6.0 FRITSCHE CREEK II TEST LOCALE

6.1 INTRODUCTION AND BACKGROUND

The Fritsche Creek II test locale is located on an alluvial-colluvial fan along the northern margin of the Minnesota River in Nicollet County, just upstream from the city of New Ulm (Figure 3.3.1-1). At least some of the fan deposits are probably associated with Holocene deposition from Fritsche Creek. The uplands in the Fritsche Creek watershed consist of New Ulm till deposited by the Des Moines lobe about 15 ky BP (Wright 1972b). Ice retreated from the area by about 12 ky BP and the River Warren, which sometimes also included catastrophic discharge from glacial Lake Agassiz in the Red River Valley, incised much of the Minnesota Valley trench between 12 ky BP and 9.5 ky BP (Fisher 2004).

The size of Fritsche Creek II test locale was 40 m × 100 m (131 ft ×328 ft) and was oriented to sample various components of the alluvial fan and present Fritsche Creek floodplain (Figure 3.3.1-1). The topography varied greatly and included over 6 m (19.7 ft) of relief from the southeast to the northwest corner of the test locale (Figure 6.1-1). Soils mapped in the area of the sampling grid are the Minneiska sandy loam (mollic udifluvent) and the Terril loam (cumlic hapludoll) (Jackson et al. 1994). The Minneiska series has an A-C horizon sequence and is calcareous up to the surface. The Terril series has a thick (70 cm [27.6 in]) dark loam to clay loam A horizon over an AB-Bw horizon sequence. The Terril series is mapped on the higher landscape at the west end of the grid, and the Minneiska series is mapped at the lower east end of the grid.

As noted previously, the Fritsche Creek II test locale is one of two test locales having a previously recorded archaeological site. As originally defined, the Fritsche Creek II site includes evidence of prehistoric occupation that spans from the Archaic to the Woodland period, although the buried component was apparently confined to the Middle Archaic and earlier occupation (Roetzel and Strachan 1992; Roetzel et al. 1994). A mid-Holocene age was assumed based on a ^{14}C age estimate of 6080±100 BP (Beta-74130) on bone collagen from the buried component (Scott Anfinson, personal communication 2004). Additionally, the buried component was associated with a bison kill and processing locale and, consequently, may reflect a single, short-term occupation.

While the geophysics surveys were primarily directed toward identifying archaeological features, the trenching and coring within the Fritsche Creek II test locale focused first on determining the presence or absence of archaeological deposits and secondly on determining the sedimentology and stratigraphic relationships of the archaeological deposits to the deposits forming the broad alluvial and colluvial fan (Figure 3.3.1-1). The fan rises about 6 m (19.7 ft) in elevation from the southeast to the northwest end of the test locale. In general, this ridge was mapped by the LfSAs as consisting mainly of a distinct and well-defined alluvial and colluvial fan. Nineteen cores and 20 augers were drilled, and seven trenches were excavated within the test locale.

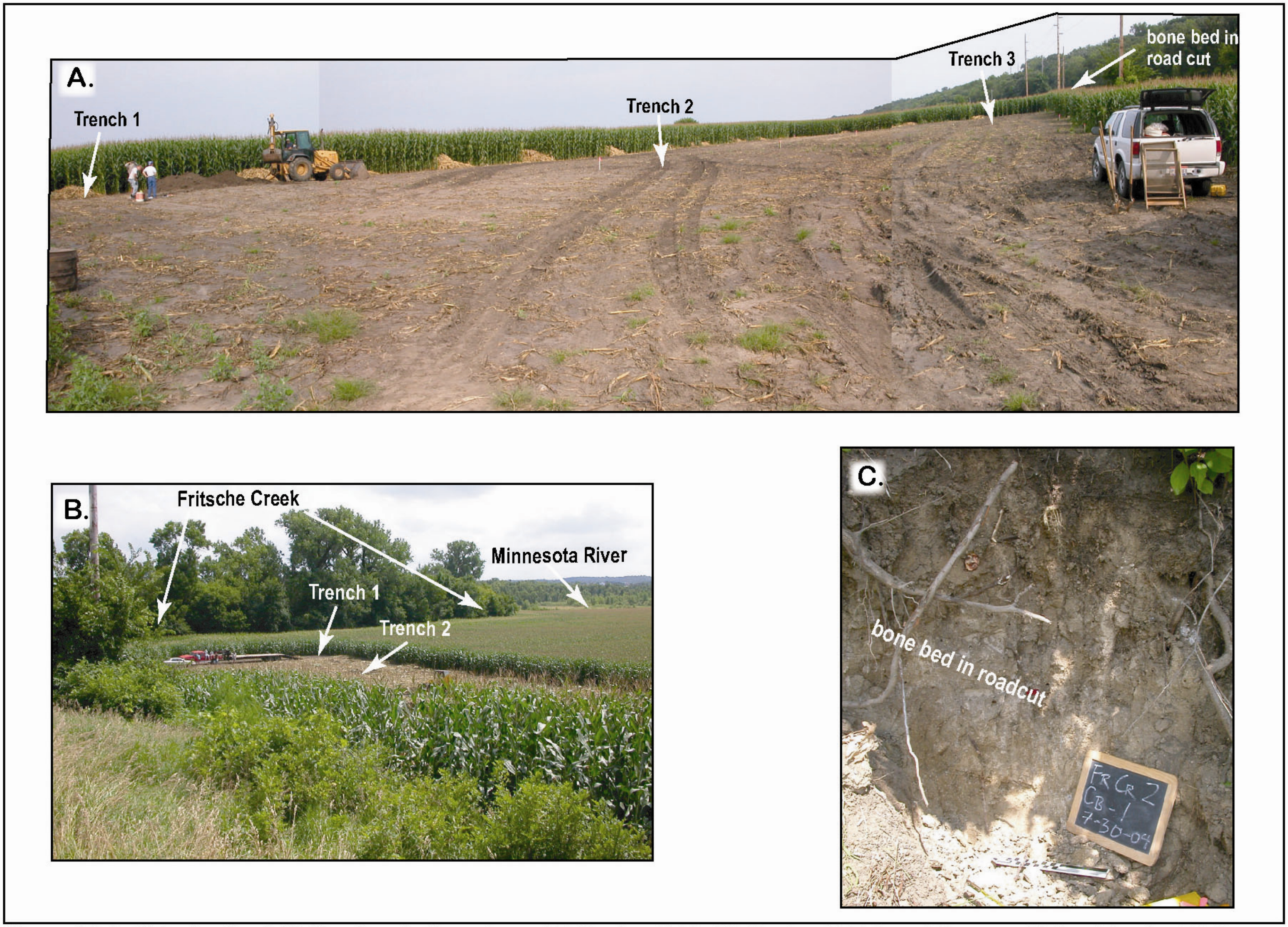

Figure 6.1-1. Fritsche Creek II Test Locale Overviews: (A) Testing Grid; (B) Testing Grid from Minnesota Valley Margin; (C) Bone Bed

6.2 RESULTS OF GEOPHYSICS SURVEY

6.2.1 Magnetics

The magnetic survey appears relatively homogenous and includes little evidence for the presence of prehistoric archaeological features. The survey data does, however, show evidence of significant historic period subsurface disturbances and artifacts (Figure 6.2.1-1). For example, a large amount of buried metal (ferric composition) debris is indicated in the northeastern and western parts of the test locale. This metal created large (ca. 10 m [33.3 ft] diameter) dipolar anomalies, limiting the ability to detect other magnetic variations in those areas. In addition, monopolar and dipolar anomalies are present in nearly all other parts of the grid. Because they are beyond the range of magnetic intensity typical of prehistoric features (>± 3nT), these probably all indicate historic material. Some of these features, however, could be highly fired prehistoric pits (Figure 6.2.1-1). For example, a relatively low magnetic high in the southeast corner could be a cultural feature, although it may be a metal artifact and represent a dipole effect arising from the large amount of metal just outside the survey grid.

6.2.2 Resistivity

The resistivity survey is similarly quiet (Figure 6.2.1-1). These data indicate that horizontal variation in the electrical properties of the subsurface is minimal and may suggest a relatively homogenous composition. Some survey noise is apparent in the southern portion of the survey grid and this may obscure potential patterning of the data in those areas. The most interesting areas from a geomorphological perspective are a series of very weak bands of higher resistivity running true north-south, in the 2 m and 3 m (6.6 ft and 9.8 ft) data layers (Figure 6.2.1-1). These may be indicative of buried alluvial features, such as erosional channels or cut and fill structures, and probably represent episodes of fan deposition.

6.2.3 Ground Penetrating Radar

The GPR survey results from Fritsche Creek II test locale are similar to those gathered from the Hoff Deep test locale (Chapter 5.0). At both of these test locales, no strong reflectors are apparent and the subsurface appears generally uniform with light, flat units (Figures 5.2.3-1 and 6.2.3-1). A number of parabolic features are present, but these appear to be diffuse and isolated. Ragged disruptions in return intensities are common. A number of data dropouts make cross sections hard to interpret. Because the GPR unit was repaired after this test locale was completed, some of the poor data resolution may reflect instrumentation problems. Regardless of instrument problems, however, some indications of surface activity appear in the middle of the survey grid.

Two dimension maps (Figure 6.2.3-1) show few features, as would be expected. A pronounced straight-line pattern, generally oriented northeast-southwest, and crop residue on the surface tend to obscure the slight subsurface differences. A subtle rectangular feature occurs at 20N/70E and a smaller rectangular feature about 10 m (32.8 ft) east of that can be seen on the 0.5 m to 1 m (1.6 to 3.3 ft) depth map. Deeper layers are featureless.

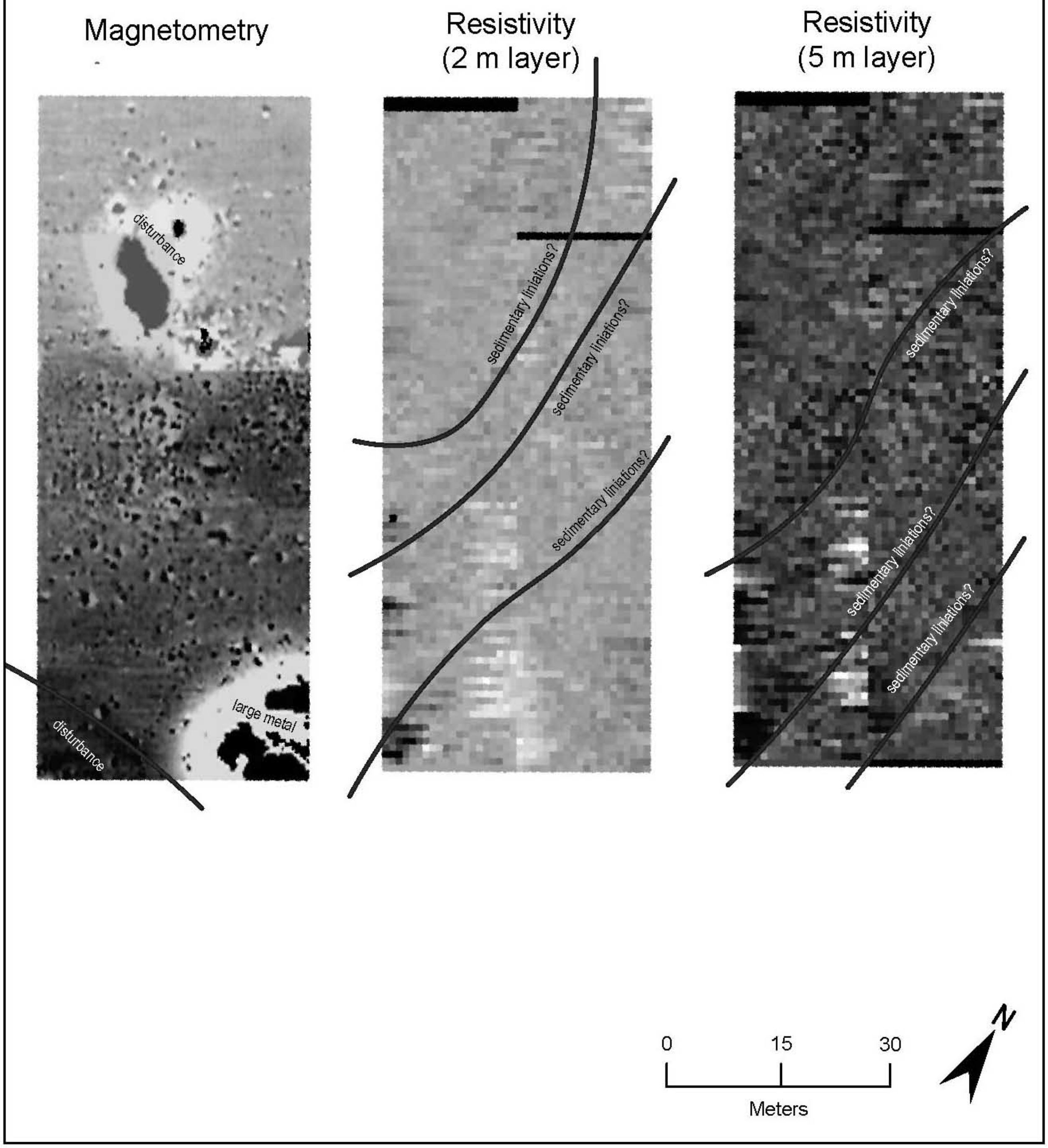

Figure 6.2.1-1. Magnetometry and Resistivity Data Plots, Fritsche Creek II Test Locale

