10.0 ANDERSON TEST LOCALE

10.1 INTRODUCTION AND BACKGROUND

The Anderson test locale is located on a gently sloping sand dune on the south shore of Howard Lake, near Forest Lake, Anoka County (Figures 3.3.2-3 and 10.1-1), on the Anoka Sand Plain (Wright 1972a). The majority of surface deposits near the testing grid are composed of outwash sand and gravel from northern and western sources (Meyer and Hobbs 1993) that have been locally reworked into dunes (Keen and Shane 1990). The sampling grid occurs on a ridge between two lake basins. Howard Lake, which consists of a large area of open water surrounded by a wetland fringe, lies to the north, while Columbus Lake, a small area of open water surrounded by extensive wetlands, lies to the south. A sandy ridge on which the testing grid is located separates these lake basins.

The setting for the Anderson test locale is unusual in this study because it is the only location that is not primarily within a fluvial or alluvial depositional environment. Rather, it occurs on an eolian (dune) landform. The location was specifically chosen because it is eolian rather than alluvial, is possibly deeply stratified, and, unlike the other test locales in this study, is composed of coarse-grained sandy sediment. According to the Mn/Model LfSAs, two distinct depositional environments occur. The higher northern end of the test locale derived from eolian processes, while the lower southern part is composed of late Wisconsinan glaciofluvial and glaciolacustrine sediments. Presumably, these older glacial deposits underlie the dune, and their reworking during the Holocene was the source for sand related to eolian deposition. The test locale was larger than the other test locales and was relatively long and narrow (30 m × 140 m [98 ft × 459 ft]) to accommodate study of the dune landform. The testing grid was oriented north-south and rose about 3 m (9.8 ft) from south to north.

The Anderson test locale is part of a large (>75 ac [30 ha] in size) buried archaeological site (Anderson site; 21AN0008; Figure 3.3.2-3) that has been known and investigated since the early twentieth century. The site includes evidence of several prehistoric occupations that span late Paleoindian or Early Archaic through the Late Woodland periods. The testing grid occurs near the eastern margin of the site. Major excavations at the Anderson site (Wilford 1937) were undertaken in the 1930s, but were located west of the 2004 testing grid. In the late 1970s, however, less extensive investigations did occur along Lake Drive and were located just south of the present Anderson test locale (Figure 10.1-1). No absolute age estimates have been obtained from anywhere at the site, making previous interpretations of the site age and chrono-stratigraphy entirely based on diagnostic artifacts. Additional details regarding the previous investigations were provided in Chapter 3.0.

The 2004 geophysics surveys were primarily directed toward identifying archaeological features. The geophysical survey was conducted when surface conditions were satisfactory. The soil was generally dry to very dry and the test locale recently had been cleared of corn and disked to remove stubble. The dry, fine, sandy nature of the surveyed area, however, created a relatively soft ground surface that resulted in some mechanical problems (wheel slippage) for the GPR.

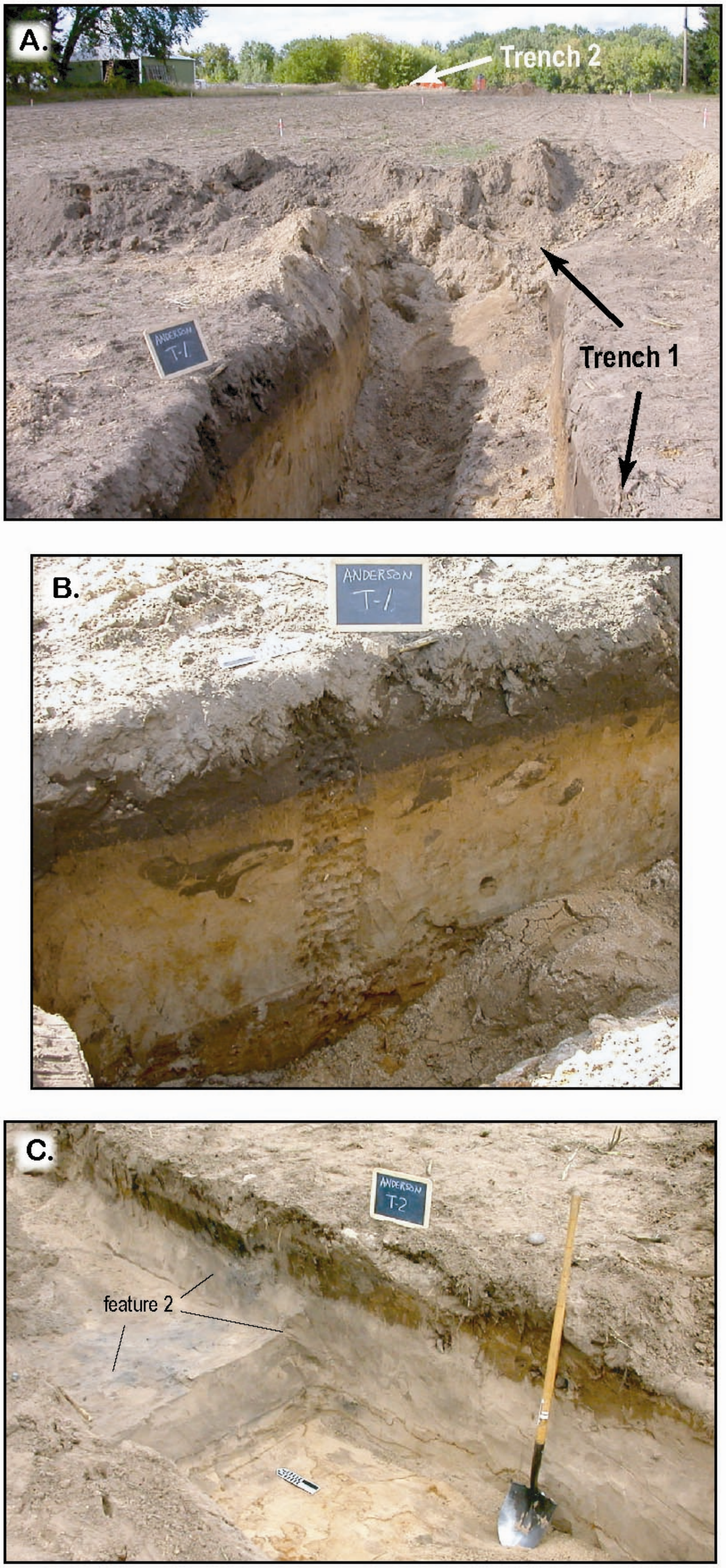

Figure 10.1-1. Anderson Test Locale Overview and Trenches: (A) Testing Grid; (B) Trench 1; (C) Trench 2 with Soil Lamella and Possible Cultural Feature

Coring and trenching focused first on ascertaining the presence and distribution of artifacts and secondly on both determining the sedimentology and stratigraphic relationships of the deposits forming the broad dune and the relationships between the artifacts and eolian sediments. Seventeen cores were excavated and, except for demonstration purposes, no augering was undertaken. Six trenches were excavated.

10.2 RESULTS OF GEOPHYSICS SURVEY

10.2.1 Magnetics

The magnetic survey data across this test locale reveal a highly variable subsurface. Immediately apparent are very broad (>6 m [>19.7 ft] wide) monopolar anomalies on the eastern and western edges of the survey area (Figure 10.2.1-1), which are due to magnetic field disturbance resulting from the metal agricultural buildings and electrical lines directly adjacent to the survey area. These anomalies may obscure more subtle anomalies of natural or cultural origin in those areas. Also of modern origin are a considerable number of dipolar spike anomalies of varying size and magnitude, which are probably from ferric objects (e.g., nails, bolts) or fragments of brick or other high-fired earthen material.

On the northern end of the survey area are three anomalies of possible prehistoric origin (Figure 10.2.1-1). These lower magnitude monopolar magnetic highs (at least two standard deviations above the mean, in nanoteslas) are approximately 2 m^2 (21.5 ft^2) or larger. Such anomalies are typical of vertical cultural features such as storage pits (Weymouth 1986:345). Another of these anomalies lies near the southern edge of the survey area. Extremely low magnitude (±1 nT) trends are apparent in the southern third of the survey area, trending southwest-northeast. These are probably responses to soil or sediment variation.

10.2.2 Resistivity

At the Anderson test locale, the resistivity survey reflects the local geomorphology more clearly than does the magnetometer survey. This is due, in part, to the fact that resistivity is less susceptible to the noise from electrical fields or metal objects that is so prevalent in the magnetic data. In addition, soil/sediment composition is not uniform in the upper data levels. The resistivity survey in the upper data levels shows lower resistivity areas in the southern ca. 20 m (66 ft), possibly resulting from a siltier, moister soil (Figure 10.2.1-1). Data for the next ca. 80 m (263 ft) to the north, over somewhat higher ground, shows the presence of a slightly more resistive, sandier soil. Some linear features of higher resistivity are evident in this area, which may indicate bands of less conductive soils. Similar linear bands crosscut these. Discrete areas of high resistivity at the far north end of the grid may indicate drier or denser soils, perhaps the result of soil compaction by modern activities. This general pattern is present through the top three data levels (Figure 10.2.1-1). In the lower two levels, the resistivity is relatively homogenous throughout, with the exception of much reduced but still present high resistivity areas in the far northern end (Figure 10.2.1-1). This indicates homogeneity in the lower subsurface, either in soil structure, hydrology, or both.

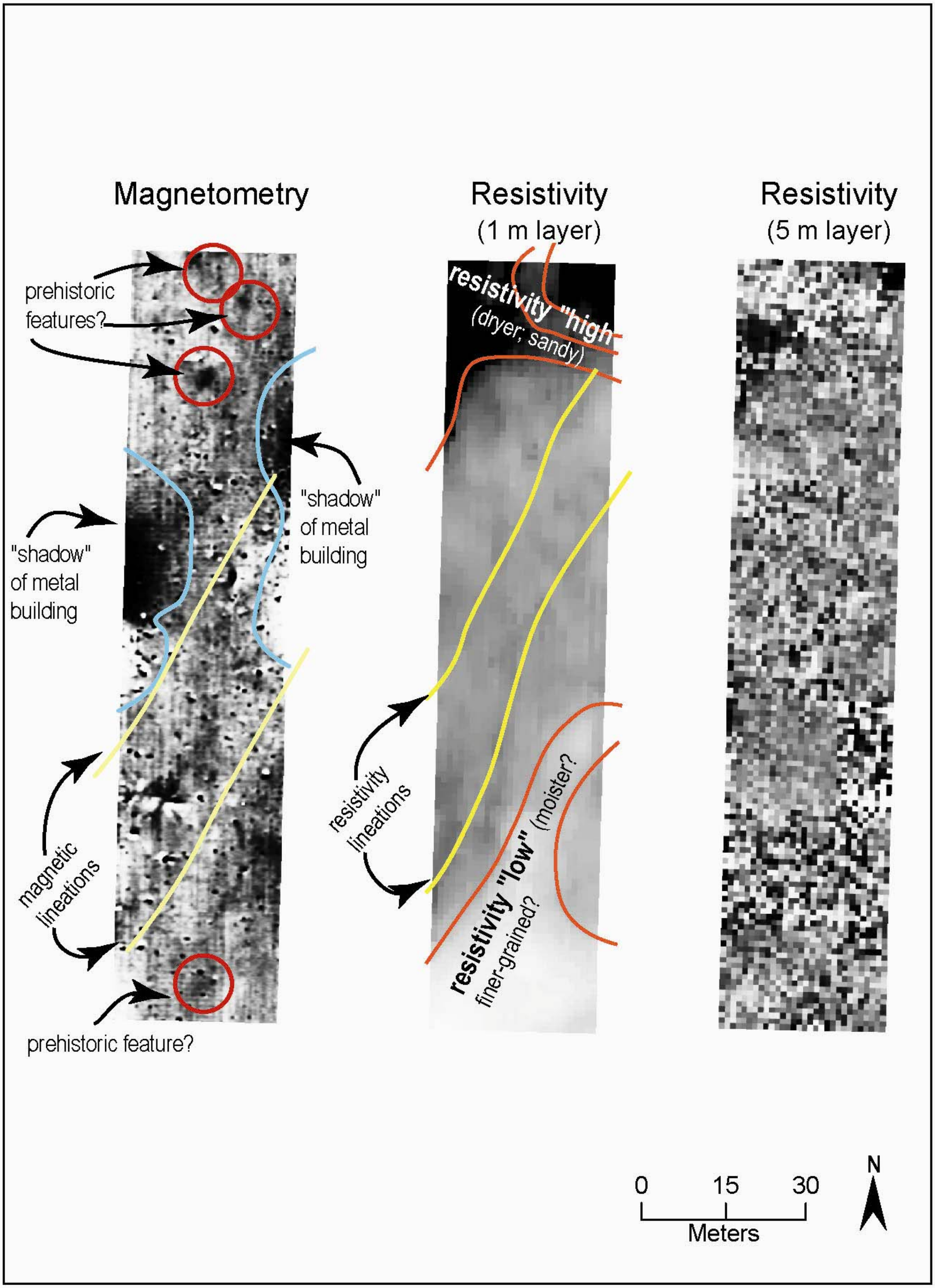

Figure 10.2.1-1. Magnetometry and Resistivity Data Plots, Anderson Test Locale

10.2.3 Ground Penetrating Radar

The Anderson test locale is the most interesting locale in this study from the perspective of the GPR survey; a technique that was also employed at the nearby 21AN0106 site (Forsberg and Dobbs 1997). It reveals numerous natural sedimentary and possible cultural features (Figure 10.2.3-1). For example, a strong double reflector occurs at about 1.25 m (4.1 ft) below surface and discontinuous, weaker beds are also apparent in the GPR traces below this depth. These reflectors continue to appear to about 2.5 m (8.2 ft) below surface. In addition, a possible cross-bedded unit occurs between about 0.2 m (0.7 ft) and ca. 1.25 m (4.1 ft) below surface, the top of the previously mentioned dominant bed complex. This strong reflector dips rapidly in the southern portion of the site into a shallow trough or basin (Figure 10.2.3-1). The basin is filled, but some sediment is disturbed. A number of clear parabolas and isolated circular patterns occur in the middle part of cross sections. Many depressions and disrupted zones occur at about 0.7 m (2.3 ft). Many of these appear to be of human origin.

