Current Approaches to the Analysis and Interpretation of Small Lithic Sites in the Northeast

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Edited by
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New York State Museum Bulletin Series 508
New York State Education Department, Albany

Printed in the United States of America

Copies may be ordered from:
Publication Sales
3140 CEC
New York State Museum
Albany, New York 12230
Phone: (518) 402-5344
Fax: (518) 486-2034
Email: nysmpub@mail.nysed.gov

Library of Congress Catalog Card Number: 2007939912

ISSN: 0278-3355
ISBN: 1-55557-237-5

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PREFACE

The importance and research potential of small lithic sites (or lithic scatters) was the subject of the general program of the Spring 2003 meeting of the New York Archaeological Council. The program sparked much discussion between the participants and the audience regarding the importance of these sites, their eligibility for the State and National Register of Historic Places (S/NRHP), and whether public funds should be expended to preserve and/or mitigate these sites before they are destroyed through construction projects.

In November 2003, Charles Fisher and I organized a colloquium entitled "Current Approaches to the Analysis and Interpretation of Small Lithic Sites in the Northeast" at the New York State Museum in Albany. The goal of this colloquium was to provide a venue within which the previous discussion could continue by including archaeologists, cultural resource managers, and state historic preservation officers from across the region.

I was concerned when the call for papers went out that we would not be able to get enough participants to make the effort worthwhile. In the end, the subject was of such interest that we received twice as many abstracts as could be presented in a daylong colloquium. Attendees included prehistoric archaeologists, cultural resource managers, representatives from various State Historic Preservation Offices, students, as well as representatives from the National Park Service and the Federal Highway Administration in Washington, D.C.

This volume has its genesis in the papers presented during that colloquium. As usual, not all of the participants were able to submit their papers for publication. The following volume includes 14 of the 23 papers presented at the colloquium. Introductory and concluding chapters complete the volume. The chapters include submissions on the importance of small lithic sites in the Northeast as it extends from Ohio to eastern Massachusetts and from southern Pennsylvania to Ontario. Small lithic sites dating from the Archaic Period (c. 10,000 B.P.) to European Contact (c. 500 B.P.) are discussed within the volume's chapters.

Given the diversity of papers, this volume is arranged topically around three general themes: Defining and Assessing the Research Potential of Small Lithic Sites, Small Lithic Sites and Their Contributions to Local and Regional Settlement Systems, and Managing and Evaluating National Register Significance of Small Lithic Sites. These themes underlay the debate over lithic scatters in the Northeast and juxtaposed in this manner provide a framework for evaluating the problems inherent in the management of these sites.

Volumes such as this are not created alone but rather rely on the talent and hard work of a number of individuals. First and foremost, I would like to thank the author's for their thoughtful contributions and their timely submissions. Without their interest in these small sites, completion of this volume would certainly not have been possible. John Skiba saw the publication through the review and publication process. Patricia Kernan drew the art displayed on the cover. Rachael DeCrescenzo provided clerical assistance during the colloquium and afterwards.

Finally, conversations with staff from the Cultural Resource Survey Program at the New York State Museum, including Scott Cardinal, Daniel Mazeau, Barry Dale, Bob Dean, David Staley, and Mike Lenardi, were important in demonstrating the pitfalls and challenges in managing and interpreting these small lithic sites. Their comments regarding these small sites (both positive and negative) did not go unnoticed. Finally, I would like to thank the two anonymous reviewers whose comments helped to refine and focus the volume.

Christina B. Rieth
January 2008

CHAPTER 1

INTRODUCTION

Christina B. Rieth

Small lithic sites (or scatters) represent one of the most common site types identified in the Northeast. These sites are commonly identified in both upland and lowland settings and represent areas where resource extraction, processing, and collection often take place. Some of these small sites may also contain residual evidence of overnight or temporary lodging and meal preparation activities (Piles and Wilcox 1978; Means 1999; Rieth 2003a; Shen 2001). In this way, these small sites offer a view of life beyond residential and community boundaries (Lennox 1995). Small lithic sites are also not limited to a single culture-historic period but rather span the region's entire 12,000-year history of human occupation (Funk 1976; Ritchie and Funk 1973; Snow 1980).

Despite the prominence of these sites across the Northeast, small lithic sites are the least commonly referenced site type in the archaeological literature and are considered by some archaeologists as the most difficult site type to deal with when assessing research potential and function (Barber 2001; Carr, this volume; Lennox 1995). The limited artifact assemblages, absence of complex and formal work areas, and limited number of features often result in the conclusion that these sites have little or no research potential.

It is with this idea in mind that the current volume is presented. Fourteen of the chapters in the volume were presented as papers in a symposium entitled "Current Approaches to the Analysis and Interpretation of Small Lithic Sites" held at the New York State Museum in Albany in November 2003. These papers are couched in between an introduction and concluding chapter. The primary goal of this colloquium was to provide a venue within which the importance and significance of small lithic sites could be discussed by including prehistoric archaeologists, cultural resource managers, and state and federal historic preservation officers from across the region.

The resulting papers (and subsequently the chapters in this volume) cover a wide range of environments and report on groups that exhibit a diverse array of settlement and subsistence attributes as measured through the types of resources exploited and the settlement features of these populations. Despite the different theoretical and methodological frameworks in which the authors pursue their work, the papers in this volume are united not only by a common thematic focus but are also united by the authors' decisions to question the assumption that these small sites do not produce meaningful information about the past and therefore have little or no significance within archaeology.

DEFINING SMALL LITHIC SITES

A volume of this nature must begin with a definition of small lithic sites (or lithic scatters). While this may seem like an easy task, Northeast archaeologists have defined lithic scatters in a variety of ways leading some archaeologists to suggest that the concept should be abandoned altogether (Barber 2001; Carr, this volume).

Beckerman (2002:1-1) has defined lithic scatters as sites composed almost entirely of chipped stone artifacts and generally measuring less than a half-acre in size. Given the temporary nature of such sites, lithic scatters are also defined by a limited number of non-residential features. Beckerman (2002) suggests that flakes are the most common artifact class found on these sites. Chipped and ground stone tools, when found, represent minor artifact classes.

