# VIII. SYNTHESIS AND CONCLUSIONS

## A. CHRONOLOGY

The archaeological investigations at the Whitby Branch Site revealed evidence of small-group visitation to the site from as early as 2000 BC up to AD 1250, spanning more than 3,000 years of prehistory. Four occupational episodes are indicated by diagnostic artifacts, although these episodes are not represented by clear-cut depositional relationships. The absence of vertical stratigraphy among the archaeological deposits can be attributed to the very gradual introduction of new soil material through aeolian deposition and the repeated use of the site over the course of three millennia, resulting in a mixing and compression of archaeological deposits on what is essentially a single occupational surface. Cultural variations, as manifested in the Woodland I complexes, reflect adaptation to local resources, environments, events, and people, but overall were modifications of the same basic pattern of lifeways found throughout Delaware.

The earliest phase of site use by Native Americans corresponds to the Clyde Farm complex of the Woodland I period, from about 3000 to 500 BC. Although poorly represented by diagnostic artifacts at the Whitby Branch Site, this time period marks the beginning of an intensified population movement into the coastal estuaries to exploit their abundant and diverse resource base (Custer 1984, 1989). Artifacts from the site that are representative of the Clyde Farm complex include a quartz Pequea point, a rhyolite Susquehanna Broadspear, and a steatite bowl fragment. A set of Poplar Island points probably overlaps the Clyde Farm complex and the subsequent Black Rock I complex, and cannot be definitively assigned to one cultural period.

The nearest excavated site with a Clyde Farm complex occupation is 12 kilometers (7.3 miles) north of Whitby Branch at the Snapp Site (7NC-G-101), located along the southern bank of the Chesapeake and Delaware Canal. Here, a large Clyde Farm complex base camp was identified with a proposed date range of circa 1200-700 BC (Custer and Silber 1995).

The next period of site use corresponds to the Black Rock I complex of the Woodland I period, which has recently been defined as dating from circa 500-1 BC (Custer 1994:23-24). Artifacts from the site attributable to this complex are limited to two sherds of Wolfe Neck-like ceramic ware, datable to 700-400 BC (Artusy 1976; Griffith and Artusy 1977). The presence of a large number of stemmed projectile points, including the Poplar Island type, may indicate a Black Rock I occupation, but these point types are difficult to associate with a single Woodland I phase. Based on the frequencies of radiocarbon and OCR assays attributable to the Black Rock I complex, however, it is possible that this was the most extensive period of site use at Whitby Branch. Three radiocarbon dates obtained from the site fall in the early part of the Black Rock I complex: 2,470 years BP ± 50 (Beta-100753), 2,600 years BP ± 60 (Beta-100754), and 2,540 years BP ± 70 (Beta-100755). Two OCR dates also indicate a Black Rock I complex occupation: 2,530 years BP ± 75 (ACT-2523), and 2,313 years BP ± 69 (ACT-2524).

Black Rock I complex settlement and subsistence patterns are believed to show a great deal of continuity with the preceding Clyde Farm complex. There appears to be a trend among Black Rock complex sites toward intensified food gathering and food production based on higher numbers of archaeologically identified storage pits. One implication of this finding is the likelihood of an increasing population base during the Black Rock I complex. The large storage pit identified as Feature 21 yielded a Black Rock I complex OCR date, and may reflect this trend toward the use of storage pits.

The third phase of site occupation occurred during the Webb complex of the Woodland I period, which is dated circa AD 500-1000. This complex is characterized by participation in an extensive trade network and by mortuary practices marked by prestigious, or exotic, grave goods (Custer 1989:291). Diagnostic artifacts from Webb complex sites include Hell Island ceramics and Jack's Reef projectile points. The Whitby Branch Site satisfies only one of these four generally diagnostic characteristics of the Webb complex, namely the presence of Jack's Reef Corner Notched points. The site, however, is within the geographic zone (southern New Castle County to southern Kent County) embracing the Webb complex, a factor that distinguishes it from the coterminous Delaware Park complex to the north. Identification of a Webb complex occupation at the Whitby Branch Site is also inferred from the proximity of the Hell Island Site (1 kilometer west) and its extensive Webb complex deposits.

The final occupational episode at the Whitby Branch Site occurred in the Woodland II period, post-AD 1000. Use of the site within the Woodland II period is based on the recovery of a single chert triangle point, and two radiocarbon assays: 880 years BP ± 60 (Beta-100757) and 730 years BP ± 40 (Beta-100752). Both radiocarbon dates were retrieved from charcoal found within small fire pits (Features 20 and 22) at the eastern edge of the site.

The Woodland II period is characterized by a contraction of the trade and interaction networks that prevailed during the Woodland I period, and by the nucleation of settlement into fewer and larger base camp sites. These changes in social processes were accompanied to varying degrees by increased reliance on the gathering of wild plants and a few domesticated cultigens, eventually leading in some areas to incipient horticultural production (Custer 1984, 1989, 1994). Full-blown agricultural subsistence is generally absent in the Delaware coastal plain.

## B. SUBSISTENCE

An understanding of prehistoric subsistence practices is greatly enhanced by the recovery and identification of botanical and faunal remains from archeological features and cultural contexts. By linking such remains with specific tool classes and feature types, it may be possible to discern subsistence trends or practices with regard to seasonality, chronology, and settlement pattern.

Faunal remains were not identified in site samples. The low quantities of archaeobotanical remains may be attributable to conditions of poor preservation within the soil matrix, or to the absence of human activities that might have contributed to their deposition within the archaeological record.

Flotation samples were collected from various excavation units and feature fills, and analyzed for remains pertaining to subsistence activities. In general, the flotation analysis yielded poor results, with few archaeobotanical remains retrieved from the samples. Charred nutshell, although found in many contexts, was present only in relatively low quantities, and only two seeds were recovered.

