SYNTHESIS OF RESEARCH RESULTS AND SITE SIGNIFICANCE (CHAPTER 10)

DATA RECOVERY AT SITE 36AL480 LEETSDALE INDUSTRIAL PARK, LEETSDALE, PENNSYLVANIA

LOCKS AND DAMS 2, 3, AND 4, MONONGAHELA RIVER PROJECT

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ABSTRACT

Chapter 10 synthesizes the results of the separate site evaluation and archaeological data recovery components performed at 36AL480. These study components consisted of the Phase I and II studies, historic and prehistoric contexts, geomorphology and environmental reconstruction, and data recovery excavations and analyses reported in Chapters 2–9. These studies describe a significant stratified, multicomponent Ohio River floodplain site whose archaeological deposits span the Middle Archaic to Early Woodland prehistoric periods, overlain by archaeological remains of a historic brickworks and recent industrial disturbances and flood deposits.

The information is used to address the research issues developed for the site. The results of investigations at Site 36AL480 are compared with other sites in the region to address research issues related to regional settlement patterns. The temporal components are analyzed and compared to address research issues related to culture chronology and adaptive change. Finally, the methodologies utilized for the data recovery are evaluated.

ACKNOWLEDGMENTS

The information analyzed in this chapter is based on excavations, analysis, and reporting by the archaeological teams for Areas 1, 2, and 3S, as well as on the cultural contexts and the geomorphological and other environmental studies. Most of the analysis and interpretation included in this chapter draws from results of this work, which is presented in the previous eight chapters.

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CHAPTER 10. SYNTHESIS OF RESEARCH RESULTS AND SITE SIGNIFICANCE

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INTRODUCTION

Phase III archaeological data recovery was conducted at Site 36AL480 in connection with the Locks and Dams 2, 3, and 4, Monongahela River Project in Allegheny, Washington, and Westmoreland Counties, Pennsylvania. The project was sponsored by the U.S. Army Corps of Engineers, Pittsburgh District (District). The work was conducted within a 30-acre construction site along the Ohio River for the off-site fabrication of sections of a replacement dam for Monongahela Dam 2 (Figure 10.1). No extant structures were located on the site during archaeological fieldwork, although residential and industrial buildings were present historically. Construction, demolition, and the placement of fill have disturbed the upper soils over much of the project area.

Phase I and partial Phase II surveys in the project area identified a 12-acre multicomponent site, designated 36AL480, that was determined eligible for listing on the National Register of Historic Places (see Chapter 1). The excavations revealed both historic and prehistoric components. The historic component consisted of the late-nineteenth-century Harmony Brickworks, including kiln foundations and other possible structural remains. The historic component had the potential to provide information related to changing architecture, technology, and economics of a brick manufactory in the nineteenth century.

The prehistoric component was in stratified context, extending up to 4.7 m below the surface, and contained occupations from the Middle Archaic through Early Woodland periods. The site is the only recorded site in the region with such a large number of intact occupations, including those from the poorly understood Middle Archaic period. Numerous prehistoric features with preserved botanical remains were identified and had the potential to

provide material for radiocarbon dating and for addressing research issues related to subsistence. The artifact assemblages included tools and chronologically diagnostic items for evaluating site age and function. The stratified site also provided information for reconstructing environmental and cultural change.

Because portions of Site 36AL480 would be destroyed by construction activities, the project was determined to have an adverse effect on the archaeological site. A data recovery plan was implemented, involving the excavation of 200 m^2 in each of three areas (Areas 1, 2, and 3) set aside prior to construction (see Figure 10.1). In addition, volunteer excavations were conducted in Area 3 in conjunction with excavations in Areas 2 and 3.

Extensive geomorphological studies were conducted prior to and during the archaeological investigations in order to interpret the depositional history of the area. As detailed in Chapter 2, three terraces were identified within the project area, bordered by the Ohio River to the west and a Back Channel to the east. The oldest and highest is the T3 terrace, which contained all of the cultural features securely dated to the Middle Archaic through early Late Archaic periods, as well as features dating to the Transitional through Woodland periods. The T2 terrace was inset into the T3 terrace and began aggradation ca. 4500 B.P. The terrace included features from the Transitional Archaic through Woodland periods. Accretion of the T2 terrace in the portion of Area 2 closest to the Ohio River was contemporaneous with deposition on the eastern margin of the T3 terrace along the Back Channel. A trend to stabilization of the T3 terrace during the Middle to Late Holocene was documented, including a period of terrace stability at about 3000 B.P. The T1 terrace represents the historic floodplain that resulted from runoff and discharge from Ohio River tributaries.

Slackwater and aquatic settings emerged in the vicinity of the present Ohio River during the middle Holocene (8000–6000 B.P.) and shifted to the Back Channel in the Late Holocene. The Back Channel was likely an active stream artery during the Early through Middle Holocene and became more stable after 4500 B.P. As a result, the Back Channel was a rich and diverse aquatic environment that would have provided both plant and faunal resources for the occupants of the site.

The results of archaeological and environmental studies are synthesized in the following sections to address the research questions defined for the site (see Chapter 1). Research issues include: 1) cultural chronology; 2) environmental context; 3) subsistence and seasonality, including diet and food procurement strategies; 4) lithic technology, including tool assemblages, lithic reduction methods, and lithic procurement strategies; and 5) intersite and intrasite settlement patterns. The results are also interpreted within a regional prehistoric framework.

CULTURE CHRONOLOGY

Reconstructing the site chronology is critical in order to assess culture change and make regional site comparisons. This section synthesizes the results from Areas 1, 2, and 3S,

and details the occupational history of the site in its environmental context. Regional comparisons with other sites are included with the settlement pattern discussion below. The chronological implications of points and ceramics identified in stratigraphic context at 36AL480 are discussed in the section on artifact assemblages.

Excavations at Site 36AL480 revealed occupations from the Middle Archaic through the Early Woodland periods in stratified context (Tables 10.1 and 10.2). Area 3S produced several Middle Woodland dates (1860 ± B.P., 1760 ± B.P.), but diagnostic artifacts in the context were primarily Early Woodland in age. The authors concluded that the Early Woodland continues temporally later than previously thought (see Chapter 8, page 8-72).

A possible Early Archaic component was identified in Area 1, based on a radiocarbon date of ca. 8550 B.P. from a bulk soil sample associated with a fire-cracked rock (FCR) cluster found at an elevation of 213.07 m NGVD. The radiocarbon date of ca. 8550 B.P. could be correct, but seems too early compared to dates from other areas of the site. Given the absence of artifacts other than FCR, no conclusions regarding activities or site function can be made for this episode of occupation.

Middle Archaic – ca. 5970 to 6790 B.P.

Two Middle Archaic occupations were identified in the Area 2 block. The more recent of the two consisted only of a reddened soil stain uncovered during mechanical expansion of the block. The second occupation was represented by three surface hearths, one of which was radiocarbon dated to ca. 6790 B.P., and a small assemblage of artifacts (Table 10.3). Walnut, possible hickory, and possible acorn nutshell was found in the features and in constant volume samples from the excavated soil, suggesting a likely fall occupation. With the exception of FCR and a point, all of the artifacts were related to stone tool manufacturing. The assemblage had a relatively high proportion of Kanawha chert, suggesting mobility or an interaction sphere extending southward.

During the geomorphological investigations at the site, four Middle Archaic features were found in Trench 3-2, located to the south of the Area 2 excavation block (Vento et al. 2002). Feature GP-00-09 was a charcoal concentration that dated to 6740 ± 40 B.P., making it roughly contemporaneous with the Middle Archaic occupation in the Area 2 block. Feature GP-00-06 was approximately 40 cm higher in the profile and returned a date of 6620 ± 40 B.P. The other two features were not dated.

Two undated occupations were found that were stratigraphically at the Middle to Late Archaic boundary, one in Area 1 and one in Area 2. Both had features and low artifact densities. The occupation in Area 1 produced a surface hearth and an FCR scatter, along with six pieces of debitage and FCR. The types and low number of features, along with the low artifact density, indicate a very short-term occupation. The FCR scatter (Feature 321) had evidence of relatively light reuse, supporting this conclusion. The occupation in Area 2 was an isolated surface hearth and could not be interpreted.

Although the evidence is limited, Site 36AL480 appears to have functioned as a series of short-term camps during the Middle Archaic. Tool discard was limited and artifact

Table 10.1. Prehistoric Components at 36AL480, Areas 1, 2, and 3.*

Age	Area	No. of Features	Feature Types	Refuse Features	Tool Types	Function
Early Woodland						
ca. 1860, 2890 BP	3S	38	3	Present	4	Base camps, long-term
2450 BP	1	1	1	0	0	Unknown
Undated	1	5	3	0	0	Base camp, long-term
Forest Notched	1	5	2	2	4	Base camp, long-term
2760 BP	2	4	4	2		Base camp, long-term
Undated	2	2	2	1	7*	Base camp, long-term
2860 BP	2	13	6	2		Multi-family base camp
Undated	2	3	1	0		Base camp
Transitional Archaic						
3050 BP	2	5	2	2	4*	Base camp
3200 BP	2	3	1	0		Base camp
3100 BP	1	4	1	0	2	Short-term camp
3100 BP	3S	14	2	0	3	Activity locus: nut processing
Undated	1	3	3	1	4	Base camp, long-term
3440 BP	2	18	4	4	4	Base camp, long-term
3470 BP	1	6	2	2	2	Base camp, long-term
3580 BP	1	13	4	3	3	Long-term or multiple short-term camps
3700 BP	1	3	3	1	1	Activity locus: roasting meat
3760 BP	2	2	2	1	0	Unknown
ca. 3800 BP	3S	16	2	0	3	Multiple camps, relatively short term
Late Archaic						
3910 BP	1	4	3	1	0	Activity locus: food prepartion
Undated	1	3	2	1	1	Base camp, long-term
Undated	1	5	3	3	2	Base camp, long-term
4480BP	2	1	1	1	0	Unknown
4730 BP	3S	8	1	0	2	Base camp, long-term
4975 BP	2	9	3	4	5	Base camp, long-term
5100-5200 BP	2	4	2	1		Base camp, long-term
5200 BP	2	8	2	1	4*	Base camp, long-term
5460 BP	2	6	3	3		Base camp, long-term
5600 BP	2	4	2	4		Base camp, long-term
Undated, but ca. 5300 B.P.	3S	2	1	1	2	Short-term or special purpose
4760 BP or 5700 BP	1	2	1	0	1	Short-term or special purpose
Middle or Late Archaic						
Undated	1	2	2	0	0	Short term
Undated	2	1	1	1	--	Unknown
Middle Archaic						
Undated	2	1	1	0	--	Unknown
6790 B.P.	2	3	1	0	1	Ephemeral camp

*Artifact assemblages from multiple occupations cannot be separated

Table 10.2. Radiocarbon Dates from Archaeological Investigations.*

Lab No.	Area	Feature	North	East	Elev	BP**	±	Calibrated Date
Middle Woodland								
182458	3S	243-2	60	231	215.13	1760	60	AD 120 to 415
176120	3S	238	57	232	215.03	1860	40	AD 70 to 240
182457	3S	243-1	60	231	215.13	1860	70	AD 5 to 340
182459	3S	243-3	60	231	215.13	1890	40	AD 40 to 230
Early Woodland								
176122	1	354	270.65	162.35	215.14	2450	40	800 to 530 BC
188210	2	443	143.77	109.21	212.96	2760	70	1055 to 805 BC
190554	2	431	152.69	111.81	213.26	2850	40	1120 to 910 BC
190555	2	445	141.75	108.13	212.84	2860	110	1380 to 1810 BC
188209	2	422	155.31	113.55	213.46	2880	60	1260 to 905 BC
159894	3S	166	70	227	214.82	2890	40	1200 to 940 BC
Late Transitional Archaic								
182788	1	322	257.80	148.99	214.11	3020	40	1390 to 1130 BC
182450	3S	172	61.5	235.5	215.00	3030	40	1400 to 1000 BC
176126	2	421	143.00	116.63	213.18	3050	40	1410 to 1200 BC
176116	3S	209	63	235	214.63	3090	40	1430 to 1270 BC
182453	3S	196	70	233	214.53	3100	40	1440 to 1280 BC
173041	2	424	146.00	122.66	213.75	*3120*	*80*	1530 to 1190 BC
176429	1	323	258.60	148.45	214.12	3160	40	1510 to 1380 BC
176428	1	312	259	148	214.08	3160	40	1500 to 1380 BC
188211	2	451	140.02	117.34	212.97	3200	80	1650 to 1300 BC
Early Transitional Archaic								
176128	2	459	144.28	111.73	212.69	3390	40	1760 to 1600 BC
188215	2	506	157.59	105.99	212.72	3430	40	1875 to 1635 BC
188212	2	465	154.10	108.95	212.92	3450	40	1885 to 1670 BC
176125	1	369	274.50	158.65	214.57	3470	40	1890 to 1960 BC
176127	2	444	146	110	212.67	3480	40	1900 to 1690 BC
182787	1	317	269.50	169.20	214.25	3570	60	2115 to 1745 BC
182785	1	311	261.90	157.40	214.15	3580	40	2030 to 1870 BC
176124	1	363	270.65	163.40	214.43	3590	40	2030 to 1870 BC
168978	1	298	276.00	159.40	214.53	***3700***	***40***	2050 to 2120 BC
176123	1	358	268.29	171.54	214.36	***3700***	***40***	2200 to 1960 BC
191963	2	513			212.41	3760	80	2450 to 1940 BC
182454	3S	220	68	233	214.39	3780	40	2310 to 2120 BC
176119	3S	227	67	230	214.47	3790	40	2330 to 2130 BC
176117	3S	217	77	225	214.14	3830		2450 to 2140 BC
176118	3S	219	71	233	214.15	3870	40	2470 to 2210 BC
Late Late Archaic								
182793	1	372	276.40	160.70	214.32	3910	80	2585 to 2145 BC
182792	1	371	264.50	170.50	214.58	***3930***	***130***	2870 to 2030 BC
176133	2	497	142.15	121.74	211.20	4480	40	3350 to 3020 BC
182790	1	341	270	169	213.96	***4760***	***40***	3640 to 3500 BC

Table 10.2 (continued). Radiocarbon Dates from Archaeological Investigations.

Lab No.	Area	Feature	North	East	Elev	BP*	+/-	Calibrated Date
Early Late Archaic								
176129	2	467	156.35	117.73	213.09	4940	40	3790 to 3650 BC
188241	2	480	155.08	118.02	212.38	***5070***	***130***	4220 to 3635 BC
188213	2	470	158.38	115.52	213.04	5080	70	3995 to 3700 BC
182786	1	313	259	148	214.14	***5130***	***40***	3990 to 3910 BC
190556	2	478	156.60	116.35	212.18	5210	40	4060 to 3960 BC
168977	1	313	263.00	157.60	214.17	***5420***	***40***	4320 to 4260 BC
191961	2	483	155.74	113.59	212.12	5440	40	4350 to 4230 BC
176132	2	494	155.07	121.68	211.93	5450	40	
176130	2	484	154.35	117.53	212.24	5480	50	4380 to 4240 BC
176131	2	488	156.04	117.33	212.01	5600	50	4520 to 4340 BC
191962	2	490	155.25	122.25	212.16	***5670***	***40***	4580 to 4440 BC
182791	1	345	269.70	167.65	213.96	***5700***	***130***	4810 to 4325 BC
Middle Archaic								
176134	2	(211.40)	156.69	116.72	211.40	5970	40	4940 to 4740 BC
179856	2	507	147.5	115	209.40	6790	50	5740 to 5620 BC
176430	1	387	276.10	168.50	213.03	***8550***	***40***	7600 to 7550 BC

*See Chapter 2, Appendix B for radiocarbon dates from areas outside the data recovery excavations.
**Dates in bold/italic are considered inaccurate based on stratigraphic position.

Table 10.3. Features and Artifacts from the ca. 6790 B.P. Occupations.

		TOTAL
Cores and raw material		3
Debitage		143
Tools and Bifaces		
Corner-notched point		1
Biface late stage		1
Biface fragment		1
	TOTAL	149
FCR		17
Manuport		19
Features		
Surface hearth		3

densities were low, indicating that the occupations were not long term. Lithic manufacturing involved only the late stages or resharpening. The short-term occupations and the relatively high proportion of Kanawha chert in the ca. 6790 B.P. occupation suggest high residential mobility for the Middle Archaic population.

Early Late Archaic – ca. 4730 to 5700 B.P.

With the exception of a short-term occupation in Area 1, early Late Archaic occupations occurred only on the T3 terrace. In addition, a feature dating to ca. 5140 B.P. was found in Block 2 of Area 1. However, the date was inconsistent with four other dates from the same approximate elevation and was likely erroneous.

An early Late Archaic occupation on the T2 terrace (Area 1) produced two pit hearths at approximately the same elevation, but with very different radiocarbon dates (ca. 4760 and ca. 5700 B.P.). Since it is not possible to know which result is correct, the occupation zone could date to either the early Late Archaic or the late Middle Archaic. The only artifact other than debitage was a hammerstone (Table 10.4). The low artifact density, near-absence of tools, and lack of refuse pits indicates that the occupation represents a relatively short-term, possibly special-purpose, camp related to use of the Back Channel, which was open at that time.

Table 10.4. Features and Artifacts from the ca. 4760/5700 B.P. Occupation.

		TOTAL
Debitage		5
Hammerstone		1
	TOTAL	6
FCR		56
Features		
Hearth		2

At least six Late Archaic occupations were present in Area 2, dating to ca. 4480, ca. 4975, ca. 5100–5200, ca. 5200, ca. 5400, and ca. 5600 B.P. Approximately 80 cm of vertical accretion separated the ca. 4975 B.P. occupation from the earliest four.

Nine features were associated with a ca. 4975 B.P. occupation (Table 10.5). The features included a cooking hearth, surface hearths, and hearth refuse, indicating a base camp occupation. Flotation samples from features included hickory, walnut, and unidentifiable nutshell. Artifacts included cores and flake tools. Points included 13 Brewerton types and one Normanskill. Five points, including three classified as Brewertons, were small side-notched points. Seven Brewerton corner-notched points had shortened blades from extensive resharpening. A variety of formal tools were present, including a knife, a drill, and a graver. Microwear analysis revealed activities including cutting meat or fresh hide, scraping dry hides, and cutting and scraping both hard material, such as bone, and soft material, such as meat or hides.

Four occupations were identified below the ca. 4975 B.P. deposits on the basis of stratigraphy and radiocarbon-dated features. They were found in a 70-cm thick alluvial package and appeared to occur on a slightly higher surface in the center of the block.

Table 10.5. Features and Artifacts from the ca. 4975 B.P. Occupations.

		TOTAL
Cores and raw material		6
Debitage		1,788
Groundstone tools		
Hammerstone		5
Possible grooved stone		1
Points		
Brewerton corner-notched		1
Brewerton corner-notched, reworked		7
Brewerton side-notched		4
Corner-notched		1
Corner-notched/scraper		1
Normanskill		1
Side-notched		4
Side-notched/scraper		1
Bifaces		7
Form tools		
Knife		1
Drill		1
Graver		1
Expedient tools		16
Utilized flake		6
	TOTAL	1,846
FCR		356
Manuport		22
Features		
Cooking hearth		1
Surface hearths		2
Hearth refuse		4
FCR dump		2
	TOTAL	9

Because there were no stratigraphic breaks in the artifact distribution, artifact assemblages for the individual occupations cannot be isolated.

The features from the latest of the four occupations included a surface hearth and adjacent hearth refuse, a pit hearth likely used for cooking, and a second surface hearth (Table 10.6). Three of the four features were in the eastern part of the block; the fourth was in the west. None of these features were radiocarbon dated, but, based on stratigraphic context, the occupation dates to between ca. 5100 and 5200 B.P. Flotation analysis produced walnut and hickory nutshell from features in all four occupations.

A ca. 5200 B.P. occupation included eight features, four pit hearths likely used for cooking, two surface hearths, a shallow pit hearth likely used for heat and light, and a hearth refuse pit. A surface hearth and hearth refuse pit were in the eastern portion of the area. The remaining features were clustered in the center. The chopper and spokeshave were in close proximity to two of the eight features and may have been associated with this occupation.

Table 10.6. Features and Artifacts from the ca. 5100-5600 B.P. Occupations

		TOTAL
Cores		29
Debitage		2,108
Groundstone tools		
Hammerstone		4
Chopper		1
Points		
Brewerton corner-notched		1
Brewerton eared		1
Brewerton eared-notched		2
Brewerton side-notched		4
Corner-notched		1
Otter Creek		1
Pentagonal		1
Side-notched		1
Vosburg		1
Bifaces		8
Form tools		
Spokeshave		1
Expedient tools		16
	TOTAL	2,180
FCR		1,225
Manuport		5
Features, 5100-5200 B.P.		
Hearth		1
Surface hearth		2
Hearth refuse pit		1
Features, ca. 5200 B.P.		
Hearth		5
Surface hearth		2
Hearth refuse pit		1
Features, ca. 5450 B.P.		
Hearth		2
FCR dump		1
Hearth refuse pit		2
Features, ca. 5600 B.P.		
FCR dump		2
Hearth refuse pit		2
	TOTAL	21

A ca. 5460 B.P. occupation was represented by six features, including two pit hearths likely used for food preparation, two hearth refuse pits, a surface hearth complex, and an FCR dump. Five of the six features were in the eastern portion of the excavation area.

A ca. 5600 B.P. occupation was represented by four features, including two hearth refuse pits and two FCR dumps. No hearths were found. The features were distributed across the excavation area.

The patterning of feature distribution in this occupation zone did not allow for the separation of temporally specific subassemblages. Microwear analysis indicated that

butchering took place during at least one of the Late Archaic occupations between 5100 and 5600 B.P. A chopper, a spokeshave, and 14 flake tools were also found. One of the flake tools was used for scraping bone or antler. Overall, however, relatively few tools were recovered from 500 years of repeated occupation. Points numbered 14 and consisted primarily of Brewerton side-notched, but also included Brewerton eared and eared-notched, Otter Creek, and Vosburg.

Interpretation of site function for the four occupations is problematic because all of the Late Archaic occupations likely extended for an unknown distance to the north of the excavation block. During the Late Archaic, this location was on the edge of a deep swale, possibly poorly drained and supporting a wetland ecosystem. Activities represented for the period included food preparation, butchering, hideworking, bone or antler working, and tool manufacturing. The variety of activities and the presence of refuse from the reuse of hearths indicate that relatively long-term base camps were present. Charred nutshell from feature contexts suggests a possible fall occupation. No other seasonal indicators were identified.

Artifacts in the ca. 5300 B.P. occupation included an untyped stemmed point, 29 pieces of debitage, and two nutting stones (Table 10.7). No radiocarbon dates were processed from the horizon. The temporal association is based on stratigraphic position. The features included a stratified cooking hearth with one piece of hickory nutshell and a roasting/cooking pit. The point had an expanding stem and was fashioned of Onondaga chert. All but one of the 29 pieces of debitage were Onondaga chert from nearby river cobbles. The horizon also produced 69 pieces of FCR. Although artifact density was low, the features suggest that the occupation in this area also functioned as a long-term base camp.

Table 10.7. Features and Artifacts from the ca. 5300 B.P. Occupation.

		TOTAL
Expanding stemmed point		1
Debitage		29
Groundstone- Nutting stones		2
Other stone		4
	TOTAL	36
FCR		69
Features		
Roasting/Cooking pit		2

Interpretation of site function for the early Late Archaic components is difficult because the occupations likely extended outside the excavated areas. The occupation with conflicting dates (Area 1) and the ca. 5300 B.P. occupation (Area 3S) were more similar to the Middle Archaic occupations, in that artifact and tool densities were low, despite the presence of features. The ca. 4975 B.P. and 5100–5600 B.P. occupations (Area 2) differed significantly from the others. Tools and features were more abundant. Activities represented in the microwear from these occupations included food preparation, butchering, hideworking, bone or antler working, and manufacturing of stone tools. The variety of activities and the presence of refuse from hearth reuse suggest that these occupations can be interpreted as relatively long-term base camps, perhaps as long as a season.

Late Late Archaic - ca. 3910 to 4730 B.P.

Features dating to the late Late Archaic were found in Areas 1, 2, and 3S, representing at least five occupations. The ca. 3910 B.P. and undated components were on the T2 terrace, whereas the ca. 4730 B.P. component was on the T3 terrace.

Four features were associated with an occupation dating to ca. 3910 B.P. (Area 1), including a roasting pit, a pit hearth, a surface hearth, and a hearth refuse scatter. No artifacts other than debitage and FCR were found in the close association with the features. An artifact assemblage definitely attributable to the ca. 3910 B.P. occupation could not be segregated from the ca. 3580 B.P. and 3700 B.P. occupations. The locus can be interpreted as an activity area for food preparation. The roasting pit and hearth refuse suggest relatively long-term occupation, likely extending outside the excavated area. The presence of black walnut and hickory/walnut in the roasting pit suggested a fall season of occupation, although occupation in other seasons could also have been present.

Based on feature elevations, two undated occupations were identified below the ca. 3910 B.P. occupation. The upper occupation included two hearths and a hearth refuse scatter with a stemmed point associated (Table 10.8). No tools other than points were found, but microwear analysis indicated activities that included boring and butchery. The hearth refuse suggests a relatively long-term occupation.

The lower undated occupation included two hearths, two hearth refuse scatters, and an FCR cluster, along with two Steubenville points, a hafted knife, and debitage (Table 10.8). Microwear analysis revealed evidence of butchery, antler boring, and wood planing. Despite the low debitage density, other evidence indicates that this occupation was a relatively long-term base camp. Lithic manufacturing activities may have taken place outside the excavation block.

The ca. 4480 B.P. occupation was represented by a single pit feature (Feature 495/497) found in the AC/C horizon in the southeast corner of the block. No tools were associated with the feature, so the function of the occupation cannot be determined.

One feature in the 3Bw horizon (Area 3S) dated to ca. 4730 B.P. Seven other features were found in the stratum at elevations between 213.12 and 213.38 NGVD. All eight were classified as hearths (Table 10.9). The occupation was concentrated in the northern portion of the block. Black walnut and hickory nutshell was recovered from hand excavation in the horizon. The two diagnostic points were classified as Bottleneck Stemmed-like and a Brewerton side-notched-like. Other artifacts included cores, bifaces, a hammerstone, and expedient tools. One whole steatite cobble was also found.

The feature dated to ca. 4480 B.P. was isolated and had no associated artifacts, so site function could not be interpreted. The ca. 3910 B.P. occupation was restricted in size and interpreted as an activity locus for food preparation. The two undated occupations had fewer features but more diverse feature types than the ca. 4730 B.P. component. These three components are classifiable as long-term base camps.

Table 10.8. Features and Artifacts from the Undated Late Late Archaic Occupation.

		Upper	Lower
Cores		1	
Debitage		204	72
Points			
Fragment		1	
Untyped stemmed		1	
Lanceolate			1
Steubenville stemmed			1
Bifaces			1
Form tools			
Knife			1
	TOTAL	207	76
FCR		181	1,733
Features			
Hearth		1	1
Surface hearth		1	1
Hearth refuse scatter		1	2
FCR cluster			1
	TOTAL	3	5

Table 10.9. Features and Artifacts from the ca. 4730 B.P. Occupations.

		TOTAL
Cores		31
Debitage		3,526
Points/Knives		
Bottleneck stemmed		1
Brewerton side-notched		1
Untyped side-notched		1
Ovate knife		1
Unidentifiable fragment		1
Biface		12
Expedient tools		2
Groundstone		1
Other stone		4
	TOTAL	3,851
FCR		371
Features		
Hearth		8

Early Transitional (Terminal) Archaic – ca. 3390 to 3800 B.P.

The data recovery excavations produced a series of radiocarbon dates between 3390 and 3870 B.P., likely representing at least five occupations. The latest and most intensive of the early Transitional Archaic occupations was in Area 2 and was represented by 19 features (Table 10.10). Four radiocarbon dates ranged from 3390 to 3480 B.P. and averaged to 3440 B.P. The dates, along with differences in feature elevation, suggest that more than one occupation was present. Three major clusters of tools were found. The northwestern portion of the block revealed a cluster of nine hearths and hearth refuse pits, along with tools and

steatite, indicating that food processing likely took place there. Most of the steatite found at the site was recovered from this location. Nutshell, predominately hickory, but also including walnut, was found in eight of the nine features. The southern portion of the block revealed a line of surface hearths and a pit hearth with two associated tool clusters related to butchering and nut processing. Charred nutshell was recovered from two surface hearths. A single debitage cluster represented an area of tool manufacturing. Over half of the cores were bipolar. The intensive food processing and use of steatite vessels suggests that the site functioned as a relatively long-term base camp during this period. Point types included an untyped broadspear, along with stemmed, side-notched, and corner-notched varieties. The occupation was interpreted as a long-term base camp.

Table 10.10. Features and Artifacts from the ca. 3440 B.P. Occupations.

	TOTAL
Cores	33
Debitage	1,864
Groundstone tools	
Hammerstone	6
Possible pipe fragment	1
Possible cobble tool	2
Nutting Stone	3
Points	
Bare Island	1
Brewerton corner-notched	2
Brewerton corner-notched, reworked	2
Brewerton side-notched	2
Contracting stemmed	2
Corner-notched	1
Expanding stemmed	1
Genesee	1
Lanceolate	1
Side-notched	1
Straight stemmed	2
Untyped broadspear	2
Other projectile point	2
Bifaces	
Biface middle stage	3
Biface fragments	6
Tools	
Scraper	1
Utilized flake	6
Retouched flake	4
Utilized prismatic blade	1
TOTAL	1,950
FCR	3,929
Steatite	109
Manuport	10
Features	
Hearths	7
Hearth refuse pits	2
Surface hearths	7
FCR dumps	2
Postmold	1
TOTAL	19

Six features were associated with a ca. 3470 B.P. date (Area 1) (Table 10.11). They included two pit hearths, two surface hearths, and two FCR scatters. Associated artifacts included a core, a scraper, a point fragment, a biface and a Steubenville stemmed point. Microwear analysis revealed activities including butchery, fresh hide scraping, and planing wood. Given the variety of activities and the scatter of heavily reused FCR, the occupation likely represents a long-term base camp.

Table 10.11. Features and Artifacts from the ca. 3470 B.P. Occupations.

		TOTAL
Cores		1
Debitage		219
Points		
Steubenville stemmed		1
Fragment		1
Bifaces		1
Form tools		
Bifacial scraper		1
	TOTAL	224
FCR		328
Features		
Hearth		2
Surface hearth		2
FCR scatter		2
	TOTAL	6

The ca. 3580 B.P. occupation zone (Area 1) had the highest number of features (Table 10.12). They included a roasting pit, nine pit hearths, two hearth refuse scatters, and an FCR scatter. One hearth produced a small amount of hickory/walnut nutshell and a second hearth produced a grape seed. The presence of a grape seed and nutshell in feature context suggests a fall season of occupation. The artifact assemblage included debitage, FCR, two cores, a tested cobble, a burin, a bifacial knife, a biface, and a pitted stone. Microwear analysis revealed evidence of butchery, antler grooving and sawing, hideworking, and hide/plant cutting. The high feature density and variety of activities suggests that the deposits represent either a long-term occupation or multiple short-term occupations.

A cluster of three features (Area 1) included a roasting pit radiocarbon dated to ca. 3700 B.P. The other two features were a hearth and an FCR cluster. The artifacts associated with these features could not be segregated from the ca. 3580 B.P. and 3910 B.P. occupations. However, a Snook Kill–like point found in the vicinity of the ca. 3700 B.P. features showed evidence of use for butchery and fresh hide scraping. The feature cluster can be interpreted as an activity area for butchering and roasting meat; it was likely part of an occupation covering a larger area.