The southern portion of the survey grid shows numerous similar patterns (Figure 10.2.3-1), including a prominent parabola that extends from the surface at 2N/58E. Disruption through the dominant reflector occurs in the northern end of the grid, but also in numerous other places (Figure 10.2.3-1). Shallow disruptions are common at the top of the section (about 0.2 m [0.7 ft]). A lens or large disruption occurs in the northern part of the survey area (Figure 10.2.3-1). These may relate to a buried landscape or probable paleosol reflector that is "draped" over a deeper (>2.5 m [8.2 ft]) "knob" on the eastern part of this test locale. Above this is a complex unit with many different bed forms, including cross beds. This unit is apparently extensively modified or disturbed. Some of the disruptions continue down through the 0.7 m (2.3 ft) reflector. A trough-like feature occupies part of the test locale. This is an extremely complex area that deserves further attention.

Two-dimensional maps (Figure 10.2.3-1) show general geological features and a number of features and modifications that may relate to both modern and prehistoric archaeological deposits. The entire test locale shows a northwest grain. The troughs are indicated by dark tones while disrupted areas show as lighter areas. Some of the disruptions indicate that metal is present and is probably recent, although they may reflect prehistoric metal (copper tools). Several ca. 4 m (13 ft) diameter circular features are present in the middle of this grid. If further GPR survey or other geophysical work is undertaken at the Anderson test locale, survey grids should be broken into smaller units for more detailed analysis.

10.2.4 Discussion of Geoarchaeological Significance from Geophysical Survey

The Anderson test locale geophysical survey was the most successful of all those undertaken during this project. The survey results are informative about both the geological and archaeological environments and contexts. This conclusion is not surprising considering that the underlying geology of the Anderson test locale is ideal for the geophysical methods employed during this project. Open, generally flat topography and mainly uniform, sandy soils present the ideal conditions, particularly for GPR. For example, cross- and tabular-bed structures are apparent on the GPR traces and some particularly strong reflectors, with differently oriented beds, occur below ca. 1 m (3.3 ft) depths. Beds with fainter structures overlie these.

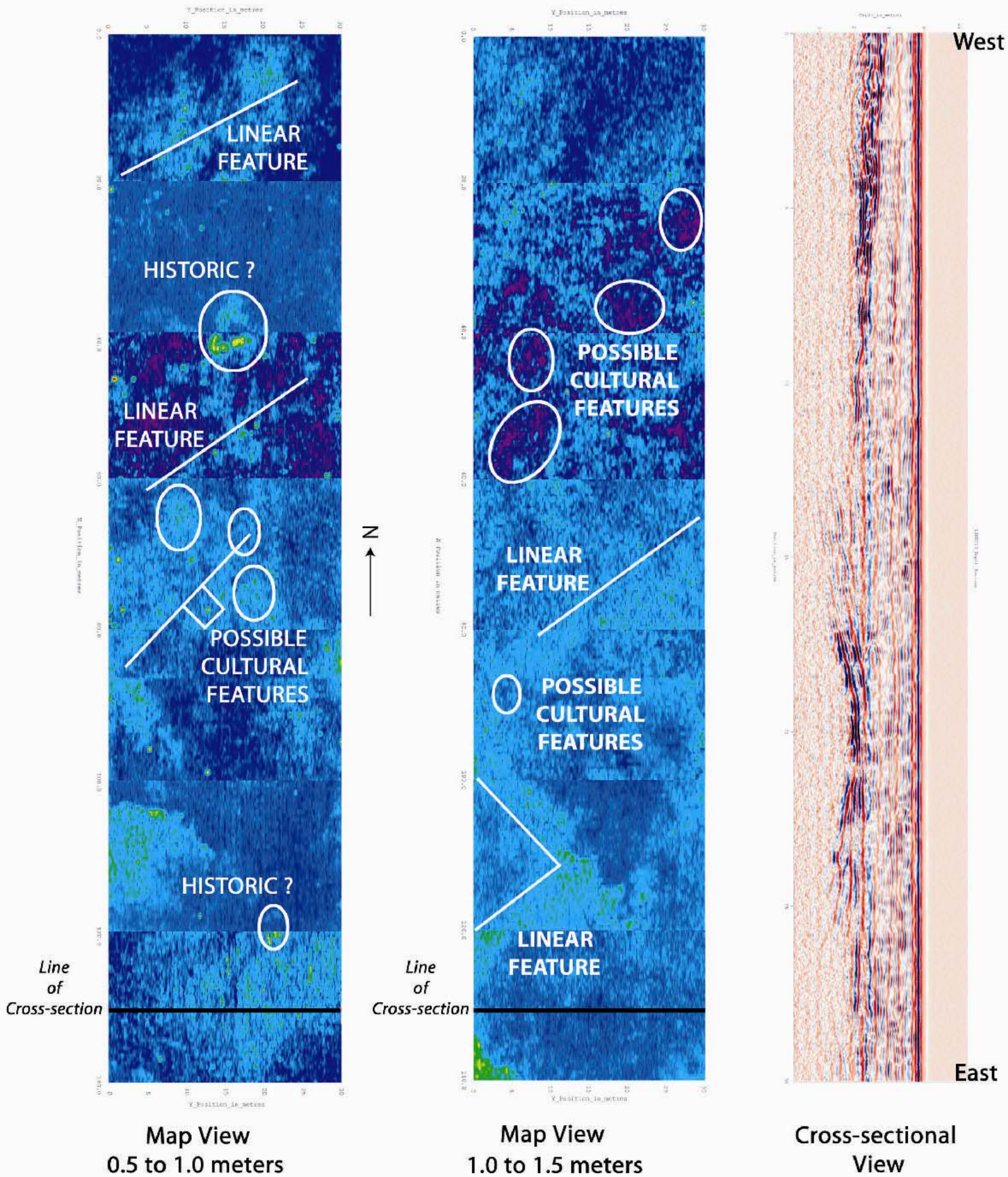

Figure 10.2.3-1. GPR Data Plots, Anderson Test Locale

The prominent modification in bedding structures and types at ca. 1 m (3.3 ft) depths may reflect the change in depositional environments from late Wisconsinan glacio-fluvial and/or glacio-lacustrine deposits (below 1 m [3.3 ft]) to the formation of Holocene, eolian sand sheets (above 1 m [3.3 ft]). Although no clear indications were actually observed from the GPR tracings, this change in deposition also implies a depositional hiatus and, consequently, may include buried soil horizons, with the potential to house buried archaeological material, at the depositional break. Alternatively, given the ca. 1 m [3.3 ft] depth of this depositional break, it may also reflect pedogenic processes. For example, the bedding differences above and below 1 m [3.3 ft] may indicate the presence of relatively minimal bioturbation and the formation of strong (Fe-) spodic subsoil (B-) horizons below 1 m (3.3 ft) and the more high pedo- and bioturbated sediments within more near-surface soil (E or E/B) horizons. Because of the sandy, well-drained nature of the soil, such Fe-rich soil horizons are likely to form and, particularly if slightly cemented or consolidated, act as strong GPR reflectors. These two scenarios – landscape burial within an eolian environment and pedogenetic horizon formation within a stable landscape – have different implications for in situ buried archaeological remains if, in fact, they are present. Unfortunately, either scenario can be inferred from and supported by the GPR survey data.

The magnetic survey data show the presence of abundant metal, which is likely historic in age, throughout the survey grid and also show how sensitive the method is in sensing large metal objects well off-grid (i.e., the metal buildings located east and west of grid [Figure 10.2.1-1]). In addition, and of particular interest to this project, possible prehistoric features were noted as monopolar magnetic highs that are typical of vertical cultural features such as storage pits (Weymouth 1986:345). These are probably in a near-surface context and likely extend below the plow zone.

Resistivity data, as was true at all the test locales, reflect the geomorphological context more clearly than the magnetometer survey; this shows how the two types of survey can complement one another. One method, however, is not necessarily better than the other because they actually measure different proprieties of the soil, sediment, and potential archaeological features. These data indicate that the upper layers (<2 m [<6.6 ft] deep) exhibit lower resistivity areas in the south end of the grid that probably result from a higher silt content and, hence, moister soil. Generally northeast-southwest lineations of higher resistivity, which indicate bands of higher resistance soils, occur across the survey area. Similar lineations are noted in the GRP survey data (Figure 10.2.3-1). Their origins are not clear, but may reflect variably thick, discrete areas of sandy, eolian sheet deposits. The sandier nature of the bands is implied by the fact that they are more resistive.

10.3 RESULTS OF CORING SURVEY

10.3.1 Deposits and Soils

Deposits at the site are predominately sand with one exception. At the base of Core 1 at 2.5 m (8 ft) below the surface is a silty clay loam diamicton that is interpreted as a till or as being derived from a till (flow till or till clast in a meltwater sequence). It does not occur in any of the other cores. Sandy deposits include textures in the loam, sandy loam, loamy sand, and sand classes. Sand texture ranges from coarse to very fine with a trend toward fining upward. Thin bedding and laminations are common at depth below the solum. The majority of the bedding and lamination is planar, with a single case of dipping or cross-bedding. The lower stratified sequences often contain very thin beds or laminae of medium to very coarse sand (Appendix B).

Morphological variation of the soils at the site is controlled by landscape position and minor differences in deposit stratigraphy. In the southwest corner of the grid the land surface is relatively low and flat and may be underlain by slowly permeable diamicton. Soils are weakly developed and consist of an Ap-C-A-C horizon sequence formed in sandy loam. Distinct redox features are present below 60 cm (2 ft). Up slope to the north at Core 2 the soil consists of an A-E1-E2-Bw1-Bw2 horizon sequence formed in very fine and fine sand. Prominent redox features are present in the Bw2 horizon. This soil is better drained and a thick B horizon has formed. The soils upslope to the north have complex subsoil horizonation. Core 6 is typical with an Ap-E1-Bt1-E2-Bt2-E3-Bt3 horizon sequence (Figure 10.3.1-1; Appendix B) formed in very fine sand. The thickness of individual horizons varies. For example, the E1 horizon varies from 30 cm (12 in) thick to 115 cm (45 in) thick. The multiple Bt horizons are analogous to thick lamella and may form in a similar manner.

10.3.2 Stratigraphy

Stratigraphy at the Anderson test locale consists of an upper and lower sequence. Together they consist of sands that become increasing fine upwards from medium sand, with some coarse and very coarse sand beds (Lower Sequence), to very fine sand (Upper Sequence). The Lower Sequence is bedded and laminated and is more poorly sorted than the Upper Sequence. A sharp contact between the Upper and Lower Sequences is not evident (Appendix B). It may have been masked by pedogenesis or is conformable and difficult to detect in cores, but there is a change in the depositional mechanism.

10.3.3 Discussion of Geoarchaeological Significance from Coring

Evidence for the origin of these landforms comes from geomorphic and stratigraphic sources. The upper and lower stratigraphic sequences represent different processes of deposition. The Lower Sequence, based on the sedimentary structure and grain-size pattern, may be near-shore lacustrine or meltwater stream deposits. The Upper Sequence is well-sorted, very fine and fine sand with no preserved sedimentary structures. It may be an eolian cap or fine end of a fining upward lacustrine or, less likely, a meltwater stream sequence.

The position of the ridge and others in the vicinity around the edges of lakes indicates that the ridge core could be uncollapsed ice contact meltwater stream deposits. The presence of ice-block lakes in a tunnel valley indicates meltwater stream activity at some point in the Late Wisconsinan history of the landscape. The meltwater deposits may then have been reworked in Glacial Lake Anoka as suggested by Meyer and Patterson (1997) and then parts of the Anoka Sand plain were modified by wind-producing isolated dunes (Keen and Shane 1990).

No deeply buried soils were encountered and no auger targets were identified; however, auger tests were placed at Core 1, where a shallow buried soil (37 cm [15 in] below surface) is present,

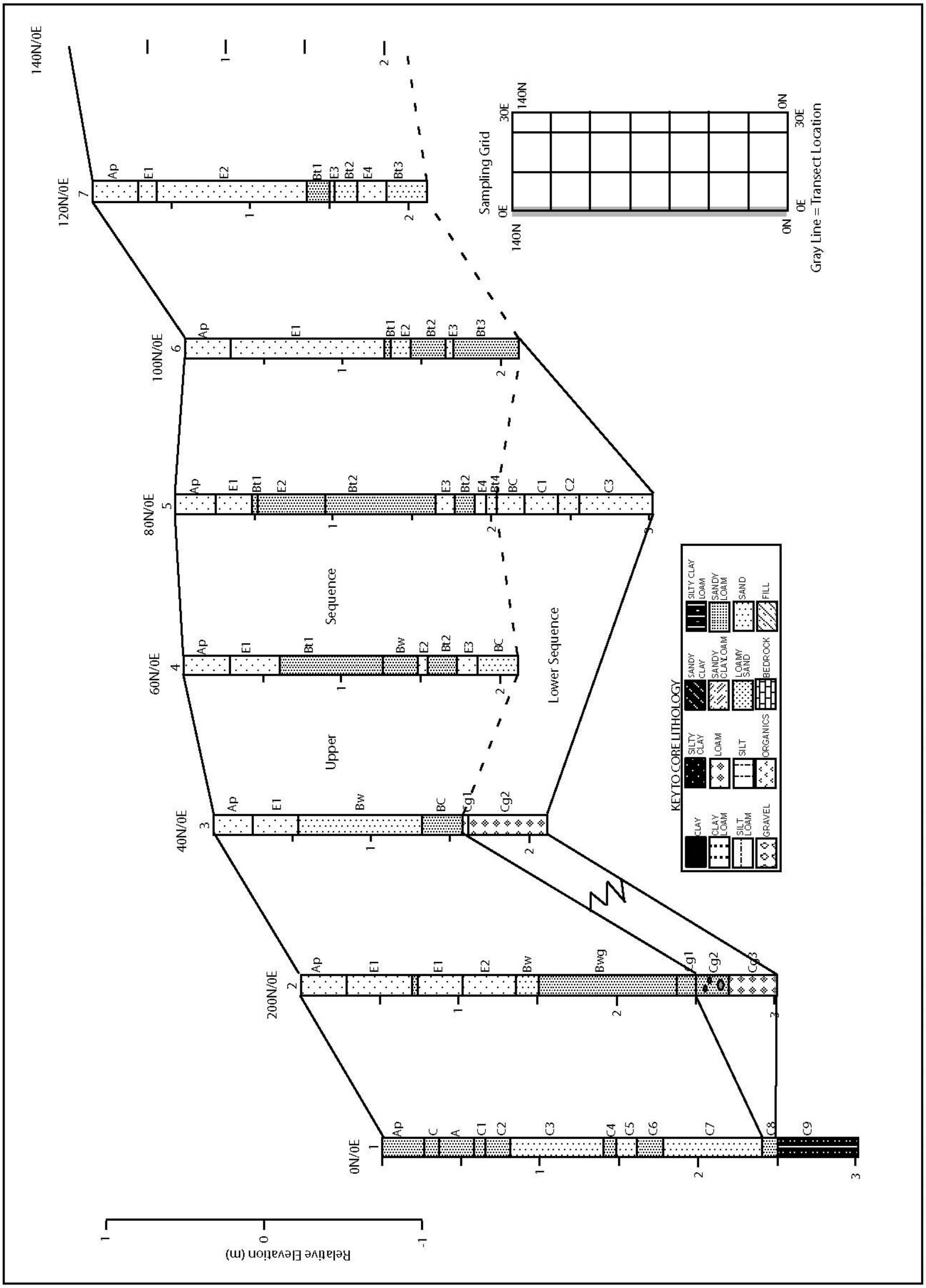

Figure 10.3.1-1. Stratigraphic Cross-Section, Anderson Test Locale

to demonstrate the auguring technique for visiting project managers. One tiny pottery sherd was recovered from the plow zone and a possible 1.7 g (0.1 oz) piece of fire-cracked rock was recovered from a depth of between 40 cm and 60 cm (15.8 in and 23.6 in).