Archaeobotanical analysis revealed the charred remains of walnut nutshell (Juglandaceae family) and hickory nutshell (*Carya* spp.). Charred nutshell was found in all 17 samples from feature contexts submitted for paleobotanical analysis (see Appendix C). Feature types containing charred nutshell included fire-cracked rock (FCR) features, cobble caches, a possible house pit (Feature 19), and a storage pit (Feature 21). Charred nutshell may represent the remains of food consumed by the site occupants, but hickory nutshell is also recognized as an efficient smokeless fuel for fires (Smith 1985). The presence of charred nutshell within hearths is an interpretive problem, since nuts were roasted for their nutritional as well as for their thermal value. The recovery of nutshell in the storage feature, however, is a clearer indicator of nuts that were used solely for food. It is notable that although *Chenopodium* is one of the most commonly found seeds at Woodland sites in eastern North America and is considered one of the principal plant foods used by pre-agricultural Native Americans, its occurrence at the Whitby Branch Site was limited to an off-site control sample.

The general absence of plant food processing and preparation tools, such as mullers, metates, and pestles, suggests that food procurement and processing was not a primary activity of the Whitby Branch Site. Although the site was on the edge of open tidal water, no fishing implements, such as netsinkers, were found. Large acute-angled scrapers, of the type useful in de-scaling and filleting fish, were also not evident. The absence of faunal remains may be attributable to specific cultural behaviors of the site occupants, but the acidic soils found at the site are a poor medium for the preservation of bone.

While the composition of the tool assemblage appears to indicate that food preparation was not a major site activity at Whitby Branch, the presence of a number of FCR hearths is highly suggestive of formal cooking/heating areas. These areas are thought to have been focal points for many of the subsistence activities undertaken within a camp (Binford 1978), and the presence of these hearths suggests that the Whitby Branch Site served as a multifunction site for Native American groups who may have been attracted by the availability of stone cobbles.

## C. SETTLEMENT SYSTEMS

Models of Woodland I settlement systems in the northern Delmarva Peninsula tend to emphasize the spatial arrangement of site types around critical resources such as water, lithic raw material, and potential food sources, and the manner in which these patterns changed through time (Custer 1984, 1989, 1994; Thomas et al. 1975). Two basic models of settlement systems have been proposed. One model suggests that Woodland I populations were centered around large "macroband" base camps from which task groups or nuclear family units moved out seasonally to occupy smaller camps and procurement sites (Custer 1984, 1989, 1994; Thomas et al. 1975). The second model

eliminates the large multifamily base camps from the settlement system, in favor of single-family recurring-use camp sites (Custer 1994).

Understanding how these small kinship groups fit within the context of "community" and "society" is relevant to the study of how settlement systems interact with other systemic components of the biosocial environment, such as subsistence and ideology (Butzer 1982). In this sense, spatial behavior is as much a result of individual and group decision making as it is of resource location and topography. At the Whitby Branch Site, evidence was collected that sheds light on the patterns of settlement from the household, community, and regional perspectives.

*Household Settlement Patterns*. If a "household" settlement pattern can be said to exist, it should derive clearly from the verification of a residential structure, or "house." The identification of semi-subterranean pit house features in the Delmarva peninsula has been controversial because of the difficulty in presenting evidence that clearly substantiates the presence of these structures. A number of natural processes, such as tree-throws and animal burrowing, can mimic the archaeological remains of pit houses, rendering positive identification of encountered features difficult (Langohr 1993; Mueller and Cavallo 1995; Schuldenrein 1995; Thomas 1995). Features interpreted as pit houses have been challenged by other researchers because they do not conform to known house configurations found elsewhere in the Middle Atlantic region (Thurman 1987).

Features 19 and 21, located at the eastern margin of the Whitby Branch Site on the landform summit, have been interpreted as the remnants of a possible pit house based on the intersection of data from soil chemistry, radiocarbon and oxidizable carbon dating, soil stratigraphy, and artifact patterning. Feature 19 is the proposed base of the house structure, and Feature 21 is a large interior storage pit at its western edge. With its relatively small size, about 3x4 meters, yielding only 9.5 square meters of floor space, this structure would have provided shelter only for a single-family unit. The remains of walnut and hickory nutshell found in Feature 21 suggest a fall or winter occupation, as these items are most abundant during the fall.

*Community Settlement Patterns*. The number of households that may have co-resided at the Whitby Branch Site is difficult to gauge because the landform summit east of Feature 19/21 has been disturbed by U.S. Route 13; highway construction could have destroyed other pit houses that may have existed in that area. The large amount of lithic debris at the site suggests occupation by a larger group, or an extended occupation by a small group. However, while the debitage and tool frequencies found at the Whitby Branch Site are extraordinarily high for such a small site area, lithic reduction experiments have demonstrated that single flintknappers are capable of producing large quantities of debris, given a steady supply of lithic material (Ahler 1989).

Chronological data indicate that the site was visited and utilized over a time span of up to three millennia. Seasonal or yearly occupations of the site through the course of even a single century could conceivably produce archaeological deposits many times as extensive as that actually found. The dense accumulation of archaeological remains at the Whitby Branch Site when viewed across the long span of known occupation would appear therefore to indicate sporadic, even infrequent site

visits. It is reasonable to assume that some occupations were more intensive and lengthy than others, but based on feature densities and overall site dimensions, it is concluded that Whitby Branch Site visits were probably undertaken by no more than one or two family units at a time.

A habitation site occupied by one or two family units has been defined by Custer (1994:74) as a microband or recurring-use base camp, and is one of three main site types proposed for Woodland I settlement systems, the others being the nucleated macroband base camp and the procurement station. In addition to being occupied by a family or an extended family unit, microband base camps should be characterized by a number of tool classes and feature types, indicative of a variety of domestic subsistence activities. The Whitby Branch Site appears to be a good fit for this site type.

*Regional Settlement Patterns*. The settlement data from the Whitby Branch Site are useful in placing the site within the regional settlement system from two perspectives: site selection processes, and cultural variation. Site catchment analysis and patterns of regional site distribution demonstrate that proximity to water and access to critical resources are the two major factors in understanding site location within the Appoquinimink River drainage. All known sites within the drainage are located within about 100 meters (328 feet) of the river, one of its tributaries, or the tidal marsh, and are generally situated on well-drained areas of prominent to slight relief. The local area contains a great number of possible locations satisfying these two basic requirements, leaving actual site selection in the hands of individual decision-makers who evaluated their choices on the basis of tradition, perceived environment, immediate needs, long-term needs, and personal preference.

The Whitby Branch Site would have satisfied several critical needs for local hunter-gatherer groups, including access to water, proximity to tidal marsh vegetation and animals, a well-drained elevated location, and a cobble source for tool production.

