SECTION 6.0 STRATIGRAPHY AND RADIOCARBON DATING

To understand the context of archaeological material found at Hickory Bluff, stratigraphic analysis and chronological ordering were necessary steps in establishing a foundation for site interpretation. During field investigations, attention was placed on the documentation of the stratigraphy. This section provides stratigraphic field observations and sedimentological and pedological analyses, followed by presentation of the radiocarbon dates obtained from the site.

ARCHAEOLOGICAL STRATIGRAPHY

Hickory Bluff was excavated according to arbitrary strata based on visible differences in soil/sediment type, Munsell® color, and alterations (e.g., plow zone). Based on field observations, the stratigraphic sequence included four main strata (Strata A-D). Artifacts were bagged and collected according to their position within these strata. To add another level of provenience control, field archaeologists divided these four strata into 10-centimeter (cm) arbitrary levels and bagged the artifacts from each level separately. Since sedimentary and preservation conditions varied horizontally and vertically across the site, not all units preserved the same sequence of strata. In some instances, areas displayed greater soil development. For example, Stratum A in the eastern portion of the site was designated as the plow zone, whereas inside the treeline, the humus and rootmat constituted Stratum A.

During the initial stages of excavation, attention was paid to subtle variations in texture and color. A concerted attempt was made to re-identify the stratigraphic sequence presented by Hunter Research in their reports (Hunter Research Inc. 1995; Liebeknecht et al. 1997), particularly re-identifying the buried AB-horizon at 60 to 120 cm below ground surface found in the later stages of Hunter Research fieldwork (Liebeknecht et al. 1997:Plate 9.6). The general sequence proposed by Hunter Research was re-identified but, despite a concerted effort, the buried AB was not relocated; thus, it is considered to have been an inaccurate field and soil classificatory observation.

As fieldwork progressed and preliminary analyses were completed, decisions were made to lump or split some of the observed variations. In the eastern portion of the site that included a recognizable historic plow zone, both the A-horizon of organic material overlying the plow zone and the plow zone itself were removed as a single stratum designated the "Ap." In effect, this separated the modern and historic land modification zones from the underlying horizons. Within the tree line outside the plowed areas, the upper organic A-horizon that included the root mat and humus was designated as the "Ao." This split was made in order to facilitate comparisons between the plowed and unplowed portions of the site. Field observations also detected variability within the subsoils, and an effort was made to split out these differences. These differences were most pronounced at the base of the elluviated zone (E-horizon) and its contact with a well developed argillic horizon (B-horizon) or the underlying Columbia Formation (C-horizon). The point of contact between these soil horizons was variable across the site and displayed slightly different soil textures and colors. As a result, these zones were removed separately and designated with separate strata identifications.

GEOARCHAEOLOGICAL STRATIGRAPHY

General Sedimentology

The sequence of Pleistocene-Holocene landform development was discussed in Section 4.0. Based on sedimentological observations across the site, most units typically consisted of fluvial and/or near-shore bedded sand and gravel deposits. Surface topography was generally level, with some modification due to incision of incipient intermittent drainages extending up-slope from the incised river bluff. Modern agricultural practices that included plowing enhanced the planar characteristic of the site, especially east of the tree line. The tree line was marked by an irregular, discontinuous, linear deposit of accumulated surface sediments that appeared to represent recent, mechanically deposited sediments (probably the result of clearing operations associated with the orchard east of the tree line, Appendix A).

Surficial sediments are primarily, well-drained, sandy-to-silty-sand deposits that reflect aspects of their depositional environment. At depths exceeding ~1m, the deposits were mainly coarse-grained sand and gravel that, in places, included abundant cobbles. These graded to fine-grained silt and sand at the surface.

Although the upland terrace consisted of deposits attributable to the Pleistocene, surface and near-surface sediments have undergone subsequent modifications. Below depths of approximately one meter, sedimentological characteristics of original deposition, such as cross bedding and sorting, were still evident. Above ~1 meter, near-surface sediments exhibited evidence of long-term weathering (or soil formation), and disturbances by cultural, biogenetic, and possible eolian agents.