A similar definition is provided by Custer (1988:31-32) who states that lithic scatters are "sites…[with]…fewer than 30 flakes and fewer than 5 bifaces or projectile points…cover[ing] less than 100 square meters". Although Custer's definition includes raw material as an important attribute of lithic scatters, raw material type is not a defining characteristic of most lithic scatters.

Finally, Barber (2001:85), drawing on the work of others states that lithic scatters include sites with the following attributes: (1) a surface scatter of debitage (although occasionally subsurface), (2) sites that are less than 30 square meters (100 square feet) in area, (3) Artifacts usually number less than 50 total, (4) Tools and bifaces are rare, and (5) Ceramics are rare.

While Barber acknowledges the fact that these characteristics are accurate in portraying sites identified as "lithic scatters" in the Northeast and Middle Atlantic, he cautions us that this definition does little to describe the function of these sites within Americanist archaeology stating

Current Approaches to the Analysis and Interpretation of Small Lithic Sites in the Northeast, Edited by Christina B. Rieth, New York State Museum, The State Education Department, Albany, New York 12230. New York State Museum Bulletin 508

that the concept itself is "devoid of cultural meaning" (Barber 2001:85).

All of these definitions contain criteria relating to the occupation's size and the density of artifacts produced per square meter. However, as Miller (this volume) points out, these criteria are often problematic since many lithic scatters are identified during cultural resource management investigations which do not investigate the entire site but rather only that portion of the site which lies within the proposed project limits. As the chapters by Blakemore et al. (this volume), Carr (this volume), and Jones (this volume) point out, these small lithic sites may also represent evidence of larger more substantial camps (and perhaps even villages) that have been deeply buried. Insufficient testing of these small sites may result in more substantial occupations never being investigated or, worse yet, being destroyed completely through construction projects.

Complicating this matter is the inherent variation in sites caused by the skill of the knapper, the material being knapped, and the type of tool being manufactured. Lithic sites with very little debitage may result from a very skilled knapper who produces limited amounts of debitage when utilizing a high quality material (Barber 2001:89; Custer 1988). That same knapper may produce much larger quantities of debitage if poorer quality materials are used and/or the piece is continuously refined to make a usable tool. Likewise, if the goal of the knapper is to re-sharpen a scraper or biface then smaller amounts of debitage should be expected when compared to an activity involving the production of a new tool.

ROLE OF SMALL LITHIC SITES IN NORTHEAST SETTLEMENT STUDIES

Although small lithic sites are regularly integrated into regional settlement and subsistence models elsewhere (e.g. Binford 1991; Bintliff et al. 1999; Gamble 1991; Piles and Wilcox 1978; Ward 1978; Zvelebel et al. 1992), in the Northeast, these sites are often viewed as unimportant when considered in relationship to larger residential sites. While this bias is partially due to academic research problems centering on the reconstruction of culture history, equally important problems have also resulted from the absence of optimal survey and excavation strategies needed to locate such sites as well as a failure on the part of archaeologists to understand the relationship between small sites and the larger settlement system (Lennox 1995; Smith 1997; Wall 1996). Studies by Lennox (1995), Means (1999), Miroff (2002), Pilon and Perkins (1997), and Smith et al. (1997) represent notable exceptions.

The archaeology of the Northeast is often characterized as one in which large camps and residential sites dot the landscape. While occupation of these larger communal sites undoubtedly played an important role in the settlement and subsistence systems of these prehistoric populations, resource processing stations, including those associated with the collection of lithic samples for the manufacture of stone tools, the processing of roots, tubers, and the like for medicinal, utilitarian, and cosmetic purposes, played a critical role in the survival of the prehistoric populations of the Northeast.

Lennox (1995:6) points out that "villages… must have been a hive of activity…with the demands…on local resources being incredible…Satellite communities as well as fishing and hunting camps and isolated activity areas must have diffused this environmental drain over a broader area… lessening the likelihood of failure". Descriptions of small fishing, food procurement, and cabin sites in ethnohistoric descriptions of the Huron (Tooker 1991:62-67), Mahican (Dunn 1994), Western Abenakis (Calloway 1994:7-8) and Five Nations Iroquois (Van den Bogaert 1988) further highlight the important role that these small sites played in the daily survival of Native populations.

While descriptions of small lithic sites are often found in published articles and non-published cultural resource management reports, it is important to note that not all lithic scatters contain the same settlement features nor do they function in the same way (Beckerman 2002; Bragdon 1996; Carr 2002; Otto 1991; Piles and Wilcox 1978; Ward 1978). As studies by Smith et al. (1997) and others have shown, small sites within a limited geographic region can be quite diverse and represent a wide range of settlement features, many of which may be unknown to archaeologists. Only by comparing the individual characteristics of these sites (e.g. spatial arrangement, types of artifacts, number and types of features, site size, geographic location, etc.), can archaeologists hope to gain a more complete picture of the role of these small lithic sites within complex settlement systems.

Finally, quite often the archaeological evidence left by these small lithic sites represents the activities of one or a few individuals (Duncan 2001:95; Lessler and Brashler 1996:189-202; Means 1999; Pilon and Perkins 1978). The activities of these individuals may occur during daily foraging forays, during periods of solitary activity, and/or out of sheer of necessity. Although these sites have traditionally been associated with male activities, recent research has suggested that some of these small lithic scatters may in fact represent the activities of women (Oskam 1999; Perrelli 2001; Versaggi 2002). The role of women's labor (as well as that of adolescences and elderly members of the community) is often overlooked and is not afforded the same attention as that of adult males when interpreting these small lithic sites.

Ethnohistoric descriptions of indigenous groups docu-

ment the important role that female, juvenile, and elderly labor played in the day-to-day survival of the community. In some instances, gender related tasks are dictated through the social organization and functioning of the larger community (Classen 1997:65-87; Perrelli 2001; Tooker 1991).

Gero (1991:163-193) in her study of genderlithics argues that gender related tasks could be reconstructed through a detailed analysis of the types of lithic artifacts found at a site. Small lithic sites utilized by females and/or other non-adult male members of a community should be expected to have different archaeological signatures from those produced by adult males. Differences may include but are not limited to, increased quantities of expedient tools, differences in the types of materials exploited, and the quality of raw materials used.