In the absence of buried soils one presumes the geomorphic surface occupied by prehistoric populations is at or near the modern surface. Actually it is not a surface but a zone of intense biomechanical mixing and pedological weathering: a geomorphic layer. With this in mind, the question is: what is the burial mechanism? For the following reasons the archaeological deposits were buried by biological and pedological processes with some eolian addition of sand after deforestation and cultivation.

1) Sand source: On the modern landscape no sand is available beyond the ridge landform. To the south, north, and east are lake basins that are certainly as old as or older than the ridge. To the west and northwest at some distance sandy surface deposits are present; however, winds from the northwest would have to carry the sand across Howard Lake and deposit it on the lee shore. This is unlikely.

2) Geomorphic evidence: Keen and Shane (1990) document three episodes of eolian activity west of the Anderson site at Lake Ann, the last one ending at 4000 BP. After this time, there was increased precipitation and dune stability.

3) Archaeological evidence: The relatively broad vertical distribution of artifacts, with diagnostic artifacts spanning the Paleoindian through Mississippian periods, and the apparent lack of archaeological stratigraphy (Wilford 1937) all point to a stable landform over much of the Holocene.

4) Pedologic Evidence: A well-developed soil with multiple Bt horizons formed in a sandy parent material takes thousands of years to form, although the exact length of time is not known.

The above evidence indicates the archaeological material was not buried by a single large sedimentation event or even a few large sedimentation events but by biological, pedological, and anthropogenic (historic and prehistoric) processes over a long period of time. Sands that contain the archaeological deposits may well be eolian but were deposited during deglaciation. One possibility is, before the buried ice in the lakes melted, a cover of sandy sediment provided the source for the eolian sand at the site.

10.4 RESULTS OF TRENCHING SURVEY

10.4.1 Stratigraphy of Soils and Sediments

Based strictly on sedimentary characteristics, the excavations reveal no clear evidence of Holocene-age, eolian-derived deposits anywhere on the site. The only exception to this might be Trench 2, located in the northwest corner and topographically highest portion of the Anderson test locale (Figures 10.4.1-1 and 10.4.1-2). Here, the upper 50 cm to 70 cm (19.7 in to 27.6 in)

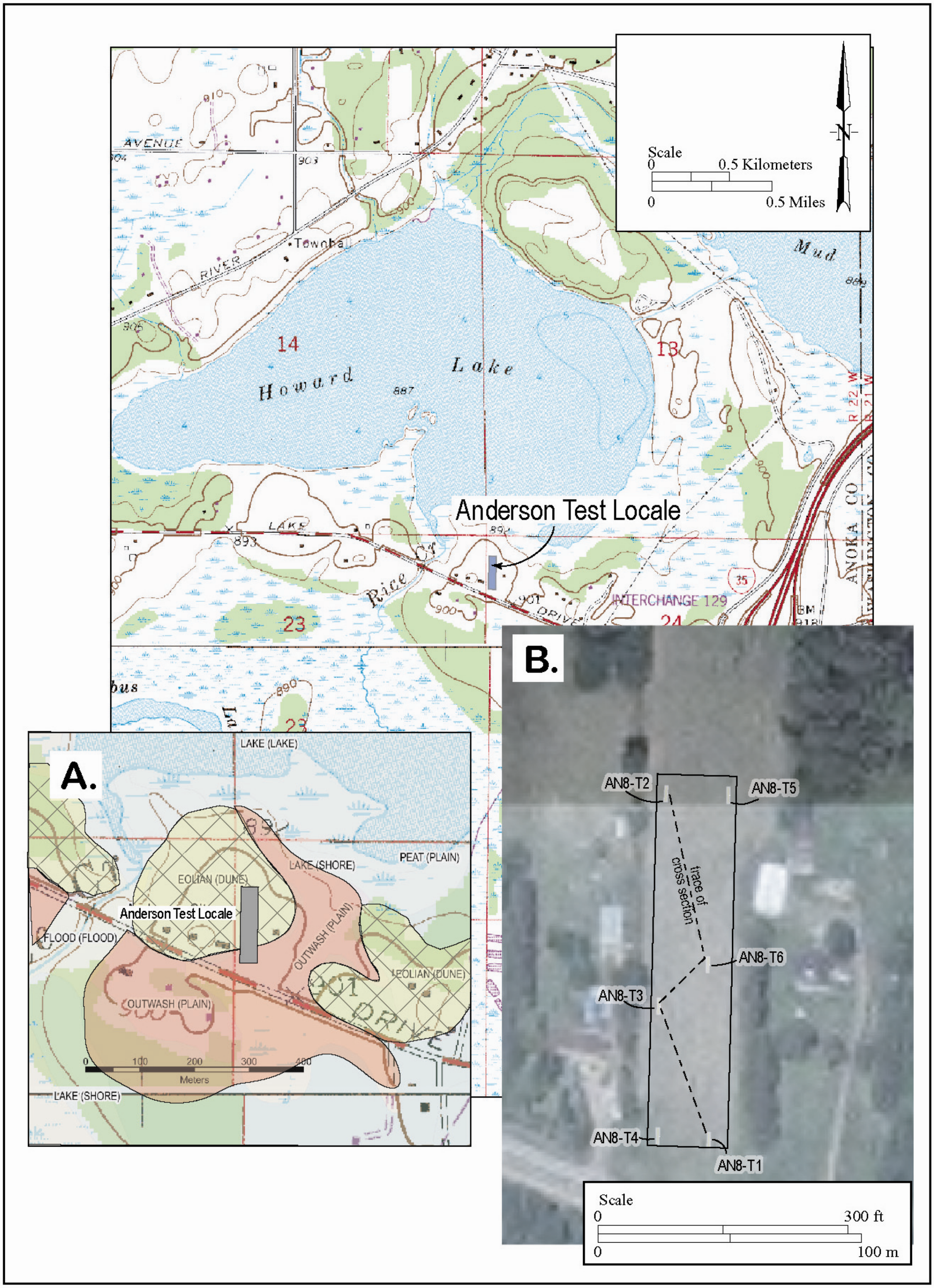

Figure 10.4.1-1. Trench Locations at the Anderson Test Locale

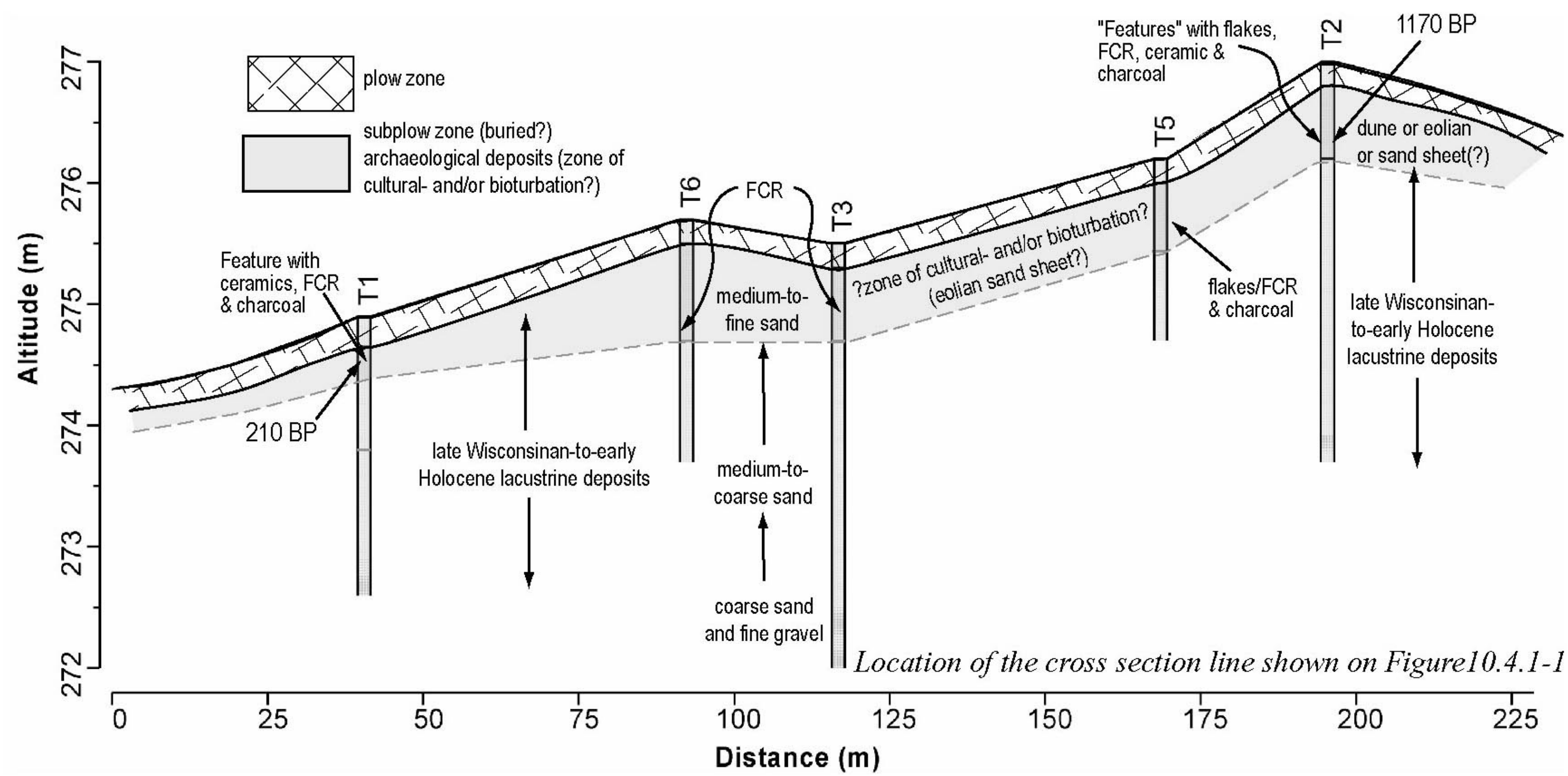

Figure 10.4.1-2. Cross Section through the Anderson Test Locale

of the sequence consists of relatively poorly sorted silty, very fine sand that may have derived from eolian reworking of underlying shallow lacustrine deposits (Figures 10.1-2, 10.4.1-2, and 10.4.1-3; Appendix C). The base of the Trench 2 sequence consists of the upper 2 m (6.6 ft) of tan to light brown/mottled reddish brown, massive to faintly bedded, fine to coarse sand. The sand texture generally coarsens with depth. The upper 20 cm to 50 cm (7.9 in to 19.7 in) of the unit is generally massive, but includes minor amounts of oxidized fine sand that form strong, partly-cemented, orange to reddish brown subsurface (Bt) soil horizons. The lower part of the sequence, however, becomes faintly cross- and tabular-bedded and forms poorly to unweathered subsurface (C) soil horizons. The base of the unit may be partly gleyed.

Elsewhere, such as Trench 6 (Appendix C), these basal sands sometimes include shallow, discontinuous cross-beds of coarse sand and fine gravel. The presence of these gravely beds indicate that this sand unit is not eolian in origin and suggest that it was deposited in either a shallow lacustrine and fluvial sedimentary environment.

The basal coarse sand grades upwards into tan/mottled reddish brown/orange, massive, medium to fine sand that includes a minor amount of silt. The unit is coarsest at the base and grades to mainly silty, very fine sand near the top. Although mainly fine sand, the presence of minor amounts of silt makes the upper part of the unit relatively poorly sorted. Evidence of bioturbation is common throughout the unit and discontinuous, thin, reddish-soil lamella also frequently occurs. These latter may mark indistinct bedding planes but more likely indicate the positions of former soil wetting zones or seasonal fluctuations in groundwater levels. The presence of these lamella, in addition to other factors, suggest that the unit forms a series of subsurface soil (B) horizons (Figures 10.1-1 and 10.4.1-3).

The silty, very fine sand grades upwards into a gray (top of the unit) and mottled tan/gray (lower part) massive, silty, fine sand. In Trench 2, the base of this unit is defined by the occurrence of a few relatively continuous and strongly developed soil lamellae. Although similar in texture to the underlying silty sand, these units can be distinguished from each other by the general absence of soil lamella in the upper unit, which were characteristic of the underlying sand, and particularly by the presence of abundant amounts of culturally derived materials including fire-cracked rock, ceramic sherds, lithic debitage, and a few charcoal concentrations. In fact, this unit, which is defined mainly in the northern end of Trench 2, may be a large, cultural feature. One of the pieces of charcoal from this context, Feature 2004-2, yielded a ^{14}C age estimate of 1170±40 BP (Beta-200797; calibrated cal yrs A.D. 960 to A.D. 1110; Appendix D; Figure 10.4.1-2). Although many of the sherds found in sub-plow zone context in Trench 2 are Middle Woodland in age, the age of the charcoal is clearly Late Woodland.