General Pedology

Weathering of near-surface sediments resulted in soil formation, enhanced by good drainage conditions. Coarse-grained sand and cobbles of the Columbia Formation underlay the site. This deposit was laterally extensive and was subsequently entrenched during the exhumation of the St. Jones River valley. Springs and seeps marked exposures of these deposits along the valley wall. Such areas indicated exit points for accumulated groundwater (largely precipitation-derived) conducted through, below, and away from the site proper. This passage of well-oxygenated water through the upper meter of site sediment has facilitated sediment weathering, organic matter decomposition, and soil formation.

Soil formation within these sandy-to-fine grained sediments resulted in an A-E-BE-Bt-BC-horizon sequence that graded into oxidized sand and gravel deposits. This horizon sequence was typical of a probable Alfisol formed in a woodland environment over a significant amount of time (Birkeland 1984). The presence of recent, cultivation-related, surface disturbances was noted east of the tree line (where the surface is noted as an Ap-horizon). The fact that a friable E-horizon (generally thinner where associated with the Ap-horizon) remained at the site suggested that net deflation during the recent past has not been excessive. Additionally, in areas not subjected to recent cultivation (west of the tree line), input of agriculture fertilizers and chemicals (typically high in nitrogen [N], phosphorus [P], potassium [K], magnesium [Mg], and sodium [Na]) was probably minimal. As such, the physical and chemical soil properties west of the tree line more closely reflected a “natural” sequence.

The majority of cultural materials, with the exception of deep features, was derived primarily from the upper 40-50 cm of the site (A-, E-, or BE- soil horizons). East of the tree line, most artifacts were recovered from the plow zone, with the remaining artifacts primarily attributable to deeper basin features. West of the tree line, artifacts were recovered from the surface A-horizon, both artifacts and features were recovered in subsoil E- and BE-horizons, and artifact-bearing basin features were found to intrude into subsoil Bt- and BC-horizons.

Typical Profile

A typical stratigraphic and pedologic sequence occurred at Unit N337 E691 (Figure 6.1 and Figure 6.2). These figures depict soil horizon characteristics, general sedimentology and geology, chemistry, texture and other physical properties of samples within the sequence, and the types and abundance of artifacts found within adjacent excavation units. This unit profile was typical of soil horizon sequences that developed within sandy, well-drained sediments. It included an A- and Ap-horizon (plow zone), a distinctive E-horizon, and a well-formed argillic-B-horizon. Notably, the archaeological material was contained mainly in the A- and E-horizons, which were also the zones of greatest oxidation, pH, and biological activity.

