2.0 GEOLOGICAL AND ARCHAEOLOGICAL BACKGROUND

2.1 GEOLOGICAL BACKGROUND AND BURIED ARCHAEOLOGICAL SITE FORMATION PROCESSES

Archaeological site burial cannot be understood without placing sites into the framework of the geological processes that resulted in their burial. Such an understanding is even more critical for predicting the possibility of site burial at a locale or, alternatively, comprehending why buried cultural deposits may be absent. This perception guided the development of the Landform Sediment Assemblages (LfSA) mapping done for Mn/Model (Hudak and Hajic 2001) and was also a vital component to similar efforts in Michigan (Monaghan and Lovis 2005). Thus, an understanding of the basic history of glacial advances and retreats, particularly during the waning stages, as well as a more detailed outline of the post-glacial, Holocene fluvial developments of the area are important. This information is presented in Section 2.1.1. In addition, models for archaeological site formation within different depositional settings are discussed in Section 2.1.2.

2.1.1 Geological Background

The physiography of Minnesota has been outlined by Wright (1972a), who divides it into several major regions based on differences in the underlying geology, soils, and vegetation, as well as climate patterns and environmental history (Figure 2.1.1-1). Although much of the physiography in Minnesota is a direct result of Wisconsinan glaciations, the preglacial geology of the state also greatly influenced the configuration, flow direction, and deposition of the various lobes of the Laurentide Ice Sheet. This is particularly true concerning the bedrock lithology and subcrop pattern. Geologically, Minnesota lies at the interface between the large Paleozoic (280-550 million years ago [mya]) sedimentary basins and platforms, which typify the upper Great Lakes in Michigan and Wisconsin to the east, the Precambrian (>550 mya) metasediments, intrusive and metavolcanic cratonic Canadian shield found to the north, and the Mesozoic (70-280 mya) alluvial deposits that underlie much of the upper Great Plains west of the state. This pattern is clear in the subcrop pattern of bedrocks, with Precambrian bedrocks underlying much of central and northern Minnesota; Paleozoic (mainly Cambrian and Ordovician) clastic and carbonate bedrocks underlying most of eastern, particularly southeastern Minnesota; and Mesozoic (mainly Cretaceous and Jurassic) shale, siltstone, and carbonate generally restricted to the western and southwestern parts of Minnesota (Figure 2.1.1-1).

The present topography and configuration of Minnesota were dictated mainly by depositional and erosional events associated with the Laurentide Ice Sheet, which spread over the state during the Wisconsinan (ca. 10 kyBP to 100 kyBP). Particularly important was the period between 20 kyBP and 10 kyBP (Mickelson et al. 1983; Wright 1972b). During this time, morainal uplands, glacio-fluvial valleys, and lacustrine plains were formed. Most of the drainage patterns developed during the late Wisconsinan retreat are the direct predecessors to the modern river systems, including the upper Mississippi, and all of the Minnesota and Red River (of the North) valleys. Even in areas that were not covered by late Wisconsinan ice, such as the Root River valley in the Driftless Area of southeastern Minnesota, outwash from the retreating glacial margin also influenced the configuration and characteristics of modern river valleys. The pattern of glacial retreat during the waning stages of disintegration of the Laurentide Ice Sheet was also

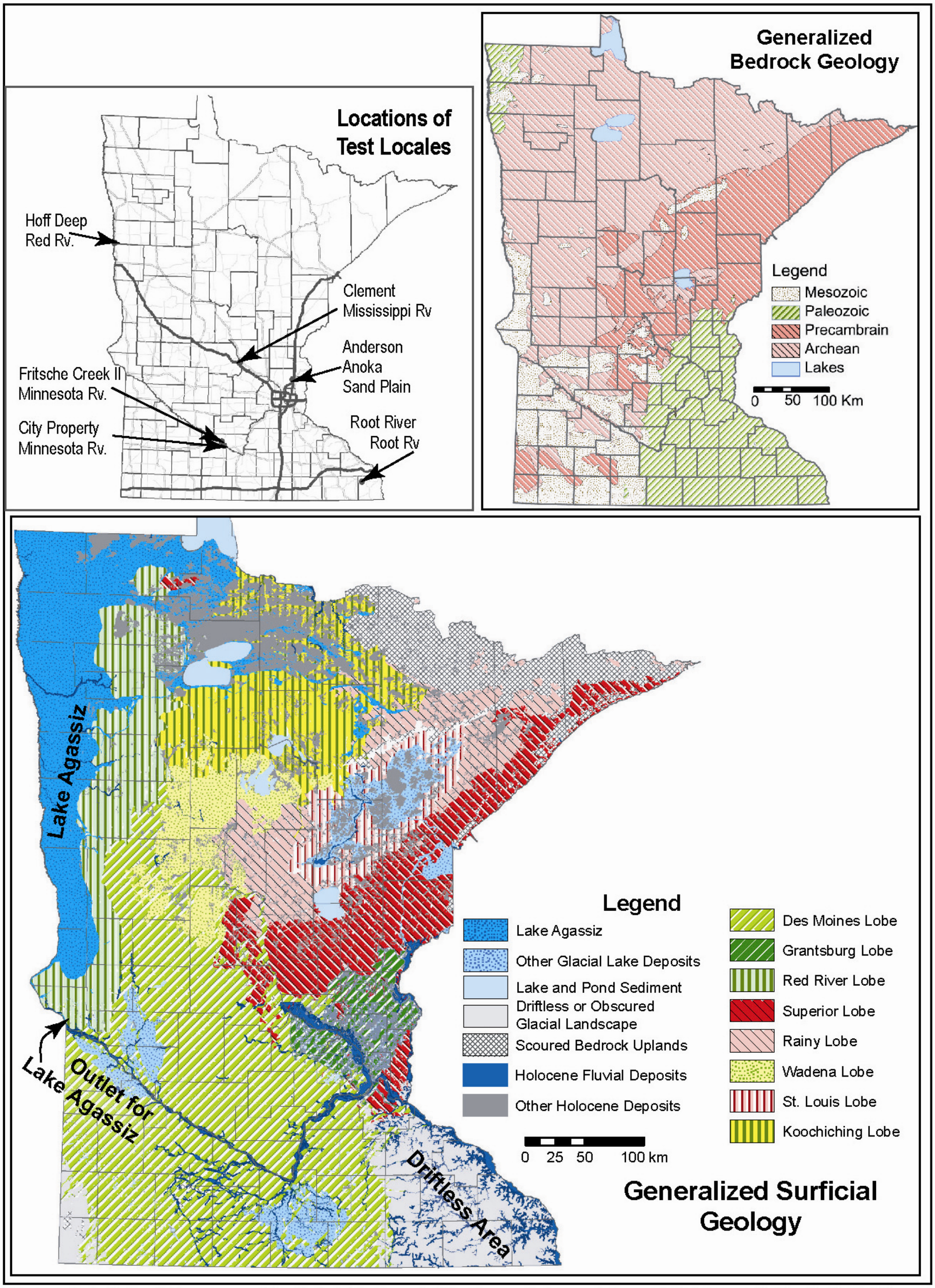

Figure 2.1.1-1. Minnesota Surficial Bedrock Geology (adapted from Hobbs and Goebel 1982, 1985)

a major factor in configuring the ancient and modern Great Lakes shorelines in northeastern Minnesota, as well as large and significant glacial lakes in northern and western Minnesota. In fact, as discussed in more detail below, variations in discharge from one of these, Glacial Lake Agassiz, also strongly influenced the characteristics of the Red and Minnesota rivers well into the early Holocene. While a summary of the glacial deposits is presented below, interested readers are referred to summaries by Wright (1972b) or the more general, popularized discussions of Minnesota geological history by Ojakangas and Matsch (1982).

Except for the far southeast corner of Minnesota, some smaller areas in north-central Minnesota (i.e., Wadena deposits), and areas associated with bedrock outcrops, most of the state's surficial deposits are associated with glacial events related to the late Wisconsinan, as noted above (ca. 10 kyBP to 20 kyBP) (Mickelson et al. 1983; Wright 1972b). The surficial deposits derived from several glacial lobes that formed as minor, local pulses from the main Laurentide Ice Sheet during specific intervals, or stades, of the Wisconsinan. These include significant and long-lasting ice lobes that were maintained through several stades as well as more minor sublobes, such as the St. Louis sublobe (Mooers et al. 2005; Figure 2.1.1-1), associated with minor pulses during the waning of the Laurentide Ice Sheet. While most of these areas are associated with the late Wisconsinan, some glacial deposits are significantly older. For example, ^{14}C age estimates of 30 kyBP to 60 kyBP from organic silts and lake sediments related to drumlins associated with the Wadena lobe (Figure 2.1.1-1) suggest an early or middle Wisconsinan age for deposits of the Wadena (or Winnipeg; Goldstein 1985) lobe (Wright 1972b). Although some of the moraines of the Wadena Lobe may have actually been formed during the initial late Wisconsinan (i.e., ca. 20 kyBP), most of the deposits suggest that they were derived from eastern or northeastern sources regardless of age (Wright 1972b).