SMALL LITHIC SITES AND THEIR TREATMENT WITHIN CULTURAL RESOURCE MANAGEMENT

The treatment of small lithic sites in the Northeast has been variably considered within the context of cultural resource management. While some archaeologists have extolled the benefits of these small sites and their importance (Bergman 2002; Perrelli 2001; Versaggi 2002), others dispute the notion that these sites can make any meaningful contributions of our understanding of the past.

Lithic scatters are often revealed through modern plowing, which disturb subsurface deposits transporting them to the ground surface. Plowing is especially problematic since subsurface features associated with these sites are all too often destroyed. Fragile artifacts such as pottery sherds and botanical remains, which may provide further contextual information about the site, may also be destroyed. A more detailed synthesis of the problems inherent in the analysis of plowed lithic sites can be found in Blakemore et al. (this volume), Carr (2002, this volume), Hasenstab (this volume), and McLearen and Fokken (1986:xiii-xiv).

Other construction projects including road building, soil mining, dredging, and pipeline surveys are equally damaging to small lithic sites (Means 1999; Montague et al. 2005; Versaggi and Hohman, this volume). The large-scale nature of these projects, combined with the limited size of these lithic sites, often results in entire sites being destroyed during a single building episode. Portions of sites not directly impacted by construction projects are often subject to other impacts caused by staging areas, trampling and modification through pedestrian activity as well as impacts that expose the site to collecting and looting by the public.

The field methods required to retrieve information about these sites are partially dependent upon the size of the site and the area being investigated. Traditionally, pedestrian surveys, shovel testing, and more substantial test unit/trench excavations have been employed to identify and mitigate these small sites (Binzen, this volume; B. Grills, this volume; S. Grills, this volume; Jones, this volume; Knapp 2005a; Leveillee and Harrison 1996; Miroff 2002; Montague et al. 2005; Rieth 2003, 2003a). Recently, however, other non-traditional field techniques have been suggested as a means of excavating and recovering information from these small sites. Included among these approaches are repeated plowing, disking, mechanical soil stripping, and the use of furrow trenching (English Heritage 2002).

More extensive analyses conducted during field excavations also have the potential to provide important information that can be used to interpret these small sites. As demonstrated by Elyea and Doleman's (2002) investigation of three lithic scatters in New Mexico, detailed geomorphologic and paleoethnobotanical analysis of soils from these sites can provide information about the local climate, physiological, and environmental setting at the time of use. These field analyses compliment artifact analyses and provide an important source of information that was otherwise not available.

In the Northeast, studies such as those conducted by Abel (2002:181-215), Miroff (2002:193-200), Knapp (2005a), Perrelli (2001), and others (MacDonald and Cremeens 2002: 17-50; Rieth 2003a) have used ethnobotanical and geomorphological data to enhance interpretations, which would not have been available from artifact analyses alone. These types of analyses have resulted in more detailed information about the function of the sites, prehistoric settlement features, and the relationship of these sites to the surrounding landscape.

Bergman (2002) and others (Jones and Beck 1992:167-192) note that in order to gain meaningful information from lithic scatters, new and more creative laboratory techniques must also become regular components of cultural resource investigations. Techniques, including use- and micro-wear analysis (Bergman 2002; Keeley 1979; Rieth 2003a), refitting studies (Bergman 2002), trace element analysis (Burke 2000:1-20; Calogero 2002:89-104), thermoluminece dating, and blood residue analysis, have the potential to provide information that is not available from simple lithic classification schemes alone. Although these analyses are often costly and require trained professionals to conduct these analyses, the information gained by these studies can provide invaluable information to support National Register determinations.

Unfortunately, archaeometric techniques such as these are currently used in limited quantity across the region. Studies by Versaggi (2002) to analyze under what circumstances expedient tools were used in the uplands of east-

ern and central New York, Rinehart (this volume) and Bernstein and Lenardi (this volume) on lithic tool manufacture in southern New England, Burke (2000) to reconstruct trade and lithic procurement patterns in the maritime peninsula of Canada, Bergman's refitting study of bifacially worked tools in Somerset County, Pennsylvania (2002) and Pope and Will's (2002) study of lithic resource use south of the Great Lakes, represent notable exceptions.

Geographic Information Systems (GIS) and other computerized modeling techniques have the potential to revolutionize our interpretation of these sites by providing a mechanism for documenting the spatial arrangement of artifacts within specific sites as well as the interpretation and spatial arrangement of small lithic sites within a larger valley corridor (Crumley and Marquardt 1990; Ebert 2004; Sloma and Callum 2002; Smith 1997; Volmar and Blancke 2002: 125-138). As the chapters by Curtin et al. (this volume), B. Grills (this volume), Miller (this volume), Perazio (this volume), and Rush et. al (this volume) point out, regional analyses of small lithic sites offer important insights into the settlement patterns, movement, and intra-regional interaction patterns of prehistoric populations.

The use of computerized modeling to create sensitivity models and reconstruct distribution patterns for these sites allows us to reinterpret older research contexts about the range of site settings occupied by past groups. As Dewar and McBride (1992), in their study of hunter-gatherer land use in Connecticut, point out the ability to expediently model these small sites, affords us the opportunity to consider the likelihood that previously unsurveyed aspects of the landscape may contain evidence of prehistoric occupation. Such information not only assists archaeologists in interpreting large areas but also provides important information that could be used to formulate new research contexts.

SMALL LITHIC SITES AND THE NATIONAL REGISTER OF HISTORIC PLACES

The National Register of Historic Places (NRHP) is the nation's official list of properties that have been determined to be significant to the prehistory and history of the nation. Quite often, properties are nominated to the NRHP through cultural resource investigations conducted to comply with Section 106 of the National Historic Preservation Act, which requires federal agencies take into consideration the effects of impacts to historic properties as a result of their undertakings.

Properties included on the NRHP include a variety of archaeological and architectural properties associated with the indigenous and historic populations of our nation (Little et al. 2000). Examples of archaeological sites on or eligible for the National Register include but are not limited to the following: large prehistoric village and ceremonial sites, lithic quarries, submerged shipwrecks, nineteenth century domestic and commercial sites, historic landscapes, monuments, and cemeteries, Colonial occupations, and Revolutionary War and Civil War battlefields (Parker and King 1992).