Table 10.12. Features and Artifacts from the ca. 3580 B.P. and 3700 B.P. Occupations.*

		TOTAL
Cores		2
Debitage		579
Points		
Snook Kill-like		1
Bifaces		1
Form tools		
Bifacial knife		1
Scraper		1
Burin		1
Groundstone tool		1
	TOTAL	586
FCR		726
Features, ca. 3580 B.P.		
Roasting pit		1
Hearth		9
Hearth refuse scatter		2
FCR scatter		1
Features, ca. 3700 B.P.		
Roasting pit		1
Hearth		1
FCR cluster		1
	TOTAL	16

*Assemblage also may include debitage and FCR from the ca. 3910 B.P. occupation.

The occupations dating to ca. 3440–3470 B.P. in Areas 1 and 2 were on the T2 terrace, but in widely separated areas of the site. The occupations likely represent a series of sequential camps. The greater variety of tools and feature types in the ca. 3440 B.P. occupation zone suggests a somewhat longer duration of occupation compared with the ca. 3470 B.P. occupation. The ca. 3580 and 3700 B.P. occupations were more similar to the ca. 3440 B.P. occupation. Notably, the Area 3S portion of the T3 terrace appears to have been unoccupied during this period.

Three features dated to ca. 3760–3870 B.P., one in Area 2 and two in Area 3S. The ca. 3760 occupation (Area 2) included two features: a pit hearth and a hearth refuse pit. The occupation extended outside the block to the southwest. No artifacts could be definitively associated with this occupation. No conclusion about the function of the site during this period can be made.

Features in the 3Ab1 and 3Ab2 horizons (Area 3S) dated to ca. 3780–3830 B.P., representing one or more occupations over a period of approximately 50 years (Table 10.13). Three cultural features were identified in the 3Ab1 horizon, all of which were hearths. Hand-collected and floated nutshell included walnut and butternut. Artifacts in the 3Ab1 horizon included a small Steubenville Lanceolate point and a Lehigh Broadspear fragment that conjoined with another fragment in the overlying 2BC horizon. One biface, six cores, and

two expedient tools were also found in the 3Ab1 horizon. Nearly all of the cores and debitage were of Onondaga chert. Groundstone tools included two nutting stones and one hammerstone/anvil. No ceramic artifacts were found.

Features in the 3Ab2 horizon produced radiocarbon dates nearly identical to those of the 3Ab1 horizon. Twelve hearth features and a pit of indeterminate function were identified in the 3Ab2 horizon. Charcoal and walnut nutshell fragments were recovered from flotation. One biface, one biface fragment, and a nutting stone were found, along with seven core fragments of Onondaga chert. No points were recovered. Debitage was predominately Onondaga chert.

Table 10.13. Features and Artifacts from the ca. 3780-3830 B.P. Occupations.

		3Ab1 Horizon	3Ab2 Horizon
Cores		6	7
Debitage		108	108
Points/Knives			
Steubenville Lanceolate		1	
Lehigh Broad		1	
Bifaces		1	2
Expedient tools		2	0
Groundstone		3	1
Other stone		3	8
	TOTAL	125	126
FCR		1,961	1,863
Features			
Hearth		3	12
Indeterminate pit		0	1
	TOTAL	3	13

Despite the similarity in radiocarbon dates, it is unlikely that occupations in Areas 2 and 3S were contemporaneous. More likely they represent sequential occupations within a short time span. Notably, the ca. 3760 B.P. occupation (Area 2) was on the T2 terrace at an elevation of approximately 212.36 m NGVD, whereas the ca. 3780–3830 B.P. (Area 3S) occupation was on the T3 terrace at an elevation of 214.15 to 214.39 m NGVD. The number of features and tool types was higher in the ca. 3780–3830 B.P. occupation, although overall artifact density was low. The function of the ca. 3760 B.P. occupation could not be determined. Given the lack of feature diversity and the low number of tools, the ca. 3780–3830 B.P. occupations were likely a series of relatively short-term occupations.

Late Transitional (Terminal) Archaic – ca. 3050 to 3200 B.P.

Occupations dating between 3050 and 3200 B.P. were found in all three excavation areas, representing three or more occupations. An undated occupation dating to sometime between 3100 and 3470 B.P. was found in Area 1.

Five features were associated with a ca. 3050 B.P. date (Area 2), including a large cooking hearth, two smaller hearths, and two hearth refuse pits (Table 10.14). All of the features contained small amounts of nutshell. Artifacts from the occupations were intermixed with those of the ca. 3200 B.P. occupation in the southern portion of the block. The 3200 B.P. occupation included a cluster of three features and an area of high artifact density. The features consisted of two large, shallow hearths with large amounts of hickory/walnut nutshell and a third smaller, deeper hearth possibly used for cooking. The occupation extended outside the Area 2 block to the south.

Tools included flake tools, drills, and a graver. One of the drills had evidence of use for drilling shell. No ceramics were associated with the occupations. Because most of the occupations dating to 3050 and 3200 B.P. appear to have been centered outside the excavation block to the south, interpretation of site function is problematic. The presence of hearth refuse indicates reuse of the hearths, suggesting that the site represented base camps rather than short-term, special purpose camps.

Six hearth features on the T3 terrace were radiocarbon dated to this period (see Table 10.14). Four features (Area 1) were in close proximity and likely represented a single occupation dating to ca. 3100 B.P. Flotation samples were processed from two of the hearths, one of which produced black walnut and hickory/walnut nutshell. In addition to debitage and FCR, artifacts included five cores, four bipolar blades, a biface, a point/knife, and an untyped corner-notched point. Two of the five cores were bipolar, which along with the bipolar blades and flakes indicates that bipolar technology was in greater use during this occupation than in others. Given the near-absence of tools and lack of hearth refuse, the occupation was interpreted as a short-term camp.

Two hearth features in Area 3S dated to ca. 3100 B.P. with nearly identical dates (see Table 10.14). In all, 14 features were identified, along with one large FCR scatter not assigned a feature number. The features included 13 hearths and a pit of indeterminate function. Nutshell from hand-collected samples and from flotation of feature soils was predominately walnut and butternut, but also included hickory, acorn, and hazel nut. Diagnostic points included Lehigh broadspears, Merom-Trimble, Kramer/Adena, and Adena Ovate types. Other artifacts included cores, bifaces, an expedient tool, a hammerstone, two anvils, and FCR. Debitage was predominantly of Onondaga chert, as were the cores (six of seven). Identifiable cobble tools included a hammerstone and two anvils.

The highest density of artifacts and features occurred in the center of the excavation block. A debitage cluster was found along the western wall of the block, but otherwise, debitage was relatively evenly distributed in very low density. Bifaces and tools were clustered in the southern portion of the block, whereas bipolar artifacts were found only in the north. FCR density was highest in association with the features.

Table 10.14 . Features and Artifacts from the ca. 3050-3200 B.P. Occupations

	ca. 3050 and 3200 B.P.	ca. 3100 B.P. Area 1	ca. 3100 B.P. Area 3S	TOTAL
Cores and raw material	32	5	7	44
Debitage	9,097	381	505	9,983
Groundstone tools				
Hammerstone	4		1	5
Anvil			2	2
Net weight	1			1
Discoidal stone (modified)	1			1
Other stone			7	
Points				
Steubenville	1			1
Merom-Trimble			1	1
Lehigh broadspear			3	3
Expanding stem point	1			1
Contracting stem point	1			1
Untyped side-notched		1		1
Bare Island	1			1
Straight stem point	2			2
Brewerton side-notched	1			1
Forest Notched	3			3
Adena			2	2
Unidentified fragment	10		7	17
Bifaces	26	1	4	31
Form tools				
Knife		1		1
Uniface	1			1
Drill	4			4
Graver	1			1
Expedient tools	44	4	7	55
TOTAL	98	393	546	1,030
Fire-cracked rock	2,163	131	2,204	4,498
Ceramic vessel sherds			1	
Features, ca. 3050 B.P.				
Hearth	2			2
Cooking hearth	1			1
Hearth refuse	2			2
Features, ca. 3100 B.P.				
Hearth		4	13	17
Indeterminate pit			1	1
Features, ca. 3200 B.P.				
Hearth	3			3
TOTAL	8	4	14	26

The undated occupation in Area 1 was represented by a hearth, a hearth refuse scatter, and a possible postmold (Table 10.15). Along with debitage, two cores, a biface, a burin, a bifacial knife, a denticulate, and four points were found. The points included a Susquehanna broadspear.

Table 10.15. Features and Artifacts from the undated occupation, ca. 3100 B.P. to 3470 B.P.

		TOTAL
Cores		2
Debitage		442
Points		
Untyped stemmed		2
Steubenville lanceolate		1
Susquehanna broadspear		1
Bifaces		1
Form tools		
Bifacial knife		1
Scraper		1
Denticulate		1
Groundstone tool		
Pitted stone		1
	TOTAL	453
FCR		211
Features		
Hearth		1
Hearth refuse scatter		1
Possible postmold		1
	TOTAL	3

The late Transitional Archaic occupations spanned both the T2 and T3 terraces, encompassing all three areas of the site. The ca. 3050 B.P. and undated occupations had the greatest feature diversity, and the latter occupation had the highest tool diversity. These characteristics suggest long-term base camp occupations. Hearths were the predominant feature type in the other three occupations, and no hearth refuse was also found, which suggests shorter-term occupation. The 3200 B.P. occupation would thus be classified as relatively short term, but it should be noted that only a small portion of this occupation was identified.

Early Woodland – ca. 1860 to 2860 B.P.

Early Woodland occupations were found in all three areas. At least three, and possibly four, occupation zones appear to be present in Area 1, each representing one or more occupations. One feature (Feature 354) located in Area 1 dated to ca. 2450 B.P. It was a small circular hearth with FCR found in the upper part of the soil profile. No other features were found nearby, nor were artifacts other than debitage and FCR recovered from this context. Feature 354 flotation produced hickory/walnut nutshell. FCR from Feature 354 showed moderate to heavy reuse, possibly indicating a relatively long-term occupation.

Undated Early Woodland resources were present in two excavation levels in Area 1 and could have represented the same occupation. The uppermost contained no features or artifacts other than debitage and FCR. Five features were found in the lower of the two levels (Table 10.16). The features consisted of a roasting pit, two hearths, and two pits of unknown function. Flotation samples from the roasting pit produced black walnut, hickory, hickory/walnut, and acorn shell, along with a pokeweed seed. In addition to debitage,

artifacts included two cores and two bifaces. The features, cores, and a biface were all found in the northern half of Block 3, indicating that this area was used for a variety of activities, including cooking and tool manufacturing. Microwear analysis of two bifaces indicated that working with wood and other plant material was also performed. Overall, the variety of tasks and presence of an elaborate cooking feature suggest a relatively long-term base camp occupation.

Table 10.16. Artifacts and Features from Early Woodland Components (Area 1).

	Undated	Forest Notched
Cores and raw material	2	2
Debitage	206	877
Groundstone tools		
Hammerstone		1
Points		
Untyped stemmed		1
Untyped side-notched		1
Forest Notched		2
Unidentified fragment		1
Bifaces	2	4
Form tools		
Knife		1
Scraper		1
Expedient tools		3
TOTAL	210	894
FCR	57	183
Ceramic vessel sherds		
Features		
Roasting pit	1	
Hearth	2	1
Surface hearth		2
Hearth refuse pits		2
Indeterminate pit	2	
TOTAL	5	5

The fourth Early Woodland occupation zone was assigned to the period on the basis of two Forest Notched points. Three additional points were found, including one untyped side-notched, one untyped stemmed, and one unidentifiable. The assemblage also included a hammerstone, two cores, three bifaces, an end scraper, a bifacial knife, two bipolar blades, and a utilized flake. Three bipolar flakes were also found, indicating that bipolar reduction was part of the manufacturing technology. Activities represented in the microwear analysis include butchery, meat cutting, fresh hide scraping, and wood planning and sawing. Onondaga chert predominated, although a relatively high proportion of rhyolite was found in Block 3. Features included a pit hearth, two surface hearths, and two hearth refuse pits. The pit hearth produced a small amount of hickory/walnut shell and two bedstraw seeds. The presence of hearth refuse pits, the relatively high artifact density, and the variety of activities suggest that the occupation functioned as a long-term base camp.

Evidence of Early Woodland occupation dating to ca. 2860–2890 B.P. was found in Area 2 and Area 3S. In Area 2, the occupation zone was in a 30-cm thick package on a

sloping surface approximately 20 cm below the base of the plowzone. Radiocarbon dates ranged from 2760 – 2880 B.P. It was in approximately the same stratigraphic position as in Area 3S, but considerably lower in elevation; i.e., 213.42 m NGVD in the north and 212.84 m NGVD in the southwest. Based on feature dates and elevations, as many as four separate Early Woodland occupations may be represented in Area 2, but the artifact assemblages from each cannot be segregated. The most intensive of the four appears to date to 2860 B.P.

Four features appear to be associated with the 2760 B.P. radiocarbon date, including a deep hearth, probably used for food preparation, along with hearth refuse and FCR deposits (Table 10.17). Thirteen features were likely associated with the ca. 2860 B.P. occupation, three of which were radiocarbon dated. This was the most intensive period of occupation in the Area 2 excavation block. Four roasting pits, three of which had nearly identical dates, were found and may represent individual family groups. Despite their physical similarities, flotation samples from two of the three features analyzed produced only small amounts of nutshell whereas the third produced over 2,200 pieces of hickory nutshell along with a small amount of walnut nutshell. The difference may be related to function, but more likely results from the use of hickory nutshell as a fuel in only one of the three pits. Other features included a hearth, likely used for cooking, a high-density FCR cluster with charcoal that was likely clean-out from use of a nearby roasting pit, and a hearth refuse pit. Four postmolds were present, forming a linear rather than circular pattern. A reddened soil stain with charcoal that likely represents a surface hearth was also found, along with a small, disturbed pit feature of unknown function.

Four possible activity areas were identified based on the distribution of tools likely associated with the 2860 B.P. occupation. However, tools from the earlier and later components are likely included. Only one of the activity areas was clearly associated with a roasting pit. This tool cluster included a scraper and a nutting stone, likely representing the food-preparation activities associated with the feature. The remaining three activity areas could not be interpreted.

Two features, a hearth refuse pit, and a large area of reddened soil appear on the basis of elevation to represent an occupation between 2760 and 2860 B.P. Three hearth features in the northwestern portion of the block appear on the basis of elevation to be earlier than 2860 B.P., but later than 3050 B.P.

A small amount of rhyolite was associated with the Early Woodland occupations, suggesting the possibility of contacts with groups to the east. The few jasper flakes in the assemblage were similar in their physical characteristics and several had pebble cortex, indicating the material had been procured from the nearby river channel rather than from quarries, such as Houserville in Centre County or the Hardyston quarries in eastern Pennsylvania.

Point types included Lamoka as well as untyped stemmed and corner-notched points. A crude point classifiable as a Brewerton eared triangular point was also found. Tools included drills, gravers, scrapers, and a spokeshave. Ninety flake tools were present. In addition to a nutting stone and chopper, representing plant food processing, three netsinkers were identified, indicating that fishing provided part of the subsistence during this period.

Table 10.17. Artifacts and Features form the ca. 2860 and 2890 B.P. Occupations.

	ca. 2860 B.P. (Area 2)	ca. 2890 B.P. (Area 3S)	TOTAL
Cores and raw material	105	65	170
Debitage	14,021	3,524	17,545
Groundstone tools			
Hammerstone	5	1	6
Chopper	1		1
Net weight	3	2	5
Pitted stone		5	5
Nutting stone		2	2
Discoidal	3		3
Other stone	1	50	51
Manuport	15		15
Points			
Lamoka	3		3
Lanceolate	1		1
Expanding stem point	5		5
Genesee		1	1
Untyped side-notched	1		1
Straight stem point	1		1
Brewerton corner-notched	1		1
Forest Notched		7	7
Brewerton eared notched	1		1
Adena Ovate		1	1
Untyped ovate		1	1
Manker		2	2
Unidentified fragment	17	11	28
Bifaces	43	11	54
Form tools			
Uniface	1		1
Drill	3		3
Graver	4		4
Scrapers	2		2
Spokeshave	1		1
Retouched/utilized bifaces	6		6
Expedient tools	70	2	72
TOTAL	14,299	3,685	17,984
FCR	6,823	4,603	11,426
Ceramic vessel sherds		222	222
Features, ca. 2760 B.P.			
Hearth	1		1
Hearth refuse	2		2
FCR cluster	1		1
Features, undated components			
Hearth	3		3
Large surface burn	1		1
Hearth refuse pit	1		1
Features, ca. 2860-2890 B.P.			
Hearth		26	26
Postmold	4	5	9
Indeterminate pit	1	4	5

Table 10.17 (continued). Artifacts and Features form the ca. 2860 and 2890 B.P. Occupations.

	ca. 2860 B.P. (Area 2)	ca. 2890 B.P. (Area 3S)	TOTAL
Nut processing features		3	3
Roasting pit	4		4
Cooking hearth	1		1
Surface hearth	1		1
Hearth refuse	2		2
TOTAL	22	38	60

Feature functions, tool types, and the presence of ceramics suggest that the site represented long-term base camps during the Early Woodland period. The individual roasting pits associated with ca. 2860 B.P. suggest a multi-family group. The absence of house patterns indicates that the occupations were not hamlets or villages. Tools and feature contents suggest hunting, gathering, and fishing were practiced during the site occupation, which likely extended from summer through fall. No evidence of cultigens was found.

The AB horizon in Area 3S produced a total of 38 cultural features in two large clusters, one in the northwest portion of the excavation area and one in the southeast. Spatial analysis indicated that artifacts also fell into two clusters at the same locations. Three of four radiocarbon dates from two features in the southeast cluster were overlapping and nearly identical at ca. 1860 B.P. A radiocarbon date of ca. 2890 B.P. was secured from a feature near the base of the AB horizon in the northwestern cluster. The results suggest the possibility that two occupations separated by 1,000 years were present in the horizon. One of the 38 features produced a ca. 3030 B.P. date and is interpreted as part of the underlying Terminal Archaic component.

The features in the northwestern cluster included 12 hearths, a postmold, and two pits of indeterminate function. Adena Plain and Half Moon Cordmarked pottery were found in this area. Features in the southeastern cluster included 13 hearths, four postmolds, three nut processing features, and two pits of unknown function. Adena Plain, Watson Cordmarked, and Half Moon Cordmarked ceramics were found in this area. Six of the pit features in the AB horizon were stratified, indicating reuse and longer-term use as cooking hearths of storage areas. The remaining features indicated shorter or less intensive use.

Point types recovered from the AB horizon included Adena Ovate, Forest Notched, Genesee, and Manker corner-notched. Manker points are generally associated with the Middle Woodland, whereas Genesee points are indicative of the Terminal Archaic. The remaining points were consistent with an Early Woodland age for the AB horizon deposits. Other artifacts included bifaces and expedient tools. Microwear analysis indicated that tools had been used for scraping moderate to hard materials. Cobble tools included nutting stones, a hammerstone/anvil, pitted stones, and two net weights. Debitage consisted almost entirely of Onondaga chert. Cores and core fragments numbered 65, all of which were Onondaga chert. Three steatite fragments were found, one each in two of the pit features with ca. 1860 B.P. dates, and one in a pit in the northwestern cluster.

Walnut, hickory, and acorn nutshell was recovered from Early Woodland features. In addition, 206 knotweed (*Polygonum erectum*) and 175 goosefoot (*Chenopodium spp.*) seeds were recovered, most from Feature 238, which dated to ca. 1860 B.P. These seeds, which were found in no other contexts in Area 3S, did not appear to be domesticated varieties. Identifiable faunal remains from features included deer and rabbit.

Activity areas included three nut processing stations and a possible fishing event represented by the two net weights. A clustering of bipolar cores, debitage, and groundstone tools suggested a possible bipolar reduction workshop.

Occupation of the site during the ca. 2860–2890 B.P. period appears to have been present in all three areas of the site, occurring in the stratum just below the plowzone. In Areas 2 and 3S, the occupations were documented with radiocarbon dates. The Area 1 occupations are undated but similar in having large roasting pits and Forest Notched points.

One nut processing station (Feature 238) in Area 3S was similar to, though larger than, the four Area 2 roasting pits. A roasting pit was also identified in an undated Early Woodland component in Area 1. However, given the distance between the areas, it seems unlikely that the roasting pits represented a single occupation. Features of this type are found at the site as early as ca. 3580 B.P., but are most common in the ca. 2860 B.P. Early Woodland component in Area 2, where they were interpreted as possibly representing nuclear family groups. Although the roasting pits suggest some degree of sedentism and postmolds were found with several of the Early Woodland occupations, no evidence of house patterns was identified. Thus, the occupations more likely represent long-term base camps.

Historic Period

The initial investigation of the historic components was conducted 2000 and 2001. Additional work on the historic component was conducted in 2002 during investigations related to the prehistoric components in Area 1. Three historic components were identified at Site 36AL480, consisting of the Hugh Bevington Brickworks and two components associated with the Harmony Brickworks.

The project area was owned by Hugh Bevington from 1864, when he began purchasing and improving lots. By 1877, however, he was in debt and lost his properties to the Real Estate Savings Bank. Among the improvements listed for his holdings were two brick kilns, a wood-frame shed drying house, residences, and outbuildings. Bricks were noted as present within the kiln, suggesting that it had been recently in use. The drying house was likely a building that protected the bricks from rain while they dried. Three features were identified in the initial fieldwork for the historic component: a coal stratum, rubble fill, and a brick floor. No artifacts diagnostic of the 1870s were found in association with the features. The construction of the Harmony Brickworks in 1889–1890 destroyed all but traces of the earlier factory. Field excavations did not find evidence of the site layout or other information that could be used to address research issues.

Supplemental archeological investigations conducted prior to work on the prehistoric component in Area 1 exposed six previously unidentified features associated with both the

Bevington and Harmony Brickworks. Features associated with the Bevington Brickworks included three brick furnaces and a hot floor remnant, a hot floor complex, and a brick foundation. The features are dated to the Bevington Brickworks period because they do not appear on any maps of the Harmony Brickworks and do not fit into the known layout. The central furnace was intensively excavated and revealed three intact walls of the firebox. Flues were identified beneath the dry-laid brick hot floor located near the furnaces. The hot floor complex consisted of a ring of four concentric brick-lined flues terminating in a central channel or flue at the western end of the feature. The function of the brick foundation could not be determined.

The Harmony Society purchased the property from the Real Estate Saving Bank in 1888 and built the brick factory in 1889–1890. The Harmony Brickworks was one of the Society's industrial investments, operated and managed by outside workers. The factory was profitable in 1892 and 1893, but a variety of problems, including flooding and a natural gas shortage, caused declines in profitability between 1894 and 1896. In 1897, floods damaged the factory, which was uninsured. In April of that year, there was a fire at the plant, which did not resume operation until August of 1897.

The Harmony Brickworks 1890–1897 archaeological component consisted of a brick structure with seven kilns and three hot floors. The first five kilns constructed at the factory were updraft, open-top kilns, which were inferior to the downdraft kilns coming into use in the 1890s. By 1894, the main building had three hot floors, two with coal- and gas-fired furnaces at opposite ends of the structure and one steam-heated floor.

Two coal- and gas-fired furnaces were found in the initial excavations, although more were likely present in the factory complex. The piping system for the steam-heated floor was also identified. The flue system was the largest feature in terms of surface area. The flues were constructed of bricks laid one course wide and up to five courses tall. Other features included a cylindrical brick shaft of undetermined function, two drain pipes and drain pipe supports, burnt timber, a brick lens, and a large foundation stone. The additional excavations identified a cistern and terra cotta pipe, a hot floor complex, and two flues associated with the Harmony Brickworks 1890–1897 component. The hot floor complex indicated that the auxiliary wing of the 1894 building was used as a hot floor for drying brick.

The Harmony Brickworks 1898–1901 dates to a period of change in layout and operations following the 1897 fire. The Harmony Society upgraded the plant's infrastructure and installed a more efficient brick-drying system, a steam drier tunnel. The data recovery excavations revealed little architectural evidence of the steam drier. Because the buildings were demolished after the factory closed in 1901, only 18 structural features were identified as definitely associated with this period. Features related to the steam drier tunnel included chimney supports, foundation walls, a crushed brick floor, steam pipe support walls, a brick pavement, a brick alignment, and a water pipe. Features associated with the attendant wing of the steam drier tunnel included a chimney stack foundation, a brick pavement, a hard-packed soil stratum, brick support bases for the steam engine, a support base for the boiler, stone flooring, and stone slabs. Two gas pipes were also found. No features associated with the Harmony Brickworks 1898–1901 component were identified in the additional investigations.

Artifacts associated with the Harmony Brickworks components consisted primarily of firebricks, bricks from structural features, handmade bricks (possibly associated with the Hugh Bevington Brickworks), and factory products. Domestic artifacts were recovered from a thick deposit of household waste deposited after the site was abandoned. The date range for the assemblage mainly clusters between the late 1890s and the 1930s.

The data recovery excavations at the Harmony Brickworks yielded important information on the layout and technology of late-nineteenth-century brick manufacturing. Nearly all the steps in the brick-manufacturing process were represented in the archaeological record. The only parts of the process not represented were clay mining, soaking, and the removal of the finished product from the site. Clay was processed into bricks in the hot floor building and dried on hot floors. Gas, coal, and steam furnaces fed the flues that heated the hot floors. After 1897, drying was accomplished using a more efficient steam drier tunnel, which substituted steam pipes for brick flues. After drying, the bricks were moved using hand-pushed carts on light-gauge rail lines to the kiln banks for firing.

ENVIRONMENTAL CONTEXT

Site 36AL480 is located in an area of complex stratigraphy, affected by erosion and deposition both from the Ohio River and from the Back Channel that was open to the east of the site prior to 4500 B.P. As part of the data recovery, geomorphological and environmental studies were conducted to place the site occupations within their environmental context (see Chapter 2). The studies were used to model the environment and the available resources for each of the occupations zones. To date, there have been no other in-depth studies of the Upper Ohio Valley environment that would contribute information to the analysis. Thus, the project relied primarily on the analysis of pollen and phytoliths and on the reconstruction of the geomorphological history of the site.

Allostratigraphic units (AU) were defined for the site and refined during the course of data recovery excavations.

AU-1 (11,500–6500 B.P.): Basal coarse sands and AC/C couplets; found in all areas of the site; Early and Middle Archaic.

AU-2a (6500–4500 B.P.): Deeply weathered fragic/argillic/cambic soils; found on the T3 terrace in southwest corner of Area 1, northeast corner of Area 2, and Area 3S; Middle and Late Archaic.

AU-2b (6500–3000 B.P.): Stacked AC/C horizons (T2 terrace) inset against the east and west sides of the T3 terrace; found on the east site of Area 1 and southwest portion of Area 2; Late and Transitional Archaic.

AU-3 (3000–500 B.P.): Thin flood deposits capped by incipient surface horizons; found on the T3 terrace, discontinuous; Early and Middle Woodland.

AU-4 (less than 500 B.P.): Historic/modern fills; found in all areas of the site; Late Woodland, Historic.

Research questions related to the environmental and cultural interactions at Site 36AL480 include:

How did the environmental setting, including climate and soil deposition, of the site change during the Holocene? How do changes in climate, deposition, stream flow, fauna, and vegetation relate to settlement activities that occurred at the site? How did flooding of the T3 terrace affect the archaeological evidence of various occupations? Was any evidence of scouring present?

As detailed in Chapter 2, the stratigraphic sequence at Site 36AL480 reflects the general climatic changes that took place in the Upper Ohio Valley. During the Younger Dryas interval of the Late Pleistocene (11,000–10,000 B.P.), the T3 terrace at Site 36AL480 was likely a mid-channel island within a braided channel pattern (AU-1). Stream flow velocities were high and the Back Channel along the eastern margins of the site was active. The Younger Dryas represented a period of relatively cold, wet climate. Although a mid-channel island could have been used by Paleoindians inhabiting the region, no evidence of occupation during this period in prehistory was found at the site, possibly because of later erosion of the low-lying landform.

After 10,000 B.P., lateral accretion shifted to vertical accretion as the stream channel changed to a meandering aspect. The climate trend was to generally warmer temperatures, but included some cold, dry episodes. Forests dominated by fir, oak, and birch replaced spruce-pine forests. Accretionary deposits consisted of stacked AC/C horizon sands, as found in Areas 2 and 3. The thin AC horizons represent short intervals of floodplain stability during what was otherwise a rapid aggradation of the T3 terrace. The T3 landform during this period was a channel bar situated within 2.5–3 m (8–10 ft) above the active river channel. This process continued until approximately 8000 B.P.

After 7000–8000 B.P., the climate continued its warming trend but became wetter. There was a slow, continuous development of cumulic A and cambic/argillic/fragic B horizons (AU-2), as evidenced in Areas 2 and 3, and minimally in Area 1. Aggradation slowed and consisted of finer sediments. Incipient A horizons formed, identified most clearly in Area 3S. The T3 terrace was bordered by the river to the west and the active Back Channel to the east. This period coincided with the Middle and Late Archaic occupation of the site, which began ca. 6970 B.P. With the exception of activities related to two features in Area 1 and one isolated feature in Area 2, all of the Late Archaic occupations prior to 3900 B.P. were on the T3 terrace.

Pollen and phytolith analysis reveals typical deciduous eastern woodland taxa from at least 7,000 years ago. A pollen sample from the Casting Basin dating to ca. 7080 ± 70 B.P. likely reflects the environment during the earliest identified occupation of the site, the Middle Archaic component in Area 2. The pollen profile indicates a forest dominated by oak, hickory, and beech, with a wide variety of other species, including chestnut, hemlock, maple, walnut, spruce, and pine. Disturbance taxa are low. The low proportion of sedges indicates

riverine aquatics rather than marshland. Nutshell was abundant in the features associated with the ca. 6970 B.P. occupation, including both hickory and walnut. Charred walnut, hickory, beech, oak, and conifer wood fragments were also found in these features, along with possible *Prunus sp.*, such as wild cherry and wild plum. Although little evidence of understory species was recovered, it is likely that a variety of fruits and berries were present. Thus, the Middle Archaic occupants were camping within a rich forest environment.

A later Casting Basin pollen sample dating to 5870 ± 50 B.P. was similar to the earlier sample. However, beech appears to have increased in the overstory at the expense of other taxa. Species recognized in the wood charcoal included maple, beech, hornbeam, hickory, and possible *Prunus sp.*, such as wild cherry and wild plum. Also, grape, which was present in the earlier sample, was not identified in this later sample. This vegetation profile corresponds fairly closely in time with the early Late Archaic occupations (4975–5600 B.P.). The major overstory species would have provided edible resources for the hunter-gatherer occupants of the site.

Between 4500 and 3000 B.P., the climate was characterized by less precipitation, but an increase in the occurrence of high energy storms that increased vertical deposition on the stream terraces. There was also periodic incision of the stream channel against older terraces, as evidenced in Area 2. The Back Channel was abandoned during this period and became a seasonal overflow chute and outlet for floodwaters. Area 1 revealed deposition and aggradation adjacent to the Back Channel between 4000 and 3000 B.P. Area 2 revealed incision of the T3 terrace sometime around 4500 B.P., followed by aggradation forming the T2 terrace. These fluvial processes had a dramatic effect on the stratigraphy and preservation of occupations at the site. Incision of the T3 terrace appears to have removed portions of the Middle and early Late Archaic occupations in Area 2. The occupations that post-dated 4500 B.P. (late Late Archaic through the Transitional Archaic) were on a lower T2 terrace landform bounded along the east by the higher T3 terrace. In Area 1, the Transitional Archaic occupations prior to 3100 B.P. were on the T2 terrace, which had aggraded to elevation of the T3 terrace. Area 3S, near the center of the T3 terrace, was relatively stable during this period. The 3Ab1/3Ab2 horizon indicated a period of surface stability ca. 3800 B.P. It was overlaid by a 2BC horizon with a ca. 3100 B.P. occupation. The two occupations were separated by only 20–30 cm, indicating a slow rate of deposition on the T3 terrace during the 800-year period.