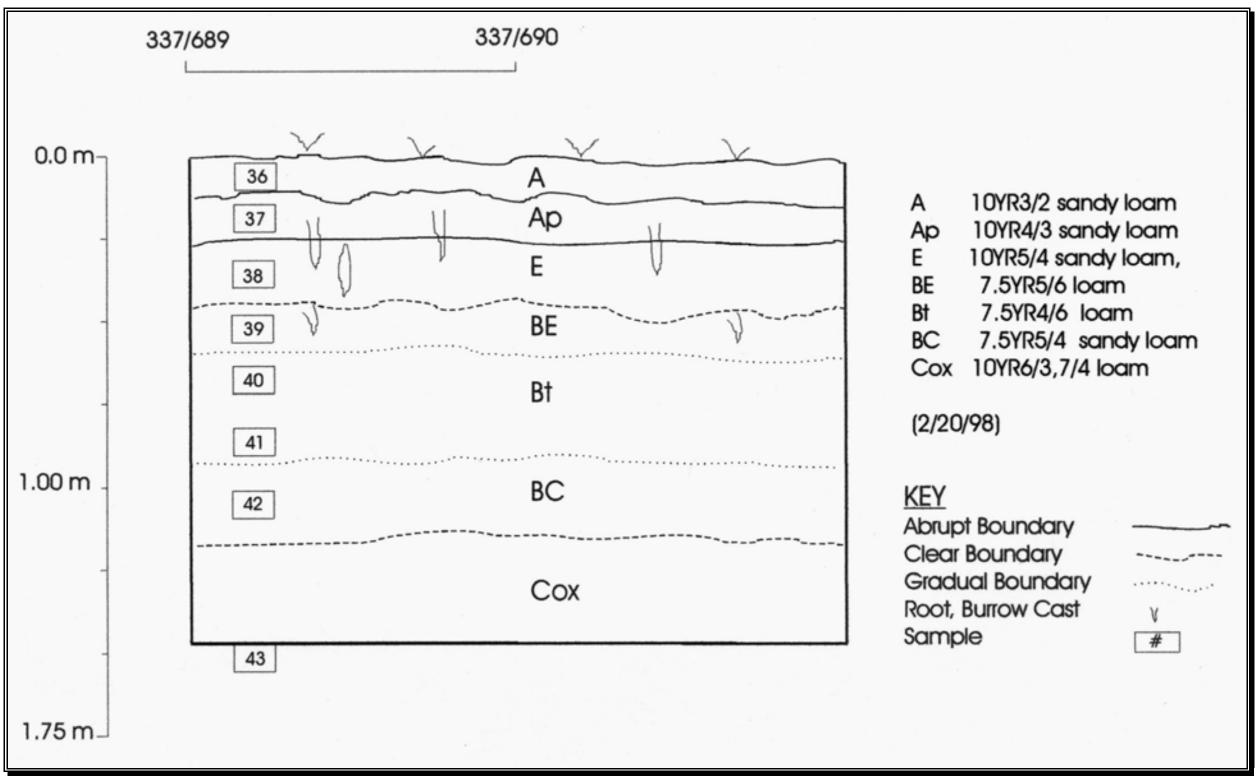

Figure 6.1 Profile of Unit N337 E691

The deposits depicted in Figure 6.2 generally fine upwards. From a sedimentological standpoint, they were bedded near the base (below about 80-90 cm) but were generally massive near the surface. Bed types included cross-bedded sand and fine gravel with occasional shallow cut-and-fill structures near the base of the profile. These likely reflected the fluvial (channel) origin of the sediments. The cross-bedded sand graded into rippled and tabular bedded sands with only a little gravel. The ripples were generally sandy and discontinuous. They were also "starved" (i.e., troughs between ripples are missing) suggesting sediment-deficient environments during ancient floodplain or overbank deposition. Altogether, the alluvial sequence suggested channel migration away from the site. The rippled and tabular bedding may also indicate a deepening of the channel and reflect incision of the St. Jones River Valley as sea level fell during the initial Wisconsinan ice advance. Although the top of the sequence was apparently associated with alluvial (and possible eolian) environments, original bedding has been obliterated by subsequent soil weathering and bioturbation.