Traditional cultural properties (TCPs), properties important for their association with a living community's cultural practices or beliefs, have also recently been included on the NRHP (Parker and King 1992). Examples of TCPs may range from small ceremonial sites with limited artifact assemblages to larger sites, such as Honolulu's Chinatown, measuring many acres in size and containing formal architectural and ceremonial features.

For a site to be eligible for the National Register of Historic Places, it must meet one of four basic criteria based on its association with an important event that has made a contribution to the broad patterns of our history (Criterion A), association with the lives of a person or persons significant to our nation's past (Criterion B), embodiment of distinctive type, period, or method of construction (Criterion C), and/or ability to contribute important information related to the past (Criterion D). Archaeological sites are usually eligible for the NRHP under Criterion D, which states "a property is significant if it has yielded or may be likely to yield information important in prehistory or history" (Little et al. 2000:29-30; Parker and King 1992:10-12).

Little et al. (2000) indicate that for a property to be significant, it must contain integrity of location, design, materials, setting, workmanship, feeling, and/or association. As Beckerman (2002:2) points out, in the Northeast, archaeological sites conveying excellent integrity are limited due to years of development and land use that have impacted many of the archaeological sites discovered today. Presently, many archaeological sites lack important settlement and diagnostic characteristics as a result of repeated plowing and collecting over the last century and a half. All too often, determinations of significance are based on less than perfect data sets which force archaeologists to make decisions as to whether a site is significant or not (see Carr, this volume). Given all of this, we are left to ask, whether lithic scatters are important enough to be included on the National Register. If so, how do we determine which sites are significant?

Small lithic sites, like other properties listed on the NRHP, represent historic resources that inform us about our past through the material and non-material assemblages produced during excavation. As previously discussed, and as the chapters in this volume demonstrate, such information has the ability to inform us about the

range of behaviors practiced by prehistoric populations beyond village limits. Small lithic sites have the ability to provide information about the range of resources exploited within a particular area as well as the use of prehistoric landscapes across both space and time. As a result, such sites, if they are able to produce information important to prehistory or history, should by definition be eligible for the National Register of Historic Places.

Having made the aforementioned statement, I recognize that not every lithic site possesses an equal ability to yield information important to history. The explanations for a site not being able to produce such information are varied and may range from internal site features to external features related to exceptional disturbances caused by modern land use.

Unfortunately, many small lithic sites are never excavated to a point where a reasonable assessment of the site's eligibility can be determined (Blakemore et al., this volume). All too often, a site is determined to have little or no research potential based on a limited amount of testing completed during a reconnaissance survey using one or two shovel test pits placed a significant distance apart. More extensive excavations, in the form of larger trenches and meter-square units, are often not employed limiting our ability to assess the integrity of subsurface deposits. Such information is crucial to determining eligibility for the National Register.

Determining whether a site is significant for the National Register is also dependent upon our ability to evaluate such sites within relevant archaeological contexts. According to Seibert (2002) and others (Beckerman 2002; Carr 2002; Versaggi 2002), the archaeological contexts that is defined for a particular area or regional are dynamic and change over time as the discipline advances. As new archaeological contexts are developed, older contexts often fade into the background relegated to disciplinary history. For this reason, mid- and late 20th-century notions that specific site types are unimportant need to be reevaluated in light of 21st-century ideology and disciplinary practice. As described above, an example of this can be seen in our current acknowledgement that traditional cultural properties are significant and constitute an important part of our heritage (Parker and King 1992).

As Seibert (2002) also points out, creative contexts for dealing with redundant data are also taken into consideration when determining significance for the NRHP. Multiple property documents (Seibert 2002:3) and the historic district concept (Versaggi and Hohman, this volume) represent creative ways of dealing with redundant, albeit important, data by identifying related archaeological contexts between sites. Programmatic agreements such as those being developed by the Commonwealth of Pennsylvania (Carr, this volume) represent equally viable ways of dealing with the question of significance.

CONCLUSION

This volume reflects the continuing interest and important contributions being made by archaeologists to the study of small lithic sites in the Northeast. In addition to highlighting the diverse activities of Native populations, much of the work in this volume challenges existing notions that these small sites do not produce meaningful data about the past by highlighting the ways in which prehistoric populations exploited the local landscape for settlement purposes.

This work has been enhanced by the use of modern analytical, recovery, and archaeometric techniques, which not only have allowed for the reanalysis of older data sets but also have added new information to an already large regional data set. If Northeast archaeologists are to make substantive contributions to the study of small lithic sites in this century, we must continue to build on the works presented in this volume in order to more fully appreciate the range of behaviors employed by the region's prehistoric occupants.

ACKNOWLEDGEMENTS

Conversations with Christopher Smith, Douglas Perrelli, Nina Versaggi, Douglas Mackey, Scott Cardinal, Mike Lenardi, Dan Mazeau, David Staley, and Ellen Cesarski helped to focus my thoughts about the importance of small lithic sites within larger settlement systems. I thank the two reviewers whose comments helped to enhance the content of this manuscript. All errors are the responsibility of the author.

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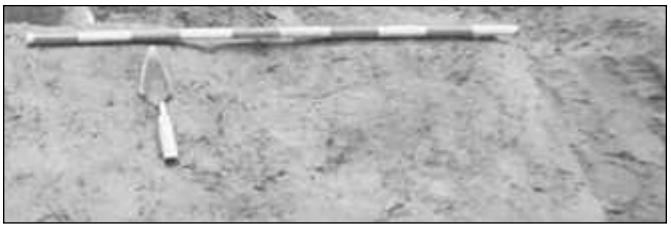
DEFINING AND ASSESSING THE RESEARCH POTENTIAL OF SMALL LITHIC SITES



CHAPTER 2

THE "LITHIC SCATTER" AS AN ARTIFACT OF FIELD TESTING

Robert J. Hasenstab

INTRODUCTION

The "lithic scatter," or prehistoric archaeological site apparently lacking features and diagnostic artifacts, has always been and remains the chief type of site encountered during archaeological survey. Shovel test pits (STPs) have always been and remain in the Northeast the chief archaeological testing technique, owing to the region's predominant forest and pasture cover and their resulting obscuring of the surface. It is my contention that all too often the "lithic scatter" is merely an artifact of the testing technique, namely the use of STPs to identify, test, and assess a site. I include in the STP category the meter square, which is essentially a large test pit, and which is relied on heavily for site assessment. I argue that when a scatter of test pits is superimposed over a distribution of archaeological remains, the result is a scatter of evidence which, most of the time, misses any significant remains that my be present below surface.