Most of the glacial deposits in Minnesota derive from three main ice lobes during various stages of the late Wisconsinan. These include the Des Moines, Rainey, and Superior lobes (Figure 2.1.1-1). For example, the Des Moines lobe, which may have also extended into the middle Wisconsinan, covered most of southern and southwestern Minnesota and flowed eastward and southeastward into the state from northern or northwestern sources after 20 kyBP (Figure 2.1.1-1; Wright 1972b). During the maximum extent of the Des Moines lobe about 16 kyBP, the Grantsburg sublobe formed in the vicinity of the Twin Cites and Mississippi-St. Croix River junction and was apparently part of the Des Moines. By about 12 kyBP and during the finial disintegration of the Des Moines lobe in Minnesota, the Red River lobe developed and occupied the Red River valley. It probably was the final glacial advance from a northern or northwestern source in western Minnesota. Conversely, the Rainey and Superior lobes were generally restricted to the northern and eastern parts of Minnesota and flowed south and west into Minnesota from sources in Ontario or the Superior Basin. Their flow was probably restricted in part by the Des Moines lobe. As was true for the Red River lobe, the St. Louis sublobe of the Superior lobe extended from the Superior Basin during the waning stages of retreat of the Superior lobe after about 12 kyBP (Mooers et al. 2005).

The patterns of retreat as well as source areas for sediment are important for understanding later environmental changes. For example, the predominance of sandy outwash deposits, including both sandur and valley-train systems related to the retreat of the Rainey and Superior lobes, is the source of the coarse grained nature of the alluvial deposits along the upper Mississippi. The pitted outwash that forms the Anoka Sand Plain region in central Minnesota also formed during the retreat of these lobes. It is the source for the relatively extensive dunes or sand-sheets that were periodically reactivated during the Holocene and may have buried many archaeological sites in the region. Similarly, as a consequence of the fine-grained sediments associated with the Des Moines and Red River lobes, as well as the silt- and clay-rich lacustrine deposits associated with Lake Agassiz, alluvium deposited during the Holocene throughout the Red River valley is predominately silt and clay. The generally rare sandy and gravely deposits are restricted to channel or bar deposits.

From the standpoint of human settlement studies, the Wisconsinan (and earlier) geologic history of Minnesota indicates that, except for the most northern parts, the state was generally free of ice by the time humans arrived. The only major exceptions to this are the periphery of the Superior Basin, which included a few re-advances of the Superior lobe after about 12 kyBP, and the Canadian border region. Regardless, even in the southern parts of the state, the influences of the Laurentide Ice Sheet continued to be felt into the early and, in a few areas, middle Holocene. These impacts are mainly related to catastrophic discharges of meltwater from the Superior Basin via the St. Croix and Mississippi valleys or from the glacial Lake Agassiz, which occupied the Red River valley in western Minnesota. While many areas were physiographically configured similar to their present form by the end of the late Wisconsinan, some parts of Minnesota, particularly in the north near Lake Superior and northwest in the Red River valley were remarkably different even into the early Holocene. Consequently, as discussed below, Paleoindian settlement was probably only vaguely based on today's environmental criteria and probably includes many unique settings for which modern analogs do not exist. For example, because Lake Agassiz was abandoned in the Red River valley only after about 9 kyBP, settlement during the Paleoindian and Early Archaic must have focused on beaches and shoreline environments along a very cold lake. In fact, as discussed below and in Chapters 3.0 and 5.0 concerning the Hoff Deep test locale, even once Lake Agassiz drained from the region after about 8.5 kyBP and the Red River drainage began to be established, the effects of Laurentide glaciation continued to influence the valley's depositional processes.

Isostatic depression, which resulted from the great mass of Laurentide Ice Sheet within the Lake Agassiz (i.e., Red River valley) basin, was greatest in the northern part during the early Holocene. Isostatic rebound, which began as the ice sheet melted and continues at a much slower rate even today, was most rapid during the early Holocene, but progressively slowed throughout the Holocene. As a result, the initial drainage of the Red River must have developed within a significantly steeper basin whose gradient also shallowed through time from north to south. The steeper gradient of the Red River valley during the early Holocene probably resulted in a more generalized channel incision and only limited channel migration. The progressive shallowing of the valley gradient during the early and middle Holocene, however, eventually would have resulted in greater horizontal channel migration, increased bank erosion, and the development of the Red River meander belt characteristic of the modern valley. Overbanking by the river, as well as vertical accretion of floodplain sediment, likely commenced related to these events, particularly during their later phases. Developmental processes like these have implications for understanding site burial and preservation, and the recognition of long-term changes in settlement and subsistence patterns. For example, if the meander belt began to form during the early part of the middle Holocene and resulted in significant horizontal erosion of the river bank, then evidence for early Holocene (i.e., Early Archaic) settlement that may have focused along the channel would have been destroyed by erosion. Similarly, the initiation of overbanking during the latter part of the middle Holocene would have resulted in the burial of Middle and Late Archaic sites.

The confluence of these natural and cultural factors also is evident in the geomorphological configuration of the lower Minnesota River valley near the Fritsche Creek II and City Property test locales at New Ulm. Here, the characteristics of Minnesota River valley were largely dictated by the underlying geological structure and the history of catastrophic discharges from Lake Agassiz, which was located far north and west of the valley (Figure 2.1.1-1; Hudak and Hajic 2001). Here, the broad, relatively deep and steep-walled valley was determined by the presence of relatively thin, fine-grained, soft and easily eroded drift and loess of the Des Moines lobe or by Mesozoic bedrock that formed the valley walls. On the other hand, erosional-resistant Precambrian (Achaean) quartzite formed the valley floor. The quartzite valley floor prevented channel (or valley) incision during high-volume, high-velocity outflows from Lake Agassiz while the more erodeable valley walls permitted horizontal expansion, which probably resulted in significant erosion and helped retain relatively steep valley walls. As a consequence, these relatively steep walls likely promoted accelerated colluviation and development of significant alluvial fans during the early and middle Holocene that resulted in the abundance of buried Early and Middle Archaic sites, such as Fritsche Creek II studied during this project, as well as others noted up and down the valley (Hudak and Hajic 2001).

2.1.2 Buried Archaeological Site Formation Processes

Understanding the processes that are responsible for archaeological site formation and burial within different depositional settings is essential not only for successful site discovery but also for efficient and effective evaluations of site integrity and NRHP eligibility. Although the deep test protocol we propose (Chapter 12.0) is relevant to most depositional settings, including site burial by fill in urban areas, the Mn/DOT DTP project concentrates mainly on test locales within alluvial settings. This focus reflects the importance of floodplain and other alluvial landforms to prehistoric settlement, as well as the fact that these areas occur frequently on the landscape and may be the most common depositional settings that must be considered during highway projects.

The focus on alluvial settings makes a great deal of sense from an archaeological as well as a geological perspective because such settings are significant for human economic activities and settlement. In Minnesota this is true not only for settings such as the Red River valley and the prairie of western Minnesota, where water is the most important and apparent limiting factor to human subsistence, but also for the large and small drainages in the wetter areas of eastern Minnesota. Here river settings are commonly ecotonal and include a variety of plant and animal communities in proximity to one another. Moreover, because alluvial settings, particularly near stream confluences, are strategic and recognizable landmarks, they are commonly reoccupied throughout prehistory. This reoccupation is important from the standpoint of this study because alluvial landforms are constructed when sediment accumulates during flood episodes, which are ultimately responsible for burying archaeological sites. Likewise, in the right circumstances, the stratigraphy of floodplain and associated archaeological deposits can provide a long-term record of cultural, climatic, and environmental changes and how subsistence/settlement strategies may vary as a consequence (Bettis and Benn 1984; Bettis and Hajic 1995; Bettis and Mandel 2002; Monaghan and Hayes 1998, 2002; Monaghan and Lovis 2005).

Flooding was not incremental or regular in most places in the East or Midwest throughout prehistory (Bettis and Mandel 2002; Monaghan and Lovis 2005; Raber and Vento 1990). Consequently, understanding the role that Holocene climate and environmental change played in sedimentation, soil formation, and human settlement patterns is critical to deconstructing the nature and significance of buried horizons at archaeological sites. For example, variations in the magnitude and duration of flooding episodes leaves a record of the alluvial history within the landform that is primarily geological, while intervening occupation horizons within this sequence reveal variations in human use of the landscape. Climatic and environmental variations are indicated by the changes in sedimentology or pedogenesis. The regularity, types, and intensity of flooding are documented by characteristics such as the thicknesses and sedimentology of alluvial and fluvial sedimentary units, while the duration of intervals marking relative floodplain stability is indicated by the relative development of intervening soils horizons that form on the floodplain surface during periods of more limited flooding. Importantly, however, these same processes and factors also apply to any archaeological occupation horizons that may be associated with these deposits. As discussed below, how the archaeological materials articulate with the alluvial deposits and paleosols found within a floodplain ultimately dictates the types of archaeological sites that can form as well as their relative "visibility" in the geological record (Hambacher et al. 2003; Monaghan and Hayes 2002; Monaghan and Lovis 2005).

While process may dictate the geomorphic character of a floodplain, the development of the archaeological record occurring within the underlying stratigraphic sequence is largely a time-dependent phenomenon that, at its simplest, is controlled by an interaction between the relative rates of sediment accretion and cultural deposition (Monaghan and Lovis 2005). Not only do these relationships hold true regardless of geomorphological setting, but they also structure the types of archaeological sites that will develop on any particular landform. For example, the idealized relationship that archaeological site formation processes have with sediment and cultural deposition at the Converse site (20KT2) in Michigan is shown on Figure 2.1.2-1. It illustrates how the stratification, types, preservation, and quality of archaeological sites are controlled by relative relationships between the accumulation of cultural material, cyclical deposition of alluvium, and *near-surface residence time* of archaeological horizons (Hambacher et al. 2003; Monaghan and Hayes 1997, 1998, 2002; Monaghan and Lovis 2005). This latter concept, near-surface residence time, is particularly critical in dictating the quality and visibility of the archaeological record at buried or stratified sites.

