V. THE LUMS POND RESEARCH DESIGN

Introduction

The prehistoric cultural remains at the Lums Pond site provided an opportunity to examine a number of issues that are relevant to archaeology in Delaware and the Middle Atlantic, as well as addressing several more universal concerns, both methodological and substantive, of interest to the general archaeological community. Archaeological research in New Castle County and the State of Delaware has focused on documenting and explaining the development of hunter-gatherer societies through time using the material evidence recovered at prehistoric sites. Most research efforts have centered on the study of prehistoric technology, settlement changes, and subsistence practices. Jay Custer (1989: 23) one of the leading regional proponents of the investigation of the interaction of aboriginal people and their surrounding environments, amply described how and why this research perspective is taken:

> To a large degree, the types of materials found in the archaeological record determine the ways in which archaeologists can study human behavior. Stone tools, house remains, living debris, and pottery fragments constitute the bulk of the archaeological record of the Delmarva Peninsula and, as a result, archaeologists have been best able to understand the technology and subsistence patterns of past groups. Plant food remains, pollen, and other data can be used to reconstruct ancient environments. Consequently, many archaeologists are drawn to anthropological theories that focus on how human cultures adapt to their natural environments.

This culture-ecological perspective, and its goal of identifying and explaining the mechanisms and dynamics behind the evolution of prehistoric societies, is at the core of most archaeological research in the Middle Atlantic region (e.g., Gardner 1978, 1982; Stewart 1980; Custer 1984, 1989). While archaeologists have made certain generalizations about prehistoric societies based on shared material traits (e.g., artifacts, community patterning), researchers have also recognized that there was tremendous geographic and temporal variability in societies. The Delmarva Peninsula is no exception to this, and a number of study units defined by time periods and regions have been identified to better understand biosocial environments and adaptations (Custer 1989). Given this research perspective, the archaeological investigations at Lums Pond were considered to be valuable for understanding prehistoric adaptations in the High Coastal Plain of Delaware, an area typified by a rolling topography, with a mosaic pattern of well drained and swampy physiographic settings. Although the study of prehistoric activity on

the upper reaches of the High Coastal Plain is of some significance for elucidating prehistoric adaptations, detailed archaeological investigations have not been conducted in all parts of the research unit, particularly in the vicinity of the Lums Pond site. As a consequence, archaeological investigations at Lums Pond were ideally suited to contribute to a greater understanding of Delmarva prehistory.

Temporal indications collected during field work at the site demonstrated that occupations likely spanned from the Archaic to Woodland II periods. Since the occupations ranged through different climatic episodes, the materials recovered from the site were a potentially valuable source of information on changing patterns of settlement and subsistence. The site also occurs in a specific environmental zone, on the floodplain and terraces of an inland stream, a tributary of the St. Georges Creek. Prehistoric occupation in these particular environmental settings has not received much archaeological attention. The Lums Pond site investigations were therefore geared to help document settlement and adaptations in relation to a distinct resource zone. The ultimate goal of the research was to compare long term land use with data from adjacent areas in order to develop a more complete understanding of hunter-gatherer adaptations.

Research Questions

To explore the question of how prehistoric inhabitants adapted to their environment, a large and diverse body of information was collected from Lums Pond. It was necessary to gather archaeological data which could address the timing of site occupation, ecological setting, technology, subsistence practices, and settlement patterning. Specific questions relating to each of these topics are presented below.

Chronology

What periods of time were represented at the site?

Human habitation in the Delmarva Peninsula occurred over a 14,000 year span. One of the most basic questions archaeologists must answer from the outset of any site investigation concerns the period of occupation. To understand what people were doing at a particular place during a particular time, it is important to know if the artifacts recovered from a site are the byproduct of only one or two occupations, or perhaps a series of many occupations. Archaeologists working in the Middle Atlantic typically rely on two sources of data to address site chronology: a) material traits, and b) radiocarbon samples.

Archaeologists have established age ranges for particular material traits. Certain projectile point styles and certain ceramic traits are considered diagnostic of specific time periods. The correspondence between certain material traits and time periods has been established through study of the position of artifacts in vertical soil profiles, in which the older styles and forms are typically found underlying younger ones. The artifacts found during the Lums Pond investigation could thus help to establish how many periods of prehistory were represented at the site. Archaeologists have also found radiocarbon dating to be valuable for accurately determining periods of site occupation. Radiocarbon dating is a laboratory technique which is based on the observation that the ratio of carbon isotopes in organic materials changes through time. Thus the ratios measured for particular samples may be compared against the established sequence, and an age approximation may be obtained. Charcoal, which is particularly suited to this type of analysis, was found in several locations at Lums Pond and was collected to date particular features and superimposed layers. In some instances, charcoal was found to be associated with projectile point and ceramic types. As a result, the Lums Pond investigations could help to refine the approximated ages of these chronologically diagnostic artifacts.

