EMM
    - Fort Yates Incised (Lehmer, 1966:29–31)(Fig. B.10k); TMM-EMM
  - Filleted (Fig. B.11l,m)
    - No Types Defined
- Undecorated Exterior Rim or Tool/Finger Impressed Lip
  - Fort Yates Plain (Lehmer, 1966:30); TMM-EMM
  - Fort Yates Decorated Lip (Sperry, 1968:45); TMM, EMM
  - Le Beau Plain (Calabrese, 1972:19); EMM

Straight/Curved Rim Form
- Decorated on the Exterior Rim
  - Horizontal Incised (Fig. B.11b)
    - Riggs Incised Rim (Wood and Woolworth, 1964:19–20; Lehmer, 1966:29–31)(Fig. B.11b); EMM-TMM
  - Cross-Hatch Incised (Fig. B.11a)
    - Riggs Cross-Hatched Rim (Wood and Woolworth, 1964:19)(Fig. B.11a); EMM
    - Riggs Incised Rim (Lehmer, 1966:29–31)(Fig. B.11a); TMM-EMM
  - Tool/Finger Impressed (Fig. B.11e–g)
    - Riggs Punctate (Lehmer, 1966:29–31); TMM, EMM
  - Filleted (Fig. B.12k–m,o)
    - Riggs Filleted Rim (Wood, 1967:65); TMM, EMM
- Decorated on the Lip
  - Pinched (Fig. B.12n)
    - Riggs Plain Rim (Wood and Woolworth, 1964:16–19)(Fig. B.12n); EMM
    - Riggs Pinched Rim (Wood and Woolworth, 1964:16–19); TMM-EMM
  - Tool/Finger Impressed (Figs. B.11c–j, B.12a–c,e–g)
    - Riggs Plain Rim (Wood and Woolworth, 1964:16–19)(Figs. B.11c–j, B.12a–c,e–g); EMM
    - Riggs Decorated Lip (Lehmer, 1966:29–31)(Figs. B.11c–j, B.12a–c,e–g); EMM, TMM
- Undecorated (Fig. B.12d,h–j)
  - Riggs Plain (Lehmer, 1966:29–31); EMM, TMM

Initial Coalescent
S-shaped/Collared Rim Form
  Decorated on the Exterior Rim
    Diagonal Incised (Fig. B.14m)
      Arzberger Diagonal Incised (Spaulding, 1956:145–148)
    Horizontal Incised (Fig. B.14j–l)
      Arzberger Horizontal Incised (Spaulding, 1956:139–141) (Fig. B.14j–l)
      Campbell Creek Collared (Smith, 1951:39–40; 1977:66–67)(Fig. B.14j)
    Cross-Hatch Incised (Fig. B.14h,i)
      Arzberger Crosshatched (Spaulding, 1956:141–145)
    Finger Impressed (Fig. B.14n)
      Arzberger Plain (Spaulding, 1956:137–139)
    Tool Impressed (Fig. B.14o)
      Arzberger Plain (Spaulding, 1956:137–139)
  Undecorated Exterior Rim
      Arzberger Plain (Spaulding, 1956:137–139)
Straight/Curved Rim Form
  Decorated on the Exterior Rim
    Finger Impressed (Fig. B.13k–o)
      Campbell Creek Pinched (Smith, 1951:38; 1977:64–65)
      Hughes Beveled (Spaulding, 1956:165–167)(Fig. B.13o)
    Horizontal Incised (Fig. B.14a–d)
      Hughes Group, Horizontally Incised Rim (Spaulding, 1956:153–154)
    Diagonal Incised
      Hughes Group, Other Incised Rim (Spaulding, 1956:153–157)
  Decorated on the Lip
    Tool or Finger Impressed
      Hughes Beveled (Spaulding, 1956:165–167)(Fig. B.13e–i)
      Hughes Group, Plain Rims (Spaulding, 1956:157–164)(Fig. B.13j)
      Talking Crow Straight Rim (Smith, 1951:36–37)(Fig. B.13f)
      Campbell Creek Cordmarked/Cord Roughened (Smith, 1951:39; 1977:66) (Fig. B.14e–f)
      Campbell Creek Indented (Smith, 1977:67)(Figs. B.13e–g,i; B.14g)
      Campbell Creek Plain (Smith, 1951:38–39; 1977:65–66)(Fig. B.13h)
    Undecorated Exterior Rim (Fig. B.13a–d)
      Hughes Group, Plain Rim (Spaulding, 1956:157–164)
      Campbell Creek Cordmarked/Cord Roughened (Smith, 1951:39; 1977:66)(Fig. B.13a,b)
      Talking Crow Straight Rim (Smith, 1951:36–37; 1977:58–59)(Fig. B.13c,d)

Extended and Post-Contact Coalescent
S-shaped/Collared Rim Form
  Decorated on the Exterior Rim
    Cord Impressed (Figs. B.15a–f, B.17a–c, B.22a–o, B.23i)
      Le Beau Horizontal Cord Impressed (Hurt, 1957:41)(Figs. B.15b,f; B.22b,c,l,o); PCC-EC
      Le Beau S-Shaped Rim: Miscellaneous Variations (Hurt, 1957:43)(Fig. B.22d,f,h,i); PCC-EC
      Le Beau Cord Wrapped Rod (Hurt, 1957:39)(Fig. B.17c); PCC
      Rygh Rainbow Corded (Hurt, 1957:42–43)(Figs. B.15e; B.22a,e,g,j,k,m,n); PCC-EC
      Colombe Cord Impressed (Lehmer and Jones, 1968:28–29)(Fig. B.17a); PCC
      Deapolis Collared Rim (Lehmer, et al. 1978:208–211)(Fig. B.23i); PCC
      Transitional S-Rim (Ahler and Weston, 1981:86–89)(Fig. B.21d,f,l); PCC
    Horizontal Incised (Figs. B.15g–j, B.17g, B.18c)
      Le Beau Incised S-Rim (Hurt, 1957:41–42)(Figs. B.15g,h,j; B.17g; B.18c); EC,PCC
      Le Beau Incised (Lehmer et al. 1978:201–202); PCC
      Iona S-Rim: Variety A (Smith and Grange, 1958:101); EC-PCC
      Akaska Stab and Drag: Variety A (Hurt, 1957:45)(Fig. B.15i); EC,PCC
    Diagonal Incised (Figs. B.15l–n, B.17f,h–j)
      Le Beau Incised S-Rim (Hurt, 1957:41–42)(Figs. B.15m,n; B.17f,h–j); EC,PCC
      Cadotte Collared: Varieties B–C (Smith and Johnson, 1968:15–16)(Fig. B.15l); PCC,EC
      Iona S-Rim: Variety C (Smith and Grange, 1958:101); PCC-EC
    Herringbone Incised (Figs. B.15k; B.17d,e)
      Cadotte Collared: Variety A (Smith and Grange, 1968:15–16)(Fig. B.15k); PCC,EC
      Iona S-Rim: Variety B (Smith and Grange, 1958:101)(Fig. B.17d,e); PCC-EC
    Tool or Finger Impressed (Figs. B.15o; B.17k,l; B.18d,k)
      Cadotte Collared: Variety D (Smith and Johnson, 1968:15–16)(Fig. B.15o); PCC,EC
      Colombe Tool Impressed (Lehmer and Jones, 1968:28–29); PCC

(*continued*)

TABLE B.1. (*continued*)

Extended and Post-Contact Coalescent (*continued*)
  Undecorated Exterior Rim (Figs. B.17m–o; B.18e,f)
    Iona S-Rim: Variety D (Smith and Grange, 1958:101); PCC-EC
    Cadotte Collared: Variety E (Smith and Johnson, 1968:15–16); PCC,EC
    Le Beau S-Rim, Plain (Wilmeth 1958:6)(Figs. B.17m–o; B.18e,f); EC
    Le Beau Plain (Lehmer et al. 1978:203); PCC
    Deapolis Collared Rim (Lehmer et al. 1978:208–211)(Fig. B.23g,h); PCC
Straight/Curved Rim Form
  Decorated on the Exterior Rim
   Diagonal/Herringbone and/or Horizontal Incised (Figs. B.16g,h,j–o; B.18a,m,o; B.19a,b)
    La Roche Diagonally Incised (Lehmer and Jones, 1968:52–54); EC
    Iona Diagonal Incised (Smith and Grange, 1958:100); EC
    La Roche Horizontally Incised (Lehmer and Jones, 1968:52–54); EC
    Iona Horizontal Incised (Smith and Grange, 1958:100–101)(Fig. B.16g, o); EC
    Nordvold Horizontal Incised (Hurt, 1957:44–45)(Figs. B.16g,h,j–o; B.19a,b); EC,PCC
    Akaska Stab and Drag: Variety B (Hurt, 1957:45)(Fig. B.18a,m,o); EC,PCC
Straight/Curved Rim Form
  Decorated on the Lip (or Rim Brace)
   Cord Impressed (may also be cord impressed on exterior rim)(Figs. B.20n,o; B.21a–o; B.23b,j–o; B.24a–k)
    Stanley Cord Impressed (Lehmer, 1951:7–8)(Figs. B.20n,o; B.21b,c,h,k,n; B.24a–g,i–k); PCC
    Knife River Cord Impressed (Lehmer et al. 1978:190–195)(Figs. B.21e,g,j; B.23b,j–o); PCC
    Talking Crow Cord Impressed (Smith, 1951:35–36; 1977:58)(Figs. B.21o, B.24h); PCC
    Le Beau Cord Impressed: Variety A (Hurt, 1957:38–39)(Fig. B.21a,m); PCC,EC
    Intermediate Cord Impressed (Baerreis and Dallman, 1961:467–468)(Fig. B.21a,m); PCC
    Steamboat Cord Wrapped Rod (Hurt, 1957:43–44); PCC,EC
   Tool Impressed (Figs. B.16a–f,i; B.18h–j; B.19l–o; B.20a–m; B.23a,b)
    La Roche Decorated Lip (Lehmer and Jones, 1968:52–54)(Figs. B.16a,b,f; B.20b,c); EC
    Le Beau Tool Impressed: Variety A (Hurt, 1957:43)(Fig. B.20d,l); PCC-EC
    Akaska Tool Impressed (Hurt, 1957:46)(Fig. B.16a–f,i); EC,PCC
    Iona Indented (Smith and Grange, 1958:98–100)(Figs. B.16a, B.19k); EC,PCC
    Stanley Tool Impressed (Lehmer, 1951:6–7)(Fig. B.20e–k,m); PCC
    Talking Crow Indented (Smith, 1951:35; 1977:57)(Figs. B.20b,c; B.16e; B.18h,j; B.19m); PCC
    Talking Crow Indented (Lehmer and Jones, 1968:30)(Figs. B.16b–f, B.18h–j, B.19m); PCC
    Talking Crow Straight Rim (Smith, 1951:36–37; 1977:58–59)(Figs. B.16b–d,f; B.18i; B.20a); PCC,EC
    Talking Crow Brushed (Smith, 1951:34–35; 1977:57–58); PCC
    Knife River Tool Impressed (Lehmer et al. 1978:195–196)(Fig. B.23a,b); PCC
    Intermediate Tool Impressed (Baerreis and Dallman, 1961:467–468)(Fig. B.20d,l); PCC
   Finger Impressed (Figs. B.18l, B.19c–f, B.20c, B.23c–e)
    Stanley Wavy Rim (Lehmer, 1951:6)(Fig. B.19c,e); PCC
    Stanley Pinched (Lehmer and Jones, 1968:26–27)(Fig. B.19c,e); PCC
    Knife River Pinched (Lehmer et al. 1978:196–197)(Fig. B.23c–e); PCC
    Talking Crow Pinched (Lehmer and Jones, 1968:30)(Fig. B.18l); PCC
    Talking Crow Brushed (Smith, 1951:34–35; 1977:57–58)(Fig. B.18l); PCC
    Le Beau Finger Indented (Hurt, 1957:39–40)(Fig. B.19d,f); PCC
    Indeterminate Wavy Rim (Baerreis and Dallman, 1961:470)(Fig. B.19d,f); PCC
   Undecorated (Figs. B.18g, B.19g–j, B.23f)
    Akaska Plain (Hurt, 1957:46)(Fig. B.19j); EC
    Stanley Plain (Lehmer, 1951:8); PCC
    Knife River Plain (Lehmer et al. 1978:198–199)(Figs. B.19i, B.23f); PCC
    Talking Crow Straight Rim (Smith, 1951:36–37; 1977:58–59)(Fig. B.19j); PCC
    Talking Crow Plain (Lehmer and Jones, 1968:30)(Fig. B.19j); PCC
    Talking Crow Brushed (Smith, 1951:34–35; 1977:57–58); PCC
    Le Beau Plain (Hurt, 1957:40)(Fig. B.19g,h); PCC
    Intermediate Plain (Baerreis and Dallman, 1961:466)(Fig. B.19g,h); PCC

Abbreviations of four taxonomic variants employed by Lehmer (1971:193): Extended Middle Missouri (EMM), Terminal Middle Missouri (TMM), Extended Coalescent (EC), and Post-Contact Coalescent (PCC). Types with labels generally occur in highest percentages in designated variants. If two or more abbreviations are separated by a comma, type is present in higher percentage in first variant; if separated by hyphen, percentages in both variants are approximately the same. No abbreviations are used for Initial Middle Missouri types, because they are not further subdivided.

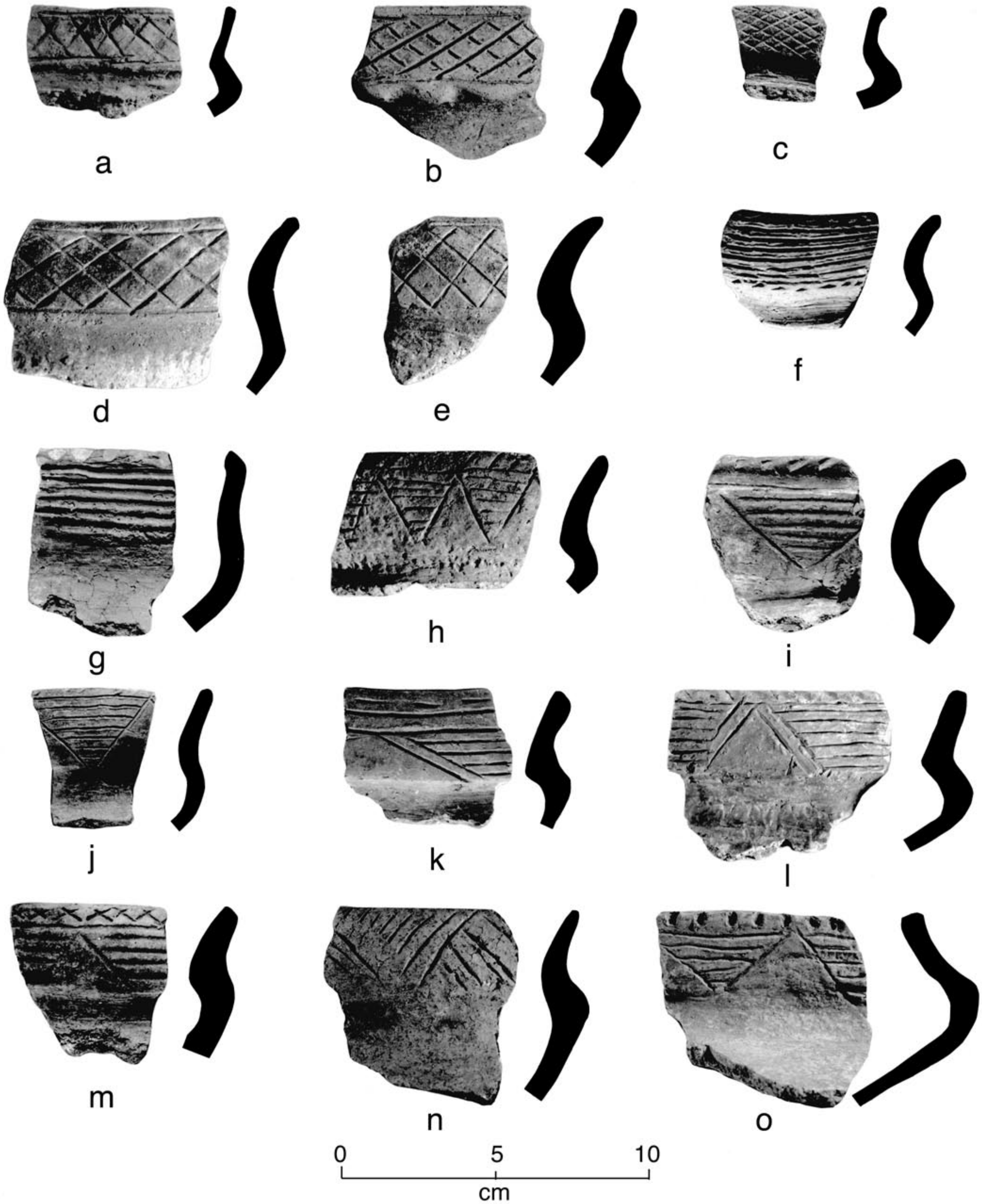

FIGURE B.1. Initial Middle Missouri rim sherds: *a–e,* S-shaped cross-hatch incised rim; *f–g,* S-shaped horizontal incised rim; *h–o*, Triangular incised rim.

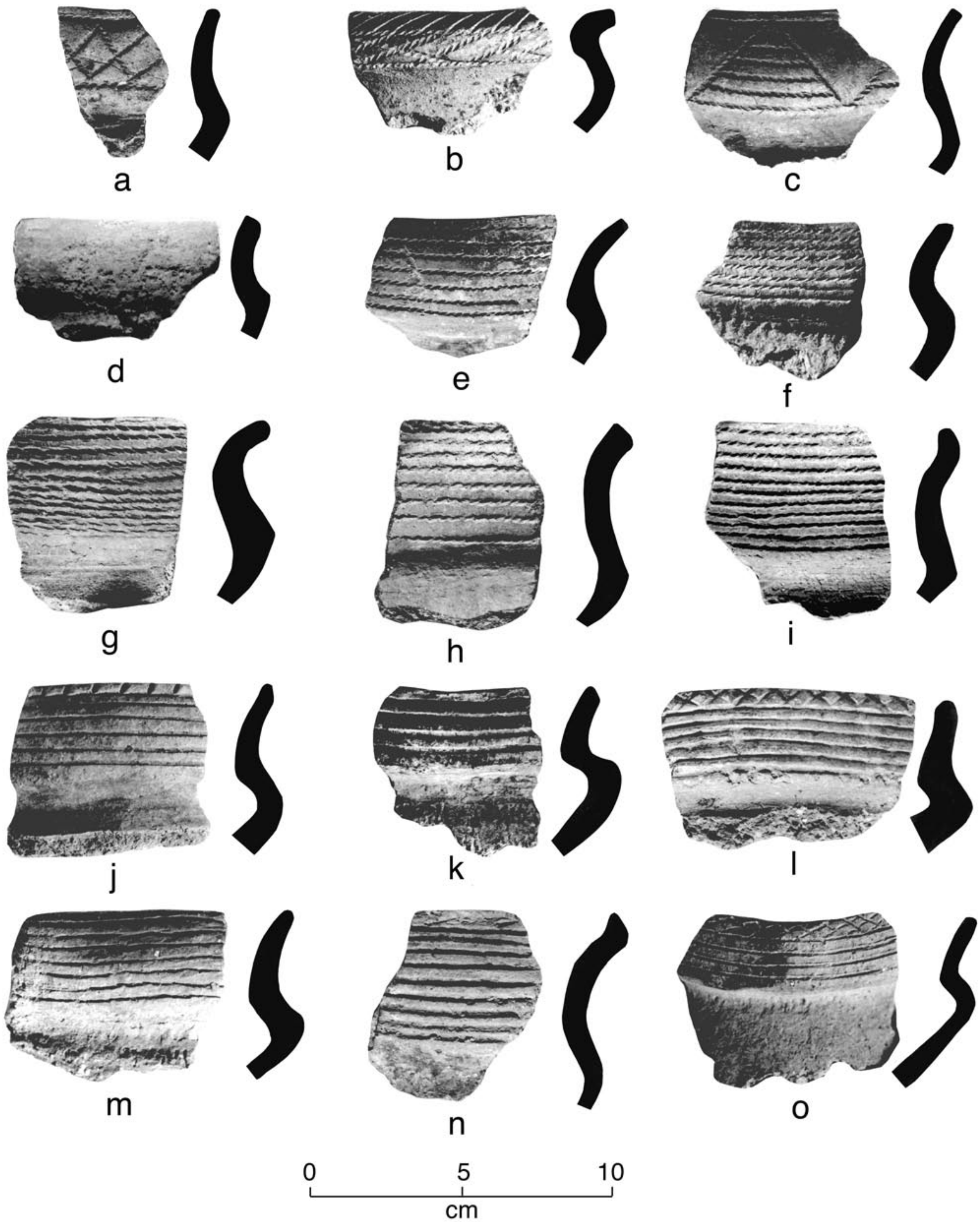

FIGURE B.2. Initial Middle Missouri rim sherds: *a–b,* S-shaped crosshatch cord impressed rim; *c,* S-shaped triangular incised rim; *d*, S-shaped undecorated; *e–i,* S-shaped horizontal cord impressed rim; *j–o*, S-shaped horizontal incised rim.

