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PREHISTORIC OCCUPATION AT THE CONNOQUENESSING SITE (36BV292), AN UPLAND SETTING IN THE UPPER OHIO RIVER VALLEY

Dennis A. Knepper and Michael D. Petraglia

A comprehensive survey, testing, and data recovery program was recently conducted at the Connoquenessing site (36BV292), a multicomponent occupation site located in the unglaciated upland plateau of western Pennsylvania. As in many upland sites, deposits were shallow and artifact distributions had been disturbed by plowing. Nonetheless, significant data were recovered from the plow zone as well as from intact features surviving in undisturbed subsoil. Diagnostic artifacts and a series of radiocarbon dates indicate that the most intensive occupations occurred during the Late Archaic and Middle Woodland periods. A coordinated, multidisciplinary program of analysis was conducted which indicated that the site served as a generalized procurement and resource processing camp during both of the major periods of use. This study confirms the quality and interpretive value of the data available through intensive study of such upland locales.

INTRODUCTION

For more than half a century, archaeological investigations have been conducted in western Pennsylvania culminating in classic works of regional synthesis such as *The Prehistory of the Upper Ohio Valley* (Mayer-Oakes 1955). Survey programs conducted under the sponsorship of academic, state, and private agencies have identified thousands of sites, dating from the Paleoindian to the Late Woodland periods (e.g., Lantz 1985; Raber 1985). Many of these sites occur in the upland portion of west-central Pennsylvania, at the transition between the glaciated and unglaciated portion of the Appalachian Plateau. Few of these sites, however, have undergone testing or excavation for the recovery of data related to aboriginal economics. Recent work at 36BV292, on Connoquenessing Creek in northern Beaver County, provided the opportunity to gather archaeological data on a more extensive scale than previously undertaken in the region. A comprehensive analytical program employed a variety of recent field and laboratory techniques. Various analyses were conducted on material from the site, including lithic tool seriation and debitage studies; immunological analysis of stone tools; feature analyses, including morphological typing, radiocarbon dating, and studies of archaeobotanical remains; and intrasite spatial analyses, involving the study of plow zone artifact distributions and comparative analyses with subsoil feature distribution.

Site 36BV292 consisted of a large, multicomponent prehistoric assemblage situated on a low terrace above Connoquenessing Creek, one of the major upland tributaries of the Beaver River in the Upper Ohio Valley. The Connoquenessing site was located in an active agricultural field near the present-day village of Hazen. Cultural resource investigations were undertaken within the portion of the site transected by a proposed pipeline corridor. The corridor crossed Connoquenessing Creek approximately 200 meters north of its confluence with a major perennial tributary, Brush Creek (Figure 1). This area is well known by artifact collectors and avocational archaeologists. Preliminary field surveys and analysis of artifact collections in the 1960s and 1970s by Donald Dragoo and Stanley Lantz of the Carnegie Museum of Natural History resulted in the recording of several prehistoric sites in the area. A historic period site, 36BV293, consisting of an early-twentieth-century trolleyline embankment, crossed the site, paralleling the stream in a wooded area near the bank (Figure 2).

SETTING

Physiographically, the Connoquenessing site lies within the unglaciated portion of the Allegheny Plateau. The general topography of the area consists of rolling and hilly uplands and narrow, steep-sided valleys. Level and undulating ground is found mainly on broad ridgetops and in river valleys (Smith 1982). While the site lies approximately 10 miles south of the southernmost extent of the last continental ice sheet, the several episodes of Pleistocene glacial advance and retreat have influenced the topography of the area. As the glaciers melted, runoff carried massive amounts of sediment and material generally southward. Thus, the entire region has been subject to aggradation, or deposition of sediments, primarily in the form of glacial outwash and drift. These sediments were frequently downcut by high-energy streams. As a result, the region does not appear as a flat plateau when viewed on the ground. Rather, it has been extensively reworked by fluvial action, producing a region of steeply cut valleys.

Connoquenessing Creek flows into the Beaver River approximately 4 miles northwest and 11 miles downstream from the site. The creek banks near the site are steeply cut, yet the terraces exhibit little small-scale relief. Consequently, the terrace system associated with the stream along this portion of its course is subtle, with the land sloping gently toward high ground to the west. The 100-year floodline, which occurs approximately 450 meters west of the bank near the west edge of the site, lies 868 feet above mean sea level (Hamel 1992: Table 2, n). Thus the entire site area is subject to extensive periodic flooding.

Soils associated with the Connoquenessing site consisted of a series of alluvial silt loams, generally laid down in pre-Holocene flood events. Each of the soil types is strongly to very strongly acidic (Smith 1982), suggesting low potential for organic preservation. Most soils are relatively deep, with pre-Holocene subsoils beginning 45 centimeters or less below grade (Hamel 1992, Martin 1977). Ground surface at the site sloped very gently to the east toward the creek, at a grade of less than 1 percent. Elevations ranged from 859 feet above mean sea level at the bank of the creek to 870 feet at the west end of the field.

FIELD PROCEDURES

The initial survey of the Connoquenessing site consisted of a single line transect of shovel tests excavated on a 15-meter interval following the centerline of the corridor (Petraglia et al. 1992a). Geomorphological analysis and deep testing of alluvial deposition was conducted simultaneously along the banks of the creek. Deep testing involved excavation of a series of backhoe trenches and hand-excavated test units. Four trench and test unit combinations were excavated on a 100-foot interval westward from the bank of the stream.

Evaluative testing of the site consisted of three co-ordinated operations: 1) controlled surface collection within the agricultural field; 2) subsurface testing, including the excavation of 1-meter-square test units throughout the site area and systematic, close interval shovel testing within the treeline; and 3) the mechanical stripping of plow zone deposits from a predetermined sample of the plowed field (Petraglia et al. 1992b). The corridor was plowed and disked over the entire width of the field. After the field had been rain-washed, walkover survey was conducted on transects approximately 2 meters apart. All prehistoric cultural material on the surface was point-provenienced using a system of trilateration from a central baseline, and the locations plotted on the existing site map. The resulting artifact distribution map was used to direct the placement of test units in areas of artifact concentration, in a procedure designed to increase the total artifact sample from plow zone contexts. The units also allowed more detailed examination of the transition to subsoil for evidence of intact deposition and the presence of subsoil features. Forty-seven test units were excavated across the field. In addition, 28 shovel tests were excavated on a 5-by-5-meter grid in the wooded portion of the site between the trolley line embankment and the creek bank. Seven 1-meter-square test units were excavated in the area in locations based on artifact distributions revealed in the shovel test grid. Finally, the plow zone

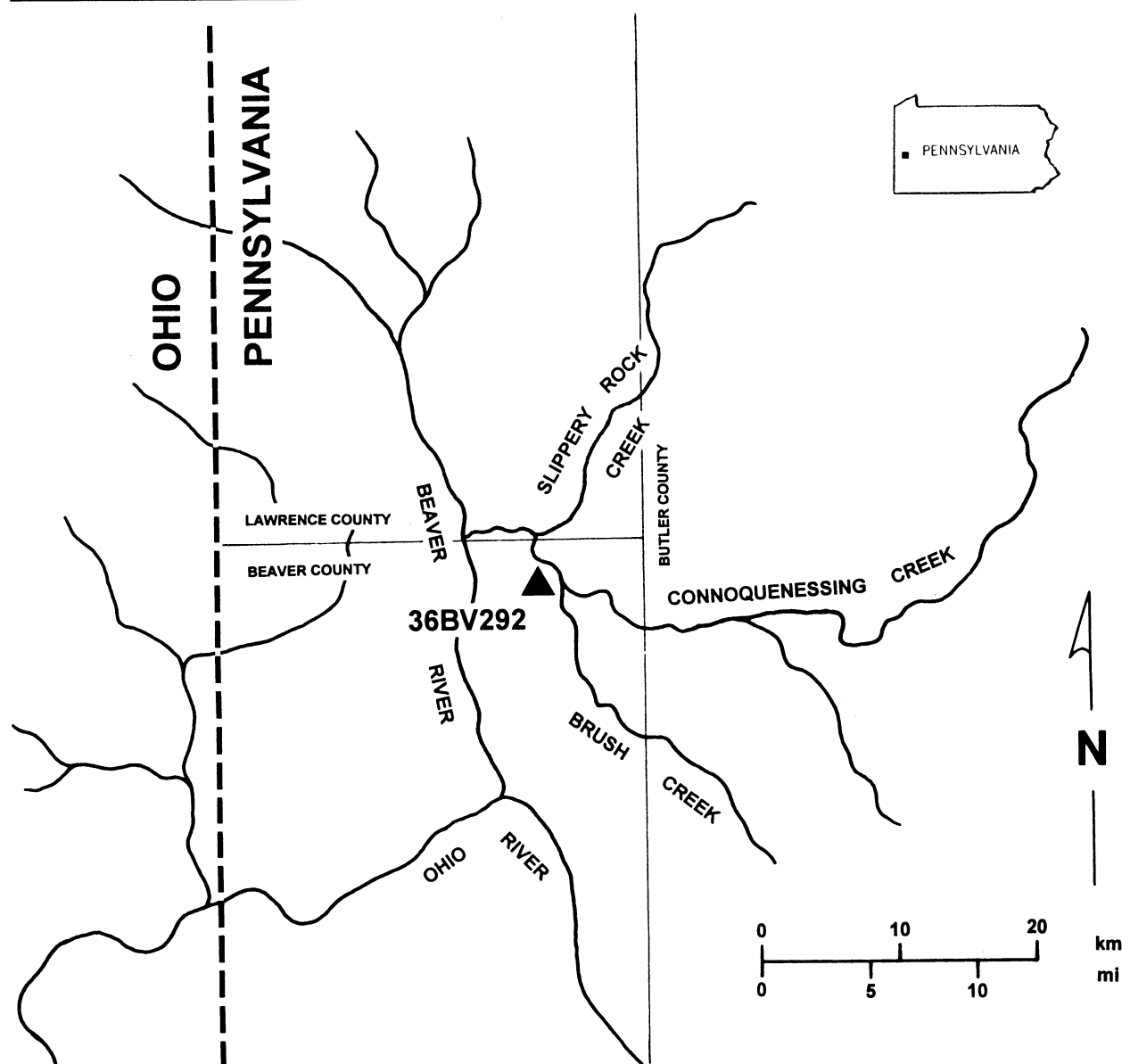


Figure 1. Regional map showing the location of the Connoquenessing site (36BV292) in relation to area streams.

was removed mechanically from seven areas within the field, totaling 1600m², to expose evidence of cultural features penetrating the subsoil. The sample of strip areas was chosen on the basis of artifact distribution plots resulting from the controlled surface collection.

Data recovery at the Connoquenessing site consisted of stripping the plow zone from the remainder of the corridor within the agricultural field to expose and document all cultural features (Knepper and Petraglia 1993). Plow zone soils were stripped from the entire right-of-way using a small bulldozer and two backhoes, each equipped with a 3-foot bucket with flat digging edge. As exposed, the subsoil surface was scraped clean with shovels. All subsoil anomalies were flagged, mapped, and cross-sectioned.