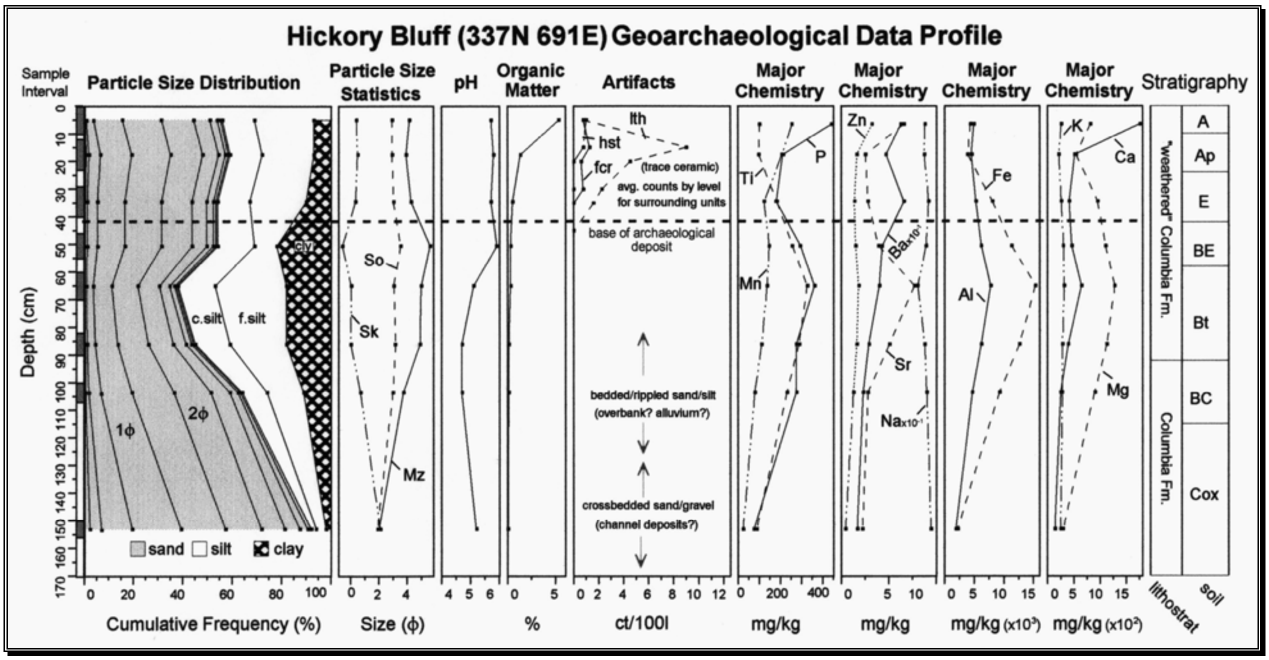

Figure 6.2 Geoarchaeological Data Profile of N337 E691

The A-horizon, as is typical, represented the zone of organic matter (OM) accumulation. Thus, it was defined by the greater abundance of OM within the horizon compared to other parts of the profile. Minor additions of mineral soil can also occur within this zone. In this location, as is typical, the plow zone (Ap) probably contained a mixture of the upper part of the E-horizon material (and associated chemistry) and the A-horizon. Based on its high OM content, the A-horizon (A and Ap) is readily apparent in Figure 6.2. It contained relatively high element abundances, particularly calcium [Ca], barium [Ba], manganese [Mn], Mg, and P (K is typically also abundant in the A-horizon, although this is not apparent in Figure 6.2). These elements generally derived from the breakdown of organic materials (plant and animal), which formed oxides that were readily leached, transferred by groundwater, and occasionally recycled back into plant and animal tissue. Within this environment, high values for these elements were maintained by continual additions of organic matter.

The E-horizon represented the zone of leaching within the soil profile. It contained relatively low abundances of elements. Additionally, finer-grained mineral components, such as silt- and clay-size particles were commonly eluviated from the horizon, and/or further degraded by organic acids. By contrast with A-horizons, organic matter, element and clay content in E-horizons were generally much lower.

The B-horizon was well developed, strongly argillic, and relatively dense. Because of redox and groundwater conditions, it represented the zone of accumulation for translocated oxides and eluviated mineral fragments. Additionally, clay can also authigenically form. Thus, the increase in clay and silt content associated with the B-horizon (Figure 6.2) was associated mainly with pedogenic, rather than sedimentary, processes. The B-horizon was marked by increases in most of the major elements, but particularly iron [Fe], aluminum [Al], and Mg. As a result of element and mineral translocations, a dense, red-colored, semi permeable layer has formed across the site. Importantly, within older archaeological sites, the B-horizon may be the ultimate repository of culturally introduced or elevated elemental abundances.

Though largely devoid of artifacts, the B-horizon was important from an archaeological standpoint. Basin features were largely recognized because they disrupted the B-horizon, which "heals" very slowly. Thus, basin-feature fills were distinctly more friable and often lighter in color in comparison with the surrounding B-horizon matrix. Such distinctions facilitated the identification and delineation of basin features.

A similar stratigraphic and pedologic sequence within a typical block excavation within the tree line (Block A) occurred at Unit N309 E659 (Figure 6.3 and Figure 6.4).