Archaeological sites must form at the ground surface and are, therefore, greatly affected by the natural and cultural near-surface processes that act on the site. To a certain extent the intensity and duration of such near-surface processes, along with the rate of sediment accumulation, determine the actual type of archaeological site that ultimately forms. Both natural and cultural surface processes act on the site. Natural near-surface activities include sediment weathering, bioturbation, and other actions related to surface soil development while common day-to-day cultural activities, ranging from foot traffic, food preparation, and resource processing to pit excavation and house construction, also affect pre-existing archaeological and natural deposits. Over the long run, both near-surface natural and cultural processes produce increasingly mixed

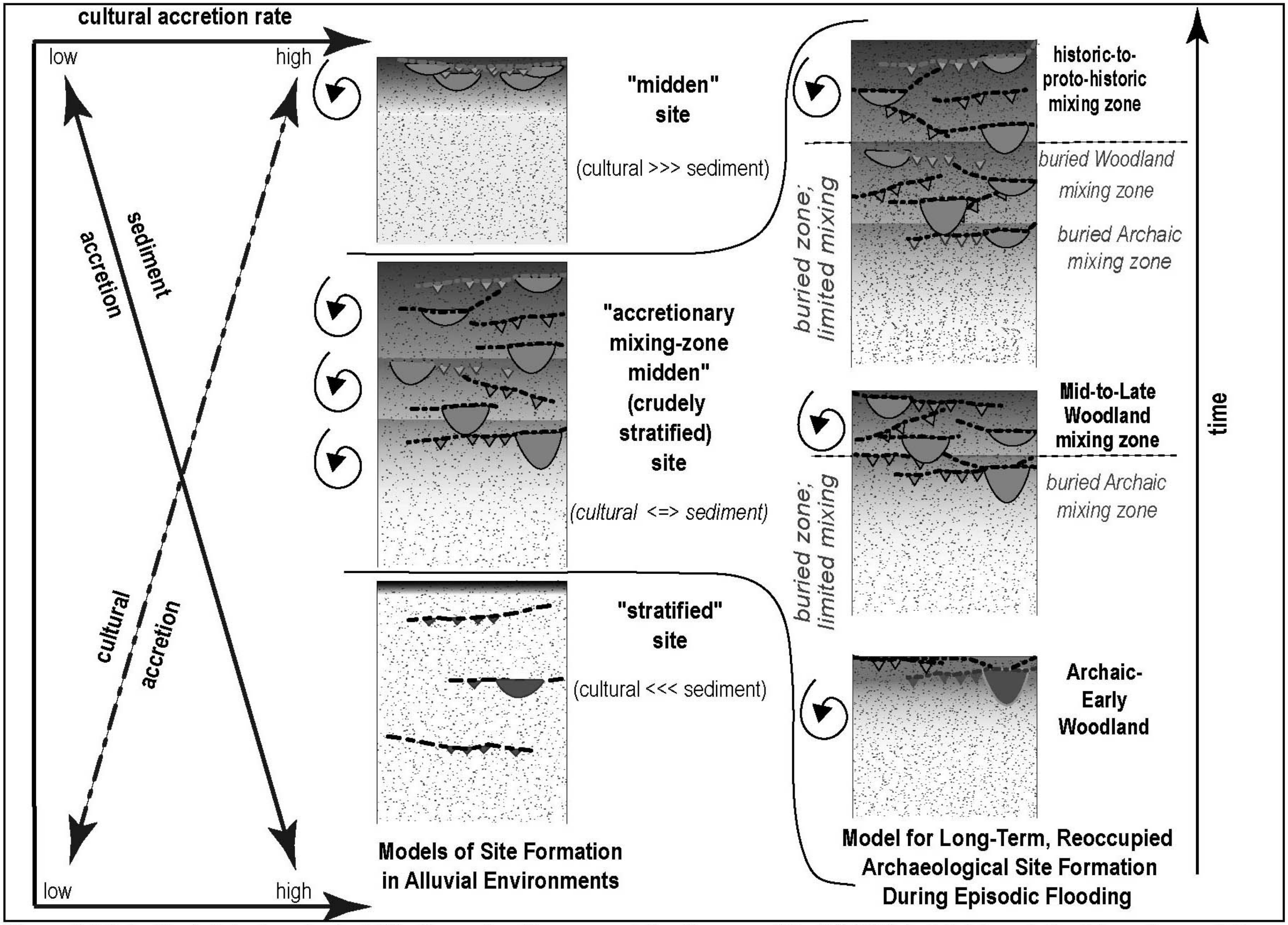

Figure 2.1.2-1. Buried Archaeological Site Formation Processes at the Converse Site (20KT2) in Michigan (after Monaghan and Hayes 2002)

or otherwise disturbed archaeological components at the site. The longer a site lies at the surface, the greater the amount and variety of cultural debris possible, but also the poorer the cultural context for these artifacts. Hence, how the rates of cultural deposition and sedimentation interact will ultimately determine the quality and types of information preserved at an archaeological site.

When the rate of sediment accumulation is low compared to the accumulation of cultural debris and features, as depicted at the top of Figure 2.1.2-1, then such horizons remain on the surface for a relatively long period. These deposits have a comparatively long near-surface residence time. Thus, intense soil formation occurs, creating dark, organic-rich and obvious A-horizons and increasingly higher densities of artifacts and features become incorporated into the sediments. Despite producing a site rich in artifacts and other cultural debris, however, such a site will undergo more disturbance from near-surface processes, as mentioned above (Monaghan and Hayes 1997, 2001; Monaghan and Lovis 2005). While this may be unfortunate from the standpoint of context preservation, the site will be more "visible" regardless of the methods used to discover it.

Conversely, if sediments accumulate rapidly on the floodplain compared to cultural material, as depicted on the bottom of Figure 2.1.2-1, then archaeological horizons will become rapidly buried and have generally short, near-surface residence time. Rapid burial generally preserves context because artifacts and features are isolated from direct surface disturbance and because they become stratigraphically separated from later occupation(s). Moreover, the alternation of human occupation and sediment accretion on the floodplain can eventually form a stratified site that is rich in context, but comparatively poor in content. Such sites with relatively low-level, sporadic occupation within stacked, ephemeral, and often discontinuous paleosols often are a challenge to identify. Even more problematic and important for the goals of this project, however, is the ability to detect the presence of an isolated, very low-density, single-use occupation within a stacked paleosol sequence. If human occupation happens during a period of regular flooding, such an occupation may also become rapidly buried and, more importantly, will not be associated with any obvious paleosol. Rather, the evidence for the occupation, such as artifacts or features, may appear to "float" within subsurface (B-) soil horizons and not emanate from a buried surface (Ab-) horizon within a paleosol (Figures 2.1.2-1 and 2.1.2-2; Hayes and Monaghan 1998; Monaghan and Hayes 1997, 1998; Monaghan and Lovis 2005). Accordingly, just because artifacts or features occur in the B horizon or subsoil context and are not related to any obvious surface soil horizon does not preclude their being in situ. While keying on paleosol A-horizons may allow increased efficiency in buried site discovery, it also risks overlooking such B-horizon occupations, which can skew our archaeological database. Therefore, the discovery of such low visibility sites requires techniques sensitive enough to reveal them.

Because the relationship between sediment and cultural deposition is continuous, sites with some characteristics of both processes (rapid versus slow burial) may develop when the rate of sedimentation is gradual or when cultural deposition occurs in the manner depicted in the middle of Figure 2.1.2-1. Such sites are frequently crudely stratified and have been referred to as "accretionary middens" or "accretionary mixing-zone middens" (Hambacher et al. 2003; Monaghan and Hayes 2002). The formation process for these is shown on the right side of Figure 2.1.2-1, and is marked by a thick, dark, multicomponent, artifact-rich occupation horizon