The top of the unit and/or feature (Feature 2004-2) has been truncated by the plow zone, which consists of dark-gray to strong-brown, massive, silty, fine sand and includes a few prehistoric artifacts (fire-cracked rock, ceramics, and lithic debitage) and charcoal. The absence of soil lamella and the massive nature of the sub-plow zone sand deposit (or feature) likely relates more to the relatively intensive bioturbation, both natural and cultural, of the unit than to any original, natural depositional or sedimentary processes. In fact, the entire upper ca. 1 m (3.3 ft) of the silty sand deposits, including the plow zone, may be sedimentologically identical and identifiable

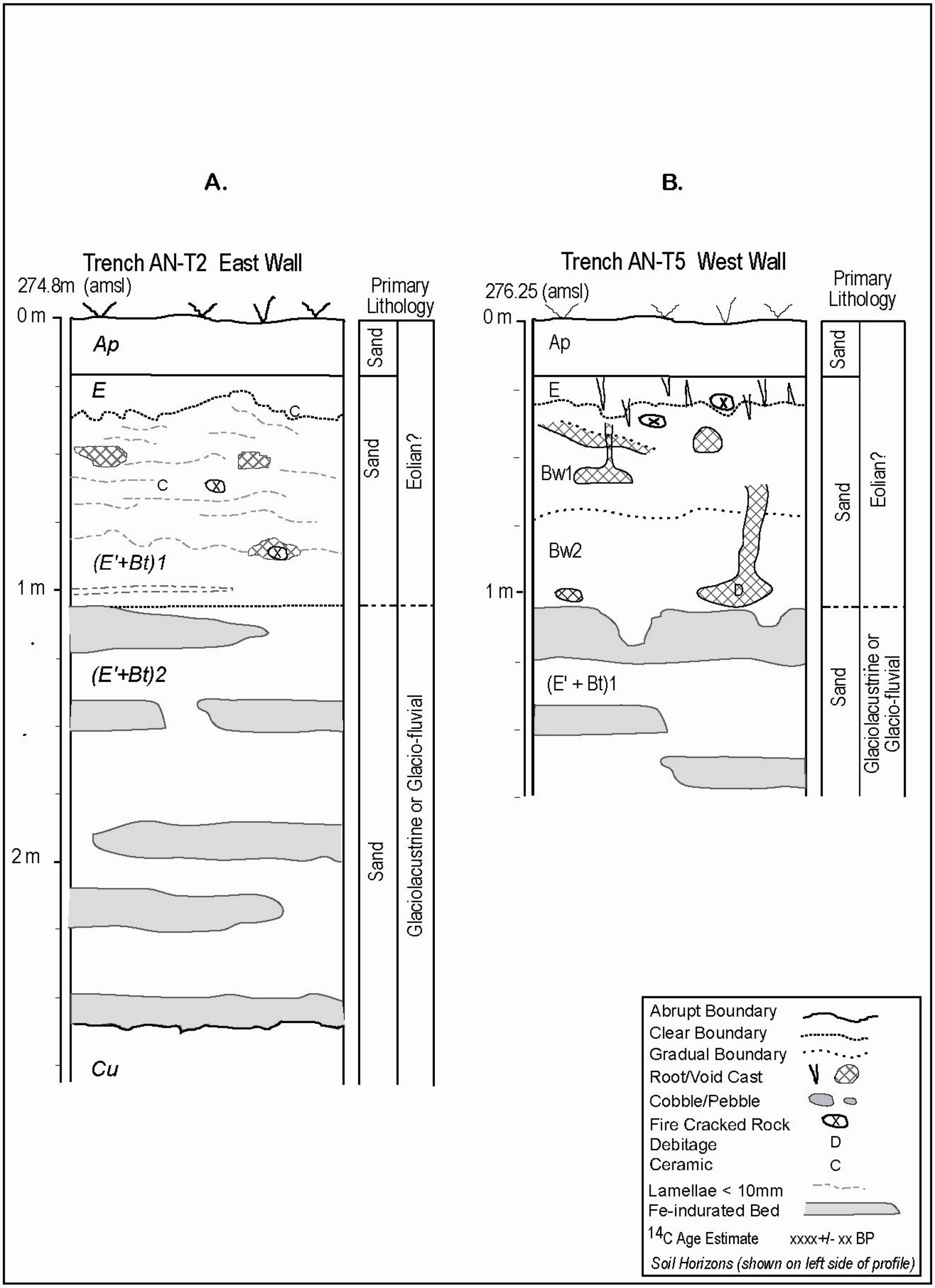

Figure 10.4.1-3. Soils and Sediments in the Upper Part of (A) Trench 2 and (B) Trench 5, Anderson Test Locale

as distinct units only by having undergone different post-depositional weathering, pedogenic, and anthropogenic (site formation) processes (Figure 10.4.1-4).

The origin of the upper meter of sediment at Trench 2, as well as the rest of the test locale, is not clear, as indicated by the ^{14}C age of 1170 BP. The cultural associations of artifacts, features, and material in the subsurface are clearly in conflict. Although mapped as eolian (dune) deposits (Figure 10.4.1-1), the massive nature and strong bioturbation processes (which may include cultural processes) have obliterated evidence of original bedding, sorting, or other characteristics of sand that indicate its depositional environment. Certainly, the texture of the sand, although relatively poorly sorted (i.e., contains some silt) could be consistent with an eolian origin, but just as appropriately, could be considered part of the top of a disturbed shallow lacustrine depositional sequence. Were it not for the presence of prehistoric artifacts at depths of up to 70 cm (27.6 in) below surface in Trenches 2, 3, 5, and 6 (Figures 10.4.1-1 and 10.4.1-2; Appendix C), the question of sediment origins could remain equivocal. As discussed below, the presence of these artifacts does not necessarily imply burial by eolian sedimentation, but can also be accounted for by several other post-depositional or post-occupational processes. A similar sequence of sandy deposits occurs in the southern, non-eolian, portion of the Anderson test locale (Figure 10.4.1-1). For example, in Trench 1, as is true throughout the site, the base of the sequence begins with the upper meter of tan to light brown/mottled reddish brown, massive to faintly bedded, medium to coarse sand that includes little silty or fine sand. The sand is typically massive in the upper part of the unit but faintly cross- to tabular-bedded within the lower part of the sequence and, as was suggested above, probably is part of a shallow lacustrine (or glaciolacustrine) sequence. The top of the unit forms a strong, partly Fe-cemented, orange to reddish brown subsurface soil (Bt) horizon and, taken as a whole, is nearly identical to the sequence in Trench 2.

The basal sands grade upward into a 110-cm (43-in) thick unit composed of gray (upper 20 cm [8 in]) to tan/mottled orange/gray (rest of the unit), massive, silty, fine sand. Bioturbation is common in the upper 30 cm to 50 cm (12 in to 20 in) but rare in the lower part of the unit. The lower part of the unit has weathered into a series of subsurface soil (Bw) horizons with orange and gray colored soil pendants. The top of the unit, however, forms at least the lower part of a relatively thick, near-surface soil (E) horizon. The upper part of this soil horizon has been truncated by the plow zone, which consists of black to strong-brown, massive, fine sand and includes a few pieces of fire-cracked rock and charcoal. A shallow, probable cultural feature, which was truncated by the plow zone, was identified penetrating into the sub-plow zone buried soil zone. This feature contained a few small, non-diagnostic ceramic sherds and fire-cracked rock along with abundant, large pieces of charcoal. A ^{14}C age estimate of 210±40 BP (Beta-200792, calibrated cal yrs A.D. 1640 to A.D. 1690, A.D. 1730 to A.D. 1810, A.D. 1920 to A.D. 1950) on charcoal from the feature indicates that it is either very late prehistoric or historic in age.

The sedimentology and geoarchaeology of the deposits within Trench 2 were repeated in Trenches 3, 5, and 6. The lower parts of each of these trenches (i.e., below 1 m [3.3 ft] depths) include the same massive lacustrine sand that shows faint bedding at its base and well-developed, stacked, and discontinuous spodic (Bt) horizons. The upper meter is also similar to

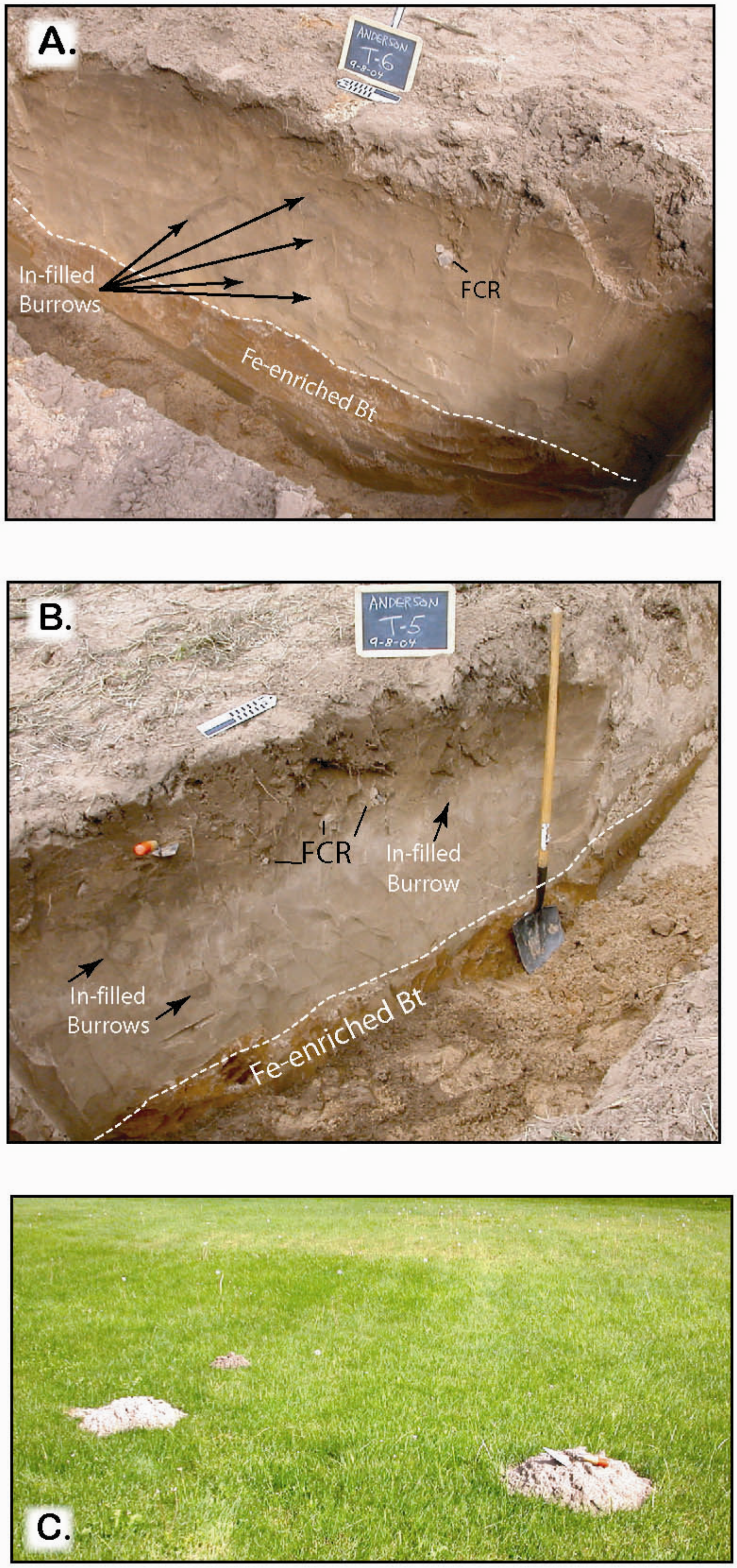

Figure 10.4.1-4. Anderson Test Locale: (A) Trench 6 In-filled Burrows; (B) Trench 5 In-filled Burrows; (C) Gopher Holes

Trench 2 in lithology and includes massive, medium to fine sand that has minor silt content. Unlike Trench 2, Fe-cemented and stained lamella are not commonly found in the upper meter of Trenches 4, 5, and 6. This is probably due to different (drier) drainage conditions and extensive bioturbation (root and rodent burrows) that attest to the general mixing by natural processes (Figures 10.4.1-3 and 10.4.1-4). Most importantly, this upper meter commonly includes prehistoric artifacts (i.e., fire-cracked rock, lithic debitage) and fine charcoal flecking that are often concentrated near the top (i.e., plow zone and just sub-plow zone) and base of the unit (i.e., 70 cm to 100 cm [27.6 in to 39.4 in]). As suggested for the upper ca. 1 m (3.3 ft) of Trench 2, the unit may be partly eolian but, regardless of the age of potential eolian redeposition, is also clearly mixed by bioturbation, including human processes. Clearly, the most significant question that emerges as crucial for the understanding of the Anderson site archaeological deposits is how the artifacts became buried. Did natural eolian dune or sand-sheet depositional processes bury them, or were they mixed into the subsurface context through bioturbation processes? The answer to this question has important ramifications for understanding and reconstructing the stratigraphy and taphonomy at the site.

10.4.2 Discussion of Geoarchaeological Significance from Trenching

The Anderson test locale occurs on the eastern edge of the Anderson site, a large archaeological site with components believed to be stratified within a dune that was periodically active during the Holocene. The trenching data provide little or no evidence to support the contention that the Anderson site occurs within an eolian stratified context. This is true even for trenches excavated near the top of the Anderson dune (i.e., Trench 2). Although some eolian reworking may have occurred, this investigation suggests that it was probably confined to the late Wisconsinan or very early Holocene.

Sub-plow zone archaeological materials, which based on ceramic typology include Middle and Late Woodland artifacts, were recovered from the first trench excavated, as well as all but one of the subsequent trenches. Stratigraphically and sedimentologically, the test locale consists mainly of glacio-fluvial or glacio-lacustrine sands that grade upwards into a thin veneer (i.e., ca. 70 cm to 120 cm [27.6 in to 47.2 in]) of possible eolian silty sand. This upper sand is typically massive and includes no evidence of bedding, grading, or other sedimentological indicators. Additionally, no evidence of periodic reactivation of the dune, such as buried soils that may represent stable occupational surfaces, or at least suggest depositional hiatuses, was noted in any trench. Regardless of origin and context, the prehistoric cultural materials and associated possible features occur within this upper sand and, interestingly enough, are generally concentrated near either the top or bottom of this zone.