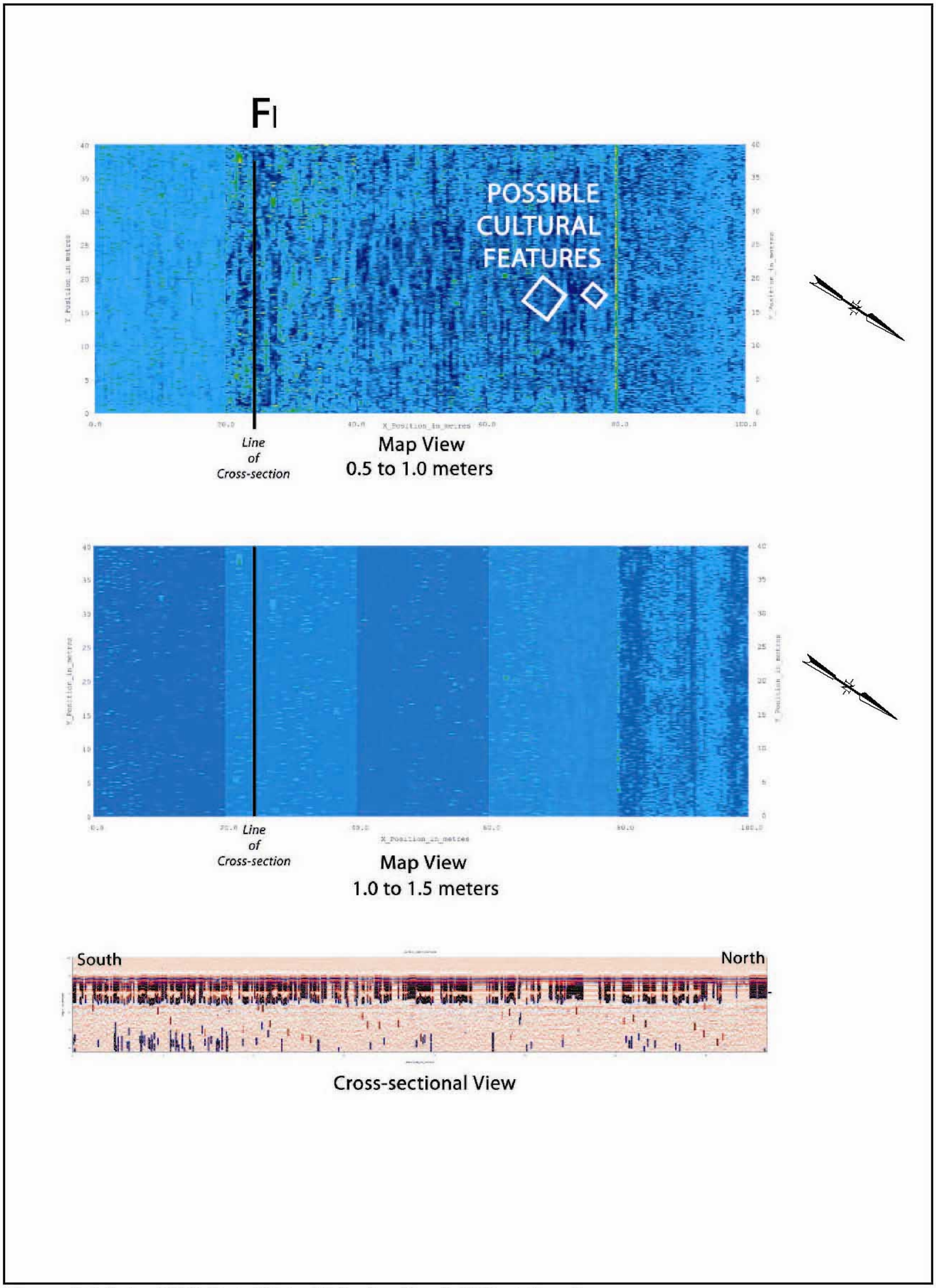

Figure 6.2.3-1. GPR Data Plots, Fritsche Creek II Test Locale

6.2.4 Discussion of Geoarchaeological Significance from Geophysical Survey

The geophysical survey results from the Fritsche Creek II test locale are generally disappointing and certainly more informative about the geological and sedimentological environments than the presence of a buried archaeological site that is known to exist here. The GPR data show few good reflectors and generally indicate only ragged and light reflections in the subsurface. This suggests a generally uniform sedimentary sequence in the subsurface, which would be unusual given the alluvial fan origin of the Fritsche Creek II landform, or could reflect instrumentation problems. If the GPR survey indicates uniform composition, the poor penetration and attenuation of the radar signal probably indicates that at least the upper portions of the deposits are composed mainly of fine grained sediments with high silt and clay content.

Similar to the GPR results, the resistivity survey is also relatively quiet, suggesting that the alluvial fan may be composed of a relatively uniform sediment package as implied by the GPR data. This conclusion, if correct, also implies that any instrument problems with the GPR survey were relatively minor and did not significantly affect the results. The most notable facet of the survey is the identification of the series of weak, north-south trending resistivity bands in the deeper layers (Figure 6.2.1-1) that may reveal buried erosional channels, cut and fill structures, or other features related to episodes of fan construction.

Although the magnetic survey data are relatively homogenous with only limited evidence for prehistoric archaeological features, they do reveal large historic period subsurface disturbances and artifacts. Buried metal debris are found in the northeastern and western parts of the survey grid, and what appears to be a large pit occurs in the western part of the grid. A few features may be highly fired prehistoric pits.

6.3 RESULTS OF CORING SURVEY

6.3.1 Deposits and Soils

Deposits and soils (Appendix B) are discussed in the context of three mini-LfSAs defined within the test locale. LfSA 1 is an Alluvial Fan/Colluvial slope. It is on the highest surface, in the northern third of the test locale (Figure 6.3.1-1). Deposits consist of a silt loam to silty clay loam diamicton over sandy stratified deposits having loam and sandy loam textures. Gravel is present in small percentages at or near the base of the cores. Sandy deposits are poorly sorted, and in some beds the grains are subangular. The cores at the western end of LfSA 1 (Figure 6.3.1-1, Core 18) are the lowest on the landscape in this LfSA, and they have silt loam and heavy silt loam below the gravels.

LfSA 2 is in the center third of the grid (Figure 6.3.1-1). Deposits consist of a silt loam diamicton overlying silt loam and silty clay loam, with these overlying silt loam and inter-bedded sandy loam. Beneath the silt loam and silty clay loam is inter-bedded silt loam and sandy loam that may correlate with the loamy and sandy deposits in the cores upslope (Figures 6.3.1-2 and 6.3.1-3). LfSA 3 is the Fan Channel Belt LfSA in the low, southern part of the grid. It consists of stratified silt loam over stratified sandy loam that coarsens downward. Sands contain small percentages of pebbles.