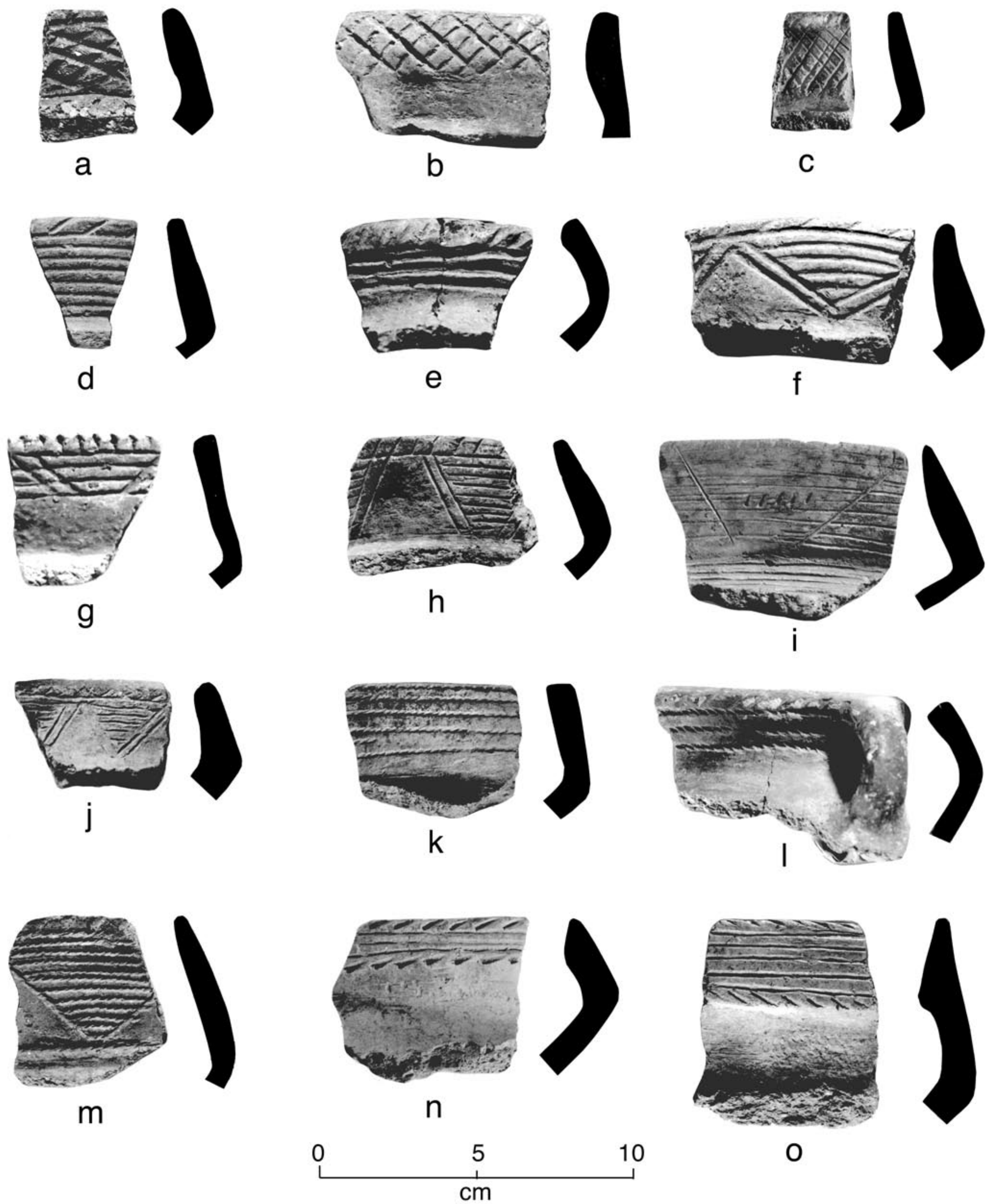

FIGURE B.3. Initial Middle Missouri rim sherds: *a–c*, Straight cross-hatch incised rim; *d–e*, Straight horizontal incised rim; *f–j*, Straight triangular incised rim; *k–l*, Straight cord impressed rim; *m*, Straight triangular cord impressed rim; *n–o*, S-shaped (collared) horizontal incised rim.

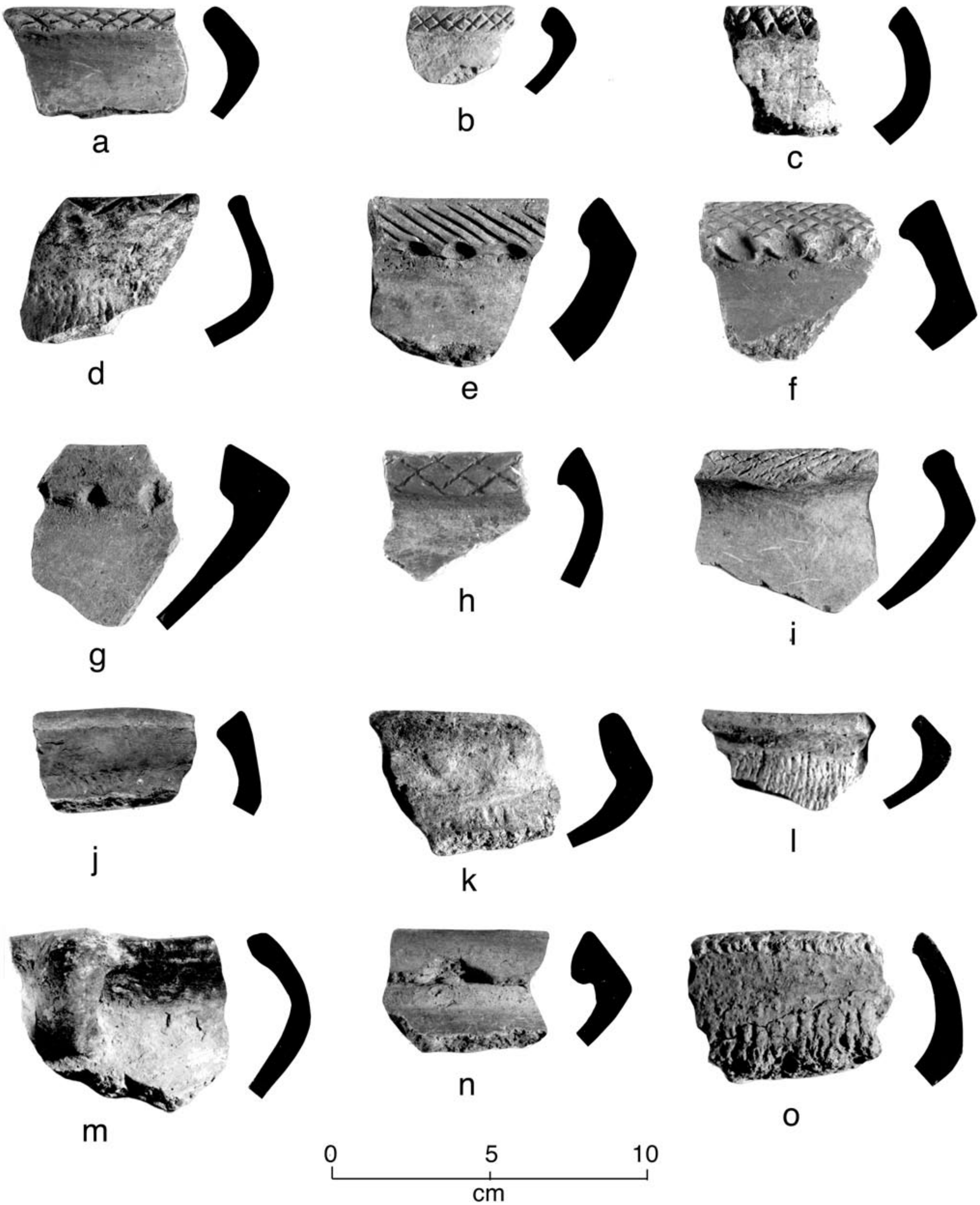

FIGURE B.4. Initial Middle Missouri rim sherds: *a–c, f*, Straight cross-hatch incised lip; *d*, Straight zig-zag incised lip; *e*, Straight tool/finger impressed lip; *g*, Straight tool impressed lip; *h–i*, Straight cross-hatch cord impressed lip; *j–o*, Straight undecorated.

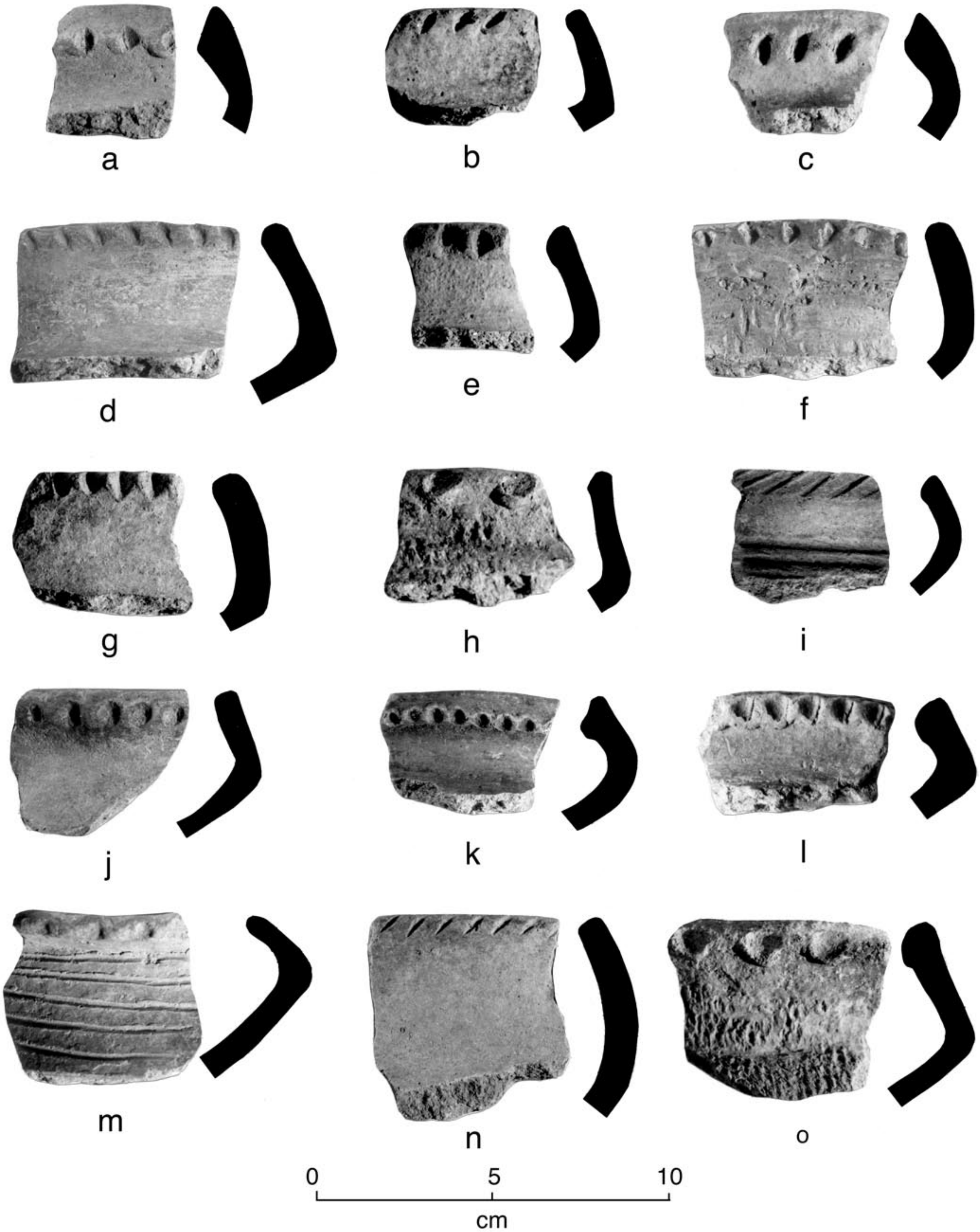

FIGURE B.5. Initial Middle Missouri rim sherds: *a–o,* Straight tool/finger impressed lip.

FIGURE B.6. Initial Middle Missouri rim sherds: *a–b,* S-shaped (collared) tool impressed rim; *c, f–i,* Rolled rim; *d–e,* Bowls.

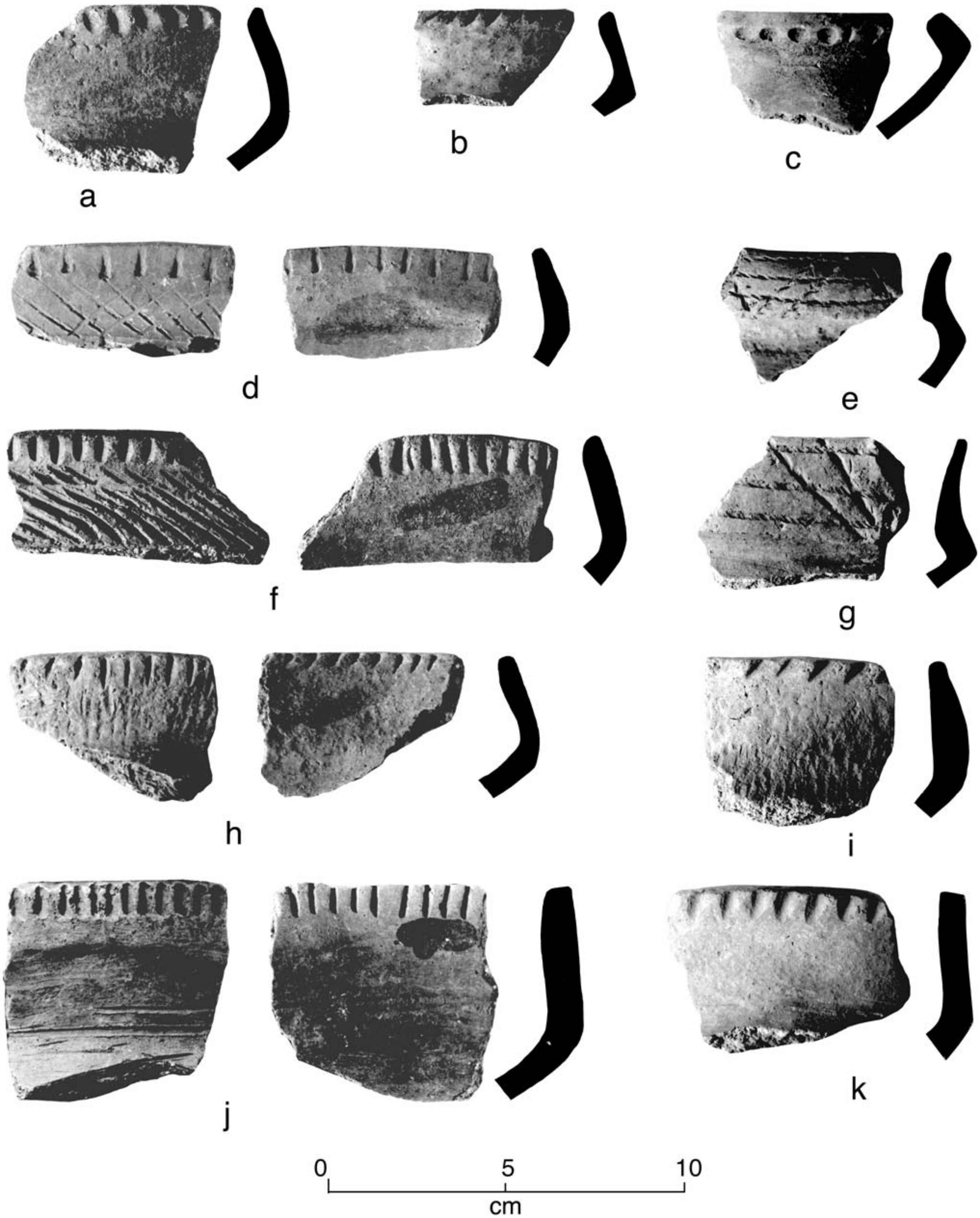

FIGURE B.7. Initial Middle Missouri rim sherds (Cambria site): *a–c, h–k,* Straight tool/finger impressed lip; *d,* Straight cross-hatch incised rim; *e, g,* S-shaped triangular cord impressed rim; *f,* Straight diagonal incised rim.

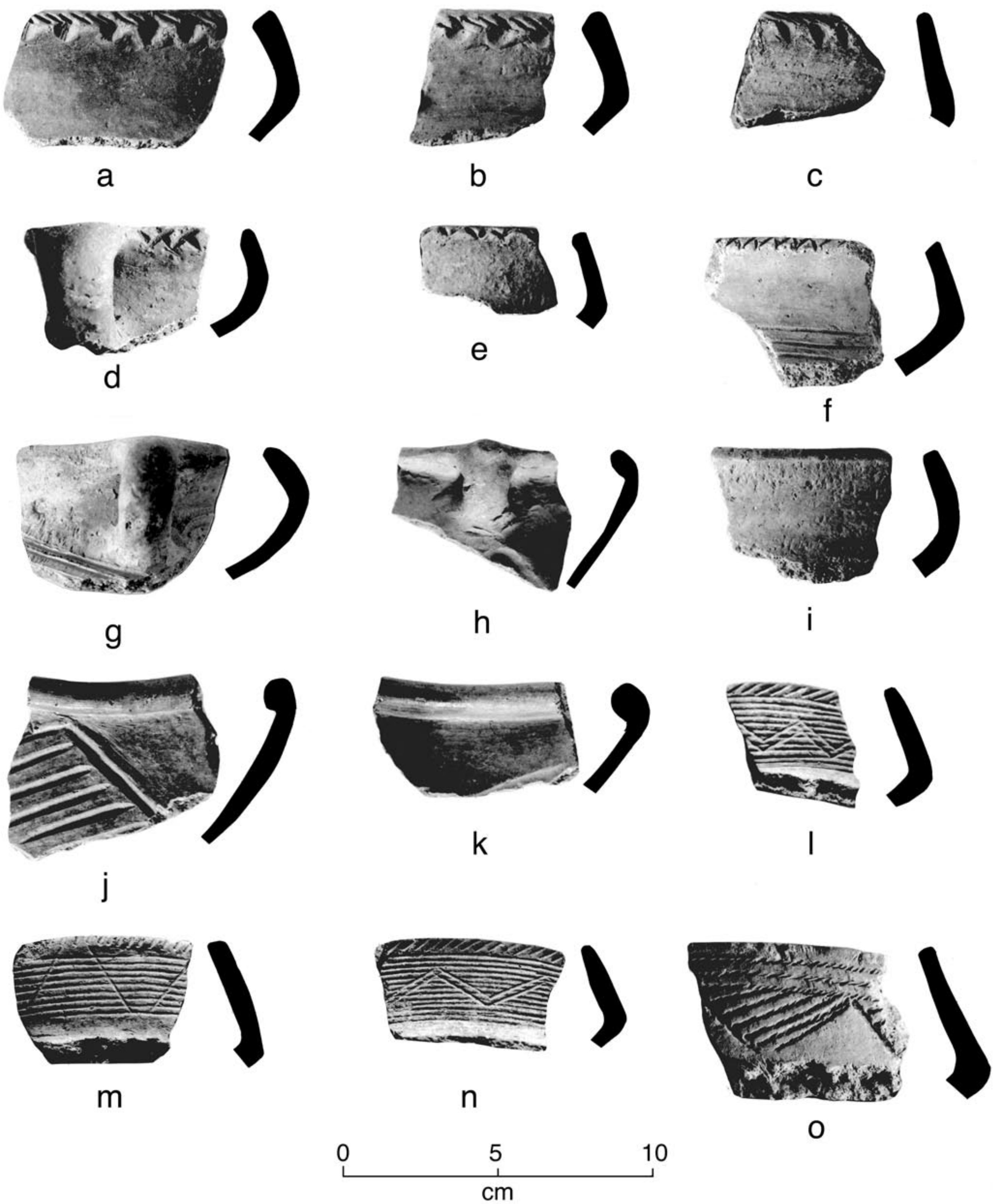

FIGURE B.8. Initial Middle Missouri (Cambria site) and Great Oasis *(l–o)* rim sherds: *a–c,* Straight tool/finger impressed lip; *d–f,* Straight cross-hatch incised lip; *g, i,* Straight undecorated; *h, j–k,* Rolled rim; *l–n,* Straight triangular/horizontal incised rim; *o,* Straight pendant triangle/diagonal cord impressed rim.

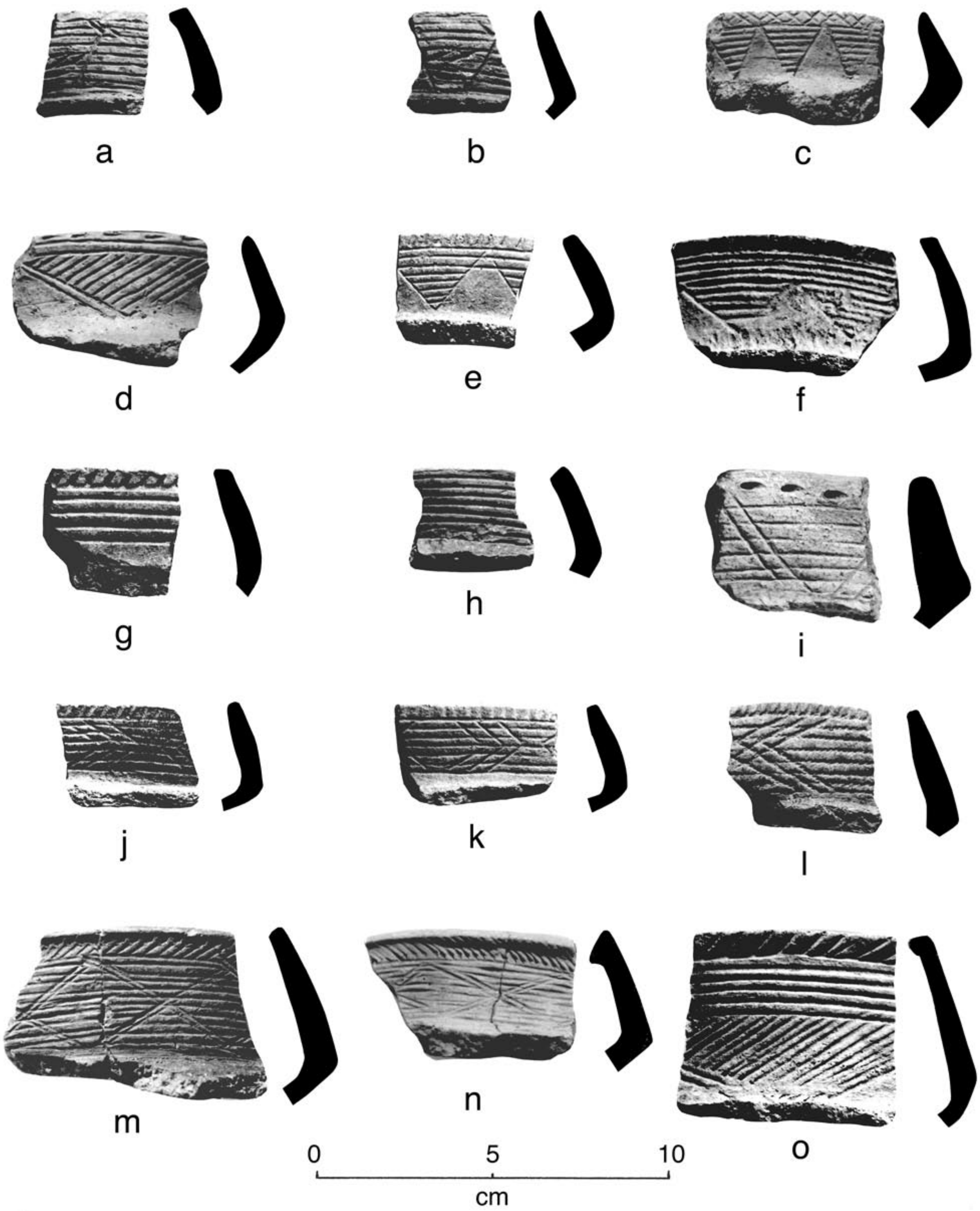

FIGURE B.9. Initial Middle Missouri (Great Oasis) rim sherds: *a, b*, Straight flag & dot horizontal incised rim; *c, e–f*, Straight pendant triangle/horizontal incised rim; *d, o,* Straight pendant triangle/diagonal incised rim; *g–h*, Straight horizontal incised rim; *i,* Straight triangular/horizontal incised rim; *j–k,* Straight chevron/horizontal incised rim; *l*, Straight chevron horizontal cord impressed rim; *m–n*, Straight criss-cross horizontal incised rim.