Stratigraphy in the plowed field was relatively simple, consisting of a plow zone approximately 30 centimeters in depth lying directly atop culturally sterile, compact silty clay subsoil. The plow zone stretched horizontally almost to the creek bank, extending beneath the historic period trolleyline embankment and into

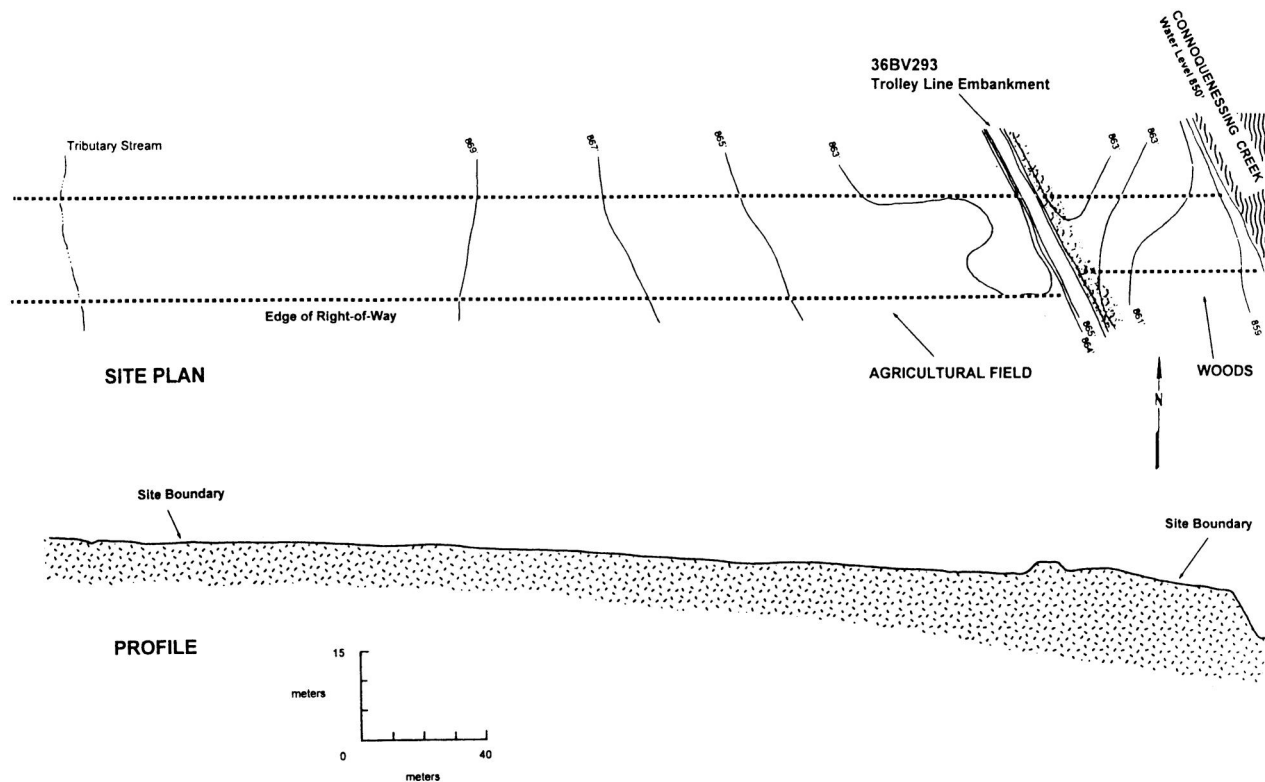


Figure 2. Connoquenessing site plan and profile. Note that right-of-way is narrower in wooded area.

the woods along the stream, demonstrating that the entire terrace had been plowed at the turn of the century. The fine sandy to silty clay subsoil lying directly beneath the plow zone was identified as Pleistocene sediment resulting from the ponding of glacial melt waters (Hamel 1992). The remains of a Pleistocene stream channel were identified in an area spanning the east and west sides of the trolley embankment. Gravels in the channel consisted of partially sorted, waterworn sandstone, comprising up to 80 percent of the deposit by volume. The base of the gravel deposit was encountered at a depth of 1.8 meters.

ARTIFACT ASSEMBLAGES

In total, 1,461 prehistoric artifacts were recovered during all phases of investigation at the Connoquenessing site: 1,459 lithic artifacts and two ceramic sherds. Total counts are summarized in Table 1. With the exception of a small number of chert flakes recovered from features, all of the artifactual material from the site was derived from plow zone contexts. Little horizontal separation of temporal components could be demonstrated, and thus temporal discrimination among non-diagnostic artifacts was not practical. Extensive analysis of lithic debitage, which constituted the majority of the artifactual material, was as a consequence considered to be of little interpretive value. More intensive analysis of chronologically diagnostic pieces was undertaken for data relevant to technological change.

A total of 37 projectile points or point fragments was recovered. Of those, 28 were either complete or were fragments retaining sufficient diagnostic attributes to allow typing (Table 2, Figures 3-4). Several others did not conform well to accepted point types from the region, but based on shape and dimensions they could be assigned general affiliation by period. Analysis of the frequency of occurrence of diagnostic points indicated that two chronological periods were most heavily represented: the Late Archaic (i.e., Brewerton

benville); and the Middle Woodland (i.e., Garver's Ferry, Kiski Notched, Murphys Stemmed, and Raccoon Notched).

Twenty-nine bifaces were recovered from the site, 13 early stage and 16 late stage. In addition, seven unifaces and 17 cores were recovered. Thirteen of the cores were multidirectional, freehand cores, and four were bipolar cores. No prepared or blade cores were present. The bulk of the debitage from the site consisted of 1,330 flakes and flake fragments. The flakes were generally small, 71 percent (n=943) weighed 0.5 grams or less, 83 percent (n=1105) 1.0 gram or less (Table 3).

The chipped stone artifacts from the site consisted entirely of chert derived from a variety of sources. Analysis of these sources was undertaken in an effort to discover trends in the temporal patterning of raw material selection. It was hoped that these data might indicate chronologically significant patterns in the horizontal distribution of debitage. Lithological analysis indicated that there are no known primary outcrops near the site (La-Porta 1993). There were, however, secondary deposits of outwash gravels occurring in isolated locations along the Connoquenessing and, more consistently, along the Beaver River. Non-local or exotic cherts were from sources in Ohio and southwestern Pennsylvania.

Three hammerstones, consisting of either greenstone or dense quartzite, were recovered. All exhibited end-battering from use in free-hand percussion. One large quartzite specimen appeared to have served a variety of purposes, with one end uniaxially flaked and used as a chopping tool, the opposite end bearing extensive battering, and one lateral surface bearing pitting from use as a bipolar anvil stone. Three additional anvil stones were recovered at the site.

A sample of 25 chipped stone artifacts from the site was selected for immunological analysis (Newman 1993). The analysis, using a method derived from forensic medicine known as cross-over electrophoresis (Newman 1990; Newman and Julig 1989), attempts to retrieve faunal data directly from lithic artifacts. Immunological analysis is still undergoing critical review (e.g., Downs and Lowenstein 1995; Fiedel 1995; Petraglia et al. 1996; Smith and Wilson 1992). Experimental studies have begun to detail the relationships between the preservation of organic residues and matters such as soil type and taphonomic conditions (Cattaneo et al. 1993; Eisele 1994). Residue analysis is a potentially useful tool for the study of subsistence and paleo-economics. It was undertaken as part of the multidisciplinary study at the Connoquenessing site to explore the likelihood of successful residue identification in mixed depositional contexts in upland regions. Artifact selection was confined to datable specimens: 23 diagnostic projectile points and 2 flakes from a radiocarbon dated provenience, Feature 34. Eleven artifacts, all projectile points, returned positive results (Table 4, Figures 3-4).¹

Two small ceramic fragments were recovered. One sherd was identified as Half Moon Ware (Mayer-Oakes 1955). It bore crushed stone temper, a smoothed interior, and parallel cord markings on the exterior surface. The second sherd was identified as Watson Ware (Mayer-Oakes 1955), based on its limestone temper. Weathering had rendered surface treatment indistinct.

Type	Count	Frequency
Flakes	1,359	93.0%
Projectile Points	37	2.5%
Bifaces	29	2.0%
Cores	17	1.2%
Unifaces	7	0.5%
Fire Cracked Rock	4	0.3%
Anvil Stone	4	0.3%
Hammerstone	2	0.1%
Ceramic	2	0.1%
Total	1,461	

Table 1. Site-wide artifact frequencies by type.

Early Archaic		Early Woodland	
LeCroy	.....1	Forest Notched	...1
Late Archaic		Middle Woodland	
Brewerton Side-Notched	....3	Garver's Ferry	...3
Brewerton Corner-Notched	..2	Kiski Notched	...4
Steubenville	.....3	Murphys Stemmed	...2
Side-Notched	.....2	Raccoon Notched	...1
		Side-Notched	...4
		Corner Notched	...3

Table 2 Projectile point frequency by type.

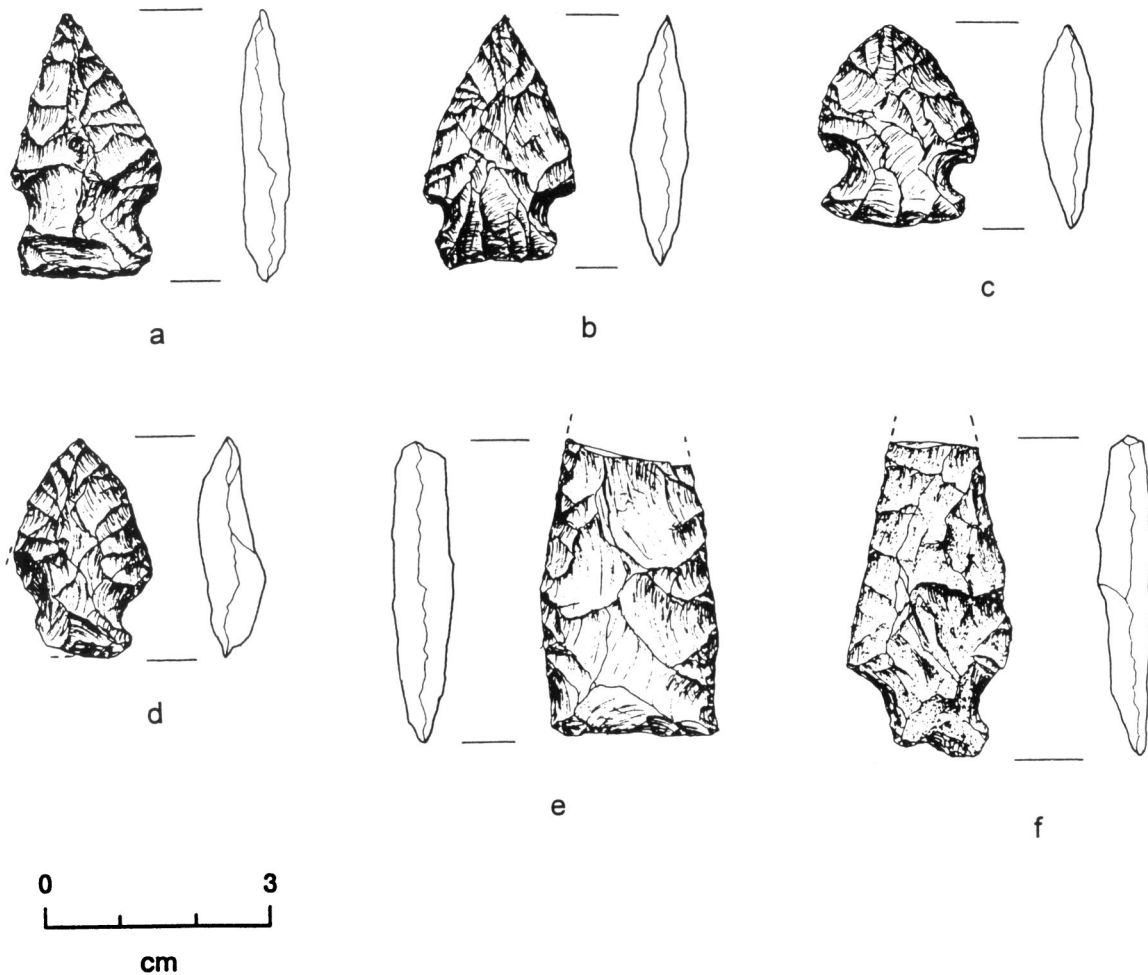


Figure 3. Selected Archaic and Early Woodland projectile points: a. Brewerton Side-Notched (Onondaga chert); b. Brewerton Side-Notched (Zaleski chert); c. Brewerton Side-Notched (Onondaga chert); d. Brewerton Side-Notched (Delaware chert); e. Steubenville Lanceolate (Zaleski chert); f. Forest Side-Notched (untyped chert).