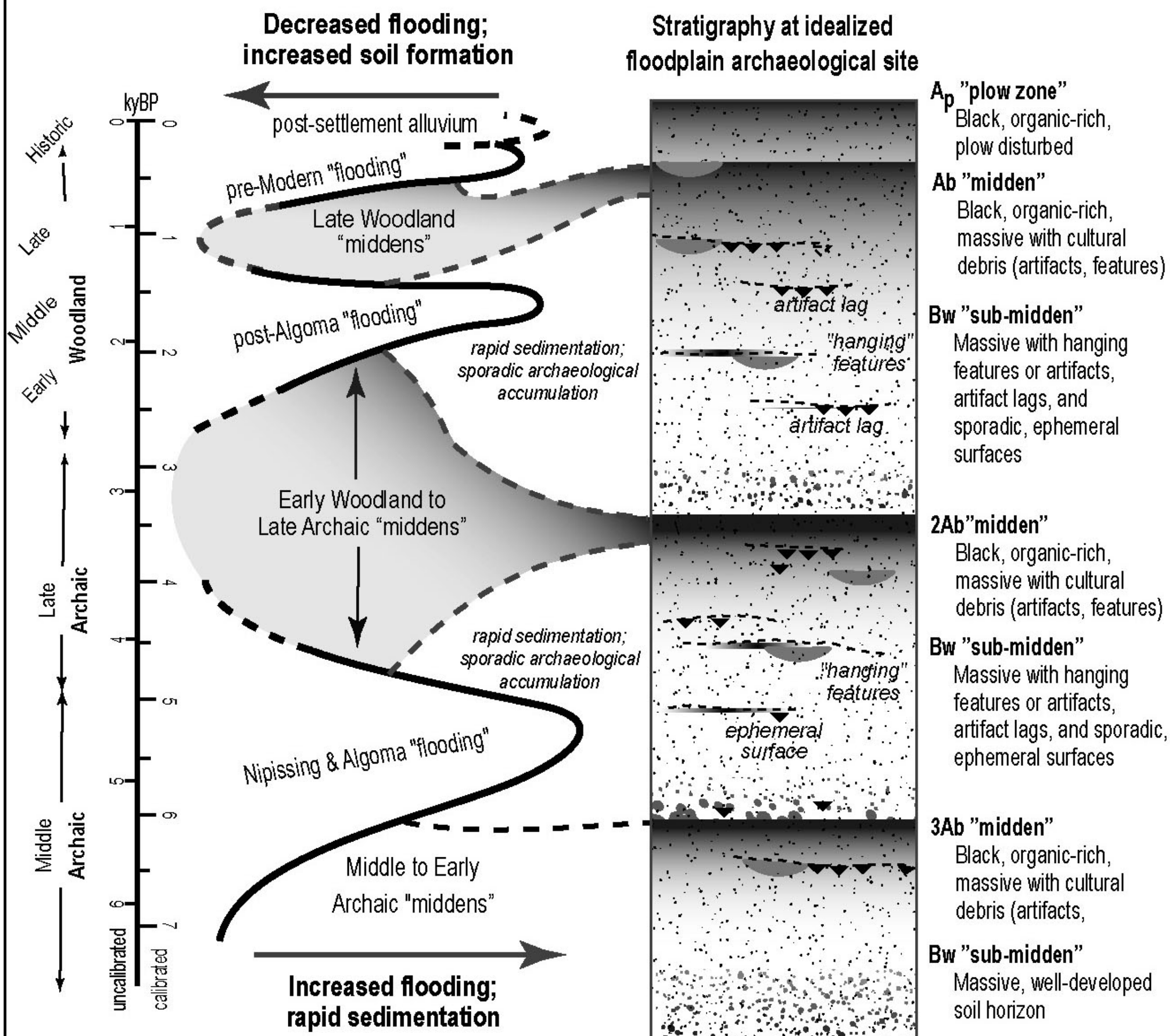

Figure 2.1.2-2. Flooding, Soil Formation, and Idealized Floodplain Stratigraphy through Time in the Upper Great Lakes Region (after Monaghan and Lovis 2005)

similar to the midden-type sites noted above. Characteristically, accretionary middens form in areas that are particularly prone to regular, seasonal reoccupation throughout prehistory and often develop during cyclical flooding patterns (Figure 2.1.2-2; Hambacher et al. 2003; Monaghan and Lovis 2005; Raber and Vento 1990).

Based on the foregoing, the whole continuum of site types discussed above and illustrated in Figure 2.1.2-1 should be anticipated by a deep test protocol because flooding was episodic during the Holocene (Figure 2.1.2-2). Several studies suggest that floodplain construction was not regular, but rather varied in cycles that were probably related to broad, regional patterns of climate variation during the middle and late Holocene (Bettis and Mandel 2002; Monaghan and Hayes 1997, 1998, 2001; Monaghan and Lovis 2005; Raber and Vento 1990;). Monaghan and Lovis (2005) suggest that in the Great Lakes and Mid-Atlantic regions, these cycles are millennial-scale episodes characterized by several hundred-year long periods of relatively limited flooding punctated by a few hundred-year long intervals when flooding was regular and intensive (Figure 2.1.2-2). For example, the Terminal Archaic and Early Woodland periods as well as the Late Woodland period were apparently associated with intervals of limited flooding and little sediment accumulation (Figure 2.1.2-2). As a consequence, the floodplain sites formed during these intervals likely have greater visibility and are more likely to be found in the subsurface because they are more likely to form darker and more "midden-like" occupation horizons (Figure 2.1.2-1). During the Middle Woodland period and just prior to European contact, however, the opposite conditions existed. Flooding and sedimentation rates were apparently relatively high, resulting in the more common development of ephemeral, less visible occupation horizons on floodplains.

From the standpoint of this study, whatever method(s) are selected as the preferred technique for deep testing must be able to find sites that are not only highly visible, easily recognized long-term, midden-type occupations, but also the less visible, ephemeral, short-term occupations. Clearly, if deep test methods are biased toward missing either of these types of occupation horizons, then whole classes of sites that represent specific parts of the settlement system may be overlooked during specific cultural periods. This will ultimately create a skewed picture of settlement and subsistence systems and their variability through time, which is contrary to the sprit of cultural heritage preservation, not to mention the scientific study of human adaptations.

2.2 ARCHAEOLOGICAL BACKGROUND

2.2.1 Prairie Region, Red River (of the North) Valley, Western Minnesota (Hoff Deep Test Locale)

The physiography of the Red River valley region is dominated by the fine-grained, generally flat-lying or low-rolling glacial Lake Agassiz plain. Relic beach ridges of Lake Agassiz and a set of Holocene-age alluvial terraces that mark the margins of the valley comprise the primary features of topographic relief in the region (Anfinson 1990; Gibbon et al. 2001a; Michlovic 1988). Following abandonment of the last stages of Lake Agassiz from the area after 9000 years before present (BP) to 9500 BP (Fisher 2003, 2004), a succession of biotic communities began colonizing the lake plain. The initial pine-dominated forest changed to open oak forest and, by about 8000 BP, prairie became established across the region (Benchley et al. 1997; Gibbon et al.

2001a). Once it became prairie, bison began to inhabit the region. Large herds of elk were also reported in the region during early historic times (Anfinson 1990) and other woodland species such as deer were probably present. In addition to the prairie resources, the Red River also provided aquatic resources such as fish, mussels, and migratory waterfowl. Important plant resources would have included various prairie species (e.g., prairie turnip), marsh plants such as cattails, and berries and nuts from the gallery forests located in the Red River valley and its tributaries (Anfinson 1990:149; Gibbon et al. 2001a; Michlovic 1983, 1988).

Because it was flooded by Lake Agassiz until about 9000 BP, Late Paleoindian occupations are the earliest sites that could be expected within the Red River valley. Moreover, the few known sites are typically associated with relict beach ridges and presumed to be encampments, although the Greenbush site (21RO0011) in Roseau County may be a lithic extraction site where raw materials were quarried from beach deposits (Michlovic 1988). Given the history of the formation of the Red River valley discussed above, Paleoindian sites are unlikely to occur within the valley. Although Michlovic (1988) suggests the potential for the presence of deeply buried Paleoindian components along the Red River, he also notes that channel incision during the Hypsithermal may have removed any deposits dating to earlier periods. Areas such as alluvial fans were suggested as possible areas where buried Paleoindian components may be preserved (Michlovic 1988), but if so, as discussed below, such sites probably have some relationship to glacial Lake Agassiz.

Evidence for the first substantial use of the Red River valley occurs during the Archaic (Gibbon et al. 2001a). While Gibbon et al. (2001a) note that most Archaic period occupations are concentrated on the beach ridges, the best information from excavated contexts comes from two Archaic components located in buried paleosols under 1.0 m to 1.6 m (3.3 ft to 5.3 ft) of alluvium in the Red River floodplain. These two sites, Canning (21NR0009) (Michlovic 1986) and Mooney (21NR0029) (Michlovic 1987), are part of the Prairie Archaic, which is a residentially mobile hunting and gathering adaptation to the tall grass prairies that dates broadly between about 8500 BP and 2000 BP (Benchley et al. 1997:85). Interestingly, both of these sites generally date to the end of the middle Holocene, or post-4000 BP, at oldest.

The Canning site includes a living floor dated between 4000 BP and 3000 BP and comprised of fragmented bison bone, lithic tools and debris, and ash stains (Michlovic 1986). Believed to be a single occupation, analysis of the faunal remains and the lithic assemblage indicates that it was a bison processing station occupied during the winter. The faunal remains were predominately limb bones that had been extensively processed to extract marrow and bone grease. Most of the tools were broken or heavily used. The chipping debris was the result of tool maintenance as opposed to tool manufacture. Diagnostic tools include Hanna and Duncan projectile points (McKean complex) and evidence of western ties is indicated by the predominance of Knife River flint for many formal tool types.

The Archaic component at the Mooney site is represented only by lithic debris and animal bone fragments that are tightly dated to 3400 BP (Michlovic 1987). The plant remains are characteristic of prairie gallery forests and fauna include bison along with a rodent incisor and fish vertebrae. The site is interpreted as a warm season occupation and the presence of bison vertebral fragments may indicate a slightly different range of subsistence activities than that noted from the Canning site.

The occurrence of a stacked paleosol sequence that includes Archaic and younger cultural deposits at the Canning and Mooney sites provides evidence for cyclical episodes of flooding and stability along the Red River during the late Holocene. Only the lowermost paleosol that contained Archaic material was dated at Canning, although several others that lacked cultural material were identified between it and the overlying Woodland occupation horizons. Based on the presence of Sandy Lake ceramics, the Late Woodland occupation at Canning is believed to have occurred after about 1000 BP (Anfinson [ed.] 1979; Michlovic 1986). The Mooney site, which is located several kilometers downstream (north) from the Canning site, also included a series of stacked paleosols, several of which underlie the Archaic component. Additionally, a buried Late Woodland component that contained Sandy lake ceramics occurred just below the plow zone and about 1 m (3.3 ft) above the Archaic component (Michlovic 1987). The average of three thermoluminescence dates on the ceramics was about 990 BP.