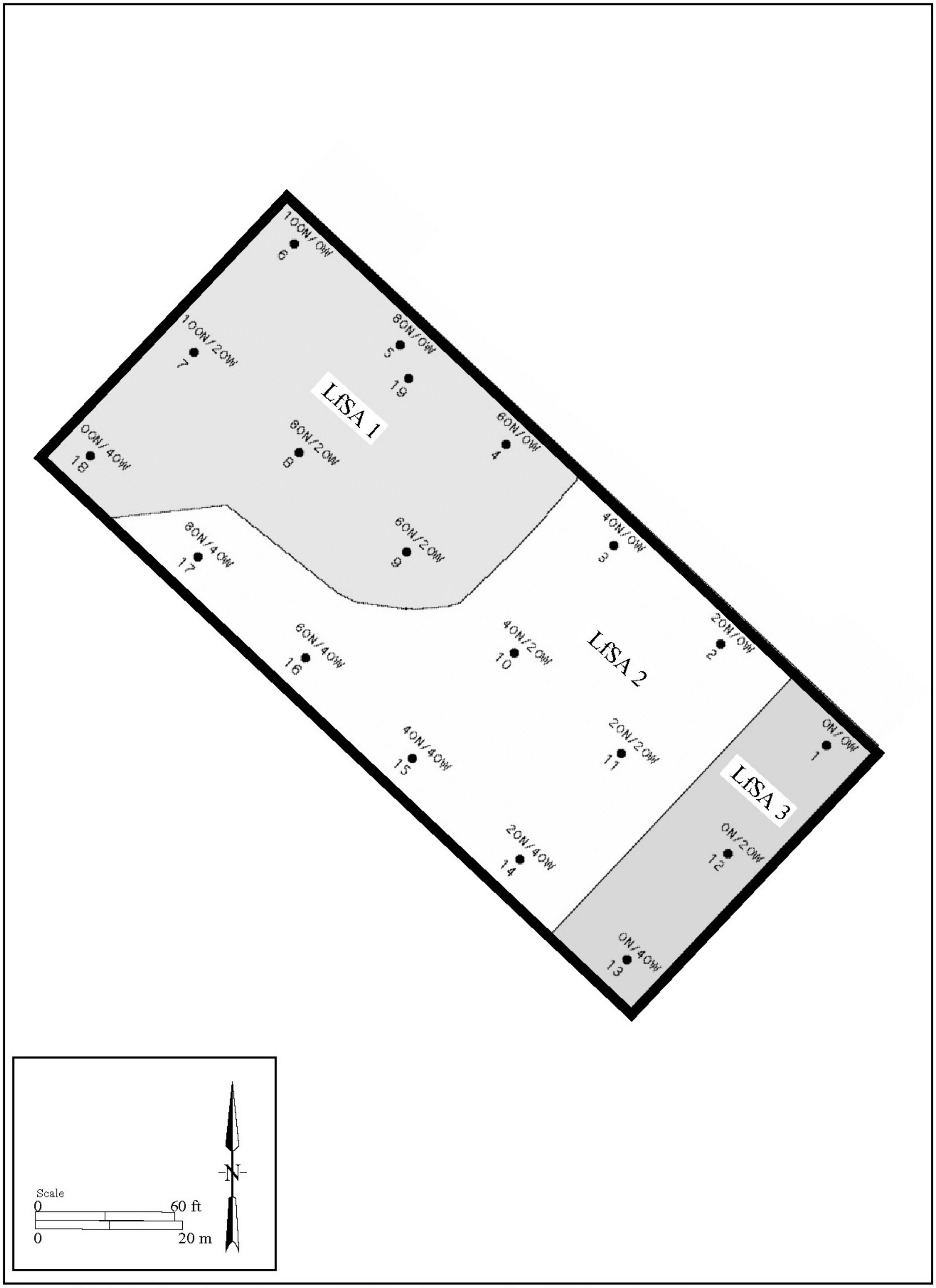

Figure 6.3.1-1. Core Locations and LfSAs, Fritsche Creek II Test Locale

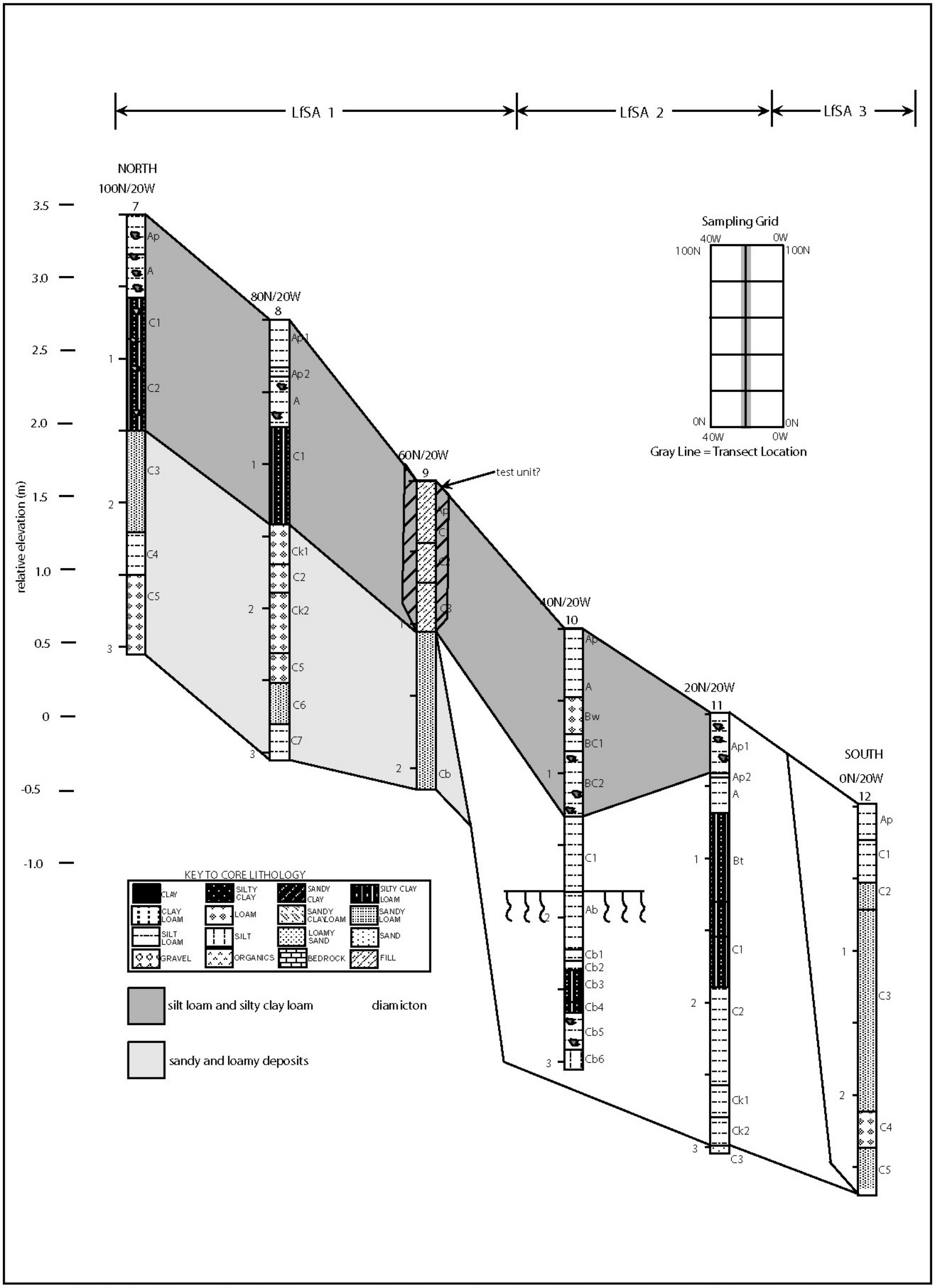

Figure 6.3.1-2. North-South Stratigraphic Cross-Section, Fritsche Creek II Test Locale

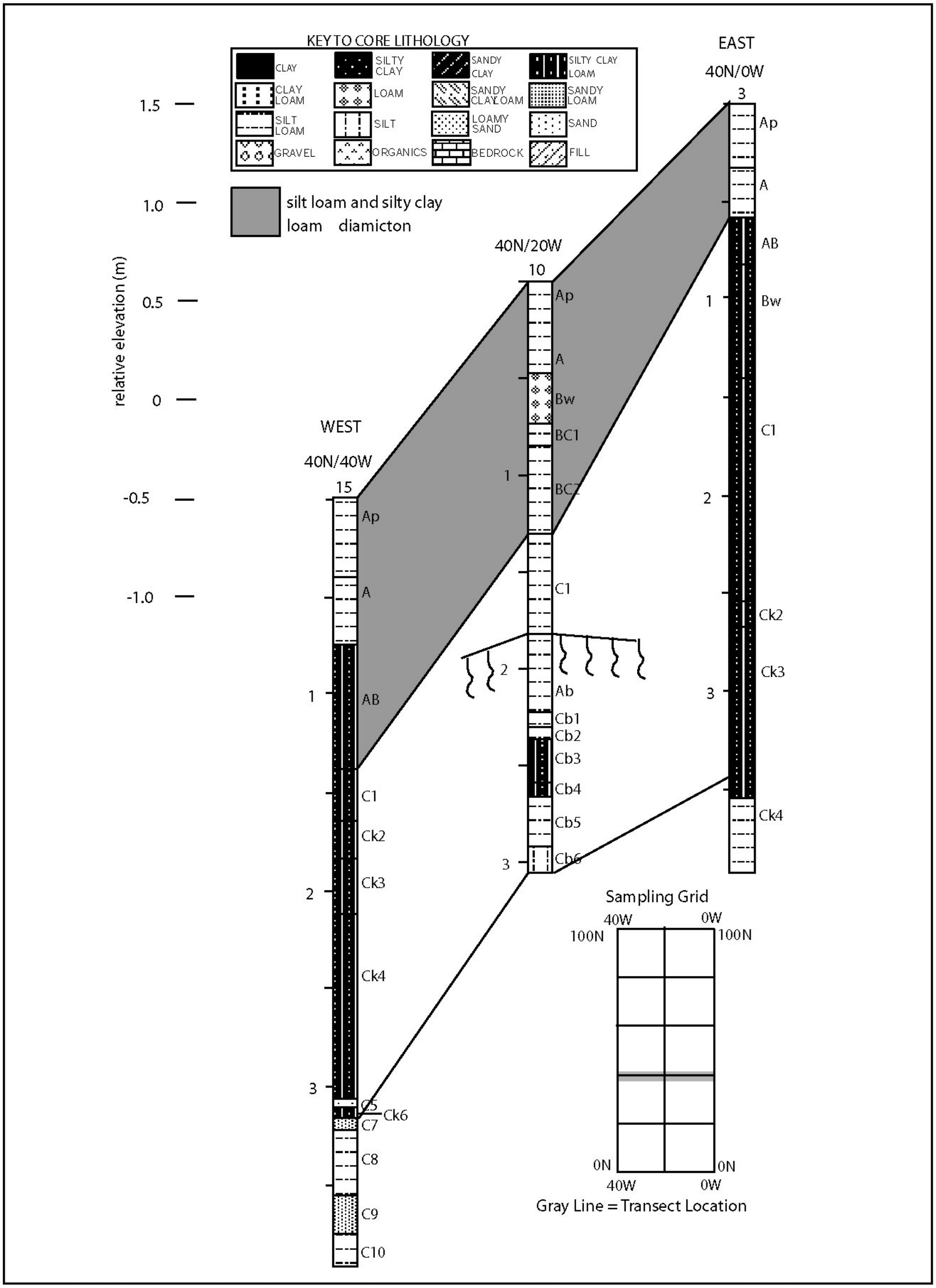

Figure 6.3.1-3. East-West Stratigraphic Cross-Section (LfSA 2), Fritsche Creek II Test Locale

6.3.2 Stratigraphy

Stratigraphy below the LfSA 1 surface consists of silty diamicton over the poorly sorted sandy loam and loam (Figures 6.3.1-2 and 6.3.1-3). Diamicton is typical of colluvium or hyper-concentrated flows on alluvial fans. The poorly sorted sandy deposits are sheet flow/fan channel deposits or, possibly, meltwater stream deposits preserved along the protected valley edge. Soils consist of a thick Ap-A horizon sequence formed in the diamicton from the modern surface. Thick A horizons result from the presence of grassland vegetation and/or the accumulation of sediment at the soil surface. Here the soil has a mollic epipedon that, in part, accounts for its thickness. It is also in a landscape position at the base of the bluffs and at the mouth of a side valley where sediment may accumulate. A lack of lithologic changes within the upper solum indicates that if the slope is receiving sediment, it is at a very low rate with any small additions of sediment quickly incorporated into the soil. Although the base of the A horizon was sometimes darker in color it is interpreted as the base of a mollic epipedon or cumlic mollic epipedon and not a buried soil that marks a formed landscape surface. Beneath the A horizons are C or AC horizons, also formed in the silt loam or silty clay loam diamicton. The AC and C horizons are calcareous (unleached). The soil surface is eroded where previously cultivated and disturbed in part by the removal of trees and presence of a building from an orchard that occupied a part of the test locale.

Stratigraphy beneath the LfSA 2 surface consists of silt loam diamicton over silt loam and silty clay loam (Figures 6.3.1-2 and 6.3.1-3). These silty deposits are relatively sand free and may be slackwater sediment deposited between 10,700 BP and 9500 BP. Sandy deposits are present at depth in Cores 11 and 15 (Figure 6.3.1-1). Weakly developed buried soils are present in Cores 2, 10, and 16 (Figure 6.3.1-1). The buried soils occur associated with mixed soil (bioturbated and eroded) and thin bedding at 90 cm to 135 cm (35 in to 53 in) below the surface. The mixed zone occurs at the base of the diamicton. The buried soil in Core 10 is the exception. It is 182 cm (72 in) below the surface and has a 30-cm (120-in) thick Ab horizon that contains charcoal. Buried soils are present but are weakly developed.

Stratigraphy beneath the LfSA 3 surface consists of thin strata of silt loam and silty clay loam over stratified sandy loam (Figures 6.3.1-2 and 6.3.1-3). Soils formed from the surface have A-C profiles. No buried soils were located. Coarse immature sand at 270 cm (106 in) in Core 12 and 165 cm (65 cm) in Core 13 mark a fan channel that subsequently filled with stratified sand and sandy loams-silt loams.

The history of the landscape at the Fritsche Creek II test locale can be reconstructed within the broader framework of the River Warren and the Minnesota River valley. When the River Warren occupied the Minnesota River valley it was a spillway for Glacial Lake Agassiz. The large volumes of water carried by River Warren down cut through the till and outwash, then incised the valley. The initial incision began about 11,800 BP when Glacial Lake Agassiz first began draining through the southern outlet (Teller 1985) and was completed by 10,800 BP (Fisher 2003). The southern outlet was then abandoned and re-occupied between 9900 BP and 9400 BP and River Warren re-occupied the spillway with minimal further modification (Fisher 2003). The River Warren down-cutting would have caused incision and head-cutting in the tributary valleys, initiating alluvial fan construction. Initially, fan construction was rapid and only slowed when the tributary channels became adjusted to the lower base level. Given the chronology at the southern outlet of Glacial Lake Agassiz (Fisher 2003) and radiocarbon dates from nearby fan and sub-fan contexts (Hudak and Hajic 2001), the construction of fans began after about 10,400 BP. The primary fan or highest fan surface may have quickly stabilized, with continued adjustment to incision and aggradation in the River Warren spillway and then Minnesota River taking place in the fan channel belt and on the secondary fan further out in the valley.