FEATURES

Twelve features, mostly consisting of pits of various sizes, were identified and documented. Archaeologists have begun to treat feature attributes in a systematic fashion to more accurately describe and better understand aboriginal functions (e.g., Hatch and Stevenson 1980; Petraglia and Knepper 1994; Snyder and Fehr 1984; M. Stewart 1977; R. Stewart 1988; Thomas 1981). The analyses performed on the Connoquenessing site features consisted of descriptive morphology and comparative analysis, along with a series of investigations of feature fill including radiocarbon dating, macrobotanical analysis, and pollen profiling. In spite of considerable plowing which had disturbed the uppermost portions of some of the pits, intrasite comparative analysis of the features was considered valid, since little sediment aggradation appeared to have occurred during the approximately 3,000 years of site use. Assuming this to have been the case, the original ground surface associated with most of the features would have remained relatively constant, and plowing would have truncated all of the features at the same depth. While there was no intact stratigraphic deposition remaining at the site to indicate the level of original ground surfaces, the shape of one pit, a Middle Woodland

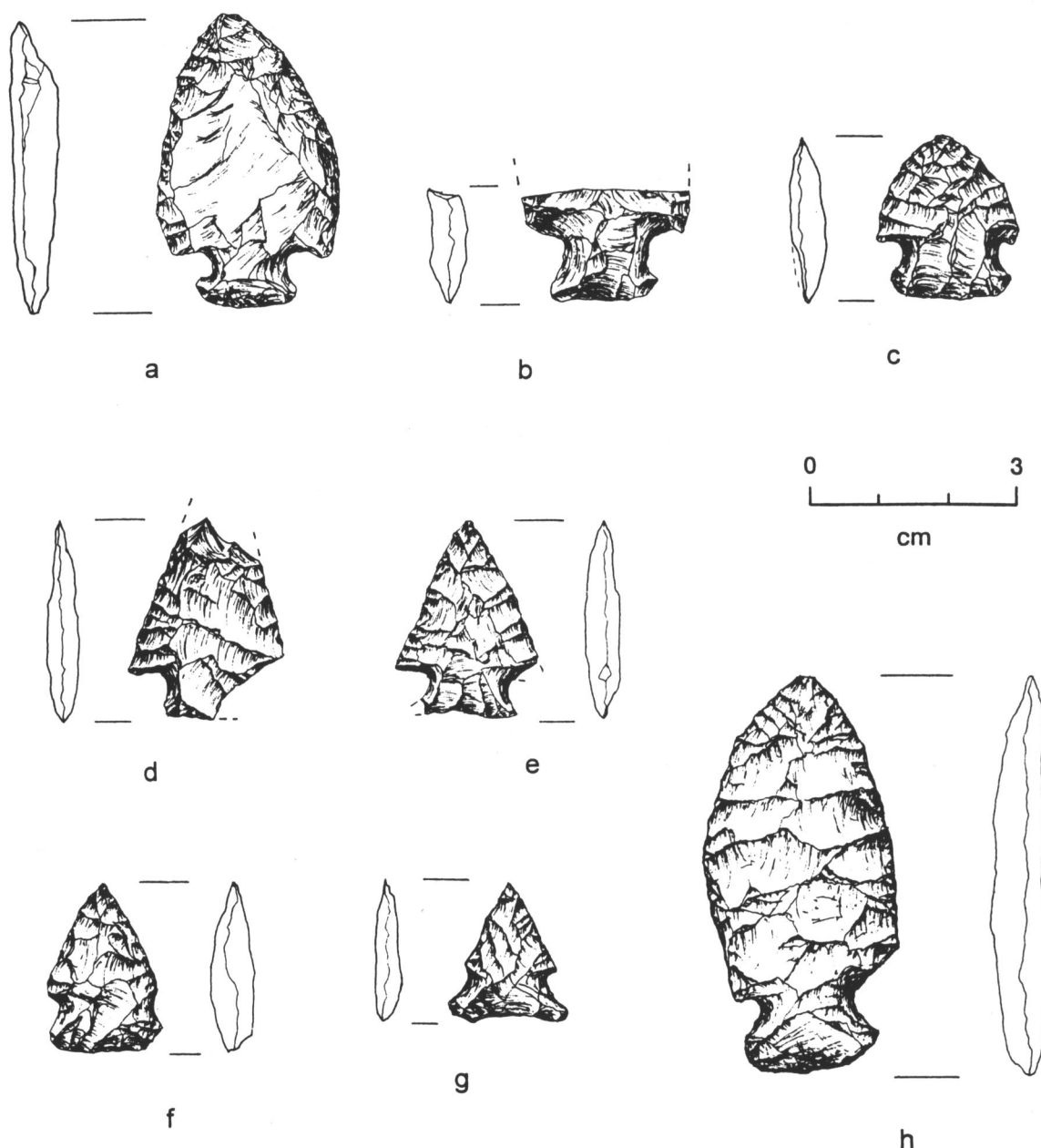


Figure 4. Selected Middle Woodland projectile points: a. Murphys Stemmed (Onondaga chert); b. Murphys Stemmed (Delaware chert); c. Raccoon Notched (untyped chert); d. Garver's Ferry (Zaleski chert); e. Garver's Ferry (Delaware chert); f. Kiski Notched (Delaware chert); g. Kiski Notched (untyped chert); h. Untyped Side-Notched (untyped chert).

hearth (Feature 13), suggested that there had in fact been relatively little disturbance. This finding implied that much of the volume of the features had survived the plow disturbance.

Morphology

Survey of the literature addressing the interpretation of archaeological features indicated that most studies focus on the categorization of features on the basis of size and shape. Following convention, the profile shapes of features at the Connoquenessing site were grouped into four main types, as depicted in Figure 5: 1) shallow

Table 3. Flake size distribution by weight.

Weight (gm)	Count	Frequency	Cumulative Frequency
0.0 - 0.5	943	70.9 %	70.9 %
0.6 - 1.0	162	12.2 %	83.1 %
1.1 - 1.5	75	5.7 %	88.8 %
1.6 - 2.0	33	2.5 %	91.2 %
2.1 - 2.5	28	2.1 %	93.4 %
2.6 - 3.0	18	1.3 %	94.7 %
3.1 - 3.5	13	1.0 %	95.7 %
3.6 - 4.0	8	0.6 %	96.3 %
4.1 - 4.5	5	0.4 %	96.7 %
4.6 - 5.0	11	0.8 %	97.5 %
5.1 - 5.5	7	0.5 %	98.0 %
5.6 - 10	14	1.0 %	99.0 %
10.0+	13	1.0%	100%
Total	1330		

basins, 2) deeper basins with more steeply sloped sides, 3) rounded pits with straight to inwardly sloping sides, and 4) shallow lenses of tabular rock. The most common shape was a shallow basin, exemplified by Feature 13 (Figure 6). The sides of these features exhibited gradual but regular, curved slopes, and bottoms were usually rounded. The surface shapes, or openings, of these features were round to slightly elliptical.

Two features, Feature 34 (Figure 7) and Feature 43, exhibited steep-sided basin shapes in profile. Both features in this category had more steeply sloped sides than features in the shallow basin group, and bases were rounded. Feature 51 (Figure 8) was the single example of the third category, a rounded pit that was deep in proportion to its diameter. The sides of the pit were steep, sloping inward near the top, producing a bell-like shape. The fourth category consisted of thin lenses of tabular sandstone rock, as exemplified by Feature 47 (Figure 9). This feature type produced little visible profile in section, though its shape may best be categorized as a shallow, flat-bottomed basin.

Table 4. Results of residue analysis. In most cases tests are only specific to the family level, thus the lists of probable fauna are based on common species within each family represented.

Artifact	Residue	Probable Fauna
<i>Archaic Period Projectile Points</i>		
Figure 3a	Cervidae/Antilocapridae/Canidae	deer, moose, wolf, dog, fox
Figure 3b	Tetraonidae/Phasianidae/Meleagrididae	chicken, grouse, turkey, pheasant, quail
Figure 3c	Erethizontidae/Aplodontidae/Sciuridae	porcupine, beaver, squirrel
Figure 3d	Tetraonidae/Phasianidae/Meleagrididae	chicken, grouse, turkey, pheasant, quail
Figure 3e	Canidae	wolf, dog, fox
<i>Woodland Period Projectile Points</i>		
Figure 3f	Sigmodontidae	mouse
Figure 4a	Cervidae/Antilocapridae	deer, moose
Figure 4b	Lagomorpha	rabbit, hare
Figure 4d	Cervidae/Antilocapridae	deer, moose
Figure 4h	Canidae	wolf, dog, fox

Radiocarbon Analysis

Seventeen radiocarbon assays were run on charcoal samples from the Connoqueensing site by Beta Analytic, Inc. Because of the potential for coal contamination, effort was spent in verifying the reliability of the dates from each feature by running second assays when possible. Due to the relatively small sizes of the samples from some of the features, several of the additional dates were obtained using either extended counting time or accelerator mass spectrometry (AMS), through the Lawrence Livermore National Laboratory (CAMS).

As indicated in Table 5, two assays were run for each of five features: Features 43, 48, 51, 52, and 53. Three dates were run for Features 13 and 34. Feature 54 contained only enough material for a single date. In most cases, multiple dates returned from features lay within fairly close ranges. The major exception

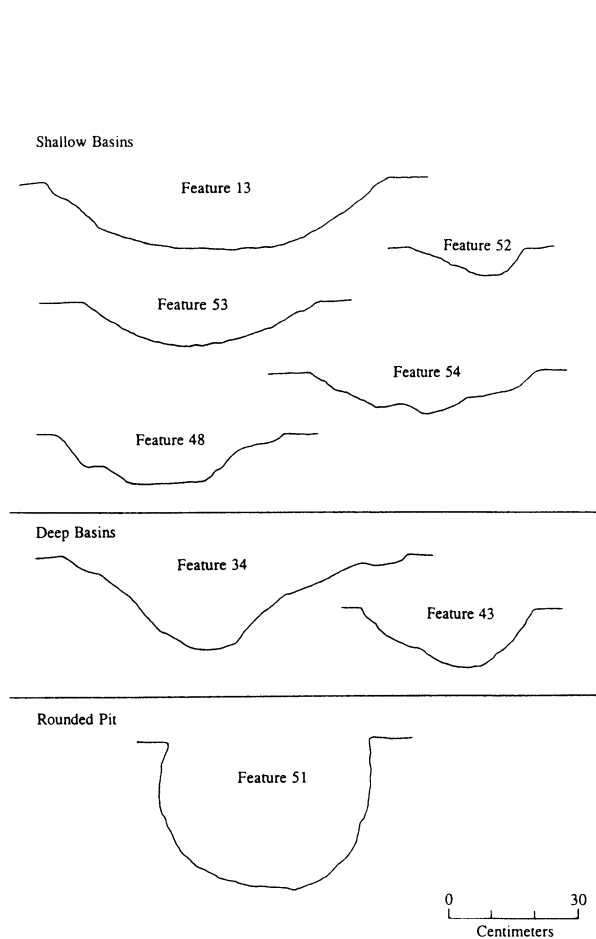


Figure 5. Summary of feature profiles.

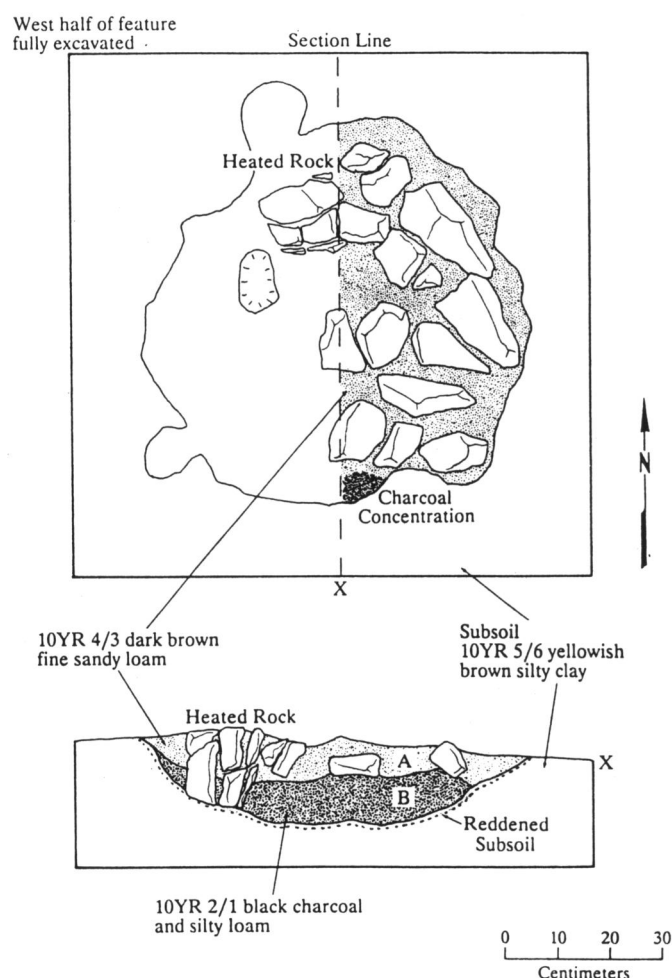


Figure 6. Feature 13, Middle Woodland shallow basin, plan view and section profile.

Table 5. Results of radiocarbon assays

Feature 13	1890 ± 60 BP (Beta 53019); 1570 ± 60 BP (Beta 57387); 1770 ± 50 BP (Beta 62472)
Feature 34	3410 ± 90 BP (Beta 53020); 12,520 ± 200 BP (Beta 57388); 3000 ± 60 BP (Beta 62473/CAMS 6519)
Feature 43	4570 ± 120 BP (Beta 57389); 4440 ± 70 BP (Beta 62474/CAMS 6520)
Feature 48	1860 ± 100 BP (Beta 57390); 1880 ± 160 BP (Beta 62475)
Feature 51	4520 ± 100 BP (Beta 57392); 4290 ± 60 BP (Beta 62477/CAMS 6521)
Feature 52	1510 ± 80 BP (Beta 57393); 1480 ± 70 BP (Beta 62478/CAMS 6522)
Feature 53	2180 ± 100 BP (Beta 57394); 1640 ± 60 BP (Beta 62479/CAMS 6523)
Feature 54	3610 ± 140 BP (Beta 57395)

was Feature 34. The first sample from that feature consisted of a concentration of charcoal that appeared to have been the remains of a single, deteriorated piece of carbonized wood. The date returned was 3410±90 B.P. A second date, from a small amount of charcoal scattered throughout the feature fill returned a much earlier date of 12,520±200 B.P. A third assay was run, using AMS due to the size of the remaining sample. The date returned, 3000±60 B.P., correlated more closely with the original assay, and the early date was rejected from further analysis.