In this paper I will show examples of sites which could be missed by a standard STP survey, and I will demonstrate how they would be missed, and how often. I will then describe the kinds of sites that may appear as lithic scatters but could potentially represent significant sites. Finally, I will offer an alternative technique for assessing apparent lithic scatters which should increase the probability of encountering subsurface features on a site, should they be present. This technique is referred to as "dead furrow" trenching.

BACKGROUND

During my early graduate training at the University of Massachusetts, I served as Research Assistant on a study—referred to as "RAASC"—which evaluated archaeological survey reports in the state of Massachusetts over a ten-year period (Dincauze et al. 1981). Part of our task was to evaluate the field test techniques used and their effectiveness. In addition to this, I undertook a term project with Professor Dena Dincauze and an independent study with Professor H. Martin Wobst addressing the question of how STP testing should be implemented to confidently identify prehistoric sites; namely: how large should STPs be, what should their interval be, and how many should be excavated (Hasenstab 1984, 1986a). It is this current concern with "lithic scatters" that prompted me to report my earlier data addressing STP testing.

Sampling Archaeological Site Constituents

McManomon (1984) identifies constituents which make up an archaeological site and which are sampled during field-testing. These are features, such as hearths and pits, and artifacts. The latter class can be subdivided into tools and culturally diagnostic artifacts on the one hand and nondescript litter, such as lithic waste material, or debitage, on the other hand. Generally, an archaeological site must contain features and tools or diagnostic artifacts to be considered significant. If it yields only lithic debitage, then it is considered a "lithic scatter" and is deemed insignificant because it has a little likelihood of yielding information about prehistory (National Register Criterion D; 36 CFR 60.6).

Compared with lithic debitage, tools and diagnostic artifacts are rare on archaeological sites. McManamon reports that bifacially flaked artifacts constitute only 2% of 4,000 lithic artifacts recovered from a sample of 45 prehistoric sites on the Cape Cod National Seashore (1980: Table 4). Similar figures may be derived from data compiled by McBride et al. for the Connecticut Valley lowland (1979: Table 3). In a sample of 54 sites, 4% of 2,000 artifacts inventoried were constituted by tools or diagnostic artifacts. The figure of 4% is an over-estimate, as plural inventory entries were counted here as single items, hence the total artifact count is greater than 2,000. Obviously, the percentage of tools in an assemblage will vary greatly from site to site, depending on site function, lithic reduction activity, and raw material type. On certain sites, tools may be difficult to find. For example on plowed sites, tools may exist in sub-plowzone features, but may have been "picked over" by collectors from the plowzone. On other sites, tools may tend to occur in peripheral areas, outside the main activity areas where archaeologists concentrate testing (see Curtin et al., this volume). Nevertheless, even if a tool-to-flake ratio of 1:10 is conservatively assumed, there are still serious implications for the ability of STP surveys to intercept at least one tool. Most survey archaeologists would probably agree

Current Approaches to the Analysis and Interpretation of Small Lithic Sites in the Northeast, Edited by Christina B. Rieth, New York State Museum, The State Education Department, Albany, New York 12230. New York State Museum Bulletin 508

that the best ways to recover tools and diagnostics are to open large excavation units; such as 2 X 2-meter squares or to plow a site and surface collect it. The advantage of surface collection over excavation has been documented by others (Dickson 2002).

In the remainder of this chapter, I address the sampling of the other archaeological constituents, namely features and lithic debitage. Regarding debitage, I will address the issue of differentiating stray finds from low density scatters from higher density habitation sites or lithic work stations. I will show how the recovery of a few flakes in an STP survey could be evidence of a more substantial site below the surface than the STP survey would lead one to believe.

METHODOLOGY

Goals of Archaeological Field Testing

The goal of archaeological testing, at least in the context of cultural resource management (CRM), is to identify potentially significant sites that may exist below ground in a project area. In scientific terms, this amounts to testing a null hypothesis—H(0)—which holds, as the name implies, that no significant resources exist in the project area. To falsify this hypothesis, the CRM survey team must uncover significant evidence.

In practice testing is done in standard, sequential stages or phases, and the nomenclature for these varies depending on which state or federal agency is overseeing the survey. I have adopted here generic terms to refer to three logical stages of survey which have implications for statistical analysis. I have listed these in Table 2.1. "Level 1" testing I define as the determination of site presence or absence, or site detection. This stage is typically referred to as site identification or site location survey. If absolutely nothing is found, then the null hypothesis is upheld and sites are presumed to be absent. "Level 2" testing follows the find of a single artifact at Level 1. It is usually referred to as verification and not given a formal stage designation, but is carried out expediently as part of the first stage. If nothing is found at Level 2, then a null hypothesis that the Level 1 find is a stray or isolated artifact is upheld and testing is terminated. "Level 3" testing follows any additional finds that may have been made at Level 2 and is aimed at evaluating the significance of the archaeological distribution identified.

The problem with the hypothesis testing logic is that in science, the null hypothesis can never be proven; it can only be falsified. The question then arose: "did the inspectors look hard enough?" In CRM, the key question is: how hard is "hard enough," i.e., how much field testing needs to be done in order to be reasonably confident that no significant cultural resources exist in a project area? This depends on the intensity of archaeological remains anticipated and the relative effectiveness of the subsurface test units at intercepting these.

Table 2.1. Logical Levels of Testing in CRM Field Survey.

Level 1:	Site presence/absence (identification/location). H(0): No prehistoric activity took place in the test area.
Level 2:	Verification of a single find. H(0): The single find made at Level 1 is stray or isolated.
Level 3:	Evaluation of multiple finds at Levels 1 or 2. H(0): The finds encountered represent a low density scatter.

Rationale for the Analysis

The goal of my analysis was to establish the range of STP sample results that could be expected from prehistoric archaeological sites in the Northeast that exhibit low artifact or feature densities yet are considered significant for research. Sites selected for analysis here were mostly single-component sites, i.e., occupied by a single culture, characterized by low artifact and feature densities (low relative to the obtrusive sites typically investigated). These sites were chosen in order to establish a baseline for what may be expected from sites during STP survey.