LfSA 1 is a part of the primary fan. It stabilized early in the process of fan construction, with low rates of colluvial sedimentation occurring after initial stabilization. LfSA 2 is in the fan channel belt, possibly on a low slackwater terrace. Buried soils are the result of adjustment of the fan channel to the continually evolving post-glacial Minnesota River. LfSA 3 is in a recent fan channel belt consisting of channel deposits with no buried soils.

6.3.3 Discussion of Geoarchaeological Significance from Coring

The lower half of the cumlic/mollic upper solum was targeted for auguring (see Appendix B) because it was designated a paleosol in previous investigations, where it yielded archaeological material, and because it appeared as a distinct dark zone at the base of the A-Ab horizons. Cumlic soils are the result of low sedimentation rates. Small quantities of sediment added to the surface during floods or off hill slopes are rapidly incorporated into the soil by bioturbation, resulting in a slow thickening of the upper solum. No discrete buried soil horizons are present and artifacts can occur anywhere in the cumlic horizon. For this reason, the lower half of the A-Ab horizon sequence was targeted for auguring. Auguring produced archaeological material from many of the cumlic soils (see Appendix B). The variability in the density and distribution of materials relates to the fact that archaeological sites are spatially discrete entities of varying size and artifacts densities. Therefore, the absence of artifacts in a targeted soil does not mean a site is not present in other locations on that buried landscape surface.

The potential for buried archaeological deposits and the soil stratigraphic contexts of those deposits varies from one mini-LfSA to the next over the small area of the sampling grid. LfSA 1 is a colluvial slope and/or primary alluvial fan landform. Stratigraphy consists of sandy stratified deposits overlain by a silty diamicton. No buried soil marks the contact between these two deposits. A soil with a thick A horizon is formed from the surface into the diamicton and the lower portion of the soil is often darker colored. It is unclear if the darker zone is a buried soil marking a former landscape surface or if it is the base of a cumlic/mollic epipedon that is darker due to better preservation of organic matter at depth. Because the dark soil occurs above the contact with the underlying sandy deposits in the diamicton, it is interpreted as the base of the cumlic/mollic epipedon. The surface of LfSA 1 has been quasi-stable since it was first constructed until Euro-American settlement. After its initial construction, the surface aggraded very slowly or not at all due to low sedimentation rates and/or minor erosion. The buried archaeological assemblage beneath the LfSA 1 surface formed by one of three mechanisms: (1) the bones and possibly the artifacts are secondary deposits, redeposited with the diamicton from upslope; (2) the dark zone at the base of the A horizon marks an old landscape surface, and the bones/artifacts were buried by colluviation through time; or (3) the bones/artifacts were deposited on the surface of the diamicton (essentially the pre-Euroamerican settlement surface) and buried by biomantling, upbuilding, and small episodic increments of colluvial sediment. The third mechanism, in combination with other pedogenic processes, would also destroy bone that was present in the upper solum leaving preserved bone in the lower solum. Mechanisms 2 and 3 also could have worked in tandem to create the observed pattern in the archaeological record. Regardless of the mechanism that formed the stratigraphy, the lower A horizon was designated a sampling target for this reason and because of the previous archaeological research at the site (Roetzel et al. 1994).

LfSA 2 is in the fan channel belt. Buried soils are present on a bench or low terrace in Cores 10, 14, 16, and 17 (Figures 6.3.1-1, 6.3.1-2, and 6.3.1-3). Ab horizons in the latter three cores are thin and weakly developed and possibly eroded and, as a result, were not sampled with the augers. All of the buried soils are formed in heavy silt loam and silty clay loam.

LfSA 3 is also in the Fan Channel belt. No buried soils were encountered. The deposits are sandy with weakly developed soils.

6.4 RESULTS OF TRENCHING SURVEY

6.4.1 Stratigraphy of Soils and Sediments

Trenching focused on tracing the extent of an alluvial fan from its topographically lowest to highest points (i.e., south to north). The bulk of sediments, as previously indicated by the LfSAs, are characterized by a relatively thick sequence of middle Holocene colluvial and alluvial fan deposits (e.g., Trenches 3 and 5), but also includes an early Holocene landscape buried within the fan, as well as late Holocene floodplain and channel deposits (Figures 6.1-1, 6.4.1-1, 6.4.1-2, and 6.4.1-3). The buried landscape is indicated by a more discrete surface, which may have formed as an alluvial terrace of the early Holocene Minnesota River, on topographically lower flanks of the fan (Trenches 2, 4, and 7; Figures 6.4.1-2, and 6.4.1-3). Both the alluvial fan and buried alluvial terrace deposits include buried prehistoric cultural material and potential features. Recent (ca. 200 BP to 300 BP) alluvium and channel deposits of Fritsche Creek underlie the southern, topographically lowest, portion of the test locale (Trench 1; Figure 6.4.1-2). Although buried soils were present, these deposits did not include archaeological materials.

The fan deposits that comprise the bulk of sediments are typified in Trench 3 and 5 (Figures 6.1-1, 6.4.1-2 and 6.4.1-3; Appendix C). The base of the sequence begins with the upper few meters of light brown to tan, inter-bedded sand, sand/silt, and sand/gravel deposits. The top of the unit includes discontinuous inter-beds of sand and gravel that grade downward to tabular bedded silty fine to medium sand. These deposits, in turn, grade down into cross and tabular-bedded sand and gravel that grade to tabular-bedded silty sand with sand partings and a few sand and gravel inter-beds. Carbonate concretions and precipitates are common in the upper parts of these deposits. The bottom of the sequence typically grades to massive to crudely bedded sand and gravel and massive silt and silty fine sand at base of the unit. Although the internal beds that comprise this unit are complex and discontinuous, collectively they probably are accumulations of alluvial and colluvial fan deposits through intermittent sheet-washing, flooding, and scouring of an early Fritsche Creek. Colluvial erosion and re-deposition of upslope sediments also