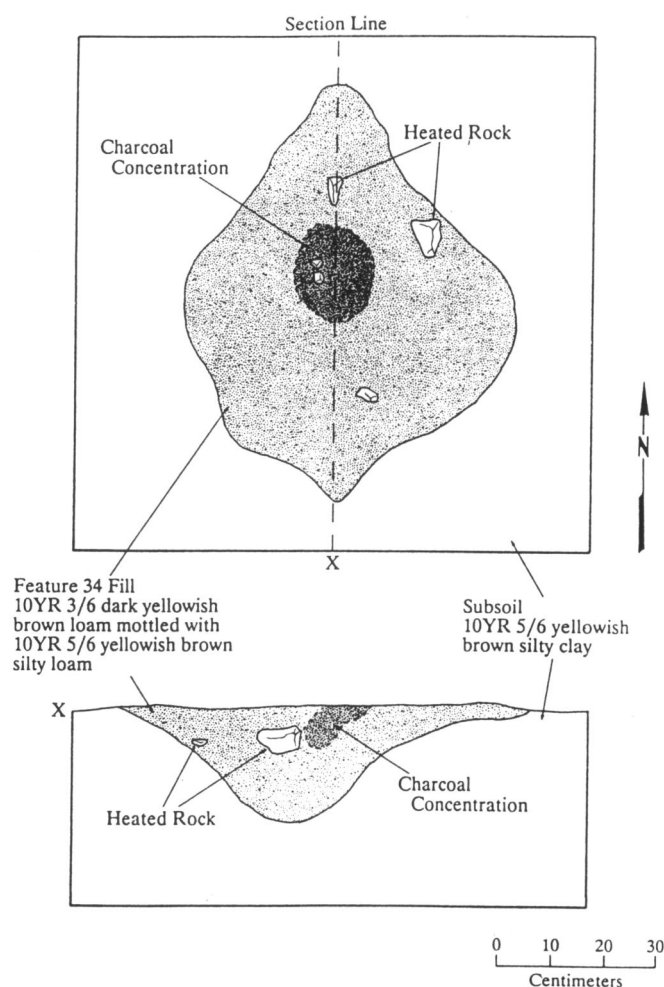


Figure 7. Feature 34, Late Archaic deep-basin pit, plan view and section profile.

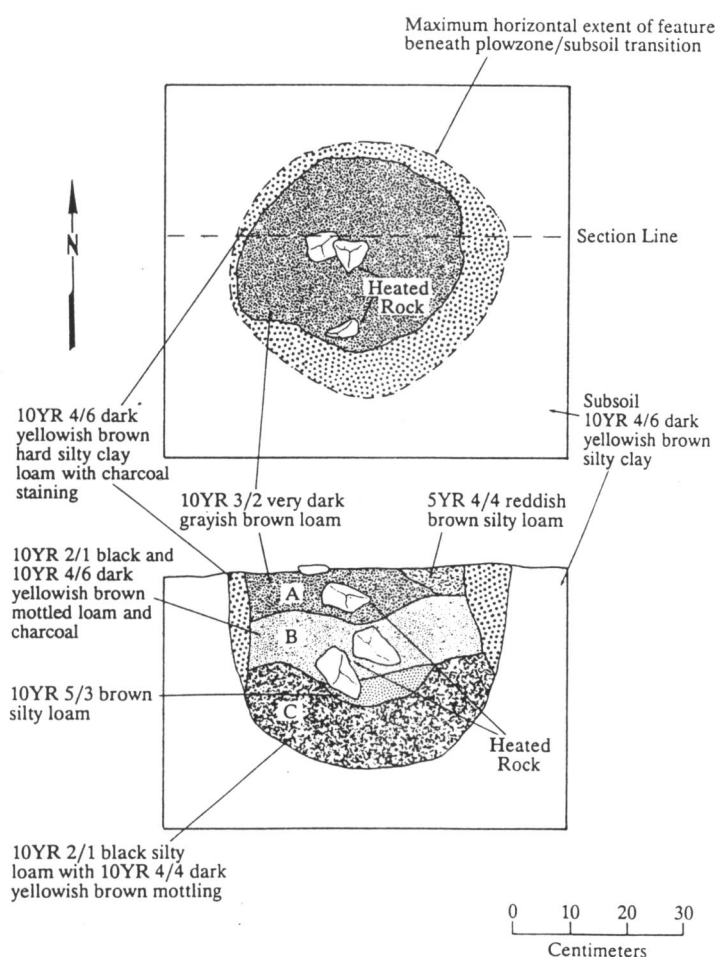


Figure 8. Feature 51, Late Archaic rounded pit, plan view and section profile.

Macrobotanical Evidence

Three main categories of botanical material were represented in the charred material from the site: seed, nutshell, and charcoal (Cummings and Puseman 1993). Varieties of charred seed included *Chenopodium* (goosefoot), Cheno-Am, *Diospyros* (persimmon), and Vitaceae (grape family). Charred nutshell included the genus *Carya* (hickory), and two species of the genus *Juglans*, tentatively identified as *Juglans cinerea* (butternut) and *Juglans nigra* (black walnut). Charcoal from five genera were identified including *Quercus* (oak), *Carya* (hickory), *Carpinus* (hornbeam), *Pinus* (pine), and the Juglandacea (walnut) family. The occurrence of these remains by feature is summarized in Table 6. In general, nuts were present in features from both the Archaic and Woodland periods, while seeds occurred only in Woodland features. Oak and hickory were the most common wood types represented in charcoal from both Archaic and Woodland features. Woodland features exhibited a wider variety of wood types.

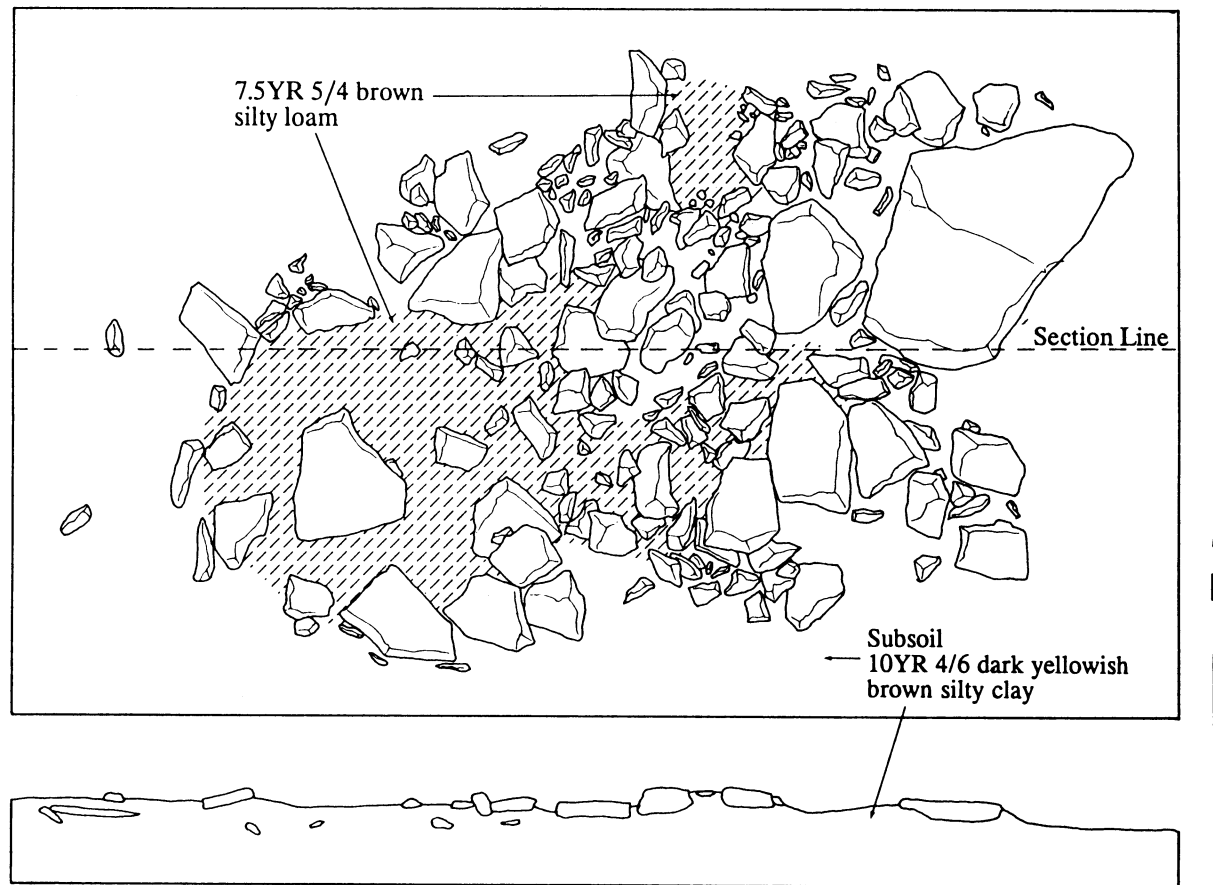


Figure 9. Feature 47, undated tabular rock cluster, plan view and section.

SPATIAL ANALYSIS

0 30
Centimeters

Artifact Cluster Analysis

Figure 10 illustrates the distribution of surface-collected material from the Connoquenessing site. Cluster analysis was conducted and the results drawn using computer-assisted mapping software. To enhance resolution, the site map was split roughly in half along the E170 meter line (Figures 11-12). Contour lines, or isopleths, connect areas with equal artifact counts, and were drawn on an interval equivalent to one artifact. The distribution of projectile points has been overlaid, with "A" indicating point-provenienced locations of Late Archaic period points (Brewerton or Steubenville) and "W" the locations of Middle Woodland period points (Garver's Ferry, Kiski Notched, or Murphys Stemmed). Feature locations are also included. The distributions exhibited by the plots indicated that Archaic and Woodland period materials were scattered across the field, with little suggestion of temporally specific clustering. Features occurring at the west end of the site did tend to occur in association with general clusters of artifacts observed in the plow zone, but without apparent relationship with the distribution of diagnostic projectile points. Features at the east end of the field did not correspond well with the surface artifact distribution, while projectile point distribution was negatively correlated with feature distribution.

The distribution of chert by geological source was also plotted in search of spatial patterning that might have implications for site use. In general, there was little distinctive patterning, each material type occurring

	Seeds	Nutshell	Charcoal
<i>Archaic</i>			
Feature 34	none	none	<i>Quercus</i> <i>Carya</i>
Feature 43	none	none	<i>Quercus</i> <i>Carya</i>
Feature 51	none	<i>Carya</i> <i>Juglans cinerea</i> <i>Juglans nigra</i>	<i>Quercus</i> <i>Carya</i>
Feature 54	none	none	<i>Quercus</i>
<i>Woodland</i>			
Feature 13	<i>Chenopodium</i> <i>Diospyros</i>	none	<i>Quercus</i> <i>Carya</i> <i>Juglandaceae</i>
Feature 48	Cheno-Am	<i>Carya</i>	<i>Quercus</i> <i>Carpinus</i> <i>Juglans</i>
Feature 52	none	<i>Carya</i>	<i>Quercus</i> <i>Carya</i>
Feature 53	Vitaceae		<i>Quercus</i> <i>Carya</i> <i>Carpinus</i> <i>Pinus</i>
Undated			
Feature 47	Cheno-Am	none	<i>Quercus</i>
Control			
	none	none	<i>Quercus</i>

Table 6. Occurrence of macrobotanical materials.

in roughly similar distributions across the field. This finding suggested an extensive amount of mixing of occupational components within the plow zone.

DISCUSSION

Chronology

Data from the Connoquenessing site provided the opportunity to assess site occupation through both absolute and relative dating. While no diagnostic artifacts were recovered from securely dated contexts, the combined analysis of radiocarbon-dated features and diagnostic projectile points provided evidence strongly supporting existing chronological interpretations of Late Archaic and Middle Woodland cultural manifestations in the region.