The scarcity of rhyolite and the near-absence of argillite from the Whitby Branch Site artifact assemblage is in sharp contrast to sites of the Barker's Landing complex on the St. Jones and Murderkill drainages, which are characterized by high frequencies of these raw materials (Custer 1984:99, 107; 1994:134). The procurement and use of differing lithic raw materials are key elements in distinguishing populations affiliated with the Barker's Landing complex from those of the Clyde Farm complex to the north. The Whitby Branch Site is 30-40 kilometers (20-25 miles) north of the Barker's Landing core area; based on lithic procurement preferences, the Whitby Branch Site appears to have been occupied by Clyde Farm complex peoples. Territorial boundaries between the two complexes are difficult to delineate and may have been fluid. The Leipsic Site (7K-C-194A), located about 20 kilometers (32 miles) south of the Whitby Branch Site, contained a small Clyde Farm component (Custer, Riley, and Mellin 1996) and may have marked the southernmost limit of this complex.

The spatial distribution of the Black Rock I complex in Delaware is comparable to the preceding Clyde Farm complex, with minor variations in subsistence and diagnostic artifact styles, particularly ceramics (Custer 1984, 1994). The Black Rock I component occurring at the Whitby Branch Site appears to have encompassed at least a late summer to early winter occupation, based on the wide

distribution of nutshell in features dating to this period. The construction of a residential structure (Feature 19) suggests cold-weather habitation.

The identification of Webb complex components at the Whitby Branch Site and the Hell Island Site, 1 kilometer to the west, establishes the Appoquinimink River as the northern margin of this cultural complex. To the north, the Delaware Park complex displayed some of the same stylistic developments, but apparently lacked linkages to the elaborate exchange networks that characterized Webb complex society (Custer 1984:143). Some evidence exists linking the Webb complex with a population movement of Algonquian speakers from western New York State that may have facilitated exchange networks across this region (Custer 1990; Fiedel 1990). It is not clear, however, how pervasive such networks may have been, and whether all groups within a regional settlement system would have participated in and benefited from them. Microband or single-family groups of the kind that visited the Whitby Branch Site may not have had direct access to such networks, and may be typical of Custer's alternative settlement model, in which isolated households rarely coalesced into larger groups (Custer 1994:84).

Access to Vera Cruz, Macungie, and other eastern Pennsylvania jaspers that had previously been arranged through extra-group exchange networks may have been diverted by realignment of kinship territories and economic adaptations stressing group fissioning (Stewart 1989). These kind of proposed dislocations during the late Woodland I period may explain the exploitation of local jasper cobbles at the Whitby Branch Site for the manufacture of Jack's Reef projectile points. This adaptation to local resources is consistent with an apparent decline in exchange and interaction between groups preceding the onset of the Woodland II period (Custer 1990; Stewart 1989).

## D. ENVIRONMENTAL ADAPTATION

As coastal environments stabilized after a long period of increasing sea rise, circa 2500 BC, human populations began to intensify their exploitation of the estuarine margins supporting a diverse array of plant and animal species (Custer 1994:16; Kraft 1977). The Whitby Branch Site, located within this ecosystem, offered a variety of resource opportunities for Native American groups, including access to water, plants, animals, and cobbles for stone tools.

The occupation or use of any site is a response to physical and social needs conditioned by population densities, settlement patterns, environmental constraints, cultural perceptions, and individual decision-making processes (Butzer 1982:266). Key factors in site selection are believed to have been access to water and the availability of critical resources. Seasonal and geographical patterning of resource distributions suggests that hunter-forager groups had a detailed knowledge of their local environment, allowing them to select from a variety of locations for generalized resource procurement. For groups that were able to utilize a wide range of possible sites, this flexible type of settlement system was an important adaptive advantage.

A broad intensification of settlement patterns is apparent throughout the Woodland I period (Custer 1994:100), suggesting that population densities were increasing due to extended periods of

sedentism and access to a more productive resource base. Periods of increased population densities around fixed resources tend to create competition between groups by limiting the number of potential sites available to any single group (Butzer 1982; Carneiro 1967).

The intensive utilization of the Whitby Branch Site cobble beds may reflect competition for control of the highly productive Iron Hill lithic quarries near Newark in northern New Castle County, due to population growth and related reduction in group territories relative to earlier periods. Although the Whitby Branch Site is only one or two days' walk from the Iron Hill area, territorial claims exerted by northern kinship groups over the quarry sites may have made Whitby Branch one of few alternative sites with accessible lithic resources south of the Iron Hill area. The issue of territoriality and accessibility to lithic raw materials may be central to understanding the role played by the cobble exposures at the Whitby Branch Site during the Woodland I period. The best evidence of territorial constraints is present in the Webb complex occupation, which is well represented at the Whitby Branch Site and at the nearby Hell Island Site. Webb complex society is characterized by its integration into long-distance trade and exchange networks, but is also marked by its restricted distribution between the Appoquinimink River to the north and the Mispillion River to the south (Custer 1989:291). The absence of Webb complex expressions north of the Appoquinimink drainage may reflect the interplay of competition from Delaware Park complex groups near Iron Hill, and the ability of Webb complex people to cycle nonlocal lithic material into their toolkits. Whitby Branch may thus have served as an important supplemental, but not critical, source of stone during the Webb complex. Site visits by groups that did not participate, or were not well-integrated into long-distance trade and exchange, may have been prompted by the lack of other options.

## E. INTRASITE PATTERNING

The reconstruction of site activities at the Whitby Branch Site proceeded from an analysis of individual artifacts and cultural features to the delineation of their spatial arrangement within the site. Discrete site-activity areas are believed to reflect the patterned behavior of site occupants as they performed a variety of subsistence-related tasks, such as plant processing, food preparation, lithic procurement, and tool production and maintenance. Despite natural and cultural disturbances to the archaeological record, some patterning of artifact and feature distributions can be discerned and applied to the interpretation of site function.