The age of charcoal recovered in association with the artifacts or features from the upper meter range from 210 BP to 1170 BP (Beta-200792 and Beta-200797, respectively; Appendix D). These dates are in general agreement with the presence of Late Woodland material from the site, but are significantly younger than implied by the abundant Middle Woodland ceramics found associated with the 1170 BP charcoal from Trench 2. This time discrepancy highlights the problems and uncertainty of the Anderson site formation and stratigraphy raised by this investigation. For example, although much of the cultural material found within the test locale, particularly in Trench 2, was clearly found below the plow zone, the depositional processes that actually buried them are not clearly evident.

Essentially, sub-plow zone artifacts at the Anderson test locale were buried either by natural eolian dune or sand-sheet sedimentation or by bioturbation and cultural turbation (biomantle) processes (Johnson 1989, 1990, 1992; Johnson and Balek 1991; Johnson and Watson-Stegner 1990) (Figure 10.4.1-4). Which of these dominate at Anderson has important ramifications for understanding and reconstructing the stratigraphy and taphonomy at the site. For example, eolian burial implies that the original contexts and relationships of artifacts and features were maintained and the occupation horizon was merely buried and preserved by a depositional event. Biomantle site burial, on the other hand, implies that sediment has not accreted on the site since occupation and the current ground surface is the same as it was during site occupation. The artifacts were introduced into the subsurface long after site abandonment by on-going soil mixing processes. From an archaeological perspective, site burial through eolian processes creates an in situ buried or stratified site. Sites buried by biomantle processes, on the other hand, have mixed cultural and stratigraphic contexts. Although they can mimic in situ stratified sites, they are actually disturbed and lack contextual integrity. Distinguishing these types of sites from one another is important for assessing the potential for the site to provide information relevant to our understanding of the past and, in turn, its National Register eligibility.

Biomantle site burial involves recycling of subsurface sediment upward mainly by worms and insects, but also, as may have occurred at Anderson, larger mammals such as gophers (Figure 10.4.1-4). As these organisms burrow and displace soil to the surface from deeper in the profile they progressively “lower” the surface soil horizon with its associated cultural material and effectively bury it by placing the subsoil on the ground surface (Johnson 1990, 1992). In addition, voids created by animal burrows or large roots may fill in via gravity and sheet-washing with near-surface sediments including archaeological debris. Clear evidence of extensive disturbances of the upper meter of sediment was noted at the Anderson test locale in nearly all of the trenches, suggesting that bioturbation is an important site taphonomic process at the site (Figure 10.4.1-4). Constraints on the maximum depth of such soil cycling, however, is indicated by the fact that well-developed Fe-cemented (spodic B) horizons and partly cemented soil lamella were clearly formed below about 1 m (3.3 ft) in each of the trenches. This observation suggests that if the biomantle process occurred at the Anderson site, like the distribution of artifacts, it was apparently confined to the upper ca. 70 cm to 100 cm (27.6 in to 39.4 in) (within the A and E soil horizons; Figures 10.1-1, 10.4.1-2, and 10.4.1-3). Moreover, the fact that concentrations of artifacts present within the profiles commonly occur near the base of these E-horizons and just above the depths at which soil lamella start (i.e., Trenches 2, 5 and 6), may reflect the development of a stone line-like feature that commonly results from the biomantle process (Johnson and Balek 1991; Johnson and Watson-Stegner 1990).

Cultural turbation processes may have buried subsurface artifacts within the Anderson test locale, as well (Monaghan and Hayes 2001; Monaghan and Lovis 2005). Instead of a post-depositional/post-occupational process implied by biomantle turbation, the cultural turbation mechanism maintains that artifacts become buried through cultural processes and the burial events are syn-depositional and syn-occupational. Essentially, artifacts that appear to lie buried in the subsurface of the site actually mark the base of cultural features whose expression in the soil profile is so thoroughly disrupted by cultural and natural soil formation processes or so old and ephemeral that they can no longer be discerned. This is particularly common in well-drained, sandy soils. Unlike biomantle burial, however, the associated subsurface artifacts are actually in place and were buried by cultural processes that are integral to the site itself (i.e., pit feature construction). The older the cultural features or the more intensive the weathering process (i.e., rapid leaching and oxidation in excessively well-drained sand), the less clear such features will be in a soil profile. Additionally, through time, feature construction often will displace older artifacts and, therefore, mask or confuse cultural stratigraphy. Monaghan and Hayes (2001) have referred to this as the "mixing midden" site formation process.

10.5 RESULTS OF ARCHAEOLOGICAL INVESTIGATION

10.5.1 Previous Investigations at the Anderson Site

The Anderson site is large (75 ac [30 ha]) and includes many different ecological settings including dune, shoreline, and riverine. The Anderson test locale occurs near the southwestern margin of the site. The site area has long been known as archaeologically rich, and artifacts have been collected since the end of the nineteenth century. Flaskerd (1943:5) indicated that the Anderson family collected thousands of artifacts from the site, including large fragments of ceramics, some of which comprise nearly complete vessels, and an estimated 3,000 complete stone artifacts. The buried, possibly stratified, nature of the site, however, was not known until 1932 when road crews began collecting artifacts from well below the surface during the construction of a road grade through the site. This, and the richness of the site, came to the attention of professional archaeologists at the University of Minnesota (Kruse 1943; Wilford 1937). As a result, professional excavations by the University of Minnesota were conducted at the site in the 1930s and 1940s (Johnson 1974; Wilford 1937), as well as during the 1970s by the Minnesota Historical Society during highway construction (Anfinson 1979a, 1979b; Harrison 1977). The earlier investigations by Wilford (1937) discovered an up to 4.5 ft (1.4 m) thick cultural sequence stratified within eolian sand deposits. He also indicated that the majority of cultural material occurred within an "occupation layer" that lay within about 3 ft (90 cm) of the surface and that this horizon was rapidly buried by eolian processes. Details of these investigations at the Anderson site, as well as the site's significance to Minnesota archaeology, are discussed in detail in Chapter 3.0.

10.5.2 Current Investigations at the Anderson Site

The stratigraphy identified at the Anderson test locale by the coring and the backhoe trenching presented a different situation than that encountered at the other test locales containing archaeological deposits. Unlike the Clement, Fritsche Creek, and Hoff Deep test locales and with only a single exception, no clearly defined target horizons were identified at the Anderson test locale. Rather, the stratigraphy at the site identified by the current investigations and Wilford's (1937) earlier investigations indicate that the archaeological deposits are contained within a single, massive, relatively thick (ca. 1 m [3.3 ft]) zone of sand to silty fine sand. The coring phase of the investigations did not identify any buried soils within the limits of the test locale. With the exception of the demonstration of augering at Core 1, no other core locations were investigated archaeologically. However, a systematic surface collection was conducted.

The locations of individual artifacts were generally assigned to an individual 20 m × 20 m (66 ft × 66 ft) grid block, although slightly less than half of the 138 artifacts collected from the surface were piece-plotted. Most of the piece-plotted artifacts are of prehistoric origin.

The test unit excavation phase of these investigations was geared toward obtaining additional information that would assist in developing an understanding of the various cultural and natural site formation processes occurring at the site and how the cultural material came to lie in its current configuration. The selection of the backhoe trenches for test unit placement was based on the potential presence of cultural features and the relative degree of bioturbation evident in the trench walls. Thus, Trenches 1, 2, and 6 were selected for test unit excavation (Figures 10.5.2-1a. 10.5.2-1b, and 10.5.2-1c). The placement of a test unit off of Trench 6 also provided an opportunity to obtain a controlled sample from the middle portions of the test locale. No test units were excavated off of Trenches 3, 4, and 5 due to the presence of the high amount of rodent activity observed.

In all of the test units the plow zone was removed as a single level and was not screened because of its disturbed nature. Because the mechanism for the burial of the cultural material (i.e., natural or cultural processes, or some combination thereof) was not clear, the archaeological field team excavated the test units in 5 cm (2 in) levels rather than 10 cm (4 in) levels, as was the case at the other test locales. The field team hoped that this would provide finer control of the vertical distribution of cultural material.

Test Unit 1, located at the southern end of Trench 1, exhibited a relatively simple stratigraphic profile (Figure 10.5.2-1a). Eight arbitrary 5 cm (2 in) levels reaching a depth of 78 cm (31 in) below surface were excavated in this test unit. Three primary stratigraphic horizons graded from a mottled-brown fine sand, to pale-brown to light yellowish-brown fine sand, and ultimately to a very pale-brown fine sand in the basal 20 cm (8 in) of the test unit. Except for the base of the plow zone, which had a sharp lower boundary, the boundaries between each of the stratigraphic horizons were diffuse. Small amounts of lithic debris and fire-cracked rock were present in all but the final two excavation levels of this test unit.

Two test units were placed adjacent to Trench 2, located at the highest part of the Anderson site landform within the test locale. Similar to Trench 1, this trench also intercepted a possible cultural feature. Test Unit 2, therefore, was placed in the west wall of the trench to intercept Feature 2004-2. The other test unit, Test Unit 3, was placed 1.4 m [4.6 ft] to the south to examine a portion of the soil profile that was not disturbed by prehistoric pit-digging.

Test Unit 2 was primarily comprised of Feature 2004-2. Although a faint indication of the feature's edge appeared at the base of the first screened excavation level, it was not clearly defined until a depth of about 25 cm (10 in) below the base of the plow zone/subsoil interface. The profile of the feature indicated that it was a relatively large, deep, possibly basin-shaped pit with gently sloping walls that extended to a depth of 83 cm (32.7 in) below surface, or about 48 cm (18.9 in) below the base of the plow zone/subsoil interface (Figure 10.5.2-1a). The feature matrix consisted of a heavily mottled grayish-brown and brown fine sand, and the boundaries were diffuse and ephemeral, a situation compounded by the extensive bioturbation

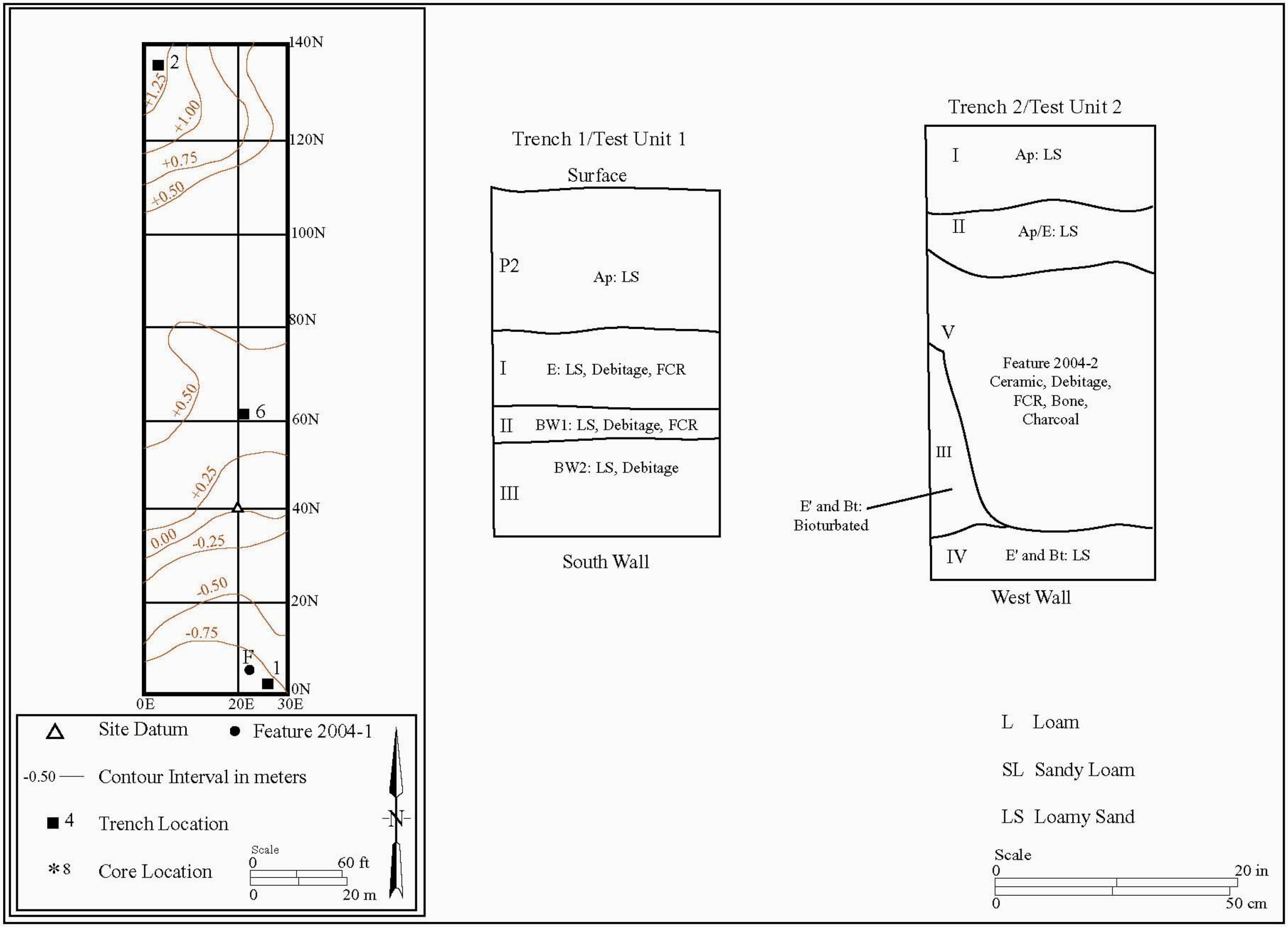

Figure 10.5.2-1a. Comparative Trench/Test Unit Profiles, Anderson Test Locale

(i.e., rodent activity) within the feature and in the surrounding Stratum III soil matrix. As a result, it was not possible to define the northern edge of the feature and obtain a width measurement. A radiocarbon date of 1170±40 BP (Beta-200797; two sigma calibrated age A.D. 970 to A.D. 1110) indicates that the age of the feature is Late Woodland. Test Unit 2 contained the greatest quantity of prehistoric artifacts of any of the test units excavated at the site; the majority of these artifacts occurred within Feature 2004-2.

Test Unit 3, also located in the west wall of Trench 2, exhibited a stratigraphic sequence that contained extensive evidence of bioturbation in the form of rodent burrows. Ten arbitrary 5 cm (2 in) levels were excavated below the base of the plow zone. The sediments in this test unit graded from a mottled brown fine sand. to a mottled pale-brown fine sand, and ultimately into a very-pale brown fine sand in the basal 20 cm (8 in) of the profile. All of the boundaries between the strata were diffuse and poorly defined. Stratum IV, at the base of the excavated sequence, was the only horizon that was not extensively disturbed by rodent activity. Cultural materials were recovered to a depth of 70 cm (28 in) below surface, or about 35 cm (14 in) below the base of the plow zone, and consisted primarily of fire-cracked rock, although small amounts of lithic debris and prehistoric ceramics were also present (Appendix E).