Analysis of the radiocarbon data from the Connoquenessing site included a form of aggregation analysis, which combines the probabilities of a series of radiometric assays and calculates the expected number of dates for a specified time range given the observed probabilities (Kintigh 1991:58). The shape of a curve defined

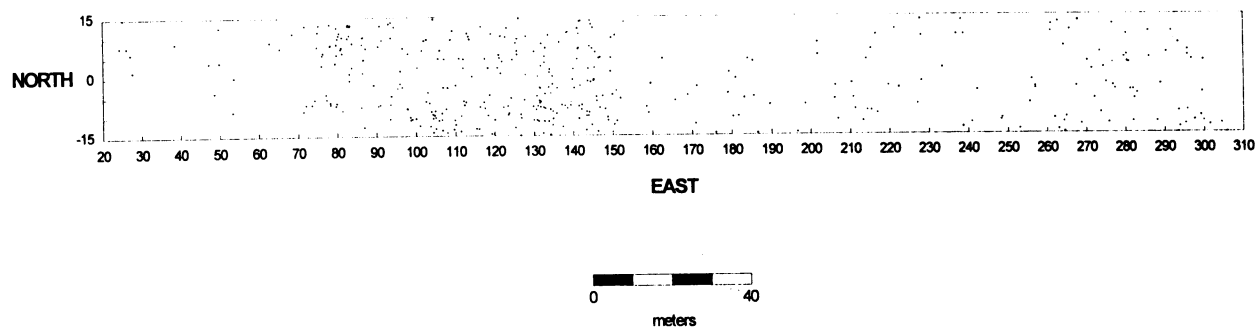


Figure 10. Connoquenessing site map showing surface distribution of artifacts (note: dots representing artifacts are not to scale).

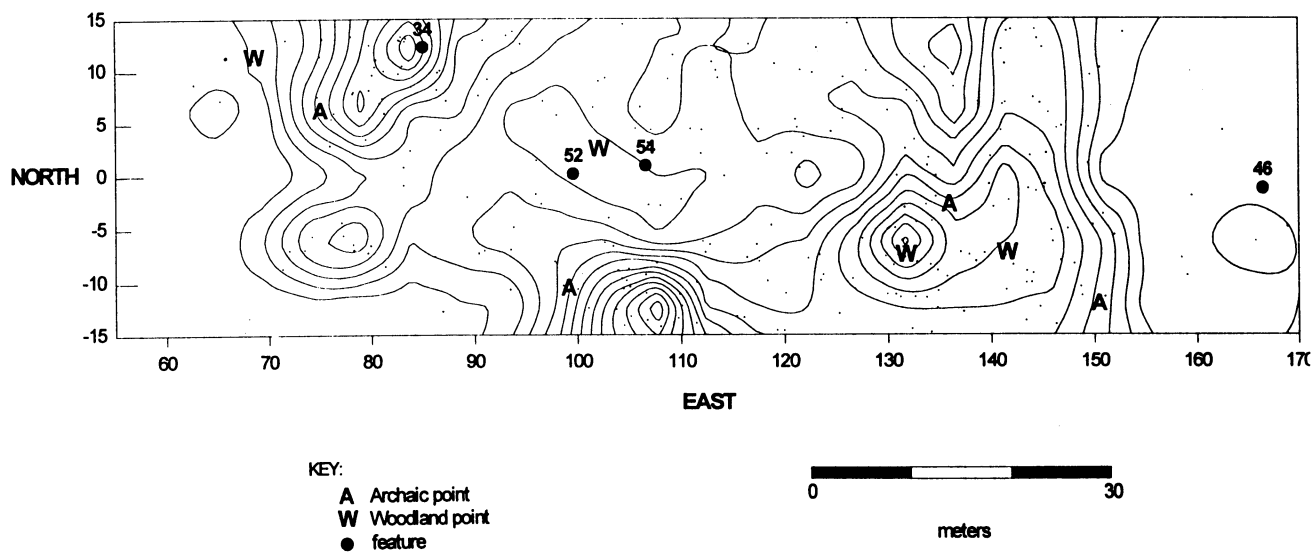
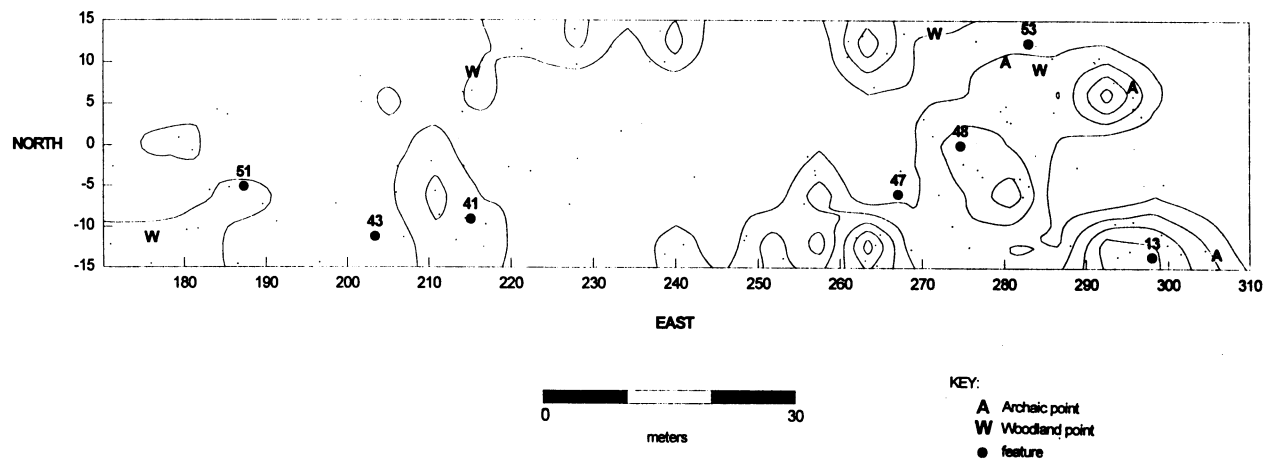


Figure 11. West end of site showing results of cluster analysis of surface artifact distribution along with the locations of diagnostic projectile points and features (contour interval equivalent to one artifact).

Figure 12. East end of site showing results of cluster analysis of surface artifact distribution along with the locations of diagnostic projectile points and features (contour interval equivalent to one artifact).



by these expected values can provide an indication of the continuity of occupation represented by the dates: a unimodal distribution, for example, might imply a single episode of occupation; a distribution with several modes might suggest multiple, overlapping or discontinuous occupations.

At the Connoquenessing site, aggregation analysis was conducted site-wide, and it was necessary that the same number of dates be considered from each provenience. While two dates were available from most features, Features 13 and 54 required different treatment. Three dates had been obtained from Feature 13, and use of all three would have added unbalanced weight to the apparent intensity of occupation represented by the feature. With no objective means of assessing the relative validity of the individual dates, they were averaged to produce two dates. The two most widely spaced pairs were chosen for averaging. Because the sigmas were dissimilar, a form of weighted average was employed, using relative weighting factors based on the ratios of the sigmas (Long and Rippeteau 1974:Table 2). The sigmas themselves were averaged as follows:

$$\bar{\sigma} = 1/\sqrt{(1/\sigma_1^2 + 1/\sigma_2^2)}$$

The averaged dates calculated for Feature 13 and used in the aggregation analysis were 1684±39 B.P. and 1730±42 B.P.

Figure 13 illustrates the results of the analysis of the data from the site, in a chart displaying the expected frequency of dates at 100-year intervals. The multiple peaks in the curve suggest non-continuous occupation of the site. Three main periods of occupation were apparent, corresponding with the Late Archaic, the Transitional, and the Middle Woodland periods. The single peak around 4500 B.P. represented Features 43 and 51, with three of four sigmas overlapping by as much as 50 years, suggesting the possibility of contemporaneity. In the central portion of the graph, representing the dates for Features 34 and 54, two clusters were visible. The peak centered around 3000 B.P. was produced by the later of two dates returned on samples from Feature 34. The final group, at the top of the chart, bore a single, relatively high peak, though at 1700 B.P., skewed somewhat toward the later end of the distribution. A longer span of site use than in previous periods was suggested by the range of the distribution, with the possibility of several contemporary features and some sporadic site use early on.

While all of the diagnostic artifacts from the Connoquenessing site were recovered from plow zone contexts, the accepted date ranges of the points, when plotted above the aggregate analysis curve, was informative. The artifact date ranges generally mirrored the spread of radiocarbon data. The original frequency distribution of point types implied that there had been two main periods of site activity, one in the Late Archaic and a second, possibly more extensive span in the Middle Woodland. Aggregate radiocarbon data indicated site use during the Late Archaic and into the Transitional period, along with a second, seemingly more intensive period of activity in the mid-to-late Middle Woodland.²

Several observations were evident from closer examination of the two data sets. There was a rather convenient overlap between the accepted date ranges of the Brewerton and Steubenville types and the Late Archaic peak in the radiocarbon data. Assuming that most or all of the Brewerton specimens were associated with the features from which the Late Archaic radiocarbon dates were obtained, the data implied that the points fell late in the Brewerton span, implying a late occurrence of the type in the region. Brewerton is often considered a manifestation of the so-called Laurentian complex occurring in central and western New York and extending into northwestern Pennsylvania. Recent reappraisal of the complex has suggested a time span of 5100-3950 B.P. (Funk 1988:28). Ritchie's original Brewerton data include dates of 4930±240 B.P. at Frontenac Island and 4000±220 B.P. at the O'Neil site, both in central New York (Ritchie 1965:107, 91). Kinsey reported a Brewerton component dated 5180±200 B.P. at the Faucett site on the Upper Delaware River (Kinsey 1972:407). Regional data from western Pennsylvania reflect the longevity of the type. A date of

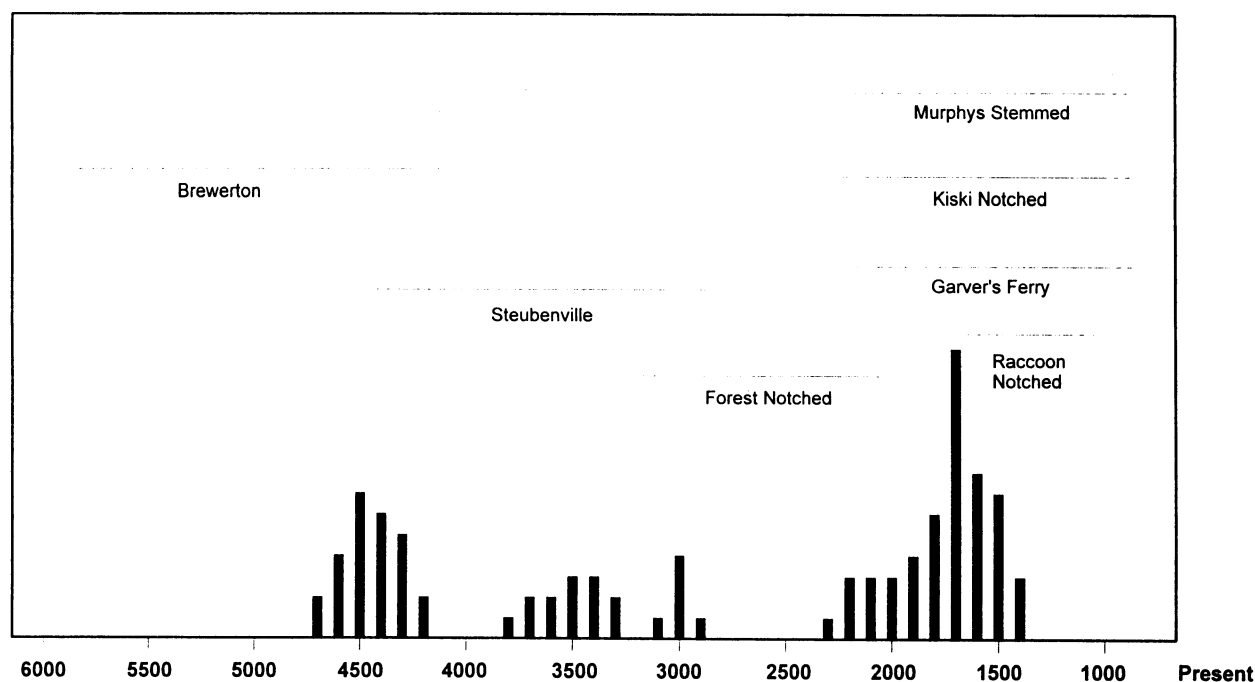


Figure 13. Summary of chronological data with results of aggregate analysis of radiocarbon dates represented as a bar chart and the approximate date ranges for projectile point types displayed above.

6090 \pm 240 B.P. was returned from a feature containing two Brewerton points at the Brown site (36AR188) on the Allegheny River below Kittanning, in Armstrong County (George and Davis 1986:14). A Brewerton component at the Zawatske site (30CA69) on the Allegheny in southwestern New York was dated at 5630 \pm 115 B.P. (Calkin and Miller 1977:310-311), while a later date of 4150 \pm 60 B.P. was recorded at the Rohr Rock-shelter in Monongalia County in West Virginia (Dragoo in George and Davis 1986:19). Thus the Brewerton component at the Connoquenessing site, while falling late in the accepted range for the point type, would not necessarily have been atypical.

The Middle Woodland points from the site appeared to correspond well with the aggregate radiocarbon data. Feature dates suggested that most of the activity in this period at the site occurred in the middle portion of the Middle Woodland. While the precise chronological placement of the Garver's Ferry, Kiski Notched, and Murphys Stemmed types is as yet unclear, most are presumed to have been manufactured and used mid-to-late in the subperiod (George 1982). Kiski Notched may extend into Early Monogahela, ca. A.D. 900-1000 (George, personal communication 1995). The Raccoon Notched type is the most securely dated of the points, with a reported range of A.D. 500-950 (Lantz 1989:33), falling somewhat beyond the maximum of the aggregate radiocarbon data.