Correlation of Archaeological and Geoarchaeological Stratigraphy

As discussed above, the archaeological field stratigraphy was an arbitrary designation, whereas the geoarchaeological stratigraphy was based on sedimentological and pedological changes. The geoarchaeological changes were generally present throughout the site, although there were local variations in preservation and depth. Since the geoarchaeological stratigraphy was generally uniform and consistent throughout the site, a universal stratigraphy for excavated proveniences was constructed that incorporated both geoarchaeological criteria and the goals associated with archaeological field designations. Artifacts from each provenience were assigned to particular universal horizon designations (e.g., A-horizon, E-horizon). The universal stratigraphy provides a basis for horizontal and vertical artifact comparison and spatial distribution. The artifact inventory preserves the original field designation by archaeologists and it presents the universalized stratigraphy.

The universal stratigraphic designations represent a bridge between arbitrary field designations and strict geoarchaeological stratigraphy. Initial fieldwork demonstrated the homogeneity of artifact classes contained in plowed areas within the upper A-horizon and the subsequent Ap-horizon, or plow zone. As a result, these two geoarchaeological strata were combined in the universal stratigraphy as the Ap-horizon. Outside the plow zone, in the western portion of the site, the upper humic root mat, and organic soils were designated as the Ao-horizon. Also noted within the tree line were the remains of a discontinuous berm from plowing or bulldozing activities. Several test units were excavated through this berm, so a separate universal stratigraphic designation was necessary to separate these deposits from the unaltered natural deposits. Artifacts removed from the berm were classified as "redeposited" in the universal stratigraphy.