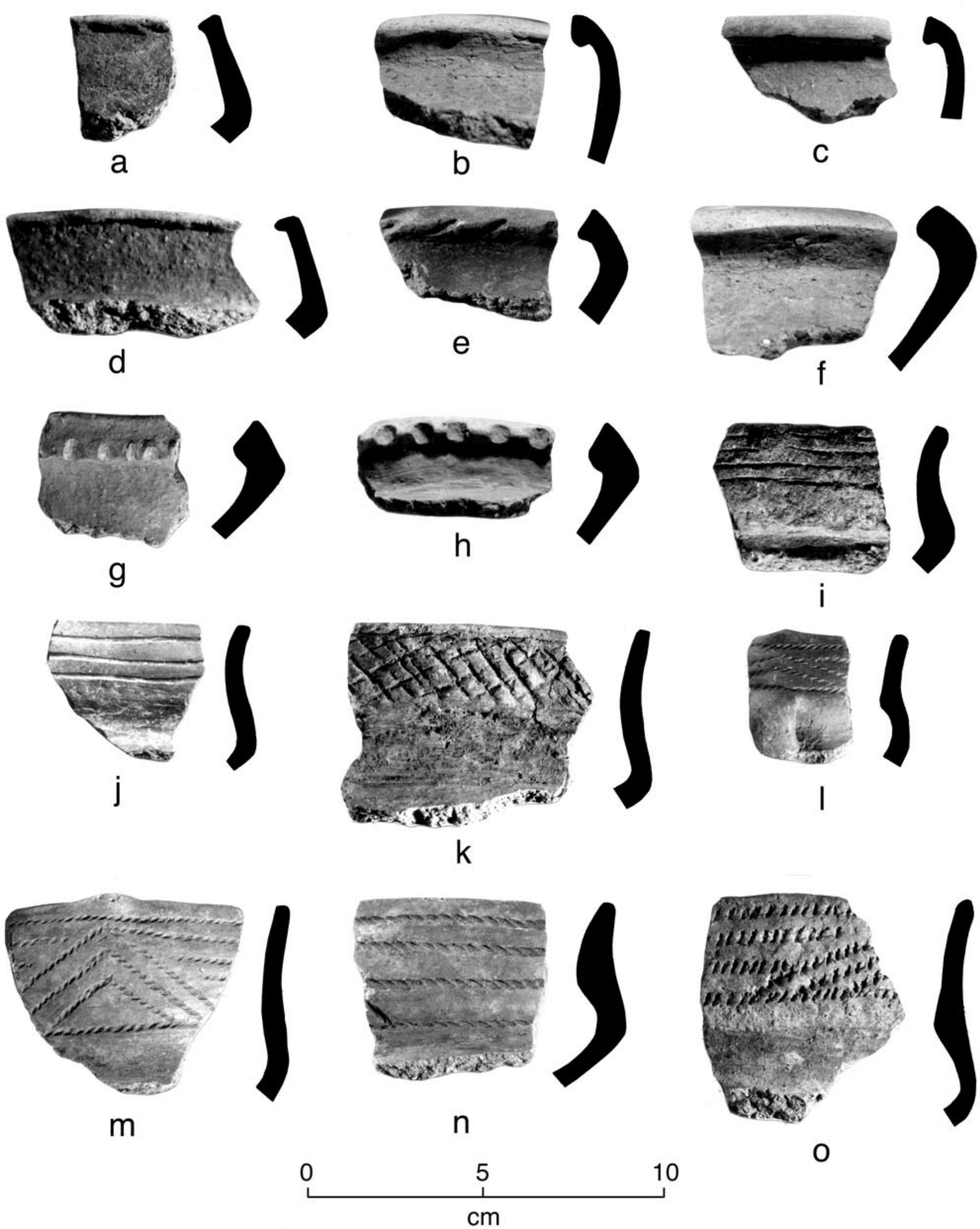

FIGURE B.10. Great Oasis (*a–h*) and Extended/Terminal Middle Missouri (*i–o*) rim sherds: *a–d, f,* Straight undecorated; *e, g–h,* Straight tool impressed lip; *i–j,* S-shaped horizontal incised rim; *k,* S-shaped cross-hatch incised rim; *l–o*, S-shaped cord impressed rim.

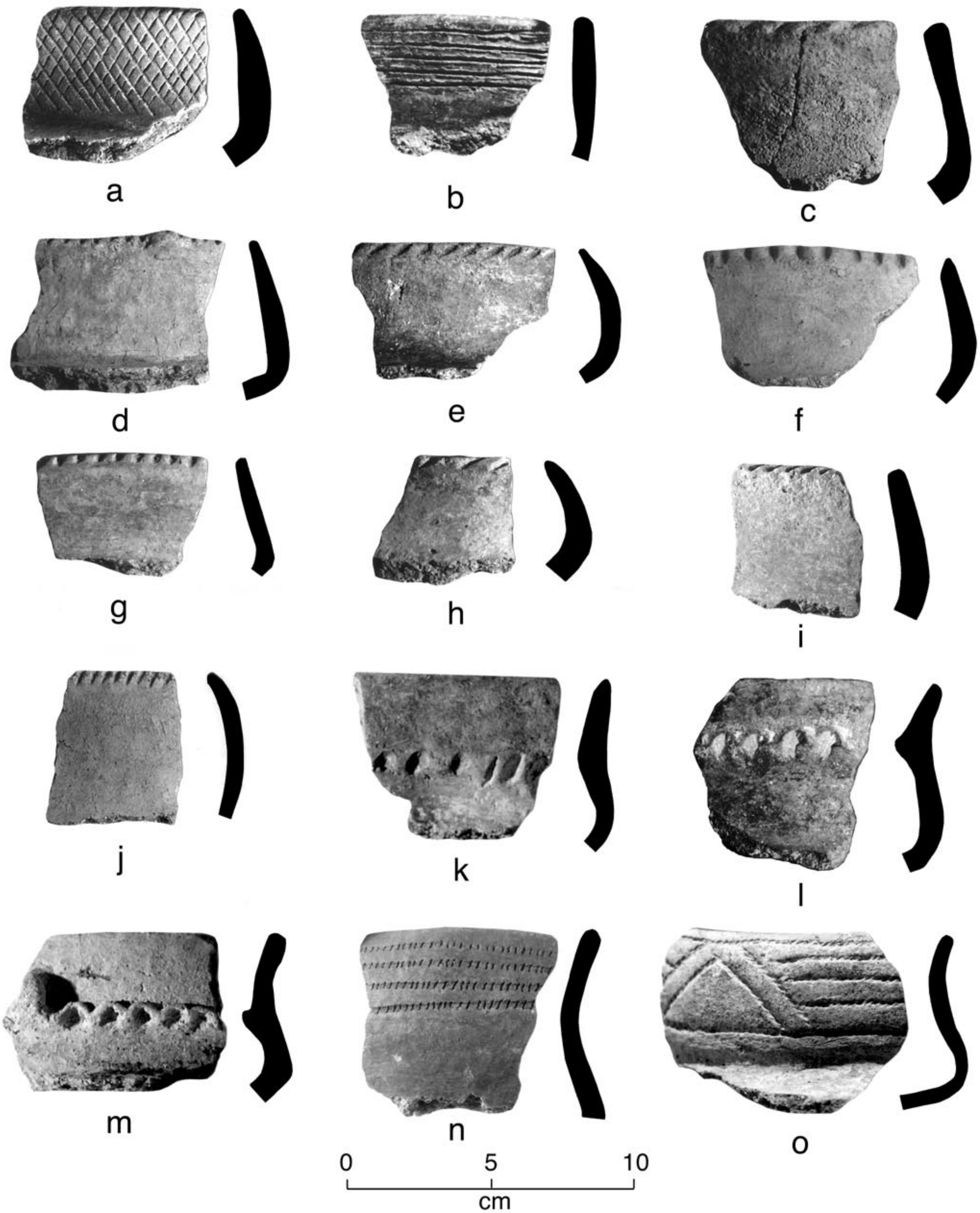

FIGURE B.11. Extended/Terminal Middle Missouri rim sherds: *a,* Straight cross-hatch incised rim; *b,* Straight horizontal incised rim; *c–j,* Straight tool/finger impressed lip; *k,* S-shaped tool/finger impressed rim; *l–m,* S-shaped filleted rim; *n–o,* S-shaped cord impressed rim.

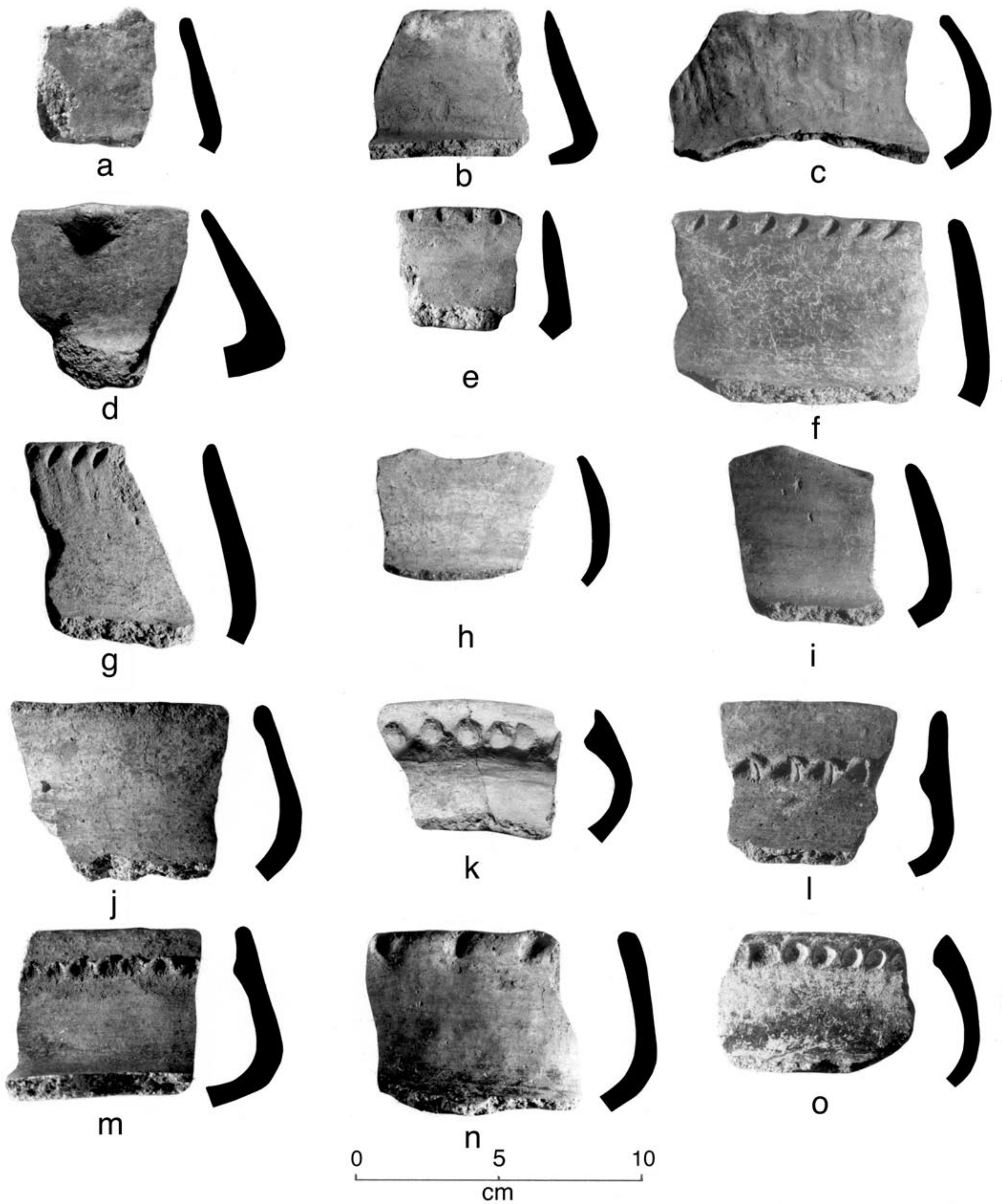

FIGURE B.12. Extended/Terminal Middle Missouri rim sherds: *a–b, e–g,* Straight tool impressed lip; *c,* Straight pinched lip; *d, h–j,* Straight undecorated; *k–m, o,* Straight filleted rim; *n–o,* Straight finger impressed lip.

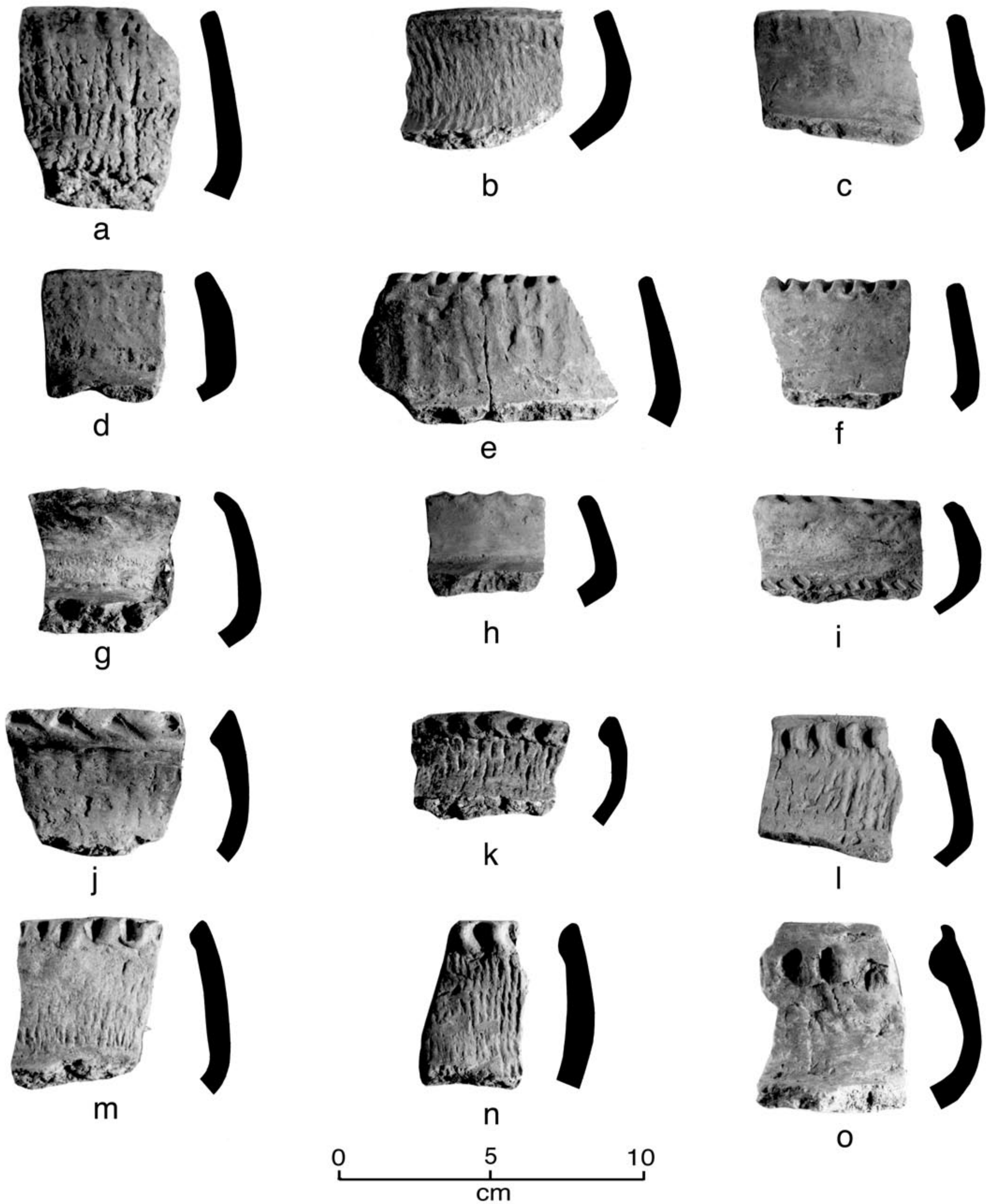

FIGURE B.13. Initial Coalescent rim sherds: *a–d*, Straight undecorated; *e–j*, Straight tool impressed lip; *k–o*, Straight finger impressed rim.

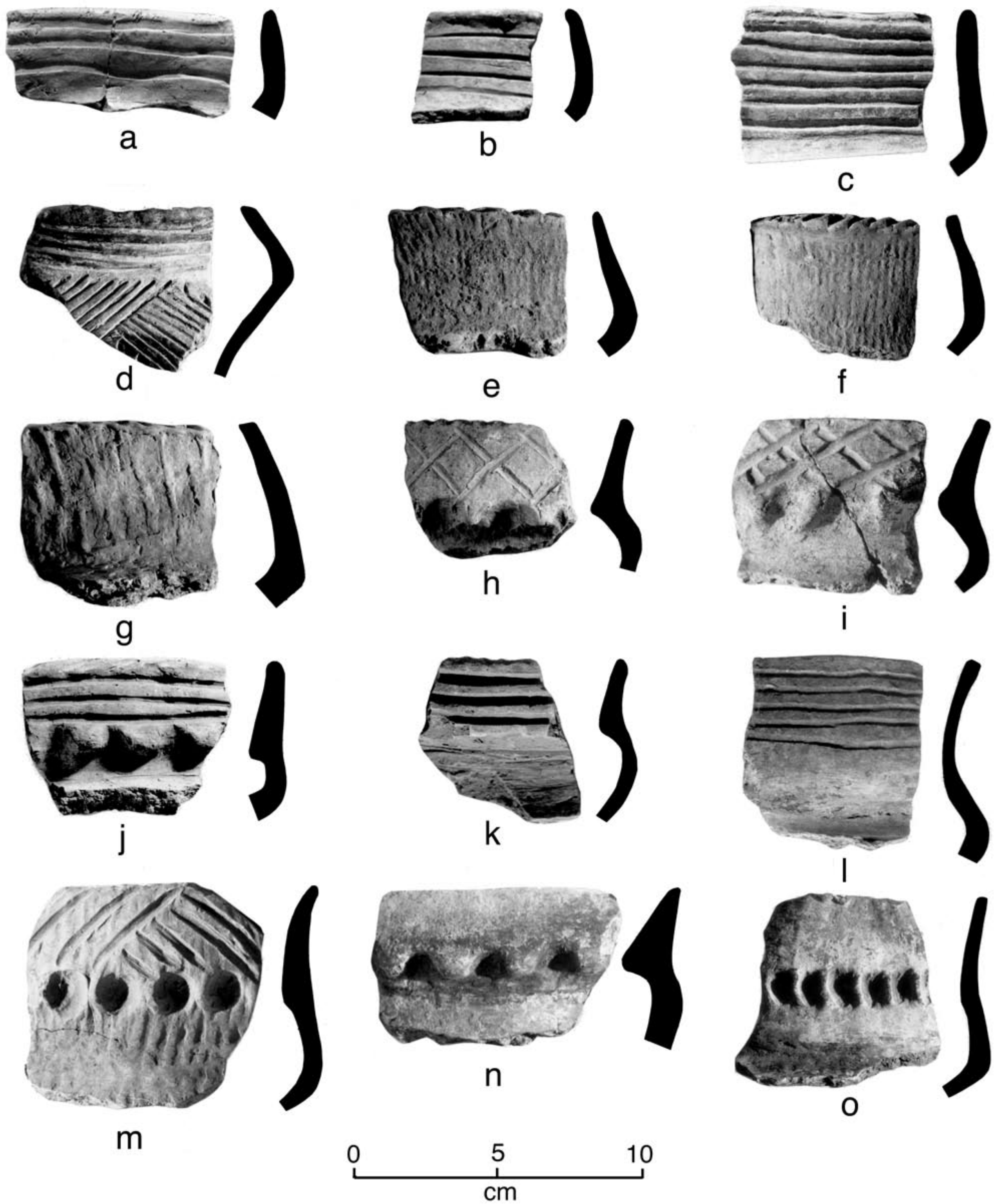

FIGURE B.14. Initial Coalescent rim sherds: *a–d,* Straight horizontal incised rim; *e–g,* Straight tool impressed lip; *h–i,* S-shaped (collared) cross-hatch incised rim; *j–l,* S-shaped (collared) horizontal incised rim; *m,* S-shaped (collared) diagonal incised rim; *n,* S-shaped (collared) finger impressed rim; *o,* S-shaped (collared) tool impressed rim.