The archaeological site constituents examined here —artifacts and features—were both taken as measurements of site occupation intensity. Because STPs are relatively small, the result of each individual STP is simply whether an artifact scatter or a feature is present at an STP location. Hence, the measurement of occupation intensity employed here was simply the ratio of "successful" to zero-count or sterile STPs, which reflects the proportion of a given site area that contains artifacts and features versus areas that are void of these at the resolution of the STP size.

Another goal of my analysis was to place statistical confidence intervals around field test results for management and decision-making purposes. This included assigning confidence levels to assessments that no significant resources are present, i.e., the degree of certainty, for example 95%, 75%, or 50%. To derive such measurements, a mathematical distribution curve needed to be adopted for field test results, so that the area under the curve representing various possible outcomes could be rigorously calculated. An analogy would be the use of the normal curve for radiocarbon dating: one can be 66% confident that the actual date is within one standard deviation of the measured date and 95% confident that it is within two standard deviations. The curve adopted here was that of binomial probability.

Binomial probability laws were used to establish a quantitative framework for assessing site occupation intensity on the basis of STP sample results. Binomial probability laws are those that might be applied to the drawing of black and white marbles from a bucket of

mixed marbles; in this case the white marbles would be analogous to positive STPs (see Greig-Smith 1964). The chance of drawing a white marble from a bucket or a positive STP from a site is referred to as the binomial probability, P, and ranges from zero to one. This so-called population probability is equal to the actual proportion of white marbles in the bucket or the proportion of would-be positive STPs on the site, if the entire site were gridded off into STP-size blocks. If one were to draw N marbles from the bucket or excavate N STPs on the site (e.g., N=30), then one could expect X, or N x P of these to be successful, plus or minus (e.g., 15 if P=.5). The "plus or minus" is governed by the laws of binomial probability (see below). Conversely, if N STPs are dug and successes are obtained in X of these (e.g., 10 out of 30), then a probability (here p=.33) can be estimated, with a specific confidence interval around it (e.g., .23 to .43 at 66% confidence). Thus, by so quantifying these data, it is possible to estimate the intensity of an archaeological constituent on a site (artifacts or features) vis-a-vis the ratio of occupied to empty space, and to define the sample size necessary for assessing this intensity. Furthermore, it was possible with binomial probability laws to place confidence intervals around the latter estimates. The "bottom line" is: the more STPs that are dug, the more confident one can be.

The final goal of my analysis was to establish a rough quantitative framework for planning STP survey at the three testing levels defined above. Specifically established are: (1) for Level 1, the minimum sample size (number of STPs) necessary to provide reasonably adequate negative evidence of prehistoric activity; (2) for Level 2, the minimum sample size necessary to claim that a single find is a stray or isolated find; and (3) for Level 3, the range of sample results expectable from habitation sites that may have low artifact densities, i.e., the critical threshold for declaring an STP sample part of an insignificant very low density scatter.

The Data Base

Fifteen prehistoric archaeological sites were selected for analysis. Five sites were chosen for artifact analysis and another 10 sites for feature analysis. These two data sets were mutually exclusive as sites with complete floor plans lacked artifact data—having had their plowzones removed—whereas sites analyzed for artifact distribution lacked consistent feature data. All sites have been significant for research. The sample includes one Paleo-Indian camp (12,000–10,000 BP, before present), one Archaic base camp (8,000–3,000 BP), four Early (ca. 500 BC to AD 200) to Late (AD 900 to 1500) Woodland camps or base camps, and two Contact Period (AD 1500–1700) villages. The sample is heavily weighted with Late Woodland and Contact sites, as these tend to be isolated and hence occur more frequently as single component occupations.

Sites Selected for Artifact Analysis. Of the five sites selected for artifact distributional analysis, three were completely or extensively excavated and the other two were intensively tested with STPs. Explicit data for artifacts recovered—by excavation unit—were available for all five sites. For the latter two sites, actual test pit results were analyzed. For the former three sites, hypothetical test pits were superimposed onto site excavation grids.

The first site analyzed was the Potts Paleo-Indian site in Oswego County, New York. Potts was known from surface collections (Ritchie 1969) and was completely excavated in 1982 and 1983 (Gramly and Lothrup 1983). Raw data on excavation results were made available by Jonathan Lothrup. The site included two major activity areas, designated Locus A and Locus B, each of which was approximately 15 to 20 m in diameter. These loci were analyzed here as separate sites. Some 700 meter-square units were excavated and of these, 294 contiguous units comprised Locus A (.029 ha) and 346 Locus B (.035 ha). Artifacts recovered and tabulated were predominantly lithic flakes recovered by dry screening through 6 mm hardware cloth. Flakes recovered by water screening were not included in the analysis.

The next site analyzed was the Christianson site in Erie County, New York. Christianson is an Iroquoian village site, covering .9 ha and dating to the fourteenth century A.D. (Vandrei 1984). Of 103 STPs excavated, 61 fell within the limits of the site as defined by the recovery of cultural materials; these 61 were analyzed here. STPs were of an unspecified size (30 cm assumed) and were spaced in a systematic, square grid at intervals of 7.6 m apart. Soil was not screened but was "carefully inspected" (Vandrei 1983). Artifacts tabulated here included lithic flakes, ceramic sherds, and fire-cracked rock (Vandrei 1983).

The third site analyzed was the Gannagaro Historic Site located in Ontario County, New York. Gannagaro was a Contact Period village measuring 3.7 ha according to STP survey. The village is known to have contained from 80 to 150 longhouses and was occupied from its settlement in 1670 to its destruction in 1687. As part of an extensive survey carried out in 1977, 680 30-cm STPs were excavated throughout the site area. Test pits were arranged systematically at intervals of 7.6 m along transects spaced 30 m east-west and 76 m north-south. Because of its clayey texture, the soil could not be screened, but was excavated by trowel (Hayes et al. 1978:22-25). Of the 680 units excavated, 179 chosen for analysis here fell within the bounds of an arbitrary ellipse enclosing the majority of the cultural materials recovered. Items tabulated included all artifacts of unambiguous seventeenth century or aboriginal origin, e.g., chert flakes, scrap copper and brass, glass and wampum beads, smoking pipe fragments, and gunflints (Hayes et al. 1978: 55, Appendix IV: 85, 90). Not included in the counts were refuse bone fragments and fire-cracked

rock fragments, which were rare (Hayes et al. 1978: Appendix V).