Lithic Raw Material Selection

The potential for affecting the chronological separation of assemblages from mixed contexts based on differences in lithic raw material use has been demonstrated in several instances in Pennsylvania and other portions of the Middle Atlantic (Bergman et al. 1992; Stewart 1986). Analysis of the sources of chert artifacts at the Connoquenessing site thus sought to discover trends in the temporal patterning of raw material selection which might be of potential use in demonstrating horizontal separation in the distribution of non-diagnostic lithic debitage.

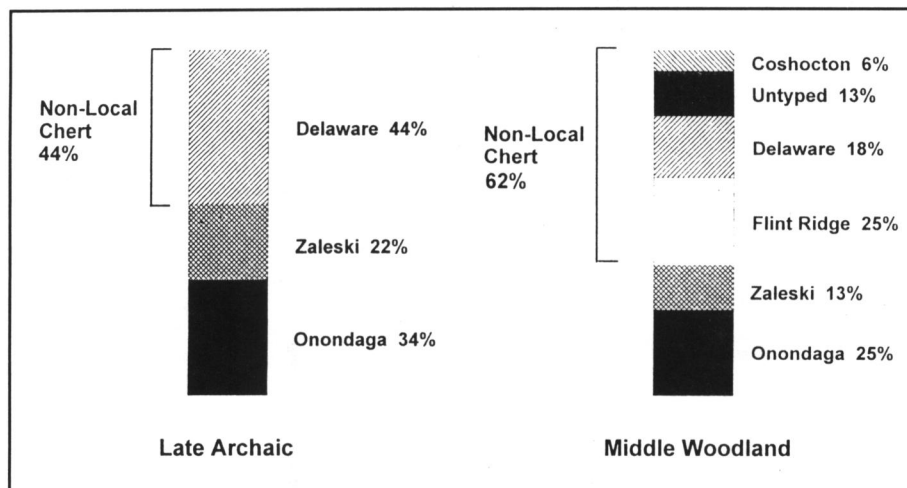


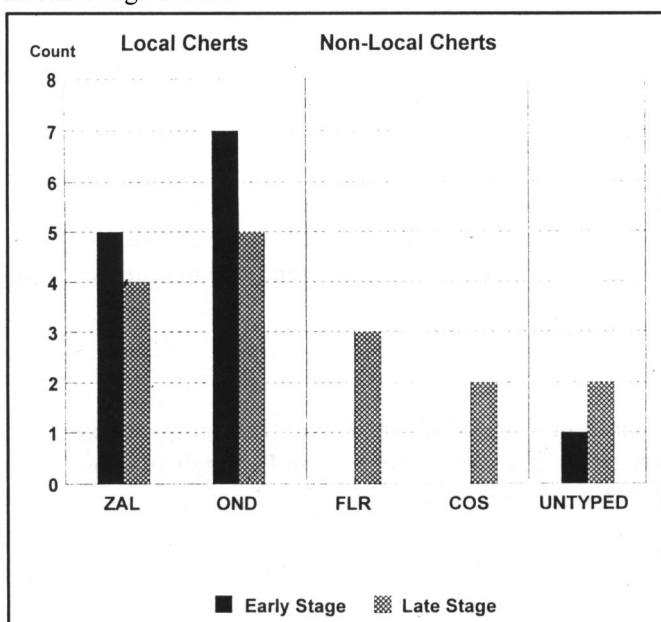
Figure 14. Temporal variation in lithic raw material selection among projectile points.

exotic chert types included Coshocton, Delaware, and Plum Run, all from sources occurring in northeastern Ohio, and Flint Ridge chert and chalcedony, with outcrops in central Ohio (Stout and Schoenlaub 1945). Additional non-local chert types consisted of material from sources located in southwestern Pennsylvania and referred to as Uniontown and Ten Mile Creek (Eisert 1974; Herbstritt 1981).

Analysis of projectile points from the site suggested a preference during the Late Archaic period for the selection of locally available chert, Onondaga or Zaleski (34 percent and 22 percent, respectively) (Figure 14). The only other lithic raw material represented in the Late Archaic points was Delaware chert, which in fact accounted for the highest frequency of occurrence among points from the period, 44 percent. Among Middle Woodland points, more extensive use of exotic lithic raw material was noted, suggesting long-distance

procurement forays or the presence of exchange networks. Only 38 percent of the points attributable to this period were made from locally available chert.

Figure 15. Variation in lithic raw material among early and late stage bifaces.



All of the early stage bifaces from the site were of either Zaleski or Onondaga chert, except for one specimen from an untyped chert source (Figure 15). Late stage bifaces occurred in cherts from both local and non-local sources: 4 Zaleski, 5 Onondaga, 3 Flint Ridge, 2 Coshocton, 2 untyped. Unifaces were evenly distributed between local and non-local chert sources. All but two of the cores from the site were of locally available chert, mostly identified as Zaleski. The two non-local examples were of Coshocton chert. Bipolar cores, representing evidence of the on-site reduction of small cobble or pebble material, were all of local material. While the sample size was small, there was some indication that cores from locally available cherts were larger than those from non-local materials.

This may suggest different reduction strategies, with local cherts being used more frequently for the production of flakes, and non-local cherts more frequently reduced to bifacial form or brought to the site in reduced form. The data also suggest that non-local materials, being harder to replace, were worked more completely.

The occurrence of flakes by raw material source is listed in Table 7, and the frequency data show a pattern similar to that of cores and bifaces. Flakes of locally available cherts were on average larger than those of non-local chert types. Delaware chert was the exception, occurring with a mean flake weight similar to that of locally available cherts. The large mean weights for other chert types, including Plum Run, Uniontown, and Ten Mile

Creek, are probably an artifact of the small samples of each of those materials. Also included in the table is the percentage of flakes from each source bearing cortex, tabulated as an indication of the form in which the raw materials entered the site. Cortical material occurred considerably more frequently among local cherts, with frequencies of 14 to 20 percent. In contrast, 4 to 5 percent of flakes of Flint Ridge and Coshocton chert bore cortex.

Chert Source	Count	Frequency	Mean Weight	% with Cortex
<i>Local</i>				
Zaleski	392	29.5%	1.0 gm	14.3 %
Onondaga	363	27.3%	0.8 gm	20.1 %
<i>Non-Local</i>				
Flint Ridge	233	17.5%	0.5 gm	4.3 %
Coshocton	120	9.0%	0.4 gm	5.0 %
Delaware	65	4.9%	0.9 gm	24.6 %
Ten Mile	15	1.1%	1.5 gm	6.7 %
Uniontown	8	0.6%	3.1 gm	0.0 %
Plum Run	4	0.3%	1.5 gm	25.0 %
Total	1330			

Table 7. Lithic raw material sources for flakes.

Immunological Testing

The frequency of positive results among the artifacts submitted for immunological analysis was 43 percent, a relatively high figure in comparison with recent studies using the same technique in Virginia (Petraglia et al. 1993), Nevada (Newman 1990), Ontario (Newman and Julig 1989), and Alberta (Kooyman et al. 1992), all of which produced identification rates between 20 and 30 percent. The results of the analysis from the Connoquenessing site suggested the economic exploitation of a variety of faunal species, both large and small (Table 4: note that the lists of probable fauna represented by positive reactions are based on common genera that may react directly or may cross-react with a particular anti-serum). Breakdown of the findings by cultural period suggested little differential patterning with time. Five artifacts each tested positive from the Late Archaic and Middle Woodland periods, and the probable species list was similar for both groups. While sample sizes and testing procedures allowed only general statements as to faunal exploitation at the site, the results of the analysis did appear to demonstrate the potential utility of immunological testing for extracting data applicable to subsistence practices, especially in instances of poor macro-faunal preservation.

Surface Distribution of Artifacts and Feature Distribution

The distributions exhibited by plots of chronologically diagnostic artifacts indicated that Archaic and Woodland period materials were scattered across the field, with little suggestion of temporally specific clustering. The implication is that site use was sporadic but frequent enough to produce a series of overlaid distributions. Alternatively, the original, discretely separated patterns may have been extensively mixed through long-term tillage. The answer probably incorporates elements of both hypotheses. The surface distribution of artifacts was not a precise or exact indicator of subsoil feature location, although features did occur in the same general areas as artifact concentrations. The features at the west end of the site were

associated with general clusters of artifacts occurring in the plow zone. Features at the east end of the field did not correspond as well, while in the central area there was no apparent correlation, largely due to the relative lack of artifacts in that area. Assuming that the surface distribution of artifacts did indeed approximate the areas of prehistoric activity at the site, several possibilities may be implied by these data. Based on the overall amount of cultural material at the site, including both artifacts and features, site activity appeared to have been intermittent. Thus the features may have represented the remains of short-term site use for exploiting specific resources, rather than long-term occupation during which a wider range of activities would have been undertaken. In addition, the activities represented may not have produced a large amount of lithic debris; that is, lithic tool use may have been non-intensive, requiring little on-site tool fabrication or refurbishing, or alternatively, non-lithic tools may have been the primary forms employed. It is also likely that there were differences in site use in different portions of the site and at different times. There may have been less intensive activity in the Late Archaic, for example, based on the amount of artifactual debris recovered in the central portion of the site.

While feature distribution at the Connoquenessing site was to some extent correlated with surface artifact concentrations, it was not possible to distinguish chronologically distinct artifact assemblages in the plow zone. The surface distribution of diagnostic lithic artifacts bore little evidence of pattern, and in some cases ran counter to the distribution of features. Correlations between time periods and the selection of lithic raw materials did not carry over into meaningful spatial distributions. The overall distribution of both diagnostic and nondiagnostic artifacts suggested the probability of multiple, relatively closely spaced, though probably non-intensive occupations. The potential for the spreading and merging of discrete depositional events as a result of plowing appeared to have been good. Even though individual occupations may have been limited in size and duration, the detailed spatial relationships between them were complex, and as such would probably have been unlikely to have survived the history of long-term tillage in evidence at the site. The present consensus among researchers investigating surface-disturbed sites is that some degree of original patterning usually remains at sites subjected to plowing (Lewarch and O'Brien 1981; Odell and Cowan 1987; Stevenson 1980). The amount of disturbance in any particular case is dependent on a variety of factors, such as soil texture and moisture content (affecting the cohesion of the soil mass, and the adhesion of soil to plow and artifacts to soil), the type of plow in use and the depth of penetration, the direction of plowing, speed (greater speed tends to throw soil farther), and the size and weight of the artifacts. Perhaps the most important factor, though, is the original degree of clustering of the material. That is, a sparsely distributed pattern will be spread by the plow but the overall patterning may remain readily identified, while more densely clustered, overlapping activity areas, such as may have been present at the Connoquenessing site, will tend to become blurred or blended together.

Feature Morphology

Few analytical techniques have been advanced for the quantitative study of feature morphology, and none have been particularly effective alone in assessing specific feature function (see as an example Stewart's [1977] multivariate analysis). One relatively simple technique that provides a degree of intersite comparative data is the examination of scatterplots based on a series of dimensional ratios. As outlined by Hatch and Stevenson (1980) at the Fisher Farm site in Centre County, Pennsylvania, the procedure involves the construction of a scatterplot of the ratio of the length to width of the opening of each feature (length being equivalent to the long axis of an ellipse) against a measure which they refer to as the *ratio depth*, defined as the average dimension of the opening divided by the depth:

$$(L+W / 2) \div D$$

In the resulting plot, distance along the x-axis represents increasingly elongated or elliptical openings, while distance along the y-axis represents shallower depth in relation to the area of the opening.