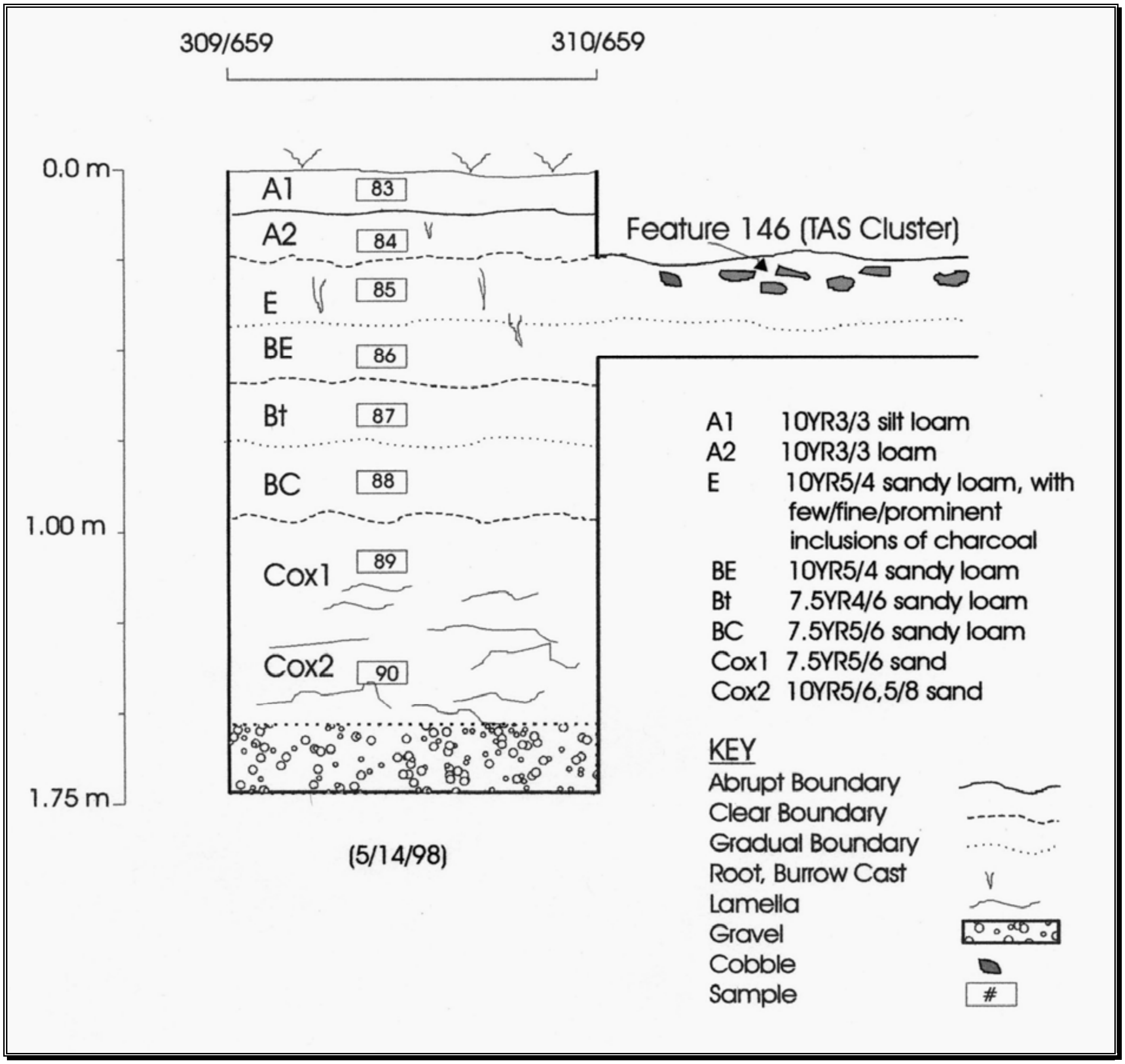

Figure 6.3 Profile of Unit N309 E659

Following in profile was the E-horizon. Recognition of the E-horizon was fairly consistent, so that the universal designation of E-horizon closely follows the geoarchaeological strata. However, a distinction was made at the base of this horizon, which was often differentially weathered and displayed various textures. This zone of weathering at the base of the E-horizon was excavated separately to examine potential artifact patterning associated with the weathering. These zones are represented in the universal stratigraphy as either an EB or an EC-horizon, and generally follow the geoarchaeological strata defined as a BE-horizon, which does not account for the slight differences of texture recognized archaeologically. For the universal stratigraphy, the EB designation refers to the zone of transition between the well drained E-horizon and the more argillic B-horizon. The EB was typically more moist and contained a siltier texture than the E-horizon. Conversely, the EC-horizon designation within the universal stratigraphy referred to the zone of transition between the E-horizon and the underlying C-horizon when a well-developed argillic B-horizon was not present. The EC-horizon was