The distribution of FCR hearths exhibits the clearest indication of spatial patterning, as most occur in the West Block Excavation. The proximity of these features to the wetland shoreline suggests that water for cooking purposes may have been a determining factor in their location. The northern edge of the West Block Excavation contains an extremely dense concentration of debitage, cores, and staged bifaces that is interpreted as a zone of discard from lithic reduction work stations centered around the hearths. The use of a hearth area as a focal point of activities within a campsite conforms to a large body of ethnographic and excavation data for hunter-gatherer cultures (Binford 1983).

Deposits associated with the Webb complex occupation (circa AD 500-1000) are inferred to be restricted to the West Block Excavation, based on the clustering there of Jack's Reef points and

jasper tools. There is a clear preference in Delaware for the use of jasper by cultures manufacturing Jack's Reef-style points (Custer 1989, 1996a), and this raw material preference appears to be reflected in the intrasite distribution of deposits at the Whitby Branch Site.

Rhyolite debitage displays a limited spatial distribution within the West Block Excavation and may represent a single episode of site occupation. As a nonlocal lithic raw material, rhyolite was probably brought to the site in unfinished form, perhaps as prepared blanks, and manufactured there into bifacial tools.

The one possible residential dwelling identified at the Whitby Branch Site was found on the summit of the site landform, situated away from the main hearth locus. The better-drained location on the summit may reflect preferences for domestic areas that were sited away from tool production areas and cooking/heating areas.

## F. TECHNOLOGY

The forms, patterns, and composition of lithic site assemblages are the means by which archaeologists attempt to reconstruct the technological organization of a prehistoric society. The choices of raw material procurement, methods of tool production and maintenance, and modes of discard are important clues as to how a society interacts with its biosocial environment. Given the durability of stone, lithic material is often the only physical residue of a prehistoric community found in an archaeological context, and is thus uniquely valuable in the analysis of that community's lifeways.

A continuum of tool manufacturing stages is evident in the Whitby Branch Site lithic assemblage. The presence of finished projectile points, staged bifaces, and flaked debris associated with early through late reduction activities attests to multiple lithic technologies employed by the site's occupants. Core reduction and bifacial reduction techniques for the manufacture of tools are inferred from tool frequency data, analyses of flake attributes, and flake-size distributions.

The excavations at the Whitby Branch Site revealed lithic artifact densities that are unusually high for either microband base camps or procurement stations in Delaware. The intensive reduction activities inferred from the observed debitage and tool frequencies suggest that the site functioned in large part as a lithic quarry and workshop. The identification of raw material sourcing for this activity would be an important step in the investigation of how prehistoric societies organized lithic procurement strategies.

The patterns of raw material procurement indicate a clear preference for local lithic sources. This assessment is based on four interrelated factors: (1) high cortex frequencies on tools and debitage, (2) low frequencies of bipolar cores and bipolar reduction flakes, (3) low frequencies of nonlocal raw material such as rhyolite and argillite, and (4) limited numbers of curated tools and formal scrapers. These indices of production and use suggest that a local source of raw material was both sufficient in quantity and appropriate in quality to satisfy most of the lithic reduction needs of site visitors.

With the exception of the Iron Hill jasper quarries located near Newark, Delaware, and ironstone quarries near the northern end of Chesapeake Bay (Custer and Galasso 1980), few lithic outcroppings are found in the Delmarva peninsula. Researchers differ on the possible strategies used by highly mobile groups of hunter-gatherers to obtain lithic resources. One school of thought has suggested that "rock hunts" were incorporated into the yearly or seasonal movements of people in search of routine subsistence resources (Binford 1979). The term "embedded procurement" was coined by Binford (1979) to reflect the belief that the acquisition of lithic raw materials was almost always structured by mundane subsistence and procurement activities pursued on a daily or regular basis. Binford's views are also a response to the fact that lithic artifacts, as highly durable materials, outlast almost all other kinds of material culture and thus as an expression of cultural behavior are overrepresented in the archaeological record. As important as stone was for hunting and resource processing, other materials, such as bone, antler, wood, and fabric, also served a multiplicity of tool functions, but these materials are not, in general, recoverable in archaeological investigations. The ubiquitous terms "stone age," "neolithic," "paleolithic," and the like as basic references to prehistoric periods is a reflection of the durability, though not necessarily the primacy, of stone.

An alternative to the notion of lithic procurement as an activity embedded in group organization is offered by Richard Gould (1980; Gould and Saggers 1985), who noted ethnographic accounts of Australian aborigines undertaking long treks to obtain stone from distant sources. Gould proposed that these nomadic groups took into account the technical properties of certain raw materials when choosing stone for specific tool types and functions, and would make special-purpose trips to collect them. He tested this idea against data from Australian sites and demonstrated a link between "exotic" nonlocal stone and a class of tools called "adzes," or hafted scrapers.

Some specialized tool forms in the Middle Atlantic region are known to have been made of exotic materials, such as cryptocrystalline Clovis fluted points, rhyolite Broadspears, and Vera Cruz jasper Perkiomen points, but the material for some of these tools may have arrived at their end point through intergroup trade and exchange mechanisms (Stewart 1989). Because the transport of stone has high costs, direct procurement may have become a less viable means of obtaining lithic raw material in the Middle Atlantic region as patterns of mobility grew more restricted with the onset of the Woodland I period. Increased population density and competition over resources may have generated territorial claims over lithic outcroppings and exposed cobble beds, forcing some groups to accept a subordinate role in a stratified system of access to resources, while other groups had the capacity to establish extra-local reciprocal relationships of trade and exchange.

Participation in intergroup exchange networks could have provided access to lithic sources outside a group's home territory, making it possible to circumvent hostile neighbors and eliminating costly long-distance treks. Other strategies to satisfy the requirements for stone implements involved the curation of tools to extend their use lives (Binford 1979, Shott 1996), and the participation in intergroup exchange networks to transport stone indirectly through trade (Stewart 1989). Another approach was the utilization of secondary lithic sources such as streambed and glacial outwash cobbles. Although cobbles are often unsuitable for tool use due to inferior quality, small spherical

size, or uncontrollable flaking characteristics, cobble sourcing may have become an important alternative in the lithic procurement strategies of Woodland I peoples in Delaware.