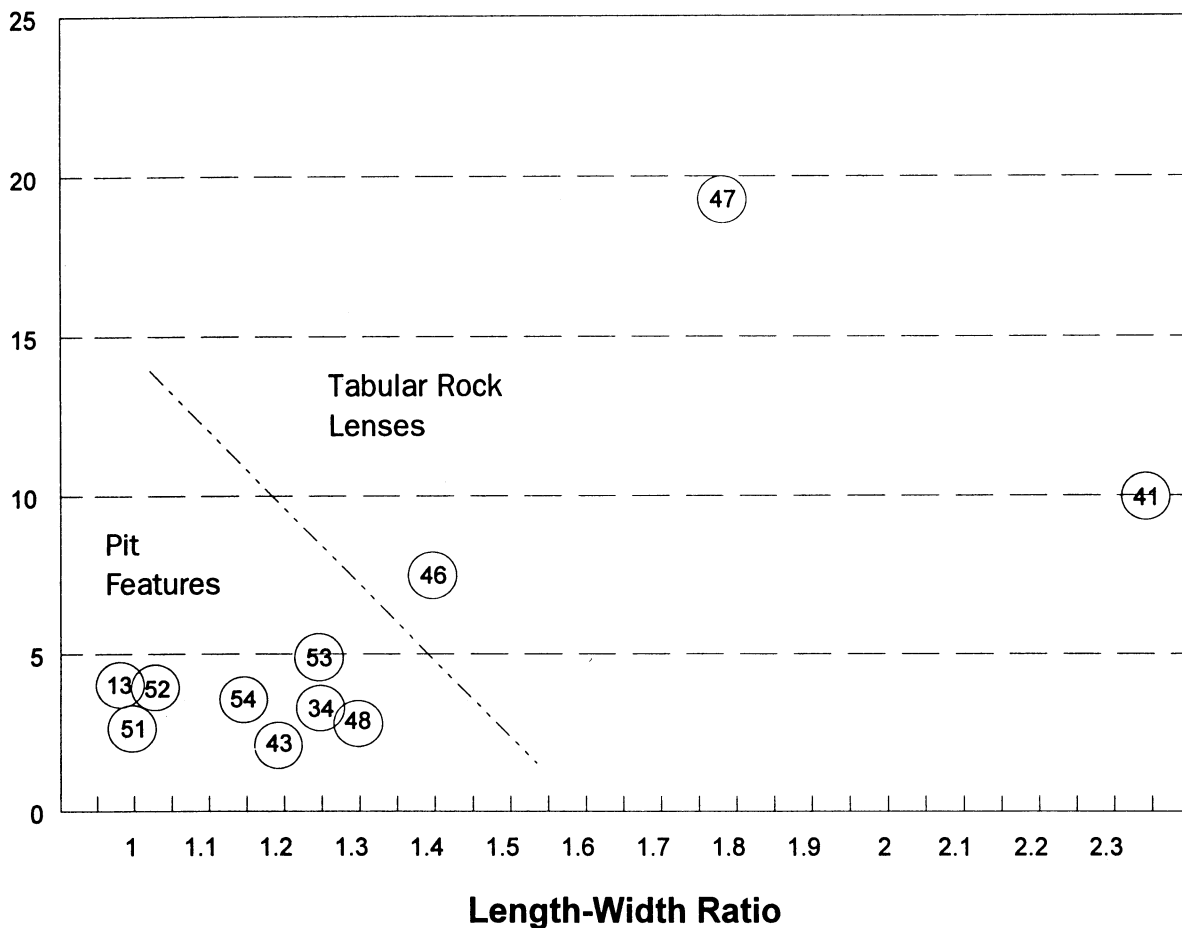
Ratio Depth

Figure 16. Scatterplot of dimensional proportions of Connoquenessing site features with greatest separation occurring between pit features and shallow, tabular rock features.

A scatterplot of the features at the Connoquenessing site using these variables is displayed in Figure 16. Most of the features can be seen clustered in the lower left-hand corner of the graph. Two closely situated clusters appeared in this region. Features 13, 51, and 52 bore length-width ratios of 1.0, indicating that the features were round in plan. The five features in the adjacent cluster, with length-width ratios just above 1.0, had slightly elliptical openings. The low ratio depths of all the features in both clusters denoted features that were deep in relation to the area of the opening, though most of the features were not deep in absolute scale. The two clusters were, in effect, distinguished only by slight differences in their surface shapes. The difference was actually quite small, and thus was not presumed to be functionally significant. The greatest separation on the plot lay between the features in the left-hand corner, which consisted of all of the pit features at the site, and three elongated, shallow, tabular rock lenses that were scattered on the right side of the plot.

The data were replotted with the features keyed for volume and chronological period. Feature volumes were calculated using standard geometric formulae. Feature volumes were sorted in ascending order. Gaps occurred at three places in the sequence, and separations were made at these points to represent low, medium, and high volumes. All three low-volume features were round or nearly round, yet high-volume features bracketed the same range of surface shapes. Medium-volume features were generally more elliptical and shallower in proportion to overall size, though again there was considerable overlap with other sizes. A similar

Ratio Depth

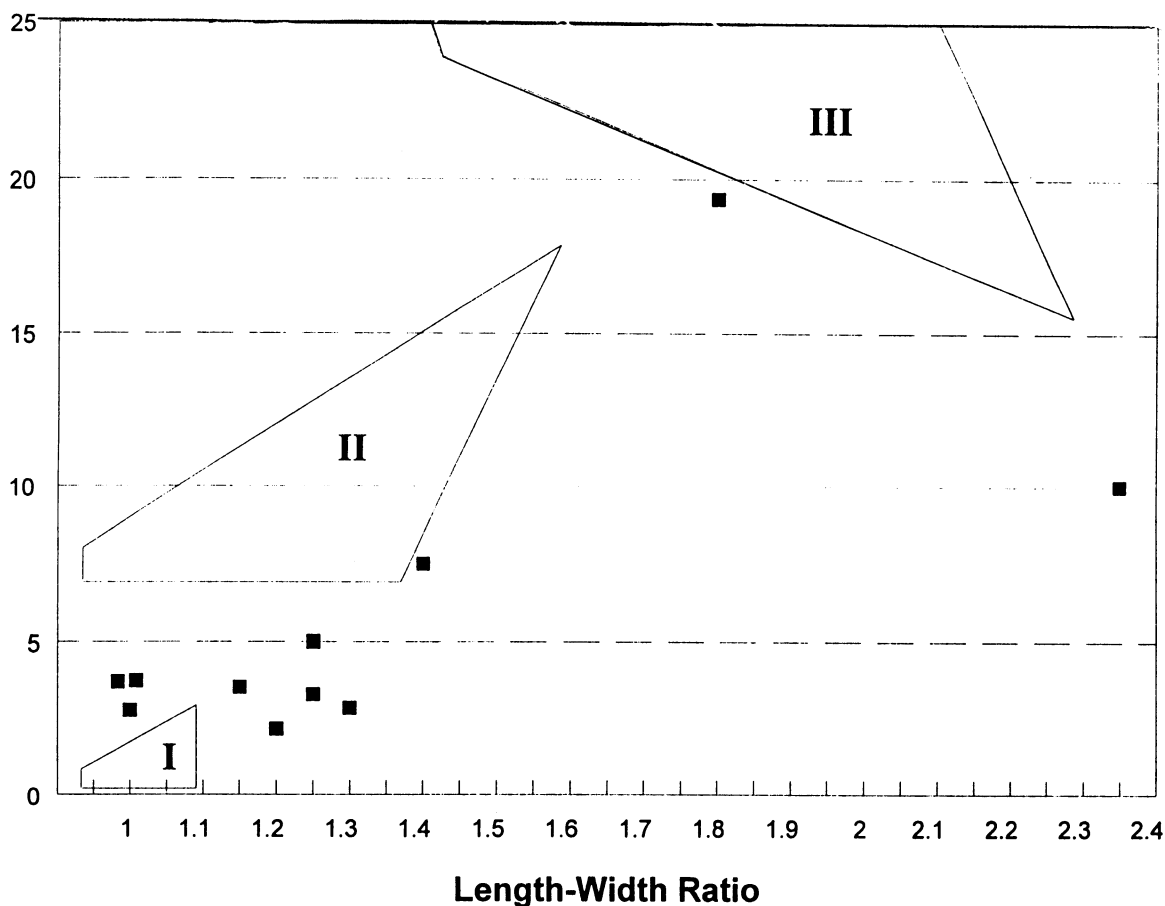


Figure 17. Scatterplot of dimensional proportions of Connoquenessing site features in relation to feature clusters at Fisher Farm site.

situation was evident when features were keyed by chronological period. Archaic period features were deep relative to overall size and exhibited length-width ratios indicating round to nearly round openings. Woodland period features displayed the same general morphological characteristics, and while several appeared slightly less deep in proportion to overall size, there was considerable overlap with the Archaic features.

At Fisher Farm, Hatch recorded somewhat more distinct clustering in a series of 59 Late Woodland features. The Fisher Farm site was a permanent village locale. It might be argued that feature function at such a settlement could be expected to vary from that at more ephemeral occupation locales such as the Connoquenessing site, yet Fisher Farm constitutes one of the only quantitative studies published from the region. Thus the data were chosen for comparative analysis. The outlines of the clusters plotted at Fisher Farm have been overlaid on the scatterplot of features from the Connoquenessing site in Figure 17. Most of the features from the Connoquenessing site fell between the plotted locations of Clusters I and II at Fisher Farm. Hatch's Cluster I features were round in plan and relatively deep, while Cluster II features were shallow and oval in shape. Hatch further subdivided the features in two ways: by volume and association with fire. The range of volumes of the features at the Connoquenessing site did not correlate well with those at Fisher Farm. There were more small features at Fisher Farm than at the Connoquenessing site, and no features at the Connoquenessing site fell within Hatch's smallest size grade. The remaining two grades at Fisher Farm

split the middle grade at the Connoquenessing site. Differences in feature function may be implied. The smallest features at Fisher Farm tended to occur in Cluster I, while the remainder were interspersed on the plot without pattern. The second analytical criterion used by Hatch was association with fire, and this characteristic was used more directly to assign feature function. Fire-related features in Hatch's Cluster I were assumed to have functioned as smudge pits, based on a taxonomy proposed by Stewart (1977) and derived from ethnographic data. Fire-related features in Cluster II were considered to have been hearths. Non-fire-associated features from both clusters were assigned a variety of nonspecific functions.

The features from the Connoquenessing site did not conform with the Fisher Farm categories. In terms of the relationship between shape, proportionate depth, and volume shown on the scatterplots, the Connoquenessing site features were intermediate to the clusters observed at Fisher Farm. This suggests the possibility of functional variability, both of features and in general site use. That is, the types of activity conducted at a Late Woodland village may have been sufficiently different from those at Late Archaic or Middle Woodland camps, both in scope and intensity, to leave different feature patterns. Thus the study of feature morphology, while not consistently revealing specific feature function, can be an effective descriptive tool which can demonstrate gross differentiation at the site level.

Macrobotanical Analysis

Presence analysis was conducted using macrobotanical data from flotation samples collected at the site. Presence analysis, or the calculation of an index of ubiquity (Popper 1988), reflects the percentage of proveniences throughout the site in which specific materials occur. By ignoring absolute counts, biases caused by differential rates of preservation may often be avoided. In spite of the relatively small number of features associated with the individual time periods represented, the analysis suggested a trend toward an increase in the occurrence of seeds and decrease in nutshell over time. Such a pattern is described in regional literature as an increasing presence (and by implication use) of seeds at the expense of nuts during a span ranging from the latter part of the Archaic period through the Woodland (Asch and Asch 1977). Archaic period features at the Connoquenessing site, both Late Archaic (Features 43, 51) and Transitional (Features 34, 54), bore no evidence of seed remains; while nutshell, including hickory, butternut, and black walnut, was abundant in one Late Archaic feature (Feature 51). In contrast, seeds were present in all features dated to the Middle Woodland period except Feature 52. Nutshell in Middle Woodland features was limited to a small amount of hickory shell in Features 48 and 52. As a further examination of the data, ratios were calculated comparing the proportion of seed-to-charcoal and nutshell-to-charcoal, charcoal frequency being used as a controlling or normalizing factor. Use of these ratios assumes that charcoal is the result of domestic activity, and tends to reduce the effect of accidentally preserved material in the samples (Miller 1988). The analysis indicated that the seed:charcoal ratio increased from 0.00 in Archaic period features to 0.03 in Woodland features, while the relative frequency of nuts appeared to decline, from 0.38 in Archaic features to 0.16 in Woodland features, replicating the pattern seen in the raw frequency data.

Patterns in the incidence of charcoal provided evidence on the availability and use of wood species. The highest indices were recorded for oak, which occurred in 100 percent of the features, and hickory, occurring in 67 percent. In agreement with regional paleoenvironmental studies (e.g., Joyce 1988), this suggests that oak was a common tree in the area, and that its wood was easily obtained and widely used for fuel throughout the periods of site use. Hickory would also have been widespread, and it too appeared to have been easily procured and frequently used for fuel. Hickory was also the most common nutshell recovered, with an index value of 33 percent. As suggested by ethnographic data, hickory nuts may have been used as both a food resource and as a fuel (Smith 1985).