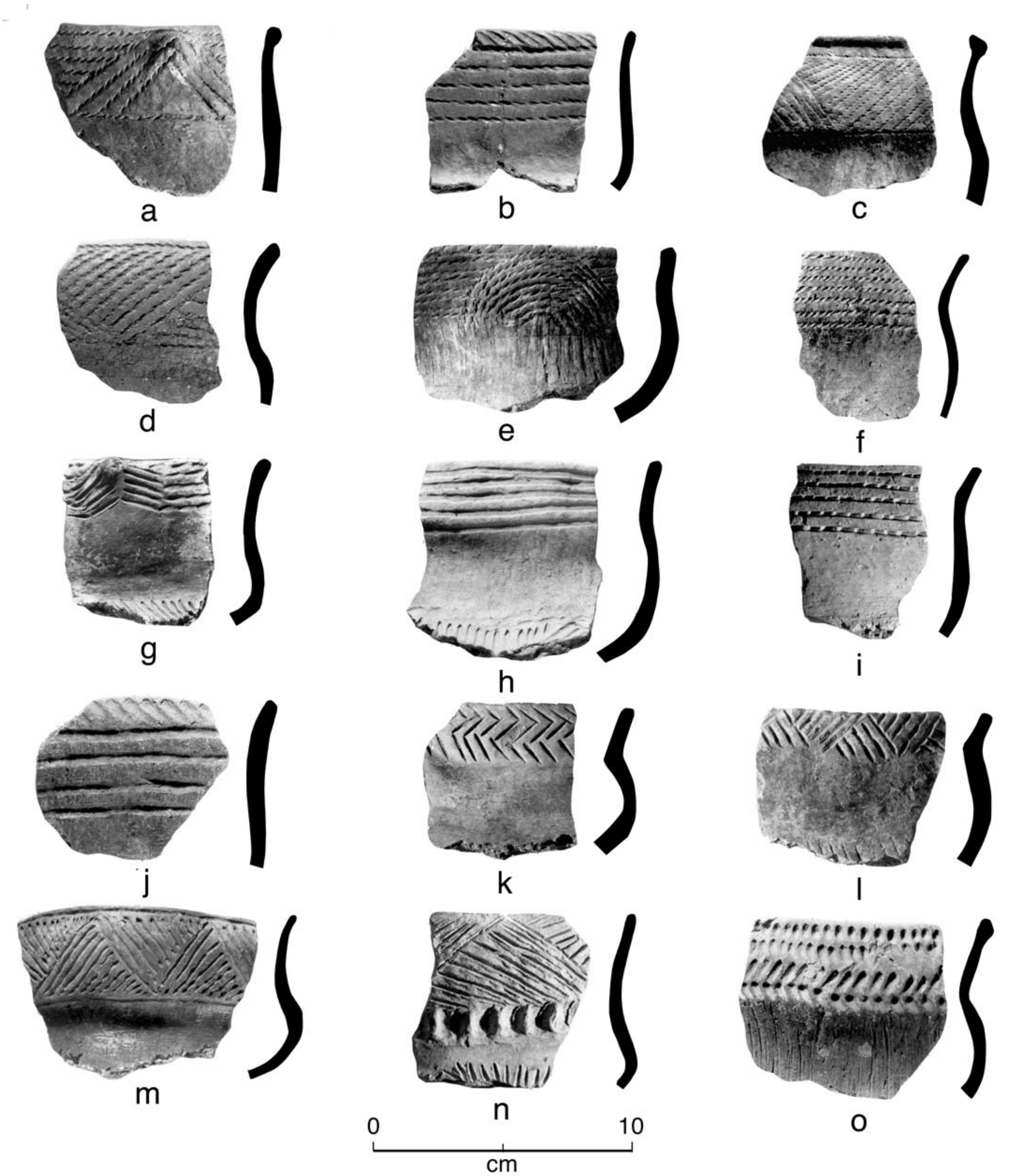

FIGURE B.15. Extended Coalescent rim sherds: *a–f,* S-shaped cord impressed rim; *g, h, j,* S-shaped horizontal incised rim; *i,* S-shaped horizontal stab and drag incised; *k,* S-shaped herringbone incised rim; *l–n,* S-shaped diagonal incised rim; *o,* S-shaped tool impressed rim.

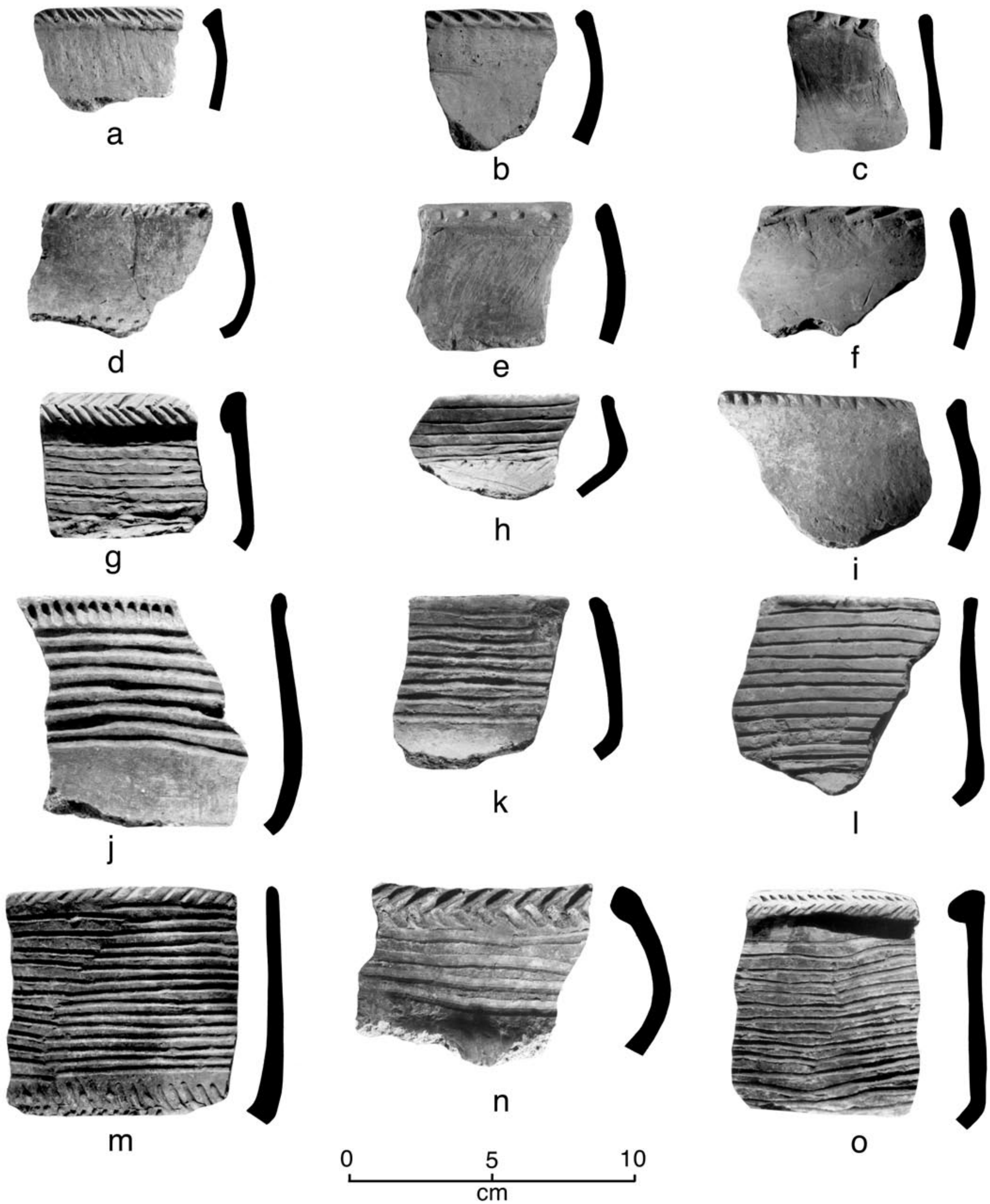

FIGURE B.16. Extended Coalescent rim sherds: *a–f, i,* Straight rim tool impressed lip; *g–h, j–o,* Straight rim horizontal incised rim.

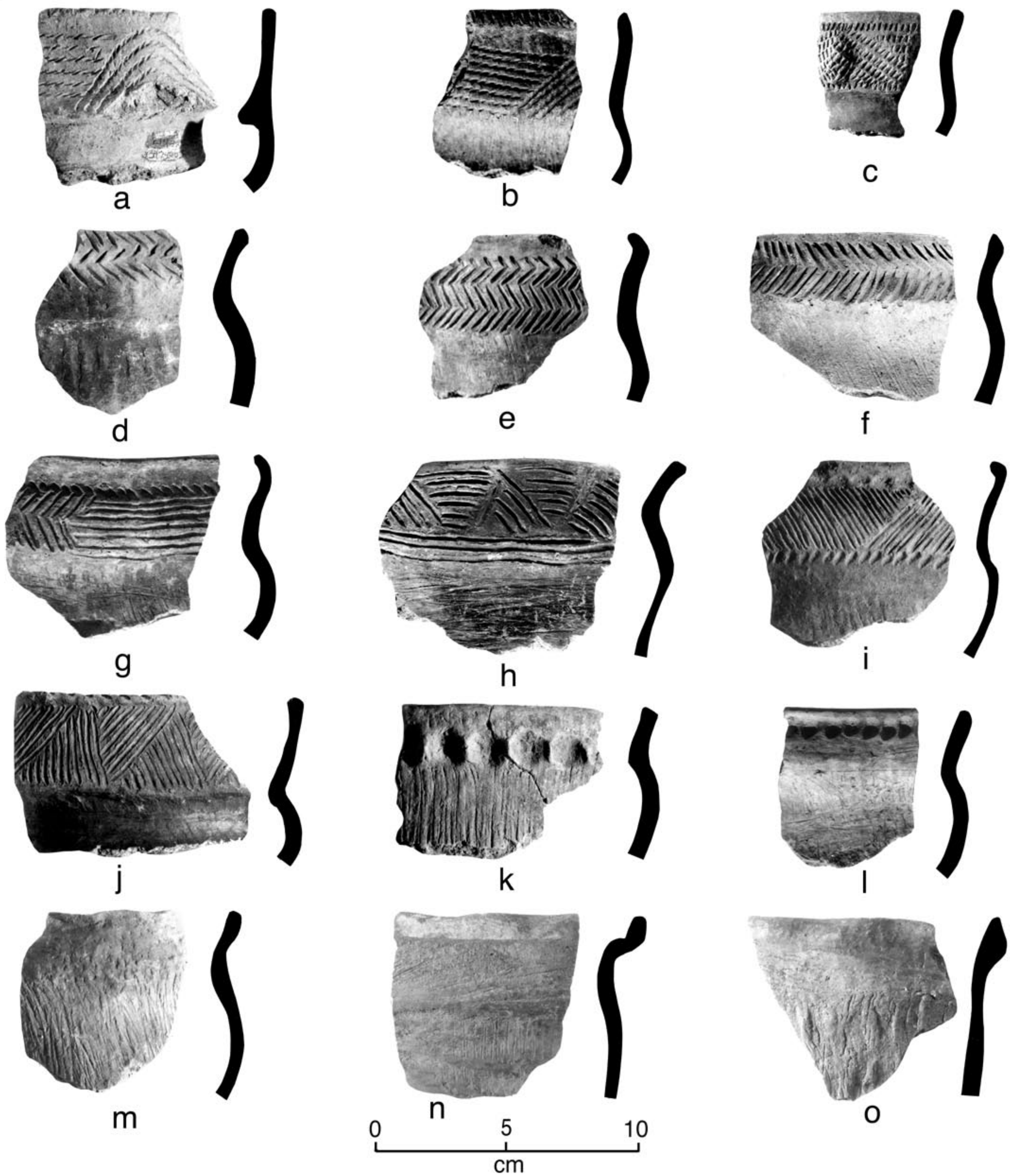

FIGURE B.17. Post-Contact Coalescent rim sherds: *a–c,* S-shaped cord impressed rim; *d, e,* S-shaped herringbone incised rim; *f, h–j,* S-shaped diagonal incised rim; *g,* S-shaped horizontal incised rim; *k, l,* S-shaped tool/finger impressed rim; *m–o,* S-shaped undecorated rim (finger impressed lip).

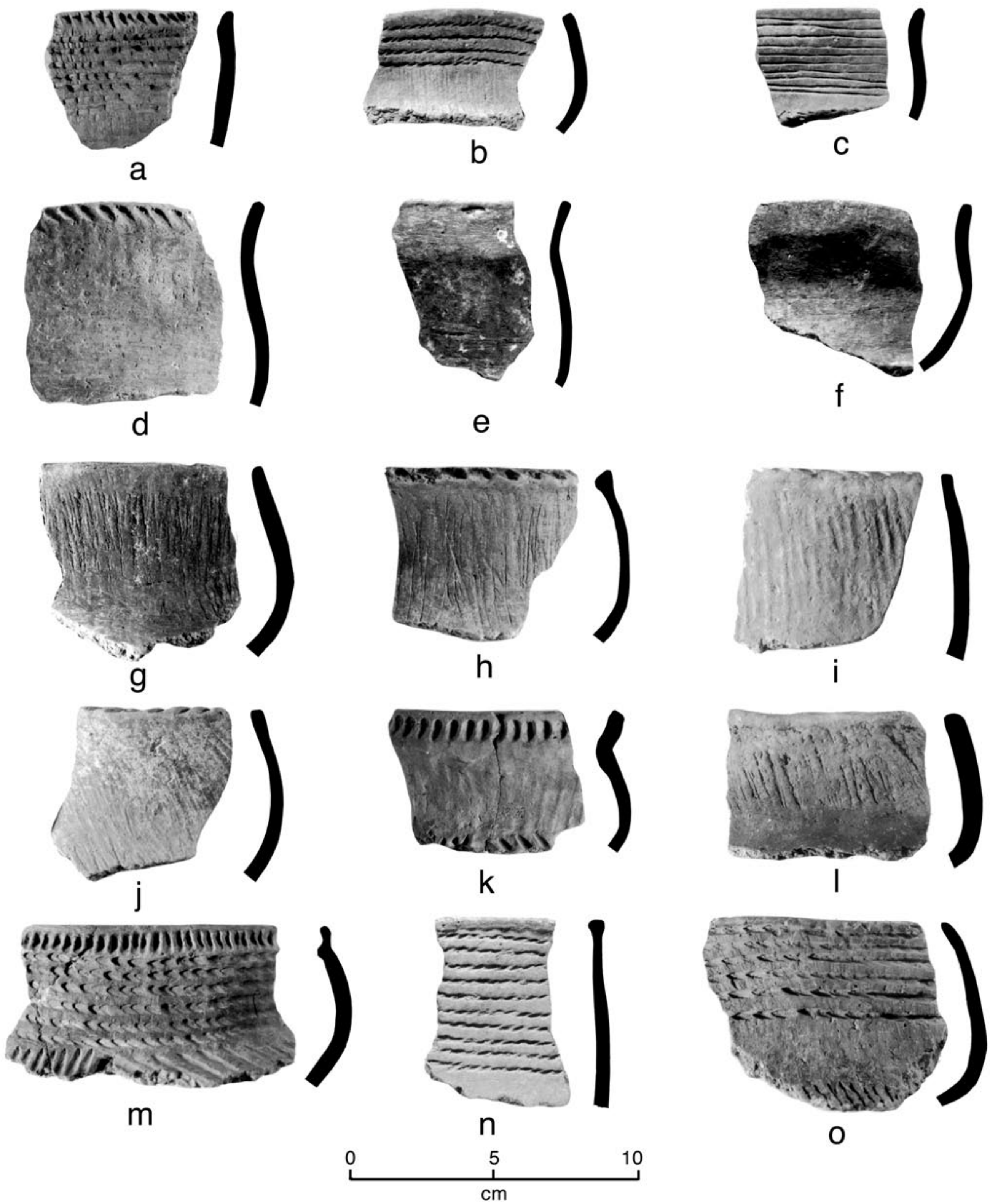

FIGURE B.18. Extended Coalescent rim sherds: *a, m, o,* Straight horizontal stab and drag incised rim; *b, n,* Straight cord impressed rim (combined with cord impressed lip); *c,* S-shaped horizontal incised rim; *d, k,* S-shaped tool impressed rim; *e, f,* S-shaped undecorated; *g,* Straight undecorated; *h–j,* Straight tool impressed lip; *l,* Straight finger impressed lip.

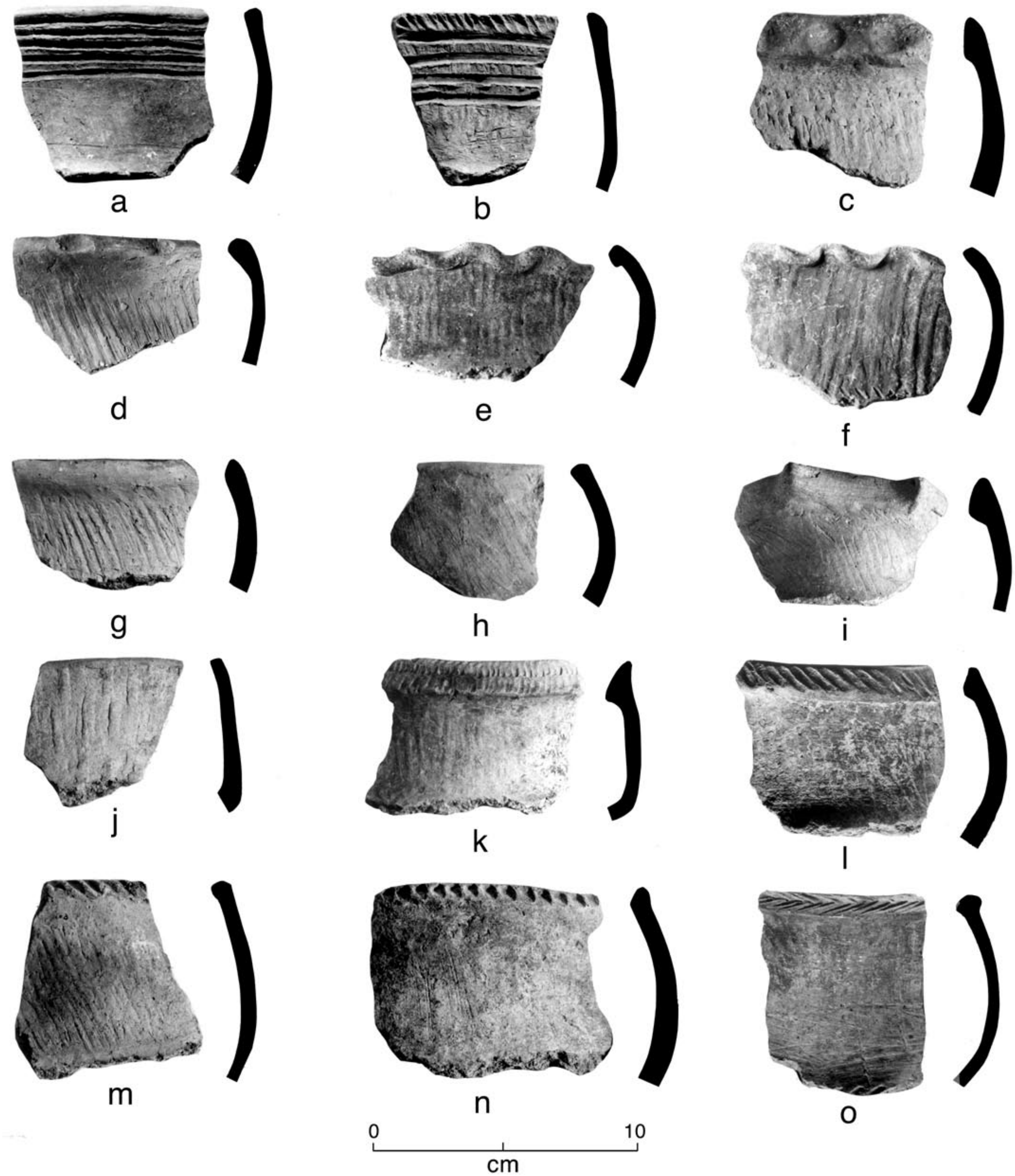

FIGURE B.19. Post-Contact Coalescent rim sherds: *a, b,* Straight horizontal incised; *c–f,* Straight finger impressed; *g–j,* Straight undecorated; *k–o,* Straight tool impressed lip.

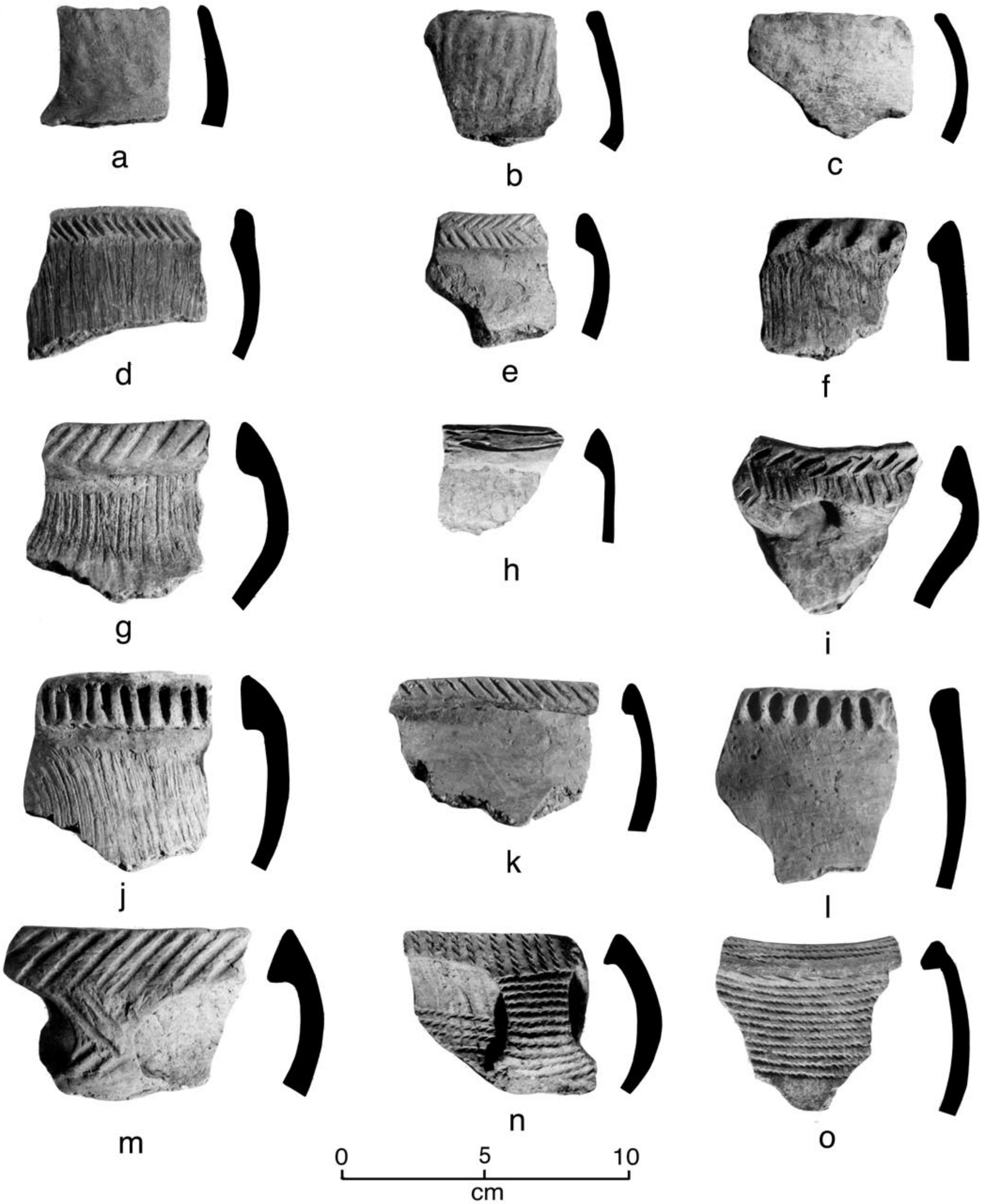

FIGURE B.20. Post-Contact Coalescent rim sherds: *a–m*, Straight tool impressed lip; *n, o,* Straight cord impressed lip.