Pollen samples from the Back Channel provide information of the surrounding forest between 4500 B.P. and approximately 2000–2500 B.P. The period corresponds with the later Late Archaic through Early Woodland occupations. Beech is an important but smaller arboreal component in these samples, which are dominated by oak, hickory, and hemlock. The forest overall contained species found in the Leetsdale region today. Non-arboreal taxa representing food resources included mayapple (fruit), elderberry, hackberry, sumac, and blackberry/raspberry (berries), cattail (tubers), and cheno-ams, such as goosefoot and knotweed (seeds). Disturbance taxa generally increased through time, likely as a result of the more intensive occupation of the site. Climatic change involving a warm, dry period cannot be ruled out, however. There were no significant temporal variations in forest composition that would indicate climatic change during this period.

Storm circulation was reduced during the period between 3000 and 2000 B.P., and the T3 terrace stabilized. Following 2000 B.P., the climate varied periodically from cool and moist to warm and moist. Overbank deposits continued until ca. 1500 B.P., but were thin and resulted in weakly developed A–B packages (AU-3). Between 3500 and 1000 B.P., arboreal phytoliths all but disappeared and grasses became more common. The grass types suggest disturbance events and are likely related to human activity, possibly including land clearance for cultivation.

There is a decrease in both pollen and charcoal concentration in soil samples after about 2500 B.P., likely indicating an increase in sedimentation rate. The continued high proportion of disturbance indicator species suggests an increase in human activity around 2500 B.P., but this is not supported by the archaeological record at the site.

Research questions were also developed to place the climatic and geomorphological investigations at Site 36AL480 within a regional framework.

What were the Holocene climatic history, depositional history, and environmental history of the Upper Ohio River Valley in the site vicinity? The Bt/Btx horizon or soil package date range appears more recent than similar soil horizons in the Susquehanna and Delaware River Valleys. Does that more recent date range hold true based on the data recovery investigation? If so, what implications does that have for climatic conditions in southwestern Pennsylvania as opposed to central and eastern Pennsylvania?

Chapter 2 compares the stratigraphic sequence at Site 36AL480 with others in the region. The results of the analysis are summarized below.

Three nearby sites on the upper Ohio River were compared with Site 36AL480. The Leetsdale Sewerage Treatment Plant Site is on the T3 terrace approximately 1 km from Site 36AL480. Both sites contained the same stratigraphic units, although the Leetsdale Sewerage site exhibited slower vertical accretion than Site 36AL480. One explanation is that the Leetsdale Sewerage site was subject to episodic erosional phases, slowing the net deposition, whereas building to the terrace at 36AL480 was more sustained and regular.

The North Shore Connector Site was located 25 km upstream from Site 36AL480 at confluence of Monongahela and Allegheny Rivers. It was 150 m from active river channel and at a height above channel similar to the T2 terrace at Site AL480. The Point State Park site was immediately upstream from North Shore Connector and exhibited two landforms, a T1 terrace and a T0 terrace. The T0 terrace correlates with T3 at AL480 and contains 4–5 m of Holocene deposits. No sandy horizons were present prior to 6000 B.P., which may indicate that large cyclonic storms could not penetrate into the Upper Ohio at this time. This location preserved the thickest and most detailed evidence of Late Archaic to Woodland in upper 1.5 to 2.0 meters of deposits.

Well-dated stratigraphic sequences from other areas of the Ohio River drainage and from sites in the Susquehanna and Delaware River drainages were also examined within the framework of allostratigraphic units found at Site 36AL480.

In AU-1, graded bedding in the form of lamellar beds (A–C successions) displaced massive sandy deposition in all three of the major river drainages following 10,000 B.P. This shift, distinguished as AU-1a to AU-1b, represents represented the shift from a braided to a meandering stream condition and earliest evidence of pedogenesis. AU-1 accounts for 40–60 percent of terrace fills by volume, but the buildup was less in Ohio and Susquehanna River Valleys than in the Delaware River Valley. AU-1a is equivalent to the Paleoindian–Early Archaic prehistoric periods, with cultural materials largely absent. AU-1b dates to the Early and Middle Archaic periods; cultural deposits are sometimes present but thin.

AU-2, which accumulated between 6500 and 3000 B.P., was thickest at Site 36AL480 and thinnest at Sandts Eddy on the Delaware River. Net AU-2 sediment accumulation was lower than in AU-1, since stream levels were relatively lower relative to terrace elevations and flooding was less frequent. In some cases, no deposition is documented during the period between 6500 and 5500 B.P., representing the contact of AU-1 and AU-2, possibly as a result of an interval of erosion during the shift from lateral to vertical accretion. After 5500 B.P., conditions were favorable to soil development in situations ranging from ongoing sedimentation to relatively stable surfaces. These conditions were favorable for both human occupation and the preservation of archaeological materials in all three of Pennsylvania's major drainages.

AU-3, which extends to 1500 B.P., is relatively thin and found on higher topographic positions typically subjected to 50- to 100-year floods. Several soil generations may be present but may have been truncated before developing B horizons. In the Susquehanna and Ohio River Valleys, soil formation is uniform with each profile containing two or three thin soils within less than 75 cm of total aggradation. In contrast, the Delaware River terrace was rarely overtopped during this period. Archaeological remains are preserved in this context, although the Middle Woodland and later components are often missing or intermixed in the plowzone.

AU-4 is related to historic-period disturbances and is highly variable from site to site. In some areas, thick flood deposits are present because of high sediment yield and runoff related to historic clearing and modern development.

As summarized in Chapter 2, the sedimentary and pedogenic cylces are largely in-phase across the three drainages. However, some unique characteristics can be identified that appear to be linked to variability in parent material and paleoclimatic influence on edaphic and stream flow conditions.

ARTIFACT ASSEMBLAGES AND LITHIC TECHNOLOGY

Artifacts recovered from Site 36AL480 consisted of lithics and ceramics; no bone or shell artifacts were found. There were significant differences in the numbers and types of artifacts found in the three areas (Table 10.18). Area 2 had substantially higher artifact densities than did Areas 1 and 3. Although many more points were found in Area 2, the proportion of points in the total assemblage was much lower than Areas 1 and 3. Cores and

expedient tools exceeded bifaces and form tools (excluding points) in Areas 2 and 3, but not in Area 1. Ceramics, especially those with diagnostic characteristics, were most abundant in Area 3, whereas steatite was largely concentrated in Area 2. Area 3 was unique in having more FCR than other artifacts. The assemblage variation reflects differences in activities, site function, and duration of occupation.

Analysis of the recovered artifacts from the three areas of the site contributed to an understanding of technology, group mobility, and the types and organization of activities at the site. Temporal differences in lithic assemblages provided information on changes in lithic procurement and use, which reflected differences in mobility and the size of territories. Research questions that could be addressed through results of the artifact analysis are discussed below.

Table 10.18. Artifacts by Class and Area.*

	Area 1		Area 2		Area 3		TOTAL	
Artifact Type	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Flaked Stone Tools								
Projectile Points/ Knives	26	0.6%	140	0.3%	61	0.5%	227	0.4%
Bifaces	12	0.3%	130	0.3%	42	0.4%	184	0.3%
Form Tools	17	0.4%	30	0.1%	2	<0.1%	49	0.1%
Expedient Tools	8	0.2%	203	0.5%	24	0.2%	235	0.4%
Cores	24	0.5%	288	0.7%	135	1.2%	447	0.8%
Debitage	4,520	97.9%	39,267	97.3%	11,374	97.4%	55,161	97.4%
Groundstone	10	0.2%	171	0.4%	21	0.4%	202	0.4%
Steatite	0	0.0%	112	0.3%	5	0.2%	117	0.2%
TOTAL	4,617	100.0%	40,341	100.0%	11,664	100.0%	56,622	100.0%
Ceramics								
Pottery	5		160		252		417	
Fired clay	0		0		133		133	
TOTAL	5		160		355		550	
FCR	3,993		23,243		12,458		39,694	

*Includes both volunteer and professional excavations.

Lithic Material Procurement and Use

What were the sources of the lithic materials represented? Were any exotic lithic materials represented in the assemblage? Were there preferences in lithic material for specific tool types or during specific periods of occupation?

Lithic Source Material and Temporal Differences

Lithic materials identified at the site consisted primarily of Onondaga and Brush Creek cherts. Many of the artifacts of these materials had pebble cortex, strongly indicating procurement from river gravels in the nearby Ohio River (see Chapter 2). Bluish-black chert was generally classified as Upper Mercer chert, which outcrops in central Ohio. Both pebble and nodular cortex was found on Upper Mercer chert artifacts, indicating that it may have been procured either nearby or from outcrop sources to the west. Vanport (Flint Ridge) chert artifacts with cortex also exhibited both pebble and nodular types. Vanport chert is a vitreous material that occurs in a variety of colors and outcrops in central Ohio. Other lithic materials identified at the site included steatite and rhyolite, both of which were likely procured or traded from southeastern Pennsylvania, and Kanawha chert, which outcrops only in a small region in south-central West Virginia. All of these materials vary in macroscopic appearance within type and the difficulty in consistently assigning lithic materials to a category must be considered. Although coordination took place in an attempt to standardize type assignments, differences among the archaeology laboratories working in the three areas has likely had some effect on the results. The most significant difference was the high proportions of Onondaga chert in Area 3S and the near-absence of other materials. Onondaga chert comprised more than 95% of the lithics in all of the Area 3S occupations. In contrast, Areas 1 and 2 had a wider variety of materials. These differences were almost certainly related to laboratory identification rather than to actual differences in material use. For this reason, the Area 3S assemblages are tabulated separately in the following tables and discussion.

Onondaga chert predominated in Area 1 except for two late Late Archaic occupations, where Upper Mercer chert was more abundant (Table 10.19). Upper Mercer chert use was relatively high in the Late Archaic, whereas Brush Creek chert use was relatively high during the Transitional Archaic and Early Woodland periods. Exotic materials such as jasper, Vanport chert, Kanawha chert, and rhyolite were present in small amounts and showed no distinct temporal patterns. Of these, Vanport chert was most abundant, ranging from 3.1 to 20.3 percent of the component assemblages.

Onondaga chert also predominated in Area 2; other materials included Brush Creek, Kanawha, Vanport, Upper Mercer, and Uniontown cherts, along with small amounts of jasper, rhyolite, and quartzite. Onondaga chert was the most common material in all Area 2 components, except for the early Transitional Archaic, where Brush Creek chert predominated. Brush Creek chert was second in proportion for all other components except the Middle Archaic. In contrast to Area 1, Vanport chert percentages were low, ranging from a high of 4.5 percent in the late Transitional Archaic to a low of 0.4 percent in the early Transitional Archaic. The early Transitional Archaic showed a wider variety of material use,

with Vanport, Uniontown, and Brush Creek cherts reaching their maximum percentages. The late Late Archaic component had relatively high percentages of Kanawha and Uniontown cherts. The pattern of lithic material use suggests a somewhat higher degree of mobility during the early Transitional and late Late Archaic periods.

Table 10.19. Lithic Material Use by Component (Percent of Total).

Area	Age	Brush Creek	Jasper	Kanawha	Onondaga	Rhyo-lite	Upper Mercer	Vanport	TOTAL (number)
Early Woodland									
1	2450 BP				100				22
1	Undated	16.8			57.9	2.1	13.7	6.3	95
1	Undated	12.4			57.1	1.4	11.4	13.8	210
1	Forest Notched	18		0.3	54.1	6.3	13.4	9.0	893
2	2860 BP	25.8	0.1	0.2	66.3	<.1	1	0.7	14102
3S	1860, 2890 BP				99.1		0.3	0.3	3524
Transitional Archaic									
2	3050-3200 BP	29.7	0	0.1	64.3	<.1	0.5	0.4	9131
1	3100 BP	12.2	1	0.5	80.4	0.3	2.3	3.1	393
3S	3100 BP				97.2		0.1	1.4	505
1	Undated	12.5	0.2	0.5	52.2	3.4	14.1	16.1	441
2	3440-3760 BP	44.4		2.3	34.7	0.8	3.4	4.5	1897
1	3470 BP	6.7		1.3	50.7	1.8	25.6	12.6	223
1	3580-3900 BP	4.8		0.6	35.0	1	46	10.9	626
3S	ca. 3800				97.2				108
3S	3850 BP				95.4		0.9	0.9	108
Late Archaic									
1	Undated	1.4	0.5	3.4	26.6		37.2	20.3	207
1	Undated	5.3		1.3	47.4	1.3	32.9	9.2	76
1	Undated	3			57.6	6.1	18.2	12.1	33
3S	4730 BP				99.9			<.1	3526
2	4975 BP	21.8		6.9	51.3	0.4	2.2	1.1	1794
2	5100-5600 BP	28.5		0.7	62.2		0.1	<.1	
3S	Undated				99.6				29
Middle Archaic									
2	6790 BP	3.4		16.9	72.3		4.7	0	149

Onondaga chert predominated in all of the occupations represented in Area 3S, ranging from 95.4 to 99.6 percent. The investigators defined the material as gray to black or nearly black in color. The category may include cherts defined as Kanawha or Upper Mercer in the other two areas of the site. No lithics were identified as Brush Creek chert, Kanawha chert, rhyolite, or jasper. Vanport chert was identified in small quantities in all but the late Middle/early Late Archaic component, but reached its highest proportion (1.4 percent of

debitage) in the Terminal Archaic component. All but four flakes of Upper Mercer chert were associated with the Early Woodland occupation.

Onondaga and Brush Creek cherts together predominated in the debitage assemblages from all periods in all three areas, indicating that source distance was the primary factor in the selection of lithic material. Other materials identified in the assemblages provided information on the range of group mobility and/or patterns of trade and exchange. Unfortunately, direct procurement is difficult to distinguish from trade and exchange in the archaeological record.

Kanawha chert comprised 16.9 percent of the debitage in the Middle Archaic component of Area 2. These results indicate that the Middle Archaic occupants of the site relied less on local pebble sources of lithic material than during later periods, likely because they had a greater range of foraging mobility under conditions of low population density. Upper Mercer chert was also at its highest proportion (4.7 percent) in the Middle Archaic component, but could have been procured from either pebble or outcrop sources.

Other temporal differences in lithic use can be identified by examining all three areas across the site, but confidence in any conclusions is limited by apparent variations in lithic classification among the three archaeological laboratories.

The lowest proportions of Onondaga chert occurred in two Transitional Archaic components. In the 3440–3760 B.P. component in Area 2, Brush Creek chert was at its highest level, whereas in the 3580–3900 B.P. component in Area 1, the low value of Onondaga chert was a result of high Upper Mercer chert. All three of the material types were available as pebble sources, so the differences do not suggest any radical change in lithic procurement patterns. Without knowing the proportions of the three material types in the channel gravels, it is unclear what preferences in pebble material, if any, may have been operating.

The use of exotic materials—such as rhyolite, Kanawha chert, and Vanport chert—appears to have varied over time, but showed no clear trends. Vanport chert use was negligible at 4975 B.P. and earlier, and no rhyolite was found. However, Kanawha chert use was relatively high during the Middle and Late Archaic. This finding may indicate that foraging ranges during those periods extended to the south rather than to the rhyolite sources to the east or the Vanport sources to the west. In contrast, most of the high proportions of Vanport chert occur in the late Late Archaic through early Transitional period, possibly indicating foraging or trading partners to the west.

Rhyolite, a material of meta-volcanic origin, outcrops to the east in the South Mountain region of the Lower Susquehanna Valley, as well as near Cactoctin Mountain in Washington and Frederick Counties, Maryland. Rhyolite was widely traded in the Susquehanna Valley between 3000 and 3800 B.P. (Miller 2008). Its highest proportions were in the Forest Notched zone of the Early Woodland and an undated Late Archaic component, both in Area 1. However, it was present in small amounts from ca. 4975 B.P. until the Early Woodland.

Jasper was present only in small amounts and only in contexts from the late Late Archaic to ca. 2860 B.P. The Area 2 material had cortex and was likely procured from stream channel gravel. Only six jasper flakes were found in Area 1. The source of the jasper is unknown.

Steatite

Steatite was found in both Woodland and Transitional Archaic contexts. A steatite vessel fragment was found in the AB horizon in Area 3S and three pieces were found in AB horizon features, two of which were dated to ca. 1860 B.P. In Area 2, a steatite fragment was found in a feature dated to ca. 2860 B.P. and one ceramic sherd with steatite temper was recovered from the same occupation zone. The bulk of the steatite (*n*=109) was recovered from the ca. 3440 B.P. context in Area 2. The artifacts included five vessel body fragments, two base fragments, and five rims. The five rims could have represented a single vessel. Exterior surfaces were varied and included striated, plain, rough, and incised. Two steatite disks were also found. Although the exact source could not be identified, sourcing studies using neutron activation analysis indicated a high correlation with source material from the Georgetown and Christiana quarries in Chester County, Pennsylvania.

Steatite was used primarily for the production of cooking vessels and was widely traded in the Midwest and Southeast. Thousands of steatite vessels were traded through the Poverty Point network. Sassaman (1993, 1997) has argued that in some areas of the Southeast, the network of trade in steatite was so important that it delayed the adoption of ceramics. In Pennsylvania, steatite moved primarily in the Susquehanna River drainage during the Transitional Archaic and was associated with trade in rhyolite and the use of broadspears. Notably, rhyolite use in Area 2 has the highest assemblage proportion in the Transitional Archaic, although still very low; the pattern does not hold in Area 1, where rhyolite proportions are higher overall. Broadspears were found in all three areas of the site, but in small numbers. Four Lehigh Broadspears were found in Area 3S, a Susquehanna broadspear and two Snook Kill broadspears were found in Area 1, and three untyped broadspears were found in Area 2. All but one of the broadspears were fashioned of materials other than Onondaga or Brush Creek cherts.

A steatite sourcing study was conducted for a sample of artifacts from 36AL480: three from Area 3S and five from Area 2, as well as for three samples from other sites in southwestern Pennsylvania (see Chapter 2, Appendix D). The steatite artifacts were analyzed using Neutron Activation Analysis (NAA) at the Pennsylvania State University Neutron Activation Facility and compared with samples from previously tested quarry sites in Montgomery County, Maryland; Chester County, Pennsylvania; Madison, Caroll, Albermarble, and Campbell Counties, Virginia; and Watauga County, North Carolina. The testing indicated high correlations among the three Area 3S samples, suggesting they may have been from the same artifact. Some of the samples from Area 2 may also have represented the same artifact, but overall likely came from the same quarry. High correlations were also found among the Area 3S samples and two of the Area 2 samples, suggesting they were from the same quarry. Although the data from the NAA studies did not correspond exactly to data from past studies, it was concluded that all of the samples were similar to the Chester County, Pennsylvania, quarries at Georgetown and Christiana.

Lithic Material and Tool Types

Nearly all of the tools found at 36AL480 were of Onondaga or Brush Creek chert from nearby pebble sources. All of the expedient tools in Area 3S and 79.2 percent of the formal tools (projectile point/knives) were of Onondaga chert. In Area 2, slightly less than 80 percent of expedient tools and 90 percent of formal tools were Brush Creek or Onondaga cherts. In Area 1, seven of the 11 expedient tools and 52.6 percent of the formal tools, all of which were points, were of Onondaga or Brush Creek chert. These were significantly lower proportions than in Areas 2 and 3S. Tools were also fashioned from Vanport, Uniontown, Kanawha, and Upper Mercer cherts.

Vanport chert and rhyolite, both of which are from relatively distant sources, do not appear to have been used for expedient tool production. No cores or expedient tools of these materials were found in Area 2 or Area 3S. In Area 1, only two Vanport cores and one utilized flake were found, along with one rhyolite blade. Andrefsky (1994) argues that high-quality lithic material, when scarce, is generally used only for formal tools (see also Rolland and Dibble 1990). The findings at Site 36AL480 generally support this statement.

All but six of the Area 3S points (pp/k) were of Onondaga chert. In contrast, Area 1 and Area 2 points were of a wider range of materials. All of the Forest Notched points in Area 2 and one from Area 1 were of Brush Creek chert, whereas all in Area 3S and one of the two in Area 1 were of Onondaga chert (Table 10.20). The only identifiable points of material other than Onondaga chert in Area 3S were a Lehigh-like broadspear of Upper Mercer chert, two Lehigh broadspears of unidentifiable material, and a Manker corner-notched point of Vanport chert. A Susquehanna broadspear from Area 1 was Monongahela chert and a Snook Kill point was fashioned of argillaceous shale. A Snook Kill–like point was manufactured from Brush Creek chert. Two untyped broadspears from Area 2 were fashioned of Upper Mercer chert and one was of Vanport chert. Thus, all but one of the broadspears were from non-pebble sources, likely because of the generally small size of the pebbles and large size of the point type. The full range of lithic materials at the site was used to fashion stemmed and notched points.

Temporal differences in tool material types were generally similar to differences in debitage (Table 10.21). The ca. 2860 B.P. and the Transitional Archaic components had a somewhat wider range of lithic materials with a greater use of Vanport and other materials. The only rhyolite tool was from a ca. 3100 B.P. occupation. Tools of Kanawha chert were found with the ca. 3440 B.P., the ca. 4975 B.P., and the Middle Archaic occupations, similar to the temporal pattern reflected in the debitage. The limited range of lithic materials in the Area 1 Late Archaic occupations may in part result from the small sample size.

Summary

Lithic materials from local pebble sources predominated in the assemblages of all three areas and throughout the prehistoric occupation of the site. Small amounts of exotic materials—such as Vanport chert, rhyolite, jasper, steatite, and Kanwha chert—were present. Little Vanport chert or rhyolite was in use during the ca. 4975 B.P. occupation and earlier, whereas Kanawha chert use was more prevalent in the Middle and Late Archaic periods. These

Table 10.20. Lithic Material Use for Projectile Points/Knives.

	Brush Creek	Other	Kan-awha	Onon-daga	Upper Mercer	Union-town	Vanport	TOTAL
Areas 1 and 2								
Triangular					1			1
Forest Notched	6			1				7
Snook Kill	1	1						2
Susquehanna Broadspear		1						
Untyped broadspear					2		1	3
Bare Island			1	1	1			3
Brewerton	10	1	2	14	1	2	3	33
Genesee	1			4		1		6
Lamoka			1	1				2
Normanskill				1				1
Steubenville			1	2	1		1	5
Straight stemmed	1			4		1	3	9
Expanding stemmed	3		1	8	1		1	14
Contracting stemmed	1			2				3
Untyped stemmed				2	2		1	5
Side-notched	4			5			1	10
Untyped notched	1	2		5	1		1	10
Lanceolate				1				1
Pentagonal				1				1
Vosburg				1				1
Otter Creek				1				1
TOTAL	21	3	6	53	7	4	11	105
PERCENT	17.6%	2.5%	5.0%	44.5%	5.9%	3.4%	9.2%	
Area 3S								
Manker corner-notched				1			1	2
Fairchance				3				3
Forest Notched				8				8
Adena ovate				3				3
Adena/Kramer				1				1
Lehigh		2		1	1			4
Steubenville				1				1
Genesee				1				1
Bottleneck				1				1
Brewerton				1				1
Merom-Trimble				1				1
Contracting stemmed				1				1
Expanding stem				1				1
Untyped notched				1				1
TOTAL		2		25	1		1	29
PERCENT		6.9%		86.2%	3.4%		3.4%	

Table 10.21. Lithic Material Use for All Tools by Component.

Age	Brush Creek	Kan-awha	Monon-gahela	Onon-daga	Other	Quartz-ite	Rhyo-lite	Union-town	Upper Mercer	Van-port	TOTAL (number)
Areas 1 and 2											
Forest Notched	8.3%			75.0%		8.3%			8.3%		12
2860 BP	29.6%			60.5%	1.2%	0.6%		3.1%	2.5%	2.5%	162
3050-3200 BP	37.2%			51.1%				5.3%	2.1%	4.3%	94
3100 BP	22.2%			55.6%	11.1%		11.1%				9
3440-3760 BP	12.2%	7.3%		36.6%	4.9%			2.4%	9.8%	26.8%	41
3470-3900 BP	8.3%		8.3%	41.7%	8.3%				33.3%		12
4975 BP	34.8%	6.5%		50.0%	4.3%			4.3%			46
5100-5600 BP	25.6%			59.0%	2.6%			10.3%	2.6%		39
Late Archaic				100.0%							4
Late Archaic		25.0%		75.0%							4
Late Archaic								100.0%			1
Late Archaic					100.0%						1
Late Archaic										100.0%	1
6790 B.P.	33.3%				33.3%			0.0%	33.3%		3
Area 3S											
1860, 2890 BP				88.0%	8.0%				4.0%		25
3100 BP				85.7%		7.1%			7.1%		14
ca. 3800 BP				75.0%		25.0%					4
4730 BP				100.0%							7
Undated, but ca. 5300 B.P.				100.0%							1

differences likely reflect differences in foraging territories or differences in interaction spheres. Overall, the data revealed no lithic material preferences for specific tool types or for expedient vs. formal tools. Points were also fashioned primarily from Onondaga and Brush Creek cherts, although the proportions were lower than for debitage and other tools. Unlike other point types, broadspears were fashioned primarily from non-pebble source material. Most of the steatite was found in association with the Transitional Archaic (ca. 3440 B.P.) occupation, consistent with its period of use elsewhere in the eastern United States.

Lithic Material and Projectile Point Function

Is there a relationship between projectile point functions and lithic raw material use?

Differences in methodology among microwear analysts from the three areas of the site limited conclusions that can be drawn regarding the relationship between point functions and lithic material type. Tools from Area 3S were analyzed using both low (10–30x) and high (up to 500x) power to identify edge damage including micro-flaking, abrasion, and polish. The working edge angles were also measured. Based on edge angle, tools were interpreted as general utility knives/scrapers (edge angles 45–60^{o}) or scrapers (>60^{o}). The type of edge damage indicated the general type of material. Only six points of materials other than Onondaga chert were examined. Three of the six were Lehigh broadspears, two of quartzite and one of Upper Mercer. The other three included the Manker point, an untyped point of Vanport chert, and an untyped point of Upper Mercer chert. There were no consistent differences in use among these materials or with points of Onondaga chert. The two quartzite points had edge angles at opposite ends of the general utility range. One had no microscars and the other had crushed microscars. The Manker point was a general utility tool with working edges of 56–58^{o} and microscars suggesting use on hard materials. The untyped Vanport chert point had steep edge angles and polish suggesting use for scraping hides. The two Upper Mercer chert points each had a range of edge angles for multiple used edges. The untyped point had abrasion and polish indicating hideworking, whereas the Lehigh broadspear had microscars indicating use on both hard and soft materials. All of these types of use were recognized in points fashioned of Onondaga chert.

No patterns of microwear relative to lithic material were identifiable in the Area 1 projectile points, which were analyzed using high-power (50, 100, and 200x) magnifications. Interpretations consisted of the type of worked material and the type of motion. Onondaga chert points as an assemblage had the widest variety of microwear, but were also the most numerous. Brush Creek and Vanport cherts were used only for butchery and fresh hideworking, but the limited range of activities may result from the small sample size. The argillaceous shale point was one of seven points that had no evidence of use other than as projectiles. The other six points included two of chert, one of Monongahela chert, one of Upper Mercer chert, and two of Onondaga chert.

The Area 2 points were analyzed using methods similar to the Area 1 techniques. Fewer of the Area 2 points that were analyzed revealed evidence of use for activities other than projection. Two Brush Creek chert points were used as knives for cutting meat and hides, and a Kanawha chert point was used as a hafted scraper.

As noted above, differences in the microwear results among areas could be due to differences among analysts. However, none of the areas exhibited any clear relationship between material type and projectile point use.

Lithic Manufacturing

Lithic Reduction Sequence

What stages in the lithic reduction sequence are evident? Are there differences in the lithic reduction strategies sequence between occupation surfaces?

Although the nomenclature differed, analysis from all three areas recognized three stages of lithic reduction. The initial stage—termed primary, decortication, or early stage—represented initial trimming and was often characterized by the presence of large amounts of cortex. The intermediate stage was termed secondary, primary, or middle stage. The final stage, which consisted of biface thinning, was termed tertiary, biface thinning, or late stage. The Area 1 analysis defined the initial stage of reduction as represented in decortication flakes, defined primarily by the presence of large amounts of cortex. Decortication flakes predominated in the assemblages from all periods; few primary flakes (intermediate stage) were identified. Area 2 debitage was classified according to attributes including size and thickness, general angle of a striking platform, the presence or absence of cortex, and the presence or absence of negative flake scars on the ventral surface. Middle stage reduction flakes predominated in all but the ca. 4975 B.P. context. Area 3S utilized platform type, size, and angle. Secondary flakes predominated throughout the occupation of the area, followed by primary flakes. The greater representation of early stage reduction material in Area 1 may indicate that earlier stages of production were more frequent there, but the difference could also be related to classification differences.

When flakes from the initial stage of reduction are compared with those of the final stage, differences among the three areas are apparent. The proportion of biface thinning flakes exceeded the number of initial stage flakes in all of the Area 1 and Area 2 components, but biface thinning flakes were fewer in all of the Area 3S contexts (Table 10.22). Areas 1 and 2 differ in that the proportions of biface thinning flakes in Area 1 ranged from 93 to 100 percent in the various temporal, block, and level contexts, whereas the proportions in Area 2 ranged from 67 to 88 percent. The differences among the three areas suggest the possibility of an effect from differences in analytic methods. An alternative explanation would require some reason why differences between the three areas extended throughout the prehistoric occupation of the site.

The highest proportions of biface thinning flakes relative to initial stage flakes in Area 1 were in the early Transitional and Late Archaic components, but the differences were slight. In Area 2, the proportion of late stage flakes generally decreased over time. Area 3S exhibited no clear temporal trend, with highest proportions of tertiary flakes in the late Transitional Archaic and Late Archaic. The highest proportion of biface thinning flakes overall was in the Middle Archaic component of Area 2, where no early stage reduction flakes were found. The lowest value was in the ca. 1860 B.P. component of Area 3S.

Table 10.22. Comparison of Reduction Stages by Component.

	Biface thinning flakes (percent)			Initial stage (decortication) (percent)		
	Area 1*	**Area 2**	**Area 3S**	**Area 1***	**Area 2**	**Area 3S**
Early Woodland						
ca. 1860			39			61
ca. 2860	100	67		0	33	
	93			7		
	97			3		
	94			6		
	97			3		
	98			2		
Transitional						
ca. 3100	100	77	46	0	23	54
	100			0		
	94			6		
	97			3		
ca. 3440	100	75		0	25	
	100			0		
	96			4		
	99			1		
Late Archaic						
ca. 47-4900	97	88	43	3	12	57
	100			0		
	100			0		
	96			4		
ca. 51-5600		68			32	

*Includes separate tabulation of multiple block/level contexts

Overall, the Early Woodland and later components exhibited lower proportions of tertiary flakes, suggesting a somewhat lesser emphasis on the later stages of manufacturing. The trend is slight, however, and may not reflect any significant change in lithic manufacturing or procurement behavior. Factors such as site function and season of occupation likely resulted in the differences seen in the debitage assemblages.

Differences in reduction stages by lithic material type were assessed for Areas 1 and 2. Area 3S data for materials other than Onondaga chert were insufficient for analysis. In Area 1, the highest proportions of tertiary flakes, representing the final stages of tool manufacturing, were associated with more distant source material, such as jasper, Kanawha chert, Vanport chert, and rhyolite. The Area 2 data indicated that the proportion of tertiary flakes was highest for Monongahela chert. All of the Kanawha chert flakes in Area 2 were middle or late stage, indicating that material brought to the site had already been through the early stages of reduction. For these materials from relatively distant sources, early reduction likely took place in closer proximity to the quarry.

Lithic Technologies

What manufacturing technologies were in use at the site? Were technologies primarily expedient or formal?

Detailed debitage analysis from the Area 3S assemblages, documenting flake characteristics such as platform size, shape, and angle, provided information on tool manufacturing methods. During the Early/Middle Woodland occupations, direct percussion was more common than pressure flaking, though both were used. More hard hammer than soft hammer percussion was identified in the sample. Hard hammer percussion also predominated during the Terminal Archaic and early Late Archaic occupations. No conclusions could be made for the other components in Area 3S. Overall, the researchers concluded that there was little temporal change in manufacturing technology or lithic material use. Comparable data from Areas 1 and 2 were not available.