The lack of stratified deposition in feature fill at the site suggested that most of the pits were infilled relatively quickly after their primary use. The relative frequency of charcoal in the fill lends support to this interpretation. Charcoal frequency in each feature was graphed as a standard score, or the number of standard

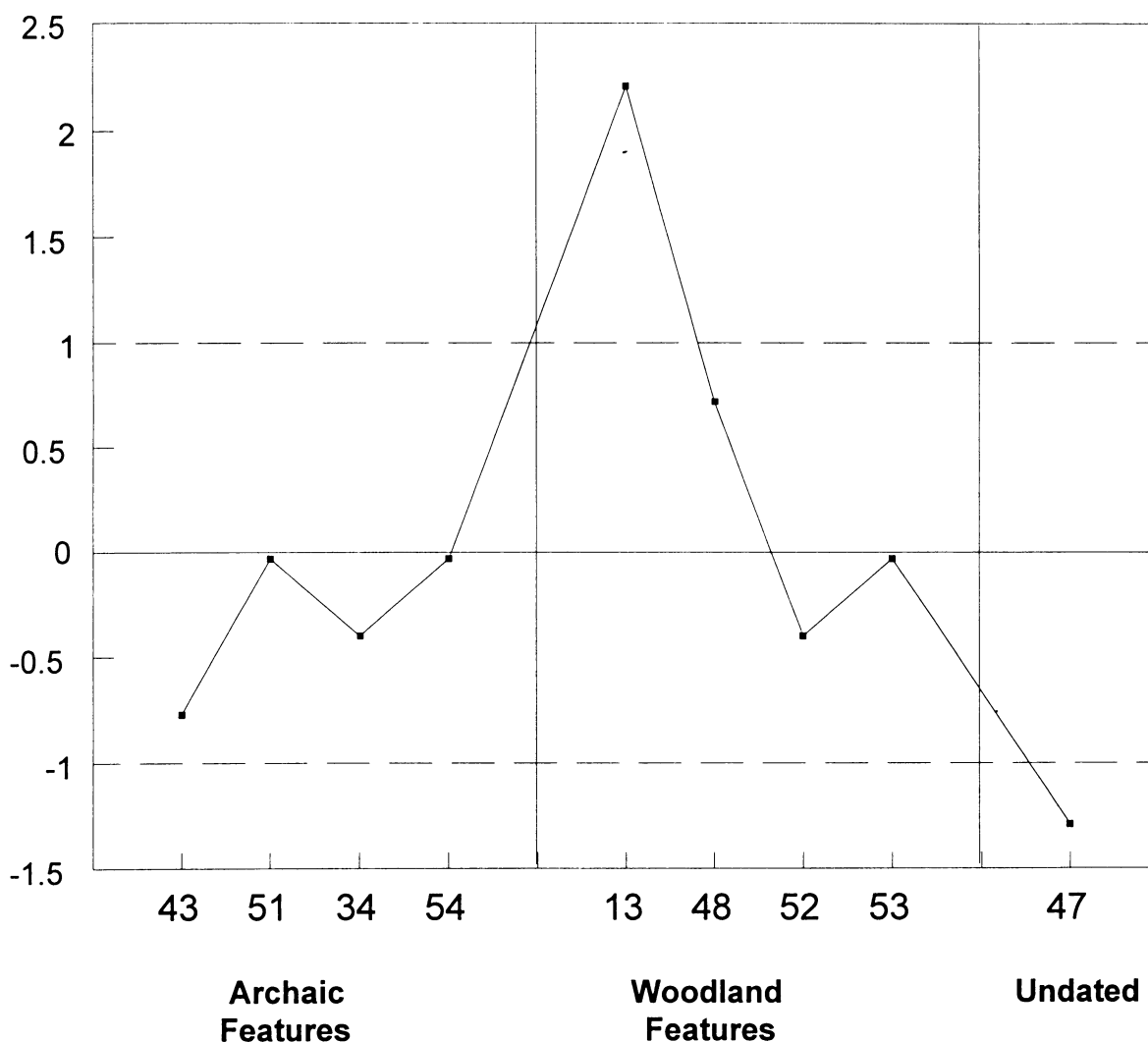
Z Scores

Figure 18. Charcoal incidence in Connoqueensing site features with frequencies graphed as standard scores with Middle Woodland hearth, Feature 13, occurring as highest peak.

deviations away from the mean frequency in all features: mean frequency 102, standard deviation 67. In the majority of the pits, charcoal frequency was less than one-half of one standard deviation away from the mean, as illustrated in Figure 18. The data suggested a similarity in the general provenance of the fill for most of the features; that is, fill was probably not the direct product of burning, but consisted of mixed debris from an area of the occupation in which fire-related activity was ongoing. The presence of charcoal in low concentrations in all features suggested that the material was widely spread across the site by postdepositional processes. The one identifiable hearth, Feature 13, was conspicuous as the peak in the graph, indicating the relatively large amount of charcoal it contained. Feature 47, one of the tabular rock clusters, displayed a frequency considerably lower than the average frequency, suggesting either a different primary function for the feature or a different source for the fill or method of infilling. A control sample taken from undisturbed subsoil also contained charcoal, though only a small amount was present in comparison with feature fill.

	Primary Use	Secondary Use	Fill
Late Archaic			
Feature 43	processing/cache	refuse disposal	incidental
Feature 51	smudge pit/hearth	refuse disposal	incidental
Transitional Archaic			
Feature 34	processing	refuse disposal	secondary fill
Feature 54	processing/cache	refuse disposal	incidental
Middle Woodland			
Feature 13	hearth/roasting pit	none	primary deposition
Feature 48	processing/cache	refuse disposal	incidental
Feature 52	processing/cache	refuse disposal	secondary fill
Feature 53	processing/cache	refuse disposal	secondary fill
Undated			
Feature 41	uncertain	none	incidental
Feature 46	uncertain	none	incidental
Feature 47	uncertain	none	incidental

Table 8. Inferred feature functions.

The material represented the remnants of either natural burning or man-made fires, the latter possibly resulting from intentional forest burn-off or consisting of material spread from surface hearths or other features.

Feature Function

Data from the various analyses of the features at the Connoquenessing site were combined to provide interpretations of feature function. Since most of the pits appeared to have contained secondary fill, use was often difficult to assess directly from feature contents. Functional interpretations were most frequently based on morphology and analogy with ethnographically documented uses and comparative archaeological interpretations.

The results furnished some general indications as to site use (Table 8). Two pits showed signs of *in situ* burning: Feature 13 contained a layer of fire-cracked rock over a deposit of charcoal, and was identified as a pit hearth or roasting pit; Feature 51 contained a charcoal-rich layer at its base, overlain by layers of lighter fill, and was interpreted as a smudge pit or hearth. Three other features, Features 41, 46, and 47, consisted of lens-like deposits of tabular sandstone, most of which bore little evidence of burning. The origin of these three features, whether natural or cultural, was unclear. The remaining features were basin-shaped, and did not bear direct evidence of primary use. Based on ethnographic analogy, the features may have been used as processing pits, possibly lined with hides which would have been removed after use, leaving little evidence of the activity represented. Each basin appeared to have been either reused for refuse disposal or, more often, to have filled in incidentally after abandonment.

Settlement

Models of regional settlement-subsistence enunciated by Gardner (1982), Hatch and associates (1985), and Custer (1989) suggest that, during the Archaic period, settlement patterns in regions such as western Pennsylvania were characterized by a high level of mobility. This mobility was dictated largely by seasonally scheduled resource procurement strategies, as suggested by Caldwell (1958) in the concept of primary forest efficiency. These settlement models note a limited range of site types, generally consisting of base camps and outlying procurement sites, arranged in a pattern that has been referred to as a radial or fission-fission system. Base camps were often located in areas of maximum habitat overlap, while procurement locales were

associated with areas of particular resource availability (Thomas et al. 1975). The intensity of site use would have been greatest during the spring and summer months, while maximum breakup of groups would have occurred in winter, during the period of lowest resource availability. Studies using ethnographic analogy, such as Custer's (1990) work with data collected by Fitzhugh (1972) among hunter-gatherer groups in the Subarctic region of eastern Canada, has suggested a parallel in the highly specific seasonal variation of group movements aimed at well-scheduled resource exploitation.

In light of these studies, it appears that the Connoquenessing site functioned during the Late Archaic period as a generalized procurement station. Comparatively few features were present, and no superpositioning or overlap of pits was observed. Lack of evidence of feature re-use, particularly for trash disposal, suggested that occupations were short-term, resulting in little need for site maintenance activities. No postmolds or other indications of structures were encountered to suggest settled occupation. Low artifact diversity suggested specialized resource exploitation. A preference for locally available lithic raw materials was evident. Macrobotanical evidence recovered from features at the site suggested that the gathering and processing of hickory nuts was at least one key activity. A wide range of large and small animals, such as deer, fox, beaver, squirrel, and turkey, may have been hunted and processed, based on protein residues remaining on lithic tools.

Most treatments of Early and Middle Woodland settlement in the Upper Ohio Valley focus on the occurrence of Adena and Hopewell sites. These are typically associated with burial mounds and are found on the floodplains of major streams, especially at the mouths of tributaries (George 1982:202; Lantz 1989:35-36). There was no evidence of either Adena or Hopewell influence at the Connoquenessing site. More generalized models proposed for the early portions of the Woodland period have suggested little differentiation from settlement-subsistence patterns seen during the latter part of the Archaic (Raber 1985:15). This apparent absence of change has led Custer (1985, 1994) to combine the Late Archaic, Early Woodland, and Middle Woodland as a single analytical unit in the Piedmont and Coastal Plain of southeastern Pennsylvania and the Delmarva Peninsula, where he refers to the entire span as Woodland I. Toward the end of the Middle Woodland, an increasing use of river terraces has been cited as a manifestation of more sedentary occupation with subsistence based on horticulture (Kent et al. 1971:265). Lantz (1989:1-3,36) has compiled a list of 236 Middle Woodland sites in the Upper Ohio Valley of western Pennsylvania and western New York, including large Hopewellian mound sites and what he identified as seven Regional Centers. Many of the sites were "satellite camps," corresponding with the procurement stations noted in the generalized models. The most heavily occupied areas were the terraces of major streams. A growing reliance on husbanded plant resources, particularly of certain starchy and oily seed-bearing weeds and grasses, has been noted farther to the west in portions of Ohio and Illinois throughout the latter end of the Archaic and early portion of the Woodland periods (Asch and Asch 1985; Smith 1992). While there was no clear evidence of such practice at the Connoquenessing site, seed remains were observed only in Woodland period features. In general, evidence of Woodland use of the Connoquenessing site suggested a resource procurement station. As during the preceding Archaic period, an absence of superpositioning or re-use of features, lack of postmolds, and low artifact diversity and little pottery suggested short-term occupation. There was evidence of a preference for higher quality, exotic lithic raw material for stone tool manufacture, possibly reflecting exchange networks or long-distance transport. The harvesting and processing of hickory nuts was suggested by macrobotanical evidence, and possibly the processing of grass seed. Immunological testing suggested the possibility that deer and smaller animals were among the fauna captured and processed at the site.

CONCLUSION

The archaeological investigations conducted at the Connoquenessing site represent a program of intensive and systematic research, undertaken to further the current state of understanding of prehistoric activity in

the upland portion of western Pennsylvania. Data recovered from plow zone contexts comprised a small but representative sample of the artifactual material from the site, providing information relative to the periods of occupation and site use. Chronological data from analysis of projectile point styles were confirmed by absolute dates returned from radiocarbon-dated features. Recovery of macrobotanical material from these features provided data concerning site use, subsistence practices, and aspects of the paleoenvironment.

Comparative survey of previous work in the three counties surrounding the Connoquenessing site, Beaver, Butler, and Lawrence counties, indicated that little work on an intensive, professional level has been carried out in the region. One reason for this may be related to the fact that the upland portions of the Upper Ohio Valley have often been considered to exhibit relatively low research potential. For unspecified reasons, the area is typically viewed in terms of Woodland settlement patterns, and is seen as an essentially unoccupied area, a no-man's-land between cultural centers to the north and south (Cowin 1985:188-193). And indeed few, if any, large-scale Woodland village sites are known in the region (the Bonnie Brook site in northern Butler County [Herbstriitt 1981] is considered an exception). Most of the information available on regional site distribution is, therefore, the result of non-systematic, surface recovery. The investigations at the Connoquenessing site, beginning with a systematic survey, and continuing through evaluative testing to mitigation, have shown that significant data can be obtained from these upland proveniences. Specifically, it was demonstrated that features are preserved at sites in these areas, even in heavily cultivated contexts. In spite of the relative lack of artifacts contained in the current features, radiometric and botanical data were recovered leading to meaningful site interpretations. The potential for the retrieval of significant data from similar locales is clear. The investigations at the Connoquenessing site were geared toward extracting the maximum feasible amount of information from the existing archaeological record. A comprehensive analytical program was undertaken which resulted in analysis beyond the level of descriptive summary. Similar work in upland areas is essential if a full picture of aboriginal settlement is to emerge.

ENDNOTES

¹The flakes from Feature 34 returned nonspecific reactions during preliminary testing against preimmune serum. Since this reaction suggests bacterial or other non-immunological contamination, the flakes were not included in further testing.

²Note that the single LeCroy point was omitted from the chronology chart because there was no additional, supporting evidence of Early Archaic activity recovered at the site. Likewise, ceramics were not included due to low frequency of occurrence.

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