The Whitby Branch Site occupied a Pleistocene landform adjacent to a scarp where there may have been exposures of accessible cobbles and gravels. Large quantities of unmodified cobbles were encountered in the soil matrix during the archaeological investigations. Analysis of the tool assemblage provides several indices for measuring the relative abundance and degree of utility of the Whitby Branch Site cobbles, and demonstrates that this local lithic resource was the basic source of the accumulated flake debris. The term "lithic landscape" refers to the distribution of lithic raw materials across a region or area. An understanding of the lithic landscape is essential to understanding lithic resource utilization patterns, and Native American groups who developed stone tool technology doubtless had an intimate knowledge of the lithic landscape.

The quarrying of cobbles and gravels from a soil matrix has not been widely reported in Delaware, although it is known that scattered secondary gravel and cobble deposits are found below the fall line. Custer and Galasso (1980) have summarized Delaware's lithic landscape, observing that bedrock or primary lithic source areas are found only in the northernmost part of the state, near the fall line, while scattered secondary gravel and cobble deposits are found below the fall line. New Castle County in particular is one of two areas in the Delmarva Peninsula where major concentrations of secondary lithic deposits are concentrated (Spoljaric 1967). (The other is near South Island and Deal Island, where the ancestral Susquehanna, Potomac, and Nanticoke rivers converged to produce large point bar deposits.) The cobble bar deposits in New Castle County are attributable to point bar deposits associated with ancient channels of the Delaware River. Spoljaric's mapping of these Pleistocene stream channels suggests that they are quite extensive throughout New Castle County; however, most of these stream channels would have been filled with Holocene deposits, rendering the cobble beds relatively inaccessible. At Whitby Branch, the stream channel apparently exposed one of these ancient, buried cobble beds, thereby revealing a lithic source area.

Comparisons with a selected group of regional sites established that the high proportions of staged bifaces and cores found at the Whitby Branch Site were statistically significant. The great number of rejected or failed bifaces and discarded cores are interpreted as evidence that conservation of raw material was not a primary consideration for the site occupants. Cores and flakes reflecting bipolar reduction, which is an expected technological approach with limited cobble sourcing (Hayden 1980), were underrepresented in the site assemblage, suggesting that supplies of stone at the site were more than adequate for the requirements of flintknappers who visited the site.

The overwhelming majority of raw material in the Whitby Branch Site lithic assemblage is made up of quartz and quartzite, with important fractions composed of jasper and chert. These four stone types are common among the unmodified cobbles recovered during excavations, and comprise most of the core sample. Cobble cortex was identified on a majority of cores, an indicator that lithic sourcing was local. Whenever stone is collected for use away from its source, the cortex, or outer rind, of a cobble is almost always removed in an attempt to reduce its weight and thus the cost of

transport. This is one form of maximizing available resources. This strategy can be clearly seen in the low cortex frequencies of the rhyolite debitage; rhyolite was transported to the Whitby Branch Site from the South Mountain region of Pennsylvania, a distance of more than 150 kilometers (100 miles).

Access to lithic sources was undeniably one of the major attractions of the site to prehistoric groups dependent on stone for tools. In this sense, the Whitby Branch Site functioned as a procurement site, or cobble quarry, for secondary lithic sources. The kinds of tools manufactured by site visitors at Whitby Branch appear to have been structured primarily by the abundance and quality of the local raw materials, while such issues as settlement configuration, group mobility, and subsistence tasks seem to have played secondary roles in the organization of technology.

It is difficult, if not impossible, to place the lithic workshop and quarry-related activities securely within the overall site chronology. However, available information suggests that these activities were most likely not associated with the Woodland II occupation, as evidence of that occupational episode was found in the eastern part of the site, while the refuse associated with the lithic workshop was concentrated in the western end of the site. Also, the limited evidence of Woodland II occupation was based on the recovery of a chert triangle point, and the workshop refuse consisted overwhelmingly of quartz and quartzite debitage. Quartz and quartzite are the dominant materials used in the Poplar Island points, suggesting that the lithic workshop activities are most strongly associated with the Black Rock I complex. The distribution of radiocarbon and OCR dates also suggests that the Black Rock I occupation may have been the most intense period of site use. The unusually large quantities of refuse associated with the lithic workshop and quarry activities suggest that the site was repeatedly visited for the same purpose; however, it cannot be stated with certainty whether the material was generated during a few relatively brief, but intense, episodes or whether it was deposited over a relatively more lengthy period of site occupations.

## G. FUTURE RESEARCH

While the excavation of the Whitby Branch Site has provided important new information regarding the prehistory of Delaware, particularly for the Woodland I period, there are still several important information needs that remain for future investigation. The most current state archaeological resource management plan for the Woodland I period defines a number of information needs, or research questions: paleoenvironmental issues, chronology, household settlement, community settlement, regional settlement, lithic technology, ceramic technology, and subsistence. Additional information needs pertain to (i) trade and exchange, (ii) mortuary ceremonialism, (iii) prehistoric migrations, and (iv) trends in sociocultural evolution. As these additional topics are deemed to be of a more theoretical nature, they are not considered to be suitable for single-site investigations (Custer 1994:171-179).

As the state plan is structured, the issue of site integrity is linked to the question of whether an individual property has the potential to contribute to one or more of the information needs. Significant sites (i.e., those eligible for the National Register of Historic Places) are those that can

be demonstrated to be intact, as opposed to "disturbed" sites. By definition, "intact" sites are those that have not been plowed or that have been plowed but possess intact features below the level of the plowzone (Custer 1994:177-178).

As many Woodland I sites, including the Whitby Branch Site, have been excavated recently, it is appropriate to review the current status of the Woodland I context and to suggest some refinements in the direction of future research. A comprehensive review of the Woodland I context is beyond the scope of this report; however, a few specific suggestions may be offered for research on settlement and subsistence patterns.

The existing model for the Woodland I period (Custer 1994) indicates that this period was characterized by a mixed economy based on hunting, fishing, and the gathering of plant foods. The existing model posits that advances in plant food processing occurred during the Woodland I period, based on the addition of plant food processing tools to the basic toolkit and the use of pits that were presumably employed for the storage of seasonally surplus foods. While many Woodland camps have been excavated, there is relatively little direct information available about the types of plant foods that were used by Woodland I groups. It is argued here that recovery of subsistence data is one of the primary research priorities for future work on Woodland I sites. Such subsistence data would include seeds or other remains of plant foods, dietary bone, and animal residues (commonly termed "blood residues").