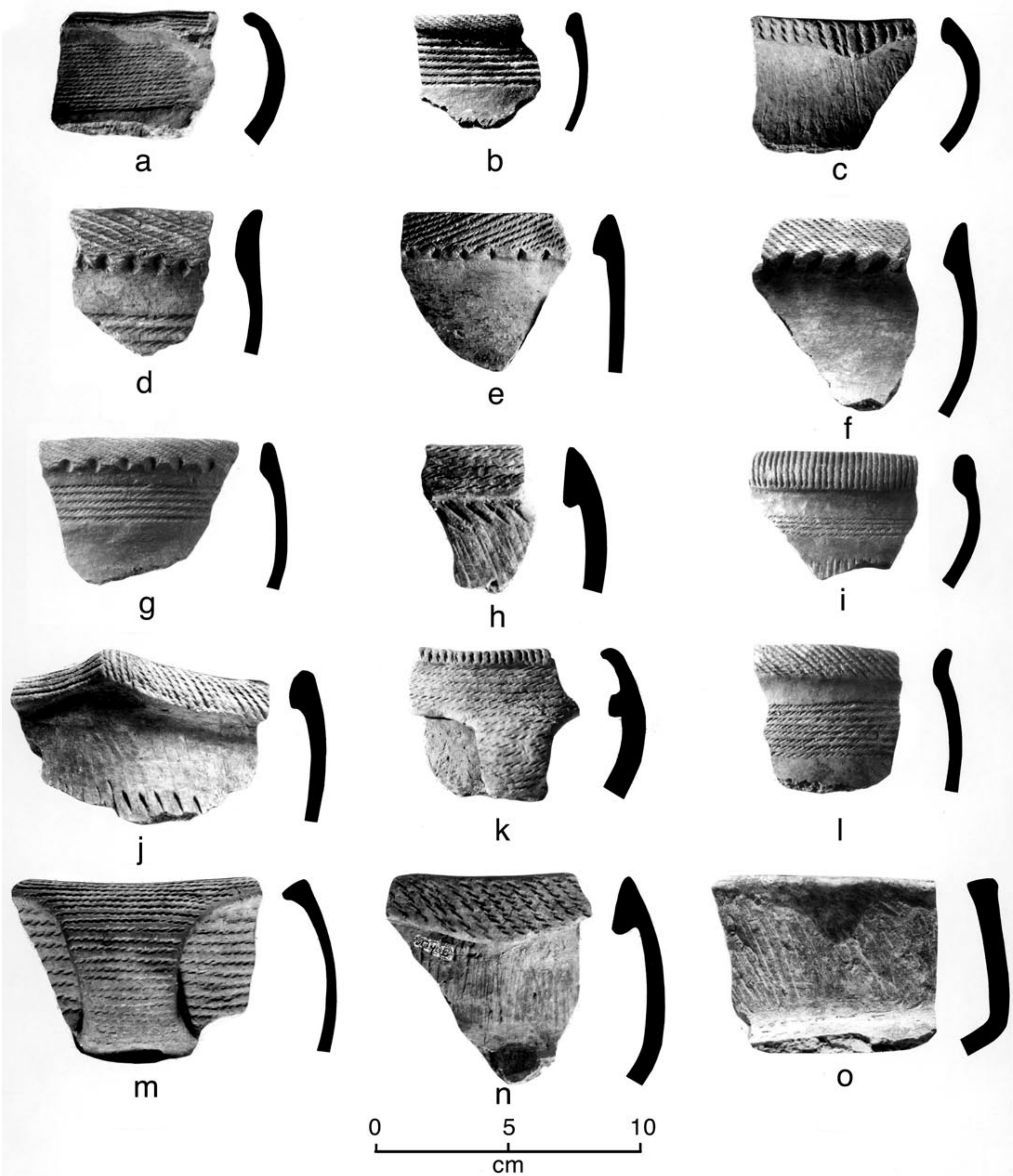

FIGURE B.21. Post-Contact Coalescent rim sherds: *a–c, e, g–o*, Straight cord impressed lip; *d, f,* S-shaped cord impressed rim.

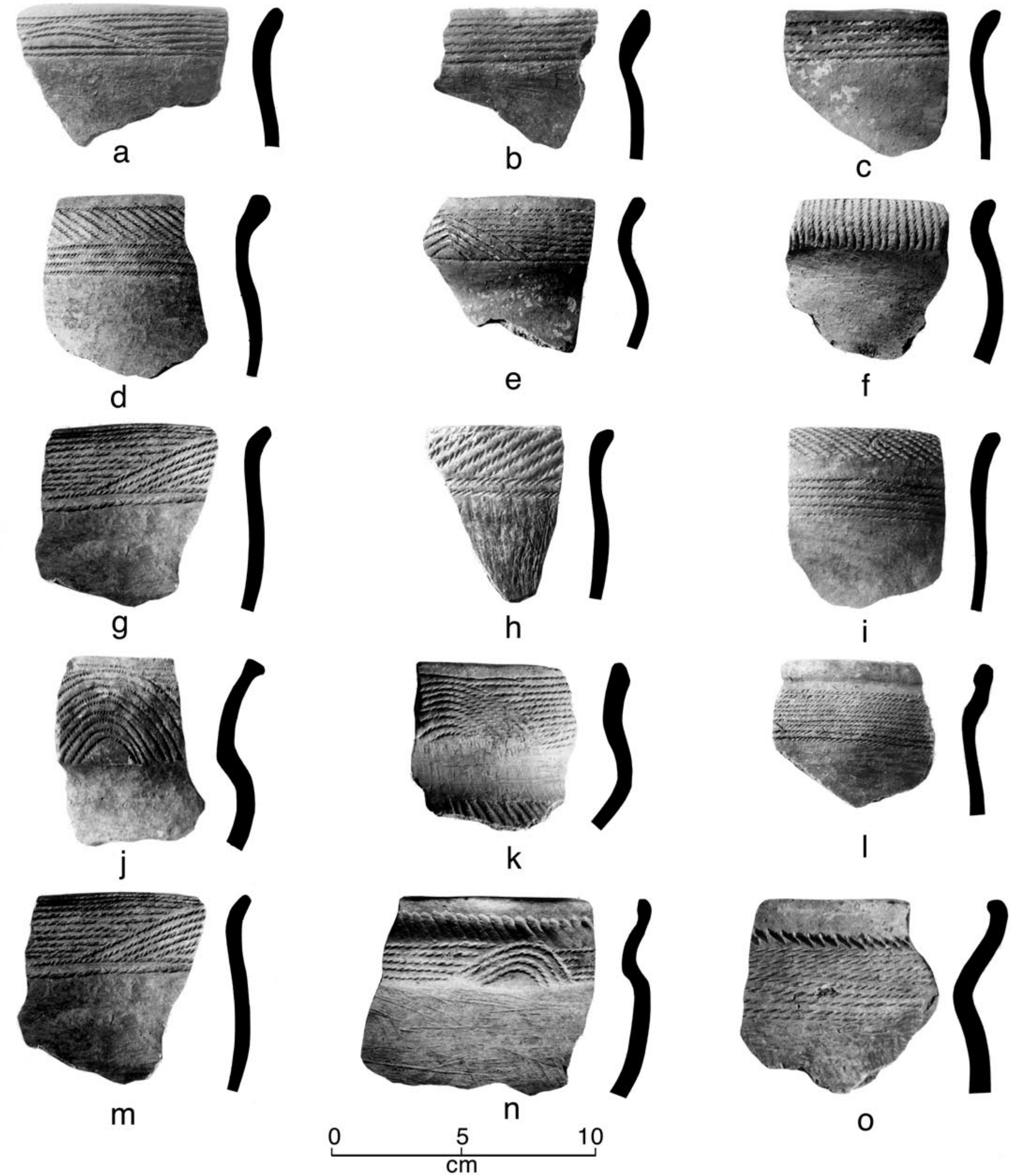

FIGURE B.22. Post-Contact Coalescent rim sherds: *a–o*, S-shaped cord impressed rims.

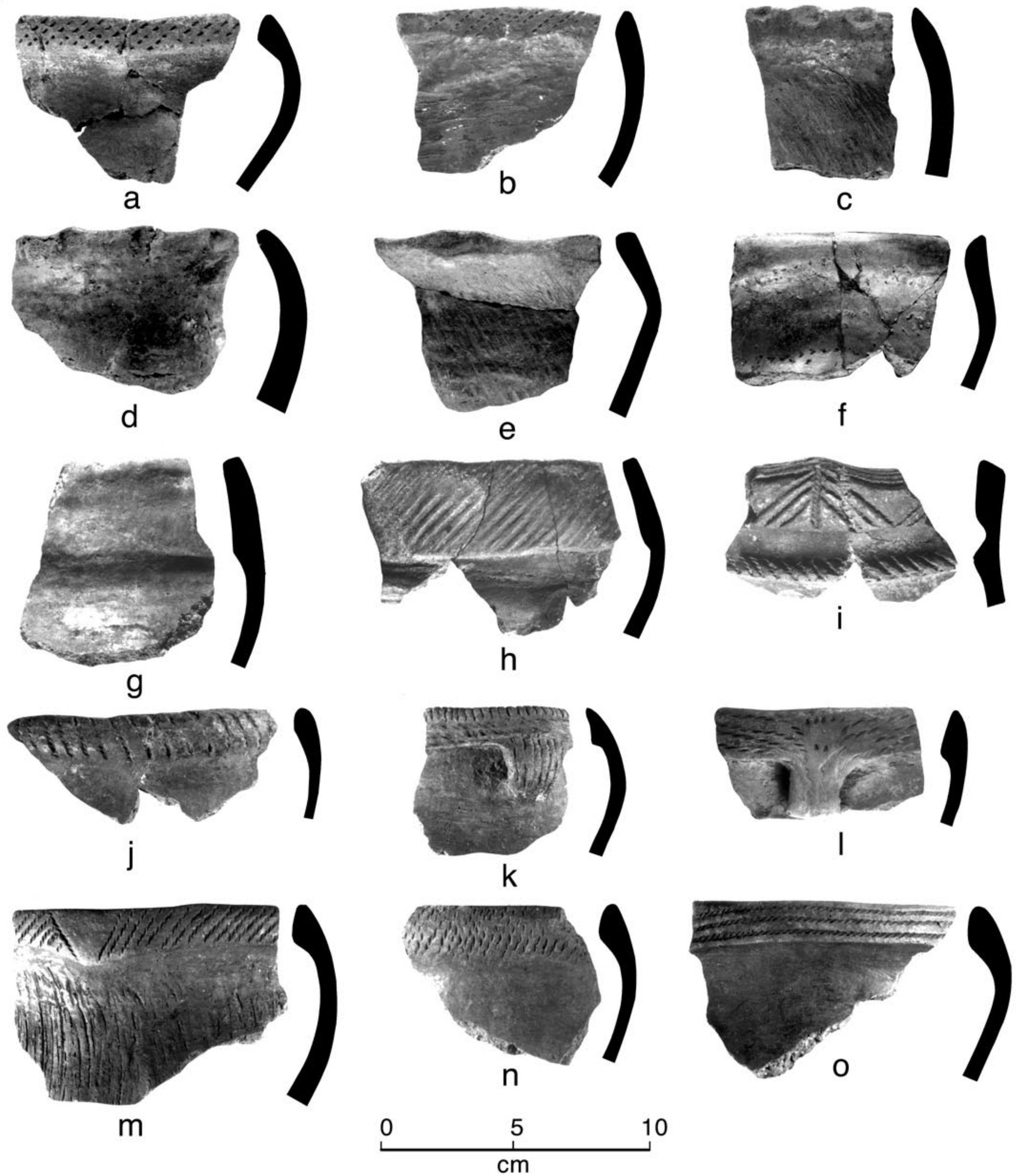

FIGURE B.23. Post-Contact Coalescent rim sherds: *a, b,* Straight tool impressed lip; *c–e,* Straight finger impressed lip; *g, h,* Collared undecorated; *i,* Collared cord impressed rim; *j–o,* Straight cord impressed lip.

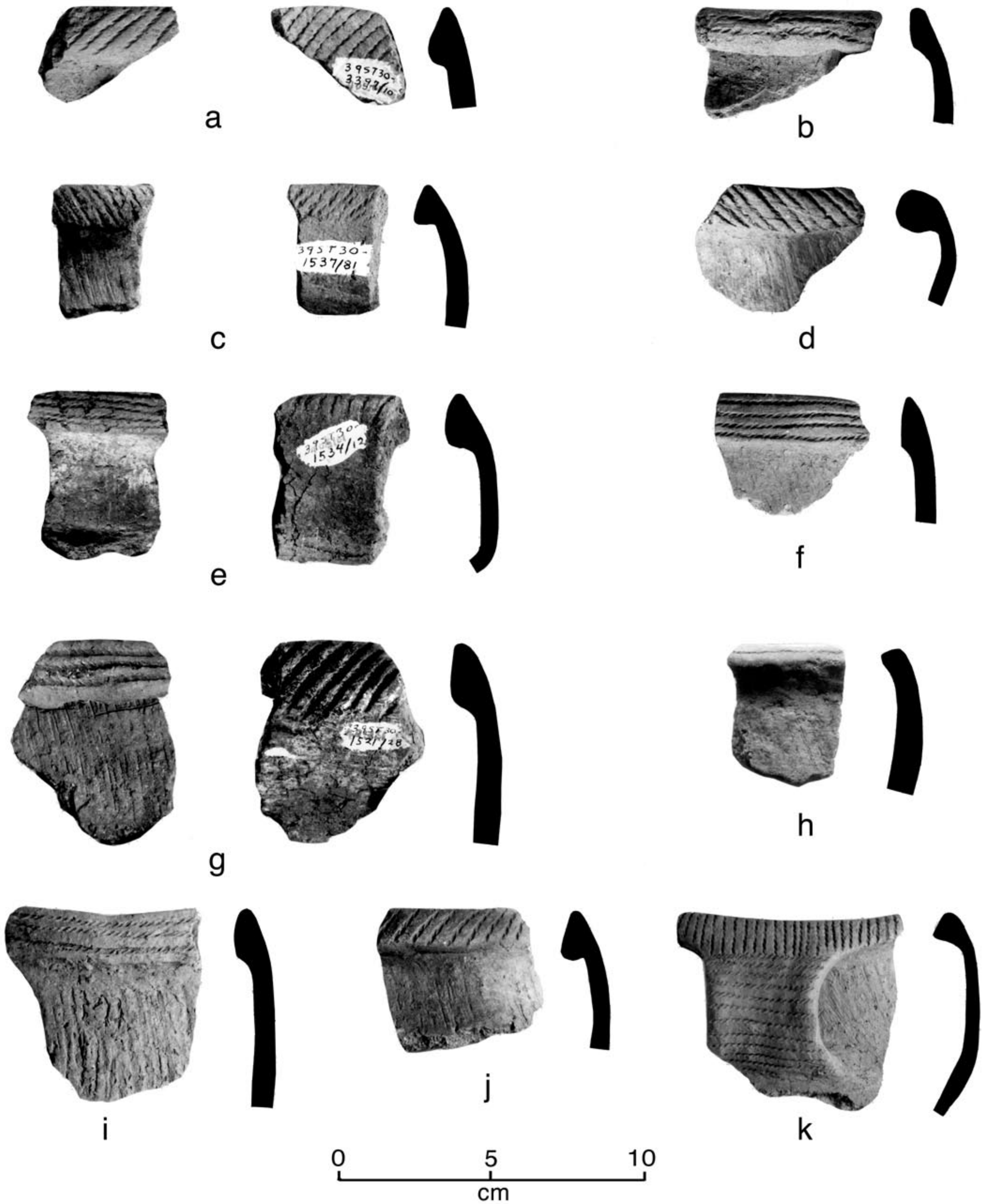

FIGURE B.24. Post-Contact Coalescent rim sherds: *a–k,* Straight cord impressed lip. Rims a, c, e, g are exterior (left) and interior (right) views.

are not illustrated because of a lack of suitable examples. Other types are illustrated that are not used in the analysis or listed in Table B.1. One example is the type Stuart Collared (Kivett and Jensen, 1976:43–44). This type is most similar in rim form to Initial Middle types with short, straight rims and does not resemble S-shaped rims. For the purposes of this report, Stuart Tool Impressed are included with Straight rims with tool impressed lips, and Stuart Plain is included in the straight, undecorated group. Stuart Incised rims (Figure 3n,o) are not included in the analysis.

Several additional comments concerning the placement of specific types also need to be clarified. First, Campbell Creek Pinched, a type occurring in Initial Coalescent contexts, is somewhat arbitrarily placed under the descriptive category "Straight/Curved Rim, Finger Impressed on the Exterior Rim" instead of in the category "Straight/Curved Rim, Finger Impressed on the Lip" where it might be better placed in order to separate it from the descriptive category "Straight/Curved Rim, Tool and Finger Impressed Lip." This is deemed necessary to maintain the distinction of the latter group, which is mostly composed of straight or curved rims with tool-impressed lips. Second, the version of Le Beau Cord Impressed defined by Wood (1967:67–68) from the Terminal Middle Missouri Huff site and later expanded upon by Calabrese (1972:18–19) also is included under the Coalescent tradition where it frequently occurs. Le Beau ware, first defined by Hurt (1957:36–44), has different temporal and spatial connotations in Coalescent tradition contexts. Third, straight/curved rims with cord-impressed, rim exteriors or with tool-impressed or undecorated lips, which occur in small frequencies in Extended Coalescent assemblages, are included within the type Coalescent type "Straight/Curved Rim with Cord Impressed Lip." The latter types are similar to the former in that cord impressing on the exterior rim is a common trait. The Extended Coalescent types represent a precursor to the post-contact, cord-impressed rims.

As a general principle, types defined on the basis of exterior rim decoration ignore variations in decoration on any other vessel part, such as the lip or shoulder. In other words, rim decoration takes precedence over lip decoration. Conversely, there are a few types (e.g., Stanley Cord Impressed and Knife River Cord Impressed) defined solely on the basis of decoration on the lip (or rim brace). These types are often decorated with cord impressions also on the rim. All these conventions are followed in this report when compiling frequencies of descriptive rim sherd categories.

Appendix C:
Tables of Radiocarbon Dates

TABLE C.1. Summary of sample location and sample type information for radiocarbon samples dated under the Smithsonian Institution Repatriation Office Plains Village dating program.

Taxon[1]	Site	Site No.	PVD No.	Sample source[2]	Lab No.[3]	^{14}C Age RCYBP corrected	Cat. no.	Provenience	Material dated	Comments on amount, preparation	Reason for selection; additional comments
IMM	Jones	39CA3	PVD-71	SDARC	DRI-3115	891±45	61	F 43, cutbank slump	unid. wood charcoal	14.0 g, all sizes	associated with cord-roughened body sherds; same context as PVD-72
IMM	Jones	39CA3	PVD-72	SDARC	ETH-16074	915±65	61	F 43, cutbank slump	unid. wood charcoal	less than 0.1 g, small diameter charred twigs	associated with cord-roughened body sherds; same context as PVD-71
IMM	Jones	39CA3	PVD-73	SDARC	ETH-16075	945±65	51	H 2, cutbank slump	unid. wood charcoal	less than 0.1 g, small diameter charred twigs	associated with cord-roughened body sherds
IMM	Jones	39CA3	PVD-74	SDARC	ETH-16076	980±65	33	Test 3, level 10 (135–150 cmsd)	charred residue	less than 0.1 g residue	on interior of cord-roughened body sherd
IMM	Jones	39CA3	PVD-75	SDARC	DRI-3116	881±37	35, 36	F 59, Test 3, levels 2–3 (165–195 cmsd)	unid. wood charcoal	10.5, small diameter charred twigs	same context as PVD-76
IMM	Jones	39CA3	PVD-76	SDARC	DRI-3117	898±30	35	F 59, Test 3, level 2 (165–180 cmsd)	unid. wood charcoal	10.5	same context as PVD-75
IMM	Jiggs Thompson	39LM208	PVD-40	NMNH	ETH-11041	770±60	47	X 4, midden test	Zea maize	0.4 g, single frag of charred cob	IMM in region; backup for Pretty Head B
IMM	Jandreau	39LM225	PVD-15	SDARC	mix-up; not dated	—	186/2 + 515	undetermined	charred residue	within incised grooves on exterior of two rim sherds	early IMM
IMM	Jandreau	32LM225	PVD-51	SDARC	ETH-11050	1015±55	769, 781	unknown	carbonized residue	residue from two rims combined; incised S-rim (CN769) and filleted and finger modified curved rim (CN781)	IMM in region
IMM	Pretty Head	39LM232	PVD-33	NMNH	SMU-2734	1002±42	1529	F 67 (cache pit) in F 22	unid charred wood	10.3 g; all pieces except small fragments selected; all sizes	IMM in region
IMM	Pretty Head	39LM232	PVD-54	NMNH	Not Submitted on Time	—	1520	F 67, cache pit within F 22	carbonized residue	on two body sherds, combined; one plain, one cord roughened	early IMM component at the site
IMM	Fay Tolton	39ST11	PVD-13	SDARC	ETH-10113	865±60	96	from within pottery vessel near burial 18, H 1	chokecherry seeds	five, charred	northern-most IMM component in region
IMM	Sommers	39ST56	PVD-34	NMNH	SMU-2736	972±73	683	XU 18, house fill	charred grass and twigs	10.5 g, mostly grass, a few twigs; roughly half of that available; probably roof fall	early IMM; check on other dates from site
IMM	Sommers	39ST56	PVD-35	NMNH	ETH-11037	940±60	810	XU 70 entrance, 3.5–4.0 ft sd	Zea maize	0.5 g charred cobs; one half of several small frags and parts of two larger frags selected	early IMM, check on other dates from site
IMM	Sommers	39ST56	PVD-36	NMNH	ETH-10418	1085±60	1753	XU 70, house floor	Zea maize	0.4 g charred cobs; single fragments in lot selected	early IMM; check on other dates from site
IMM	Sommers	39ST56	PVD-37	NMNH	ETH-10419/ ETH-11038	835±50/ 1065±55	1837	XU 18, floor fill	Zea maize	0.3 g charred cobs; small parts of two cobs selected	early IMM; check on other dates from site
IMM	Cattle Oiler	39ST224	PVD-39	NMNH	ETH-11040	690±60	2432	F 98, pit fill	grass, reed	0.9 g, charred; four stems 0.5 cm dia selected	IMM in region
EMM	Havens	32EM1	PVD-48	SHSND	ETH-11047	560±55	—	F 446 in X 103	Zea maize	charred cobs; frags of three selected	late EMM in region
EMM	Havens	32EM1	PVD-49	SHSND	ETH-11048	615±55	11861	unknown	Zea maize	charred kernels; five kernels split and selected	late EMM in region
EMM	Paul Brave	32SI4	PVD-61	SHSND	DRI-3206	755±63	1417	F 32, pit in X 4	unid. wood charcoal	10.6 g	EMM type site in ND; check on M-2364 and M-2365
EMM	Paul Brave	32SI4	PVD-62	SHSND	DRI-3207	783±47	1495	F 15, pit in south end X 5 (trench)	unid. wood charcoal	10.8 g	EMM type site in ND; check on M-2364 and M-2365