Anfinson (1990:159) has proposed a Woodland period settlement model for the Red River valley that includes base camps located in proximity to wood and specific food resources. Temporary camps for resource extraction are also part of this settlement pattern, but these could occur anywhere in the region depending on the specific resources that were targeted. For example, lithic procurement sites should occur in areas where rivers or streams have cut through Lake Agassiz beach ridges, creating concentrations of gravels. Anfinson's (1990) model is based on survey data compiled by Anfinson (1990:159; Minnesota Historical Society [MHS] 1981) for Clay County, Minnesota, and by Michlovic (1982, 1987) for Norman County, Minnesota, and Cass County, North Dakota. Not surprisingly, these surveys suggest that settlement focused on settings near the Red River. For example, the Minnesota Statewide Archaeological Survey (SAS) of Clay County indicates that the greatest number of sites (22 percent) occurred in riverside settings followed by only a modest number of sites (13 percent) in the beach ridge/river intersection settings. Only five percent of sites occur on beach ridges and even fewer (3 percent) are found in non-beach-ridge, away-from-water settings (Anfinson 1990:159). While varying types and degrees of sampling bias have been identified in the SAS (Gibbon et al. 2001b), these data nonetheless are basic information that can be used to develop more refined and sophisticated questions about the nature of prehistoric settlement across a particular region and guide future survey efforts. The Norman County, Minnesota survey (Michlovic 1982) focused on areas adjacent to the Red River and identified 41 new sites, most of which contained Late Woodland ceramics. In contrast, the Cass County, North Dakota survey examined a 6.0-mi (3.7-km) wide transect that extended from the Red River to the Agassiz beaches, some 30 mi (48 km) distant (Anfinson 1990:159-160; Michlovic 1987). Most of the sites occurred in river shore settings, with only 10 percent occurring in lake plain settings, and none in beach ridge settings.

While Woodland period sites tend to occur in proximity to the Red River and its major tributaries, details about the settlement systems are not well understood. Water is a primary attribute governing site location strategies, which is not surprising given the relative dryness of this prairie region. Ceramics associated with all of the sub-periods of the Woodland period occur in the Red River valley including Brainerd ware, St. Croix Stamped, Laurel, Blackduck, and Sandy Lake ware (Anfinson 1979; Benchley et al. 1997; Gibbon et al. 2001a). Gibbon et al.

(2001a) note a tendency for Late Woodland sites to occur on meander loops of the Red River and a preference for the use of beach ridges and lakeside settings, such as that represented by the Lake Bronson site (Anfinson et al. 1978). Besides the resident Psinomani culture makers of Sandy Lake wares, the settlement dynamics of the region are complicated by data suggesting that Woodland-based populations such as Laurel and Blackduck made seasonal bison hunting forays into the Red River valley region (Gibbon et al. 2001a).

2.2.2 Prairie Lakes Region, Minnesota River Valley, South-Central Minnesota (Fritsche Creek II and City Property Test Locales)

The Minnesota River valley of south-central Minnesota lies in the Prairie Lakes region (Anfinson 1990, 1997; Gibbon et al. 2001a). Two nearby but different depositional environments in the central part of the Minnesota River valley served as the settings for the Fritsche Creek II and City Property test locales. The surrounding region is typified by the undulating till plain and hilly moraine topography into which the Minnesota River valley has been entrenched. Although the area became ice-free before 12,000 BP (Anfinson 1997:9-10), it continued to be influenced by glacial activity well into the Holocene. In fact, much of the early development of the Minnesota River valley resulted from episodic outbursts of meltwater from Glacial Lake Agassiz across its southern outlet at Boulder Falls (the head of the Minnesota River) and into River Warren, an ancestor to the Minnesota River. These outbursts occurred periodically between ca. 12,000 BP and 9500 BP and resulted in high-velocity, catastrophic flood events within the early Minnesota Valley.

Prior to the establishment of the tall grass prairie ca. 9000 BP (Anfinson 1997:17; Benchley et al. 1997; Gibbon et al. 2001a), a rapid succession of biotic communities presented adaptive challenges to initial human populations in the region. Spruce parkland forest was the first forest community established. This was briefly replaced by a mosaic of birch, alder, black ash, and fir, but by about 10,500 BP, oak-elm forests developed and apparently dominated for several thousand years. With the continued amelioration of the climate these forest communities in the region were replaced about 9000 BP by a mixed prairie that became the dominant biotic community across all but northeastern Minnesota by the height of the Hypsithermal. After the peak of the Hypsithermal (6000 BP to 6500 BP), cooler climatic conditions began to dominate and, by 5500 BP, oak forests began to develop (Anfinson 1997:17). Although tree pollen was abundant, prairie remained the dominant biotic community until about 3000 BP. By the time of European contact, tall grass prairie that included river-bottom forests and patchy oak woodlands with large prairie openings dominated the region (Gibbon et al. 2001a). The modern prairie-forest boundary was probably established by the beginning of the Initial Woodland period. With the establishment of essentially modern environmental conditions during the middle Holocene, bison and elk herds dominated the upland areas, with white-tailed deer also present in the Minnesota Valley/upland woodland interface (Gibbon et al. 2001a). Additionally, the Minnesota River, its tributaries, and many small lakes across the area provided a variety of aquatic and riparian resources. Given the upland prairie settings, these riverine and lacustrine areas contained the majority of the economically significant plant resources. Although wild rice was present, it apparently occurred in quantity only along the Minnesota River. Other plant resources such as prairie turnip, ground plum, and acorns were available in the uplands (Gibbon et al. 2001a).

Early Paleoindian sites (i.e., Clovis and Folsom) are primarily scattered finds, a number of which come from the counties through which the Minnesota Valley passes, and none have been formally excavated (Anfinson 1997:28-29; Gibbon et al. 2001a). A similar situation also characterizes Late Paleoindian finds. While early Paleoindian populations followed a mobile hunting economy targeting late Pleistocene megafauna, they also exploited a variety of other smaller animals and plant resources (Anfinson 1997:34-35). Anfinson (1979:34-35) has suggested that the early Paleoindians may have preferred the uplands, while the use of lacustrine and riverine settings possibly increased during Folsom times, especially the broad alluvial terraces from Glacial River Warren in the Minnesota Valley. The Late Paleoindians continued to hunt large game, although the target species shifted to bison during this time. Gibbon et al. (2001a) suggest Paleoindian sites may be buried under alluvium or colluvium in the Minnesota and other valleys. While not in a buried setting, the occurrence of Late Paleoindian points, along with those of the Early and Late Archaic, were noted in collections from the Fritsche Creek I site (21NL0062) (C. Johnson, personal communication 2005) and confirm the use of these settings by early populations. Moreover, a radiocarbon date of 8100 BP from the Fritsche Creek II site (21NL0063) reported during this study (see Chapter 6.0) also confirms the presence of stable land surfaces during the Late Paleoindian and Early Archaic periods. Such settings, with paleosols of similar age, are apparently common up and down the Minnesota Valley (Hudak and Hajic 2001)

The Prairie Archaic tradition (7500 BP to 5000 BP) corresponds with eastward grassland expansion during the Hypsithermal. The settlement and subsistence systems during this period begin to shift to a more foraging oriented strategy. This is evidenced by the addition of a variety of notched projectile point forms and ground stone tools, although bison hunting continued as the focus of the regional economies (Anfinson 1997:35, 122). Prior to the excavations at the Fritsche Creek II site (Roetzel and Strachan 1994; Roetzel et al. 1992), the Granite Falls Bison site (21YM0047) was the only well-dated Early Archaic site in the region and one of the few buried Archaic occupations in the region (Anfinson 1997:36). This site contained a bed of butchered bison bone representing four adults and one immature individual and was buried under about 2.8 m (9.2 ft) of alluvium and colluvium. Radiocarbon dated to between ca. 6800 BP and 6400 BP, this occupation it believed to have taken place in the late fall or early winter. A second cultural horizon represented by lithic debris and fire-cracked rock was identified at about 1.8 m (5.9 ft) below the surface and suggests a cyclical pattern to land surface stability and instability, a pattern noted elsewhere by Hudak and Hajic (2001).

A more lacustrine-oriented settlement pattern developed after 5000 BP and may be related to post-Hypsithermal cooler and moister climatic conditions. This period marks the beginning of an extended period of continuity in settlement and subsistence strategies termed the Mountain Lake phase (5000 BP to 2250 BP) (Anfinson 1997:42, 45, 85-88). Although the exploitation of aquatic resources takes on an increasingly important role, bison hunting continues to play a dominant role in the subsistence strategy. While most of the Mountain Lake phase sites produce milling stones, no other evidence of the exploitation of nut resources or incorporation of incipient horticulture is apparent. Faunal data from the Fox Lake site, which is dominated by bison, muskrat, and fish as well as small mammals, turtle, and waterfowl, reflect a broad range of resource exploitation (Anfinson 1997:45).

The distribution of Mountain Lake phase sites shows extensive use of lacustrine settings (Anfinson 1997:45; Gibbon et al. 2001a). Island and peninsula settings, in particular, were favored not only for the variety of nearby resource zones, but also for protection from environmental hazards and inter-group conflict. These types of settings, however, offer only limited potential for site burial. Wooded areas, particularly in river valleys, may have been preferred settings for winter occupation because of their sheltered locations and easy access to critical resources like firewood (Anfinson 1997:45). In contrast to lacustrine settings, these riverine settings offer greater potential for site burial.

Beginning around 2200 BP, the Fox Lake phase (2250 BP to 1250 BP) marks not only the introduction of ceramics, but also the first widespread, or at least visible, use of the Prairie Lakes region (Gibbon et al. 2001a). Continuity with the preceding Mountain Lake phase is illustrated by the fact that the sites are frequently multi-component and commonly include both Late Archaic and Lake Benton phase materials (Anfinson 1997). Twenty-six known Fox Lake components are located on lakes, while only nine occur in riverine settings (Anfinson 1997:71). However, site burial may be a contributing factor to the apparently low proportion of Fox Lake phase sites in riverine settings. In fact, four of the riverine sites occur at river/stream junctions, while the others are all on stream terraces adjacent to ravines (Anfinson 1997:71). While river valley settings may have been a favored location for winter habitation, the presence of warm-season aquatic faunal remains from the Hildahl site (21YM0035) indicates that river valley settings were also used during the warm season as well. Gibbon et al. (2001a) suggest that Fox Lake and Lake Benton phase sites, particularly winter occupations, may lie deeply buried in river valleys.