Bipolar technology was evidenced in all three areas of the site. In Area 3S, possible bipolar reduction activity areas were found with the ca. 1860 B.P. and Terminal Archaic occupations. In Area 1, bipolar technology was best represented in the Early Woodland (Forest Notched) and two late Transitional Archaic occupation zones. Area 2 produced the largest number of bipolar cores, which were identified in all of the temporal subassemblages. Based on the proportion of bipolar cores relative to other cores, bipolar technology was best represented in the ca. 3440 B.P. occupation (bipolar=52 percent of cores) and least present in the ca. 3100 and ca. 2800 B.P. occupations (bipolar=17 percent in each). Only one core was found in the Area 2 Middle Archaic component; it was a bipolar core on Onondaga chert. The Area 2 data differs somewhat from Areas 1 and 3S and suggest that the use of bipolar technology was unrelated to the temporal period of occupation. Bipolar technology is often used with small or near-exhausted cores and would be expected where pebble sources are utilized (Cobb and Webb 1994; Petraglia et al. 2002). In support of this proposition, 95.7 percent of the bipolar cores in the three areas were of Onondaga or Brush Creek cherts available in the nearby stream gravels.

Evidence of blade technology was identified in Areas 1 and 2. In Area 1, five blades and two bladelets were identified, occurring primarily in the Early Woodland (Forest Notched) and ca. 3100 B.P. occupations. No prepared cores were found. All of the blades and bladelets were produced using bipolar technology, which represents an efficient use of raw material (see Chapter 8, Appendix M). In Area 2, two blade cores, both of Onondaga chert, were found. One was found in the early Transitional and one in the late Transitional Archaic assemblages. Fourteen prismatic flakes and blades were also found, largely confined to these two contexts. The findings suggest a very limited use of blade technology at the site beginning in the Transitional Archaic and extending into the Early Woodland.

Evidence of heat treatment to improve the fracture characteristics of lithic materials was identified in all three areas, but suggested very limited use of the technique. In Area 1, flakes with evidence of heat treatment were found in small quantities throughout the occupation of the site. Materials classified as “Other Chert” and “Unknown” had the highest proportions of heat treated artifacts (85.7 and 96.1 percent, respectively), followed by Brush Creek chert (16.0 percent) and Monongahela chert (9.5 percent). A relatively high proportion of heat treatment was found in Late Archaic context (8.2 percent) and included

the artifacts classified as unknown material that appeared to have been heavily altered during heat treatment. Based on this evidence, heat treatment would appear to be more prevalent in the Late Archaic than in later periods of occupation in Area 1.

In Area 2, evidence of heat treatment was encountered in all occupation zones, with the highest proportions in the Early Transitional period (24.6 percent). Although all lithic material types were subjected to heat treatment, Brush Creek (18.9 percent), Upper Mercer (25.0 percent), and jasper (28.0 percent) had the highest proportions.

The proportion of thermally altered flakes in Area 3S generally ranged from 0 to 10 percent by component, but was at 33 percent in the Late Archaic (3Bw horizon). However, it was concluded that this high proportion was more likely related to a burned tree fall.

Overall, the data indicated that thermal alteration was utilized primarily for Brush Creek and Upper Mercer cherts, as well as jasper and Monongahela chert. The greatest use of heat treatment appears to have been during the Late Archaic to Early Woodland periods.

Archaeological studies have attempted to link the intensity of lithic reduction to settlement pattern and mobility (Andrefsky 1991; Bamforth 1991; Binford 1979; Parry and Kelly 1987). Binford characterized the intensity of reduction and use along a continuum of expedient to curated technologies. Curated technologies are defined as including tools that are manufactured in advance of their use, maintained through a number of uses, transported from locality to locality, and recycled to other tasks. Expedient tools are less formal and manufactured in response to specific tasks (Binford 1979). Other researchers have contrasted expedient technologies with formal technologies, which refers to the production of bifacial tools.

Binford (1979) related curated technologies to logistical patterns of mobility, wherein hunter-gatherer groups establish base camps and use task groups for special-purpose procurement. In contrast, Andrefsky (1991) discusses studies demonstrating that sedentary populations practice expedient technologies, whereas mobile groups use formal technologies, reducing risk by transporting multifunction tools with them. Parry and Kelly (1987) have demonstrated a temporal trend from formal to expedient tool use in the Eastern Woodlands, represented in part by a decrease in the use of bifaces as cores and an increase in expedient cores. They also identified a decrease in the percentage of tools with facial retouch. Populations of the Eastern Woodlands are generally believed to have decreased in residential mobility over time.

However, the relationship between settlement pattern and lithic technology is not indisputable. Andrefsky (1994) argues from ethnographic and archaeological data that high-quality lithic material, when scarce, is generally used only for formal tools (see also Rolland and Dibble 1990). Mobility/sedentism is less important in conditioning the type of tool manufacture under these circumstances. Ethnographic studies indicate widespread use of simple flake tools by both mobile hunter-gatherers and sedentary agriculturalists (Gould 1980; Parry and Kelly 1987). Bamforth (1986) argues that raw material shortages can result in curated technologies and that such shortages can occur as a result of behavior as well as geography.

The relative proportions of cores and bifaces can provide an indication of the relative importance of expedient and formal technologies. At 36AL480, cores were equal to or outnumbered bifaces in all three areas except for the ca. 4975 Late Archaic and Middle Archaic components of Area 2 (Table 10.23). However, there were no apparent temporal patterns in the ratio of cores to bifaces. The results of the comparison of cores and bifaces supports the conclusion that expedient technologies predominated at the site throughout most of its occupation, likely as a result of the proximity of lithic cobble resources.

Table 10.23. Core:Biface Ratios

	Core	Biface	Core:Biface
Area 1			
ca. 2450 B.P.	0	0	--
Early Woodland undated- 1	0	0	--
Early Woodland undated- 2	2	2	1:1
Forest Notched	2	2	1:1
ca. 3100 B.P.	5	1	5:1
Late Transitional, Undated	2	1	2:1
ca. 3470 B.P.	1	1	1:1
3580-3900 B.P.	1	2	2:1
Late Archaic, Undated	1	0	--
Area 2			
Undated, Level III-1	13	8	1.6:1
Undated, NE corner	5	1	5:1
Undated, Level III-2	8	7	1:1
Early Woodland	89	50	1.8:1
Late Transitional	32	27	1.2:1
Early Transitional	25	9	2.8:1
Late Late Archaic	4	7	0.6:1
Early Late Archaic	26	8	3.3:1
Middle Archaic	1	2	0.5:1
Area 3			
Early Woodland ca 1860 B.P.	65	11	5.9:1
ca. 3100 B.P.	7	4	1.8:1
ca. 3800 B.P.	13	3	4.3:1
Late Archaic ca. 4740 B.P.	31	12	2.6:1
Other Sites			
Connoquenessing	17	29	0.6:1
Mayview Bend	26	8	3.3:1
Cross Creek	62	81	0.8:1

Flake tools outnumbered formal tools (excluding points) in all contexts in Area 2. Only eight expedient tools and no formal tools other than points were found in Area 3S. In Area 1, formal tools exceeded expedient tools by approximately 2 to 1. Formal tools included drills, gravers, burins, knives, spokeshaves, and scrapers. Low proportions of formal tools could occur because they are more likely to have been carried off the site and discarded

elsewhere, especially if associated with short-term occupations. However, there is no apparent association in the 36AL480 components between length of occupation and proportion of formal tools. High proportions of expedient tools likely occur because of the proximity of pebble sources suitable for the manufacture of flake tools.

The results indicate that tool manufacturing during all periods of occupation was primarily the expedient production of flake tools from river cobbles. Bifaces were found in all contexts, however, indicating that the production of formal tools through biface reduction was also practiced. Given the trends related to period or length of occupation, manufacturing technology at the site was clearly related to the characteristics of the available raw material rather than to the degree of settlement mobility.

Projectile Point Chronology

How does the stratigraphic distribution of points at the site relate to existing point chronologies?

Points associated with the Early/Middle Woodland components in Area 3S included Manker corner-notched, Adena Ovate, Forest Notched, and Genesee (Table 10.24). The Early Woodland component in Area 2 produced Brewerton, Lamoka, untyped lanceolate, eared triangular, stemmed, and notched points.

Table 10.24. Identifiable Point Types from 36AL480.[1]

Type	Cultural Affiliation	Date Range	Distribution
Adena Ovate	Early Woodland to Early Middle Adena	800 to 300 B.C.	IL and adjacent states
Bare Island[2]	Late Archaic	3000 B.C. to A.D. 500	PA, MD
Bottleneck	Early Late Archaic	3770 to 3000 B.C.	OH, IN, Midwest
Brewerton corner-notched	Late Archaic (Laurentian)	2980 to 1723 B.C.	NY, PA, Midwest
Brewerton eared	Late Archaic (Laurentian)	2980 to 1723 B.C.	NY, PA, Midwest
Brewerton side-notched	Early Late Archaic	2980 to 1723 B.C.	NY, PA, Midwest
Forest Notched[3]	Early Woodland	980 to 780 B.C.	Western PA
Genesee	Transitional Archaic	2980 to 1723 B.C.	NY, PA, Midwest
Lamoka	Late Archaic (Lamoka)	3500 to 1800 B.C.	NY, PA, Midwest
Lehigh Broad[4]	Transitional Archaic	2500 to 1700 B.C.	NY, PA, Midwest
Manker Corner-Notched[5]	Middle Woodland	130 B.C. to A.D. 320	Ohio River Valley
Merom-Trimble	Transitional Archaic	1710 to 810 B.C.	Lower Ohio Valley
Normanskill[6]	Late Archaic	3500 to 1800 B.C.	NY, PA, Midwest
Otter Creek[7]	Middle - Late Archaic (Laurentian)	3500 to 2500 B.C.	New England, NY, PA
Snook Kill	Transitional Archaic	1800 to 1470 B.C.	NY, PA

Table 10.24 (continued). Identifiable Point Types from 36AL480.[1]

Type	Cultural Affiliation	Date Range	Distribution
Steubenville Lanceolate[8]	Late Archaic to Transitional Archaic	2400 to 1580 B.C.	WV, Upper Ohio Valley
Susquehanna Broadspear	Transitional Archaic	1700 to 700 B.C	NY, PA, Midwest
Triangular	Late Woodland[9]	1000 A.D. to Contact	Northeastern U.S.
Vosburg	Late Archaic (Laurentian)	3200 to 2500 B.C.	NY, PA, Midwest

[1] Dates and distribution from Justtice (1987) unless otherwise noted

[2] Morphological correlate of Lamoka (Justice 1987); date and distribution based on Custer (2001) and Ritchie (1971)

[3] Morphological correlate of Ashtabula (Justice 1987); date range based on George (1998)

[4] Morphological correlate of Genesee (Justice 1987); date range based on Custer (2001)

[5] Morphological correlate of Chesser Notched (Justice 1987); date based on Chapter 8, this report

[6] Morphological correlate of Lamoka (Justice 1987); part of Laurentian (Ritchie 1971); date based on Lamoka range

[7] No dates or distribution in Justice (1987); dates based on Ritchie (1981)

[8] Not included in Justice (1987); dates and range based on Ritchie (1971)

[9] Triangular points have been identified frequently in Archaic and Transisitonal contexts in the Susquehanna and Delaware drainages, but none to date in the Ohio River drainage

Manker corner-notched points are a small variety of Snyders point, a Middle Woodland type found throughout the Ohio Valley (Justice 1987). Both Manker stemmed and corner-notched points were found in study collections examined for the project (see Chapter 3). The Manker corner-notched point at 36AL480 was found in the general vicinity of the two features in Area 3S that dated to ca. 1860 B.P., which is within its current date range.

The most common Early Woodland point in Area 3S was the Forest Notched point, of which eight specimens were found. Three of the four Forest Notched points in datable contexts in Area 2 were interpreted as belonging to the ca. 3100 B.P. component, and the fourth was with the ca. 2860 B.P. component. In Area 1, two Forest Notched points were found in an undated component bracketed by dates of ca. 2450 and 3470 B.P. Forest Notched points are regional variants of fishtail points (Custer 2001). Points of this type are datable from the late Transitional Archaic to the early portion of the Early Woodland period; i.e., between 2800 and 3200 B.P. (Custer 2001; Ritchie 1971; George 1998). Thus, the Site 36AL480 results are supportive of the existing data.

Three Adena Ovate points were found. Adena culture points are found on some, but not all, Early Woodland sites in the region, so their limited number at 36AL480 is not unusual. One was found in an Early Woodland context and two in an underlying stratum dating to the Transitional Archaic. The typological assignment for the two points in the lower stratum was not definitive, however (see Chapter 8:8-127), and does not provide support for extending the date range for this point type.

The Early Woodland presence of types such as Brewerton, Genesee, and Lamoka—as well as numerous untyped stemmed and notched points, all of which had been associated

traditionally with the Archaic period—confirms more recent evidence that the use of these point types extended into the Early Woodland and beyond (Fiedel 1988; Miller 1998). Although Brewerton, Genesee, and Lamoka types were originally defined as part of the Lamoka Lake or Laurentian cultures in New York (Ritchie 1971), these types are widely distributed throughout Pennsylvania.

Late Transitional Archaic points included three points classified as Lehigh Broadspears and one Susquehanna broadspear, as well as Steubenville, Bare Island, Brewerton, and Merom-Trimble types. The early Transitional Archaic components produced an untyped broadspear and a Lehigh broadspear fragment that conjoined with one of the late Transitional Archaic Lehigh points. Other points from the early Transitional Archaic occupations included Bare Island, Genesee, Steubenville, Brewerton side- and corner-notched, and untyped stemmed points. Seven points from Area 2 were small examples of corner-notched, side-notched, and stemmed points, similar to points classified as Merom-Trimble and likely fashioned from small pebbles.

As noted above, Brewerton points are common throughout Pennsylvania and have been considered to mark the beginning of the Late Archaic period. However, they have been found in contexts earlier than 5000 B.P. and extending into the Early Woodland (Hart et al. 1995; Miller et al. 2007a, 2007b). Bare Island points were originally defined in the Lower Susquehanna Valley and of Late Archaic origin, but the point type is similar to other straight stemmed point types and is considered by Justice (1987) to be a correlate of Lamoka points. Points identified as Bare Island are not common in the Upper Ohio Valley and may have been brought to Site 36AL480 along with steatite, rhyolite, and other Lower Susquehanna Valley point types such as Susquehanna and Lehigh broadspears.

Late Archaic point types included Bottleneck stemmed, Steubenville stemmed and Lanceolate, and Brewerton side- and corner-notched. The Area 2 assemblage included seven Brewerton corner-notched points with blades that had been shortened as a result of resharpening.[1] Overall, a very restricted range of point types was associated with the occupations from this period. The distribution of Bottleneck stemmed points is primarily in the Midwest, extending eastward to the Pennsylvania border (Justice 1987).

Steubenville points are broad, medium-to-large points found primarily in the Upper Ohio Valley and associated with the Panhandle Archaic of West Virginia and extending into Pennsylvania (Mayer-Oakes 1955; Ritchie 1971). Steubenville points have not been firmly dated but are considered to be Late to Transitional Archaic in general age. The Steubenville points found in the 36AL480 investigations were in contexts dating from prior to ca. 3910 B.P. to ca. 3050 B.P., providing a firmer date range than has previously been established. Both stemmed and lanceolate varieties were found and there is no evidence to suggest one variety was earlier than the other. Like the Laurentian Tradition, the Panhandle Archaic in the strict sense is based on the co-occurrence of traits (e.g. shell middens, crescent bannerstone), but the diagnostic point type is more widely distributed.

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1. Single examples of the reworked points were also found in the early Late Archaic component and in the early Transitional Archaic.

In addition to Brewerton types, the early Late Archaic produced Laurentian Otter Creek and Vosburg types. These point types are common throughout Pennsylvania and are consistent with their temporal context. The only point in the Middle Archaic component was an untyped side-notched point.

In general, the point types found at Leetsdale were consistent with point types from other sites in the upper Ohio River drainage. The findings confirmed that stemmed and notched point types once considered characteristic of the Late Archaic were also in use during the Transitional Archaic and Early Woodland periods. Broadspears, which are numerous on Transitional Archaic sites in the Susquehanna and Delaware River drainages, are not common in the region, but were found at in small numbers at 36AL480. Their presence, along with Bare Island points, steatite, and small amounts of rhyolite, indicates interaction with the Lower Susquehanna Valley.

Small points, approximately 1 inch or less in length, were found in the Late Archaic, Transitional Archaic, and Early Woodland components in Areas 2 and 3S. The point in Area 3S was classified as Merom-Trimble, a composite of two small point types defined as having a relatively limited distribution associated with the Late Archaic Riverton Culture (Justice 1987). However, these points have a wider distribution, extending into northern West Virginia and the Ohio River valley (see Chapter 3:3–129). Merom points are stemmed and Trimble points are side-notched. However, the small points found at 36AL480 exhibited a variety of stylistic types, including stemmed, side- and corner-notched, and one bifurcate base. The Area 2 small points do not fit the description of Merom or Trimble and should not be classified together on the basis of size alone. Although small point types such as Merom, Trimble, Innes, and Crawford Knoll are associated with the Late Archaic, small points have also been found in Early Archaic contexts at Site 36PE16, located along the Susquehanna River. Small points were found in Late Archaic to Early Woodland contexts in Area 2. Only six of 20 Area 2 points had evidence of retouch or resharpening, indicating that the small size was not solely the result of reuse. Resharpened points were most often associated with the ca. 4975 Late Archaic period occupation, but also occurred in the ca. 3400 and ca. 5460 B.P. components. Although the use or function of these tools is not clear, one example had microwear evidence of cutting bone and one for cutting meat or hides, suggesting that after resharpening they functioned as butchering tools. Small points without evidence of resharpening may have been small because of the size of the source material or for functional reasons.

Notably absent were triangular points in Archaic period contexts at 36AL480. Triangular points have been found with increasing frequency in early contexts in the Delaware and Susquehanna River drainages (Custer et al. 1994; Miller et al. 2008; Stewart and Cavallo 1991). The absence of triangular points in pre-Woodland contexts is consistent with other findings in the Upper Ohio Valley, although it should be noted that the number of excavated, stratified sites in the region is relatively small.

Ceramics

What ceramic types are present? What are the vessel forms?

No prehistoric ceramics were found in the Area 1 investigations. Area 2 produced 160 ceramic sherds in association with the Woodland components, but none were chronologically diagnostic. Area 3S produced 222 ceramic sherds and 133 fragments of fired prepared clay surfaces or floors. All but four were from the Early Woodland component in the AB horizon. No rims were recovered. Sherds were assigned to a ceramic type based on cordage impressions, temper, wall thickness, and provenience. Diagnostic types in the AB horizon included Adena Plain (*n*=9), Half Moon Cordmarked (*n*=25), Watson Cord-Marked (*n*=4), and McKees Rocks Plain (*n*=1), all associated with the Early Woodland period. A Middle–Late Woodland Mahoning Cord-Marked type was found in the plowzone. Twenty sherds in the AB horizon assemblage exhibited smooth exterior surfaces and 54 evidenced cord-marked or variously smoothed-over cord-marked exterior surfaces. The remaining ceramics were eroded sherds or spalls. Due to the degree of erosion, cordage twist could not be identified on any of the sherds. Temper types included chert, limestone, hematite, crushed quartz, siltstone, sandstone, claystone, igneous rock, shale, ironstone, quartz gravel, fireclay, shale pebbles, and quartz pebbles in decreasing order of frequency.

The fired clay is associated with prepared floors in Features 238 and 243, both of which dated to ca. 1860 B.P. Two diagnostic sherds from two Adena Plain vessels were recovered from Feature 238. If the feature dates are correct and if the Adena vessels were used and deposited in the feature during the same period, the finding suggests a continuation of the vessel type beyond the end of the Adena period. The Half-Moon Cordmarked sherds fit within the broad definition of the type (Mayer-Oakes 1955: 184, 189), but their characteristics suggested a local ceramic industry transitioning from Early Woodland ware to early Middle Woodland types.

Adena and Half Moon ceramics are common on Early Woodland sites in the region. These ceramic types were found at Crawford-Grist Site #2, along with radiocarbon dates ranging from ca. 1490 to 2430 B.P. Half Moon ceramics were found at Mayview Depot and Mayview Bend, as well as at the Georgetown Site.

Tool Kits and Activity Areas

What is the tool kit composition for each occupation and how do these assemblages compare between occupations? What types of activity areas are present?

General Considerations

The identification of "tool kits"—i.e. co-variant sets of tools—requires the assumption that assemblages related to individual occupations can be isolated with certainty. However, the definition of both tool kits and activity areas is problematic because occupation

zones recognized in the stratigraphic analysis generally contain multiple occupations. In addition, a number of behavioral and post-depositional factors affect the archaeological distribution of tools.

Behavioral factors include discard behaviors, cleaning of household areas, and trampling and scuffage. Gifford-Gonzales et al. (1985) distinguish between expedient and systematic refuse disposal. Expedient disposal results in the formation of toss zones. In contrast, secondary deposits from systematic cleanup are expected to occur on the site periphery and might contain a higher proportion of small items than refuse from expedient cleanup. These patterns would become more distinct the longer a site was occupied (Gifford-Gonazles et al. 1985).

O'Connell et al. (1991) noted that activity areas of the Hazda, a tribe located in Tanzania, Africa, were cleared of refuse by sweeping, hearths were periodically cleared of ash, and secondary refuse formed along the edges of an activity area in circular or subcircular concentrations. Larger items were more likely removed, whereas smaller items were more often trampled into ground.

Ethnographic research by O'Connell (1987) indicates that due to frequent secondary disposal of larger items, small refuse items are more likely to be found at the location of their use. He concluded that researchers cannot infer that objects found together were used together for the same activity in the past.

Keeley (1991) cites factors that affect deposition, including disposal considerations (cleanup, tossing, etc); length of site occupation and timing of an activity within the occupation; and retooling of hafted artifacts. He summarizes the literature on disposal, noting that the size of tool affects its probability of disposal near point of last use since smaller pieces are more likely to escape cleanup. Cleanup is more likely around intensively used areas, such as hearths. He agrees with O'Connell (1987) that the actual loci of activities is likely only represented by small tool fragments or resharpening flakes from the tools used there. Keeley (1982, 1991) also argues that tools that have been hafted are dropped where they are replaced in the haft, not where they were used. Unhafted or briefly used tools are more likely to be abandoned near last use.

The studies discussed above indicate that post-depositional behaviors such as trampling and scuffage affect horizontal and vertical distribution of artifacts (Hivernel and Hodder 1984). The shorter-term the occupation, the less such factors would be expected to affect artifact distribution. One result of trampling is vertical and horizontal size sorting of artifacts. Stevenson (1985, 1991) noted that larger artifacts are more susceptible to movement as a result of foot traffic (see also Stockton 1973). O'Connell (1987) observed in ethnographic studies that larger items migrate farther from use. Some trampling studies indicate smaller items go deeper (Gifford and Brehensmeyer 1977). However, no size/weight effect for vertical movement was identified by Gifford-Gonzales et al. (1985).

The type of soil has an effect on vertical movements. Experiments show little vertical movement in loam, but more movement in sand: 3–8 cm (1–3 in), but up to 11 cm (4 in). Burial was more immediate in sand. In contrast, artifacts in loam showed more horizontal

dispersal than vertical. Based on these experiments, the vertical movement of artifacts in the clayey B horizon soils at 36AL480 was likely minimal.

Early Woodland

The AB horizon in Area 3S contained two clusters of artifacts and features, one in the northwest and one in the southeast (Table 10.25). Two features in the southeastern cluster dated to ca. 1860 B.P., whereas a feature in the northwestern cluster dated to ca. 2890 B.P. Tools in the southeastern cluster included five pitted stones, a netsinker, and a Manker point. Tools in the northwestern cluster included a flake tool, a netsinker, and two nutting stones, as well as three Forest Notched and one Genesee point. One piece of steatite was found in the northwest and two were found in the southeast. Ceramic artifacts were found throughout the excavation area. The artifacts and feature types in the two clusters were similar, suggesting generalized activities likely associated either with two contemporary social groups or with two separate visits by a small group.

Two large radiocarbon-dated features (Features 238 and 243) in the southeastern feature cluster were interpreted as nut processing facilities. Both had fired clay floors and large amounts of nutshell. The features were likely the focus of a nut processing activity area. An additional nut processing or consumption area is suggested by the presence of two nutting stones within a 16 m^2 area. Maintenance or repair of fishing nets may be indicated by the presence of two net weights in an 8-m x 10-m portion of the excavation block. A bipolar reduction work area may be indicated by the collocation of bipolar cores and debitage, along with groundstone tools, including hammerstones and anvils.

Table 10.25. Tool Kits and Activity Areas.

Component	Area	Diagnostics	Other Artifacts	Activity Areas
Early Woodland				
1860 BP, ca. 2890 B.P.	3S	Forest Notched, Manker, Adena, Genesee points; Half Moon, Adena, Watson, and McKees Rocks ceramics	Netsinker, flake tool, nutting stones	Nut processing, bipolar reduction workshop, fishing maintenance
2450 B.P. and undated	1	Forest Notched	Bifacial knife, end scraper	None identifiable
2860 B.P.	2	Untyped stemmed and notched	Netsinkers, nutting stones, drills, gravers, scrapers, spokeshave, flake tools, chopper	Cluster 1: food preparation, Clusters 2,3, and 4: unknown
Transitional Archaic				
3050 B.P.	2	Untyped stemmed and side-notched, Forest notched, Lehigh and Susquehanna broadspears, Merom-Trimble, Steubenville, Bare Island, Brewerton	Hammerstones, anvils, netsinkers, drills, graver, uniface, flake tools	Bipolar reduction (3100 B.P.)
3100 B.P.	1, 3S			
3200 B.P.	2			

Table 10.25 (continued). Tool Kits and Activity Areas.

Component	Area	Diagnostics	Other Artifacts	Activity Areas
Undated	1	Susquehanna broadspear	Burin, knife, denticulate	None identifiable
3440 B.P.	2	Brewerton side- and corner-notched, Bare Island, Genesee, untyped Broadspear, untyped stemmed and notched, reworked Brewerton corner-notched	Hammerstones, nutting stones, a scraper, flake tools; steatite bowl fragments	Cluster 1, food preparation (cooking); Cluster 2:butchering/nut processing; Cluster 3: discard
3470 B.P.	1	Steubenviller stemmed	Scraper	None identifiable
3580 B.P.	1	None	Burin, bifacial knife, pitted stone	Processing and roasting meat
3700 B.P.	1	Snook Kill-like	None	Butchering and roasting meat
3800 BP	2, 3S	Steubenville, Lehigh broadspear	Hammerstones, nutting stones, flake tools	None identifiable
Late Archaic				
3910 B..P	1	None	None	Food preparation
Undated	1	Untyped stemmed, Snook Kill, Steubenville	Knife	None identifiable
4730 B.P.	3S	Bottleneck, Brewerton side-notched	Hammerstone, flake tools	None identifiable
4760-5700 B.P.	1	None	Hammerstone	None identifiable
4975 B.P.	2	Brewerton side- and corner-notched	Hammerstone, knife, drill, graver	Cluster 1: bone working; Clusters 2 and 3: butchering/dry hideworking; Clusters 4, 5, and 6: unknown
5100-5200 B.P.	2	Brewerton eared and eared-notched, side- and corner-notched, Otter Creek, Vosburg, pentagonal	Hammerstones, chopper, spokeshave, flake tools	None identifiable
5200 B.P.	2			
5460 B.P.	2			
5600 B.P.	2			
Middle Archaic				
6790 B.P.	2	Side-notched point		Debitage: tool finishing/retouch

Few activity areas were identified in Area 1 because of the relatively low artifact density. Tools in the Early Woodland (Forest Notched) component included points, a bifacial knife, an end scraper, and a utilized flake. Although a wide variety of activities were

identified in the microwear, no tool or feature clusters were found that would suggest activity areas.

The Early Woodland component in Area 2 included at least four occupations, the most intensive of which dated to ca. 2860 B.P. The tool kit included drills, gravers, scrapers, a spokeshave, and a variety of flake tools. Groundstone tools consisted of hammerstones, netsinkers, a nutting stone, and chopper. Points consisted primarily of untyped stemmed and notched specimens. Four tool clusters and two feature clusters were found. Feature Cluster 1 consisted of a roasting pit, hearth refuse, and a possible burned post, all of which were overlain by a reddened soil stain. Tool Cluster 2 was found immediately to the south of the feature cluster. It consisted of a variety of flake tools and other tools, but no features. Its function could not be determined, but it may represent secondary discard from activities focused on Feature Cluster 1. Tool Cluster 3 was found on the eastern margin of Feature Cluster 1 and may also have been related to activities there; it consisted of flake tools and a netsinker. Chronologically non-diagnostic ceramic artifacts were found distributed in densities of 1 to 4 per excavation unit. The highest densities were along the eastern margin of Feature Cluster 1. Tool Cluster 4 consisted of points and flake tools and may have been associated with Feature Cluster 2, which included a roasting pit and two hearths. Tool Cluster 1 included a scraper and a nutting stone associated with a roasting pit and likely representing a food preparation area.

Transitional Archaic

Late Transitional (Terminal) Archaic components were present in both Areas 2 and 3S. Tools in Area 3S (ca. 3100 B.P.) included a hammerstone, two anvils, and a flake tool. Transitional Archaic points included a Merom-Trimble and three Lehigh types. A roasting pit was identified near the center of the excavation area and likely represents a focus of nut processing. A work area for bipolar reduction appeared to be present in the northern portion of the excavation area.

A ca. 3100 B.P. occupation was also found in Area 1. Tools associated with the occupation included a point/knife, flake tools, and an untyped corner-notched point. The occupation was confined to a small portion of the excavated area. No activity areas were identified.

Two Late Transitional Archaic occupations, dating to ca. 3050 and ca. 3200 B.P., were found in Area 2. However, the artifacts could not be separated into distinct subassemblages. Tools included two drills, a graver, a uniface, and 45 flake tools. Hammerstones and a netsinker were also found. Points included Steubenville, Bare Island, Brewerton, Forest Notched, and untyped stemmed points. The tools were densely scattered across the area and no distinct activity areas could be identified. The ca. 3200 B.P. occupation was identified on the basis of three hearths clustered on the southern end of the excavation block, but no tools were directly associated with the features.

Early Transitional Archaic occupations in Area 1 included an undated occupation between ca. 3100 and 3470 B.P., as well as occupations dating to 3470, 3580, and 3700 B.P. Tool types associated with the Transitional Archaic occupations in Area 1 included points,

bifacial scrapers, burins, bifacial knives, a denticulate, and pitted stones. Several possible activity areas were also found. The undated component revealed a cluster of three butchering tools. The ca. 3470 B.P. occupation had a cluster of tools with a variety of functions including fresh hide scraping and planing wood. An FCR scatter was associated with the cluster. The cluster could represent multiple activities in a single area, but more likely represents discard of tools and FCR in a trash zone. The ca. 3580 B.P. occupation revealed a distinct patterning of features and artifacts. A roasting pit was found at the center of four hearths. Hearth refuse and FCR scatters were found in a circular area around the roasting pit. Hide and antler working tools were found in association with one of the hearths, likely representing a locus for processing animal byproducts. The 3700 B.P. occupation included butchering/fresh hide scraping tools associated with a roasting pit and hearth. The locus may represent an activity area for roasting and processing game.

Early Transitional Archaic occupations in Area 2 dated to ca. 3440 and ca. 3760 B.P. Artifacts from the ca. 3760 B.P. occupation could not be segregated. Tools from the ca. 3440 B.P. occupation included hammerstones, nutting stones, a scraper, and flake tools. Points included Bare Island, Genesee, and Brewerton side- and corner-notched types, along with an untyped broadspear and untyped stemmed and notched points. Steatite bowl fragments were also found. Spatial analysis revealed three artifact clusters. Cluster 1 artifacts included burnt steatite bowl fragments associated with a series of hearths. The cluster was interpreted as a food preparation area involving boiling in steatite vessels. Clusters 2 and 3, along with associated features, were interpreted as an activity area for butchering and the processing of nuts. The interpretation is based on the presence of nutting stones, high densities of FCR, and microwear indicating that butchering was performed.