EMM	Paul Brave	32SI4	PVD-63	SHSND	DRI-3208	674±62	1607	F 46, pit in north end of X 6 (trench)	unid. wood charcoal	15.9 g	EMM type site in ND; check on M-2364 and N-2365
EMM	Vanderbilt	39CA1	PVD-64	SDARC	DRI-3113	673±44	—	F 6, slump in cutbank	unid. wood charcoal	10.5 g, all sizes	same context as PVD-65; check on UGa-3355, UGa-3356
EMM	Vanderbilt	39CA1	PVD-65	SDARC	ETH-16069	745±65	—	F 6, slump in cutbank	Zea maize	Less than 0.1 g, two kernels and one cupule	same context as PVD-64, check on UGa-3355, UGa-3356
EMM	Vanderbilt	39CA1	PVD-66	SDARC	ETH-16070	750±65	—	H11, slump on beach	charred vesicular organics	Less than 0.1 g, 3 pieces	check on UGa-3355, UGa-3356
EMM	Helb	39CA208	PVD-42	MWAC	ETH-11043	515±55	1873	L 4, F 352, H 14	Zea maize ??? check on this substitution	charred kernels; five fragments	early EMM in region; check on NWU-45,53
EMM	Helb	39CA208	PVD-43	MWAC	ETH-11044	600±55	2184	L 5, F 417, H 15	Zea maize	charred kernel	early EMM in region, check on NWU-46, 52
EMM	Jake White Bull	39CO6	PVD-1	UND	SMU-2663	747±64	55	L 2, 15–40 cmsd, outside and south of H4	unid. wood charcoal	ca. 10 g, all sizes	early end of EMM; matches UGA-1493 = 910 50 BP
EMM	Jake White Bull	39CO6	PVD-2	UND	ETH-10109	720±60	17, 22, 38, 43, 48	F 2,7,10,11 combined; pits assoc. w/ H 4	Zea maize	two equal-sized fragments of kernel from each CN	early end of EMM; context roughly matches UGA-1558 = 975 105 BP
EMM	Jake White Bull	39CO6	PVD-3	UND	ETH-9328	975±75	18	F 3, H 4, subfloor pit	carbonized residues	on lip and exterior shoulder of pottery fragment	early end of EMM; context roughly matches UGA-1558 = 975 105 BP
EMM	Jake White Bull	39CO6	PVD-58	UND	DRI-3204	770±41	51	South fortication ditch, 70–100 cmsd.	unid. wood charcoal	10.0 g	early end of EMM, same context as UGA-1492
EMM	Calamity Village	39DW231	PVD-4	SDARC	ETH-10110	795±60	874/17 + 874/18	uncertain	carbonized residues	body sherd exterior	EMM with anomalous chipped stone collection
EMM	Calamity Village	39DW231	PVD-5	SDARC	ETH-10111	665±60	1039	uncertain	Zea Maize	carbonized cob fragment	EMM with anomalous chipped stone collection
EMM	Sully School	39SL7	PVD-52	SDARC	ETH-11051	775±55	446	unknown	carbonized residue	on exterior of Fort Yates cord-impressed S rim	EMM in region
EMM	Sully School	39SL7	PVD-53	SDARC	ETH-11052	795±55	773, 773	unknown	carbonized residue	two Riggs decorated lip rim sherds	EMM in region
EMM	Cheyenne River	39ST1	PVD-17	NMNH	ETH-10413	675±50	—	Area 3, F 34, cache 2	unid. bark, wood	ca. 0.7 g, uncharred	EMM component at important site
EMM	Black Widow Ridge	39ST203	PVD-56	NMNH	ETH-11053	555±55	1309	unknown	Zea Maize	split parts of four charred cob frags.	EMM in region
EMM	Black Widow Ridge	39ST203	PVD-57	NMNH	Not Submitted on Time	—	1221	unknown	carbonized residue	on interior of single simple stamped body sherd	EMM in region
TMM	Shermer	32EM10	PVD-46	SHSND	ETH-11045	620±55	3362	F 417, H 4	Zea maize	charred kernels; six split and selected for sample	TMM in region
TMM	Shermer	32EM10	PVD-47	SHSND	ETH-11046	785±55	3364	F 243, H 6	Zea maize	charred kernels; six split and selected for sample	TMM in region
TMM	Shermer	32EM10	PVD-59	SHSND	DRI-3205	518±51	F789	F 789 in X 692, trench rear H 7	unid. wood charcoal	14.2 g	check on PVD-46, PVD-47, PVD-60
TMM	Shermer	32EM10	PVD-60	SHSND	ETH-16394	435±45	4159	uncertain, need field catalog info.	Zea maize	charred kernels; six split and selected for sample	check on PVD-46, PVD-47, PVD-59
TMM	Shermer	32EM10	PVD-60R	SHSND	ETH-17511	660±50	4159	uncertain, need field catalog info.	Zea maize	charred kernels; six split and selected for sample	rerun of ETH-16394
TMM	Huff	32MO11	PVD-67	SHSND	DRI-3114	598±39	H6F87	F 87 in H 6	unid. wood charcoal	15.5 g	type site for TMM; check on other dates; same context PVD-68

(*continued*)

TABLE C.1. (*continued*)

Taxon[1]	Site	Site No.	PVD No.	Sample source[2]	Lab No.[3]	^{14}C Age RCYBP corrected	Cat. no.	Provenience	Material dated	Comments on amount, preparation	Reason for selection; additional comments
TMM	Huff	32MO11	PVD-68	SHSND	ETH-16071	660±60	H6F87	F 87 in H 6	charred vesicular organic	less than 0.1 g, seven pieces	type site for TMM, check on other dates; same context as PVD-67
TMM	Huff	32MO11	PVD-69	SHSND	ETH-16072	730±65	H6F102	F 102 in H 6	unid. wood charcoal	less than 0.1 g, small diameter charred twigs	type site for TMM, check on other dates
TMM	Huff	32MO11	PVD-70	SHSND	ETH-16073	490±60	H9F147	F 147 in H 9	unid. wood charcoal	Less than 0.1 g, small diameter charred twigs	type site for TMM, check on other dates
IC	Lynch	25BD1	PVD-50	UNM	ETH-11049	780±55	2-4113	unknown	carbonized residue	interior??? residue on a large cord-roughened rim sherd	IC in Nebraska
IC	Arzberger	39HU6	PVD-14	SDARC	ETH-10114	440±55	AI198	F 9 in H 1	charred residue	on interior of plain body sherd	late end of IC in region
IC	Arzberger	39HU6	PVD-41	NMNH	ETH-11042	340±60	—	F 1	wild sunflower seeds	0.4 g, uncharred	late end of IC
EC	Demery	39CO1	PVD-44	SHSND	SMU-2800	509±47	—	F 65 in X 5, bell shaped pit	unid charred wood	9.3 g, selected for small diameter twigs only	northernmost EC component
EC	Demery	39CO1	PVD-45	SHSND	SMU-2789	583±58	—	F 67, bell shaped pit	Zea maize	9.0 g charred cobs	northernmost EC component
EC	Lower Grand	39CO14	PVD-10	MWAC	SMU-2689	395±57	746	F 59, lenses C & D L 8 in pit, outside H 12	unid charred wood	16 g, non-twigs/branches	check on well-dated site and potentially early EC dates in region
EC	Lower Grand	39CO14	PVD-11	MWAC	SMU-2725	326±66	993	F 102, W 1/2, L 4 (L 6 lab); black ash layer, assoc. w/ H 12	unid. charred wood	ca. 18 g, selected for twigs and branches	check on well-dated site and potentially early EC dates in region
EC	Lower Grand	39CO14	PVD-12	MWAC	ETH-10112	470±55	993, 1053, 1065, 1087 1068, 1066 1069	F 102, L 6 (west 1/2) and Ls 2,3,4,6,8 (east 1/2); assoc. w/ H 12	Zea maize	four charred kernel frags and four charred cob frags	check on well-dated site and potentially early EC dates in region
EC	Lower Grand	39CO14	PVD-16	MWAC	ETH-10412	280±55	176 (Bowers excav.)	F 3 within H 11	Zea maize	halves of five charred kernels	check on well-dated site and potentially early EC dates in region; only dated material from Bowers excavation.
EC	Potts	39CO19	PVD-23	NMNH	ETH-10120	235±55	767	F 2, cache 3	Zea maize	ca. 0.2 g charred kernels; four kernels split for sample	EC in region
EC	Potts	39CO19	PVD-24	NMNH	ETH-10121	415±55	251	F 8, postholes in bastion	Zea maize	ca. 0,5 g charred cob; seven frags selected	EC in region
EC	Meander	39LM201	PVD-19	NMNH	ETH-10116	350±55	49	XU 1, cache pit fill	Zea maize	single charred kernel, all in sample	late EC in Big Bend region
EC	Meander	39LM201	PVD-20	NMNH	ETH-10117	395±55	67	XU 1, 2.0 ft sd to bottom	Zea maize	0.6 g cob fragment; single cob sectioned and small frag. chosen	late EC in Big Bend region
EC	Meander	39LM201	PVD-21	NMNH	ETH-10118	275±55	68	XU 1, 2.0 ft sd to bottom	unid fruit pit;???	o.2 g charred; one of two pits selected	late EC in Big Bend Region
EC	Hosterman	39PO7	PVD-30	NMNH	SMU-2728	747±62	738	F 3, 170L30, 3.0-3.5 ft sd	Zea maize	8.5 g charred cobs; all cobs from lot selected; some root penetration	EC in region
EC	Hosterman	39PO7	PVD-31	NMNH	SMU-2731	530±64	776	F 3, 170L30, 3.5 ft sd	Zea maize	9.2 g charred cobs; all individual cobs from bags 1-5 selected; some root penetration	EC in region
EC	Hosterman	39PO7	PVD-32	NMNH	SMU-2732	232±56	863	F 3, 170L30, 4.0 ft sd	Zea maize	10.0 g charred cobs; all but three frags selected	EC in region

EC	Hosterman	39PO7	PVD-22	NMNH	ETH-10119	295±55	1149	F 9, 80L20, 5.0-5.5 ft sd	Zea maize	0.3 g charred cob; small fragments of two larger cob pieces selected	EC in region
EC	Sully	39SL4	PVD-27	NMNH	ETH-10416	365±55	4949	F 113, H 1, cache 4	Zea maize	0.2 g charred kernels; two kernels taken in entirety; large fruit pit is same lot retained	earliest EC component at this important site
EC	Sully	39SL4	PVD-28	NMNH	ETH-10417	265±55	7906	F 206, cache 7	cucurbit seeds	<0.05 g uncharred, probably squash	later EC component at this important site
EC	Sully	39SL4	PVD-29	NMNH	SMU-2726	400±63	7962	F 206, cache 8	Zea maize	8.3 g charred cobs; most of six larger cob frags and all smaller frags selected	2 cord-rod impressed S-rim, 2 straight rims, tool imp lips
EC	Sully	39SL4	PVD-55	NMNH	Not Submitted	—	4871	F 113, cache 2, H 1	Carbon residue on 5 sherds	early EC component at this important site	
EC	Over's La Roche	39ST9	PVD-25	NMNH	ETH-10414	250±55	652	Area A, H 1, XU 2, Sq. 6, N 1/2, 0.25–1.0 ft sd	unid fruit pits ???	ca. 0.6 g pits, chokecherry or plum; fragments of pointed specimens selected; larger rounded specimens retained	early EC in region
EC	Over's La Roche	39ST9	PVD-26	NMNH	ETH-10415	420±55	951	Area A, H 3, west quad, house fill	Zea maize	0.5 g charred cob; 11 small fragments selected, others retained	early EC in region
EC	Over's La Roche	39ST9	PVD-38	NMNH	ETH-11039	345±60	643	Area A, H 1, XU 2, Sq. 6, 0.25–0.75 ft sd	unid. fruit pit	0.5 g, charred; two of four similar pits selected; very round in shape	EC in region
EC	Walth Bay	39WW203	PVD-6	MWAC	SMU-2685	320±63	859	F 116, H 19 burn and roof fall	unid. charred wood	ca. 20 g, selected for small twigs and branches only	check on well-dated site; same context as RL-304 = ???
EC	Walth Bay	39WW203	PVD-7	MWAC	SMU-2687	321±57	1642	F 318, L 5, 2.0–2.5 ft pd, pit fill assoc. w/ H 19 burn	unid. charred wood	ca. 15 g, mostly small twigs and branches	check on well-dated site
EC	Walth Bay	39WW203	PVD-8	MWAC	SMU-2677	322±64	1838	F 387, L 8, pit assoc. w/ H 19/21	unid. charred wood	ca. 16 g, some small branches and twigs	check on well-dated site; same context as PVD-9
EC	Walth Bay	39WW203	PVD-9	MWAC	SMU-2678	279±46	1838	F 387, L 8, pit assoc. w/ H 19/21	Zea maize	ca. 12 g charred kernels	check on well-dated site; same context as PVD-8
PCC	Dodd	39ST30	PVD-18	NMNH	ETH-10115	160±55	2058	F 17, fill	Zea maize	ca. 0.2 g, split halves of four charred kernels	IMM type site

PVD = Plains Village Dating

[1] Taxon abbreviations: IMM = Initial Middle Missouri; EMM = Extended Middle Missouri; TMM = Terminal Middle Missouri; IC = Initial Coalescent; EC = Extended Coalescent; PCC = Post-Contact Coalescent

[2] Sample Source abbreviations: MWAC = Midwest Archeological Center; NMNH = National Museum of Natural History; SDARC = South Dakota Archaeological Research Center; SHSND = State Historical Society of North Dakota; UND = University of North Dakota; UNM = University of Nebraska Museum

[3] Lab abbreviations: DRI = Desert Research Institute; ETH = ETH Hönggerberg; SMU = South Methodist University

TABLE C.2. List of radiocarbon dates from Plains Village components.

Tradition/Variant/Component	Provenience*	Lab number†	RCYBP‡	13C/12C	Reference
MIDDLE MISSOURI TRADITION					
Initial Middle Missouri					
Broken Kettle West (13PM25)	H 3, Pit 16	Wis-433	1070 ± 55	—	Radiocarbon, 1973:232–233
	H2, entrance	Wis-439	1090 ± 55	—	"
	H 3, Pit 18	Wis-440	1100 ± 50	—	"
	H 2, Pit 5	Wis-451	840 ± 55	—	"
	H 3, Pit 19	Wis-455	940 ± 50	—	"
	H 3, Pit 25	Wis-452	880 ± 55	—	"
	H 3, Pit 25	Wis-488	890 ± 55	–26.4	"
	H 2, entrance	Wis-481	980 ± 55	–26.5	"
	H 3, Pit 25	Wis-499	965 ± 55	–27.7	"
Williams (13PM50)	T 1	Wis-555	890 ± 55	—	Radiocarbon, 1973:614
		Wis-558	880 ± 50	—	"
Larsen (13PM61)	F 11	Wis-868	740 ± 60	—	Radiocarbon, 1978:159
	F 15	Wis-870	730 ± 50	–25.8	"
	F 10	Wis-874	710 ± 55	–24.7	"
	F 2	Wis-875	730 ± 60	–25.4	"
Low Village (21MU2)	F C	Wis-532	975 ± 65	—	Radiocarbon, 1973:235
Thompson (21MU17)	F 2	Wis-522	1050 ± 60	–26.5	"
Cambria (21BE2)	—	GX-6778	815 ± 125	—	Gibbon, 1991, table 11.1
	—	GX-6779	775 ± 130	—	"
Jones (21BE5)	—	Beta-83237	750 ± 100	—	M. Scullin, pers. comm., 2000
	—	Beta-83240	870 ± 110	—	"
	—	Beta-83241	780 ± 100	—	"
	—	Beta-83242	920 ± 90	—	"
	—	Beta-113877	700 ± 60	—	"
Price (21BE25)	F 1	I-8881	845 ± 80	—	Gibbon, 1991, table 11.1
	F 1	I-8882	885 ± 80	—	"
	F 1	I-8883	1000 ± 80	—	"
Packer (25SM9)	Storage Pit	Wis-1762	900 ± 70	–25.6	Radiocarbon, 1987:398
	Storage Pit	Wis-1763	970 ± 70	–25.7	"
	Storage Pit	Wis-1764	940 ± 70	–25.1	"
Crow Creek (39BF11)	House Posts	M-836	900 ± 100	—	Radiocarbon, 1959:179
	F 4	I-577	850 ± 80	—	Haug, 1986, table 8.1
	F 9	I-578	900 ± 80	—	"
Swanson (39BR16)	H 2, Post C	M-839	1100 ± 125	—	Radiocarbon, 1960:40
	H 2, Post D	Wis-524	1090 ± 60	–22.8	Radiocarbon, 1973:236–237
	H 2, Post C	Wis-526	925 ± 55	–23.2	"
	H 1, Post 2	Wis-523	1450 ± 60	–21.9	"
	H 1, Post 2	Wis-529	1190 ± 70	–22.8	"
	H 2, Post C	Wis-553	810 ± 55	–23.1	Radiocarbon, 1973:618–619
	ST.T., No. 1	Wis-554	810 ± 60	–22.9	"
	H 2, Post D	Wis-551	1080 ± 65	–22.2	"
	H 2, Post F	Wis-552	1040 ± 55	–22.5	"
	H 2, Post D	Wis-650	1100 ± 65	–22.3	Radiocarbon, 1975:127
	H 1, Post 2	Wis-651	955 ± 60	–21.6	"
	H 1, Post 2	Wis-657	1130 ± 60	–22.5	"
	H 2, Post C	Wis-660	935 ± 55	–23.0	"
Arp (39BR101)	Extension 3	M-1411	790 ± 100	—	Radiocarbon, 1968:94
	T 7, F 1	M-1413	930 ± 110	—	"
Jones Village (39CA3)	H 3	UGa-3357	710 ± 65	—	Falk and Pepperl, 1986, table B139

	H 10	UGa-3358	1045 ± 65	—	Falk and Pepperl, 1986, table B139
	H 15	UGa-3359	335 ± 90	—	"
	H 15	UGa-3360	1010 ± 95	—	"
	F 43, slump	**DRI-3115**	**891 ± 45**	**–25.7**	**This report**
	F 43, slump	**ETH-16074**	**915 ± 65**	**–23.0**	"
	H 2, slump	**ETH-16075**	**945 ± 65**	**–19.9**	"
	T 3, 135–150 cmbs	**ETH-16076**	**980 ± 65**	**–18.5**	"
	T 3, F 59	**DRI-3116**	**881 ± 37**	**–25.4**	"
	T 3, F 59	**DRI-3117**	**898 ± 30**	**–25.9**	"
Arp (39BR101)	Extension 3	M-1411	790 ± 100	—	Radiocarbon, 1968:94
	T 7, F 1	M-1413	930 ± 110	—	"
Mitchell (39DV2)	F 6, Sq J	Wis-509	825 ± 55	—	Radiocarbon, 1973:235–236
	F 5, L 9	Wis-510	960 ± 55	–25.5	"
	H 3, Sq I	Wis-512	965 ± 50	–25.7	"
	H 4, Sq U	Wis-514	890 ± 55	–25.6	"
	H 4, Sq W	Wis-518	910 ± 55	–25.4	"
	Sq U, Post	Wis-521	950 ± 55	—	"
	H 4, Sq Z	Wis-567	1015 ± 60	–25.8	Radiocarbon, 1973:619
	H 4, Sq X	Wis-568	770 ± 60	–27.5	"
	H 4, Roof	Wis-569	865 ± 60	–25.0	"
	H 4, Roof	Wis-570	695 ± 55	–29.0	"
Bloom (39HS1)	XU 3	TX-8155	1050 ± 50	—	Haug et al., 1994:48
St. John (39HU213)	T 18	SI-476	1180 ± 60	—	Radiocarbon, 1970:195–196
Twelve Mile Creek (39HT1)	F 2	Wis-536	1000 ± 60	—	Radiocarbon, 1973:619–620
	F 4	Wis-581	720 ± 60	–25.9	"
King (39LM55)	House Post	Wis-744	830 ± 60	–27.1	Radiocarbon, 1976:131
	House Post	Wis-748	855 ± 60	–25.6	"
Antelope Dreamer (39LM146)	H 11, F 107	UCR-2308	660 ± 50	–10.40	Toom, 1990:T92–93
	H 11, F 107	UCR-2309	735 ± 50	–10.31	"
	H 11, F 107	UCR-2310	720 ± 50	–9.99	"
	H 15, F 100 P	UCR-2311	870 ± 90	–22.88	"
	H 15, F 103 P	UCR-2312	800 ± 80	–21.42	"
	H 15, F 101 P	UCR-2313	820 ± 80	–22.54	"
Jiggs Thompson B (39LM208)	—	I-1186	670 ± 120	—	SI Chronology Statement No. 5
	—	I-1187	670 ± 120		"
	X 4, Midden	**ETH-11041**	**770 ± 60**	**–12.9**	This report
Langdeau (39LM209)	F 4, F 60	SI-51	950 ± 65	—	Radiocarbon, 1964:185
	F 11, F 58	SI-54	850 ± 55	—	"
	F 10 House	SI-57	810 ± 70	—	"
Jandreau (39LM225)	F 9, Post 30	SI-377	1100 ± 150	—	Radiocarbon, 1969:68
	F 3	**ETH-11050**	**1015 ± 55**	**–22.4**	This report
Pretty Head A (39LM232)	—	SI-166	650 ± 140	—	Radiocarbon, 1967:369
Pretty Head B (39LM232)	—	SI-165	520 ± 80	—	"
	F 22, F67	**SMU-2734**	**1002 ± 42**	**–26.0**	This report
Heath (39LN15)	—	I-9499	940 ± 195	—	Winham et al., 1992a:80
Over's La Roche C (39ST9)	H 2, F 25	SI-105	570 ± 55	—	Radiocarbon, 1965:248
	H 2, P 11	SI-170	560 ± 150	—	Radiocarbon, 1967:369–370
	H 3, P	SI-242	600 ± 100		Radiocarbon, 1969:168
Fay Tolton (39ST11)	F 2, P	M-1082	860 ± 75	—	Radiocarbon, 1962:195
	H 2, F 10	Wis-722	885 ± 50	—	Radiocarbon, 1976:131–132
	H 2, F 10	Wis-728	920 ± 60	—	"
	—	NWU-50	850 ± 170	—	Wood, 1976, table 20
	H1, B 1B	**ETH-10113**	**865 ± 60**	**–27.1**	This report

(*continued*)

TABLE C.2. (*continued*)