The settlement pattern of the succeeding Lake Benton phase (1250 BP to 750 BP) is almost indistinguishable from the preceding Fox Lake phase (Anfinson 1997:83-84). Whereas significant changes in subsistence patterns occur in adjacent regions, a similar level of change does not occur in the Prairie Lakes region. For example, even though stands of wild rice may have been present in the Minnesota River valley, no evidence exists that its exploitation became an important part of the economy as it did in regions to the northeast. Moreover, the repeated use of the same site locations over the course of the Late Archaic and the Initial Woodland may reflect where significant patches of woodland environments existed (Anfinson 1997:83). Understanding the reasons for the lack of settlement/subsistence change during the 4000-year long Late Archaic and Initial Woodland period will require the examination of sites without multiple components such as the Gautefald site (21YM0002) and any yet undiscovered buried or stratified sites with undisturbed single component occupations.

Significant changes to settlement and subsistence systems in the Prairie Lakes region occur after about 1000 BP. Horticulture begins to emerge and riverine settings become increasingly important (Anfinson 1997:89; Gibbon et al. 2001a). Cultural expressions indigenous to the region, as well as those related to both Plains Village and Oneota occupations, also develop during the late prehistoric period. These developments are related to the rise of Mississippian societies in the central Mississippi River valley and the expansion of these populations into adjacent regions. Over the course of the late prehistoric period, partitioning of the Prairie Lakes region among the different groups is evident. This is particularly apparent for the Oneota populations.

Anfinson (1997:124) suggests that the Great Oasis (1050 BP to 750 BP) and Big Stone (850 BP to 650 BP) phases exhibit the greatest similarity in lifestyles with the Terminal Woodland populations of the region. The Great Oasis phase is most clearly expressed to the south in northwestern Iowa (Henning 1971), although it also extended into the southwestern part of the Prairie Lakes region. In this area, Great Oasis continues the lacustrine orientation noted for earlier periods and sites occur on islands, peninsulas, and isthmuses. While evidence of houses has not been recovered, the presence of storage/trash pits along with dense concentrations of debris suggests residential stability at these sites (Anfinson 1997:95; Benchley et al. 1997:168). Although a variety of terrestrial, aquatic, and avian species were exploited, bison continues to play an important role in the Great Oasis subsistence pattern within southwestern Minnesota. The role of horticulture in these economies is unclear, although it is probably not significant.

The mixed Woodland-Plains Village lifestyle apparently also continues into the Big Stone phase (Benchley et al. 1997:168). Primarily located within the Big Stone Lake and Lake Traverse areas of the northern Prairie Lakes region, settlement during this phase is characterized by the use of small fortified habitations on promontories and non-fortified sites located on the lower terraces along Big Stone and Traverse lakes (Anfinson 1997:112; Benchley et al. 1997:168). Small lithic scatters, interpreted as "lookout" sites on bluffs, also have been associated with this phase. Although subsistence data is not abundant, sites such as Hartford Beach (39RO0005) and Shady Dell (21TR0006) suggest that bison hunting continued as a key element, while smaller mammals, fish and mussels, as well as maize horticulture, also played a role in the economy (Anfinson 1997:110).

The Cambria phase (950 BP to 750 BP) is another local expression of the Late Prehistoric Plains Village horticultural pattern in the Prairie Lakes region (Anfinson 1997:124; Gibbon et al. 2001a). While it is poorly understood, Anfinson (1997:96) characterizes it as a complex blend of Late Woodland, Middle Mississippian, and Plains Village elements that are particularly well expressed in the ceramics. Large villages were apparently the center of the settlement system in the Minnesota Valley. Small camps and special activity sites occur in lacustrine settings forming another important part of the settlement system (Gibbon et al. 2001a). Johnson (1986) suggests a four-part settlement system for the Cambria phase. This includes large villages along the Minnesota River (e.g., Cambria [21BE0002] and Gillingham sites), small villages on the terraces of the Minnesota River near the larger ones (e.g., Owen Jones, Price, and Gautefald), small habitations along lakes or interior rivers, and burial sites. He also suggests that the Cambria phase is the terminal end of a trade network linking the region with Cahokia-based Mississippian populations via the Red Wing area. This network apparently exchanged bison meat and other products from the north for horticultural products and exotic goods such as marine shell from the south.

Cambria phase botanical remains from the Price site (21BE0036) indicate that horticultural crops (i.e., maize, curcurbits, and sunflowers) were augmented with a number of wild plants including chenopodium, walnut, rose, *Prunus*, and *Polygonum*. The possible use of beans and wild rice has also been suggested but not confirmed (Scullin 1979 cited in Anfinson 1997:102). Faunal remains from several Cambria phase sites indicate that variety of species were exploited. As at the Price site, white-tailed deer was the most common species represented, although bison actually provided the greatest amount of potential edible meat; elsewhere, however, beaver dominated and most of the bison bone was represented by tools such as scapular hoes and knives (Anfinson 1997:102; Watrall 1974). Other fauna recovered include a wide array of medium and small terrestrial mammals, a range of fish and aquatic amphibians, some freshwater mussels, and large birds, most likely waterfowl.

Oneota-related Blue Earth phase sites (950 BP to 300 BP) are concentrated in the Blue Earth River valley. Known primarily from the Center Creek and Willow Creek localities of the Blue Earth Valley (Anfinson 1997:112-114; Benchley et al. 1997:168; Dobbs and Shane 1982; Gibbon 1983; Wilford 1941, 1945, 1955), these groups probably diverged from other more typical Oneota. Major Blue Earth phase habitation sites, along with cemeteries, occur on elevated outwash deposits in the Blue Earth Valley (Anfinson 1997:118; Dobbs and Shane 1982). Smaller habitations located at higher elevations outside river valleys apparently served as animal processing, hide-working, and lithic reduction stations. Detailed subsistence data is restricted to the Vosburg site (21FA0002). Here, four varieties of maize, common beans, and sunflower are the primary horticultural products, while wild plant remains include hazel, wild plum, and hawthorne (Anfinson 1997:117-118). Additionally, of the 15 animal species identified, beaver, deer, and elk are most important.

2.2.3 Driftless Area of the Southeast Riverine Region, Root River and Mississippi Valley, Southeastern Minnesota (Root River Test Locale)

The Root River valley lies within the Southeast Riverine region of Minnesota (Anfinson 1990; Gibbon et al. 2001a). The central part of the valley is the setting for the Root River test locale. It is also part of the larger Driftless Area, which extends across adjacent parts of northeastern Iowa and southwestern Wisconsin, and was not glaciated during the last glacial episode (i.e., Wisconsinan; Figure 2.1.1-1). As such, the region is characterized by streams that dissected terrain lacking interior lakes, although some large valley bottom lakes like Lake Pepin occur along the Mississippi River. The Root River constitutes one of three major rivers in Minnesota that extend into the interior of the Driftless Area. Because of the lack of glacial deposits, other than outwash or valley train deposits, this region also commonly includes bedrock outcrops. These not only contained several different chert types that were commonly exploited throughout the prehistoric period, but also provide a geologic setting that is conducive for rockshelter formation.

Even though the Southeast Riverine region was not glaciated, the effect of the Wisconsinan glaciation was felt both in terms of outwash sedimentation and climate. Vegetation during the end of the late Wisconsinan consisted of spruce parkland forest that included a mix of spruce and fir trees and open grasslands. By 11,500 BP, a mixed spruce-ash forest had invaded the region. This was replaced by pine around 11,000 BP, which then developed into another mixed forest dominated by birch, alder, and pine (Benchley et al. 1997; Gibbon et al. 2001a). The forest succession continued as the climate readjusted and by around 9000 BP, a mixed oak and elm forest developed. Prairie grasslands invaded by 7000 BP to 8000 BP and dominated the region until about 5000 BP when cooler, moister conditions caused the prairie to retreat westward. By about 3000 BP, forest cover finally stabilized to mixed deciduous, which consisted of maple, elm, and basswood in the uplands and elm, ash, and cottonwood in the river bottoms. Patches of oak barrens in the western part of the region added to the environmental diversity.

In keeping with the general pattern across much of Minnesota and the Upper Great Lakes, evidence for Paleoindian occupations consist mainly of scattered surface finds of diagnostic points (Benchley et al. 1997; Gibbon et al. 2001a; Theler and Boszhardt 2003). Although a number of Late Paleoindian Plano points have been reported from the Mississippi Valley, most occur away from the river. This may reflect the economic emphasis on large game (i.e., bison) hunting that characterizes Paleoindian subsistence elsewhere. Alternatively, as noted by Gibbon et al. (2001a), other Paleoindian and Archaic sites that reflect different aspects of the settlement system may be deeply buried in alluvial or colluvial settings.

Limited data available for the Mississippi Valley region suggest that bison hunting continued as a significant economic emphasis into the Early Archaic. During this period, which is associated with a climatic optimum, prairie spread to its maximum eastward extent (Theler and Boszhardt 2003). An increase in the size and number of sites occurs during the Middle Archaic, and is attributed to a more stable environment, more predictable aquatic resources, and increases in population. A "settling into" the environment and the beginnings of more restricted territories by different groups also may be indicated. Increased use of rockshelters in the Driftless Area also characterizes the Middle Archaic, a factor that has played an important role in the development of Archaic and Woodland period chronologies in the region.