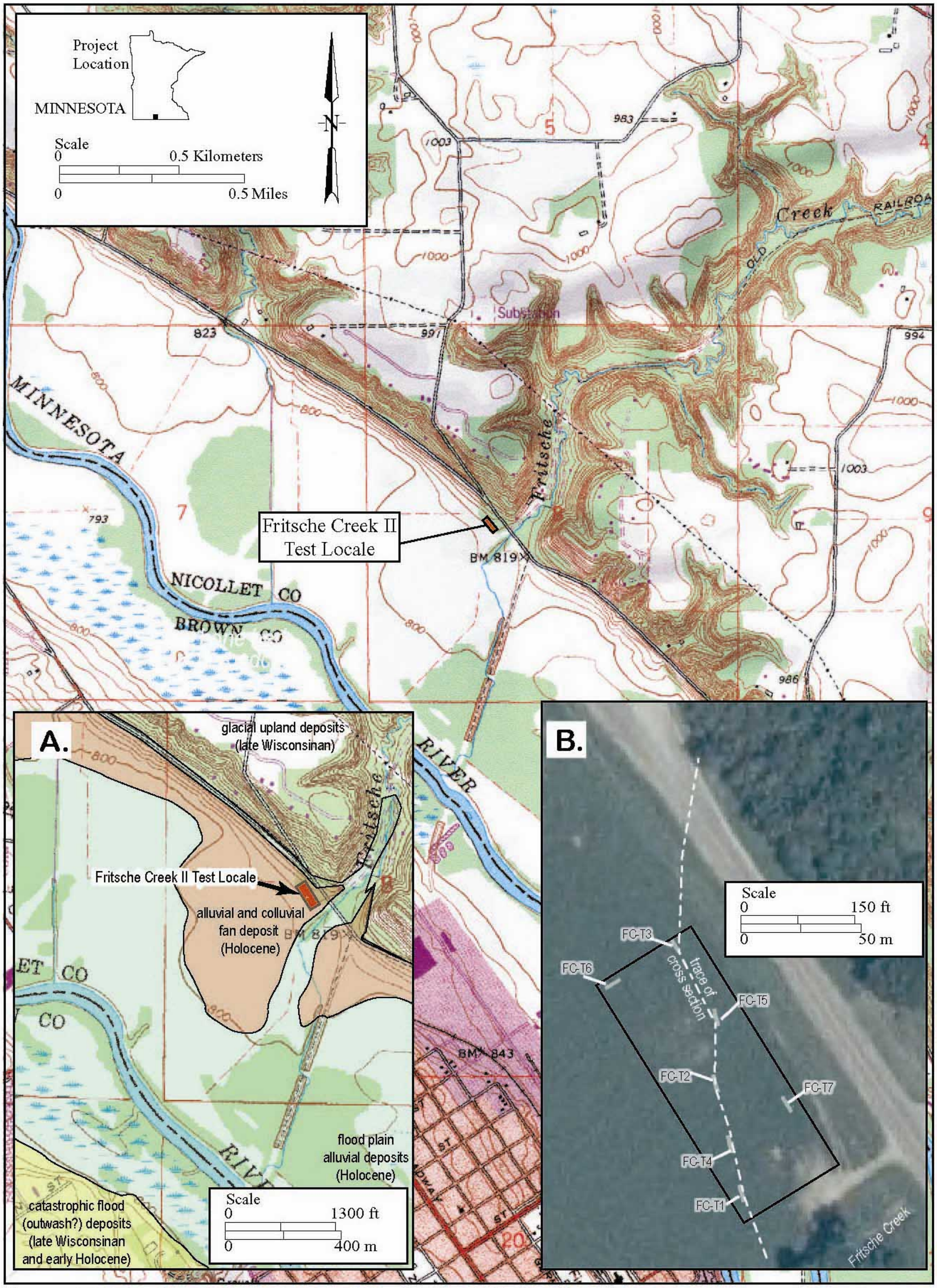

Figure 6.4.1-1. Trench Locations at Fritsche Creek II Test Locale

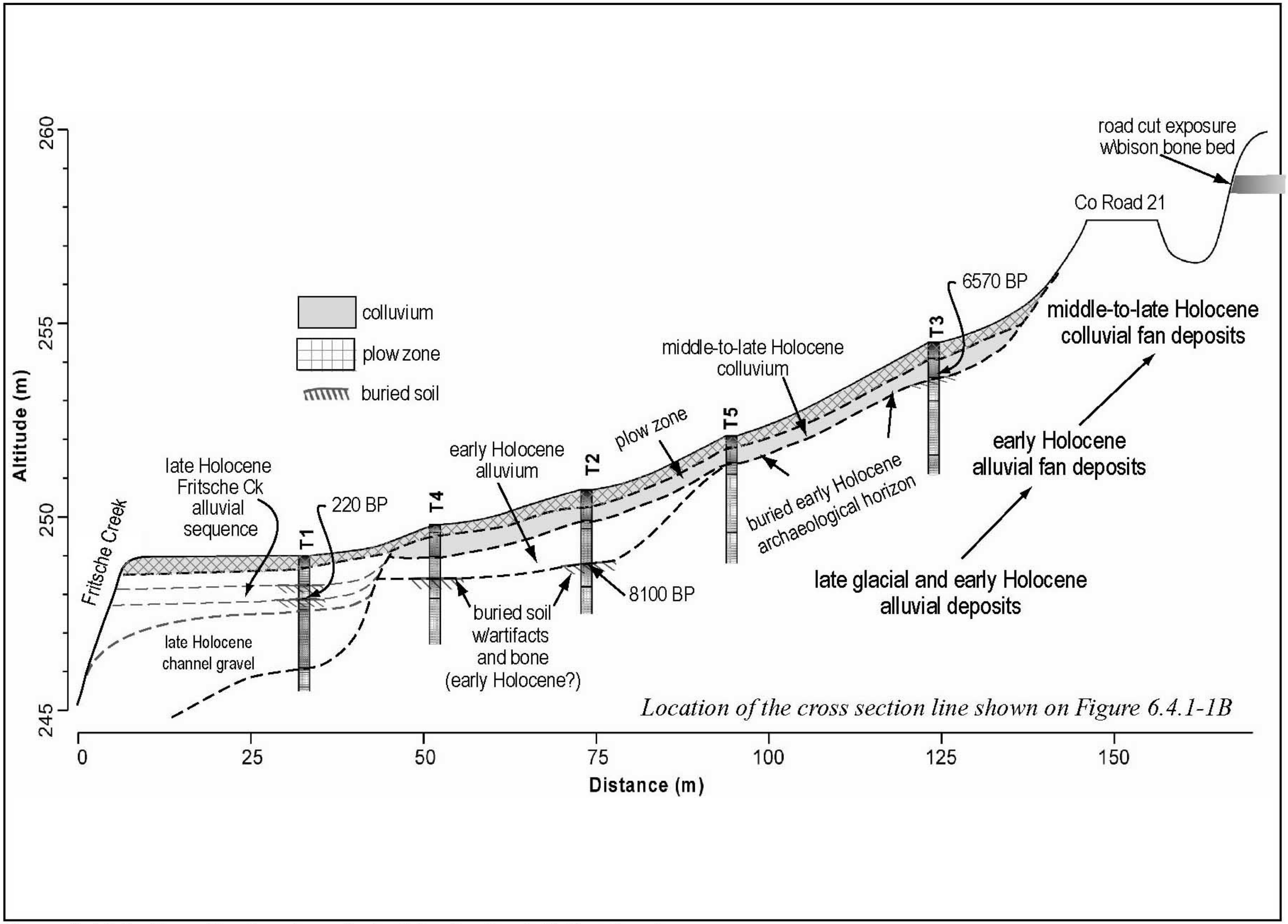

Figure 6.4.1-2. Cross Section through the Fritsche Creek II Test Locale

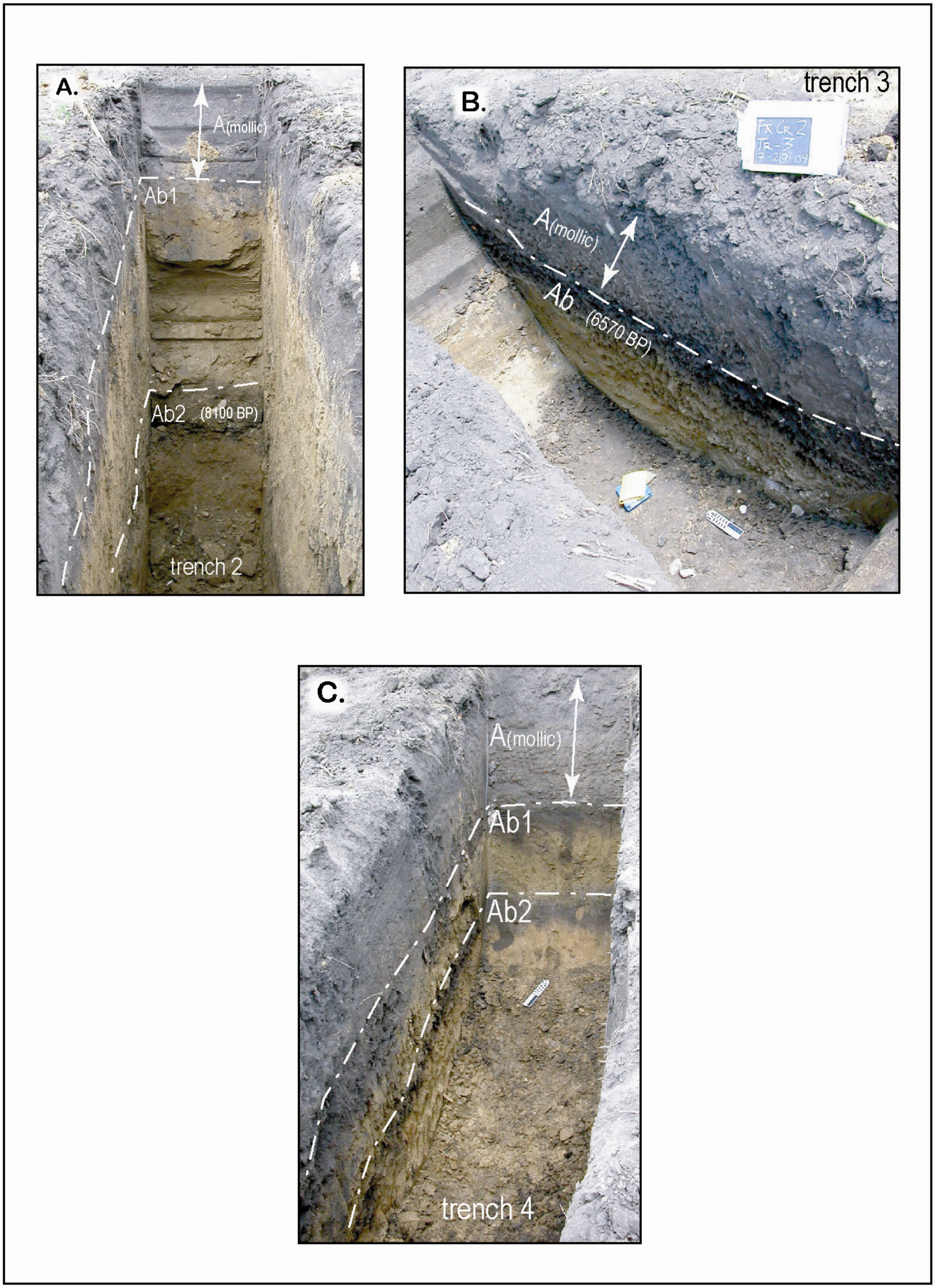

Figure 6.4.1-3. Trenches at the Fritsche Creek II Test Locale: (A) Trench 2; (B) Trench 3; (C) Trench 4

contributed to the fan sediment package. Neither paleosols nor archaeological materials were noted within these fan deposits in the topographically higher parts of the fan.

Similar deposits form the basal sediments throughout most of the test locale, suggesting that, during construction, other surfaces that may have been present were likely eroded. This observation implies an early age for fan development. Additionally, such a contention is supported by the general absence of any buried soils or archaeological materials (except as discussed below, in the upper 1 m [3.3 ft] of deposits) within the accreting alluvial fan sequence. These also imply rapid, or at least very early, deposition and fan formation. Chronologically, the fan probably began forming during the end of the late Wisconsin or very early Holocene. This timing is indicated by ^{14}C age estimates collected from the top of the alluvial fan or within overlying buried landscapes, which show that most of the fan must have accumulated prior to 6500 BP to 8100 BP (Beta-200796 and Beta-200795, respectively, Appendix D; Figure 6.4.1-4). Such fan deposits are common along the Minnesota Valley and, given the early age of the Fritsche Creek fan, may have developed in response to valley-wall destabilization during catastrophic flood outbursts from Lake Agassiz through River Warren.

In Trench 3 (Figure 6.4.1-4) at the highest, northern corner of the test locale, the coarse grained, early Holocene alluvial fan deposits are overlain by about 1 m (3.3 ft) of generally dark brown to brown, massive silty clay and clayey silt. The lower part of the unit is more clay-rich and includes occasional pebbles, as well as abundant carbonate concretions and precipitates. The upper part of the unit is siltier, but also includes occasional pebbles. The more poorly sorted, fine grained nature of the upper meter of sediment in Trenches 3, 5 and 7 suggest that, while probably fan-related, colluvial rather than alluvial processes may have dominated during its deposition. The top of the unit is defined by the modern plow zone, while the base is marked by a few discontinuous interbeds of medium to coarse-grained sand. Thus, the basal contact with the lower more “alluvial” fan sediment is gradational and arguably may be more closely related to the underlying sequence of fan deposits. Such a contention is supported by the fact that a dark brown, organic-rich, buried surface (Ab) soil horizon marks the lower 20 cm (7.9 in) of the unit. This soil horizon probably marks a relatively long period of stability on the fan surface. Importantly, this zone also included a concentration of charcoal, burned and unburned bone, and lithic debitage, which collectively may have formed a cultural feature. A piece of associated wood charcoal was dated 6570±40 BP (Beta-200796; calibrated cal yrs B.C. 5610 to 5470; Figure 6.4.1-4; Appendix D) and, together with the 6030 BP (Beta 74130) date collected from a similar stratigraphic context during the 1994 excavation, suggest a Middle Archaic cultural affiliation.

The lower paleosol is directly overlain by 80 cm (31.5 in) of somewhat lighter brown sandy silt that has weathered into a buried and cumulative surface (A) soil horizon (Figure 6.4.1-4). The topmost ca. 30 cm (11.8 in) of this soil forms the modern plow zone and its contact with the lower paleosol is abrupt, suggesting that a depositional hiatus occurred between their formations. While the thickness of this soil horizon (70 cm to 80 cm [27.6 in to 31.5 in]) and other characteristics suggest that it probably formed as a cumulative mollisol, the lower paleosol is different and may have some other, non-mollic origin. This not only implies that a depositional hiatus occurred between these two sequences, but also suggests that the hiatus may also correspond to more significant, regional environmental changes. A similar sequence of alluvial

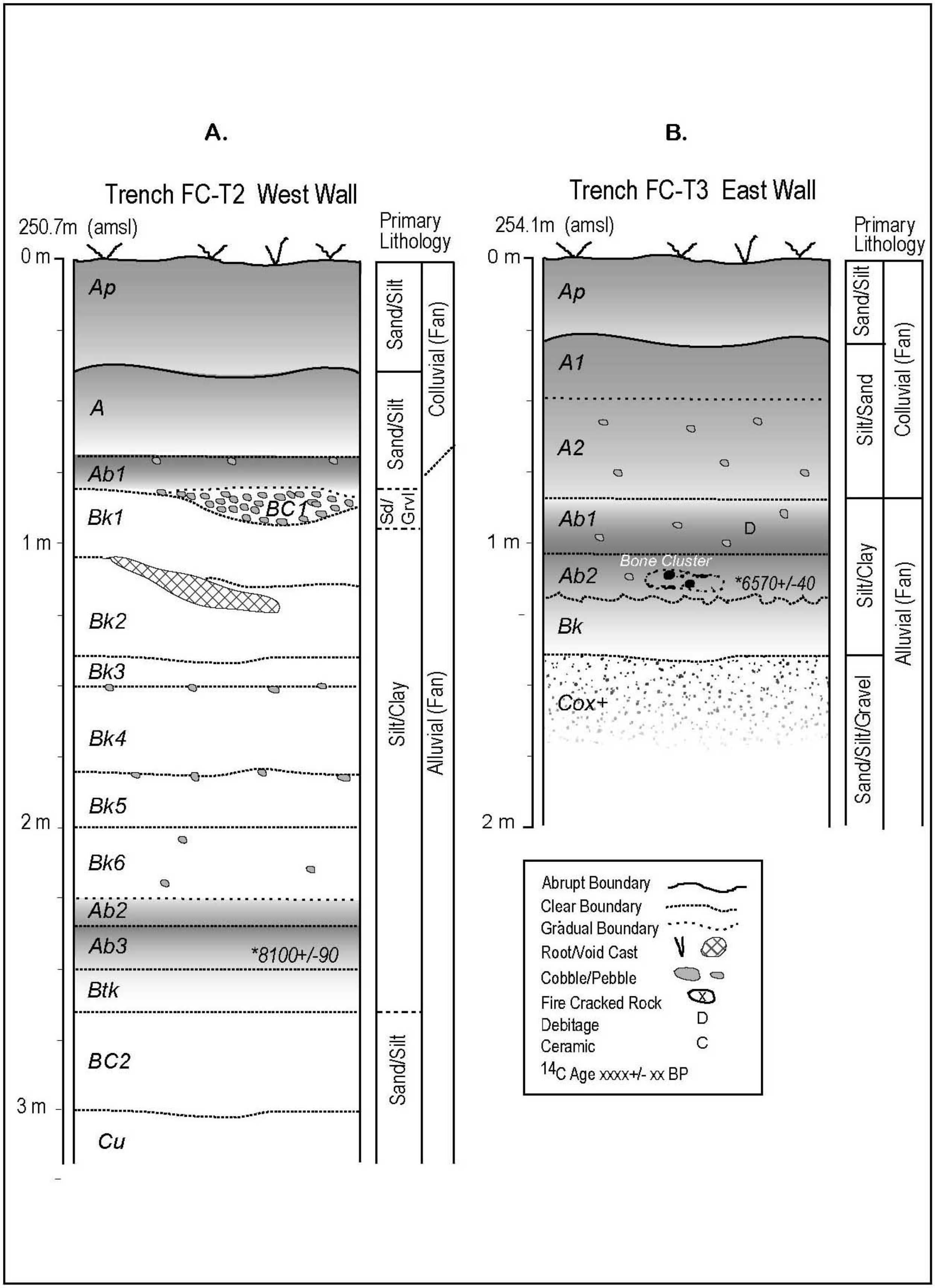

Figure 6.4.1-4. Soils and Sediments within the Upper Part of (A) Trench 2 and (B) Trench 3, Fritsche Creek II Test Locale

fan-paleosol/archaeological site-colluvial fan-mollisol-plow zone characterizes the subsurface in Trenches 5 and 7.