Tradition/Variant/Component	Provenience*	Lab number†	RCYBP‡	13C/12C	Reference
MIDDLE MISSOURI TRADITION (*continued*)					
Initial Middle Missouri					
Breeden A (39ST16)	F 1, F 14	M-608	1240 ± 75	—	Radiocarbon, 1960:39
	Grass	Wis-513	730 ± 55	–12.1	Radiocarbon, 1973:237
	F 1	Wis-548	960 ± 60		Radiocarbon, 1973:620
Dodd: Anderson (39ST30)	F 29, P	M-843	800 ± 100	—	Radiocarbon, 1960:40
Sommers (39ST56)	XU 18, P	SI-314	550 ± 100	—	Radiocarbon, 1967:370
	XU 17, P	SI-315	975 ± 185	—	"
	XU 18, P	Beta-1901	1080 ± 60	–22.16	Steinacher, 1990, table 6
	XU 18, P	Beta-1902	1240 ± 70	–22.12	"
	XU 18, P	Beta-1903	1090 ± 60	–21.40	"
	XU 70, P	Beta-1904	1420 ± 70	–20.53	"
	XU 70, P	Beta-1905	1280 ± 60	–21.39	"
	XU 70, P	Beta-1906	950 ± 60	–26.83	"
	XU 18, Fill	**SMU-2736**	**972 ± 73**	**–13.15**	This report
	XU 18, Floor	**ETH-10419**	**835 ± 50**	**–9.0**	"
	XU 18, Floor	**ETH-11038**	**1065 ± 55**	**–8.8**	"
	XU 70, Entrance	**ETH-11037**	**940 ± 60**	**–7.2**	"
	XU 70, Floor	**ETH-10418**	**1085 ± 60**	**–10.9**	"
Cattle Oiler (39ST224)	F 40, P	SI-316	980 ± 130	—	Radiocarbon, 1967:370
	F 39, F 90	SI-317	840 ± 100	—	"
	F 85, P	SI-318	690 ± 140	—	"
	F 124, P	SI-474	1140 ± 60	—	Radiocarbon, 1970:195
	F 130	SI-475	860 ± 60	—	"
	F 98	**ETH-11040**	**690 ± 60**	**–11.9**	This report
Eagle Feather (39ST228)	—	UCR-2447	760 ± 40	—	Toom, 1992c, table 5.8
Stony Point (39ST235)	H A	UCR-2314	685 ± 60	–26.50	Toom, 1990, tables 92,94
	H A	UCR-2315	840 ± 50	–26.36	"
Extended Middle Missouri					
Havens (32EM1)	F 164	M-2362	730 ± 100	—	Radiocarbon, 1972:179–180
	F 164	M-2363	720 ± 100	—	"
	X 103, F 446	**ETH-11047**	**560 ± 55**	**–13.1**	This report
	—	**ETH-11048**	**615 ± 55**	**–9.6**	"
Clark's Creek (32ME1)	T 1, F 1	M-2366	670 ± 100	—	Radiocarbon, 1972:179–180
	T 1, F 1	M-2367	770 ± 110	—	"
	T 1, F 1	SMU-1286	750 ± 50	—	Ahler and Haas, 1993, table 8.2
White Buffalo Robe (32ME7)	H 1, F 144	SMU-796	580 ± 60	—	Lee and Ahler, 1980, table 7.1
	H 6, F 38	SMU-729	608 ± 52	—	"
	H 1, F 118	SMU-724	692 ± 59	—	"
	H 8, F 240	SMU-732	703 ± 63	—	"
	H 1, F 121	SMU-794	742 ± 60	—	"
Bendish (32MO2)	H 3	NWU-17	620 ± 100	—	Thiessen, 1976, table 48
	H 3	NWU-18	980 ± 130	—	"
	H 3, F 19	NWU-47	730 ± 80	—	"
	H 6, P 169	NWU-48	1000 ± 140	—	"
Cross Ranch (32OL14)	H 3, F 105	M-2368	420 ± 100	—	Radiocarbon, 1972:180–181
	H 3, F 158-159	M-2369	590 ± 100	—	"
	H 7, F 53	SMU-1059	650 ± 40	—	Ahler and Haas, 1993, table 8.2
	H 7, F 63	SMU-1202	530 ± 50	—	"
	Cache Pit	GX-19395	450 ± 125	—	T. Larson, pers. comm., 1994
	Cache Pit	Beta-66015	660 ± 70	—	"
Fire Heart Creek (32SI2)	House	SI-213	720 ± 80	—	Radiocarbon, 1966:416

Paul Brave (32SI4)	H 2, F 42	M-2364	920 ± 100	—	Radiocarbon, 1972:179–180
	H 2, F 42	M-2365	850 ± 100	—	"
	F 32	**DRI-3206**	**755 ± 63**	—	This report
	F 15	**DRI-3207**	**783 ± 47**	—	"
	F 46	**DRI-3208**	**674 ± 62**	—	"
Ben Standing Soldier (32SI7)	F 3	SI-368	1050 ± 150	—	Radiocarbon, 1969:166–167
	H 1, F 3	SI-369	560 ± 150	—	"
	H 1, F 25	SI-370	370 ± 150	—	"
	H 5, F 20 P	SI-371	510 ± 140	—	"
	H 7, F 30	SI-372	1170 ± 100	—	"
	H 5, F 28 P	SI-373	1620 ± 150	—	"
	H 7, F30 P	SI-374	1030 ± 150	—	"
South Cannonball (32SI19)	H 1	I-4202	840 ± 90	—	Radiocarbon, 1970:117–118
	H 5	I-4203	610 ± 95	—	"
	H 4	I-4204	630 ± 95	—	"
	H 2	I-4205	820 ± 100	—	"
	F 93, Post 3	Wis-1011	760 ± 70	–26.5	Radiocarbon, 1981:146–147
	F 93, Post 1	Wis-1098	750 ± 60	–26.5	"
	F 74	Wis-1100	740 ± 60	–27.6	"
	F 7, Post 75	Wis-1110	680 ± 70	–27.4	"
	F 5, Post 79	Wis-1106	660 ± 70	–26.2	"
	F 7, Post 33	Wis-1105	630 ± 60	–26.8	"
	F 16, Post 1	Wis-1104	600 ± 70	–28.3	"
	F 16,Post 50	Wis-1097	570 ± 70	–26.3	"
	F 15,Post 27	Wis-1103	560 ± 60	–26.6	"
	F 13,Post 29	Wis-1102	510 ± 70	–28.3	"
McKensey (39AR201)	XU 1, P	SI-382	510 ± 100	—	Radiocarbon, 1969:169
Vanderbilt Village (39CA1)	H 11	UGa-3355	600 ± 60	—	Falk and Pepperl, 1986, table B160
	H 11	UGa-3356	595 ± 105	—	"
	F 6, slump	**DRI-3113**	**673 ± 44**	**–25.2**	This report
	F 6, slump	**ETH-16069**	**745 ± 65**	**–10.6**	"
	H 11, slump	**ETH-16070**	**750 ± 65**	**–25.3**	"
Helb (39CA208)	F 1	RL-298	940 ± 90	—	Radiocarbon, 1977:252
	H 8, F 12	RL-299	430 ± 90	—	"
	F 1	NWU-38	900 ± 90	—	Thiessen and Nickel, 1975, table 1
	F 1	NWU-39	930 ± 100	—	"
	H 7, F 80 P	NWU-40	980 ± 100	—	"
	H 14, F 352	NWU-45	800 ± 110	—	"
	H 15, F 417	NWU-46	910 ± 80	—	"
	H 15, F 417	NWU-52	560 ± 80	—	"
	H 14, F 352	NWU-53	570 ± 70	—	"
	H 8, F 12	NWU-54	330 ± 80	—	"
	F 97, P	NWU-55	660 ± 300	—	"
	H 14, F 352	**ETH-11043**	**515 ± 55**	**–11.7**	This report
	H 15, F 417	**ETH-11044**	**600 ± 55**	**–16.3**	"
Jake White Bull (39CO6)	F 2	UGa-1488	1450 ± 65	—	Ahler, 1977a, table 40
	H 4, F 7	UGa-1489	1275 ± 65	—	"
	H 4, F 11	UGa-1490	1310 ± 60	—	"
	Fort Ditch	UGa1491	945 ± 55	—	"
	Fort Ditch	UGa1492	985 ± 60	—	"
	Midden	UGa1493	910 ± 50	—	"
	F 2, 7, 11	UGa1558	975 ± 105	—	"
	H 4, South	**SMU-2663**	**747 ± 64**	**–24.13**	This report
	H 4, Pits	**ETH-10109**	**720 ± 60**	**–9.0**	"
	H 4, F 3	**ETH-9238**	**975 ± 75**	**—**	"
	S. Fort Ditch	**DRI-3204**	**770 ± 41**	**–24.9**	"
Travis I (39CO213)	F 36	Wis-1709	780 ± 70	–26.5	Radiocarbon, 1986:1207–1208
	F 18	Wis-1710	780 ± 70	–26.9	"

(*continued*)

TABLE C.2. (*continued*)

Tradition/Variant/Component	Provenience*	Lab number†	RCYBP‡	13C/12C	Reference
MIDDLE MISSOURI TRADITION (*continued*)					
Extended Middle Missouri					
Thomas Riggs (39HU1)	H 2 Post	M-838	730 ± 100	—	Radiocarbon, 1959:179
	—	NWU-49	300 ± 80	—	Thiessen, 1977, 81
Calamity Village (39DW231)	—	SI-375	1090 ± 200	—	Radiocarbon, 1969:168
	XU 1, F43	**ETH-10110**	**795 ± 60**	**–19.2**	This report
	XU 1, F44	**ETH-10111**	**665 ± 60**	**–12.2**	"
Sully School (39SL7)	**F 4**	**ETH-11051**	**775 ± 55**	**–22.5**	This report
	F 5, C 3	**ETH-11052**	**795 ± 55**	**–22.7**	"
Zimmerman (39SL41)	House Post 5	I-613	430 ± 95	—	Radiocarbon, 1963:72
Cheyenne River (39ST1)	F 34, F 103	M-840	650 ± 100	—	Radiocarbon, 1960:40
	F 34, F 103 P	I-581	775 ± 125	—	Radiocarbon, 1963:71
	F 5 P	I-582	350 ± 85	—	Radiocarbon, 1965:247
	F 34, F 102 P	SI-12	1030 ± 60	—	Radiocarbon, 1964:184–185
	F 24	SI-15	800 ± 60	—	"
	F 34, F 103	SI-17	870 ± 60	—	"
	F 5 P	SI-116	800 ± 60	—	Radiocarbon, 1965:247
	F 34, F 102 P	SI-117	790 ± 60	—	"
	F 34, F 103 P	SI-118	870 ± 60	—	"
	F 34 Midden	SI-119	610 ± 100	—	"
	F 34, C 2	**ETH-10413**	**675 ± 50**	**–25.8**	This report
Indian Creek (39ST15)	F 43	I-18,039	330 ± 80	—	Winham, 1995
	F 30	I-18,040	450 ± 80	—	"
	F 7	I-18,041	300 ± 80	—	"
	F 5	I-18,042	330 ± 80	—	"
Black Widow Ridge (39ST203)	**F 30, Floor**	**ETH-11053**	**555 ± 55**	**–13.6**	This report
Ketchen (39ST223)	F 3, P	SI-378	690 ± 140	—	Radiocarbon, 1969:168–169
	F 17	SI-477	810 ± 60	—	Radiocarbon, 1970:196
	F 3, Post 14	Wis-759	830 ± 60	—	Radiocarbon, 1976:132
	F 17, 157B	Wis-762	725 ± 50	—	"
Cattle Oiler (39ST224)	F 3, P	SI-379	1030 ± 190	—	Radiocarbon, 1969:169
Durkin (39ST238)	XU 6, Floor	Wis-743	640 ± 55	–26.6	Radiocarbon, 1976:131
	XU 5, Floor	Wis-746	655 ± 60	–27.9	"
Extended Middle Missouri/Terminal Middle Missouri					
32MO291	F 25	ETH-18092	425 ± 55	–9.6	Ahler and Metcalf, 2000, tables 5.3–5.4
	F 25	ETH-18093	520 ± 50	–9.6	"
	F 35	ETH-18094	430 ± 50	–14.2	"
	F 35	ETH-18095	690 ± 50	12.9	"
	F 40	ETH-18096	420 ± 50	–12.2	"
	F 40	ETH-18097	480 ± 50	–24.9	"
	F 41	ETH-18098	405 ± 50	–11.3	"
	F 41	ETH-18099	375 ± 50	–11.0	"
	F 50	ETH-18100	565 ± 50	–24.6	"
	F 50	ETH-18101	390 ± 50	–24.7	"
	F 58	ETH-18102	430 ± 50	–26.3	"
	F 58	ETH-18103	790 ± 55	–22.5	"
	F 76	ETH-18104	350 ± 50	–15.6	"
	F 76	ETH-18105	505 ± 50	–12.5	"
	F 35	DRI-3375	505 ± 69	–25.2	"
	F 40	DRI-3376	545 ± 53	–24.8	"
	F 41	DRI-3377	603 ± 92	–25.7	"
	F 50	DRI-3378	480 ± 62	–25.0	"

	F 58	DRI-3379	524 ± 54	–25.3	"
	F 60	DRI-3380	604 ± 58	–25.1	"
	F 76	DRI-3381	859 ± 58	–25.1	"
Terminal Middle Missouri					
Huff (32MO11)	H 3	SI-178	310 ± 190	—	Radiocarbon, 1966:416
	H 3, P	SI-179	470 ± 90	—	"
	H 8	SI-180	180 ± 120	—	"
	H 8, P	SI-181	530 ± 100	—	Radiocarbon, 1967:371
	H 12	SI-182	770 ± 140	—	"
	H 12, P	SI-183	Modern	—	"
	H 5/H 25	SI-446	390 ± 130	—	Radiocarbon, 1969:167
	H 5/H 25	SI-447	500 ± 130	—	"
	H 5/H 25	SI-448	600 ± 300	—	"
	House Post	USGS-29	440 ± 55	—	Thiessen, 1977:68
	F 501	ETH-21581	475 ± 55	–8.3	Ahler, 2000a, table 6
	F 501	ETH-21582	355 ± 50	–9.2	"
	F 501	ETH-21583	455 ± 50	–10.0	"
	F 502	ETH-21584	335 ± 50	–10.6	"
	F 502	ETH-21585	455 ± 50	–9.7	"
	F 502	ETH-21586	500 ± 50	–8.8	"
	H 6, F 87	**DRI-3114**	**598 ± 39**	**–26.2**	Ahler, 2000, table 3
	H 6, F 87	**ETH-16071**	**660 ± 60**	**–23.3**	"
	H 6, F 102	**ETH-16072**	**730 ± 65**	**–21.6**	"
	H 9, F 147	**ETH-16073**	**490 ± 60**	**–23.9**	"
Shermer (32EM10)	**H 4, F 417**	**ETH-11045**	**620 ± 55**	**–5.0**	This report
	H 6, F 243	**ETH-11046**	**785 ± 55**	**–9.7**	"
	XU 692, F 789	**DRI-3205**	**518 ± 51**	**–26.0**	"
	—	**ETH-16394**	**435 ± 45**	**–24.0**	"
	—	**ETH-17511**	**660 ± 50**	**–7.6**	"
COALESCENT TRADITION					
Initial Coalescent					
Crow Creek (39BF11)	F 100, P 46	M-1079a	560 ± 75	—	Radiocarbon, 1962:194
	Bone Bed B	Wis-1074	610 ± 55	–26.8	Radiocarbon, 1980:116
Whistling Elk (39HU242)	F 2	UGa-3366	1060 ± 55	–28.19	Toom, 1983b, tables 26–27
	H 1, F 9	UGa-3369	1020 ± 55	–27.95	"
	F 2	UGa-2599	975 ± 80	–27.08	"
	F 2	UGa-2600	900 ± 65	–27.20	"
	H 1, F 9	UGa-3368	870 ± 75	–27.60	"
	F 1	UGa-2601	660 ± 50	–26.25	"
	F 2	UGa-3367	555 ± 60	—	"
	H 2	UCR-2035	650 ± 60	–9.10	D. Toom, pers. comm., 1991
	H 2	UCR-2036	550 ± 70	–9.16	"
	H 2	UCR-2037	710 ± 70	–9.29	"
Arzberger (39HU6)	X 26, Bastion	M-1126a	430 ± 100	—	Radiocarbon, 1962:193–194
	X 28, Hearth	M-1126	500 ± 75	—	"
	H1, F 9	**ETH-10114**	**440 ± 55**	**–18.0**	"
	F 1	**ETH-11042**	**340 ± 60**	**–15.9**	"
Lynch (25BD1)	Trench SI-4	M-842	250 ± 75	—	Radiocarbon, 1960:40
	X 65, H 3	M-1127	540 ± 100	—	Radiocarbon, 1962:194
	X 52, H 1	M-1128	820 ± 100	—	"
	Trench S3-S11	**ETH-11049**	**780 ± 55**	**–17.5**	"
Extended Coalescent					
Elbee (32ME408)	F4, L2	SMU-797	440 ± 40	—	Ahler, 1984b, table 3
	F4, L2	SMU-1101	270 ± 40	—	"
	F4, L4	SMU-1103	330 ± 30	—	"
Demery (39CO1)	—	USGS-168	495 ± 45	—	C. Falk, pers. comm., 1978
	X 5, F 65	**SMU-2800**	**509 ± 47**	**–25.47**	This report
	F 67, P	**SMU-2789**	**583 ± 58**	**–10.13**	"

(*continued*)

TABLE C.2. (*continued*)

Tradition/Variant/Component	Provenience*	Lab number†	RCYBP‡	13C/12C	Reference
COALESCENT TRADITION (*continued*)					
Extended Coalescent					
Lower Grand (39CO14)	F 102	RL-300	590 ± 90	—	Radiocarbon, 1977:252–253
	H 12, F 402	RL-301	650 ± 120	—	"
	F 582	RL-302	490 ± 90	—	"
	T 6	RL-303	600 ± 90	—	"
	Cache Pit 1	I-17,912	510 ± 90	—	Winham, 1995
	Cache Pit 4	I-17,913	270 ± 80	—	"
	F 59	**SMU-2689**	**395 ± 57**	**–25.41**	This report
	H 12, F 102	**SMU-2725**	**326 ± 66**	**–25.54**	"
	H 12, F 102	**ETH-10112**	**470 ± 55**	**–7.4**	"
	H 11, F 3	**ETH-10412**	**280 ± 55**	**–9.3**	"
Potts (39CO19)	**F 2, C 3**	**ETH-10120**	**235 ± 55**	**–7.9**	"
	F 8, Posts	**ETH-10121**	**415 ± 55**	**–6.8**	"
Molstad (39DW234)	—	I-720	385 ± 95	—	SI Chronology Statement No. 5
	—	I-721	275 ± 85	—	"
	Bastion Post	SI-25	475 ± 100	—	Radiocarbon, 1964:185
	F 10	SI-59	360 ± 50	—	Radiocarbon, 1965:246
McClure (39HU7)	H 2, F 3	SI-380	670 ± 140	—	Radiocarbon, 1969:169
Little Pumpkin (39HU97)	F 1, Pit	SMU-2627	430 ± 60	–25.7	Toom, 1992d, tables 3–4
	F 1, Pit	SMU-2628	330 ± 60	–25.7	"
	F 4, Hearth	SMU-2629	320 ± 100	–26.3	"
Bowman (39HU204)	H 1, F 3	SI-381	Modern	—	Radiocarbon, 1969:169
Meander (39LM201)	**XU 1, Pit**	**ETH-10116**	**350 ± 55**	**–7.7**	**This report**
	XU 1	**ETH-10117**	**395 ± 55**	**–7.4**	"
	XU 1	**ETH-10118**	**275 ± 55**	**–24.2**	"
Hosterman (39PO7)	**F 9, 180L20**	**ETH-10119**	**295 ± 55**	**–9.1**	**This report**
	F 3, 170L30	**SMU-2728**	**747 ± 62**	**–9.23**	"
	F 3, 170L30	**SMU-2731**	**530 ± 64**	**–10.02**	"
	F 3, 170L30	**SMU-2732**	**232 ± 56**	**–10.09**	"
Sully (39SL4)	**H 1, C 4**	**ETH-10416**	**365 ± 55**	**–9.6**	This report
	F 206, C 7	**ETH-10417**	**265 ± 55**	**–24.5**	"
	F 206, C 8	**SMU-2726**	**400 ± 63**	**–9.97**	"
39SL24	F 21	I-614	240 ± 80	—	Radiocarbon, 1963:71
Over's La Roche (39ST9)	—	SI-95	270 ± 50	—	Radiocarbon, 1965:248
	P	SI-97	290 ± 60	—	"
	H 3, P 185 A	SI-104	430 ± 60	—	"
	H 4, F 10 B	SI-106	310 ± 55	—	"
	H 1, P 102 A	SI-169	450 ± 120	—	Radiocarbon, 1967:369–370
	H 1, XU 2 A	ETH-10414	250 ± 50	–24.1	This report
	H 3, Fill A	ETH-10415	420 ± 55	–10.1	"
	H 1, XU 2 A	ETH-11039	345 ± 60	–16.5	"
Eagle Feather (39ST228)	—	UCR-2448	340 ± 60	—	Toom, 1992c, table 5.8
Bower's La Roche (39ST232)	—	SI-214	550 ± 210	—	Radiocarbon, 1969:168
	H5, Post 1	SI-215	710 ± 90	—	"
Walth Bay (39WW203)	H 19, F 116	RL-304	450 ± 90	—	Radiocarbon, 1977:253–254
	H 9, F 257	RL-305	450 ± 90	—	"
	H 15, F 593	RL-306	380 ± 90	—	"
	H 16, F 741	RL-307	310 ± 90	—	"
	H 19, F 116	SMU-2685	320 ± 63	–26.45	This report
	H 19, F 318	SMU-2687	321 ± 57	–24.92	"

	H 19/21, F 387	SMU-2677	322 ± 64	–25.43	"
	H 19/21, F 387	SMU-2678	279 ± 46	–9.79	"
Post-Contact Coalescent					
Talking Crow Phase					
Rattlesnake Keeper (39LM160)	T 11, F 1	UCR-2381a	210 ± 60	—	Toom, 1989, tables 10 –11
	T 11, F 1	UCR-2381b	<150 ± 50	—	"
	T 6	UCR-2382	<150 ± 50	—	"
Bad River Phase					
Ghost Lodge (39ST20)	H 2, F 101	UCR-2316	<150	–24.87	Toom, 1990, tables 92,95
	H 2, F 101	UCR-2317	175 ± 80	–25.36	"
Dodd (39ST30)	F 17, Fill	ETH-10115	160 ± 55	–9.6	This report
Stony Point (39ST235)	—	GX-13406	295 ± 75	–11.0	D. Toom, pers. comm., 1991

*Provenience abbreviations: H = House, F = Feature, T = Test, XU or X = Excavation Unit, P = Post, Sq = Square, L=Level, C = Cache pit. Provenience designations refer to those as first reported. Designations may have changed in the site reports. The original provenience units from the South Cannonball site (32SI7) have been reassigned by Griffin (1984) as follows: H1=F15, H2=F13 & F74, H3=F93, H4=F7, H5=F5, H7=F16. All dates in bold are part of the Plains Village Dating (PVD) program sponsored by the Smithsonian Institution Repatriation Office and the University of North Dakota, Department of Anthropology.