The fourth site analyzed was Fort Hill in Cheshire County, New Hampshire. Fort Hill was a Contact Period fortified village located through documentary research (Thomas 1990). A portion of the village was excavated consisting of 135 1.5m squares. All told, 140 features—predominantly pits—were excavated. Fort Hill appeared as a low-density site because most of the village's refuse had been placed into abandoned storage pits, resulting in a low surface artifact density. Artifact counts per excavation unit were reconstructed here from a density contour map (Thomas 1990: Figure 19). Most artifacts were ceramic sherds; lithic artifacts were scarce, probably having been replaced by brass.

The last site to be analyzed for artifact distribution was the Indian Crossing Site in Hampden County, Massachusetts (Ulrich 1977). Indian Crossing was a stratified Late Woodland base camp of .8 ha. It was located with a predictive model, but was otherwise a very unobtrusive site, i.e., the researchers argued that the location was strategic and had to contain a site, despite meager initial test results (Thorbahn and Paynter 1975). A total of 202 one-meter squares was excavated—81 as part of an areal sample and the remaining 121 as feature-specific excavations. Over 30 features were excavated, including a large stone pavement interpreted as a fish-drying platform. For purposes of site assessment, the systematic sample of 81 squares was analyzed here. Raw data were compiled by Mitch Mulholland. All artifacts tabulated here were recovered from 3 mm screen and include lithic flakes, ceramic sherds, and fire-cracked rock fragments.

Sites Selected for Feature Analysis. Sites analyzed for feature content were taken from the definitive work of Ritchie and Funk (1973) on aboriginal settlement patterns in the Northeast. All but one of the detailed floor plans printed in the latter volume were analyzed here. The goal of this analysis was to determine the proportion of STPs that would have intercepted features, had the sites been subjected to STP survey.

Sites compiled by Ritchie and Funk were intended to be representative of all prehistoric time periods. All sites were located in New York State. One site, O'Neil, was an Archaic basecamp (Ritchie and Funk 1973: Figure 10). Three were Early/Middle Woodland camps (500 BC - AD 900): Scaccia, Westheimer (Locus I only), and Kipp Island (habitation area only; Ritchie and Funk 1973: Figures 11, 14, and 15, respectively). The remaining sites were Late Woodland villages: Roundtop, Maxon-Derby (Houses A and B only), Sackett (Areas A and B combined), Bates, Nahrwold (Component 1 only), and Getman (Ritchie and Funk 1973: Figures 17, 19, 22/23, 24, 27, and 28, respectively).

Most of the sites in this sample were short-term, single component occupations, although O'Neil, Westheimer, and Roundtop were multi-component, and Kipp Island and Nahrwold were recurrently occupied. Lamoka Lake was not included in the sample as it was exceptionally intensively occupied. the site sample runs the gamut for what might be expected of feature content on Northeastern sites. Maxon-Derby, for example, represents a single occupation of short duration. Being situated on "pebble and gravel-filled glacial till," it contained one storage pit; food was probably stored in above-ground storage bins at the ends of longhouses (Ritchie and Funk 1973: 198, 201). On the other end of the spectrum, O'Neil was covered by midden debris and was intensively occupied. Hence, the site sample should provide a full range of feature content on prehistoric archaeological sites in the Northeast.

Analytical Procedures

Preparation of Artifact Count Data. Two of the sites analyzed for artifact distributions, viz., Christianson and Gannagaro, had been tested with large samples of STPs; these data were used "as is." For the remaining sites, however, data were available by excavation unit—Indian Crossing and Potts data were compiled by meter-square, Fort Hill by 1.5-m-square. These raw data are presented in Table 2.2. Data from Potts are divided between Locus A and Locus B.

For the latter sites, hypothetical STP units were reconstructed within each excavation square. For ease of calculation, a 30/33.3-cm STP was considered, hence meter-squares were divided into nine sectors, 1.5-m-squares into 25 30-cm sectors. The 30/33-cm size was chosen, in favor of 25- or 50-cm STPs (see Hasenstab 1986a), because it probably most accurately represents the actual size of STPs used in the field. STPs are typically two shovel widths, or 44 cm, but because of tapering with depth, they usually diminish to around 75% at the B-horizon (subsoil). The 30/33-cm size was also chosen for consistency with the feature analysis, as those sites were laid out and analyzed in one-foot (30.5-cm) grids. Suffice it to say here that the probability of encountering artifacts in an STP diminishes geometrically, i.e., by the inverse square of the STP dimension, so that a 25-cm STP has one quarter the effectiveness of a 50-cm STP (the probability is a function of area).

Artifacts tabulated by square were randomly distributed by computer within each square. The proportion of empty STPs expected on each site was calculated rigorously. Any meter-square, for example, with a zero count would have yielded nine zero-count STPs, whereas a meter-square with a single artifact would have yielded one one-count STP and eight zero-count STPs. Meter-squares with multiple artifact counts would have yielded STPs of varying count, depending on the distri-

Table 2.2. Raw Artifact-count Data, by Excavation Unit, for a Sample of Single Component Sites in the Northeast.