In sum, the Trench 3 sequence indicates that the upper ca. 1 m (3.3 ft) of sediment marks a change from predominantly alluvial to mainly colluvial fan deposits and was probably derived from erosion and sheet-washing of upslope material. The lower paleosol likely formed along the top of the alluvial fan during the early or middle Holocene and, therefore, stratigraphically marks the change in depositional style. Based on the ^{14}C chronology, the soil probably developed over at least a few thousand years (8100 BP to 6500 BP), but could have also been the ground surface on the fan for several thousand years. The 6570 BP age (Beta-200796; Appendix D), together with 6030 BP date collected from a similar stratigraphic context during the 1994 excavation, suggest that colluvial deposition probably began by about 6000 BP. Interestingly, most of the artifacts, charcoal, and bone indicating human occupation at the site derived from either the lower paleosol or base of the overlying (colluvial) mollisol. This suggests that colluvial deposition was rapid and, moreover, may have been confined to a discrete mid-Holocene interval. Given the age of these deposits, a relationship between warm and relatively dry Hypsithermal conditions, accelerated colluviation, and a change to more prairie (mollic) soils is certainly possible.

While the upper part of the sequence noted in Trench 3 (i.e., paleosol/archaeological site-colluvial fan-paleosol-plow zone) was also duplicated in Trenches 2, 4, and 7 on the lower part of the fan, the lower sediments were somewhat different and included an even older sedimentary sequence and associated paleosol (Figures 6.4.1-2, 6.4.1-3, and 6.4.1-4). A paleosol, buried well below this upper sequence, was situated between 140 cm and 240 cm (55.1 in and 94.5 in) deep in Trench 4. It included small pieces of bone, as well as a few artifacts. The presence of such a soil, as suggested for the lower paleosol in Trench 3, indicates that an earlier depositional hiatus apparently occurred during fan formation. The age of this soil, and by association the archaeological material, is given by a ^{14}C age estimate on charcoal from Trench 2 of 8100±40 BP (Beta-200795; calibrated cal yrs BC 7160 to 7040; Figure 6.4.1-4; Appendix D). This significantly predates the 6470 BP date from the Trench 3 occupation and implies an Early Archaic cultural association for the Trench 4 cultural material. Even more importantly, it also suggests that occupation probably occurred periodically during both the Early and Middle Archaic at the Fritsche Creek II site and spanned at least 2,000 years. Whether the early Holocene depositional pause at 8100 BP indicated by soil formation and subsequent reactivation of fan deposition is related to the end of River Warren drainage in the Minnesota Valley, or a change in early Holocene climatic conditions, or simply represents idiosyncratic variation in the evolution of the Fritsche Creek fan is not known.

The youngest sedimentary sequence occurs at the toe of the fan in the southeastern-most portion of the test locale and consists of recent, basal channel sand and gravel that is conformably overlain by a series of alluvial sands and silts (Trench 1; Figures 3.3.1-1 and 6.4.1-2; Appendix C). The basal channel deposits related to this sequence in Trench 1 consist of cross- and tabular-bedded sand and gravel whose base is marked by large cobble and pebble lag on alluvial fan deposits. These gravels were apparently deposited as Fritsche Creek meandered into and eroded the margin of the early Holocene alluvium. The gravels grade upwards into discontinuous inter-beds of silty sand and sand, which are in turn overlain by a series of thin, discontinuous inter-beds of tan, medium to coarse grained sand, and more thickly bedded massive to tabular-bedded sandy silt and silty sand. The sandy inter-beds are thicker in the lower part of the sequence and include a few fine gravel and coarse sand beds near the bottom of the sequence. These probably are late Holocene flood deposits of Fritsche Creek, the tops of which typically include discontinuous, ephemeral AC paleosols. The upper ca. 75 cm (29.5 in) of the sequence probably also derived as flood deposits, but has been mixed to include at least two buried plow zones. The presence of such a thick, multiple plow zone sequence indicates that alluviation and upslope colluvial erosion and redeposition apparently continued into modern time. In fact, as indicated by a ^{14}C age of 220±40 BP (Beta-200794; calibrated cal yrs A.D. 1640 to A.D. 1680, A.D. 1730 to A.D. 1810 and A.D. 1930 to A.D. 1950; Appendix D) on a piece of detrital charcoal from one of the paleosols in the lower flood sequence, the entire sequence is quite late and may be entirely historic.

6.4.2 Discussion of Geoarchaeological Significance from Trenching

The Fritsche Creek II test locale encompasses most of a small archaeological site (Fritsche Creek II Bison Kill, 21NL0063) that includes evidence of Early Archaic through Woodland occupations. The buried component, however, was apparently confined to the Middle Archaic and earlier occupation, which has been associated with a bison kill and associated processing. Consequently, it was thought that the buried occupation may reflect a single, one-time occupation. Trenching focused not only on finding the buried archaeological material but, more importantly, on determining the sedimentological and stratigraphic relationships between the archaeological deposits and sediments that form the broad alluvial and colluvial fan on which the site lies. The results indicate that the upper portion of the fan was clearly derived from a combination of alluvial and colluvial depositional processes and is very old, while the lowest, southeastern-most toe was apparently composed of young alluvial and fluvial (floodplain) deposits related to the modern configuration of Fritsche Creek. The colluvial and alluvial fan processes were apparently most active during the early and middle Holocene and the fan was relatively stable, or possibly eroded, during the late Holocene. The timing for fan activation and stabilization is supported by the ^{14}C age of charcoal collected from paleosols containing archaeological material, one of which was buried more than 2 m (6.7 ft) deep in the fan. Dates of 8100 BP for the more deeply buried soil and 6570 BP for the more shallow sequence were obtained (Beta-200795 and Beta-200796, respectively; Appendix D, Figure 21). The topographically lower Fritsche Creek alluvium was probably related to a channel meander during the past few hundred years and, therefore, has little potential for including in situ buried archaeological material.

Archaeological material was discovered in all but two of the trenches and was first noted in the second trench excavated (the first trench was placed at the toe of the slope within the historic-age channel cut and fill sequence). Although the archaeological material recovered in the trenches occurred in similar stratigraphic contexts to those noted in earlier work at the site, we also identified other cultural horizons associated with more deeply buried paleosols. Importantly, these deeper components suggest that the site may include stratified Middle and Early Archaic components. Most of the cultural material found consisted of lithic debitage and fire-cracked rock that were not diagnostic of any particular cultural period(s) or time.

Interestingly, bone was ubiquitous throughout the test locale, but was particularly common within the lower, more alluvial portion of the fan and occurred in both the 6000 BP and 8000 BP buried cultural horizons. Compared to the lower, buried horizons, bone was relatively rare within the younger, upper meter of colluvial-derived fan sediments. This segregation of bone may relate to altering climate conditions after 6000 BP, a change in subsistence patterns, sampling error associated with different activity areas, or variations in bone preservation resultant from vertical changes in soil pH conditions.

6.5 RESULTS OF ARCHAEOLOGICAL TESTING

6.5.1 Previous Investigations

The 1990 investigations focused on surface inspection of the general project area as well as some limited shovel testing. Scrutiny of the road cut at the base of the Minnesota River valley bluff adjacent to the site revealed a bed of bison bones in the face of the road cut (Figure 6.1-1). Archaeological materials subsequently were recovered between 90 cm and 125 cm (35 in and 49 in) below surface in at least one of these shovel tests. A second related archaeological site, designated Fritsche Creek I (21NL0062), was also discovered along the Fritsche Creek floodplain. Phase II evaluation of these two sites occurred in 1991 and indeed discovered Early and Middle Archaic occupations horizons that had been buried within what was assumed to be an early and middle Holocene alluvial fan (Roetzel and Strachan 1992). Details about the results of these investigations, as well as those related to subsequent Phase III data recovery efforts (Roetzel et al. 1994), are discussed in Chapter 3.0.

6.5.2 Current Investigations

Archaeological investigations in 2004 at the Fritsche Creek II test locale involved the excavation of four 50 cm × 50 cm (20 in × 20 in) test units off the edges of selected backhoe trenches.[1] Although the buried paleosol was the primary target horizon at the site, several factors were taken into account in developing the excavation strategy at the site. First, the site is considered eligible for inclusion on the National Register and known archaeological deposits were preserved at the site. Second, a surface and near-surface Late Woodland component at the site was known to be present. Third, while the previous investigations suggested that the majority of the cultural material occurred in either the plow zone or immediate sub-plow zone levels and in the buried paleosol, cultural materials could also be present throughout the entire profile at the site. Because of these factors the field team excavated each test unit in its entirety from the surface to the base of the paleosol, and into the underlying subsoil.

Test Unit 1 was placed in the west wall of Trench 1 in the topographically lowest portion of test locale. Four stratigraphic zones were recorded including the plow zone (Figure 6.5.2-1a). Except for the base of the plow zone, which was clearly defined, the boundaries between each of

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[1] Although cultural materials were identified in the wall of Trench 2, Test Unit 2 was not excavated. This was because the buried paleosol (target horizon) occurred at 2.5 m (8.2 ft) below surface. To excavate a test unit to this depth and meet OSHA safety standards, a rather large area would have to be disturbed, which was considered too damaging to this National Register-eligible site.

the stratigraphic zones were gradational. A modern fence staple that occurred in the plow zone was the only cultural material present in Test Unit 1.

Just to the north of the area of Trench 1, the topography rises, and both cores (e.g., Core 14) and test trenches (e.g., Trench 4) revealed sedimentary horizons that had a high potential for containing archaeological materials. Though no cultural materials were recovered from the augers excavated in this area of the site, Test Unit 4, which was placed in the west wall of Trench 4, did produce evidence of archaeological occupation. The soil profile exposed by this test unit was typical for the site, except for the presence of a lighter zone of soil in Stratum VI (Figure 6.5.2-1a). The lower stratigraphic units also exhibited a fair amount of rodent disturbance. Cultural material from Test Unit 4 is limited to four flakes from the plow zone; one flake and two small fragments of animal bone from Level 4/Stratum III; one flake and two small bone fragments from Level 6/Stratum IV; and one flake, one fire-cracked rock, and one bone fragment from Level 7/Stratum V. In addition, archaeological materials were also mapped and collected from the wall of Trench 4 (Appendix E).

On the highest portion of the test locale, which corresponds to the primary fan deposits, both trenches (Test Trenches 5 and 3) and cores (Cores 4-8) indicated that the potential for buried archaeological materials was high (Figure 6.5.2-1b). Bone, possibly indicative of prehistoric activities, was recovered at four core locations (Cores 4-7) from a total of seven augers excavated into the target horizon. A more definite presence of a prehistoric occupation was obtained from the test units placed along the edges of Trenches 3 and 5.