One or more early Transitional Archaic occupations dating to ca. 3800 B.P. were found in the 3Ab1 and 3Ab2 horizons of Area 3S. Tools from the component consisted of two flake tools, three nutting stones, and a hammerstone/anvil. Points included a Steubenville and a Lehigh Broadspear. The nutting stones were recovered from a single unit and three features contained large amounts of nutshell. Together the evidence suggests that this was a nut processing activity area.

Middle and Late Archaic

Artifact and tool densities were relatively low in the Late Archaic occupations of Area 1. The ca. 3910 B.P. occupation covered only a small portion of excavated area and produced no tools. The presence of a roasting pit indicated a food preparation area. A possible activity area was identified in an undated Late Archaic context, where a variety of tools were found in association with a hearth. The tools were used for butchering, wood planing, and antler boring. Although the evidence is limited, it is possible that this was a smaller camp in which activity areas were less segregated and most activities took place around a hearth.

Late Archaic assemblages dating to ca. 4730 B.P. (Area 3S) and ca. 4975 B.P. (Area 2) were identified. The only tools in the ca. 4730 B.P. assemblage were two flake tools—a Bottlenecked stemmed point and Brewerton side-notched point. No activity areas were identified. The ca. 4975 B.P. assemblage included five hammerstones, a knife, a drill, a

graver, a hafted scraper, and 14 flake tools. Points were classified as Brewerton side- and corner-notched and Normanskill. Seven Brewerton corner-notched points had been heavily reworked, shortening the length of the blades. Cluster analysis revealed six clusters. Cluster 1 was interpretable as a possible bone-working locus and Cluster 3 was interpreted as an area for butchering and dry hideworking. The other four clusters could not be interpreted as activity-specific areas.

A series of base camps dating between 5100 and 5600 B.P. were found in Area 2, but artifact assemblages specific to each camp could not be isolated. Overall, the assemblage included four hammerstones, a chopper, a spokeshave, and 16 flake tools. Points included Brewerton varieties, along with an Otter Creek and a Vosburg point. Because of the admixture of artifacts from multiple camps, no activity areas could be isolated.

Artifacts in the 4Bw horizon of Area 3S were in undated context, but were interpreted as late Middle to early Late Archaic and could have been contemporaneous with the ca. 5100–5600 B.P. occupation of Area 2. Tools included two nutting stones and an expanding stemmed point. No activity areas were identified.

A Middle Archaic (ca. 6790 B.P.) assemblage was identified in Area 2. The only tool was an untyped side-notched point of Brush Creek chert. Debitage consisted primarily of Onondaga, Kanawha, and Brush Creek cherts. The debitage was tightly clustered, indicating a manufacturing locus, but no other activity areas were found.

Discussion

Although the number and variety of tools increased over time at 36AL480, the trend does not appear to result from technological innovation. With the exception of netsinkers, all of the tool types present in the Early Woodland period were also present in the Late and Transitional Archaic occupations. Thus, the increased variety is not the result of the introduction of new tool types. Rather, the increased range of tool types is likely a result of greater tool discard because of longer-term occupations in the Woodland period. Site function and intrasite patterning could also be factors, since few tools were found with the Early Woodland occupation in Area 3S, whereas the greatest number and variety of tools were found in the Early Woodland occupations in Area 2. Since netsinkers are found on Archaic sites elsewhere in the Middle Atlantic region (Miller et al. 2007a, 2007b), it is likely that their absence during the Late Archaic at 36AL480 is related to site function.

Although a total of three steatite fragments were found with the Early and Middle Woodland occupations in Area 3S and one was found in an Early Woodland feature in Area 2, most of the steatite was recovered from the early Transitional Archaic component in Area 2. The material was used for both utilitarian purposes (bowls) and, as indicated by the two steatite disks, for ornamentation. The major period of use at 36AL480 corresponds to its widespread use and trade in the Susquehanna River Valley and elsewhere in the eastern United States. However, steatite is relatively rare in the Upper Ohio River Valley.

Possible activity areas related to general maintenance were identified, including areas for food preparation, butchering, nut processing, bone working, and dry hideworking. Given

the high proportion of flake tools relative to form tools, microwear analysis was especially useful in identifying activity areas. The most common activity areas were related to food processing, including both game and nuts. None of the activity types correlated with specific temporal periods or with specific areas of the site.

The large numbers of cores and debitage indicates that tool manufacturing was an important activity at the site throughout its occupation. Bipolar reduction work areas were identified in the Early Woodland and Transitional Archaic periods. Debitage concentrations possibly representing chipping clusters were present in nearly all of the occupation zones, but in general artifacts related to lithic manufacturing were dispersed across the excavation areas and specific lithic manufacturing activity areas were not identified.

Regional Comparisons

Are the lithic technologies and tool assemblages identified at Site 36AL480 similar to other sites in the region of the same time period?

Lithic Material Procurement and Use

The relatively high degree of Kanawha chert use in the Area 2 Middle Archaic component is similar to material use patterns represented in Middle and Late Archaic artifacts at the Meadowcroft (36WH297) and Mungai Farm (36WH106) sites in the Cross Creek drainage to the south of 36AL480 (GAI Consultants 2003) (Figure 10.2). The Middle Archaic lithic use pattern is similar to the pattern observed in the Cross Creek drainage and reflects a relatively high mobility encompassing the region in what is now south-central West Virginia. No bifaces or early stage bifaces were found with the occupation, indicating that the early stages of reduction took place elsewhere and finished or near-finished tools were brought to the site. The absence of Kanawha chert discarded tools is likely the result of a short-term occupation. Notably, the main lithic reduction activity involved the reduction of local pebble cherts.

Late Archaic projectile points from several sites located to the north of the Cross Creek drainage do not reveal the use of Kanawha chert, whereas sites in the Cross Creek drainage to the south do contain the material. Diagnostic projectile points from the Connoquenessing Site (36BV292), located along Connoquenessing Creek, indicated a strong preference for locally available chert during the Late Archaic (Knepper and Petraglia 1996). Non-local materials were from northeastern and central Ohio; no Kanawha chert was present. Similar patterns of lithic material use for Brewerton, Otter Creek, and Steubenville points were found at the Dravo Site (36BV240), located on the Ohio River west of Leetsdale, and the St. Joe #1 Site (36BV230), located along Raccoon Creek near its confluence with the Ohio (GAI Consultants 2003). The differences in the use of non-local materials during the Late Archaic appear to be related to geographical distance from the sources.

The Late Archaic lithic use patterns in Areas 1 and 2 are more similar to the Raccoon and Connoquenssing Creek drainages in the north, as compared to the Cross Creek drainage

sites in the south. The Late Archaic assemblages have a high proportion of locally available cherts, but also include non-local cherts, reflecting either exchange or direct procurement from regions to the east, west, and south.

Broadspears are rare at sites in the Upper Ohio River Valley, where stemmed and side-notched points were used during the Transitional Archaic and are indistinguishable from those of earlier and later periods. The few Transitional Archaic components that have been excavated are in multi-component contexts, including Meadowcroft Rockshelter, the Connoquenessing Site, and Cross Creek Village. The primary occupation of Scenery Hill 1 is Transitional Archaic, but a Late Archaic occupation is also present. Other than 36AL480, there are few data available on lithic material preferences during the Transitional Archaic.

Proportions of Vanport chert at seven Early/Middle Woodland habitation sites in the Youghiogheny River drainage ranged from 1 to 22 percent (Grantz 1986). Upper Mercer chert, categorized by Grantz as an exotic material, ranged from <1 to 7 percent. Jasper comprised 5 percent of the small assemblage from the Crawford-Grist Site #2 (36FA262), but was largely absent from other sites. Grantz concluded that the Early/Middle Woodland populations of the region focused primarily on local lithic materials. Local materials also predominated at the Thorpe Site (George 1998). The inhabitants of Dravo #1, located along the Ohio River near the Ohio border, utilized local gravel sources along with smaller amounts of Vanport chert. This pattern is similar to the one found at 36AL480, although rhyolite and outcrop sources of Upper Mercer chert contributed to other non-local materials utilized at Leetsdale. In contrast, the high proportion of exotic materials such as Vanport and Upper Mercer in Early Woodland points at Mungai Farm (45.2 and 35.5 percent, respectively) and Avella Mound (50 and 25 percent, respectively) suggest a greater Adena influence at those sites. Middle Woodland points at the Connoquenessing Site indicated more extensive use of exotic materials, primarily Flint Ridge (Vanport). Kanawha chert had relatively high proportions at Meadowcroft and other sites in the Cross Creek drainage (GAI Consultants 2003).

The Early Woodland lithic material use pattern at Site 36AL480 is more similar to that of Dravo #1, Crawford Grist #2, Thorpe, and Meadowcroft in the focus on local materials, but including small proportions of Vanport and Upper Mercer cherts from central Ohio. This pattern indicates a lesser influence of the Adena culture at 36AL480 as compared with Mungai Farm and Avella Mound. It is consistent with the small number of Adena points and the lack of any other Adena-related artifacts at 36AL480. The differences between the two groups of sites may be related to site function. Mungai Farm is a short-term camp that may have been occupied by groups traveling to or from a ceremonial site (GAI Consultants 2003:84). Avella Mound, a Middle Woodland mortuary site, was also a short-term occupation and may have had the same function.

Steatite sources are located throughout the eastern Piedmont and, likely because of source distance, the material is rarely found in the Upper Ohio River Valley. In addition to the three sites included in the steatite sourcing study, four steatite sherds and a point assigned to the Susquehanna Cluster were found at Site 36SO220 in the Cassalman River drainage (Coppock et al. 1998). Mayer-Oakes (1955) reported two sites with steatite: Site 36FO1, a multicomponent site in Forest County, Pennsylvania, with eight steatite sherds; and an

unnamed site in Trumbull County, Ohio, with fragments of a steatite vessel. None of these sites report steatite disks or artifacts other than vessel sherds. The evidence also indicates that occupants of the Upper Ohio Valley during this period did not participate heavily in steatite trade networks such as those in the southern Mississippi region or in the Susquehanna River Valley. The reason for this is not clear.

Lithic Manufacturing

Little comparative data on lithic reduction stages from sites in the region are available, since few single-component or stratified sites have been excavated. In addition, differences in analytic techniques make comparisons problematic. Unfortunately, as noted above, there were significant differences in the data among the three areas of Site 36AL480 that likely result from differences in analytic technique.

Data on lithic reduction stages were available for only a few sites in the region. A sample of debitage from Cross Creek Village (36WH293), a Late Archaic/Early Woodland base camp, contained relatively high proportions of primary decortication flakes (16.3 percent) and chunks/chips (11.4 percent) (Fitzgibbons 1982). Secondary flakes comprised 65.0 percent of the debitage and tertiary flakes comprised 7.2 percent. Considering primary and tertiary flakes alone, the former comprises 69.4 percent and the latter 30.6 percent. The analysis indicated that the base camp was also a major workshop related to a nearby outcrop of Monongahela chert. Cores and bifaces were common, as were utilized and retouched flakes, which together comprised 23 percent of the tools. In contrast, the nearby Meadowcroft Rockshelter produced few primary decortication flakes from assemblages throughout its occupation (Fitzgibbons 1982). Data from the Thorpe Site, an Early Woodland quarry-related camp, were available to compare the proportion of biface thinning flakes (76.6 percent) to decortication flakes (23.4 percent) (George 1998). The Thorpe Site is situated at a source of Uniontown chert, which comprised 93 percent of the lithic material. Thus, initial reduction of the material was likely a major component of the lithic manufacturing activities at the site.

The Area 1 and Area 2 assemblages produced greater proportions of biface thinning flakes relative to early reduction flakes, whereas the reverse was true for Area 3S (see Table 10.22). The proportions of early reduction and tertiary flakes in Area 2 were similar to those in the assemblages at the Thorpe Site, which was associated with a Uniontown chert source. The Area 3S assemblage is similar to that of Cross Creek village, a major lithic reduction workshop located near a Monongahela chert outcrop. The high proportions of biface thinning flakes in Area 1 are not found at the two sites, but may be more similar to Meadowcroft. Overall, however, the data on lithic reduction stages from sites in the region do not provide any clear patterns.

The assemblages in all three areas of Site 36AL480 had large proportions of expedient tools from local deposits. Similarly, utilized flakes were by far the most abundant tool type at the Dravo #1 Site, where, as at 36AL480, nearby glacial till cherts were the predominant lithic material (Davis 1988). In contrast, utilized and retouched flakes were not listed in the Connoquenessing Site assemblage, which produced more bifaces than cores (core:biface ratio=0.6:1; Knepper and Petraglia 1996). These results indicate a focus on

formal tool production rather than expedient tool use. Outwash gravels were a locally available lithic source for the occupants of this site, but non-local cherts from sources in Ohio and southwestern Pennsylvania were also utilized. The Mayview Bend Site, located on Chartiers Creek near a Uniontown chert source, produced a high core:biface ratio (3.3:1). Utilized and retouched flakes were abundant at Cross Creek Village, although bifaces outnumbered cores (core:biface ratio=0.8:1). The site was interpreted as a reductions site for local Monongahela chert. Overall, the data suggest that expedient technologies predominated at sites where primary or secondary lithic sources were adjacent to the site.

Bipolar technology was identified at all three areas and throughout the occupation of 36AL480. Bipolar reduction is considered an efficacious means of reducing small pebbles. At the Hickory Bluff Site in Delaware, where the primary lithic source was Pleistocene gravels, 200 bipolar cores were found (Petraglia et al. 2002), predominantly of gravel materials and smaller overall than the multidirectional cores. At the Connoquenessing Site, all bipolar cores were of local pebble sources (Knepper and Petraglia 1996). Bipolar cores are not listed at the Dravo #1 Site, despite the heavy use of local till cherts. The presence of bipolar technology at 36AL480 is likely related to the use of small pebbles for manufacturing tools.

Evidence of blade technology was identified in the Area 1 and Area 2 components from the Late Archaic to Early Woodland. Evidence has also been found at other sites in the region. Seven blades, primarily prismatic with unprepared platforms, were found at Cross Creek Village in association with a Late Archaic Steubenville point (GAI Consultants 2003). Twenty-four prismatic blades of exotic lithic material were found at the Late Archaic to Early Woodland Dravo #1 Site. Together the data indicate that blade technology was in use prior to, as well as during, the Adena cultural period. Although the Dravo #1 Site points included Adena culture point types such as Cresap, Robbins, and Adena, the Cross Creek Village and Site 36AL480 assemblages did not.

Thermal alteration was used at the site to improve fracture characteristics. It was used primarily for Brush Creek and Upper Mercer cherts and during the Late Archaic to Early Woodland periods. Proportions of heat treated debitage ranged from 0 to 28 percent, with the highest proportions found in Area 2. Investigations at an Upper Mercer quarry/workshop (33PE839) in Ohio revealed evidence of thermal alteration both for Upper Mercer chert varieties and for Vanport chert (Miller and Formica 2010). Proportions of heat treated debitage were higher for Upper Mercer chert than for Vanport chert. Upper Mercer proportions varied across the site from a low of 16.9 percent up to 36.4 percent. Vanport proportions ranged from 4.4 to 36 percent, with the highest proportions from the Vanport Nethers variety. By comparison, the Area 2 data indicate a proportion of heat treatment at 25 percent, second only to jasper at 28 percent. The Upper Mercer proportion is similar to values at 33PE839 and suggests that this material benefitted from the effects of thermal alteration. Brush Creek chert values were also high at 36AL480, indicating that heat treatment was effective for this material. Few data are available from other sites in the region. Dravo #1 had evidence of heat treatment on six projectile points and over 300 other artifacts, mostly tertiary flakes (77.2 percent). The treatment was identified primarily on "lighter-colored till cherts," possibly referring to Brush Creek.

Tool Kits and Activity Areas

Single-component Late and Transitional Archaic sites in the Upper Ohio River Valley are relatively rare, so data on period-specific tool kits and activity areas for comparison are limited. GAI Consultants (2003) note an increased use of cobble tools, such as manos, metates, and pitted cobbles in the Late Archaic period for food processing. The increased use of cobble tools correlates with the increased use of storage pits and food processing features, such as roasting pits and earth ovens. These feature types, when found with cobble processing tools, suggest extended stays at one location (GAI Consultants 2003).

Tool types associated with the Late Archaic occupations at 36AL480 included points, knives, flake tools, a drill, a graver, a chopper, and a spokeshave. Tool types associated with the Transitional Archaic occupations included points, drills, scrapers, burins, knives, a denticulate, and pitted and nutting stones. These tools represent a variety of activities, including hunting, butchering, hide working, wood working, and nut and/or seed processing. These assemblages represent somewhat broader tool assemblages than were found at upland sites such as Scenery Hill 1. The Scenery Hill 1 data recovery produced drills, a uniface, a multifunction tool, and 36 notched flakes; although interpreted as a base camp, it appeared to have a more limited range of activities than at 36AL480 (East et al. 1996). For example, tools for seed and nut processing and butchering were not found. Villa St. Joseph, Locus 5 (36BV85)—located on the Ohio River terrace and interpreted as a short-term camp—produced bifaces, cores, and points, but no other tools, also indicating a very limited range of activities (Baker 1996). A hearth and two indeterminate pits were also found, but no features such as roasting pits or FCR scatters that would suggest a long term occupation. A greater variety of tool types could result from longer occupations, as well as from a greater variety of activities.

Early Woodland tools at the Thorpe Site included drills, bifacial knives, scrapers, spokeshaves, flake tools, and a celt. The Early Woodland Crawford-Grist Site produced scrapers, flake tools, and a celt. Mayview Bend tools included unifaces, an axe, a chopper, a pitted stone, and a hammerstone (Kellogg et al. 1998). Crawford-Grist #2 produced scrapers, flake tools, and a celt. Overall, the assemblages from other Early Woodland sites in the region were similar to those of the Early Woodland components at Site 36AL480. Notable differences include the absence of celts at Site 36AL480 and the absence of net sinkers at other sites in the region. These differences are likely related to differences in site function or to differences in the sampled portions of the sites. These sites differ from the Dravo #1 Site, which produced Adena points, prismatic blades, and cache blades, along with scrapers, drills, adzes, and celts. The Ohioview Site (36BV9), an Adena component located on the Ohio River near Dravo#1, produced a birdstone, an Adena tablet, gorgets, and a cache of bifaces, clearly indicating interaction with the Early Woodland Adena culture to the west (Alam 1961; GAI Consultants 2003).

SUBSISTENCE AND SEASONALITY

Flotation of samples from features recovered plant and other food remains, providing information on the diet of the prehistoric site occupants, as well as seasonality of site

occupation. Artifacts related to food procurement and processing, such as net weights and nutting stones, also provide information on subsistence. Subsistence activities are interpreted within the environmental context discussed above. Recovery and analysis of subsistence remains permitted comparisons with other sites in the Appalachian Plateau province and Upper Ohio Valley.

What types of plants, nuts, and berries were identified? What floral remains were possible food sources? During what season are these floral remains collected for food? Is there evidence of cultigens?

Nutshell was the most common inclusion in features from all areas of the site and during all periods. Walnut species (black walnut and butternut) predominated in all periods in Area 3S and was also the dominant material in Area 1 features. Hickory, acorn, and hazelnut were also identified in Area 3S, but only one acorn shell and no hazelnut remains were found in Area 1. In Area 2, hickory and walnut predominated and both were present in Middle Archaic through Early Woodland features. Hickory was found in 42 features, as opposed to 18 features that contained walnut. Acorn was found in five Early Woodland features, but no hazelnut was identified in Area 2. Nutshell may be abundant in features because it was used as fuel, either gathered from the ground or collected after processing for the nutmeat.

Walnut and hickory were both identified in pollen assemblages from the Casting Basin. Hickory was a dominant species in the pollen assemblage from as early as 7080 B.P. Walnut prefers moist floodplains and was present as a minor species in the overstory surrounding the site. Notably, hickory is less costly in time and energy to process, since it can be boiled to separate the meat from the shell, whereas walnut meat does not separate well from the shell by boiling (Talalay et al. 1984). However, walnut must have been a preferred resource, given that its representation was low in the pollen profile but high in the feature fills. Oak and beech were also predominant species in the surrounding forest, but based on flotation results do not appear to have been utilized as food resources. Acorn requires relatively high time and energy inputs for shelling, grinding, leaching, and baking (Petruso and Wickens 1984), but its absence in the archaeological record may be due to the fact that acorn shell is relatively thin and more likely than other shell to have been completely consumed in the fires.

Nut resources ripen in the fall and, due to competition from animals, would only be available for gathering during a short period. However, nuts can also be stored and were likely used throughout the winter months.

No seeds of edible berries or fruits were found in Area 3S. One grape seed was found in Area 1, Feature 311, which dated to ca. 3600 B.P. One blackberry/raspberry seed was found in an undated Early Woodland feature, Feature 420, in Area 2. Grapes ripen in the fall, whereas blackberry/raspberry ripens in the summer. Fruits and berries are almost certainly underrepresented in the archaeological record. Seeds and fruit pits were likely not discarded into hearths and, when they were, they were likely completely consumed by the fire.

No evidence of Mesoamerican cultigens was found during excavations at Leetsdale. However, two features in Area 3S dated to ca. 1860 B.P. produced chenopodium and knotweed seeds in numbers large enough to suggest their possible use as a food source. Although the seeds do not appear to represent domesticated species, they may have been cultivated. None of the other components at the site produced charred seeds in significant quantities.

What wood species were used for firewood?

Representation of species in the wood charcoal of hearths is related both to the presence and abundance of the species in the vicinity of the site and the species-specific rate at which dead limbs are shed. Elm, hickory, and walnut were the most common species used for firewood in Area 1, with maple, oak, sycamore, and pine also well represented. Ash, black locust, and willow were each present in a single feature. Hickory, walnut, and maple charcoal predominated in Area 2 features, along with smaller amounts of Kentucky coffee tree, sycamore, elm, beech, hornbeam, conifers, and the rose family, which includes black cherry, plum, crab apple, and shadbush. Hickory, walnut, and honey locust were the dominant species in the Area 3S charcoal, along with smaller amounts of maple, ash, oak, elm, beech, hop hornbeam, chestnut, and sycamore. The wood charcoal exhibited no clear changes in composition over time.

Johannson (2003) interprets the Area 3S data as indicating the firewood was gathered primarily within the river bottom (see Chapter 8, Appendix P). Johannson also notes the absence of oak and the low amount of beech, both of which were abundant in the overstory in the vicinity of the site. Oak and beech were also poorly represented in Areas 1 and 2. It is unlikely that these species were selected against, however. Oak is an excellent firewood and was found in all but one context at the Meadowcroft Rockshelter (Cushman 1984). Beech was also found at the rockshelter, although less frequently. Pine, walnut, and hemlock were also abundant at Meadowcroft.

What animal species were present? What animals were consumed? What is the habitat for these faunal resources? During what season are these animals easiest to procure?

No identifiable faunal remains were found in Areas 1 or 2. Faunal remains were found in the two Area 3S roasting pits (Features 238 and 243) that dated to ca. 1860 B.P., in a feature nearby (Feature 159), and in the soil near the three features. Faunal remains were also in a feature (Feature 165) near the ca. 2860 B.P. roasting pit and in the soil outside features in the northern portion of the excavation block. Identifiable species included deer, found in Feature 238, and rabbit from the soil near the ca. 1860 B.P. roasting pits. An unburned large mammal bone fragment was found in the Transitional Archaic component. No indication of the seasonality of site occupation could be obtained from the faunal evidence, since deer and mammals were available during all seasons in the forested habitat that surrounded the site.

No shell was recovered from prehistoric components at the site, despite the proximity of the Ohio River.

What specialized food acquisition and/or processing tool types were recovered? How were foods processed or prepared?

The most abundant tools for food acquisition at the site were projectile points, which were found in all contexts. Microwear analysis of tools from Area 3S indicates that they were used as knives, but none were interpreted as having been used for butchering. In contrast, microwear analysis of Area 1 tools indicated that butchery and meat and hideworking had been a major activity at the site during all of the major occupations. Most of the Area 2 tools with microwear evidence of butchering were found with the early Late Archaic component, but butchering tools were also found with the ca. 4975 Late Archaic and early Transitional Archaic occupations. Residue analysis of ceramic sherds from an Early Woodland context in Area 2 revealed blood residue from deer. These findings confirm expectations that hunting was an important part of the subsistence strategy throughout the occupation of the site.

No groundstone tools related to food processing were found in Area 1. Nutting stones were found with all occupations in Areas 3S and in the early Transitional Archaic component of Area 2, consistent with the presence of nutshell in features.

Netsinkers were found in the late Transitional Archaic and Woodland components in Areas 2 and 3S, but none were recovered in Area 1. This finding may result from the fact that Area 1 was the most distant from the river. Area 1 was located along the Back Channel, which was abandoned during most of the Area 1 occupation.

Little evidence was available on how foods were processed and prepared. Deer blood residue was found on ceramic sherds but, given the small size of the sherds, it is unclear whether the vessels were actually used for cooking deer; i.e., boiling or stewing, or as containers for deer meat before or after it had been roasted. The nutting stones from Area 3S indicate that nuts were crushed, but the nutmeat could have been picked by hand or boiled to separate the shell.

How important are riverine versus non-riverine resources in the diet? Is there evidence of site specialization or abundance of certain types of subsistence resources?

The archaeological record generally does not provide good evidence for the relative importance of food resource types in the prehistoric diet. To some extent, this is a result of the different ways that dietary indicators enter the archaeological record. Nutshell and bones may be deliberately tossed into hearths, for example, whereas seeds enter only by chance. Variable preservation is also a factor. Fish bones are generally not preserved on archaeological sites, for example, while shell is often well-preserved. Likewise, nutshell, both because of its composition and its use as a fuel, is likely over-represented in the archaeological record. At 36AL480, nutshell and nutting stones were common, strongly suggesting the nuts were an important part of the diet. Despite the limited number of faunal remains, points and butchering tools indicate that hunting was also important. The only evidence of fishing generally found on sites predating the Late Woodland is netsinkers. Although few were found at 36AL480 and no shell was identified, it is likely that riverine resources were part of the subsistence during all periods of occupation. Data from Area 3S

indicate that native seeds were added to the diet ca. 1860 B.P. Thus, the diet appears to have been broad in spectrum, with no evidence of dietary specialization during any of the occupations at the site.

During what season(s) was each living surface occupied? Are there storage pits or other features present, which would indicate longer periods of occupation?

Few seasonal indicators were identified at the site. Nuts and acorns are gathered during the fall, but because they are easily stored, may have been consumed during the winter or spring. The grape and pokeberry seeds are fall season indicators, whereas raspberry/blackberry ripens in the summer. The native seeds from the ca. 1860 B.P. features in Area 3S suggest an occupation between June and October, although, like nutshell, the seeds could have been stored.

None of the Area 1 or Area 2 features were interpreted as storage pits. However, the two features in Area 1 and the 14 features in Area 2 interpreted as hearth refuse pits could have been used for storage and filled with hearth refuse after they were empty. The two Area 1 pits were in an Early Woodland (Forest Notched) component. The feature type was associated with all periods of occupation in Area 2, except the Middle Archaic. Six possible storage pits were found in Area 3S—four of the possible storage features were associated with the ca. 1860 B.P. feature cluster, one with the Early Woodland occupation, and one with the Transitional Archaic occupation. The Area 3S findings suggest increasingly longer-term occupations beginning in the Transitional Archaic, which is consistent with the higher artifact and feature densities during that time. The Area 1 results are similar, although based on more limited evidence. The Area 2 results would refute the proposition if the hearth refuse pits were actually used for storage.

Is there variability in plant and animal remains between features that may add to our inferences regarding activity areas? What does archaeological evidence suggest as to how and where food processing or preparation was performed?

With the exception of nutshell, botanical remains were too few to suggest food processing activity areas. Nutshell in Area 1 features was in small amounts relative to Areas 2 and 3S. The highest amount (n=67) in Area 1 came from Feature 335, an Early Woodland roasting pit.

Features with high amounts (n >200) of nutshell in Area 2 included three hearths associated with the ca. 3200 B.P. occupation. Two contained high amounts of undifferentiated hickory/walnut nutshell and one contained high amounts of walnut. High amounts of hickory nutshell were found in a roasting pit dating to ca. 2860 B.P.

Areas 3S yielded three features as possible nut processing or roasting features, all of which were in the AB horizon. Two of the three features were radiocarbon dated to ca. 1860 B.P. and all three were in close spatial proximity in the southeastern portion of the excavation block. Nutshell in the features was primarily walnut.

If these features were used for roasting of nuts within them, they can be considered the center of activity areas for nut processing. More likely, nuts were processed by other

means and the nutshell was used as fuel. Ethnographic evidence indicates a variety of methods for preparing hickory, including crushing and boiling to separate nutshell from meat or crushing nuts in water to make a milk-like broth or butter (Swanton 1946; Talalay et al. 1984). Walnut was not as suitable for these methods, since boiling created a bitter water that affected the taste. The only treatment mentioned that involves nuts within a hearth feature is drying on reeds over a fire, but this process would not result in substantial amounts of charred nutshell in the feature. The features may have been used for roasting meat or bread. Ethnographic accounts describe heating hearth stones in a fire, laying loaves of corn bread on the stone, and covering it with reeds or a ceramic dish (Swanton 1946).

The features were all associated with the Transitional Archaic or later. The high amounts of processed nuts may suggest larger group sizes during these periods compared to the Middle and Late Archaic.

Tools and feature types provided additional information on the spatial patterning of food processing activities. In Area 1, food processing loci were identified in the ca. 3700 and ca. 3910 B.P. occupations based on feature clusters, each with a roasting pit, hearth, and hearth refuse. The ca. 3700 B.P. occupation had a point with microwear indicating use for butchering and fresh hide scraping. In the Area 2 ca. 2860 B.P. occupation, a scraper and a pitted stone were associated with a roasting pit, suggesting the processing of nuts or other food. However, only six pieces of nutshell (hickory) were found in the feature. Two possible activity areas were found in the ca. 3440 B.P. occupation of Area 2. One consisted of hearths and hearth refuse pits with steatite bowl fragments, possibly indicating food processing. The southern portion of Area 2 excavation block had hearths and tools suggesting butchering and nut processing. No activity areas related to food processing were found in Area 3S.

Is there any evidence of diachronic change in subsistence practices?

Overall, the archaeological evidence at 36AL480 reveals a broad-spectrum diet based on hunting, gathering, and fishing that continued throughout the site occupation. The types of tools and features suggest little change in procurement and processing, although the presence of roasting pits after ca. 3910 B.P. suggests more intensive food processing, possibly for larger groups.

Walnut appears to have been the preferred nut resource, followed by hickory. Where acorn does appear, it is in Transitional Archaic and Early Woodland contexts, which could indicate it was added to the diet relatively late in the hunter-gatherer era. Acorn has relatively high processing costs and may not have been used under conditions of low population density when other nut resources would have been sufficient. Alternatively, the pattern could simple represent differential preservation. The preference for walnut is somewhat difficult to explain, given its higher procurement and processing costs. But the preference for walnut is found at other sites in the region, such as the Mayview Depot and East Steubenville sites, and at 36AL480 extends throughout the occupation of the site.

The only other temporal change in evidence was the addition of chenopodium and knotweed (both native seeds) to the diet ca. 1860 B.P. as represented in Area 3S. The seeds

did not show evidence of domestication, but the plants could have been tended and harvested. The addition of native seeds to the diet was likely a result of increasing population density that required an increase in the number of calories procured from within a given territory.

How does the evidence compare with other sites in the region?

The Meadowcroft Rockshelter provides the longest record of plant food use in the Upper Ohio River drainage (Cushman 1984). Many of the plant food remains are non-carbonized, but were found in sealed feature contexts indicating cultural origin. Walnut predominates throughout the Meadowcroft record and hickory was also present. Acorn was present in contexts post-dating 7165 B.C. With the exception of the Meadowcroft Rockshelter, evidence cited for the use of nuts in the Middle Archaic generally focuses on an apparent increase in ground and pecked stone tools (see Chapter 3). Thus, the Middle Archaic features in Area 2, which contained substantial amounts of hickory and walnut nutshell, represent a significant finding in terms of Middle Archaic subsistence.