Environment

What was the habitat like and what plant resources were present?

Prehistoric economies were adapted to, and developed within, certain habitats. The distribution and abundance of critical resources often shaped settlement strategies. Reconstruction of particular habitats is most often accomplished by study of topography, soil, and vegetation. The modern landscape at Lums Pond shows some degree of diversity, the rolling topography containing a hill crest and a sloping surface which meets a stream with its associated floodplain and wetlands. During the 14,000 years of human habitation of the region, the landscape likely changed in subtle, but significant ways. Discovering the extent of these changes may have implications for our understanding of human responses and activity. Observation, identification, and mapping of the location of certain types of soil deposits provides an effective way to identify major landforms and detect changes in the topography. In addition, changes in the landscape may be signaled by differences in sediment grain size and chemicals in soils, indicating contributions of certain environmental processes. Variations in deposits of sediment grains are sensitive indicators of dominant environmental processes, such as wind- or stream-borne conditions. Chemical tests of soils were proposed based on the hypothesis that particular elements are associated with certain moisture regimes and climatic conditions.

The Lums Pond site preserved aboriginal features with charcoal and horizons rich in carbonized organic remains. The presence of carbonized botanical remains in features and horizons was presumably the result of burning during site occupation. The presence of these macrobotanical remains presented the possibility that identifiable plant and wood fragments were preserved, thereby providing a picture of the immediate vegetative community.

If information about the landscape and vegetative communities at Lums Pond could be gathered, it might be possible to correlate the evidence with established regional models. Similarities and differences between those models and the Lums Pond data could indicate the place of the site within the regional environmental context, further elucidating aspects of prehistoric settlement and subsistence.

Technology

What kinds of artifact types are represented at the site?

Prehistoric peoples relied on wood, bone, shell, and stone to fashion a variety of tools. Since stone is the only substance that preserves well over hundreds if not thousands of years, the main source of information archaeologists have at their disposal is this highly durable material. Stone objects may include chipped, ground, or battered materials depending on the technique of artifact manufacture and use. As at most archaeological sites, chipped stone objects, produced by the splitting or reduction of rock by percussion, were the most commonly identified materials at Lums Pond.

In addition to stone tools, pottery is the only other form of aboriginal material that usually survives in archaeological context in the Middle Atlantic region. Beginning around 3,000 years ago aboriginal peoples began to manufacture ceramic vessels by treating, molding, and firing clay. Manufacturing techniques and decorative patterns used on ceramics varied according to location and time, and thus archaeologists have classified a number of these attributes into a variety of time-sensitive markers.

All of the artifacts recovered in the Lums Pond excavations were classified into discrete categories, such as flake, biface, projectile point, or ceramic (see glossary and Appendix A for the artifact catalog). In certain cases, particular artifact categories could be further subdivided into classes (e.g., Brewerton projectile point). Archaeologists have created these classifications based on ethnographic accounts of how objects were used by aboriginal peoples and from archaeological investigations which have recognized common material traits which can be codified into typologies. Once artifact

classifications were accomplished, analysis of the frequency and diversity of artifact types could be conducted, with the main aim of inferring the kinds of prehistoric activities occurring in the site.

What raw materials were used to fashion chipped stone tools and where were they obtained?

Aboriginal peoples intentionally selected certain types of stone to fashion chipped stone objects. Stone materials suitable for flaking were usually chosen for their inherent properties for controlled fracturing. The controlled fracture of stone allowed for the manufacture of certain tool forms such as projectile points. Among the types of raw materials that were commonly used in Northern Delaware are chert, jasper, argillite, rhyolite, ironstone, quartz, quartzite.

The raw materials available for stone tool manufacture in the region differ in regard to the natural form in which they occur. Stone is available in two forms, as weathered debris in geologic outcrops or as pebbles and cobbles in secondary outwash deposits such as gravel bars in streambeds. The size and form of the original raw material has an obvious effect on the potential form of the stone tool it is used to manufacture—tools produced from pebbles cannot assume the size and proportions of a tool produced from large nodules from a geologic outcrop. The Lums Pond data set could provide potential information about how aboriginal peoples used and manufactured these variable stone materials.