The profile of Test Unit 5 exhibited the typical sub-plow zone stratigraphic sequence for this area of the test locale with a paleosol (Stratum IV) occurring at a depth of about 72 cm (28 in) below surface (Figure 6.5.2-1b). Cultural material from this test unit included five pieces of debitage, one piece of fire-cracked rock, and 23 small fragments of animal bone, all of which occurred in Level 5, which corresponds with the buried paleosol.

The placement of Test Unit 3, which was located in the west wall of Trench 3, was based on the presence of a possible feature exposed in the floor of the backhoe trench. During the excavation of the backhoe trench, a circular, dark grayish brown stain measuring approximately 60 cm (24 in) in diameter and containing calcined bone fragments and charcoal flecking was noted at the base of a paleosol at a depth of approximately 1.1 m (3.6 ft). Since this stain possibly was a cultural feature, excavation with the backhoe was halted and the stain was exposed, mapped, and cross sectioned by troweling. Upon cross sectioning, the feature appeared to be a small dip or undulation in the base of the paleosol. To further ensure that the stain was not a cultural feature, Test Unit 3 was placed in the adjacent part of the west wall of the backhoe trench.

Seven stratigraphic zones, including the plow zone, were identified in the profile of Test Unit 3 (Figure 6.5.2-1b). Cultural material included several small brick fragments and a piece of glass from the plow zone and an edge damaged flake and 157 tiny fragments of bone from Stratum VIIa (Figure 6.5.2-1b). All but 20 of these bone fragments were collected from the stain designated Feature 1 in the floor of Trench 3. In addition, flotation sample-derived bone from so-called Feature 1 numbered 4,150 fragments.

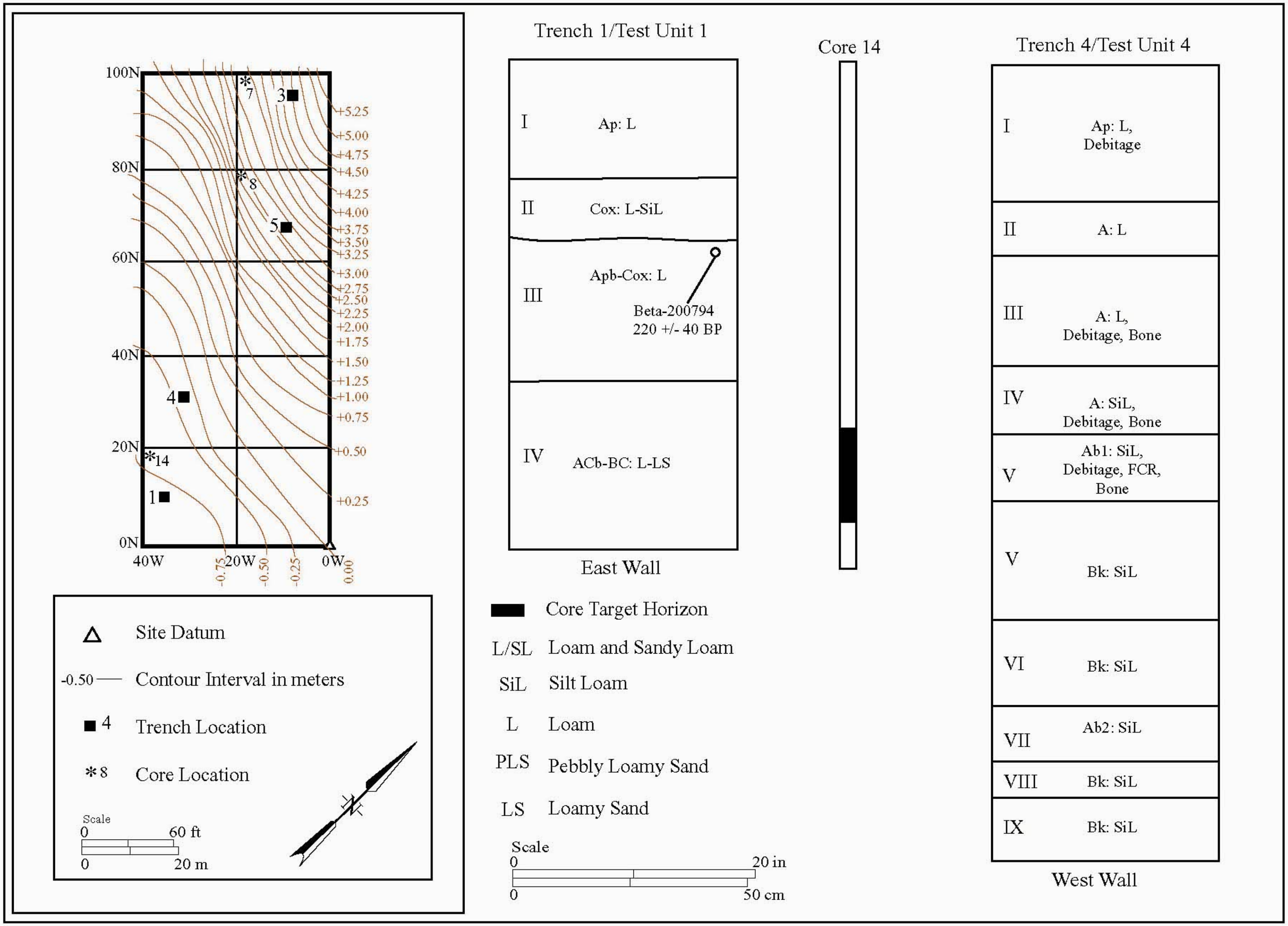

Figure 6.5.2-1a. Comparative Trench/Test Unit Profiles, Fritsche Creek II Test Locale

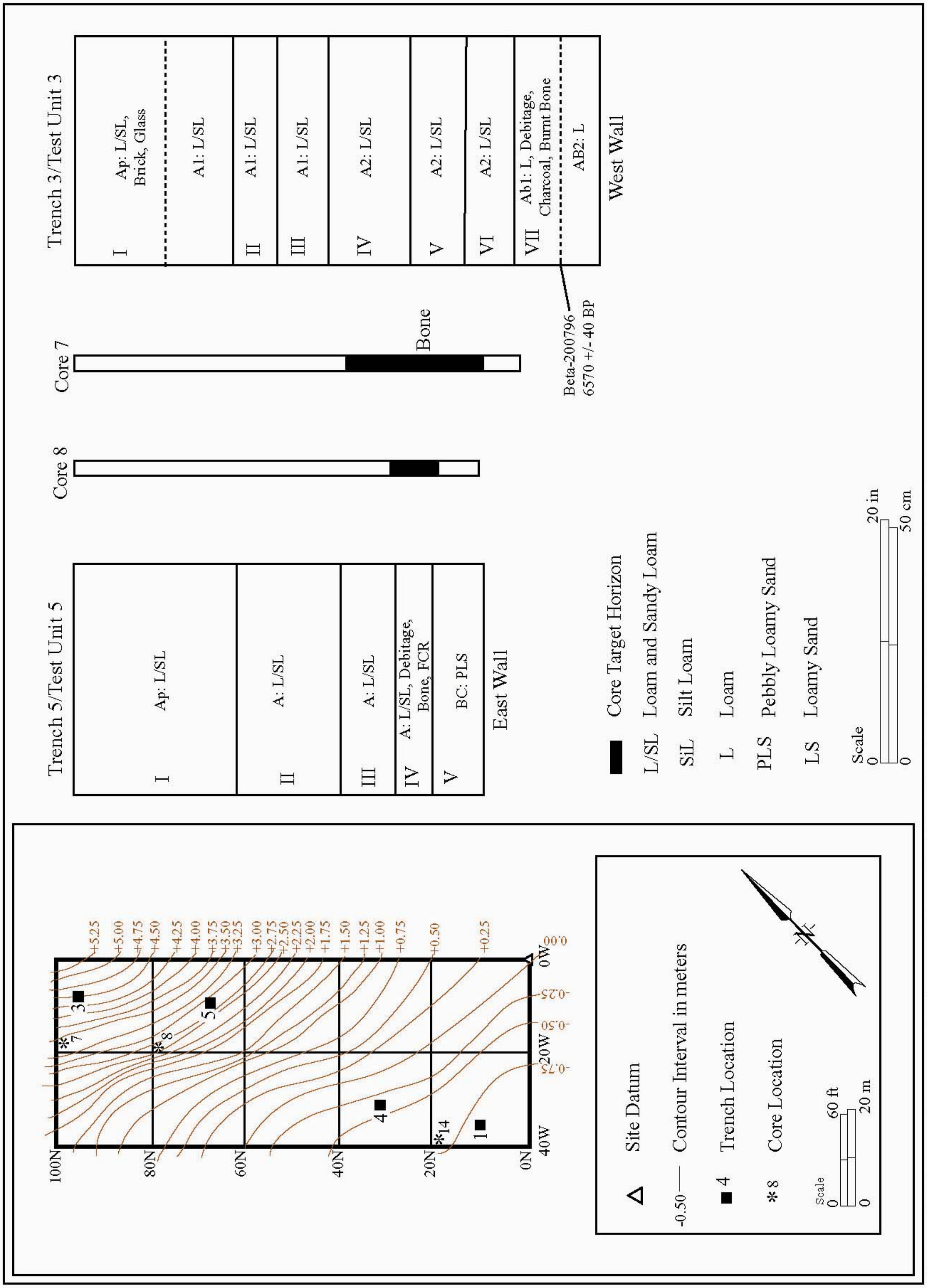

Figure 6.5.2-1b. Comparative Trench/Test Unit Profiles, Fritsche Creek II Test Locale

6.5.3 Artifact Assemblage

Prehistoric Assemblage

The prehistoric artifact assemblage from the Fritsche Creek II test locale includes five chipped stone tools and tool fragments, one core, 26 pieces of debitage, and 10 pieces of fire-cracked rock with an aggregate weight of 3.5 kg (7.7 lbs) (Appendices E and F). Chipped stone tools from the site include a triangular projectile point, a possible hoe or digging tool fragment, an expedient end scraper, and two edge damaged flakes.

The triangular projectile point was recovered from the surface of the site. It is made from a flake of Prairie du Chein chert and has a thin plano-triangular cross section (Figure 6.5.3-1A). Retouch is limited to the margins of the tool. It measures 30.2 mm in length, 14.6 mm in width, and 4.8 mm in thickness. This projectile point is associated with the previously documented Late Woodland occupation (Roetzel and Strachan 1992; Roetzel et al. 1994).

The only other formal bifacial artifact is a fragment of a large hoe or other digging tool. It is a large rectangular tool with a relatively thin tabular cross section (Figure 6.5.3-2). It is made from a tabular piece of Sioux quartzite. Flaking of the tool is limited to very short bifacial retouch along the edges of the specimen. Although one end of the tool is missing, the nature of the flaking along the intact edges is more suggestive of use as a digging tool than as a coarse butchering tool. It has a fragmentary length of 161.5 mm and is 126.0 mm wide and 20.4 mm thick. Since this tool was collected from the surface of the site it is presumed to be associated with the Late Woodland component at the site.

A small expedient end scraper was also collected from the surface of the site and is also presumed to be associated with the Late Woodland component. It was made from a narrow, triangular blocky secondary flake of white quartz and has a plano-triangular cross section (Figure 6.5.3-1B). The distal end of the flake has been steeply retouched from use as a scraping tool. This end is also slightly beaked in profile. It measures 21.1 mm in length, 10.5 mm in width, and 6.5 mm in thickness.

The first edge-damaged flake was collected from the surface of the site. It occurs on a rectangular unfaceted flat secondary flake of oolitic Prairie du Chein chert and has a thin wedge-shaped cross section. The proximal two-thirds of both lateral edges and the distal end of the flake exhibit extensive edge damage in the form of steeply and moderately steeply angled microflaking and rounding suggestive of use for both cutting and scraping tasks. It measures 35.2 mm in length, 18.2 mm in width, and 5.9 mm in thickness.