As at Leetsdale, walnut was the most common nutshell at a number of other sites in the Upper Ohio Valley. At Mayview Depot (Early through Late Woodland) and Mayview Bend (mostly Early Woodland), walnut was the most common nutshell, followed by smaller amounts of hickory nutshell (Kellogg et al. 1998). Black walnut was the most common nutshell in Late Archaic contexts at the East Steubenville Site (46BR31); hickory and one acorn fragment comprised the rest of the nut assemblage (Woodward McKnight 2002). Scenery Hill 1, a Terminal Archaic site occupied between ca. 2200 and 1775 B.C., differed in producing a nut assemblage that was predominantly hickory, with only a small amount of walnut (East et al. 1996).

Seeds of fruits and berries occur in small amounts at other regional sites, although in somewhat greater diversity than at Site 36AL480. At Meadowcroft Rockshelter, fruit seeds increased in number and diversity through time. Hackberry seeds were abundant throughout the record, but decreased over time. *Prunus sp.* (wild cherry and wild plum), blueberry, and blackberry/raspberry were common after 6060 B.C. A small number of wild cherry, sumac, blackberry/raspberry, and grape seeds were found in Late Archaic contexts at the East Steubenville Site (Woodward McKnight 2002). At both Mayview Depot and Mayview Bend, various fruit remains were recovered in small numbers (Kellogg et al. 1998).

Starchy native seed species—such as little barley, chenopodium, and knotweed—were in general use in the Midwest by the Late Archaic period and are termed the Eastern Agricultural Complex (Fowler 1971; Streuver and Vickery 1973; Yarnell 1993). The strongest argument for the cultivation of native seeds is their association in features with clearly cultivated food resources, such as Mesoamerican domesticates, and in their occurrence outside their native ranges. Also cited is an increase in seed size over time, as seen in archaeological samples of species such as chenopod, sunflower, and sumpweed, indicating selection of larger seeds for replanting (Asch and Asch 1977, 1978; Yarnell 1978). Evidence for the cultivation and domestication of these plants is also based on studies of morphological attributes such as seed coat thickness and fruit shape (Fritz and Smith 1988; Smith 1992).

Evidence of the use of native seed species has been found in a number of Late Woodland and Late Prehistoric contexts in southwestern Pennsylvania (King 1999). King reports only one instance of earlier native seed use, at the Middle Woodland Dunsfort Site. Here, 60 percent of the seeds were of the Eastern Agricultural Complex and included erect knotweed, marshelder, goosefoot, and maygrass. The numbers of starchy seeds found at the Meadowcroft Rockshelter is too small to suggest their use as a food resource (Cushman 1984). Mayview Depot and Mayview Bend produced various starchy seeds, but in very small numbers (Kellogg et al. 1998). No carbonized starchy seeds were found at Crawford Grist #2 (Grantz 1986).

Evidence of Late and Transitional Archaic use of native seeds comes both from direct evidence and from residue analysis of steatite vessels at several sites in the Susquehanna River Valley. Hordeum/Elymus-type starch residues in the steatite artifacts from Calver Island (36DA89) and from 36PE16, both in the Susquehanna River Valley, suggest that little barley and/or other grass seeds were cooked in steatite vessels. Chenopodium and grass seed proteins were found on steatite fragments from 36PE60, located along the Susquehanna River. In addition, 10 chenopodium seeds were found in a Calver Island feature dated to ca. 3900 BP. The seeds had morphological characteristics suggesting the possibility that they were cultivated. Together the evidence suggests that native seed species were in use in the Susquehanna River Valley by the Transitional Archaic. Rather than grinding and baking into breads, it appears that the seeds were cooked in steatite vessels.

Johannson (2003) argues that the Upper Ohio Valley data suggest the beginnings of plant husbandry in the region during the Early Woodland. Site 48AL480 shows no evidence of the use of starchy seeds until ca. 1860 B.P., by which time agriculture was well established in the Midwest. This could indicate that the Early Woodland occupants of Site 36AL480 had sufficient nuts and other wild plant food resources on the fertile river terrace and did not need to make use of seeds. However, since seeds are small and easily consumed by fire, their absence in Early Woodland features may result from lack of preservation.

No evidence of the use of Mesoamerican cultigens was recovered at Site 36AL480, although maize is present at Meadowcroft Rockshelter by ca. 2300 B.P. and cucurbit by ca. 2800–3065 B.P. Six squash rind fragments were found at Mayview Bend in a feature dating to 2400–2000 B.P. (Kellogg et al. 1998) and a maize kernel was found at the Thorpe Site (King 1998).

Overall, the data from 36AL480 are consistent with regional data indicating a focus on wild plant foods from the Middle Archaic to Early Woodland periods. Walnut appears to have been the preferred nut species at many sites in the region throughout this period, although hickory is also common. The diet in this period and throughout the region consists of a broad range of plant food resources, including a variety of nuts, fruits, and berries. The data suggest a relatively stable subsistence strategy until ca. 2000 B.P., when evidence of the use of native seeds appears. The subsistence record differs markedly from regions to the west, where the use of starchy seeds began in the Late Archaic and where agriculture was firmly established by the Middle Woodland. The use of starchy seeds and squash has also been documented during the Late and Transitional Archaic in the Susquehanna River Valley. However, there is no information that would explain a substantive regional difference in the

timing of subsistence change. More likely, the apparent regional differences result from the limited amount of data from the Upper Ohio River Valley.

SITE SETTLEMENT PATTERN

Research issues related to settlement patterns include questions related to both intrasite and intersite patterns. Intrasite patterning refers to internal site arrangement, whereas intersite patterning deals with the relationship among sites, both in terms of distribution on the landscape and the functional relationships among sites. Determining the site function of each of the components represented at 36AL480 is important for understanding settlement systems and the land use strategies from which they evolve. As established in the data recovery plan, large excavation blocks were excavated in order to examine the spatial patterning of features, artifacts, activity areas, and other data that may relate to site function.

Intrasite Patterns/Community Studies

There is a variety of data that contributes to understanding intrasite patterning and site function. Intensity and duration of occupations are useful in identification of site type. The duration of occupation is reflected in the presence or absence of storage pits and houses or other shelter. Artifacts, features, and activity areas are used to identify site function. Site structure studies focus on identifying the relationship of features, activity areas, and occupations in order to understand the social structure that produced the intrasite patterns. Site structure can be examined by identifying occupation size, types of features and activity areas, and spatial patterning or relationships of features and activity areas within the occupation horizon. This information can be used to make inferences concerning group size. Estimating population size has been accomplished using various methods, including: average floor space per person, relationships between settlement size and population size, and number of fire pits or hearths per occupation. It is critical to control for chronology in these studies. Also, as noted above, the accuracy of activity area definition is affected by post-depositional processes that move artifacts from their primary depositional contexts.

Intrasite Patterning and Site Function

Research issues related to the intrasite patterning and the interpretation of site function include:

What is the site type? What is the size of the occupation surface? What types of features and activity areas are represented? What is the spatial patterning or relationship of features and activity areas? Is there evidence of structures or shelters? Is there evidence of storage features?

General Considerations

A number of research postulates related to intrasite patterning have been developed inductively from ethnoarchaeological research. Ethnographic studies suggest that camps have household, communal, and special activity areas (O'Connell et al. 1991). Since activities often focus on hearths, the number of hearth-associated assemblages, if contemporaneous, could indicate the number of family groups occupying a site. The organization of activities may provide some information on social organization if, for example, single-task activity areas are assumed to represent task groups and multi-task areas are assumed to represent household groups.

O'Connell (1987) suggests that there should be different patterns of activities between foragers and collectors, as defined by Binford (1980). Camps of foragers, who move between resource locations relatively frequently, should be organizationally undifferentiated and seasonally redundant. In contrast, both characteristics should be highly differentiated in collectors, who establish long-term base camps and use satellite camps for logistical forays. He notes that identifying these site characteristics requires large-scale exposures.

O'Connell (1987) lists the archaeological assumptions associated with the interpretation of intrasite patterning: that activities are spatially segregated; that activities typically produce characteristic co-variant sets of artifacts; and that artifacts and other refuse associated with an activity are deposited at or very near their place of use. As stated by O'Connell et al. (1991), it must be assumed that activities are differentially distributed within a site and that there is a consistent quantitative relationship between performance of the activity and deposition of artifacts. O'Connell (1987) cites challenges to these assumptions based on ethnographic observations. His study of the Alyawara found that some activities are associated with hearths, roasting pits, and structures, but that other activities were more likely to be relocated based on weather, visitors, and other events.

With these concerns in mind, the data from the major components at the site—i.e., those with sufficient numbers of artifacts, features, and activity areas for pattern analysis—were examined to assess intrasite patterning. The spatial relationships of features and activity areas were considered, along with the distribution of tools and ceramics. The post-depositional factors that affect artifact distributions must be considered when evaluating the results of the analysis.

Early Woodland

Two Early Woodland components with relatively high artifact and feature densities were found at Site 36AL480, one in Area 2 dating to ca. 2860 B.P. and one in Area 3S dating to ca. 1860 B.P. Other Early Woodland components produced fewer features and tools, and no evidence of activity areas.

Four tool clusters and two Early Woodland feature clusters were found in the ca. 2860 B.P. component in Area 2 (Figure 10.3). Tool Cluster 1 included a scraper, a chopper, points, and flake tools, all of which were in close proximity to one of the four roasting pits and associated hearth refuse. This location may represent a food processing area. Tool Clusters 2 and 3 were found near Feature Cluster 2, which included a roasting pit and areas

of hearth refuse and reddened soils. The tools were primarily flake tools and the types of activities they represented are unknown. Although ceramic densities were very low, the highest densities were found in this area. Tool Cluster 4 was found immediately to the east of Feature Cluster 3, which also included a roasting pit. The tools consisted of points and flake tools, and the activities represented are unknown. Thus, three major activity areas are present, represented by three roasting pits and associated features and tools. The fourth roasting pit was found outside the block during mechanical excavation and was likely also a focus of Early Woodland activities.

Additional tools and features were scattered across the excavated area. None of the features could be clearly identified as storage facilities. Several postmolds were found, but no structure patterns were identified.

The AB horizon in Area 3S produced two clusters of artifacts and features that did not appear to be functionally distinct (Figures 10.4 and 10.5). The artifacts and features indicated general activity sets that could represent two contemporary social units, such as two nuclear families. Alternatively, the clusters could represent two separate visits by a small group. Two features in the southern cluster dated to ca. 1860 B.P. and were interpreted as nut processing facilities. Structurally, the features were similar to the features defined as roasting pits in Areas 1 and 2. Two pitted stones were found nearby and supported the interpretation of this area as a nut processing area. Four clusters of bipolar artifacts were found and likely represent manufacturing loci. Bipolar artifact distributions correlated with the distribution of groundstone artifacts, including anvils and nutting stones. No evidence of storage features was found with either cluster.

Transitional Archaic

In Area 1, only the ca. 3580 B.P. Transitional Archaic occupation revealed distinct patterning (Figure 10.6). Features in the northern excavation block (Block 3) consisted of a roasting pit at the center of four hearths. Hearth refuse and FCR scatters were present in the circular area surrounding the roasting pit. Small clusters of FCR were associated with the hearth features. Hide- and antler-working tools were found in association with one of the hearths, representing an activity area for processing animal byproducts. The pattern could represent four family groups sharing a roasting facility. Five hearths were clustered in the northeast corner of the southern block (Block 2), but their relationship to the Block 3 features is unclear. They could represent sequential reuse of hearths by a fifth family group.

The excavation of the ca. 3440 B.P. occupation in Area 2 revealed two major activity areas that may have been part of a single occupation (Figure 10.7). The area in the northwestern portion of the block (Cluster 1) revealed a cluster of surface and pit hearths and hearth refuse pits. Nutshell was present, but only in small amounts. Assuming artifacts in the vicinity of features were discarded in the general location of their use, this area likely represented food processing that involved boiling foods, possibly meat or greens, in steatite vessels. The southern portion of the Area 2 excavations revealed a line of surface hearths and a pit hearth with associated tools (Cluster 2) and a tool cluster (Cluster 3). Nutshell was found in association with surface hearths and the hearth refuse pit. This area appears to have been used for butchering, as well as for processing of nuts. A chipping cluster of Brush

Creek chert associated with tool Cluster 2 represents an area of tool manufacturing. Both clusters appear to have been the focus of food processing, although involving different types of activities. Since the two clusters do not represent similar activities, they likely do not represent separate social units.

The only activity area identified in the Area 3S Terminal Archaic was represented by a nut processing feature. The Terminal Archaic component also had evidence of lithic manufacturing clusters, with bipolar manufacturing focused in the northern half of the block, along with a small concentration of groundstone artifacts. No evidence of storage features was found.

Late Archaic

Tools and features were tightly clustered in the ca. 4975 B.P. occupation in Area 2 (Figure 10.8). Six small tool clusters were identified. A graver and a flake tool used for cutting bone were found in the vicinity of a surface hearth (Feature 462), suggesting that this may have been a bone-working locus (Cluster 1). A concentration of debitage representing a variety of lithic materials was present in this location. Two side-notched points (Cluster 2) were found near Feature 468, a much smaller surface hearth. The largest tool cluster (Cluster 3) was associated with a pit hearth, two surface hearths, and a refuse pit (Features 464, 466, 470, and 471). Corner-notched points, seven of which had been reworked, were concentrated in Cluster 3. Microwear analysis of four of the tools indicated that they were used for butchering and dry hideworking. A knife and drill were also present at this location and were likely related to these two activities. No interpretation of activities could be made for Clusters 4, 5, and 6. The patterning of activities suggests occupation by a single social unit with activities segregated in specific areas of the camp.

At least four occupations were identified in Area 2 between ca. 5100 and 5600 B.P., each represented by multiple hearths. Hearth refuse pits or scatter were present in three of the four occupations. However, artifact subassemblages associated with specific occupations could not be segregated, so intrasite patterning could not be assessed.

The Area 1 Late Archaic components produced only one possible activity area, consisting of tools representing a variety of activities associated with a hearth. The area may represent hearth-related activities of a small social group.

The Late Archaic components in Area 3S each consisted of a variety of tools associated with hearths. Evidence of nut processing was present in all. As in Area 1, the Late Archaic occupations likely represent hearth-related activities by one or more small groups, but the activities could be contemporaneous or sequential.

Middle Archaic

The Middle Archaic component in Area 2 consisted of three surface hearths and a small number of artifacts. The only tool was a side-notched point with no microwear. The occupation was likely very short in duration and by a small family group or task group. No patterning of activities was present.

Diachronic Comparisons

Ethnographic evidence suggests that hunter-gatherer bands almost universally gather in "macrobands" during parts of the year. Evidence for this practice is available for groups as diverse as the Great Basin Paiute and Shoshone (Steward 1938), the !Kung San of the Kalahari (Lee 1979), and the Eskimo (Balikci 1970). These gatherings generally have economic causes, such as the need for cooperation in subsistence activities (e.g., seal hunting through the ice among the Eskimo) or the restricted distribution of a vital resources (e.g., water in the dry season of the Kalahari). Such gatherings have important social purposes as well, including the exchange of information and the acquisition of mates from outside the immediate kin group. However, the interpretation of the social group composition for occupants of Pennsylvania sites is problematic. Large sites were not necessarily produced by macrobands, but may simply represent repeated, spatially overlapping encampments by small groups. Conversely, small, low artifact density scatters are not necessarily microband camps, but may instead be special-purpose camps occupied by task groups. Clear intrasite patterning of hearths or houses that might provide evidence related to group organization is rare in the Ohio River drainage.

Patterning of features and artifacts from the Early Woodland in Areas 2 and 3S suggest occupation by multi-family groups. This in turn suggests an increase in group size, whereby multiple families joined together in macrobands. Large groups of kin-related families often occupy macroband base camps in resource-rich localities and disperse into smaller microbands during lean seasons. The ca. 3580 B.P. occupation in Area 1 revealed a single roasting pit surrounded by four hearths. This pattern differs from the Early Woodland pattern and possibly indicated four related nuclear families utilizing the same cooking feature.

In contrast, earlier occupations appear to represent single families or small task groups of a few individuals. Features consist primarily of hearths that appear to be the focus of camp activities. The ca. 3440 B.P. and ca. 4975 B.P. occupations in Area 2 suggest more diverse activities than earlier and a segregation of activity areas. The occupations are likely longer term, a season or more, than those of the Middle and Late Archaic periods.

Population Size and Density

What is the estimated population size and/or population density?

Despite the fact that large blocks were opened in each area, in most cases occupations extended outside the blocks; as a result, excavations generally represented only a part of each occupation. In addition, each component represented multiple occupations. Therefore, it was not possible to determine group size based on parameters such as average floor space per person or relationships between settlement size and population size. With two possible exceptions, spatial analysis was not able to identify hearth groups or other intrasite patterning indicative of group size and composition. The exceptions are the Early Woodland components in Areas 2 and 3S. The ca. 2860 B.P. component in Area 2 contained four roasting pits that could each have been associated with a family group. The Area 3S Early Woodland stratum contained two subareas with similar features and artifact assemblages that

could have represented two family groups. However, it is not certain in either case that these possible family-related areas were contemporaneous occupations.

There is some evidence from Site 36AL480 to suggest that group size and population density increased over time. The Middle Archaic occupation was small in area, with a low artifact density, few discarded tools, and a relatively high proportion of non-local chert. These factors suggest short-term occupation by a small group that foraged widely, unfettered by competition for resources. Artifact densities increased in the Late and Transitional period occupations, as did the type and number of features, indicating longer-term occupations and decreased mobility. Early Woodland pottery further indicates reduced mobility and the use of large roasting pits suggests food preparation for larger groups.

Specialization

Is there evidence of specialization or abundance of certain types of resources?

No evidence of specialization of production was identified at Site 36AL480. The only resources found in relative abundance were local pebble cherts and charred nutshell from walnut and hickory. These resources were present in all areas of the site and throughout the prehistoric occupation, and were the result of their abundance in the environment surrounding the site.

Intersite Settlement Patterns

The results of excavation at Site 36AL480 can also contribute to an understanding of regional settlement patterns. In order to place the information gained from the excavations at 36AL480 in its proper context, it is necessary to compare the information from this site with patterns observed from other sites in the Upper Ohio Valley and Appalachian Plateau region.

Research questions related to intersite settlement patterns include:

How does this site compare to other riverine sites dating to the Archaic and Woodland periods? How does the information from this site "fit" with current settlement pattern models for the region? Are the site functions identified at Site 36AL480 similar to other sites in the region of the same time period? How do the Early Woodland components at Site 36AL480 relate to the Adena Culture?

Archaic Period

Archaeological data for the Ohio River Valley indicate that prehistoric populations practiced a hunter-gatherer subsistence strategy during the Archaic period (see Chapter 3). Binford (1980) modeled two alternative hunter-gatherer strategies, actually representing ends of a continuum, based on the characteristics of the resource environment. Foraging strategies involved "mapping on" to resource patches that are non-seasonal and relatively undifferentiated. In contrast, logistical, or collecting, strategies involved responses to resource distributions that are highly differentiated—that is, those that are seasonal or are

clumped and unevenly distributed. Foraging strategies would result in a series of base camps, occupied by the entire group, where maintenance activities such as food preparation and tool manufacturing took place. Occupants of the camp make daily foraging trips to procure nearby resources, and, when resources are depleted, move on to new camps. Logistical strategies, on the other hand, involve longer-term forays by a subset of the group for specific procurement tasks, such as hunting or fishing. This strategy results in a more differentiated site typology, including base camps and an array of special-purpose camps for hunting, fishing, acorn processing, etc.

In order to place settlement systems within the Binford model, it is necessary to determine the functions—base camp vs. special-purpose camp—for contemporaneous sites. Site function for the occupations at Site 36AL480 (see Table 10.1) and at other excavated sites is generally interpreted on the basis of the densities and types of tools and features identified. Unfortunately, it is difficult to determine the functions of sites that have not been excavated.

Cowin (1991) proposes a Middle Archaic settlement pattern model involving base camps in riverine and floodplain habitats with small procurement camps in upland settings and near lithic outcrops. The site typology suggests a logistical mobility pattern. Recorded Middle Archaic sites in the Raccoon Creek watershed consist primarily of open camps or lithic reduction sites on floodplains and terraces (GAI Consultants 2003).

Few other Middle Archaic sites have been excavated in the Upper Ohio Valley region. The State Road Ripple Site (36CL52) produced dates similar to the Area 2 date, but diagnostic points at that site differed in that they were bifurcates (Herbstritt 1988). Dates from ca. 5300 to 6670 B.P. were produced from Stratum IIb at Meadowcroft, but no detailed information on the occupation is available (GAI Consultants 2003). Only two other Middle Archaic components were identified in the Cross Creek drainage survey in 1988, including a possible base camp at Mungai Farm and a site interpreted as an ephemeral bivouac (Adovasio et al. 1998; Fryman 1988).

The ca. 6790 B.P. Middle Archaic occupation in Area 2 appears to represent a small, transient camp. The lack of pit features and any evidence of feature reuse suggest the possibility of an ephemeral stay. The absence of tools is likely the result of this short period of occupation. The relatively high proportion of Kanawha chert suggests that the Middle Archaic occupants were highly mobile and that their foraging range included regions to the south, in what is now West Virginia. This high mobility is consistent with Binford's foraging (collector) model, wherein populations move frequently as resources near the camp are depleted. This strategy is practical under conditions of relatively low population density and little competition for resources. The conclusion contrasts with Cowin's model, which suggests a logistical pattern. In Binford's (1980) model, the collector and logistical patterns represent ends of a continuum. It is likely that the Middle Archaic strategy falls somewhere along the continuum between the collector pattern of the Paleoindian/Early Archaic and the logistical pattern evident in the Late and Transitional Archaic.

The 21 Late Archaic/Transitional Archaic sites in the Raccoon Creek watershed survey included base camps, two of which had major lithic workshops, and bivouacs (GAI

Consultants 2003). Sites interpreted as base camps were nearly all in lowland settings. But overall, sites expanded to nearly all usable settings, suggesting an increasingly logistical settlement strategy following the Middle Archaic. An analysis of Pennsylvania Archaeological Site Survey (PASS) file data showed no apparent difference in preferred settings from Late Archaic to Transitional (Terminal) Archaic, indicating continuity in the settlement pattern (see Chapter 3).

A number of Late and Transitional Archaic period sites in riverine settings produced features similar to those at Site 36AL480. Transitional Archaic features at Scenery Hill consisted of a variety of pits, including two roasting pits, one of which was slab-lined, and a cylindrical pit interpreted as a possible earth oven. The site was interpreted as a base camp (East et al. 1996). Two features radiocarbon dated to ca. 4550 B.P. at the Connoquessing Site were a deep, somewhat bell-shaped pit interpreted as a smudge pit/hearth and a feature interpreted as a processing feature or cache (Knepper and Petraglia 1996). The two radiocarbon-dated Transitional Archaic features at the site consisted of a basin and a steep-sided pit similar to that of the earlier occupation. All four had secondary use for refuse disposal. Features in the Middle to Transitional Archaic stratum at Meadowcroft Rockshelter included hearths, refuse/storage pits, ash/charcoal lenses, and specialized activity areas (Adovasio et al. 1998). These feature types are consistent with base camp occupations. Adovasio et al. (1998) note a greater diversity in lithic assemblages from sites of this period, suggesting greater variety of activities and supporting an interpretation of longer-term occupations at base camps. Sites with Archaic period house features are not found.

The Late and Transitional Archaic occupations at Site 36AL480 fit well within the logistical settlement pattern. Most of the Late and Transitional Archaic occupations are interpreted as base camps. Occupations in Areas 1 and 2 appear to have been somewhat longer term than Area 3S based on artifact density and the numbers and types of features. Roasting pits, which represent more elaborate cooking methods and likely longer-term occupations by larger groups, first appear at Site 48AL480 in the ca. 3910 B.P. occupation. A similar date represents the early use of this feature type in the Susquehanna River Valley (Miller et al. 2007b). Roasting pits become more common on Transitional Archaic and Early Woodland sites in both the Susquehanna and Ohio River drainages. Along with the general increase in the number of tool types, the increase in roasting pits—and feature types overall—suggests an increase in sedentism and group size as the Late Archaic ends and the Transitional Archaic begins. This change would have taken place within a logistical strategy, but would have involved larger groups in resource-rich localities, such as along the Ohio River.

The Transitional Archaic component produced small amounts steatite and rhyolite, the source of which is in the lower Susquehanna River Valley. Broadspears of types centered in the lower Delaware and Susquehanna River Valleys were also recovered. These findings suggest contacts with regions to the east, either through trade or direct procurement forays. Given the relatively high degree of sedentism during this period, the former explanation seems more likely.

Early Woodland

Early Woodland settlement types include mortuary/ritual sites on alluvial terraces of major streams and resources extraction camps in uplands and along smaller streams (GAI Consultants 2003). The former type has Adena burial goods. Extraction camps are similar to camps of Archaic period foragers, but include pottery. Examples of mortuary sites include McKees Rocks Mound, located approximately 20 kilometers (12.5 miles) up the Ohio River from Leetsdale; Peters Creek Mound and Crall Mound on the Monongahela River; and Grave Creek Mound and Cresap Mound, located downriver in the West Virginia panhandle.

Early Woodland habitation sites without mounds are also part of the settlement strategy. Early Woodland groups appear to have resided in hamlets or villages during parts of the year and made seasonal forays, likely breaking into smaller groups. Habitation sites include Crawford-Grist #2, Mayview Depot/Mayview Bend, Georgetown, and Thorpe, none of which produced a substantial number of Adena-related artifacts. The Ohioview Site, in contrast, was a habitation site with a strong Adena component, including a bird stone, gorgets, celts, an Adena stone tablet, and a cache of bifaces (Alam 1961). If a mound was ever present at the site, it was destroyed before it could be documented. The Dravo #1 Site also had evidence of Adena associations, including prismatic blades, cache blades, a ground slate pendants, and points, including Adena, Cresap, and Robbins (Davis 1988).

Early Woodland sites in the Upper Ohio River basin of Pennsylvania with Cresap and Robbins points are found in riverine settings only, whereas sites with Adena stemmed points are also in upland settings. Adena and Cresap represent the early Adena, whereas Robbins points represent the late Adena (Dragoo 1963). The distribution of mound sites suggests Adena influence in the southern portion of the study area, off the glaciated plateau (Weed 2004, see Chapter 3). Initially, the Adena presence in the region was interpreted as the movement of Adena populations into the area (Ritchie and Dragoo 1959), but more recent interpretations focus on the development of a formal exchange network and the spread of mound-related burial practices (Thomas 1970).

The Cultural Resources Geographic Information System (CRGIS) documents 71 Early Woodland sites within 10 km of 36AL480, a distance that would likely encompass the range of foraging centered on the site. Recorded sites occur in a wide variety of topographic zones, including floodplains, terraces and stream benches, hill tops and ridges, saddles, and slopes. Unfortunately, sites types are generally listed as habitation or unknown. However, three mound sites are within the area: McKees Rocks, Avella, and the J. Gagich Mound. Two sites in floodplain/terrace settings are listed as lithic reduction sites. Two villages are recorded—the Parish Farms Site on a floodplain and the Shaffer Inc. Site, located on a side slope. The Cross Creek drainage survey indicated a continued increase in population density during the Early Woodland, but no difference in the pattern of site distribution (Adovasio et al 1998).

Scattered postmolds are found at Early Woodland sites, but house structures, which would suggest hamlets or villages, are rare in the Upper Ohio Valley. At the Thorpe Site, from one to five houses and a possible sweathouse were found (George 1998). Postmolds identified in arcs that could represent houses were found at Crawford-Grist (Grantz 1986). However, no midden deposits or overlapping features were found, so the occupation was

interpreted as relatively short term. House patterns were found at the Georgetown Site (Davis and Lantz 1987) and a possible Early Woodland circular house with a central pit was found at Mayview Depot (Kellogg et al. 1998).

Various types of hearths, including roasting pits, are common on Early Woodland sites (Weed 2004, see Chapter 3, Appendix F). The only earth oven reported was at the Thorpe Site, but its form differed from the small deep pits usually interpreted as earth ovens (George 1998). Early and Middle Woodland shallow roasting pits were found at the Fishbasket Site (Burkett 1999). Both deep and shallow roasting pits were found at Mayview Bend (Kellogg et al. 1998). The pits were similar in form and content to those found at 36AL480. Roasting pits were also found in the Early Woodland stratum at Meadowcroft Rockshelter (Adovasio et al. 1998). Unlike hearths, roasting pits show evidence of preparation, with layers of FCR covering the basin and charcoal lining the base. Roasting pits are often surrounded by scatters of FCR and charcoal, reflecting reuse of the roasting pit. The presence of such pits suggests relatively long-term occupation, perhaps a season or more. Roasting pits were found at 36AL480 in association with the Early Woodland component and may represent food preparation areas for nuclear family groups.

Storage features are generally defined as large, straight-sided or bell-shaped, and flat bottom pits (Bursey 2001). However, shallower pits with refuse may have been previously used for storage. The latter type is more common on Early Woodland sites. Storage/refuse pits were found at Mayview Bend and Mayview Depot, suggesting multi-seasonal occupation (Kellogg et al. 1998). Deep storage pits at the Fishbasket Site (36AL134) were associated with the Late Prehistoric and Late Woodland occupations (Burkett 1999). Seventeen postmolds and a variety of pit features were identified at Crawford Grist #2. Most of the features appeared to be refuse pits; two U-shaped pits may have functioned as storage pits (Grantz 1986). No storage pits were identified at 36AL480, although refuse pits that originally could have functioned for storage were present in the Early Woodland component at the site.

Thorpe and Crawford Grist #2 can be interpreted as hamlets, although the latter site was likely not a year-round occupation. Mayview Bend represents a series of Early Woodland occupations between ca. 2240 and 1960 B.P., which were interpreted as intermittent and seasonal despite the presence of storage pits and a midden deposit. Mayview Depot had a possible Early Woodland house structure and may represent an Early Woodland hamlet, but the most intensive occupation of the site was during the late Middle Woodland and Late Woodland periods. Very little pottery and no features were found at Dravo #1, and it was interpreted as an ephemeral occupation and as a satellite camp related to the nearby Georgetown Site (Davis 1988).

No deep storage pits, house patterns, or Adena burial items were identified at Site 36AL480. This finding generally supports conclusions based on previous investigations that the Early Woodland at Site 36AL480 reflects a continuation of the Archaic period adaptive strategy. However, as discussed above, occupations in the Early Woodland appear to represent multi-family groups, whereas those in the Middle Archaic and early Late Archaic appear to be small groups, likely single families. The use of roasting pits during the Early Woodland period at 36AL480 and elsewhere suggest longer-term occupations and food

preparation for larger groups. Site 36AL480 is similar in feature types to Mayview Bend. Although the presence of roasting pits at the two sites suggests seasonal occupations, no structures were found. Thus, the two sites may represent summer to fall occupations, with sites such as Thorpe or Crawford-Grist #2 representing winter to spring occupations. The occupants of Site 36AL480 would have stayed long enough to deplete readily available walnut and hickory nuts, then moved to winter quarters early enough to gather nuts in the immediate vicinity for storage.

Lithic procurement practices at Site 36AL480 showed no temporal trends from the Late Archaic to Early Woodland, with nearby gravel deposits providing most of the lithic material. The Late Archaic to Early Woodland use of Vanport and Upper Mercer chert from what became the Adena heartland at 36AL480 and other sites in the region suggests that exchange between the two regions started before the beginnings of the Adena culture. This finding generally supports the conclusion that the Adena culture was the result of the establishment of formal exchange networks. With the exception of Adena points and Adena Plain pottery, no Adena artifacts were found with the Early Woodland occupations at 36AL480. If the occupants of the site participated in Adena trade and burial practices, they did so while occupying sites elsewhere, likely in proximity to burial mounds. Sites such as Georgetown and Ohioview may represent gatherings of macrobands for ceremonial purposes. Notably, however, small amounts of steatite, likely traded from the Susquehanna River Valley, were found in Early Woodland contexts.