The King Coulee site (21WB0056) in the Mississippi Valley, which includes cultural deposits buried up to 5.5 m (18 ft) deep in an alluvial fan, includes important data for the Late Archaic period (Perkl 2002). The Late Archaic component at this site has been dated to 3450 BP and 2350 BP and also includes evidence of domesticated squash use. In fact, one squash seed was dated to 2530 BP and is the earliest appearance of a horticultural element in the upper Mississippi Valley. Other flora includes nuts, which form a significant proportion of the recovered botanical remains. Fauna recovered from the site are evenly balanced between mammals and fish, suggesting a diverse economy. Because no evidence for winter occupation was noted, the Late Archaic occupation of the King Coulee site is believed to have occurred during the warm season (Perkl 2002:108). In addition to the floodplain setting of the King Coulee site, Archaic occupations also occur on bluff tops, caves and rockshelters, river and stream terraces, stream deltas, and knolls in the floodplains, although the individual roles of these settings in the settlement systems are not well understood.

Gibbon et al. (2001a) note that the appearance of Woodland period sites in the Southeast Riverine region marks the first evidence of intensive human occupation of the region. The distribution of Woodland period habitation sites continues the pattern that was established by the Late Archaic and includes river terraces, knolls and stream deltas in the floodplains, as well as bluff tops, caves and rockshelters in the upland (Anfinson 1990:157). For example, the SAS survey in the Root River identified only a slightly higher occurrence of sites in near water (i.e., stream/spring) settings than in other settings (MHS 1981). Numerous lithic scatters occur away from water in the region's interior, most likely reflecting specialized resource procurement activities. The lack of Early Woodland sites in the floodplain settings may reflect that many lie buried in alluvium, which results in skewed models for site distribution (see Figure 2.1.2-2). This notion has been advanced by Anfinson (1990:157) who speculates that both Early and Middle Woodland sites may be buried under alluvium in the lowlands; a fact that is verified by the King Coulee site.

The Early Woodland is marked by the introduction of ceramics into the region. For example, La Moille Rockshelter, which was partially excavated by Wilford (1954), includes more than 5 m (16 ft) of deposits; it is one of the earliest ceramic locales in Minnesota and the type site for Early Woodland La Moille Thick ceramics (Anfinson [ed.] 1979). The site was a seasonal camp where fishing and the exploitation of other riverine resources were the primary subsistence-related activities. Interestingly, despite the addition of ceramics, the Early Woodland societies apparently continued a largely Late Archaic lifeway of exploiting a balance of terrestrial and aquatic species, including fish and mussels, as well as plant resources, especially nuts (Gibbon 1986; Mason 1981; Perkl 2002:108). By the end of the Early Woodland period at the King Coulee site (ca. 1940 BP), however, some changes in the subsistence economy became apparent (Perkl 2002:108-109). Based on the relative volume of material recovered, the most intense use of the site occurred at this time. While a mix of terrestrial mammals, reptiles, and birds continue to be exploited, fish became a more important resource. This may reflect the increased reliance on wetland resources noted throughout the upper Midwest during the Middle Woodland period (Fitting 1975; Mason 1981).

Nuts and a variety of unidentified seeds were also recovered, but the overall amount of plant remains decreased during the Middle Woodland (Perkl 2002). As was true for the late Early Woodland, another increase in the density of artifacts occurs near the end of the Middle Woodland occupation at King Coulee, which might suggest a shift towards a more sedentary lifestyle.

A greater reliance on horticultural products at the beginning of the Late Woodland period, which is well-documented throughout the Midwest, is also evidenced at the King Coulee site (Perkl 2002). Given the site's location, it is not surprising that it continues to reflect an active exploitation of the riverine environment, although a marked decrease in the amount of faunal remains is noted. This decrease in faunal exploitation is matched by an increased reliance on plant resources including squash, nuts, and seeds. The density of Late Woodland Madison wares at King Coulee during this period is interpreted as reflecting a larger, more sedentary resident population.

The most visible Late Woodland archaeological remains within the Southeast Riverine region are those from the Red Wing locality, located at the junction of the Cannon and Mississippi rivers. This area was intensively used by both Effigy Mound (ca. 1450 BP to 750 BP) and Mississippian (ca. 850 BP to 650 BP) people (Benchley et al. 1997; Gibbon et al. 2001a; Theler and Boszhardt 2003). Benchley et al. (1997:128-129) characterize the Late Woodland subsistence strategy for this region as a stable and effective adaptation to the mixed deciduous forest and riverine environments. Using data from adjacent areas of southwestern Wisconsin and Iowa, Theler (1987) suggests a seasonal economic round that includes fall, winter, early spring, and summer components and is driven by the seasonal availability of certain animal taxa. The uplands were used during the fall and winter and focused on procuring large mammals. Warm-season occupation then shifts to the floodplains of the Mississippi River and its major tributaries, where a variety of aquatic resources, primarily fish and freshwater mussels, become the focus of the subsistence activities. At least some limited use of maize in the economy is indicated, although the specific amount and the manner in which its use influenced the Late Woodland settlement pattern is not clearly understood (Benchley et al. 1997:129).

Beginning with the appearance of Mississippian-style lifeways (ca. 850 BP), the role of maize in the region explodes and becomes an intensive focal point of the settlement-subsistence system (Benchley et al. 1997:169-172; Gibbon et al. 2001a; Theler and Boszhardt 2003). At this time, the subsistence economy as well as the settlement pattern undergoes a major shift and fortified horticultural villages become the center point of the settlement system. These villages are usually located on the higher river terraces where horticultural gardens were presumably located. The presence of deep, large storage pits in these villages bespeak the year-round nature of their occupation. The agricultural products at the center of the subsistence base were augmented by gathering certain wild plants, deer hunting, and exploiting fish and freshwater mussels. Extractive camps from which these other resources were procured occur in a variety of settings and are an indication of the increasingly sophisticated nature of the societies inhabiting the region.

2.2.4 Central Lakes Deciduous Forest Region, Upper Mississippi Valley and Anoka Sand Plain, Central Minnesota (Clement and Anderson Test Locales)

The Central Lakes Deciduous Forest region (Gibbon et al. 2001a), originally termed the Central Deciduous Lakes by Anfinson (1990), covers much of central and eastern Minnesota. It includes parts of our study area along the upper Mississippi River near St. Cloud and within the physiographically unique Anoka Sand Plain in Anoka County. These two areas were the settings for (respectively) the Clement and Anderson test locales. The broader Central Lakes Deciduous Forest region has been characterized as a mosaic of moraines, till plains, and outwash plains containing numerous lakes (Anfinson 1990; Gibbon et al. 2001a). The Anoka Sand Plain is generally flat, sandy lake plain with sandy terraces along the Mississippi River (Hobbs et al. 2001), but also includes late Wisconsinan pitted outwash sequences throughout most of Anoka County. The topography ranges from nearly level to gently rolling and with kettle lakes and other ice-block depressions common.

As with the other regions of southern and central Minnesota, a rapid succession of forest communities follows the final retreat of glacial ice from southern Minnesota. Large portions of the nascent Mississippi Valley were opened following the demise of the Grantsburg Sublobe of the Des Moines Lobe by 13,000 BP (Figure 2.1.2-2; Wright 1972b). The initial cover included a spruce parkland forest composed of conifer, oak and other deciduous species intermixed with grassy openings. By 10,000 BP, a pine dominated forest covered most of the Central Lakes Deciduous Forest region. This was replaced in the southern part of the region by forest composed of birch, alder, and pine by about 9500 BP and by 9000 BP, a mixed oak and elm forest spread across the southern and western parts of the region (Gibbon et al. 2001a; Wright 1974). Probably related to warmer and drier conditions, prairie began to expand eastward after 9000 BP and reached its farthest eastern extent at the northeastern corner of Minnesota by about 7000 BP. With the return of cooler and moister conditions, prairie retreated back westward and was replaced by an oak dominated forest east of the Mississippi River by about 5000 BP. The oak forest was especially prevalent on the morainic ridges, while an oak-poplar-brush prairie or woodland filled the prairie openings (Gibbon et al. 2001a). By about 3000 BP, the modern distribution of forest communities in central Minnesota was established and consisted of mixed deciduous forest transitional between the prairie to the west and the mixed coniferous-deciduous forest of northeastern Minnesota.

At the time of European contact, the region's vegetation was dominated in the south and west by Big Woods species with some oak openings and prairie and in the east by an oak dominated forest (Gibbon et al. 2001a). The Big Woods (maple, elm, and basswood dominated forest) was probably a recent event and was most likely preceded by an oak-dominated forest during the Late Holocene. The droughty, sandy soils of the Anoka Sand Plain supported oak barrens, oak openings, and brush prairies (Hobbs et al. 2001). The central Anoka Sand Plain was dominated by aspen-oak woodland and included smaller, interspersed areas of Big Woods, while wet prairies existed within the Mississippi Valley and dry prairie dominated in uplands parallel to the Mississippi Valley.

Plant resources, such as acorns, would have been abundant in the oak forests throughout prehistory, while wild rice beds were probably present as far south as Sherburne County, which is near the southern edge of its distribution. White-tailed deer and small herds of bison and elk in the south and west, and beaver, bear, and moose in the eastern and northern parts of the region comprised the primary faunal resources. The scattered lakes would also have provided a variety of fish and other aquatic resources. Additionally, a rich array of migratory waterfowl would have been attracted to the Mississippi River and its major tributaries.

Despite the occurrence of Paleoindian projectile points across the region, especially those of the late Paleoindian or Plano period, the settlement and subsistence patterns of early Holocene populations are only rudimentarily understood. Diagnostic tools from the Paleoindian period are mostly known from surface collections at sites that are often multi-component. A significant exception is the East Terrace site, located on the east side of the Mississippi River near St. Cloud (BRW 1994; MHS 2005). The presence of two Hell Gap points in one area of the site, and Scottsbluff and Alberta points in another part of the site indicate that at least two occupations, separated by about a millennium, occur at the site. While not deeply buried, these materials were recovered from below younger deposits. This is important from the standpoint of this study because it indicates that similar late Wisconsinan or early Holocene cultural deposits could be buried within Mississippi River terraces.