The sole core from the site is a small exhausted remnant of a bipolar core made from Prairie du Chein chert. It has a rectangular shape and cross section (Figure 6.5.3-1C). Narrow linear flakes have been removed from the entire periphery of the core before it was discarded. It measures 20.2 mm in length, 8.1 mm in width, and 5.8 mm in thickness.

In addition to the chipped stone tools and core, 27 pieces of debitage were collected from the surface of the site, the augers, and the test units (Appendix E). Overall, this debris indicates the

Figure 6.5.3-1. Chipped Stone Tools and Bipolar Core from the Fritsche Creek II Test Locale

Figure 6.5.3-2. Possible Digging Tool from the Fritsche Creek II Test Locale

mix of both core reduction and tool resharpening was taking place at the site, with a slight emphasis on the former activity. Debris derived from core reduction includes a single decortication flake, five blocky secondary flakes and flake fragments, and seven unfaceted flat secondary flakes. With the exception of one blocky secondary flake, all of these flakes are small. Debris from the maintenance of chipped stone tools is limited to three faceted flat secondary flakes, all of which are small. An additional 11 flat secondary flake fragments complete the debitage assemblage. The relatively high percentage of broken flat secondary flakes in the assemblage can largely be attributed to damage from plowing since eight of these flakes were collected from the surface. Although the debitage assemblage is small and prone to the effects of sampling error, the preponderance of core reduction debris may be an indication that there was a reliance on expedient flake tools rather than formal bifacial or unifacial tools for the animal carcass processing activities that took place at the site.

The debitage assemblage includes a broad range of different raw material types, most of which are locally available. With a total of eight specimens each, Prairie du Chein chert and quartzite are the only raw material types represented in any quantity in this small assemblage. Burlington chert, which originates from the Illinois Valley region, is the next most frequently occurring raw material with a total of three flakes. The remaining raw material types include two flakes of orthoquartzite, two flakes of possible Grand Meadow chert, and a single flake each of Hixton-like silicified sandstone, Tongue River silica, miscellaneous glacial chert, and quartz (Appendix E).

The Fritsche Creek faunal assemblage consists of 5,032 pieces of bone, of which all but three occurred below the plow zone and almost all of which occurred within target horizons (Appendix F). Consequently the bone is presumed to be prehistoric in age. Most specimens are only generally identifiable (see Appendix F), as 4,184 specimens cannot be categorized to either element or taxonomic group and, as noted above, most are small fragments recovered from flotation samples. All of the unidentifiable remains are calcined; none display butchering marks.

One right 3rd molar crown, eight cheektooth fragments, and four longbone shaft pieces are identifiable as bison. A single older adult animal is indicated, based on the degree of wear on the molar tooth. Several of the cheektooth fragments were refit, and it appears that only a single tooth is represented by these fragments. Two of the longbone shaft pieces were refit; all four compare favorably with bison. Two small refit pieces of tooth enamel are indeterminate bovid or cervid (family Cervidae) based on their shape, overall size, and other traits. None of these bison or bovid/cervid remains are burned or calcined, and none exhibit cut marks.

Mammal remains predominate among identifiable bone in the Fritsche Creek assemblage. One hundred thirty-eight specimens are categorized as large mammal, with indeterminate fragments ubiquitous. A limited number of longbone shaft and tooth fragments also are present. None of the large mammal bones exhibit butchering or processing marks; 122 are burned or calcined. Six hundred ninety-two pieces of bone are indeterminate mammal. None can be identified to element. No cut marks were observed, and 677 specimens are burned or calcined. With regard for approximate live weight, most are likely from medium or large mammals.

Of the three pieces of bird bone in the assemblage, two are longbone shaft pieces, one of which displays medullary bone characteristic of egg-laying females. The third element is the distal shaft portion of a right humerus from a chicken- or duck-sized bird. No cut marks were observed on the bird remains, and none are burned.

Historic Artifact Assemblage

A small assemblage of Historic period artifacts was also collected (Appendix E). The 27 historic artifacts include five ceramic artifacts, 16 glass artifacts, five metal artifacts, and one graphite artifact. Except for a single white paste earthenware sherd, small brick fragments constitute all of the historic ceramics from the site. The whiteware sherd can only be broadly placed within a late nineteenth to twentieth century time frame (Majewski and O'Brien 1987). Fragments from various types of bottles and jars comprise most of the glass artifacts. Although most of these fragments did not contain temporally sensitive attributes, most appear to be relatively recent introductions to the site. One bottle base fragment contained a portion of an Anchor Hocking maker's mark indicative a post-1938 date of manufacture (Toulouse 1971). The metal artifacts also appear to be twentieth century additions to the site and include a fence staple, two wire nails, a zinc canning lid fragment, and an unidentified flat fragment of iron/steel. All of the historic artifacts occurred in the plow zone.

6.5.4 Discussion of Archaeological Significance

The 2004 investigations, particularly data from the backhoe trenching, supplement and enhance what is known about this site. A systematic surface collection of the test locale verified the presence of the Late Woodland component. The occurrence of a Late Woodland projectile point on the surface clearly indicates that hunting was one of the activities carried out at the site; however, the presence of a fragment of a hoe-like chipped stone tool, as well as the ceramics identified by the earlier investigations, imply that hunting was not the only Late Woodland activity at the site. The coring and augering survey successfully identified the presence of a paleosol across the site. However, cultural material in the individual augers was limited in quantity. For example, cultural material that is presumed to be prehistoric in age occurred in only seven of the auger holes. This material was exclusively comprised of small animal bone fragments. Of the 20 bone fragments from the augers, eight are bison tooth fragments, one is a cervidae/bovidae tooth fragment, nine are large mammal bone fragments, one is a medium to large mammal bone fragment, and one is an unidentified variety of bird. No lithic or ceramic artifacts were recovered during augering.

The backhoe trenches and, to a lesser extent, the test units adjacent to the trenches, provided the most detailed and comprehensive archaeological data for the Fritsche Creek II test locale. Only a limited quantity of artifacts, however, was obtained from the test units, and virtually all of the prehistoric cultural material recovered from the test units occurred in the paleosol. Test Unit 4 was the only test unit that produced cultural material from sub-plow zone levels, between the plow zone and above the upper paleosol. This test unit produced one piece of debitage and two bone fragments at depths between 50 cm and 60 cm (20 in and 24 in) and one piece of debitage and two bone fragments at depths between 70 cm and 80 cm (28 in and 32 in).

Some cultural material (e.g., fire-cracked rock and animal bone) observed in the profiles of the backhoe trenches also confirms the ephemeral use of the site following the burial of the paleosol.

Data pertaining to the original paleosol associated with the bone bed further support the Middle Archaic age for the archaeological component housed within the paleosol. The date from organic materials collected from this horizon in Trench 3 is 6570 BP. Similarly, the previously undated lowest paleosol testifies to a Plano-period occupation dating to 8100±40 BP on organic materials obtained at a depth of 2.5 m (8.2 ft) in Trench 2. Additionally, analysis of the artifacts recovered suggests that the test locale was probably used primarily for the final processing of the bison carcasses, specifically the processing of bone for its grease and marrow.

6.6 SYNTHESIS AND INTEGRATION

The geophysical survey results from the Fritsche Creek II test locale by themselves are generally disappointing and appear to be more informative about the geological and sedimentological environments than the presence of a buried archaeological site. The real possible cultural indications from magnetic survey data were several anomalies that probably resulted from large amounts of historic debris in many portions of the test locale. Numerous historic metal, brick, and ceramic artifacts on and below the surface were noted.

Initially, the weak bands of higher resistivity running true north-south, in the 2 m (6.6 ft) and 3 m (9.8 ft) data layers (Figure 6.2.1-1) are likely indicative of buried alluvial features, such as erosional channels or cut and fill structures, formed as fan deposition progressed. The cores and trenches did not reveal such features. Rather these data indicate that fan structure runs roughly perpendicular to the “grain” noted within the resistivity layers. However, gravel layers were noted in several cores, and definite channel-like gravel deposits occurred below about 1 m to 1.5 m (3.3 ft to 4.9 ft) in several trenches, particularly Trenches 3, 5, and 7. While neither coring nor trenching data resolved the geometry of these gravel bodies, the resistivity data suggest that they form broad, roughly parallel “channels” trending down slope on the fan. This pattern is consistent with fan formation and suggests that these bands may themselves be parts of the fan structure. If so, such patterning is apparent only from the geophysical survey and is also independent of the reconstructed LfSA developed from coring survey (Figure 6.3.1-1). From the standpoint of preservation of buried cultural material, these channel-like features probably are places in the subsurface where cultural material was probably reworked and are not likely to preserve good cultural context.

Coring, trenching, and test unit excavations all revealed the presence of a buried archaeological site. Although coring successfully identified the previously identified Middle Archaic horizon throughout the site, no artifacts were discovered through augering. Rather the augers produced only small amounts of bone, and these were restricted in their spatial distribution to the northeast corner of the test locale, which is the location of the primary fan deposit. While the presence of bone may be an indicator of human activity, particularly if it was burned or calcined, its mere occurrence is not necessarily indicative of an archaeological site. The presence of lithic or ceramic artifacts, as observed in the trenches, is unequivocal evidence of human activity. Coring did not identify the second, more deeply buried occupation zone. This zone, which was dated to 8100±40 BP (calibrated cal yrs B.C. 7160 to B.C. 7040), was discovered in the second trench excavated. The stratigraphic context, depth, and age of this horizon were previously unknown and clearly indicate a somewhat different and more complicated stratigraphy than was originally described. This can, in part, be attributed to both the depth limitations and small size of the profiles exposed in excavation units of the earlier archaeological study and the fact that a geomorphologist was not part of the original research team. This situation is clear evidence of how backhoe trenching can effectively clarify depositional and stratigraphic relationships between sediments and archaeological materials.

Test unit excavations did not always efficaciously supplement the information obtained by trenching alone. For example, the 1994 excavations (Roetzel et al. 1994) demonstrated that Late Woodland materials were present below the plow zone in an excavation unit near the southern end of the 2004 test locale. Although no typological affiliation was noted for these ceramics (Roetzel and Strachan 1992; Roetzel et al. 1994), Late Woodland materials in this part of the Minnesota River valley are usually associated with the Lake Benton phase (1250 BP to 750 BP) (Anfinson 1997). No unambiguous trace(s) of Late Woodland artifacts/deposits were identified in Test Unit 4 or Trench 4; yet, the geoarchaeological analysis of the landform suggests that such deposits could be preserved under alluvium in this portion of the site, but not likely preserved elsewhere in the test locale.

In fact, no diagnostic artifacts occurred in any of the occupation horizons and the non-diagnostic artifacts that were found were neither numerous nor varied enough to interpret cultural use of the site with certainty. The greatest quantities of subsistence remains were found during trenching when the so-called Feature 1 was exposed in Trench 3. This brings into question whether the extra labor and cost of excavating 50 cm × 50 cm (20 in × 20 in) test units are worthwhile. Most of the bone from Trench 3 was recovered during the excavation of Feature 1 and within the associated soil in the trench floor rather than from the test unit excavated on the side of the trench.

Finally, the Fritsche Creek II work demonstrates how detailed geoarchaeological studies focused on landform development and reconstruction facilitate the complete and comprehensive identification of buried archaeological deposits and are essential before undertaking investigations (Phase II) to evaluate the National Register eligibility of a site and/or gather sufficient data on which to base a data recovery plan. By the time such studies are implemented, the majority of geoarchaeological data (except for more detailed studies of such issues as feature chemistry) should be collected to avoid stratigraphic surprises of undiscovered buried horizons, as were found in Trench 2 at a depth of some 2.5 m (8.2 ft). In fact, without a more or less complete understanding of the formational history of the associated landform, including the pre- and post-occupation periods, a well-conceived and comprehensive excavation plan cannot be undertaken.