Well-preserved dietary bone assemblages have been very infrequently reported from Woodland I sites in Delaware; this is generally attributed to the acidic coastal plain soils. Although it was anticipated that the Whitby Branch Site might provide new information about Woodland subsistence patterns, the excavation results were somewhat disappointing in this regard. The lack of well-preserved archaeofaunal assemblages, with the exception of shellfish, has been typical of many other Woodland sites that have been recently excavated in Delaware: for example, the Snapp Site (Custer and Silber 1995), the Carey Farm and Island Farm sites (Custer, Watson, and Silber 1996), the Leipsic Site (Custer, Riley, and Mellin 1996), and the Lums Pond Site (Petraglia et al. 1997).

While recent excavations have consistently failed to recover significant faunal assemblages, the recently developed techniques for the identification of "blood residue" on stone tools appear to have some potential for interpreting prehistoric subsistence patterns. However, the results in this area have not yet matched initial expectations, and there is disagreement regarding the utility of these techniques for archaeological analysis (Custer et al. 1988; Dent 1995:173; Eisele et al. 1995; Inashima 1992; Kooyman et al. 1992; Smith and Wilson 1992). Given the general lack of well-preserved faunal assemblages in Delaware coastal plain sites, further exploration of the techniques for detection of animal residues on stone tools would appear to have some merit for Woodland sites in Delaware.

Analysis of protein residues on stone tools has met with equivocal results in the Middle Atlantic region. Skepticism about the validity of such analysis has been a common response to negative results, or to results that one would intuitively regard as suspicious. This has led to a belief among

some researchers that protein residue analysis is based on questionable methodology, or that residues are so poorly preserved in northeastern environments that reliable results will be unobtainable. Given these doubts, many feel that scientific resources should be targeted toward other procedures.

Recent investigations of Site 36CO17 and Site 36CO18 on the North Branch of the Susquehanna River, however, indicate that some of the difficulties encountered in residue analysis may be the result not of fundamental principles, but rather of the kinds of protein antisera against which stone implements have been tested. Artifacts are often tested against antisera that have been developed from nonlocal species that share protein signatures with indigenes only to the family level. In an effort to obtain species-specific results, live fish specimens known to have been indigenous to the Susquehanna River during the major occupational phases of the two sites were used to prepare antisera (Jacoby et al. 1996). Artifacts from the site were then tested against these local species, as well as several commercially available terrestrial and aquatic species. Strongly positive results were obtained from two of the locally caught fish species, gizzard shad (*Dorosoma cepedianum*) and American eel (*Anguilla rostrata*). Positive results from the commercial series were refined only to the family level for trout (Salmonidae) and catfish (Ictaluridae). The ability to relate positive antisera results to specific indigenous species is viewed as an important advance in the utilization of relict residues on stone tools recovered from prehistoric archaeological sites, and it is recommended that this method be tested at other sites.

The existing model for Woodland I subsistence posits an increasing reliance on plant foods, and the current state plan has established the recovery of archaeobotanical assemblages as the top priority for Woodland I subsistence patterns (Custer 1994:175). The recovery of archaeobotanical material is, in large measure, dependent on the application of flotation recovery techniques. Botanical data, however, present a unique set of interpretive problems, and it does not necessarily follow that all seeds, charred or otherwise, recovered from archaeological contexts represent plants that were consumed or intentionally used by the site inhabitants (see Holt 1991; Keepax 1977; Minnis 1981; Moeller 1986; Smith 1985). Flotation recovery has been successful at a few Middle Atlantic sites (e.g., see Dent and Kauffman 1985; LeeDecker et al. 1991), thus significantly expanding the understanding of prehistoric subsistence practices. The recovery of analytically significant material from flotation samples taken from Delaware sites has been inconsistent, for reasons that are not fully understood at present. For example, at the Two Guys Site (7S-F-68) in Sussex County, a very small but analytically significant assemblage of charred sumpweed (*Iva annua*) was recovered from Woodland I and Woodland II contexts (LeeDecker et al. 1996). Sumpweed, which has not been reported from any other site in Delaware, was one of the earliest domesticated plants in eastern North America, having been recovered from contexts dating as early as 7,000 years BP, and it is believed to have played a prominent role in the transformation from gathering wild plants to intensive agriculture (Smith 1992a, 1992b).

Flotation analysis has been reported from a number of recently excavated Woodland sites in Delaware, but the results have been perplexing. For example, at the Leipsic Site (Custer, Riley, and Mellin 1996), historically introduced taxa (copperleaf, carpetgrass, and bristlegrass) were present in the assemblages recovered from supposedly intact pit house features. The presence of European

plant species at the Leipsic Site features could, however, be attributable to rodent disturbance, as the excavators noted rodent burrows in a number of the pit features. The high frequency of European seeds together with rodent disturbances at the Leipsic Site points up the need to investigate sites that exhibit a high level of integrity. Similar problems with the flotation data have also been reported from the Carey Farm Site (Custer, Watson, and Silber 1996:46). It is recommended that future paleobotanical studies in Delaware be carried out with a rigorous methodology, and that alternative explanations be developed for "intrusive" material.

Lithics are typically the most abundant type of artifact at prehistoric sites in the Middle Atlantic region, and lithic remains are found at nearly all Woodland I sites in Delaware. Lithic technology is therefore one of the most common research areas investigated at these sites. The analysis of small flaked lithic debris, or debitage, has only recently come into its own as an integral component of archaeological investigations, with particular reference to prehistoric economy and technology (Shott 1994). Drawing on an increased understanding of the physical properties involved in lithic fracturing and an enhanced ability to source lithic raw materials, researchers have been able to document relationships between archaeological assemblages and the human activities responsible for their production and deposition. Still, the large quantity of debitage yielded by some sites can consume a sizable portion of the analyst's time and budget, reducing the level of effort in the analysis of other artifact classes. An alternative analytical approach that treats debitage in the aggregate rather than individually is presented as a viable means of categorizing flaked debris by reference to specific size grades. Ahler (1989) termed this method "mass analysis" because of its ability to quickly order large numbers of debitage through the use of a series of graduated geologic screens. Data sets obtained in this manner can also be easily compared with other site assemblages because of the reliance on objective, replicable traits such as flake size and weight. In the current study, Berger was able to demonstrate interesting contrasts between two sets of debitage by using this kind of approach, illustrating differences that were not apparent in the more traditional analysis of diagnostic flake attributes. Mass analysis appears to be a fruitful avenue of future research because of its ease of use, ability to generate data that can be subjected to a variety of statistical techniques, and comparability between data from different sites.