Test Unit 4 was placed in the east wall toward the southern end of Trench 6. Reaching a maximum depth of 110 cm (43 in) below surface, this was one of the deepest test units excavated at the site. Twelve arbitrary 5 cm (2 in) levels were excavated in Test Unit 4, which revealed five stratigraphic horizons including the plow zone (Figure 10.5.2-1b). The color and texture of the stratigraphic horizons were similar to that exposed in the other test units excavated at the site. Once again, the boundaries between the horizons were diffuse and poorly defined and a moderate amount of bioturbation was evident in Strata II and III. Cultural material, primarily in the form of fire-cracked rock, was present in every excavation level in this test unit. A small amount of lithic debitage and several prehistoric ceramic sherds were also recovered from this test unit.

Two additional soil anomalies were observed during trenching. Feature 2004-3, was located in the east wall of Trench 3 and consisted of a small concentration of charcoal. Upon closer inspection it had no clear boundaries, and no associated prehistoric artifacts were present. The field team concluded that this anomaly was not cultural.

Another possible cultural feature was observed in the eastern wall of Trench 1 toward its northern end. This sub-plow zone soil anomaly was designated Feature 2004-1 (Figure 10.5.2-1c). It consisted of a shallow basin-shaped depression that was in-filled with two distinct, stratigraphically superimposed zones. Since the feature was intercepted by the backhoe trench, the shape of the feature in plan is not known, although based on its profile it was probably either circular or ovoid in shape and at least 83 cm (32.7 in) in length. A small portion of the northern end of the feature was lost as a result of a partial collapse of the trench wall. The upper zone of the feature, Zone A, was an approximately 12 cm (4.7 in) thick zone of mixed and mottled grayish brown and yellowish brown loamy sand, while the lower zone, Zone B, was an approximately 13 cm (5 in) thick zone of mottled brown and yellowish brown loamy sand along with moderate amounts of small charcoal flecking. Although a smoothed prehistoric ceramic

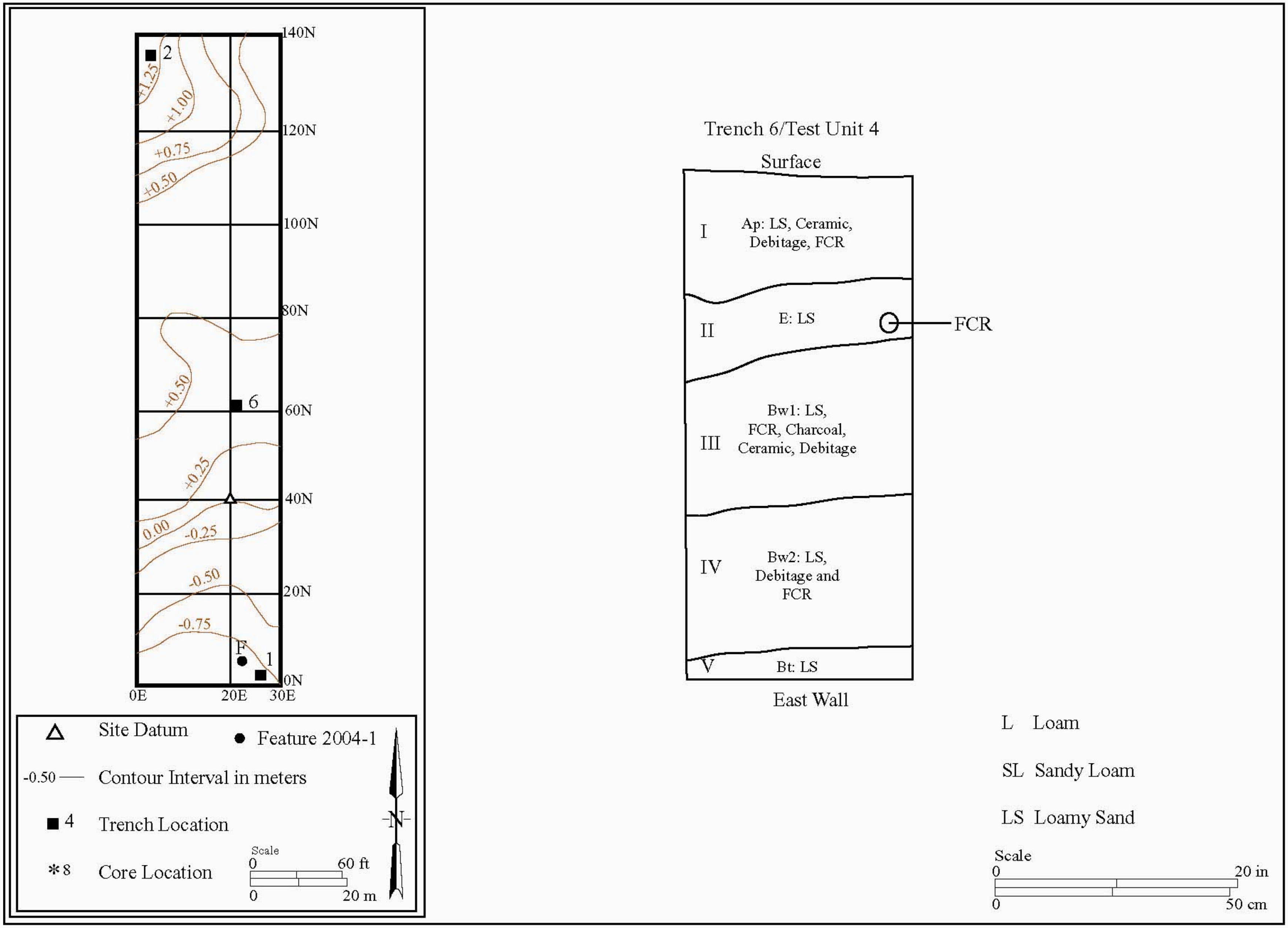

Figure 10.5.2-1b. Comparative Trench/Test Unit Profiles, Anderson Test Locale

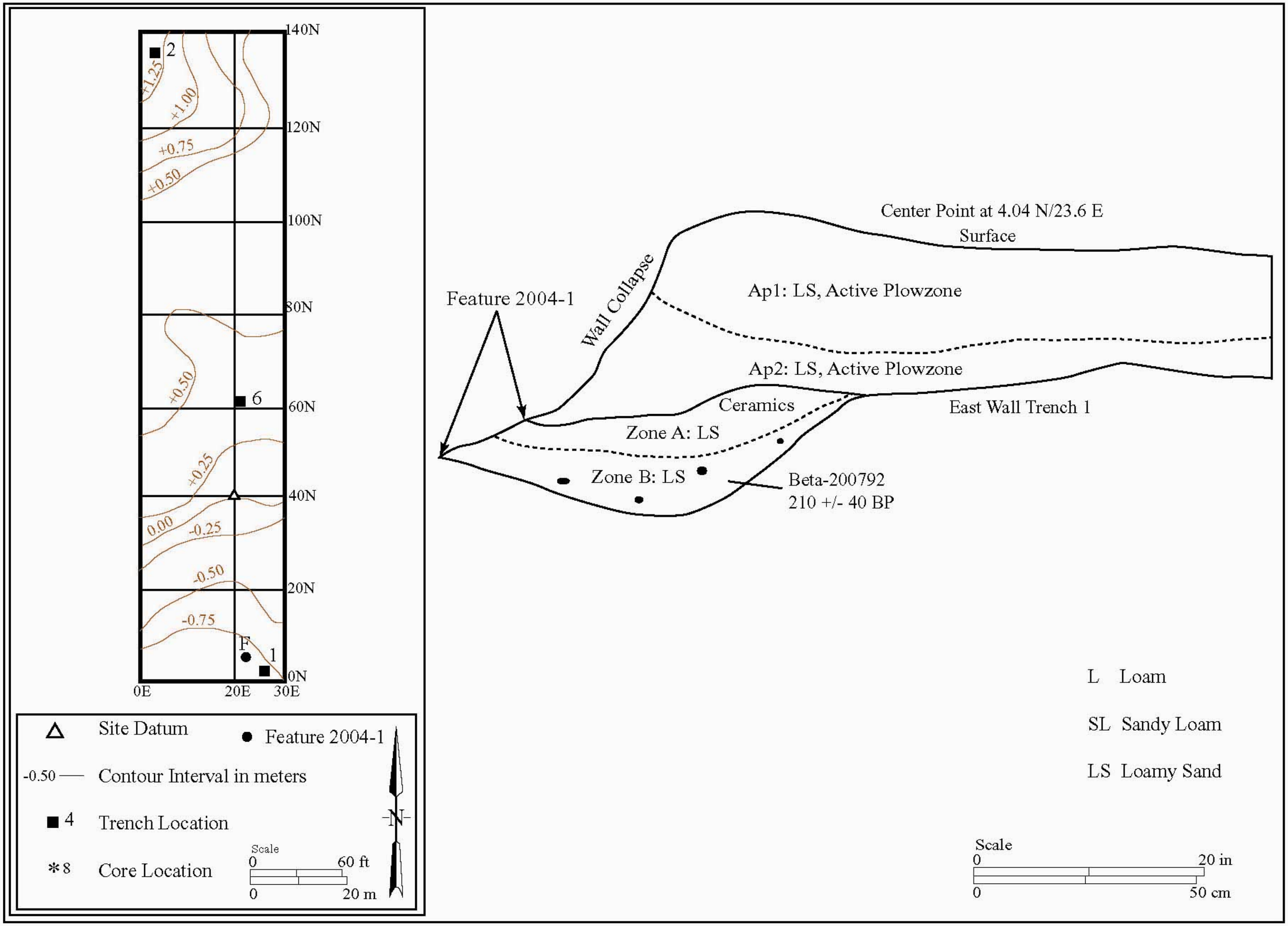

Figure 10.5.2-1c. Trench 1/Feature 2004-1 Profile, Anderson Test Locale

sherd was present in the feature, the sharpness of the feature's boundaries and the 210± 40 BP (Beta-200792; 2 sigma calibrated age A.D. 1640 to A.D. 1690; A.D. 1730 to A.D. 1810, A.D. 1920 to A.D. 1950) radiocarbon date from Zone B indicates that it is a recent disturbance and not associated with the prehistoric occupation.

10.5.3 Artifact Assemblage

Prehistoric Assemblage

The prehistoric artifact assemblage from the Anderson test locale includes 38 ceramic sherds, six formal and expedient chipped stone tools, one core, 92 pieces of debitage, 117 pieces of fire-cracked rock, and one piece of bone from a sub-plow zone context in Test Unit 2 (Table 10.5.3-1; Appendices E and F). Bone collected from the surface is considered to be of indeterminate cultural association. The lithic and ceramic assemblages are described in detail, below.

Table 10.5.3-1 Prehistoric Artifact Assemblage from Anderson Site (21AN0008)

Artifact Type	Frequency
Ceramic Rim Sherd – Howard Lake Phase	3
Ceramic Rim Sherd – Late Woodland	2
Undecorated or Exfoliated Body Sherds – Middle Woodland	31
New Impressed Body Sherd – Middle Woodland or Early Woodland	1
Projectile Point – Notched Triangular Point – Late Woodland	1
Projectile Point – Turkey Tail – Late Archaic/Early Woodland	1
Drill	1
Biface	1
Biface Fragment	1
Piece Esquillee	1
Edge-damaged Flake	1
Core	1
Debitage	92
Fire-cracked Rock	117
Bone	1
Total	**255**

Ceramics

The ceramic assemblage consists of 38 sherds (152.2 gm) and includes five rims and one decorated neck sherd. The remaining 32 fragments are undecorated or exfoliated body sherds exhibiting a narrow range of exterior surface treatments. Three of the rims and decorated sherds are associated with the Middle Woodland Howard Lake phase occupation of the site, and the other two are associated with the Late Woodland component (Figure 10.5.3-1).

With a single exception, the undecorated body sherds also are associated with the Middle Woodland component. The exception has a distinctive surface treatment type and may be associated with an earlier Middle Woodland or possibly Early Woodland component at the site.

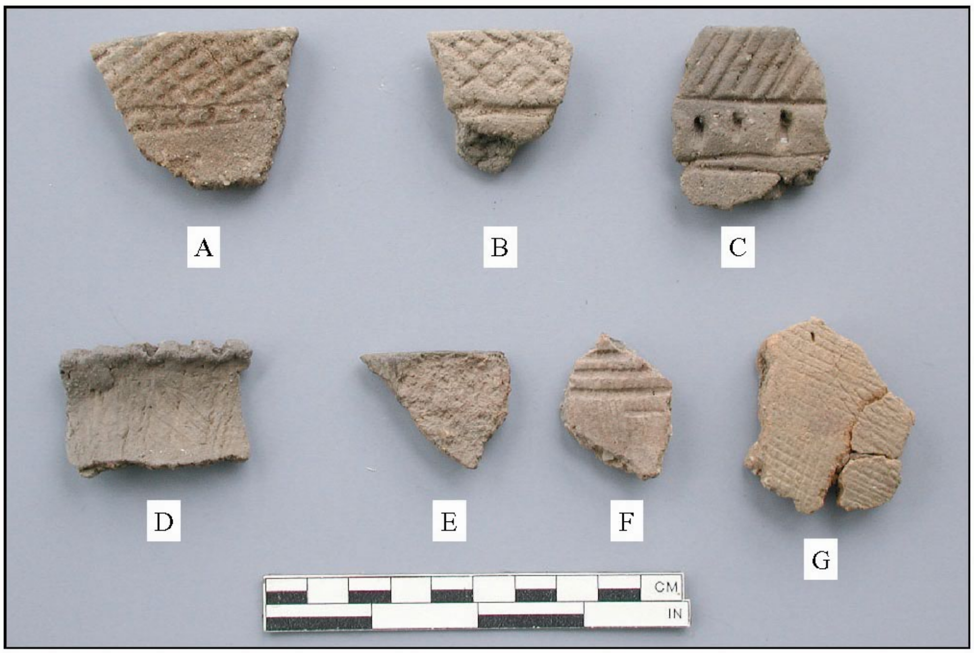

Figure 10.5.3-1. Diagnostic Ceramic Rim, Decorated, and Body Sherds from the Anderson Test Locale

Two of the rim sherds exhibit crosshatched and zoned decorations. The first one, recovered from Level 10 of Test Unit 3, is a straight rim with a flattened, smoothed lip that is 9.5 mm thick. The exterior of the rim is decorated along the upper part with a band of fine crosshatching that is underlain by a narrow horizontal zone defined by two parallel incised lines (Figure 10.5.3-1A). A single row of closely spaced punctates, possibly made with the end of a plain paddle, fill the linear zone below the crosshatching. The second crosshatched rim has a slightly cambered profile and a smoothed lip with an interior bevel (Figure 10.5.3-1B). On this rim, the band of crosshatching is bordered by a single deeply incised horizontal line. Additionally, the interior margin of the lip is decorated with a series of short, closely spaced, plain tool or paddle edge impressions. Both of these sherds exhibit relatively thick walls (9 mm-10.5 mm thick) and moderately compact to compact silty pastes that are tempered with moderate amounts of crushed granitic grit.