EVALUATION OF METHODOLOGIES

Field Methods

The data recovery field excavations at Site 36AL480 were conducted by three contractors, each working in separate excavation blocks of approximately 200 square meters. Excavation techniques were similar among the three areas in terms of spatial controls, feature excavation, and artifact recovery. Although different standard forms were used for recording field data, the information recorded was, for practical purposes, identical. The excavations were unified by a single grid system covering the entire site. The excavations were overseen by a District Principal Investigator who assured comparability in overall field procedures. Comparability was also increased through meetings of the District Principal Investigator, Principal Investigators for each of the three areas, and the geomorphology team. A single geomorphology team was contracted to evaluate the overall site setting and the stratigraphy in each excavation block, providing interpretation for the entire site.

The use of three separate contractors facilitated completion of such a large-scale project within a reasonable period of time. As noted above, a number of measures were taken to ensure comparability of the excavations. Given that the basic excavation methodology was established by the District, the use of separate contractors did not adversely affect the field investigations.

The staged excavations, using a test unit sample to assess artifact densities and develop an excavation strategy for each 1-m vertical soil package, proved to be an efficient

method of targeting excavations to the most productive contexts. The scope of work provided sufficient flexibility to extend excavations outside the original block as needed or, when appropriate, to remove soil without screening. Distribution maps were generated at decision points and were useful in guiding the excavations.

Soil was mechanically removed without screening from within blocks after each 1-meter block was sampled. Soil was mechanically removed outside of block excavations in some areas to reach archaeologically productive soils. Monitoring was conducted during mechanical excavations and was successful in identifying several features. In some cases it was possible to associate those features with a prehistoric component, in other cases it was not. In some cases, monitoring proved to be effective in recovering information relevant to the block excavations. For example, in Area 2 a roasting pit and four other charcoal-rich features were uncovered during mechanical excavation adjacent to the main block that could be associated with Transitional Archaic and Early Woodland occupations.

Three 200-square-meter excavation blocks were excavated across the site area as opposed to one large block covering the same area. A larger block is more likely to produce information on intrasite patterning by capturing a greater number of activity areas. However, the use of three smaller blocks sampled the variability at the site, identifying a greater number of the occupational components and providing a clearer picture of the relationship between the T2 and T3 terrace occupations.

Laboratory and Data Analysis Methods

Laboratory difference in the classification of lithic materials and reduction stages is a recognized problem in comparing assemblages from various sites. Although lithic identification was discussed at a Principal Investigator's meeting, there appeared to be some differences in analysis among the laboratories analyzing artifacts from each of the three areas. Onondaga chert in Area 3S ranged from 95.4 to 99.6 percent, a much higher proportion than in Areas 1 and 2. The authors note in their discussion that black chert with a brownish hue was categorized as Onondaga chert, whereas the blackest cherts were categorized as Upper Mercer (see Chapter 8). Thus, some black chert classified as Upper Mercer chert in Areas 1 and 2 was likely classified as Onondaga chert in Area 3S.

Similarly, there appeared to be differences across laboratories in the assignment of debitage to lithic reduction stages. Mass analysis was developed as one means of addressing this issue (Ahler 1989). The technique relies on size grading of debitage, as well as recordation of attributes including quantity of cortical fragments, presence or absence of thermal alteration, and weight per size grade. Mass analysis of debitage was conducted only for the Area 3S collection. However, the interpretation of lithic reduction stages was based on a detailed analysis of a sample of flakes that measured presence or absence of a percussion bulb; platform shape (faceted, flat, cortical, or lipped); platform size (thickness); platform angle, in 5^{o} increments; and overall length, width, and thickness. Similar characteristics were used, but not recorded for each artifact, in Areas 1 and 2. The mass analysis, using proportions of debitage by size grade and average debitage weights by size grade, revealed no temporal differences in lithic reduction methods in Area 3S. The detailed debitage analysis was more useful in providing information on reduction techniques,

although the implications of individual attributes were sometimes contradictory. In terms of the stated goal of quickly identifying the reduction stages of artifacts based on size, the mass analysis results were not useful given that, unlike the detailed debitage analysis and the Areas 1 and 2 methods, the mass analysis did not identify any meaningful patterns in reduction technology. The only temporal differences were among the small size grades, and the authors concluded that the differences did not have cultural significance (see Chapter 8:8-236).

There was a basic difference in the method of stratigraphic analysis between Area 3S and Areas 1 and 2, which were conducted by the same investigator and author of this chapter. The analysis in Area 3S focused on soil horizons (e.g., AB, 2BC, 2Ab2, etc.), whereas the analysis in the other two areas focused on excavation levels. The Area 3S analysis by soil stratum in some cases incorporated large blocks of time (e.g., 1860–2860 B.P. in the AB horizon), and because of that fact, post-depositional processes causing vertical movement of artifacts had less effect on the results. However, analysis based on excavation levels has the potential to define multiple occupations in a single horizon. Since horizon boundaries are a consequence of soil development rather than cultural processes, it is not unexpected that a cultural component would cross-cut a horizon boundary.

Analysis by excavation level also presents problems in interpretation. As discussed above, post-depositional processes—both natural and cultural—result in the vertical movement of artifacts. Also, excavation levels can cross-cut cultural components if the slope of the level differs from the ground surface at the time the site was occupied. Thus, interpretations based on level-by-level analysis must be considered cautiously, since there is invariably some degree of intermixing of material from adjacent occupations.

Raw materials for the chipped stone tool assemblage were identified on the basis of macroscopic characteristics and assigned to type based on similarity to known source samples. The types of material available in the region were described. As indicated above, this method is subjective and results can vary by analyst and by lab. Chemical sourcing and mircoscopic analysis of thin sections is more reliable, but not feasible for a large assemblage. Prior to the Site 36AL480 data recovery, the geomorphology team reviewed the macroscopic, characteristics, petrography, geological origin, and geographic location of each of the major varieties available to the site's inhabitants. The review was important in providing a raw material typology for the lithic analysis, although it was not sufficient to eliminate inter-laboratory differences in classification.

In contrast, steatite generally cannot be sourced on the basis of macroscopic characteristics alone. Sourcing of steatite samples from 36AL480 and other sites in the region was conducted using neutron activation analysis to identify rare earth elements. The analysis demonstrated that steatite artifacts found in Area 2 were similar in composition and likely from the same quarry and the samples from Area 3S were also likely from the same quarry. The author noted that assigning the samples to a specific quarry was problematic because of difference in data between the reactor used for the current samples and the reactor used 30 years ago to generate the source data. However, with that caveat, it was concluded that the Site 36AL480 samples likely came from the Georgetown or Christiana steatite quarries in Chester County. As in any sourcing study, the reliability increases with the

number of source samples and comparability of the source and artifact analytic measurements.

The environmental reconstruction at the site was a multidisciplinary effort that included geomorphology, soil analysis, macrobotanical analysis, and pollen and phytolith analysis. Along with the archaeological data, these methods provided a detailed reconstruction of the terrace system and the environment surrounding the site.

The pollen sampling was most productive in aggrading areas of the site, such as the Back Channel and relict stream channel, where preservation was greatest. The pollen and phytolith data provided information on the vegetation in the region and surrounding the site. The information supplemented macrobotanical analysis of wood charcoal samples from features. The latter method produced more precisely dated information, but revealed a narrower range of resources.

Detrital grain analysis, biogeochemistry, clay mineral analysis, and micromorphology of soil samples from prehistoric features and excavation block walls was conducted to provide data on the depositional history of the area and to assess anthropogenic effects on soils. Higher acidity, higher phosphate, calcium, and potassium values, and higher organic material tended to correlate with higher artifact densities in some but not all areas of the site. Higher calcium and potassium values and higher organic material were found in samples from feature fills from Areas 1 and 2. Elevated concentrations of these materials are believed to represent burning and intensive use of surfaces at prehistoric sites. The analysis also produced some unexpected results, such as the low concentration of phosphorus, a diagnostic indicator of human activity, in the features—a finding that was difficult to explain. Feature signatures based on phosphate fractionation analysis were compared to data from other village and hunter-gatherer sites and, with a large data set, would have the potential for identifying shifts in prehistoric land use at Site 36AL480 over time. The soil analyses were extensive and valuable for this and future research for the interpretation of the relationship between human activity and depositional context.

Immunological analysis of protein residues from ceramic and steatite vessel fragments, the stone bowl identified in the Phase II survey, and projectile points and bifaces was conducted (Appendix B). Two ceramic sherds produced residue from the Cervidae family (deer, elk, moose, or caribou) and one produced evidence of rabbit. The findings suggest that meat was routinely cooked in ceramic vessels. Two points and a biface produced residues of deer and rabbit, consistent with our current understanding of prehistoric hunting behavior. The stone bowl tested positive for capparadeaea antiserum, the caper family. Overall, the residue analysis provided little new information on subsistence.

Microwear analysis provided a wealth of information on the activities that took place at the site. Because many of the tools were multifunctional or expedient, microwear was critical in providing information on how the tools were used. In turn, the information was useful in defining activity areas and site function for each occupation. In addition, the range of activities represented in the tool assemblage reflects the duration of occupation. Short-term occupations tend to have tools used for butchering and fresh hide working only,

whereas longer occupations exhibit activities such as bone and antler working and dry hide working.

Spatial analysis was conducted for occupations in all three areas of the site. In Areas 1 and 2, artifact distributions were mapped for all excavation levels using a mapping software. The distributions were then examined for artifact clusters that could represent activity areas. In Area 3S, formal spatial analysis was conducted on two "living surfaces," or cultural components with the densest cultural remains. In addition to contour mapping of artifact distributions, statistical tests were used to examine spatial distributions. Both contour mapping and statistical analysis were successful in identifying artifact patterning. For example, the statistical analysis identified a spatial correlation in the Early Woodland component between bipolar artifacts and groundstone, which in that component included nutting stones, pitted stones, net weights, and a hammerstone/anvil. In the Terminal Archaic period component, the statistical analysis identified a distinct distribution pattern for bipolar flakes, as well as negative associations between flakes and FCR and positive associations between features and FCR. These finding provided information on how activities are spatially related.

Refitting of artifacts was conducted for specific contexts in Areas 2 and 3S. Refitting of FCR was undertaken in Area 2 in an attempt to clarify associations of Late Archaic features with similar radiocarbon dates but different elevations. It was hoped that patterns of refits among features in the Late Archaic zone would supplement the information from radiocarbon dates to provide a better understanding of feature associations. Although a number of refits were found, the analysis was not successful in tying features together, possibly because reuse of rock occurred across occupations.

Most of the refits in Area 3S were based on distinctive material types that appeared to be from the same nodule. Three mending refits between two levels were found in the 2BC horizon; one mending refit in the 3Ab2 horizon in the same level of adjacent units; and three artifacts mended across three levels of the 3Bw horizon. The authors concluded that the refit analysis provided little information on the integrity of the site deposits.

Finally, radiocarbon dating is clearly the most important analytic technique on deeply stratified sites. As more radiocarbon-dated stratified sites have been excavated, it has become clear that point types once considered temporally diagnostic were in use over long periods of time. Well-dated stratified sites are necessary to more accurately define the age of occupation zones. The radiocarbon dating for the Site 36AL480 was largely successful in facilitating the reconstruction of the occupational history at the sites. The additional dating authorized during the course of the excavations contributed to this effort.

Recommendations for Future Investigations

The field methods utilized for the Site 36AL480 investigations provide a useful guide for fieldwork at other large-scale stratified sites. The staged sampling was successful in focusing work on the most productive occupation zones. The generation of distribution maps at decision points is critical. The creation of sequential safety benches allowed excavation to the deepest components in a safe work environment.

Radiocarbon dates are by far the most important analytic technique and, as a general principal, the more samples that are dated, the more precise the occupational history of a site can be. A sampling strategy for radiocarbon dates should include a series of dates during the course of the investigations, but allow for dates to also be submitted during the post-fieldwork analysis, when gaps in the chronology are identified.

Microwear analysis is one of the most important techniques for identifying the types of activities in each component and identifying activity areas. The technique is especially important where expedient tools, whose function cannot be determined by form alone, predominate. Microwear analysis of the largest possible sample of formal and expedient tools is recommended.

Protein residue analysis was of little value in contributing to an understanding of prehistoric subsistence. Starch grain, pollen, and phytolith analysis of washes from steatite and ceramic vessels and groundstone tools has been successful in identifying evidence of native seed and tuber use at a number of sites (Miller et al. 2007b, 2008) and is strongly recommended for future studies.

Physical and chemical analysis of soil is also recommended. The investigations at 36AL480 identified the potential for assessing changes in prehistoric land use over time using phosphate fractionation analysis from a large number of features in stratified contexts. Data from other village and hunter-gatherer sites exists for comparing the results.

A multi-disciplinary approach such as the one used for the Site 36AL480 investigations is recommended for future data recovery projects. The approach maximized an understanding of the interaction between environmental setting and human occupation of the site.

SUMMARY OF STUDY SIGNIFICANCE

Prehistoric Components

General Summary

Site 36AL480 represents one of a very small number of stratified sites in the Ohio River Valley that has been systematically investigated and documented. In the Ohio River drainage of Pennsylvania, only the Meadowcroft Rockshelter provides a similar level of data, although for a longer temporal span. Single component sites in non-stratified contexts are also rare, so information on temporal change in adaptive strategies and lifeways for the region is extremely limited. The data recovery investigations at 36AL480 are also unique in the large area excavated, comprising over 600 m^2, and in the variety and intensity of the multidisciplinary studies supporting the investigations.

The data recovery investigations produced a detailed watershed synthesis of existing archaeological data that provided a base line for the Site 36AL480 investigations. The synthesis included a detailed cultural overview of the region, including an examination of

existing artifact collections and previous archaeological research reports, and research contexts for the five major themes identified for the Site 36AL480 investigations. In addition to providing a framework for the data recovery, the synthesis is additionally valuable in that it provides a context for future archaeological studies in the region.

The investigations contributed to the development of excavation strategies for complex, deeply stratified prehistoric sites. The method of initially sampling 1-meter-thick vertical packages and using the resulting data to determine the intensity of excavation appropriate for each package proved effective in targeting the effort on the most productive archaeological zones. The large block excavations provided data for assessing artifact distributions and activity areas.

Overall, the site has contributed important information on the five research themes established in the data recovery plan and increases our knowledge of the prehistory of the region.

Culture Chronology

The site produced a large number of charcoal-rich features that provided samples for the radiocarbon dating of site occupations and for reconstructing the occupational history of the site. Carbon samples were processed from 50 Phase III data recovery features. The excavations provided evidence of site occupation from as early as 6790 B.P. to as late as 1860 B.P. At least eight Early Woodland, 10 Transitional Archaic, 12 Late Archaic, two undated Middle or Late Archaic occupations, and two Middle Archaic occupations could be distinguished. The presence of a large number of components at a single site provided evidence for cultural change over a broad period of prehistory. The adaptive differences among occupations at a single site more clearly relate to temporal change as opposed to geographical differences that might affect the interpretation of culture change using multiple, single-component sites. Indeed, single-component sites are also very rare in the archaeological record.

The data recovery investigations provided information on a possible refinement to Early Woodland diagnostic points and ceramics. Sherds of Early Woodland types such as Adena Plain, Half-Moon Cordmarked, Watson Cordmarked, and McKees Rocks were found in the Area 3S AB horizon, where four of six radiocarbon dates were ca. 1860 B.P., which falls within the Middle Woodland. Adena and Forest Notched points were also found in this context. The result could indicate that Early Woodland ceramic and point types continued in use into the Middle Woodland period. Alternatively, since an Early Woodland radiocarbon date was also produced and Middle Woodland diagnostics were also found, the assemblage could be an admixture of two periods of occupation.

Environmental Context

Extensive geomorphological investigations were conducted prior to and during the data recovery investigations. The studies included backhoe trench excavations and the analysis of deep archaeological excavation profiles. The work resulted in a detailed and comprehensive reconstruction of the depositional history of the site that provided both a

context for interpreting the prehistoric archaeological components as well as data relevant to general depositional processes along the Ohio River. The allostratigraphic model developed as a result of the field data provides a baseline for evaluating other floodplain settings in the Ohio River region and beyond. The model encompasses measures of environmental change based on radiometrically calibrated periods of alluvial deposition and stable environments as reflected in the depositional record. The allostratigraphic model is based on a genetic stratigraphy approach that merges the disciplines of geology, pedology, alluvial sedimentology, climatology, and archaeology. The result was a comprehensive paleoenvironmental and human ecological reconstruction of the past 11,500 years in the Upper Ohio Valley.

The research provided information to address a number of research questions, including: How did the environmental setting change during the Holocene? How did these changes relate to settlement at the site? What are the implications of the site's stratigraphy, including the Back Channel, for the broader region? And do the Middle Archaic depositional rates reflect warm and dry episodes associated with zonal atmospheric circulation, a climatic condition that affected a broad region of North America?

Pollen and phytolith analysis also produced information on the local environment, providing a context for interpreting the occupation of the site. In all, 44 samples contained well-preserved fossil pollen, providing pollen sequences form the casting basin and Back Channel. The results provided a composite of climate change from ca. 7080 to 5870 B.P. in the casting basin and from 4500 to a period after 2500 B.P. in the Back Channel. Samples from Area 3 provided phytolith data spanning the occupation of the site. In addition to providing a reconstruction of the surrounding vegetation during the occupation of the site, the data provided information on overall climate change in the region, including information from Pleistocene-era channel lag deposits.

Artifact Assemblages and Lithic Technology

The site produced numerous artifacts, including diagnostic points and ceramics, FCR, tools, and tool manufacturing byproducts. The analysis of point types from firmly dated stratigraphic contexts provided information of projectile point chronology in the region that can be useful in dating other sites. Analysis of tool types and microwear provided information that identified the types of activities that took place during each of the occupations. The tool assemblage also revealed a strong relationship between the presence of nearby pebble sources of lithic material and the types of tools produced. The tool assemblage throughout the occupational sequence was dominated by expedient tools fashioned from river gravels. However, exotic materials—such as jasper, Vanport chert, Kanawha chert, and rhyolite—were also present and provided information on the degree and direction of group mobility and long-distance contacts. Steatite artifacts were sourced to quarries in Chester County, Pennsylvania. The small quantity of steatite suggests the material likely resulted from trade rather than direct procurement. The analysis of lithic reduction indicated that bipolar techniques were used almost exclusively (95.7 percent) with pebble source materials. Heat treatment of lithic materials was identified to some degree throughout the occupation of the site.

Subsistence and Seasonality

The site produced data related to subsistence, including nutshell and a small number of fruit seeds. Very little subsistence data is available for the Middle Archaic. Middle Archaic features produced hickory and walnut, indicating that those resources were utilized during that period. No Mesoamerican cultigens were found. Knotwood and chenopodium were found in features dating to ca. 1860 B.P., supporting the findings from the Middle Woodland Dunsfort Site indicating the use of native seeds. The absence of seeds in earlier contexts does not necessarily indicate that they were not utilized, since preservation of seeds is generally poor. Data for the early use of native seeds in the Susquehanna River drainage come primarily from the analysis of steatite bowl residues.

Site Settlement Pattern

Intrasite patterning was revealed in several of the major components of the site. The ca. 2860 B.P. occupation in Area 2 produced three activity areas, each of which included a roasting pit. The pattern suggested that the social group consisted of multiple families, each of which utilized its own cooking facility. The ca. 3580 B.P. occupation in Area 1 revealed a roasting pit surrounded by four hearths, possibly indicating four related nuclear families utilizing the same cooking feature. Overall, the data revealed an increasing intensity of occupation, with Middle Archaic components containing low artifact densities and limited numbers and types of features to later components with high artifact densities and a greater number and variety of features and tools.

The site provided information for comparison with other sites in the region, including research questions related to settlement strategies and changes over time. The data indicated a highly mobile pattern for the Middle Archaic occupants of the site. The few other Middle Archaic sites that have been investigated in the region are consistent with this interpretation. Later occupations at 36AL480 suggest decreasing mobility, increasing sedentism, and larger group sizes. The information on mobility patterns has contributed to our understanding of regional settlement patterns by supporting models suggesting increasing sedentism and larger group sizes over time.

The Early Woodland component is consistent with habitation sites such as Crawford-Grist #2, Mayview Depot/Mayview Bend, Georgetown, and Thorpe, none of which produced a substantial number of Adena-related artifacts. Possible house patterns have been found at some, but not all, Early Woodland sites. The absence of house patterns at Site 36AL480 indicates that the site was not a hamlet or village, but rather a seasonal or longer-term camp, likely with temporary shelters rather than houses. Along with Mayview Bend, Site 36AL480 has provided data to show that this type of habitation was part of the Early Woodland settlement pattern.

The data recovery investigations also provided information on regional interactions, either through mobility patterns or trade and exchange. Unfortunately, trade or exchange is difficult to distinguish from direct procurement in the archaeological record. The Middle Archaic component had a high proportion of Kanawha chert, a lithic material from regions to the south. Data suggest a high degree of mobility during this period, so the Kanawha chert

likely represents an indication of the foraging territory of the Middle Archaic occupants of the site. Later occupations show evidence of small amounts of materials originating in the Susquehanna River Valley, such as rhyolite and steatite. Transitional Archaic broadspears are found and, although within their geographical range, also suggest contacts with the Susquehanna River Valley. An especially significant finding is that these contacts appear to have continued into the Early Woodland, when the region was within the Adena geographical sphere, centered to the west of the site. In contrast, with the exception of Adena points and Adena Plain pottery, no Adena trade artifacts were found with the Early Woodland occupations at Site 36AL480. Other materials reflecting influence to the west are limited to Vanport and Upper Mercer cherts, a Bottleneck stemmed point, and Merom-Trimble points.

Overall, Site 36AL480 produced extensive information on the prehistoric occupation of the region. The multiple occupations dating from the Middle Archaic to Early Woodland periods have provided a broad data set for regional comparisons and for understanding changes in prehistoric behavior over time.

Historic Components

Historic components at the site included the Hugh Bevington Brickworks and two periods of the Harmony Brickworks. The Bevington factory was largely destroyed by construction of the Harmony Brickworks. However, the supplemental investigations of the historic component provided important information on Hugh Bevington's brickworks. It appears that Bevington used coal as a fuel in his operation; this was apparent from the excavation of one of the four furnaces used to heat and subsequently dry out the green brick. It was filled with a thick deposit of coal slag, ash, and soot. The investigation also provided information on what appears to be either a previously unrecorded type of coal-heated hot/drying floor that consisted of four concentric brick flues terminating into a central flue located at its eastern and western ends. Based on the presence of thermally altered soil, it was determined that the heat source was located at the eastern end of the hot floor and was delivered to the flue system via an arched brick conduit. Lastly, a brick foundation to a structure was located at the western end of the hot floor. Although the exact function of the building could not be determined, it could have housed the chimneystack for venting the hot air from the hot floor complex.

The Harmony buildings were largely demolished after the factory closed in 1901. However, the archaeological components revealed a wealth of data about the spatial organization and technology of nineteenth-century brickmaking. Five kilns and a large, multi-room structure for clay processing and brick molding were found. The additional investigations determined that the southern auxiliary wing of the large structure was used as a hot floor and that wood planking covered it in order to support the weight of the green bricks and protect the brick subfloor and flue system. In addition, the northern auxiliary wing may have contained a steam boiler(s) used for supplying heat to the hot floor located in the southern wing.

Of great importance was the evidence of different brick drying technologies, an aspect of the process that is often overlooked in the focus on brick kilns. These technologies included a circular hot floor complex associated with the Hugh Bevington Brickworks,

furnace-heated hot floors associated with the early Harmony Brickworks 1890–1897 component, and a steam drier tunnel associated with the later Harmony Brickworks 1890–1897 component.

Nearly all the steps in the brick-manufacturing process were represented in the archaeological record at the site, from processing and drying the brick to firing. The only parts of the process not represented were clay mining, soaking, and the removal of the finished product from the site. The data addressed a number of research questions related to the site-specific manufacturing process and layout, manufacturing technology, facility architecture, site proxemics, the economics of brick manufacturing, and the transportation network. Influence of the Harmonist religion on the design and construction of the factory was not in evidence. However, the spatial layout of the factory was revealed in sufficient detail for comparison to other brickworks in the region.

In addition to the results of the field investigations, the project produced a detailed synthesis of the history of the property, as well as the history of the Harmony Society and the nineteenth-century brickmaking industry. The research compared the technology and administration of the Harmony Brickworks with other brick factories in the region, finding that although the Harmony Brickworks technology was average, it was planned for the efficient transportation of raw materials and finished products. In addition to contributing to the interpretation of the archaeological findings, the synthesis provides a contextual framework for future archaeological studies of brickmaking factories.

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APPENDIX 10A: FIGURES

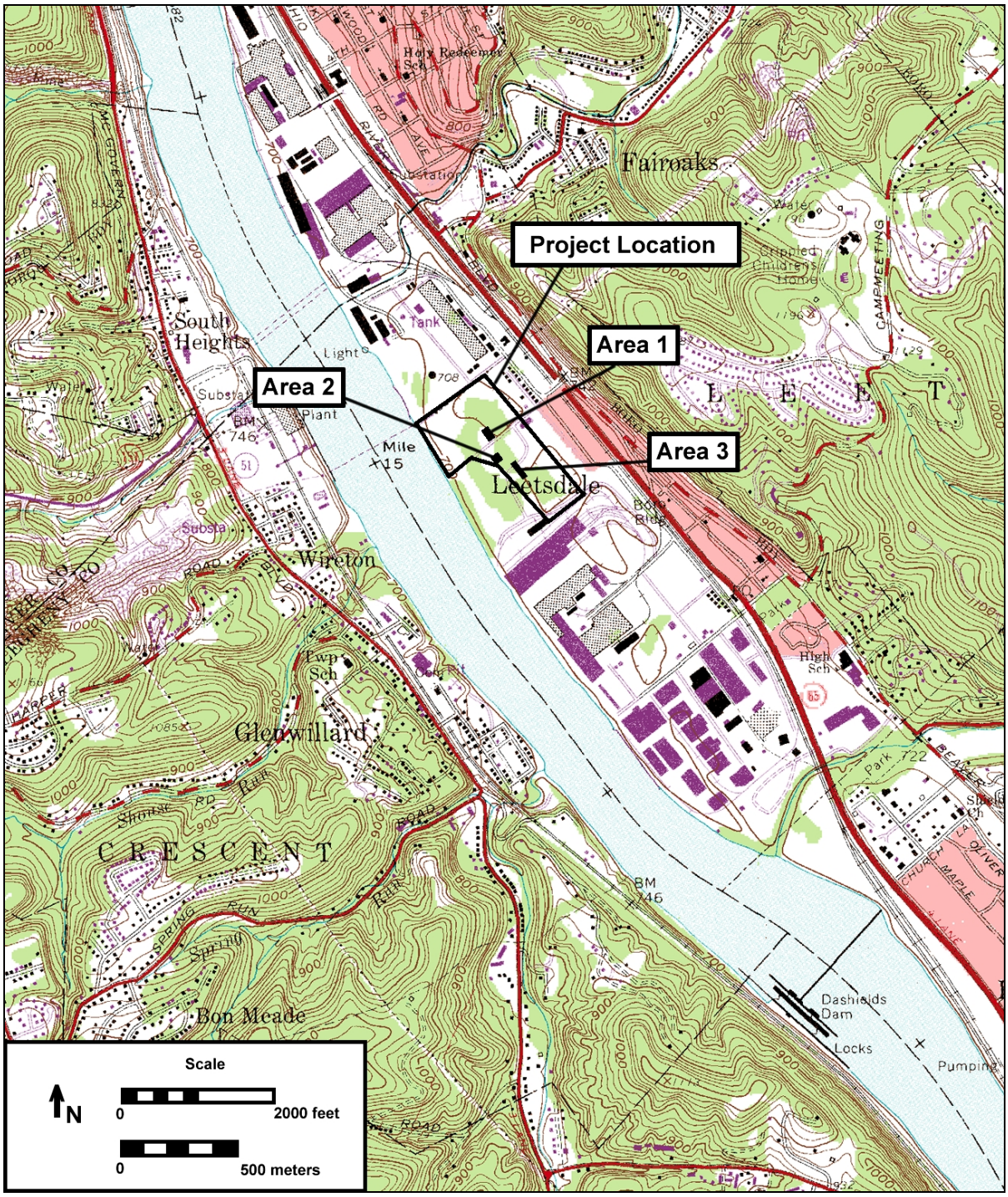

Figure 10.1. Vicinity of the project area, showing Areas 1, 2, and 3.

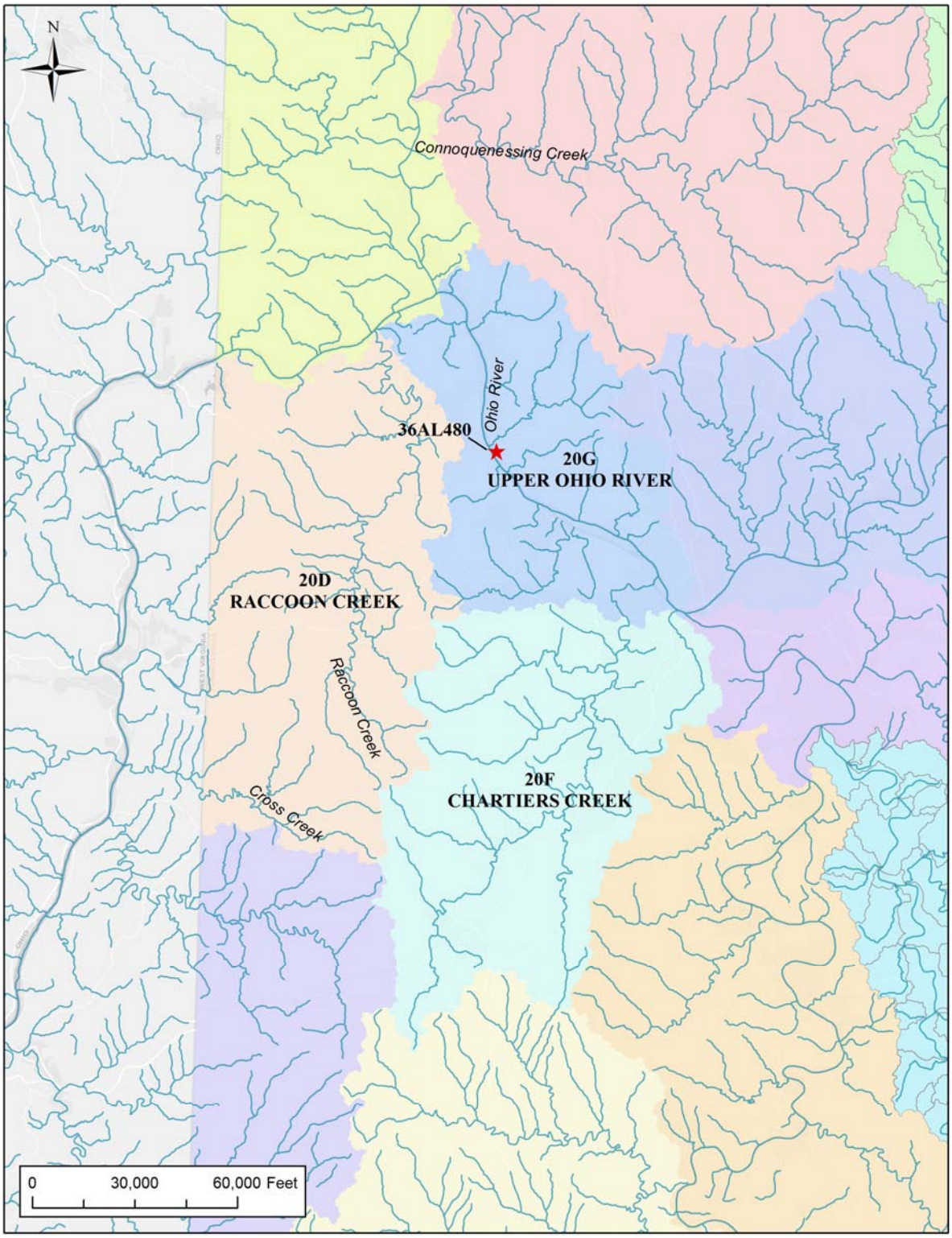

Figure 10.2. Streams and watershed in the vicinity of 36AL480.