As in other areas of Minnesota, archaeologists suggest that early Paleoindian populations were highly mobile and practiced a focal economy organized around the hunting of herbivorous megafauna. During the Late Paleoindian period, however, the target species apparently shifted to bison and possibly elk. Paleoindians certainly also exploited a variety of other resources, but on a more opportunistic or encounter basis (Cleland 1976; Kelly and Todd 1988). Although limited, the available data suggests that Paleoindian settlement patterns were oriented around the major river valleys and larger lakes (Gibbon et al. 2001a). In fact, the geomorphic evolution of the broad Mississippi Valley trench during this period and the succession from spruce parkland to encroaching prairie towards the end of the Paleoindian period provided ideal habitat for such large game animals and the valley likely also served as a natural conduit for their migrations.

Paleoindian presence within the Anoka Sand Plain is evidenced by scattered fluted points and, more commonly, Plano-style points. Both of these point forms have been recovered from a number of sites, including the Anderson site (21AN0006) (Flaskerd 1943, 1944). At this site, Paleoindian points comprise a minor component that is intermixed with later occupational debris. The use of dune and other lakeside settings, such as at Anderson, may indicate that these mobile, large game hunters took advantage of the specific regional geomorphological and ecological configuration that affected game animal movements.

The Archaic period (8000 BP to 3000 BP) in central Minnesota is also poorly understood (Benchley et al. 1997:83; Gibbon et al. 2001a). Early Archaic populations apparently followed a similar lifestyle to Late Paleoindians and focused on bison hunting, a pattern that presumably moved eastward in response to the expanding prairies. Radiocarbon dates that range from 8000 BP to 7000 BP at the Itasca Bison Kill site (Shay 1971) support the idea of continuity of the Late Paleoindian subsistence strategy. Data from the Granite Falls Bison site and the Fritsche Creek I and II sites in the Minnesota Valley indicate that bison hunting and processing locales also occur in alluvial/colluvial settings within major river valley. Similar valley margin and colluvial settings in the Mississippi Valley also include buried Early Archaic sites (Hudak and Hajic 2001).

Cooler, moister climatic condition began to prevail in Minnesota by the end of the Hypsithermal interval. While riverine settings continued to be exploited, the climatic change also apparently coincided with the development of a more lacustrine-oriented lifestyle after about 5000 BP. During this time, Archaic populations located in central Minnesota also began to interact with more distant populations. Evidence for this is primarily based on stylistic similarities between Archaic projectile points from central and eastern Minnesota and those from Wisconsin and Illinois (e.g., Caine 1974). Although no diagnostic points or other tools were found, a 5300 BP radiocarbon date from the East Terrace site suggests that more intensive use of riverine settings occurred during the Middle Archaic (MHS 2005). An increasingly efficient strategy for exploiting adjoining upland settings also occurred (Benchley et al. 1997:86).

By the Late Archaic, the use of longer-duration, more residentially stable base camps was probably established. Data from the East Terrace site also indicate that continued use of small, short term encampments located adjacent to rivers was also part of the settlement system (MHS 2005). The hearths, chipping debris, and Pelican Lake and Dickson/Waubesa points (ca. 2900 BP and 1870 BP) from the site are the result of the numerous short-term occupations that occurred throughout the Late Archaic and persisted into the Early Woodland and Middle Woodland periods at this site.

The beginning of the late Middle Prehistoric period (ca. 2250 BP) coincides with a major shift in the settlement/subsistence patterns in the Central Lakes Deciduous Forest region (Gibbon et al. 2001a). One of the hallmarks of this period is the introduction of ceramics and the beginnings of burial mound usage. La Moille Thick (Anfinson 1979) ceramics that occur at this time exhibit broad similarities with other thick Early Woodland wares found across the Upper Midwest. Although La Moille Thick ceramics occur at the Schilling site on Grey Cloud Island near St. Paul and possibly at the Anderson site in Anoka County, they are mainly distributed south of the region (Gibbon 1986). The settlement pattern associated with the beginning of the Woodland period is not well understood, but lithic assemblages at this time indicate a continuation of earlier Archaic traditions. This pattern is viewed by Gibbon (1986) as a florescence of the existing hunter-gather lifeway. Brainerd wares (ca. 3000 BP to 2400 BP) are another Initial Woodland ceramic type whose southern limit of distribution reaches Sherburne and Anoka counties

(Hohman-Caine and Goltz 1995). The distribution of Brainerd wares suggests a further intensification in the use of lacustrine and riverine environments.

Middle Woodland cultural expressions in the region are dominated by Howard Lake phase materials within the Anoka Sand Plain and by both Malmo and Howard Lake phases within upper Mississippi Valley near St. Cloud. Malmo (2200 BP to 1750 BP) is among the earliest ceramic traditions in east-central Minnesota and is considered part of the broader Lake Forest Middle Woodland adaptation. Malmo sites are typically associated with the transitional forests that stretch across the entire upper Great Lakes region (Fitting 1975; Mason 1981). Like so many of the prehistoric cultural complexes in Minnesota, however, the settlement-subsistence strategies employed during the Malmo phase are only broadly understood.

Howard Lake phase ceramics are mainly distributed south of Malmo ceramics. The Howard Lake phase is one of the northern-most extensions of Havana Hopewell-related cultures, which stretch from the Illinois Valley, northward into the upper Mississippi Valley. Since this cultural relationship is expressed only in the ceramics, Howard Lake culture is best characterized as a regional manifestation of the broader Middle Woodland cultural developments across southern and central Minnesota. In general, Middle Woodland settlement shifted away from the diffuse Archaic settlement pattern to one increasingly focused on larger villages located near lakes (Gibbon et al. 2001a). Smaller habitation sites and special function camps also occur in both riverine and lacustrine settings. The subsistence economy, however, continues to focus on exploiting a wide variety of seasonally available terrestrial, riparian, and aquatic resources (Gibbon and Caine 1980). Use of dunes or inlets and outlets of lakes, such as at the Anderson site, reflect the increasing importance of wetland resources in the subsistence strategies of the Middle Woodland populations.

The St. Croix phase (ca. 1500 BP to 1000 BP) is associated with the transition between the Middle Woodland and Late Woodland periods across central and eastern Minnesota (Benchley et al. 1997:133; Gibbon and Caine 1980). Most of the sites associated with this phase occur within the Carolinian-Canadian transition zone, although a number also occur in adjacent biotic provinces. An increase in site frequency and greater range of site sizes compared to the earlier Middle Woodland period occurs at this time; increased variability in both the artifact assemblage and the settlement pattern also occurs. These changes suggest less frequent interaction among groups or increasing regionalization of local St. Croix populations (Gibbon and Caine 1980).

Kathio phase (ca. 1000 BP to 650 BP) settlements are chiefly associated with the interface between the southern boundary of the Carolinian-Canadian transition zone and the Lakes District of west-central Minnesota (Gibbon and Caine 1980). The Clam River focus is closely related to the Kathio phase and mainly restricted to the Carolinian-Canadian transition zone. The Clam River focus is distinguished by use of small triangular projectile points, the presence of grit-tempered cordmarked vessels decorated with a variety of cord and corded tool impressed motifs, and use of conical and linear mounds. Houses found at Kathio phase and Clam River focus sites indicate a degree of sedentism not previously noted in the region (Gibbon and Caine 1980). Although wild rice was systematically exploited during the Middle Woodland period (Arzigian 2000; Valppu and Rapp 2000), it was a focus of the subsistence economy by the early Late Woodland. White-tailed deer and an array of medium and small mammals also were hunted.

Summary survey data for the Woodland period reported by Anfinson (1990:157-158) for the Anoka Sand plain reveal the general settlement trends for the Woodland period. Lake-stream junctions contain 50 percent of the sites in the surveyed areas, while lakeshore settings account for only 30 percent and stream-shore settings only 15 percent; sites located away from water are uncommon. These data, along with the settlement-subsistence patterns outlined by Benchley et al. (1997) and Gibbon et al. (2001a), suggest a high degree of redundancy in the patterning of sites across the landscape. Although the sampling bias extant in the existing archaeological survey database must be taken into consideration, particularly with regard to specific site location tendencies, these data provide evidence for general settlement trends present within the region.

During the Late Prehistoric (or Late Woodland), the harvesting of wild rice and horticulture intensified for many groups in central Minnesota, particularly among the makers of Kathio, Onamia, and Sandy Lake ceramics, and possibly the Oneota populations that were present along the Mississippi and St. Croix rivers (Benchley et al. 1997:368-369). Floodplain use intensified and became the locus of permanent or semi-permanent villages. This is due to the fertile alluvial soils and the fact that these settings are ecotonal and include a wide variety of economically important resources. Consequently, during the Late Woodland period, small special function sites commonly occur in a wide variety of settings to target specific resources. From the standpoint of site discovery, large Late Woodland villages with relatively thick middens, as well as special function camps, could both occur and be buried on floodplains (Figure 2.1.2-2). Importantly, the discovery of both site types is needed to reconstruct the Late Woodland settlement and subsistence system.

Residential mobility decreased during the Late Woodland while population levels increased (Gibbon et al. 2001a). With the development of Sandy Lake villages in the northern parts of the region, Plains Village complexes to the southwest, and Oneota manifestations to the south, the central part of the Central Lakes Deciduous Forest region may have only been used seasonally to procure specific resources, although the villages located near stands of wild rice also occurred (Gibbon et al. 2001a).