†Lab codes: Beta = Beta Analytic, DRI = Desert Research Institute, ETH = ETH Hönggerberg, GX = Geochron, I = Isotopes, Inc. (except for the Heath, Indian Creek, and Lower Grand sites, which are from the University of Washington, Quaternary Isotope Laboratory), M = University of Michigan, NWU = Nebraska Wesleyan University, RL = Radiocarbon Ltd., SI = Smithsonian Institution, SMU = Southern Methodist University, TX = University of Texas, UCR = University of California-Riverside, UGa = University of Georgia, USGS = United States Geological Survey, Wis = University of Wisconsin.

‡Additional Comments on dates: Wis-570 (Mitchell) dates willow wands. UCR-2308, UCR 2309 and UCR 2310 date corn. SI-475 (Cattle Oiler) dates grass. M-1126a (Arzberger) dates bone and wood. SI-381 (Bowman) dates corn. SI-95, SI-104, SI-169, ETH-10414, ETH-10415, ETH-11039 date component B at Over's La Roche. SI-97 and SI-106 date component A at Over's La Roche. Cheyenne River (39ST1) equivalent redates on same samples: SI-12 = SI-117 = I-591, SI-17 = SI-118 = M-840, SI-116 = I-582. SI-119 (Cheyenne River) dated on material above F 34. Sample numbers in comments section for the Cheyenne River site (39ST1) are re-dates of associated samples.

The dates reported by the University of Michigan from 25BD1, 39BF11, 39BR16, 39HU1, 39ST1, 39ST16 and 39ST30 in 1959, 1960 and 1962 (M-608, M-836, M-838, M-839, M-840, M-842, M-843, M-1127, M-1128) are listed in Radiocarbon with 2-sigma errors. They are listed in this table with the standard 1-sigma errors. The radiocarbon dates from White Buffalo Robe (32ME7) do not include 15 dates from the University of Georgia Laboratory. An extensive array of radiocarbon and thermoluminescent dates from the components within the Knife River Indian Villages National Historic Site (KNRI) are not included in this table (see Ahler and Haas, 1993).

TABLE C.3. Radiocarbon dates from Plains village sites, combines Smithsonian Institution Repatriation Office and preexisting date. (Corrections are based on CALIB 3.0.3 in Stuiver and Reamer, 1993, decadal tree-ring option, method B probabilities; P = probability.)

Variant and site	Number of dates averaged	Age (RCYBP)	Calibration curve intercepts (AD)	Dates (AD) and relative area under probability distribution 68.5%	P	95.4%	P
INITIAL MIDDLE MISSOURI							
Broken Kettle West (13PM25)	3	912 ± 34	1075,1076,1155	1042–1091	.47	1031–1144	.64
				1119–1140	.20	1146–1212	.36
				1150–1163	.11		
				1169–1192	.20		
				1202–1206	.02		
Williams (13PM50)	2	889 ± 40	1161,1172,1189	1059–1088	.23	1033–1143	.46
				1121–1138	.14	1147–1223	.49
				1151–1214	.62	1230–1243	.03
				1247–1257	.02		
Larsen (13PM61)	4	727 ± 30	1285	1263–1273	.22	1222–1233	.02
				1276–1295	.78	1235–1252	.04
						1256–1305	.86
						1307–1317	.02
						1371–1386	.05
Price (21BE25)	3	910 ± 48	1156	1041–1092	.42	1022–1222	.98
				1118–1140	.18	1234–1238	.01
				1150–1164	.12	1250–1256	.01
				1166–1194	.21		
				1198–1207	.06		
Great Oasis (21MU2/17)	2	1015 ± 47	1020	984–1042	.69	899–919	.04
				1091–1119	.22	945–950	.01
				1140–1150	.10	958–970	.01
						976–1158	.94
						1181–1185	.00
Packer (25SM9)	3	937 ± 42	1057,1088,1121, 1139, 1151	1034–1075	.37	1022–1165	.85
				1075–1133	.50	1165–1208	.15
				1134–1142	.07		
				1148–1155	.06		
Crow Creek (39BF11)	2	875 ± 59	1164,1167,1194, 1198,1207	1058–1088	.19	1030–1194	.41
				1121–1138	.12	1146–1223	.58
				1151–1223	.58	1272–1276	.09
				1230–1241	.07		
				1248–1257	.05		
Swanson (39BR16)	3 (H2 P. C)	891 ± 34	1160,1173,1188	1065–1087	.19	1033–1143	.46
				1122–1138	.14	1147–1222	.52
				1152–1213	.67	1234–1239	.01
						1249–1256	.01
	3 (H2 P. D)	1090 ± 39	984	897–921	.34	877–1024	1.00
				944–937	.32		
				975–999	.34		
				1015–1015	.01		
Jones Village (39CA3)	5	899 ±22	1158,1185	1068–1084	.20	1036–1096	.31
				1124–1137	.15	1115–1142	.16
				1153–1165	.14	1148–1216	.53
				1166–1195	.38		
				1196–1207	.13		

Mitchell (39DV2)	9	908 ± 20	1156	1059–1088	.36	1036–1100	.40
				1121–1138	.21	1114–1142	.18
				1151–1163	.03	1148–1212	.42
				1169–1192	.27		
				1202–1206	.03		
Bloom (39HS1)	1	1050 ± 50	997	898–919	.18	885–1067	.88
				945–950	.03	1085–1125	.08
				958–970	.07	1137–1153	.04
				976–1032	.71		
				1144–1147	.02		
St. John (39HU213)	1	1180 ± 60	881	779–792	.09	692–702	.01
				800–898	.66	710–749	.06
				919–945	.16	766–990	.92
				948–959	.06		
				970–976	.03		
King (39LM55)	2	842 ± 45	1214	1159–1176	.15	1015–1045	.00
				1186–1262	.85	1049–1089	.08
						1119–1139	.05
						1151–1282	.87
Antelope Dreamer (39LM146)	6	740 ± 27	1282	1263–1274	.36	1222–1233	.04
				1275–1290	.64	1234–1253	.08
						1256–1298	.88
Jiggs Thompson B (39LM208)	1	770 ± 60	1265,1266,1277	1215–1290	1.00	1073–1077	.00
						1128–1135	.01
						1154–1326	.95
						1352–1361	.01
						1366–1389	.04
Langdeau (39LM209)	3	871 ± 38	1165,1195,1208	1070–1082	.09	1030–1096	.18
				1124–1136	.08	1115–1142	.10
				1153–1222	.77	1148–1263	.72
				1234–1237	.02	1274–1275	.00
				1251–1256	.04		
Pretty Head B (39LM232)	1	1002 ± 42	1022	994–1043	.60	903–909	.01
				1090–1119	.28	981–1158	.99
				1139–1151	.12	1181–1185	.00
Over's La Roche C (39ST9)	1	570 ± 55	1406	1324–1354	.41	1299–1436	1.00
				1357–1368	.11		
				1388–1425	.48		
Fay Tolton (39ST11)	4	885 ± 32	1162,1171,1190	1068–1084	.14	1036–1098	.24
				1124–1137	.11	1115–1142	.12
				1153–1214	.75	1148–1224	.58
						1228–1258	.06
Sommers (39ST56)	3	1001± 39	1022	996–1042	.60	982–1075	.59
				1091–1119	.28	1075–1157	.41
				1140–1150	.12		
Cattle Oiler (39ST224)	1	690 ± 60	1292	1279–1327	.60	1223–1231	.02
				1351–1363	.11	1238–1250	.02
				1366–1390	.29	1256–1407	.96
Eagle Feather (39ST228)	1	760 ± 40	1279	1223–1230	.11	1208–1301	.99
				1240–1248	.13	1374–1378	.01
				1257–1289	.76		
Stony Point (39ST235)	2	774 ± 42	1264,1269,1276	1222–1234	.20	1163–1168	.01
				1237–1251	.21	1192–1203	.02
				1256–1284	.58	1206–1297	.97

(*continued*)

TABLE C.3. (*continued*)

Variant and site	Number of dates averaged	Age (RCYBP)	Calibration curve intercepts (AD)	Dates (AD) and relative area under probability distribution 68.5%	P	95.4%	P
EXTENDED MIDDLE MISSOURI							
Havens (32EM1)	2	588 ± 41	1332,1342,1396	1322–1355	.48	1300–1375	.64
				1356–1369	.16	1375–1422	.36
				1387–1411	.36		
Clark's Creek (32ME1)	1	750 ± 50	1281	1222–1233	.13	1164–1167	.00
				1236–1251	.16	1193–1201	.01
				1256–1294	.71	1206–1325	.92
						1353–1359	.01
						1367–1389	.05
White Buffalo Robe (32ME7)	5	660 ± 28	1299	1292–1323	.58	1285–1330	.51
				1354–1357	.03	1345–1394	.49
				1368–1388	.39		
Bendish (32MO2)	1	730 ± 80	1284	1218–1323	.86	1074–1076	.00
				1355–1356	.01	1133–1135	.00
				1368–1387	.14	1155–1412	.99
Cross Ranch (32OL14)	3	613 ± 31	1328,1350,1391	1305–1314	.12	1299–1407	1.00
				1315–1333	.25		
				1340–1371	.46		
				1385–1397	.16		
Fire Heart Creek (32SI2)	1	720 ± 80	1286	1222–1233	.07	1159–1180	.02
				1237–1251	.09	1186–1412	.98
				1256–1326	.62		
				1352–1361	.05		
				1367–1389	.17		
Paul Brave (32SI4)	3	744 ± 35	1282	1245–1245	.01	1214–1302	.99
				1257–1295	.99	1373–1380	.01
South Cannonball (32SI19)	13	655 ± 20	1301,1374,1378	1295–1322	.56	1289–1328	.50
				1355–1355	.02	1348–1392	.50
				1369–1387	.43		
Vanderbilt Village (39CA1)	3	710 ± 34	1288	1264–1271	.09	1243–1246	.00
				1276–1303	.77	1257–1327	.79
				1372–1383	.14	1350–1391	.21
Helb (39CA208)	2	558 ± 41	1409	1328–1349	.36	1304–1371	.47
				1391–1427	.64	1385–1433	.53
Jake White Bull (39C06)	3	751 ± 33	1280	1225–1226	.01	1217–1297	1.00
				1244–1246	.03		
				1257–1292	.96		
Travis I (39CO213)	2	780 ± 59	1263,1273,1275	1214–1287	1.00	1069–1083	.01
						1123–1137	.01
						1153–1321	.95
						1369–1387	.02
Calamity Village (39DW231)	1	665 ± 60	1298	1287–1327	.51	1262–1411	1.00
				1350–1390	.49		
Zimmerman (39SL41)	1	430 ± 95	1445	1418–1524	.66	1319–1369	.05
				1564–1565	.05	1386–1665	.95
				1575–1627	.28		

Cheyenne River (39ST1)	1	675 ± 50	1295	1285–1326 1353–1360 1367–1388	.59 .08 .32	1264–1271 1276–1334 1336–1405	.02 .50 .48
Black Widow Ridge (39ST203)	1	555 ± 55	1409	1326–1352 1362–1366 1389–1433	.34 .05 .61	1300–1375 1376–1441	.48 .52
Ketchen (39ST223)	3	782 ± 35	1263,1275	1222–1233 1238–1250 1256–1281	.21 .22 .57	1195–1195 1208–1292	.00 1.00
Durkin (39ST238)	2	647 ± 42	1303,1372,1383	1295–1327 1351–1364 1365–1389	.47 .17 .37	1286–1334 1337–1405	.44 .56
EXTENDED MIDDLE MISSOURI/TERMINAL MIDDLE MISSOURI							
32MO291	11	471 ± 17	1437	1427–1443	1.00	1413–1451 1464–1475	.95 .05
TERMINAL MIDDLE MISSOURI							
Shermer (32EM10)	2	591 ± 38	1332, 1343, 1395	1322–1355 1356–1368 1387–1410	.50 .17 .34	1299–1419	1.00
Huff (32MO11)	6	424 ± 22	1446	1441–1455 1456–1478	.41 .59	1431–1496 1603–1611	.98 .02
INITIAL COALESCENT							
Crow Creek (39BF11)	2	592 ± 47	1331,1343,1394	1318–1370 1386–1411	.67 .33	1297–1423	1.00
Arzberger (39HU6)	2	400 ± 48	1454,1457,1478	1441–1520 1593–1622	.74 .26	1433–1533 1542–1636	.60 .40
Whistling Elk (39HU242)	3	638 ± 40	1317,1370,1386	1259–1328 1350–1390	.42 .58	1290–1334 1337–1405	.41 .59
EXTENDED COALESCENT							
Elbee (32ME408)	1	440 ± 40	1443	1430–1488	1.00	1412–1521 1585–1624	.89 .11
Demery (39CO1)	3	523 ± 31	1418	1407–1436	1.00	1330–1347 1392–1442	.11 .89
Lower Grand (39CO14)	4	366 ± 30	1494,1602,1615	1485–1524 1564–1574 1575–1627	.39 .08 .53	1449–1532 1545–1635	.46 .54
Molstad (39DW234)	2	365 ± 45	1494,1601,1616	1455–1456 1481–1528 1558–1631	.01 .39 .60	1448–1638	1.00
Little Pumpkin (39HU97)	2	377 ± 43	1490	1451–1465 1465–1523 1580–1626	.11 .48 .41	1442–1530 1539–1637	.50 .50
Meander (39LM201)	3	338 ± 33	1524,1564,1575, 1627	1501–1511 1516–1533 1540–1599 1618–1636	.08 .17 .57 .18	1455–1456 1478–1647	.00 1.00
Hosterman (39PO7)	1	295 ± 55	1643	1501–1509 1517–1598 1619–1663	.05 .61 .34	1450–1676 1776–1803 1940–1955	.92 .06 .03
Sully (39SL4)	3	337 ± 34	1525,1563,1628	1502–1510 1516–1534 1538–1599 1618–1637	.08 .18 .57 .17	1455–1457 1477–1648	.01 .99

(*continued*)

TABLE C.3. (*continued*)

Variant and site	Number of dates averaged	Age (RCYBP)	Calibration curve intercepts (AD)	Dates (AD) and relative area under probability distribution 68.5%	P	95.4%	P
Extended Coalescent (*continued*)							
39SL24	1	240 ± 80	1660	1523–1580	.19	1489–1823	.81
				1626–1691	.30	1827–1885	.08
				1729–1811	.37	1912–1955	.11
				1923–1955	.14		
Over's La Roche B (39ST9)	3	330 ± 32	1528,1558,1631	1518–1597	.80	1485–1649	1.00
				1620–1640	.20		
Over's La Roche A (39ST9)	2	301 ± 41	1641	1520–1589	.67	1484–1668	.98
				1623–1654	.33	1784–1796	.01
						1950–1952	.00
Eagle Feather (39ST238)	1	340 ± 60	1523,1565,1578, 1627	1494–1603	.81	1442–1660	1.00
				1612–1638	.19		
Walth Bay (39WW203)	4	312 ± 28	1535, 1638	1523–1579	.73	1492–1602	.74
				1626–1647	.27	1616–1653	.26
Post-Contact Coalescent							
Rattlesnake Keeper (39LM160)	1	210 ± 60	1669,1783,1797, 1948,1952	1647–1691	.27	1528–1558	.03
				1729–1811	.53	1631–1894	.80
				1923–1955	.20	1908–1955	.17
Ghost Lodge (39ST20)	1	175 ± 80	1678,1765,1775, 1805,1939,1954	1663–1703	.19	1531–1550	.02
				1723–1815	.46	1634–1955	.98
				1840–1866	.16		
				1917–1955	.19		
Dodd (39ST30)	1	160 ± 55	1683,1735,1809 1934,1954	1671–1703	.19	1664–1893	.83
				1723–1781	.35	1908–1955	.17
				1799–1815	.09		
				1839–1877	.19		
				1917–1946	.17		
				1953–1955	.01		
Stony Point (39ST235)	1	295 ± 75	1643	1492–1604	.62	1441–1689	.82
				1608–1667	.33	1731–1810	.13
				1785–1795	.05	1924–1955	.05
						1952–1952	.00

Appendix D: Dendrochronological Dates

This brief appendix consists of Figure D.1, which is a plot of the ranges of the available dendrochronological dates from a number of Plains Village sites. This information was extracted from four sources (Missouri Basin Chronology Statement No. 3; Weakly, 1971; Will, 1946, 1948). Dates from the same component from these sources were combined in this figure. The ranges of dates in this figure are the maximums, or latest, for each series of dates, which presumably reflect the nearest ones to cutting dates. They are not considered in the development of the various chronologies proposed in this study because of the problems outlined by Bell (1948) and Caldwell and Synder (1983). Although many of these are at variance with available radiocarbon dates, some are more credible than others. The following is a brief review of the dates, arranged by taxonomic unit.

The dates from the Initial Middle Missouri are 100–200 years later than the accepted range of the AD 1000 to AD 1400. More specifically, the Sommers site dendrochronological dates are about 400 years later than the radiocarbon dates. Most of the dates from Sommers relate to two houses (XU 17 and XU18), although there is little difference between them (see Weakly, 1971, table 13). As a result, all Sommers dates were combined. A similar difference between the dendrochronological and radiocarbon dates also is apparent for the St. John site, although only one date is involved for each series.

The dendrochronological dates for the Extended variant of the Middle Missouri variant tend to be about 200 years later than their comparable radiocarbon dates. Four dendrochronologically dated components (Ketchen, Cheyenne River, Thomas Riggs, McKensey) have radiocarbon dates associated with their occupations. The McKensey site is the only one that has a radiocarbon date that even approaches its late dendrochronological date.

The dates from Coalescent tradition, Heart River complex, and Le Beau and Talking Crow phases, are closer to their chronological positions, either as a result of radiocarbon dating or ceramic ordinations. The earliest dendrochronological dates from the Initial variant Crow Creek site are similar to the date

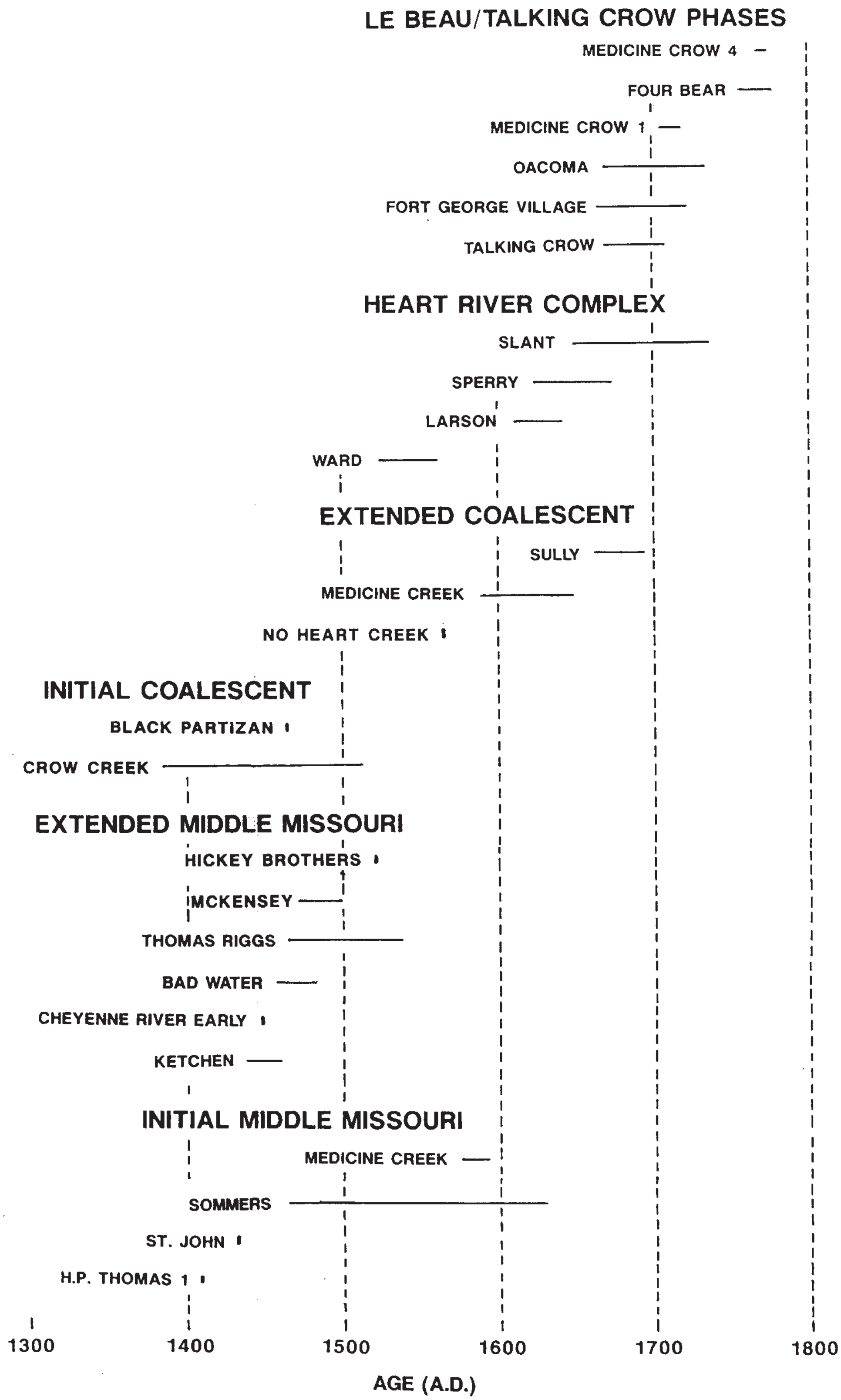

FIGURE D.1. Plot of the ranges of the latest dendrochronological dates from Plains Village sites within the Middle Missouri subarea.

of about AD 1400 obtained by radiocarbon determinations. The late series of dendrochronological dates from the site are about 100 years too late. The three dated Extended Coalescent sites (No Heart Creek, Medicine Creek, Sully) are within or close to the range of the radiocarbon dates from Sully and other Extended variant components. The four Heart River complex sites also fall within the estimated range of this taxonomic unit at AD 1450/1500 to AD 1785 (Ahler, 1993b:69). Similarly, the Le Beau and Talking Crow phase components fall within the estimated range of these taxonomic units. It also is interesting to note that the dendrochronological dates from Medicine Crow 1 and Medicine Crow 4 agree with the temporal order of these two components established by intrasite ceramic ordination.

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