What was the source of the jasper from Lums Pond?

Jasper was a well known rock type to aboriginal peoples of Delmarva, and it was extensively used in all periods of prehistory. Regionally, jasper occurs in outcrops in southeastern Pennsylvania, northeastern Maryland, and northwestern Delaware. In Delaware, jasper outcrops in a number of locations on and near two well known hills called Iron Hill and Chestnut Hill. Archaeologists have grouped the Delmarva outcrops under one broad term, the "Delaware Chalcendony Complex". Although typed under one term, the Delmarva sources vary in color, texture, and potential manufacturing quality. Visual inspection and initial geochemical studies indicate that stone from the Delaware Chalcendony Complex may be distinguished both from other jasper quarries, such as those in the Hardyston Formation further north, in Pennsylvania, and from each other.

To confidently assess the original sources of the jasper from Lums Pond, visual and laboratory analyses were proposed. The primary goal was to determine if the jasper at the site were obtained from the Hardyston Formation or from the Delaware Chalcedony Complex. If from the latter, analysis was further aimed at pinpointing the particular outcrop. To examine the variability in sources, samples from various quarries had to be obtained. Once acquired, the visual study entailed comparison of the Lums Pond material to the acquired quarry samples. To further distinguish the materials, laboratory studies were undertaken, and included microscopic examination of the structure of the stone material as well as chemical studies. If the quarries could be successfully discriminated by visual and laboratory studies, the original location of the Lums Pond materials could be traced, contributing to our understanding of human mobility patterns or trade networks. Moreover, if a regional model could be developed from this study, it might serve as the basis for future studies, further examining the movement of materials throughout Delmarva.

What were the quality and flaking characteristics of jasper from Lums Pond?

Jasper recovered from Lums Pond that came originally from quarry sources was probably selected by aboriginal peoples based on its favorable flaking characteristics. The jasper within Delmarva quarries is known to vary tremendously in quality, ranging from fine grained material that can be predictably shaped into tools to coarse grained and flawed material that does not allow for controlled flaking. To better understand the relative quality of the Lums Pond jasper for controlled flaking, experimental research was conducted. Jasper exhibiting a range of quality was selected from Northern Delaware outcrops to examine its varying flaking characteristics. Once these characteristics were determined, a comparison could be made with the archaeological samples from Lums Pond. Such a comparison allowed for a greater insight into whether the jasper on site represented unusable and discarded debris or high quality materials that were manufactured into tools and carried away.

What reduction methods were used to fashion chipped stone tools?

Stone tool manufacture begins with procurement of naturally occurring raw materials. To manufacture tools, knappers strike off pieces from a natural stone until a desired product is reached, whether a tool manufactured from the original stone itself or the flake byproducts. A variety of techniques and combinations of techniques may be employed to reduce stone. For example, prehistoric knappers may have reduced natural stone by free hand percussion, where the stone was held in the hand, carefully struck by a

stone hammer, and subsequently thinned and finished. In contrast, knappers may have employed the bipolar technique, where a stone was rested on the hard surface of another stone, referred to as an anvil, and struck with a stone hammer, resulting in shattered debris. Each of these techniques and manufacturing stages results in recognizable sizes and shapes of tools and debris.

Archaeologists have realized that important behavioral information may be obtained by analyzing the characteristics of tools and debris. The attributes provide clues about reduction techniques employed and the manufacturing stages represented on site. The frequency of occurrence of certain tool types and the morphological characteristics of particular tools (e.g., early or late stage bifaces) may distinguish tool types. Mass analysis, a technique developed to examine attributes related to size in large artifact assemblages, is of use for discriminating stages of stone tool manufacture. Flake attributes (e.g., weight) and their striking surface attributes (e.g., platform size, angles, crushing), may also assist in interpreting the reduction method used. The degree to which cortex is present also gives an indication of whether the early or later stages of manufacture are represented. Refitting, or reassembly of stone debris, may help to reconstruct the precise ways in which flaking was conducted.

What residues were preserved on stone tools?