In the Delaware state plan, settlement patterns may be examined from the perspective of (i) household settlement patterns, (ii) community settlement patterns, and (iii) regional settlement patterns (Custer 1994: 172-173). Regional settlement patterns, according to the state plan, are not well suited to investigation at the level of small-scale surveys or individual site investigations. Household and community settlement patterns are appropriately studied at the level of the individual site excavation.

At the regional level of analysis, settlement pattern models based on a distinction between "microband base camps" and "macroband base camps" are widely used. The distinction between these two site types is based on the premise that under certain circumstances, individual families or households would aggregate into larger, or "macro," family units to accomplish specific subsistence tasks, perform community rituals, or seek common protection against intrusive groups (Custer 1984:67). Typically, macroband base camps were formerly thought to be characterized by a broad

range of tools, large quantities of debitage, and access to a wide spectrum of subsistence resources. The advantageous environmental settings of these larger base camps and the large artifact assemblages associated with them suggested long-term multiple occupations by large groups. Microband base camps were understood to display evidence of occupation by a small group, such as a single family or household. The expected quantities of artifacts found at these sites would be less than at macroband base camps, and the productivity of the surrounding ecosystem would likely be lower. However, it is difficult to discern objective criteria to distinguish sites occupied by microbands from those occupied by microbands. Given the conceptual difficulties in distinguishing between these site types, it is appropriate to examine the utility of these site types in future work. Custer, who once freely employed the "macro-band" terminology, has come to question whether such camps exist, and he suggests that the search for a clear-cut example of a Woodland I macroband base camp should be given a high priority (Custer 1994:83, 173).

Although many Woodland sites have been excavated in Delaware, there is a great deal of uncertainty concerning the characteristics of the household and community settlement patterns associated with these sites. In the state plan, household settlement studies focus around pit houses (Custer 1994:46, 172-173). These houses are generally recognized in the archaeological record by subsurface pits which represent the basement of a structure that would have been covered with skins or bark over a structure of posts cut from saplings. After abandonment of the houses, the basement pits become filled with organic matter, which enables recognition of such pits during archaeological excavation. Some of the pits also include cooking/heating areas, represented by clusters of FCR, and deeper pits for the storage of surplus foods (Custer 1994).

The recognition of prehistoric house pits in Delaware has been viewed with skepticism on the part of many archaeologists, for a number of reasons. First, prehistoric houses in the surrounding region are generally recognized by the presence of post molds, which represent the decayed supports for the houses' superstructure. Most of the reported examples of Delaware pit houses lack associated post molds; this could, however, be the result of poor preservation. Also, many of the Delaware pit houses lack associated cooking/heating areas or organic fills, which leads many archaeologists to believe that the pit-like features seen in the archaeological record are disturbances in the soil that would result from natural processes such as the uprooting of trees during high winds. Resolution of the debate (Custer 1994; Custer and Silber 1995; Liebknecht 1995; Mueller and Cavallo 1995; Schuldenrein 1995; Thomas 1995; Thurman 1987) concerning the origin of these pit features is central to understanding Woodland I household and community patterns, and this should be a priority for research.

While thousands of pit houses have been excavated and reported from sites in Delaware, such as the Delaware Park (Thomas 1981) and Clyde Farm (Custer and Bachman 1982) sites in northern Delaware, and the Snapp (Custer and Silber 1995), Leipsic (Custer, Riley, and Mellin 1996), and Carey Farm (Custer, Watson, and Silber 1996) sites along the SR 1 corridor, key questions remain unresolved with regard to the identification and function of pit features. The most important problem relates to the identification of pit houses and whether they are legitimate representations of prehistoric structures, or whether they are simply natural disturbances coincidentally found in

archaeological contexts (see Mueller and Cavallo 1995; Small et al. 1990). Feature 153 at the Snapp Site is considered to be one of the few examples of a well-preserved pit house feature (Custer and Silber 1995:43). The proposed house outline for Feature 153, however, is relatively large for so few posts; only nine posts are represented in the house outline. Perhaps this will eventually be considered a common pattern in Delaware prehistoric pit house construction. The problem is that the overwhelming majority of similar house-like features in Delaware lack clearly defined posts.

At the Carey Farm Site, nearly 2,000 pit features were excavated, and the majority were ultimately declared to be non-cultural. Among the non-cultural features, most were determined to be tree-related, and one-third were historic fenceposts. Tree-related features were identified by the presence of "irregular root protrusions that extended from the base of the soil stains" (Custer, Watson, and Silber 1996:71), which indicates that it was necessary to excavate the features in order to determine whether they were tree-related or cultural.

Identification of the pit features as cultural rather than natural phenomena seems to be based primarily on their visual characteristics, i.e., slight variations in the soil color. At the Locust Grove Site (7NC-F-13), a similar pit feature was found in the yard of a nineteenth-century farmhouse. During data recovery (Affleck et al. 1997), this feature (Feature 9) was treated as a possible prehistoric house, and was fully excavated. Feature 9 at the Locust Grove Site exhibited a well-defined basin-shaped profile and an oval plan view, comparable to features that have been interpreted as prehistoric house pits at other sites in Delaware. However, very little evidence of prehistoric occupation was recovered from the Locust Grove Site during Phase I, Phase II, and Phase III excavations. A few pieces of lithic debitage were recovered from the site, along with a narrow-bladed, stemmed projectile point. No prehistoric artifacts were recovered from the Feature 9 fill, although a small amount of historic glass and brick was recovered. No suitable charcoal samples were recovered from the pit fill, but four soil samples were processed for OCR dating. The OCR dating results were inconclusive; one control sample from the adjacent subsoil yielded a calculated OCR date of 5,569 years BP, and three samples from the pit fill yielded OCR dates of 3,700 years BP, 5,915 years BP, and 6,100 years BP (Affleck et al. 1997:65-67). Feature 9 at the Locust Grove Site was also investigated by a series of soil chemistry tests. Chemical readings from the Feature 9 fill did not differ significantly from those of the surrounding subsoil (Affleck et al. 1997:116-117).