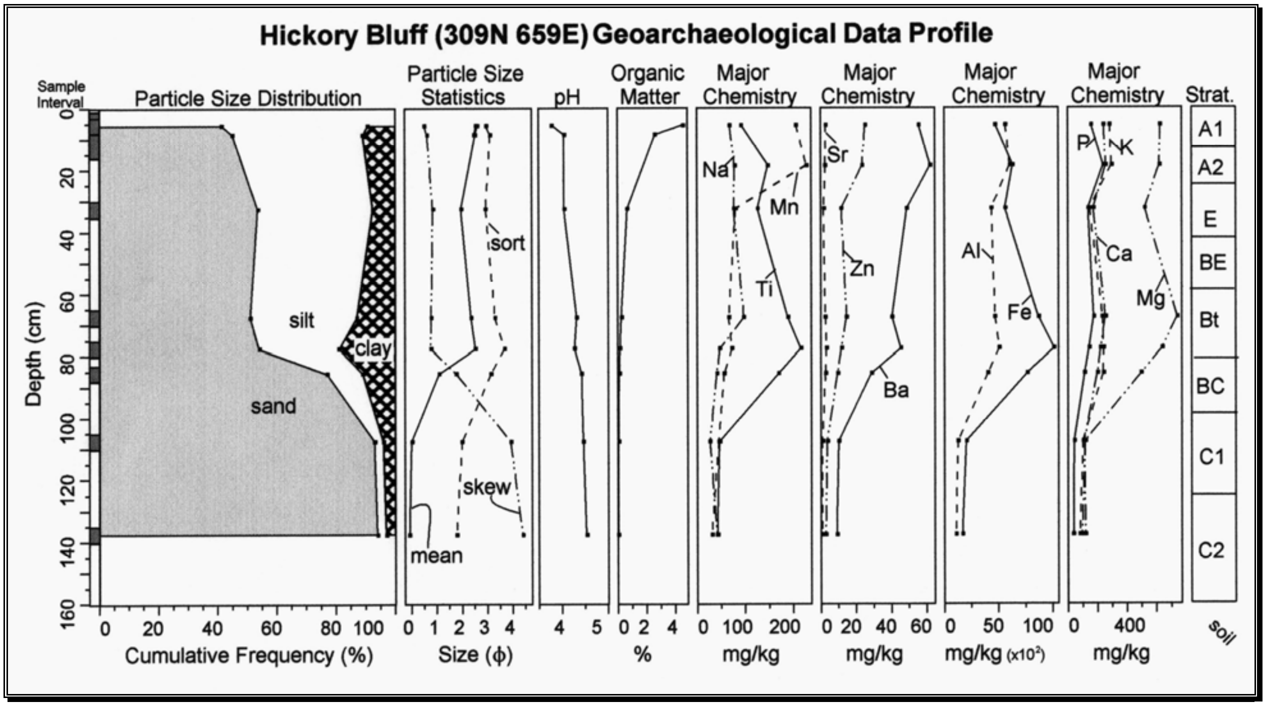

Figure 6.4 Geoarchaeological Data Profile of Unit N309 E659

typically dry, highly compacted, and had a sandier texture than the overlying E-horizon. Although these differences were slight, they were recognizable and accounted for within the universal stratigraphy.

The remaining designations within the universal stratigraphy follow the geoarchaeological strata definitions. The B-horizon refers to the well developed argillic B-horizon found variably across the site. Likewise, the C-horizon designation correlates to the geoarchaeological definition of the Columbia Formation. Although in general, both of these strata were devoid of artifacts, random artifacts were recovered from them either introduced by biotic agents or recovered near the diffuse edges of deep basin features. Feature numbers were also used within the universal stratigraphy designations to illustrate more clearly the association of features and artifacts.

RADIOCARBON DATING

A total of 25 samples was submitted from Hickory Bluff for radiocarbon dating (Table 6.1). All radiocarbon dates were processed by Beta Analytic, Inc., of Miami, Florida, using Accelerator Mass Spectrometry (AMS). Three samples were initially submitted by Hunter Research, Inc. (Liebeknecht et al. 1997) (identified in Table 6.1 with n/a sample numbers). During field investigations by Parsons, 11 radiocarbon samples were submitted to assist in interpretation, to clarify stratigraphic relationships and to determine the ages of particular features or particular material culture associations while the site was being excavated. Seven additional dates were obtained after excavations and a full analysis of depositional contexts had been completed. These dates were run on samples from feature contexts and from identifiable charred materials, including nutshell. During laboratory processing of ceramics, it was noticed that some sherds had visible organic residues on their inner surfaces. Charred debris was removed from the walls of four different vessel fragments and submitted for dating.

While sampling of the types of material and proveniences was not systematic, the locations from which the samples were taken were varied enough to provide date ranges for accurate representation of the later periods of site occupation. Given the sandy, well-drained nature of the sediments at the site, organic preservation was poor. Old charcoal would thus be less likely to be preserved, and thus early occupations may be under-represented by the radiocarbon sampling. Nonetheless, the radiometric data tend to corroborate the chronology of the artifacts from the site. The cluster of early dates is notable in that they are essentially identical, statistically averaging about 2800 B.C. Two of the four dates are aggregate samples from a single feature, while the other two were from hickory nutshell fragments recovered from widely separated proveniences.