Aboriginal peoples employed chipped stone in a wide range of activities, many of which left material residues on the surfaces of the tools. Prehistorians have recognized that these potential sources of information may be preserved on some of the stone tools that are found archaeologically. Consequently, archaeologists have attempted to extract residues from stone tools as a means of determining which animals or plants were important in prehistoric economies. This kind of archaeological research is in its developmental stages, however, and much careful research needs to be conducted before positive identifications can be made. The goal of the Lums Pond residue study was to contribute to the scientific development of residue techniques, determining whether animal or plant residues were present or absent on stone tools and to what level of resolution these could be recognized. A larger goal was to investigate the practical use of residue studies in examining prehistoric economies at this stage of archaeological research and to make recommendations as to whether they might be effectively employed at other sites in Delmarva.

Subsistence

Was evidence present which related to prehistoric diet?

Archaeologists have recognized that subsistence practices of aboriginal peoples varied significantly owing to changes in environment and variations in settlement systems. One major change seen across the broad span of regional prehistory was the transformation from small, highly mobile, foraging groups early in prehistory to fully sedentary, horitculturally based villages in later periods. The Lums Pond site contained features and organic layers indicating that there was a potential to examine prehistoric diets during particular periods of time. The excavation was therefore geared towards recovering macrobotanical remains such as seeds and nuts from prehistoric contexts. If botanical remains could be identified, subsistence practices could be determined.

Settlement

What spatial patterns attributable to prehistoric activity were recognized within the site?

One aim of archaeological research is understanding how the spatial arrangement of artifactual debris at a site represents the remnants of prehistoric activity. The excavations at Lums Pond were geared towards locating intact deposits with artifacts and features. The main goal was to understand the overall site structure, or how artifact patterns and features related and articulated with one another.

One of the first aims of the site structure study was to identify any potential features which could provide information on past activity. Since natural processes may replicate or mask features that are cultural in origin, formal feature analysis is a critical part of archaeological investigation. To examine whether the features at Lums Pond represented primary human activity, natural processes, such as animal burrowing or tree throws, or a combination of processes, the features were examined with regard to morphology and contents. Particular analytical techniques were used, such as geochemical testing. If certain features could be shown to be the result of cultural processes, then particular site activities could be determined, such as residential occupation, food processing, or storage. Once cultural feature types were better understood, their relationship to overall artifact patterns could also be examined.

Often, the meaning of the distribution of artifacts over horizontal surfaces is not readily apparent from direct observation. As a consequence, archaeologists have employed mathematical techniques to analyze artifact distribution and identify patterns

that may be attributable to human activity. Contour mapping of artifact frequency gives an impression of the density of materials in a particular location, potentially referable to individual occupation episodes or activity sets specific to a particular period of time. Spatial plotting may be performed for artifacts in intact deposits or it may be used in disturbed contexts, for example, examining the extent to which behavioral patterns may survive in plowed soils. In this way, distribution maps of artifact densities, tool types, debitage types, raw materials, and fire-cracked rock from intact surfaces may reveal locations of primary behavioral activities.

In addition to understanding prehistoric technology, artifact refitting is also potentially useful in deciphering aspects of site structure. Observation of the locations of refitted chipped stone artifacts and fire-cracked rock can provide important information about the degree to which site patterns are intact. For instance, widely separated refits over horizontal and vertical horizons may indicate disturbance by human activity such as trampling over occupation surfaces, or by natural transformations such as animal burrowing. If refitting can demonstrate that patterns represent primary areas of behavioral activities, reassembly can indicate how space was used by the site occupants.

What was the nature of settlement in the project area through time, and how do these patterns compare with settlement patterns in other geographic locales?

The ultimate aim of the Lums Pond excavations was to understand how the site functioned in an overall settlement system. The Archaic period has been characterized as a time during which small, mobile groups utilized a variety of environmental settings, scheduling activity in response to changing seasonal habitats and resources. Archaic settlement was focused on a variety of productive habitats, particularly swampy settings, and an intensified use of plant foods. In contrast to Archaic adaptations, Woodland period settlement was geared towards increasing reliance on stable estuarine marshes and riverine resources, resulting in more sedentary lifestyle able to support larger groups of people. From these semi-permanent base camps, it is theorized, limited forays by smaller groups were made into interior areas to procure resources. The Lums Pond site can be used to test particular aspects of these Archaic and Woodland settlement pattern models. Data from Lums Pond as to the number of occupations represented, their temporal ranges, the size of the occupations and specific activities performed will aid in interpreting the use of inland riverine settings along streams such as St. Georges Creek, and in particular microenvironments of the upper fringes of the High Coastal Plain.