A series of flotation samples from the Locust Grove Site were also processed, including a sample from Feature 9 and a control sample from beneath Feature 9. The Feature 9 sample did not contain any botanical material that would suggest that it was a prehistoric house pit, and the control sample beneath Feature 9 contained modern weed seeds (Affleck et al. 1997:108-115). An additional point that raises doubt about a prehistoric origin for Feature 9 is the site location, which is hundreds of meters from any surface water source; most prehistoric sites from which pit houses have been reported are campsites located near a source of water. Overall, the investigation of Feature 9 at the Locust Grove Site would indicate that it was a modern or historic disturbance, possibly produced by an uprooted tree, although it was indistinguishable from a "Delaware pit house," based on its visual characteristics when first observed in the field and during its subsequent excavation.

Excavation of the feature did not reveal any direct evidence, such as irregular root protrusions, that it was an uprooted tree.

Excavations at the Whitby Branch Site have provided another example of a Woodland camp with a possible pit house. The Whitby Branch Site included numerous cooking/heating areas represented by FCR clusters, as well as a refuse disposal area for lithic debris, and a single possible pit house feature, with an interior storage area represented by a deeper storage pit. Overall, the Whitby Branch Site had a high degree of integrity, and most of the site had never been plowed. Intrasite patterning showed that the possible pit house was separated by some distance from the refuse dump and the cooking/heating area represented by FCR clusters. Interpretation of this feature as a prehistoric house is supported by (1) its shape (roughly oval in plan view), (2) its large size—3.45x3.1 meters in plan, (3) elevated levels of total phosphorus, in comparison to samples from non-feature contexts, and (4) a radiocarbon date from the pit fill which falls in the Woodland I period. Aside from total phosphorus, other soil chemical tests were somewhat equivocal regarding the prehistoric origin of this feature.

There are numerous other archaeological examples that fail to show a clear-cut pattern of association of pit features and prehistoric cultural deposits, which calls into question the attribution of prehistoric origin for these features. Similar pit features have been found at a number of historic sites that have been excavated in Delaware. At the Moore-Taylor and Benjamin Wynn farmsteads, for example, numerous soil discolorations have been documented and determined to be non-cultural (Grettler et al. 1996). In plan view, these features exhibit the range of shapes and sizes that have been assigned to various Woodland I pit house types. While these historic site examples indicate that pit features are found throughout Delaware on both historic and prehistoric sites, archaeologists do not have explicit criteria for separating them into prehistoric pit houses or other entities.

One of the strongest arguments for the prehistoric origin of these pit features is their occurrence at prehistoric sites, but this argument loses validity when one considers that such features are found throughout Delaware, not only at prehistoric sites. The presence of these features at historic sites such as Locust Grove, and the Moore-Taylor and Benjamin Wynn farmsteads, has been noted. At prehistoric sites, there are also anomalous intrasite distributional patterns that call into question the prehistoric origin of these pit features. At the Leipsic Site, for example, prehistoric artifacts were concentrated in the southern portion of the site, while pit features were found throughout the stripped area. The investigators claimed that the paucity of artifacts in the northern portion of the site was due to erosion (Custer, Riley, and Mellin 1996). This explanation is not fully convincing, however, as one would expect that artifacts would have been left in the northern area of the site as lag deposits.

Another anomaly in the association of prehistoric material and the pit house features is the phenomenon of the "floating" FCR clusters. Some Woodland I pit houses reportedly have interior cooking/heating areas that would be represented in the archeological record by clusters of FCR or burned earth, and the idealized reconstructions show a hearth area on the basement floor of the pit house (Custer 1994). There are, however, a number of excavated examples in which the hearth area, represented by an FCR cluster, seems to "float" above the floor of the pit feature, such as Feature

45 and Feature 198 at the Snapp Site (Custer and Silber 1995:77, plate 29; 89). Neither of these two examples could be interpreted as an interior hearth, as the FCR is stratigraphically above the fills deposited in the pit after its abandonment. At the Hockessin Valley Site, the stratigraphic position of the hearth area is uncertain, as FCR was pedestaled above the pit floor during excavation (Custer and Hodny 1989:plate 1, 32; plate 2, 35). Exterior hearths, possibly communal processing areas, are also hypothesized for Woodland I base camps (Custer 1994), and the "floating" FCR features could represent such features. At the Whitby Branch Site, FCR clusters were located in a separate area of the site, away from the possible pit house feature.

While analogies for pit houses can be found in the ethnographic record, it is ultimately necessary to deal with the archaeological representations of domestic structures. Surface structures such as wigwam-type houses with shallow posts are not uncommon in the ethnographic record, nor are igloo-shaped and longhouse forms with straight posts sunk deeper into the subsoil uncommon. Pit houses with excavated "basement" floors, but lacking posts, are indeed rare; hence the argument that structures without posts represent the basal portion of structures compromised by plowing (Custer and Silber 1995). Logically, the *absence* of post molds cannot be used to support the argument that the pits are cultural, notwithstanding the known effects of historic cultivation.

Another problem with proposed pit house features is the inconsistency in individual structure size and in the overall community pattern. In any culture area, there is a range in stylistic attributes and a range of variation in size for the prehistoric structures that characterize that region. For example, Monongahela houses in western Pennsylvania range between 4 and 6 meters in diameter, are circular in outline form, have central hearths, and form part of a community pattern that consists of a circular pattern of structures around an open central plaza (George 1974). Even numerous episodes of structure rebuilding have done little to obscure this general cultural pattern. The same kinds of consistencies need to be discerned in Delaware pit house communities. Custer's argument that large sites such as the Carey Farm Site (Custer, Watson, and Silber 1996), the Snapp Site (Custer and Silber 1995), and the Leipsic Site (Custer, Riley, and Mellin 1996), with numerous overlapping pit features, represent a series of small, repeatedly occupied microband base camps, rather than a large macroband base camp, could explain the apparent lack of a community pattern at these Woodland I base camps, but the wide variety of individual house types suggests that some proportion of the features are non-cultural. Objective criteria for identifying pit houses in Delaware will only become available through additional research.