Table 6.1 Radiocarbon Dates for Hickory Bluff

Excavation Sample No.	Sample Material	Analysis	Provenience	Conventional Radiocarbon Age	Calibrated Results (2 sigma)	Laboratory Sample Number
5018	charcoal	AMS	N283 E646, Stratum B, Level 2	90 +/- 50 years B.P.	A.D. 1675 to 1775 and A.D. 1800 to 1945	Beta-114734
5000	charcoal	AMS	N371 E643, Stratum B (above Feature 1)	150 +/- 50 years B.P.	A.D. 1655 to 1950	Beta-113652
5040	charcoal	AMS	N351 E652, Feature 37	320 +/- 50 years B.P.	A.D. 1455 to 1665	Beta-117150
5624	charcoal (Hickory)	AMS	N372 E635, Stone Feature 296	570 +/- 40 years B.P.	A.D. 1300 to 1425	Beta-128591
5595	charcoal (Hickory nut)	AMS	N352 E648, Stone Feature 176	610 +/- 40 years B.P.	A.D. 1290 to 1415	Beta-128590
5712	charcoal (White Oak)	AMS	N360 E642, Stone Feature 46, Level 1	850 +/- 40 years B.P.	A.D. 1050 to 1095 and A.D. 1140 to 1265	Beta-128587
5589	charcoal (Hickory)	AMS	N308 E659, Basin Feature 120, Level 1	920 +/- 50 years B.P.	A.D. 1010 to 1225	Beta-128586
5005	charcoal	AMS	N338 E677, Feature 4, Levels 4-5	1540 +/- 50 years B.P.	A.D. 420 to 635	Beta-113654
5189	charcoal (Hickory)	AMS	N370 E631, Stone Feature 87, Level 1	1550 +/- 40 years B.P.	A.D. 420 to 610	Beta-128588
5119	charcoal	AMS	N312 E673, Feature 38, Level 7	1650 +/- 40 years B.P.	A.D. 340 to 530	Beta-117151
1207-1	ceramic residue	AMS	N389 E624, Stratum B, Level 2	1850 +/- 60 years B.P.	A.D. 45 to 330	Beta 128592
4268-1	ceramic residue	AMS	N366 E648, Stratum B, Level 2	1930 +/- 40 years B.P.	B.C. 5 to A.D. 140	Beta-141000
CX107/S	ceramic residue	AMS	N314 E673, Feature 415	1980 +/- 40 years B.P.	B.C. 55 to A.D. 95	Beta-141001
5016	charcoal	AMS	N405 E618, Stratum C, Level 1	2070 +/- 50 years B.P.	B.C. 190 to A.D. 55	Beta-114733
1437-1	ceramic residue	AMS	N370 E633, Stratum A, Level 2	2160 +/-50 years B.P.	B.C. 375 to 55	Beta-141542
n/a	charcoal	AMS	N370 E643 (78-88 cm), Feature 313	2480 +/- 60 years B.P.	B.C. 795 to 400	Beta-79172
n/a	charcoal	AMS	N390 E689 (78-86 cm), Feature 3	2600 +/- 60 years B.P.	B.C. 835 to 755	Beta-79173
5261	charcoal (Hickory nut)	AMS	N314 E658, Stone Feature 98, Level 1	2660 +/- 40 years B.P.	B.C. 885 to 790	Beta-128589
5031	charcoal	AMS	N371 E655, Feature 2, Level 6	2790 +/- 40 years B.P.	B.C. 1015 to 830	Beta-117149
n/a	charcoal	AMS	N390 E689 (55-62 cm), Feature 3	2790 +/- 60 years B.P.	B.C. 1065 to 815	Beta-79174
5002	charcoal	AMS	N370 E643, Feature 313, Level 5	3000 +/- 50 years B.P.	B.C. 1390 to 1045	Beta-113653
5676	charcoal (Hickory nut)	AMS	N402 E624, Basin Feature 90, Level 7	4070 +/- 40 years B.P.	B.C. 2855 to 2810 and B.C. 2690 to 2480	Beta-128585
5013	charcoal	AMS	N298.8 E665.4, Feature 9, Level 4	4180 +/- 60 years B.P.	B.C. 2900 to 2580	Beta-114731
5152	charcoal (Hickory nut)	AMS	N381 E631, Stratum B, Level 2	4210 +/- 50 years B.P.	B.C. 2905 to 2610	Beta-117152
5014	charcoal	AMS	N298.8 E665.4, Feature 9, Level 5	4210 +/- 60 years B.P.	B.C. 2910 to 2595	Beta-114732