The two crosshatched rims reflect the stylistic influence of southern Havana Hopewell ceramics extending up the Mississippi Valley into southeastern Minnesota. Typological placement of these rims is hampered not only by the fact that they are broken just below the base of the rim and the crosshatched decoration, but also by varying definitions of what constitutes and differentiates Havana-related Middle Woodland ceramics in southern Minnesota. For example, in his analysis of the Middle Woodland ceramics from the Brower site in Mille Lacs County, Gibbon (1975:17) characterizes Howard Lake ceramics as including "interiorly beveled lips, cross-hatched incised rims, incised zoning, cord-wrapped stick stamping, alternating bosses and punctates, and dentate and incised lines in alternate area patterns." However, using the ceramics from the Anderson site and the Howard Lake site (21AN1), Anfinson's ([ed.] 1979:95-101) definition of Howard Lake phase ceramics emphasizes the occurrence of interior beveled lips and exterior decoration composed of straight dentate stamps, ovoid stamps, trailed lines, and bosses on a smooth surface, while lip and interior rim decoration is usually executed with a dentate stamp or a cordwrapped stick. Crosshatching is not noted in this definition of Howard Lake phase ceramics. The use of crosshatching on the upper rims, however, is a characteristic associated with Sorg phase ceramics, although the occurrence of interior beveled lips is not indicated for these ceramics (Anfinson [ed.] 1979:197-202). In fact, the illustration of a rim of the provisional type Sorg Banded, Trailed (Anfinson [ed.] 1979: Figure 91b) bears close resemblance to one of the crosshatched rims from the Anderson test locale. Anfinson ([ed.] 1979:96) also notes the presence of some other flat-lipped rims with bands of crosshatched trailed lines in the Anderson collection. These rims could be classified as Sorg ceramics, which were used to develop the type definition of Howard Lake phase ceramics.

A third Middle Woodland rim from the Anderson test locale is associated with Howard Lake phase ceramics. It has a straight rim with a smooth flat lip that is decorated with shallow, narrow, closely spaced plain tool impressions (Figure 10.5.3.1C). The exterior of the rim is decorated with a band of closely spaced, oblique right-incised or trailed lines along the top of the rim. This band is underlain by a linear zone that is set off by two parallel incised lines, with the zoned area containing a horizontal line of plain tool or paddle corner punctates. The beginning of a third incised line angling downward from this linear zone may indicate the presence of a second zoned area on this vessel. The paste and temper characteristics of this rim are the same as the crosshatched rims from the site.

A fourth rim from the site is associated with the Late Woodland component at the Anderson site. It is an undecorated, moderately everted rim with a smooth flattened lip that is slightly thickened and decorated with a series of closely spaced transverse cordwrapped stick edge impressions (Figure 10.5.3-1D). Heavily smoothed cordmarking is present on the exterior of the rim and neck. The interior of the rim is also decorated with a series of long, linear, knotted cord impressions that begin slightly below the interior margin of the lip. The vessel is well made, uniformly thin (4.4 mm), and has a compact silty paste that is tempered with moderate amounts of crushed quartzitic grit. Broad similarities can be found between this rim and vessels of the Kathio phase (Anfinson [ed.] 1979:103-107).

A second untyped rim sherd is associated with the Late Woodland component of the Anderson site. This sherd also has a flat smoothed lip, but most of the exterior surface is exfoliated. The small remnant of the exterior surface that is present is suggestive of either a vertically cordmarked or smoothed cordmarked exterior surface treatment (Figure 10.5.3-1E). The rim appears to be slightly everted. It has a compact silty paste that is tempered with small amounts of medium and finely crushed quartzitic grit.

In addition to the above described rim sherds, one decorated neck sherd in the assemblage also is associated with the Middle Woodland occupation of the site. This sherd (Figure 10.5.3-1F) is from a vessel with a slightly constricted neck. It is decorated with a series of four parallel, horizontal-incised or trailed lines. After the lines were executed, the exterior surface of the vessel was vertically brushed or combed with a fine tool. Interestingly, the brushing extends into the bottom of the trailed lines. The sherd is 7.3 mm thick and has a compact sandy paste that is tempered with a small amount of coarse granitic grit.

The remaining 32 sherds recovered from the Anderson test locale are either undecorated or their exterior surfaces are exfoliated. Cordmarked exteriors are the most common type of exterior surface treatment, with 12 cordmarked specimens representing 31.6 percent of the ceramic count and 16.8 percent of the aggregate ceramic weight. Body sherds with completely smoothed exteriors are only slightly less frequent, with a total of 10 specimens or 26.3 percent of the sherd count and 16.7 percent of the sherd weight. An additional three body sherds, comprising 7.9 percent and 2.0 percent of the sherd count and weight, respectively, have smoothed-cordmarked exteriors, while a single sherd has a net impressed exterior (Figure 10.5.3-1G). The exteriors of the remaining six sherds, or 15.7 percent of the sherd count and 2.3 percent of the sherd weight, are exfoliated. Most of these latter sherds consist of tiny fragments.

Examination of the surface treatment types in conjunction with sherd thickness, paste, and temper attributes in this small assemblage suggests some temporal trends. With a single exception, the cordmarked sherds exhibit moderately compact to compact silty pastes. Additionally, most of these sherds are tempered with low to moderate amounts of fine to medium felsic grit temper. They tend to have relatively thin walls measuring between 3.5 mm and 5.0 mm thick. These characteristics suggest that most of the cordmarked sherds are associated with the Late Woodland component at the site. The single exception is one relatively thick (7.5 mm) cordmarked sherd with a moderately compact sandy paste tempered with moderate amounts of coarse felsic grit that is likely associated with the Middle Woodland component. The smoothed cordmarked sherds exhibit similar characteristics as the majority of the cordmarked body sherds, and they too are probably associated with the Late Woodland component at the site.

In contrast, using these same attributes, the smoothed body sherds appear to be a mix of Middle Woodland and Late Woodland sherds. Seven of the smoothed sherds exhibit moderately compact to compact silty pastes, while the other three sherds exhibit sandy pastes. No appreciable differences are noted in the tempering characteristics of these sherds. Three of the sherds are relatively thin, with wall thicknesses measuring between 2.8 mm and 4.8 mm, while the remaining smoothed sherds are noticeably thicker, measuring between 5.6 mm and 8.5 mm thick. On the basis of sherd thickness it is suggested that the former sherds are associated with the Late Woodland component, while the latter sherds are associated with the Middle Woodland occupation of the site.

The final body sherd in the ceramic assemblage exhibits a net impressed exterior surface (Figure 10.5.3-1G). The sherd is 10.4 mm thick and has a moderately compact, sandy paste containing only a small amount of medium felsic grit temper. Most net impressed ceramics in the region are typically associated with Brainerd ware. Originally defined by Johnson (1971) at the Gull Lake site, Brainerd ware was initially believed to date to the late Middle Woodland period (Anfinson [ed.] 1979:45-50). More recent calibrated radiocarbon data, however, indicate that Brainerd ware appeared sometime after about 3550 BP, peaking in frequency around 2750 BP, and then rapidly declining after 2350 BP (Hohman-Caine and Goltz 1995). In a response to Anfinson's ([ed.] 1979) characterization of Brainerd ware, Neumann (1984) argued that Brainerd Net Impressed and Gull Lake Net Impressed could be differentiated on the basis of the manner in which the net impressions were created and that Brainerd ware should continue to be associated with the Middle Woodland period. Unfortunately, the impressions on the net impressed sherd from the 2004 investigations at the Anderson test locale could not be so classified. Nevertheless, the presence of a diagnostic Early Woodland projectile point fragment from the current investigations, as well as other Early Woodland points from earlier investigations (Flaskerd 1943, 1944; Wilford 1937), certainly leave open the possibility for the occurrence of Early Woodland ceramics at the site.

<u>Lithics</u>

The lithic assemblage includes six formal and expedient chipped stone tools, one core, 92 pieces of debitage, and 117 pieces of fire-cracked rock with an aggregate weight of 3.5 kg (7.7 lb) (Appendix E). The chipped stone tools from the site include one complete and one fragmentary projectile point, a probable drill fragment, a biface fragment, a probable piece esquillee or wedge, and an edge damaged flake. The attributes of the tools and core are briefly described, as is the debitage assemblage from the site.

The sole complete projectile point from the site was recovered from the surface and is associated with the Late Woodland component. It is a small, well-made triangular projectile point with a thin lenticular cross section and a slightly incurvate base that has been notched (Figure 10.5.3-2A). The notches consist of small unifacial side notches, which are barely perceptible and only 1 mm deep, placed approximately midway up the sides of the projectile point. It is made

Figure 10.5.3-2. Chipped Stone Tools from the Anderson Test Locale

from Cochrane chert, a generally low quality chert the use of which is largely restricted to southwest Wisconsin and southeast Minnesota (Bakken 1997; Bozhardt 1998). The projectile point is 24.2 mm long, 16.6 mm wide, and 4.1 mm thick. The second projectile point from the site is a small, proximal fragment of a Turkey Tail point made from Wyandotte chert, or Indiana Hornstone, that was collected from the surface (Figure 10.5.3-2B). Consisting only of the "tail" portion of the tool, it is too fragmentary to collect any meaningful descriptive attributes. Turkey Tail points are diagnostic of Late Archaic/Early Woodland transition and generally date to the period between about 3500 BP and 3000 BP (Justice 1987:173-179).

A proximal fragment of a probable drill was also collected from the surface of the Anderson test locale. Although most of the bit is missing, it has an expanded ovate to subrectangular haft element with straight lateral edges and an excurvate base (Figure 10.5.3-2C). It is made from a broad, short, side-struck, unfaceted flat secondary flake of Prairie du Chein chert. The cross section is wedge-shaped and flaking of the tool is limited to short, marginal retouch along the lateral edge of the haft and bit. It has a fragmentary length of 34.6 mm with a haft length of 23.9 mm, a maximum width of 20.6 mm, and a thickness of 8.3 mm.

The only biface in the lithic assemblage is a small medial lateral edge fragment that was recovered from the surface of the site (Figure 10.5.3-2D). The shape of the biface is indeterminate, but it does have a plano-convex cross section. The final flaking of the biface is refined and well executed, and it is made from a high quality, semi-translucent very dark gray and black quartz of unknown origin. It has fragmentary measurements of 21.6 mm in length, 19.5 mm in width, and 6.8 mm in thickness. The quality of the final retouch suggests a Middle Woodland rather than a Late Woodland affiliation for this tool fragment.

A possible piece esquillee, or wedge, was collected from the surface of the site. This tool consists of a small ovoid unfaceted flat secondary flake with a biconvex cross section that is made from opaque white quartz. Evidence of bipolar battering subsequent to the flake removals from the core occurs on both ends, but both the brittle nature of quartz and its refractive qualities prohibit a definitive attribution to the origin of this damage. The specimen measures 13.7 mm in length, 13.3 mm in width, and 4.4 mm in thickness.

The final chipped stone tool in the lithic assemblage is an edge-damaged flake. Recovered from Feature 2004-2, this is the only tool in the lithic assemblage that was not collected from the surface of the site. It consists of a rectanguloid, faceted, flat secondary flake with a thin plano-convex cross section. The distal end of the tool is missing. It was heavily used and edge damage in the form of edge nibbling, steep conchoidal scarring, and heavy rounding is present along all of the intact edges. The nature of the edge damage suggests that it was used for a combination of cutting and scraping tasks. The tool has a fragmentary length of 25.3 mm, is 18.4 mm wide and 2.3 mm thick, and is made from a high quality, lustrous, mottled white and very light gray chert that is visually reminiscent of Burlington chert from the Illinois Valley region.

The core is a split cobble with an ovoid shape and cross section. It is made from a fist-sized siltstone cobble that was split approximately in half (Figure 10.5.3-3). Several flakes were then removed from the interior face to prepare a striking platform. The core was discarded after a.

Figure 10.5.3-3. Cobble Core from the Anderson Test Locale

single, thin decortication flake was removed from one face. The core measures 68.1 mm in length and is 87.1 mm wide and 62.1 mm thick..

The debitage assemblage totals 92 flakes, flake fragments, and pieces of shatter. The composition of the debitage assemblage indicates both an emphasis on the middle to later, final stages of lithic reduction and core reduction activities. Blocky secondary flakes (n=16) and unfaceted flat secondary flakes (n=24) derived from core reduction activities comprise 17.4 percent and 26.1 percent of the debitage, respectively. In contrast, the early stages of lithic reduction are limited to a single small piece of shatter and four decortication flakes. Together these two classes of flaking debris comprise only 5.4 percent of the debitage from the site.

Debris derived from bifacial reduction is limited to 18 flakes, or 19.6 percent of the debitage assemblage (Appendix F). These flakes tend to be small and are primarily the result of tool finishing and resharpening activities as all are less than 20 mm in maximum dimension. Unlike the other classes of chipping debris, most of the faceted flat secondary flakes are chert, predominately Prairie du Chein chert, which is represented by 10 flakes. Other raw materials, represented by one or two flakes each, include Burlington chert, *affinis* Burlington chert, possible Grand Meadow chert, and Knife River flint. Only two of the faceted flat secondary flakes are made of quartz, and only a single flake is made of orthoquartzite.

The 29 flat secondary flake fragments account for 31.5 percent of the chipping debris from the site. The majority of these flakes are made of quartz (n=13), quartzite (n=4), or orthoquartzite (n=5). The brittle nature of these raw material types is a significant contributing factor to the relatively high proportion of broken flat secondary flakes in the assemblage.