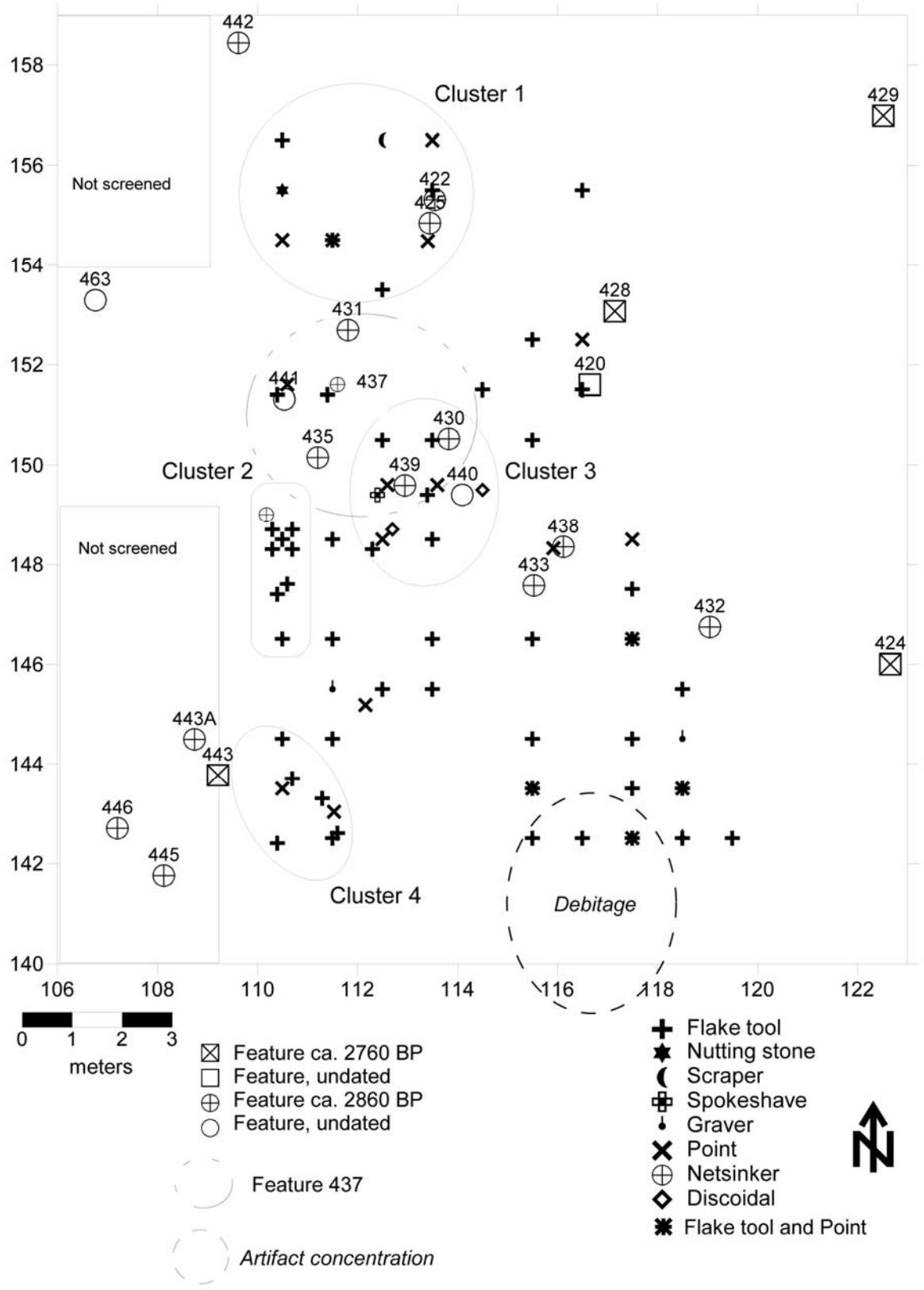

Figure 10.3. Distribution of features and tools in Area 2, ca. 2860 B.P.

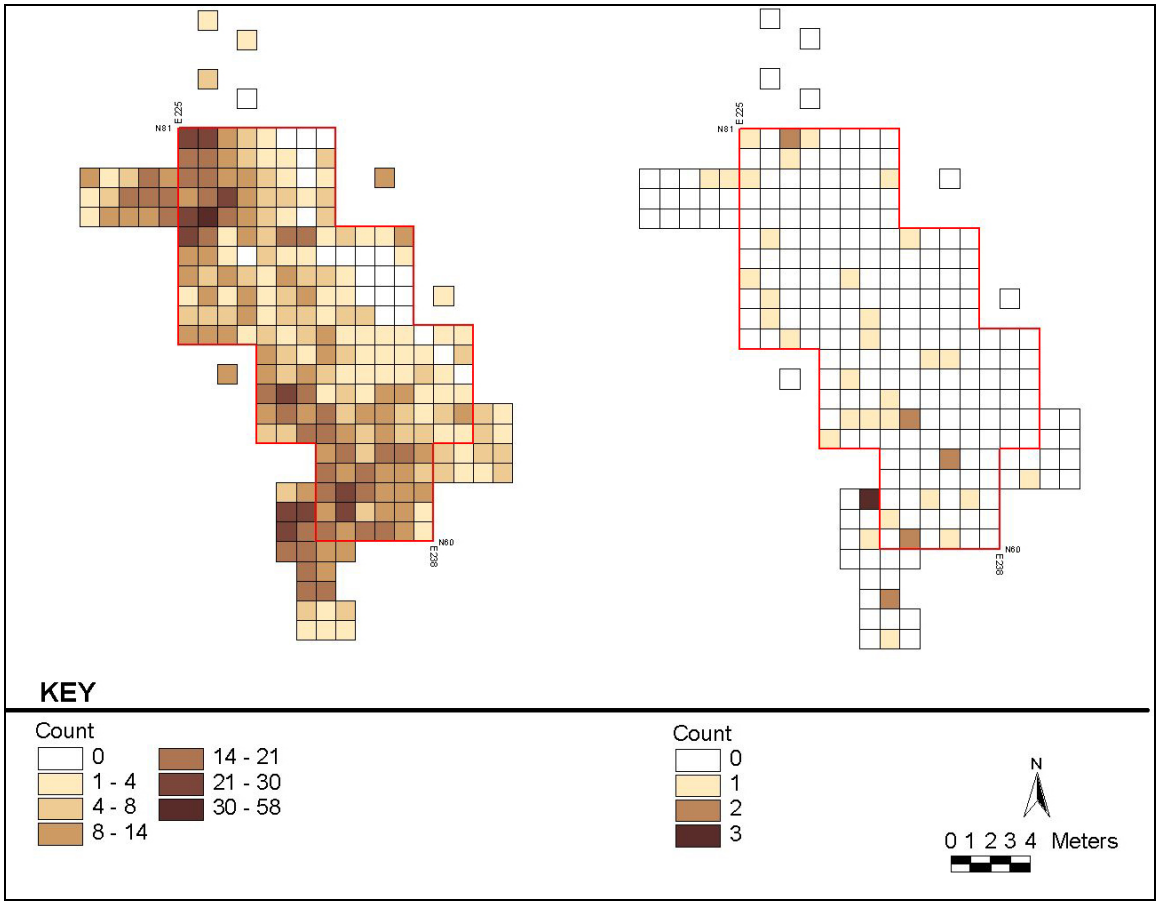

Figure 10.4. Area 3S, AB horizon distribution of lithic debitage (left) and lithic tools (right) (from Chapter 8).

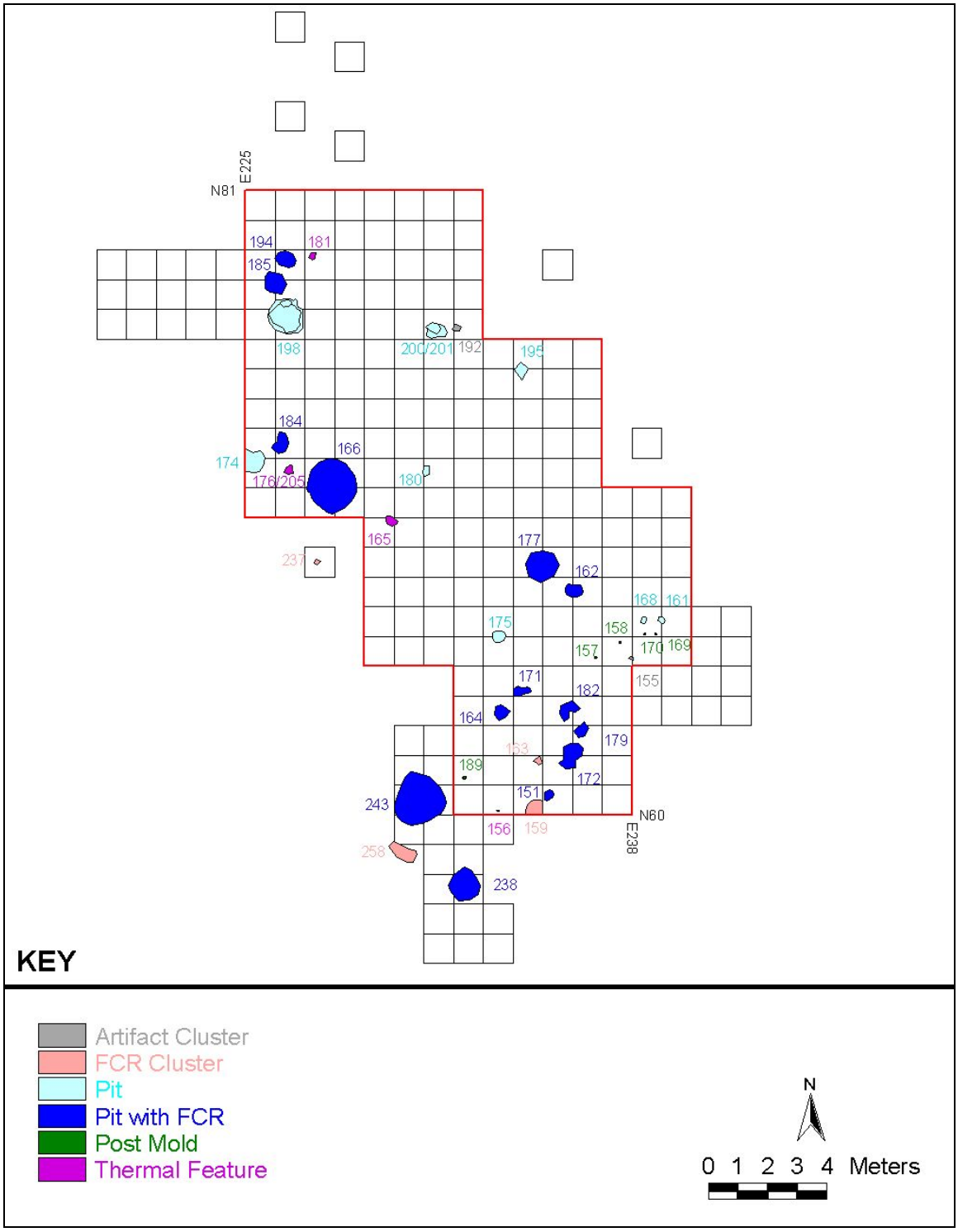

Figure 10.5. Area 3S, AB horizon feature distribution (from Chapter 8).

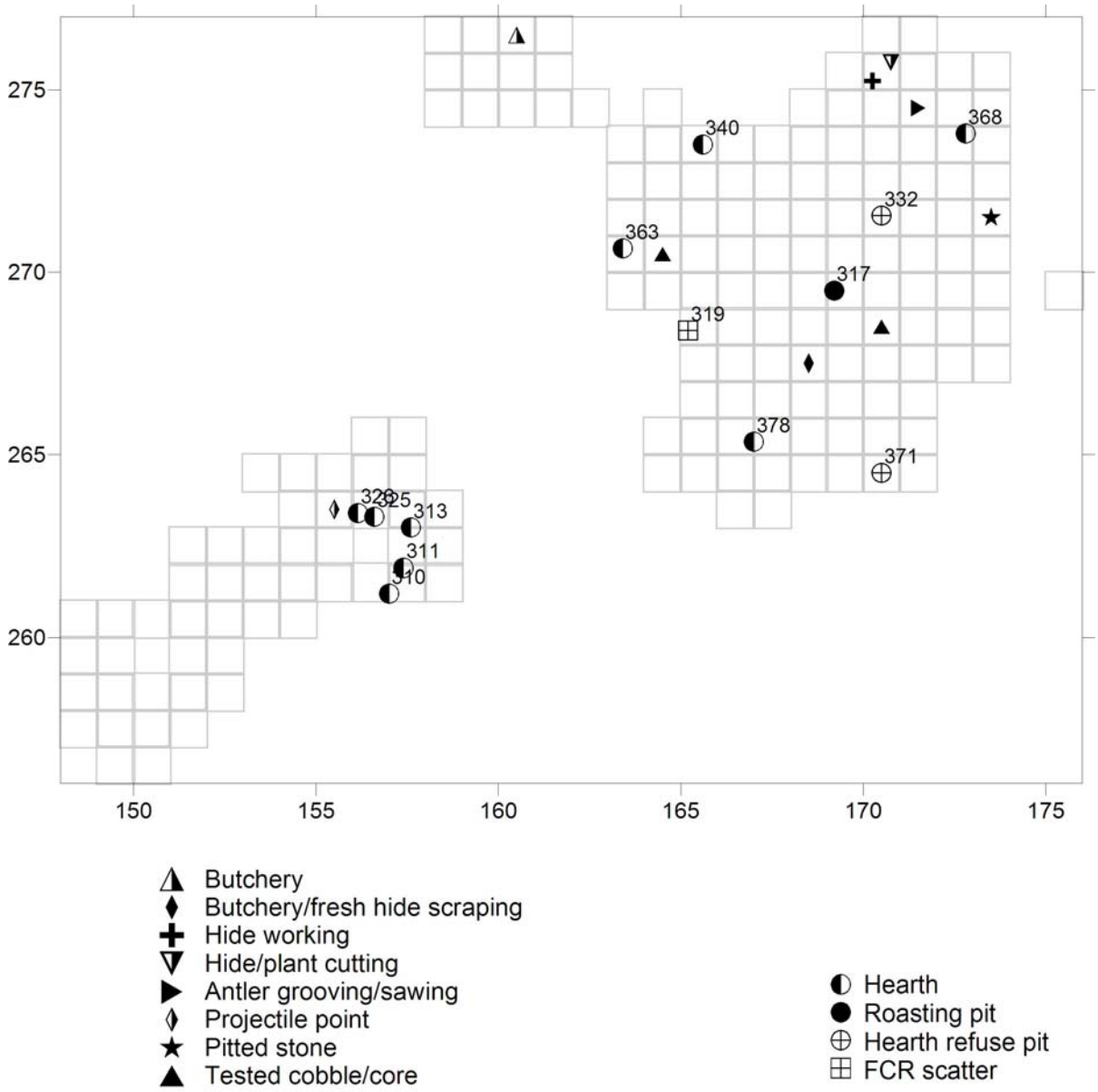

Figure 10.6. Distribution of Features and Tools in Area 1, ca. 3580 B.P.

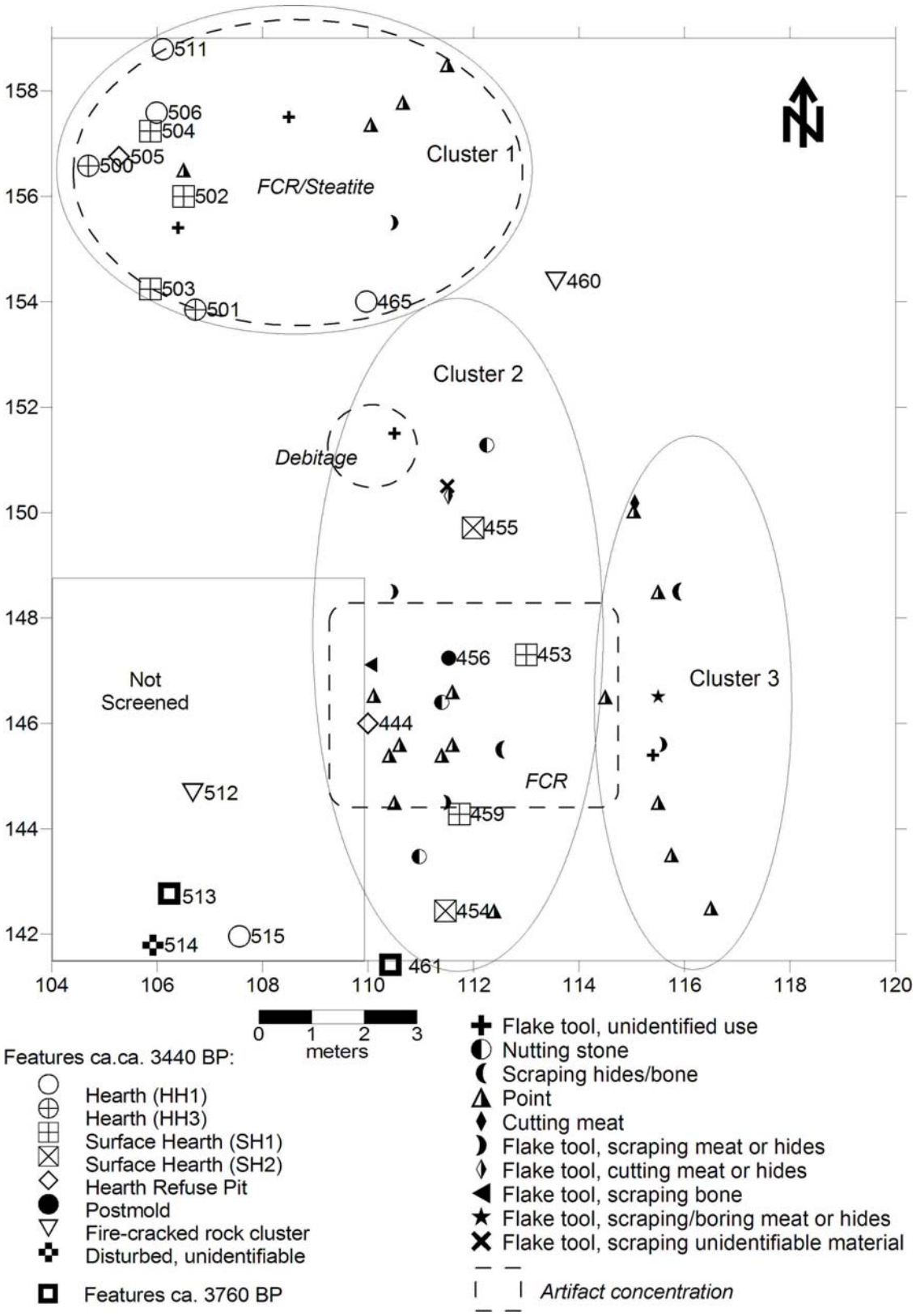

Figure 10.7. Distribution of Features and Tools in Area 2, ca. 3440 B.P.

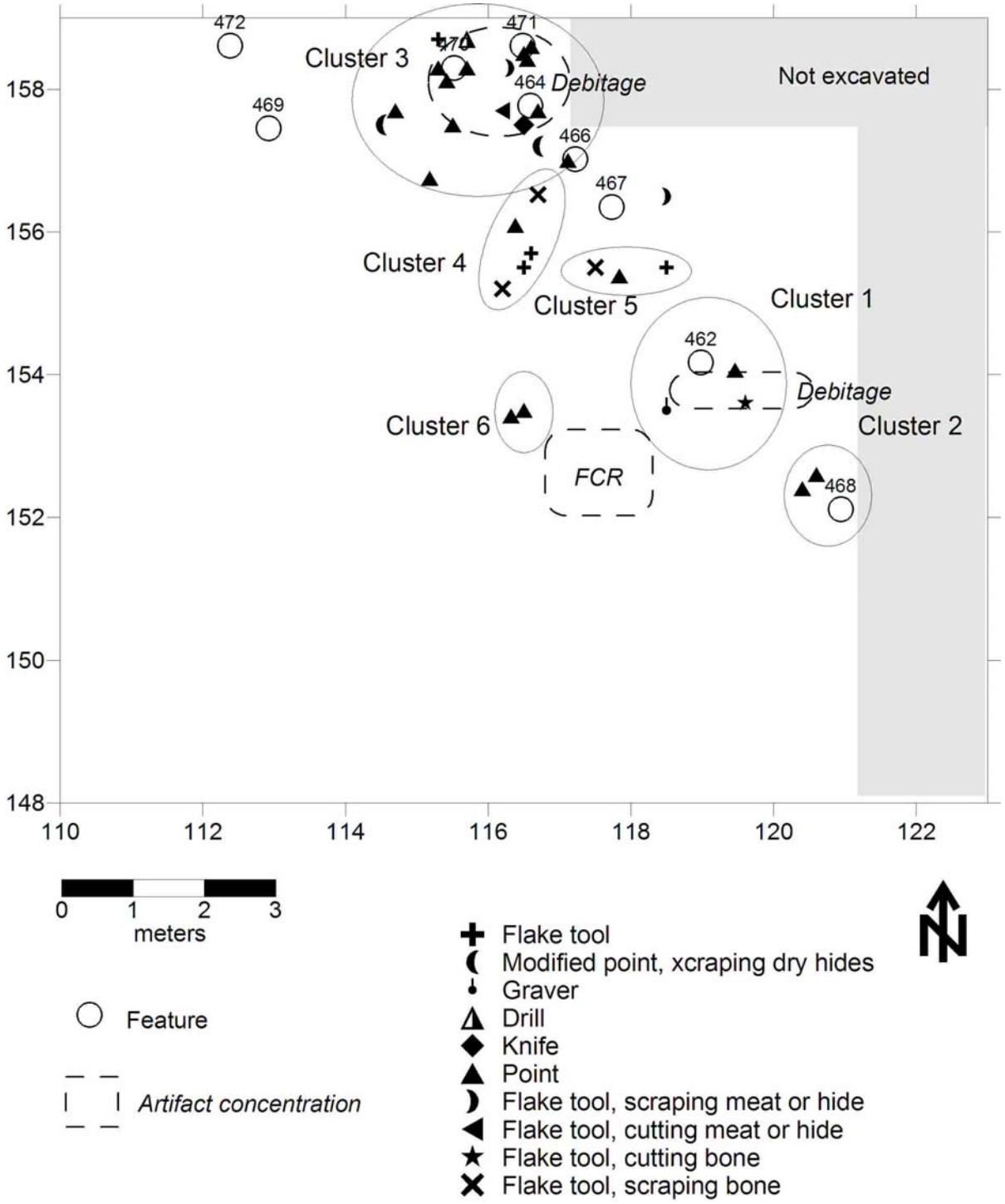

Figure 10.8. Distribution of Features and Tools in Area 2, ca. 4975 B.P.

APPENDIX 10B: IMMUNOLOGICAL ANALYSIS OF ARTIFACTS

IMMUNOLOGICAL ANALYSIS OF ARTIFACTS

FROM SITE 36AL480

PREPARED FOR

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Introduction

In the past twenty years research carried out in Europe and North America clearly show that organic residues recovered from lithics, ceramics, coprolites and soils, can be identified through the use of chemical and molecular biological techniques. Although these techniques are used with confidence in the `hard sciences', their application to archaeology is relatively new and, as such, there are still problems areas that need to be resolved (Thomas 1993). However, it is clear that data obtained by the use of these modes of analysis can provide unique insight into the evolution of animals and humans, prehistoric environments, prehistoric diet and subsistence, and tool function.

Immunological methods have been used to identify plant and animal residues on flaked and groundstone lithic artifacts (Allen *et al.* 1995; Gerlach *et al. 1996;* Henrikson *et al.,* 1998; Hyland *et al.* 1990; Kooyman *et al.* 1992; Newman 1990, 1995; Petraglia *et al. 1996;* Shanks *et al.*1999;Yohe *et al.* 1991) and in Chumash paint pigment (Scott *et al.* 1996). Plant remains on artifacts have been identified through chemical (opal phytoliths), and morphological (use-wear), studies (Hardy and Garufi 1998; Jahren *et al.,*1997, Sobolik 1996). Plant and animal residues on ceramic artifacts have been identified through the use of gas-liquid chromatography, high performance liquid chromatography and mass spectrometry (Bonfield and Heron 1995; Evershed *et al.* 1992*;* Evershed and Tuross, 1996; Heron *et al.* 1991, Patrick *et al.* 1985). Serological methods have been used to determine blood groups in skeletal and soft tissue remains (Heglar 1972; Lee *et al.* 1989) and in the detection of hemoglobin from 4500-year-old bones (Ascenzi *et al.* 1985). Human leukocyte antigen (HLA) and deoxyribonucleic acid (DNA) determinations made on human and animal skeletal and soft tissue remains have demonstrated genetic relationships and molecular evolutionary distances (Hänni *et al.* 1995; Hansen and Gurtler 1983; Lowenstein 1985, 1986; Pääbo 1985, 1986, 1989; Pääbo et al. 1989). Successful identification of residues on stone tools dated between 35-60,000 B.P. have been made by DNA analysis (Hardy *et al.,* 1997, while residues on surgical implements from the American Civil War were identified by immunological and DNA analysis (Newman *et al.,*1998). Horse exploitation was identified by immunological analysis of residues retained on Clovis points dated to ca. 11,200 B.P. recovered from a site in southern Alberta (Kooyman *et al.,* 2001) while a recent study demonstrated the viability of identifiable immunoglobulin G in 1.6 million-year-old fossil bones from Venta Micena, Spain,(Torres *et al.,* 2002).

The use of forensic techniques in the investigation of archaeological materials is appropriate as both disciplines deal with residues that have undergone changes, either deliberate or natural. Criminals habitually endeavor to remove bloodstains by such means as laundering, scrubbing with bleach, etc. yet, such degraded samples are still identified by immunological methods (Lee and De Forest 1976; Milgrom and Campbell 1964; Shinomiya *et al.* 1978, among others). Similarly it has been shown that immunological methods can be successfully applied to ancient human cremations (Cattaneo *et al.,* 1994). Forensic wildlife laboratories use immunological techniques in their investigation of hunting violations and illegal trade, often from contaminated evidence (Bartlett and Davidson 1992; Guglich *et al.* 1994; Mardini 1984; McClymont *et al.* 1982; among others).

Immunological methods are also used to test the purity of food products such as canned luncheon meat and sausage, products which have undergone considerable degradation (Ashoor *et al.* 1988; Berger *et al.* 1988; King 1984). Species identification of cooked meats has also been carried out by DNA hybridization assay (Chikuni *et al.*, 1990). Thus the age and degradation of protein does not preclude detection (Gaensslen 1983:225).

Materials and Methods.

The method of analysis used in this study of archaeological residues is cross-over electrophoresis (CIEP). (Newman 1990). Prior to the introduction of DNA fingerprinting this test was used by forensic laboratories to identify trace residues from crime scenes. Minor adaptations to the original method were made following procedures used by the Royal Canadian Mounted Police Serology Laboratory, Ottawa (1983) and the Centre of Forensic Sciences (Toronto). The solution used to remove possible residues is 5% ammonium hydroxide which is the most effective extractant for old and denatured bloodstains without interfering with subsequent testing (Dorrill and Whitehead 1979; Kind and Cleevely 1969). Artifacts are placed in shallow plastic dishes and 500 µl of 5% ammonia solution applied directly to each. Initial disaggregation is carried out by floating the dish and contents in an ultrasonic cleaning bath for two to three minutes. Extraction is continued by placing the boat and contents on a rotating mixer for thirty minutes. The resulting ammonia solutions are removed and placed in numbered, sterile, plastic vials and stored at -20C prior to testing It is important that on-site and off-site soil samples be included in all analyses as contaminants in soils, such as bacteria, tannic acid and iron chlorates, may result in nonspecific precipitation of antisera (Gaensslen 1983). Sterile equipment and techniques are used throughout this analysis and duplicate testing is carried out on all positive results.

A total of fourteen artifacts, recovered from site 36AL480, was submitted for immunological analysis of protein residues. Residues were removed from the artifacts as discussed above. Initial testing of samples was carried out against pre-immune serum (i.e., serum from a non-immunized animal). A positive result against pre-immune serum could arise from non-specific protein interaction not based on the immunological specificity of the antibody (i.e., nonspecific precipitation). No positive reactions were obtained and complete testing of artifacts was continued against the antisera shown in Tables 1and 2. Antisera from Cappel, produced for use in forensic medicine, provides family level identification only. The relationship of antisera to possible prey species is shown in Table 3. The plant antisera, raised against samples from modern species, provide family level identification only. Immunological relationships do not <u>necessarily</u> bear any relationship to the Linnaean classification scheme although they usually do (Gaensslen 1983).

TABLE 1: ANIMAL ANTISERA USED IN ANALYSIS.

ANTISERA	SOURCE
BEAR	CAPPEL
BOVINE	"
CAT	"
CHICKEN	"
DEER	"
DOG	"
GUINEA-PIG	"
RABBIT	"
RAT	"

TABLE 2: PLANT ANTISERA USED IN ANALYSIS

ANTISERA	SOURCE
AMARANTHACEAE	UNIVERSITY OF CALGARY
CAPPARADACEAE	"
CHENOPODIACEAE	"
COMPOSITEAE	"
GRAMINEAE	"
MALVACEAE	"

TABLE 3: POSSIBLE PREY SPECIES IDENTIFIED

ANTISERA TO:	POSSIBLE SPECIES IDENTIFIED
BEAR	BLACK, GRIZZLY
BOVINE	BISON, COW
CAT	BOBCAT, LYNX, MOUNTAIN LION. CAT.
CHICKEN	CHICKEN. TURKEY, QUAIL, GROUSE, PHEASANT
DEER	DEER, ELK, MOOSE, CARIBOU, PRONGHORN.
DOG	COYOTE, WOLF, DOG, FOX.
GUINEA-PIG	PORCUPINE, SQUIRREL, BEAVER, GUINEA-PIG.
RABBIT	RABBIT, HARE, PIKA.
RAT	RAT (ALL SPECIES), MOUSE (ALL SPECIES).

RESULTS

The results of the analysis are shown in Table 4 and discussed below.

Positive reactions to deer antiserum were obtained on two projectile points, FS# 1148 and FS#868 and two sherds, FS# 889 and #1047. As shown in Table 3 any member of the Cervidae family may be represented by these results but cross-reactions to other families do not occur with this antiserum.

Two artifacts, a biface, FS#2532 and a ceramic, Bag 14, Block 5, elicited positive reactions to rabbit antiserum. Any member of the order Lagomorpha may be represented by this result but cross-reactions with other families do not occur with this antiserum.

A stone bowl tested positive to capparadeaea antiserum. As previously discussed, this antiserum provides family level identification only and exact species cannot be determined at this time.

No other positive reactions were found in this analysis. The absence of identifiable proteins on artifacts may be due to poor preservation of protein or that they were used on species other than those encompassed by the antisera. It is also possible that the artifacts were not utilized.

TABLE 4 : RESULTS OF ANALYSIS:

ARTIFACT #	ARTIFACT TYPE	RESULT
1191.02	STEATITE	NEGATIVE
1675.01	CERAMIC	NEGATIVE
1999.03	STEATITE	NEGATIVE
1056.01	CERAMIC	NEGATIVE
889	CERAMIC	DEER
1047	CERAMIC	DEER
1148	PROJECTILE POINT	DEER
1081	PROJECTILE POINT	NEGATIVE
2532	BIFACE	RABBIT
2224	CERAMIC	NEGATIVE
26	PROJECTILE POINT	NEGATIVE
868	PROJECTILE POINT	DEER
BL. 5, BAG 14	CERAMIC	RABBIT
STONE BOWL	BOWL	CAPPARADACEAE

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