Although a wide array of raw material types is represented in the lithic assemblage, locally available materials predominate. The two most frequently occurring raw materials are quartz, which accounts for 37 percent of the chipping debris, and Prairie du Chein chert, which accounts for 33 percent of the chipping debris. As noted previously, the occurrence of Prairie du Chein chert is closely tied to biface finishing and resharpening activities. Quartzite and orthoquartzites are the next most frequently occurring raw materials, although they number only six (6.5 percent) and seven (7.6 percent) specimens, respectively. Other locally available raw materials occur in only trace amounts and include two flakes of possible Grand Meadow chert, one flake of miscellaneous glacial chert, one flake of Tongue River silica, two flakes of jasper, one flake of silicified siltstone, and one flake made from slightly siliceous sandstone. The only non-local raw materials are two flakes of Burlington chert, four flakes of *affinis* Burlington chert, and a single flake of Knife River flint.

Historic Assemblage

A small assemblage of 25 historic period ceramic (n=12), glass (n=5), and metal and other miscellaneous historic period artifacts (n=8) was collected (Appendix E). With a single exception, all of this material was from the surface of the site. The only historic artifact that was not recovered from the surface of the test locale is a small fragment of undecorated white paste earthenware that occurred in Level 9 of Test Unit 4. This material dates to the late nineteenth and twentieth century use of the general site area and does not indicate the presence of a significant historic component at the test locale. In fact, it supports the contention that archeological materials at the site have been subject to bioturbation processes that translocate artifacts vertically.

10.5.4 Discussion of Archaeological Significance

The investigations at the Anderson test locale produced a modest assemblage of prehistoric artifacts and a small assemblage of historic period artifacts. With the exception of the one historic period ceramic sherd that was recovered from a sub-plow zone context, these artifacts are not considered further in this report.

The prehistoric artifacts from the Anderson test locale were recovered from both surface and sub-surface contexts. Most of the artifacts, including the majority of the most sensitive diagnostic artifacts, occurred on the surface of the site or in other disturbed contexts. Four of the five chipped stone tools, the core, about 70 percent of the debitage, 23 percent of the prehistoric ceramics, and 67 percent of the fire-cracked rock by weight were collected from the surface. Diagnostic artifacts predominately date to the Middle Woodland and Late Woodland periods. The prehistoric artifacts on the surface of the site formed a diffuse scatter of material that stretched across most of the test locale, with a slight concentration of material in the southern half. Additionally, one of the Middle Woodland crosshatched rims and one of the Late Woodland tool impressed rim sherds were collected from Trench 2 backdirt.

Cultural material recovered from the augering at Core 1 included one tiny exfoliated ceramic sherd from the plow zone and a small piece of possible fire-cracked rock. Only a small amount of prehistoric cultural material was recovered from Test Unit 1, and none of this material was temporally diagnostic. Recovered artifacts are limited to a single small ceramic sherd, seven pieces of debitage, and five fragments of fire-cracked rock with an aggregate weight of only 20.3 gm (0.7 oz). Because of the small number of artifacts it is difficult to draw any strong conclusions about the vertical distribution of cultural material in this test unit. However, it is worth noting that most of the material occurred in Stratum I, which lies immediately below the base of the plowzone, and that no artifacts occurred in the plow zone of this test unit. Artifacts from Stratum I include five of the flakes and five pieces of fire-cracked rock (15.9 gm [0.6 oz]). A single flake and one piece of fire-cracked rock (4.4 gm [0.2 oz]) were found in Stratum II and another flake in Stratum III. The small ceramic sherd was recovered at a depth of 47 cm (18.5 in). This small sherd has a smoothed exterior surface, but could not be definitively associated with either of the major Woodland components at the site.

The largest quantity of prehistoric cultural material occurred in Test Unit 2, which was located at the topographically highest part of the Anderson test locale. Prehistoric artifacts recovered include 21 ceramic sherds, or slightly more than half of the prehistoric ceramics from the investigations, one expedient flake tool, 10 pieces of debitage, and 25 pieces of fire-cracked rock weighing 406 gm (14 oz). Diagnostic artifacts are limited to the ceramics, and sherds tentatively assigned to both the Middle Woodland and Late Woodland components are represented.

Unfortunately, the most temporally sensitive ceramic sherds (i.e., decorated rim sherds) from this part of the site occurred in the backdirt of Trench 2 or other disturbed contexts in Test Unit 2.

Along with the single sherd from the plowzone, the 10 sherds from disturbed contexts comprise slightly more than half of the ceramics from this test area. The remainder of the ceramics, all but one of the flakes, and all but nine fragments of the fire-cracked rock (283 gm [10 oz]) came from within Feature 2004-2. Within this feature the greatest amount of material was found in the first excavation level, with a diffuse scatter of material continuing to its base. Although no rims or decorated sherds were found within the feature, a number of the body sherds are tentatively assigned to either the Middle Woodland or the Late Woodland component on the basis of paste and temper characteristics and sherd thickness. Assuming that these assignations are reasonable, it is interesting to note that the only two sherds assigned to the Middle Woodland component were in the first excavation level in the feature and that the sherds recovered from greater depths are all either assigned to the Late Woodland component or are indeterminate in terms of their age. This suggests that the deposits in this portion of the site have been "churned" or otherwise disrupted by cultural processes such as pit excavation (e.g., Feature 2004-2) during the course of the prehistoric occupation of the site.

Test Unit 3, which was also excavated at the Trench 2 locale, produced a much smaller amount of prehistoric cultural material. Included here are five ceramic sherds, two flakes, and 14 pieces of fire-cracked rock (155.8 gm [5.5 oz]). The vertical distribution of these artifacts in this test unit can be characterized as a diffuse scatter of material with no clear concentration within any particular excavation level. Four of the five ceramic sherds in this test unit are tentatively assigned to the two major components at the site. In this instance, both of the body sherds attributed to the Late Woodland component were found stratigraphically above the two probable Middle Woodland sherds. While this might suggest that there is some stratigraphic separation of the two components in this part of the site, the sample size is not sufficient to draw any definitive conclusions.

The amount of cultural material recovered from Test Unit 4 is also small. Artifacts recovered from this test unit included eight pieces of debitage, two ceramic sherds, 29 pieces of fire-cracked rock (541 gm [19 oz]), and a single historic whiteware sherd. As with Test Unit 3, the vertical distribution of cultural material did not exhibit any clear concentrations within any of the excavation levels and can best be characterized as a diffuse scatter of material throughout the profile. Although the presence of a historic whiteware sherd in Level 9 indicates the presence of some degree of more recent disturbance processes at this locale, it is nonetheless intriguing to note that the net impressed body sherd, which may be associated with either a Early Woodland or earlier Middle Woodland occupation of the site, occurred in Level 4, well below the only other sherd from this test unit, which is attributed to the Middle Woodland component.

10.6 SYNTHESIS AND INTEGRATION

The Anderson test locale proved to be a challenging, if not overtly frustrating, context for evaluating the efficacy of the deep testing methods. We expected relatively deep, stratified deposits, but what we discovered were shallow, sub-plow zone "mixed" deposits. Of all the test locales, Anderson was ideally suited to using geophysical methods of survey, as the data collected informs on both the geological and archaeological contexts. Most importantly from an archaeological standpoint, anomalies indicating the presence of possible cultural features were identified during the remote sensing survey. Nevertheless, the data were suggestive, not definitive, and further physical testing would be required to obtain confirmation of cultural association for the soil anomalies and geological signatures revealed by the geophysics data. Ironically, however, even hand excavations failed to definitively answer whether a suspected feature (Feature 2004-2) was indeed a pit feature or the product of other natural and/or cultural site formation processes.

Many questions related to the geophysical survey data became clearer once the geological structure was known. For example, even through the postulated archaeological features in the magnetic data layer were not tested, the data clearly indicate that large prehistoric pit features are probably present. While Feature 2004-1 was not apparent in the magnetic data, small magnetic highs were encountered in the vicinity of Trench 2, which revealed Feature 2004-2. In fact, this feature is actually located within a broad magnetic low and several other lows of similar size, shape, and intensity can be found within the survey area. Why such “features” would exhibit lowered magnetism is unknown (the expectation is that cultural activity is marked by magnetic highs, not lows, that are related to burning or concentrations fire-cracked rock, ceramics, etc.), but may reflect some sort of prehistoric cultural activity.

Located on a sand “dune” ridge, the Anderson test locale was particularly amenable to resistivity survey. For example, a resistivity high in the northern part of the test locale probably reflects the ca. 1-m (3.3-ft) thick E-horizon that also marks the zone of bio- and cultural turbation (Figures 10.4.1-3 and 10.4.1-4). This stratum continues through the mid-level resistivity band on the center of the survey area, but here it is much thinner, underlain by less resistive sand loam. It is also topographically lower and may have elevated soil moisture content in the more near-surface soil horizons. Similarly, the low resistivity area in the southern end of the grid coincides with the topographically lowest part of the site and, similarly, may reflect higher soil moisture or, alternatively, well indurated, Fe-rich Bt-horizons. The 1-m (3.3-ft) probe separation data layer clearly depicted the strata as modeled by the core and trench data. As with the other sites where geomorphology or pedology was successfully detected with resistivity, however, only general explanations (e.g., fluvial features, water table) could be offered. From the core and trenching data, we can now explain the nature of the fluvial or other features detected, and, by using multi-method geophysical survey results, we can actually map them in three dimensions.

Evidence of buried stacked subsurface horizons noted in the GPR survey became dubious when the results were compared with what was actually observed in trenches and core. For example, the GPR survey showed what was believed to be a “buried landscape” about 1 m (3.3 ft) below the surface and indications of eolian bedding (Figure 10.2.3-1). These generally included two distinct stratigraphic horizons shown by good reflectors in the “lower” landscape and poor reflectors in the “upper.” While this appeared sensible at first, once compared with the ground-truthed geomorphological data it became clear that what the GPR actually mapped were the zones of bio- and cultural turbation (poor reflectors) and iron-rich soil lamellae and Bt horizons (strong reflectors). Although the initial interpretations of the GPR survey were certainly reasonable, they were nevertheless incorrect.

The remote sensing survey data from Anderson illustrate the place that geophysical methods should have in the deep testing process. For example, the GPR data show how easy it is to misidentify subsurface stratigraphic contexts without knowing at least the general picture of its structure. The successes of the magnetic survey data in "finding" possible cultural features, on the other hand, demonstrates that remote sensing methods can, in the right circumstances, albeit incompletely, map the distribution of cultural features. Knowing the distribution of such features is of paramount importance for Phase II evaluations. Ultimately, the more knowledge we have concerning the general configuration of the subsurface in alluvial settings, particularly pertaining to the general stratigraphy and sedimentology, the better the geophysical interpretations will become by making use of converging lines of evidence. Thus, although the conclusions about the subsurface may have been mistaken, the GPR data do allows us the "map" the distribution of the top of the B-horizon or the "zone of bio- and cultural turbation" represented by the E- and EB-horizons across the site only when the GPR data are augmented by and combined with the trench and core data. While the uncertainties of remote sensing methods make their usefulness for deep testing as stand-alone methods questionable, combining trenching, coring, and remote sensing, even if at different stages in the deep testing process, can lead to a more complete reconstruction of the subsurface, a more informed interpretation of archaeological site formation processes, and a better research design to test the integrity, distribution of features, and archaeological significance of the buried components at the site.

Coring revealed no deeply buried soils or target horizons to test for archaeological content; yet, the cores did provide sufficient geomorphological information to conclude that 1) the depositional context is not likely eolian; 2) prehistoric occupation likely occurred at or near the modern surface; and 3) the presence of archaeological materials at appreciable depths below the plow zone is probably due to biological and pedological processes. With the exception of a demonstration of the augering method for project visitors, no augering was performed because no buried horizons representative of discernable stable paleosurfaces were discovered at Anderson. Does this mean a site like Anderson with a sub-plow zone component might be missed? Probably not, since artifacts, including diagnostic artifacts, are abundant on the surface at Anderson, and a Phase II evaluation almost certainly would be recommended. Had this site been located in a setting with inadequate surface visibility, Phase I shovel testing would also have revealed the presence of materials at depths of 30 cm (12 in) and greater. Thus, the likelihood of missing such a site is negligible. However, without the deep test process, the "deeply buried" component of the site might not be observed. If missed, it would have probably been discovered during Phase II evaluation of the site, but would have also been an unpleasant surprise to the investigators. If standard survey methodologies were employed in tandem with trenching, coring, and/or geophysical surveys, however, a clearer picture of the three-dimensional configuration of the site would have emerged.

As was the case for the coring, trenching did not reveal any paleosurfaces, but did discover that abundant artifacts and possible features existed in a sub-plow zone context. Like the coring data, the trenching data led to the conclusion that buried artifacts at the Anderson site (or at least this portion of the site) were not mainly buried by eolian processes. Rather, artifacts were probably introduced into the subsurface by a combination of cultural and bio-turbation processes (e.g., pit-digging, gopher burrows). Importantly, trenching also revealed the presence of possible pit features in Trenches 1 and 2. In fact, Feature 2004-2 in Trench 2 provided a ^{14}C date and became the target of Test Unit 2. As noted above, even hand excavations failed to discern if the feature was a cultural or natural phenomenon. Similarly, the distribution of artifacts in this and other test units failed to unequivocally demonstrate that the artifacts were not mixed. In fact, the ambiguity of both the artifactual and geomorphological data supports the conclusion that the deposits were mixed into the subsurface primarily by other than eolian processes.

The extent to which eolian, biomantle, and cultural turbation processes dominate at the Anderson site as a whole, however, is not clear from the deep test investigation. Because the site is so large (i.e., 75 ac [30 ha]) and culturally varied, any conclusions reached from our study may not apply to the site in general. Minimally, the previous assumption of site burial by eolian processes should be re-evaluated in light of these results. Little evidence of eolian site burial was observed and distinctive eolian bedding and other indicators of paleosurfaces, such as buried soils, heavy mineral lags on bedding planes, and distinct changes in sediment texture, are absent. Whether biomantle or cultural turbation processes dominate at the site, however, is also open to question. Even though bioturbation clearly has and continues to occur at the site (Figure 10.4.2-4), the data collected during this study are not sufficient to reach definitive conclusions. These investigations, however, do provide a basis for developing an explicit Phase II research strategy that could address the nature of the interplay between biomantle and cultural turbation processes at this site, as well as at other sites in similar geomorphic settings.