	Site Analyzed (Excavation Unit Size)							
	Indian Crossing		Potts Locus A		Potts Locus B		Fort Hill	
Artifact Count per	(1 m)		(1 m)		(1 m)		(1.5 m)	
Excavation Unit	N of Units	% of Units	N of Units	% of Units	N of Units	% of Units	N of Units	% of Units
0	11	13.6	47	16.0	26	7.5	—	——
1	13	16.0	58	19.7	36	10.4	48	35.6
2	2	2.5	57	19.4	45	13.0	27	20.0
3	8	9.9	43	14.6	42	12.1	33	24.4
4	5	6.2	28	9.5	37	10.7	7	5.2
5	2	2.5	24	8.2	25	7.2	5	3.7
6	1	1.2	14	4.8	30	8.7	0	0.0
7	2	2.5	6	2.0	16	4.6	0	0.0
8	4	4.9	7	2.3	12	3.5	6	0.0
9	4	4.9	5	1.7	15	4.3	0	0.0
10	2	2.5	2	0.6	13	3.8	9	6.7
11	2	2.5	0	0.0	6	1.7	0	0.0
12	0	0.0	0	0.0	6	1.7	0	0.0
13	0	0.0	0	0.0	7	2.0	0	0.0
14	0	0.0	0	0.0	5	1.4	0	0.0
15	1	1.2	0	0.0	3	0.8	4	3.0
16	1	1.2	0	0.0	5	1.4	0	0.0
17	3	3.7	3	1.0	3	0.8	0	0.0
18	2	2.5	0	0.0	2	0.6	0	0.0
19	0	0.0	0	0.0	2	0.6	0	0.0
20	1	1.2	0	0.0	1	0.3	2	.5
21	0	0.0	0	0.0	1	0.3	0	0.0
22	1	1.2	0	0.0	1	0.3	0	0.0
23	0	0.0	0	0.0	2	0.6	0	0.0
24	0	0.0	0	0.0	1	0.3	0	0.0
25	1	1.2	0	0.0	0	0.0	0	0.0
26-50	8	9.9	0	0.0	2	0.6	0	0.0
51-100	3	3.7	0	0.0	2	0.6	0	0.0
101-200	4	4.9	0	0.0	0	0.0	0	0.0
Total	**81**	**100.0**	**294**	**100.0**	**346**	**100.0**	**135**	**100.0**

bution of artifacts within each unit. The expected number of zero-count STPs within such a unit was calculated rigorously as the number of component STPs (e.g., nine) multiplied by the probability of a zero-count in a single STP, i.e., of missing all the artifacts in the unit. The latter probability was calculated as the probability of missing one artifact with an STP (e.g., 8 out of 9 or .89) exponentiated by the total number of artifacts in the unit, i.e., of missing each and every one of the N artifacts simultaneously. Expected numbers of STPs yielding higher counts (one, two, etc.), were calculated with more complex formulae (Greig-Smith 1964: 12-14) but suffice to say these could ultimately be considered simply as "positive" STPs. Expected numbers of STPs yielding these various artifact counts within excavation units were calculated accordingly as fractional numbers within each unit and were later summed across all excavation units.

Figure 2.1 illustrates the outcome of this calculation for the Potts Site, Locus B (the entire excavation area). Note from Table 2.2 that 43% of all meter-squares contained three or fewer items. Figure 2.1 shows that 65% of all anticipated 33-cm STPs would exhibit zero-counts. In other words, low artifact density areas would appear as mostly empty space if tested with STPs.

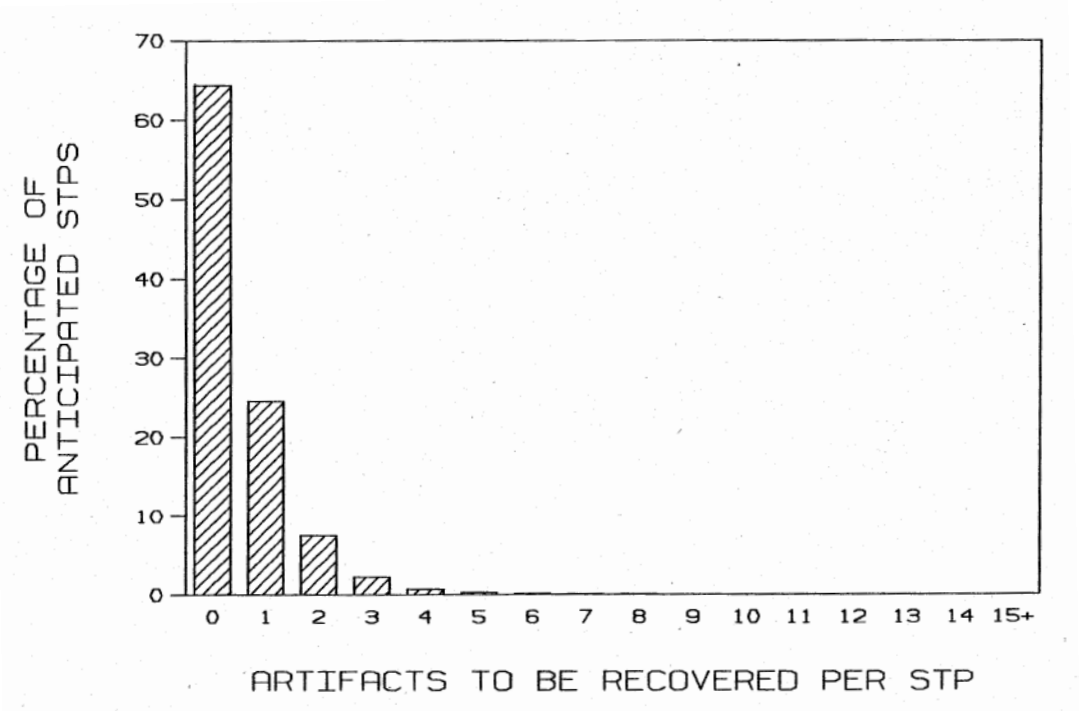


Figure 2.1. The distribution of 33-cm STPs within meter squares excavated, according to anticipated artifact counts, from the Potts Site, Locus B. See Table 2.2 for raw data.

Preparation of Feature Distribution Data. The goal of the feature distribution analysis was to estimate the proportion of potential STPs on each site that would intercept a feature. Accordingly, an approach similar to that taken for artifact distribution analysis was taken, viz., excavation units were subdivided into component STPs. All excavation units employed by Ritchie and Funk were ten-foot square (305-cm-square), hence each unit was divided into a ten-by-ten grid of 100 30.5-cm STPs. Any component STP overlapping a feature in the floor plan of a unit was considered a successful STP; STPs missing features were considered empty.

This procedure is illustrated in Figure 2.2, for the Scaccia Site. Features intercepted by STPs are indicated by shading. These include features that could be noticeable by STP excavation: pits, hearths, burned or stained areas, and fire-cracked rock concentrations. Natural depressions and rodent burrows were not included, nor were post molds. The latter stains were extremely difficult to discern even with proper floor skimming procedure (Ritchie and Funk 1973: 293-295); they would probably not be recognized during normal STP excavation. For each site, the total numbers of successful and unsuccessful STPs were tallied to derive the proportion of each site occupied by features, relative to a 30.5-cm-STP grid.

Statistical Methods. As stated above in "Rationale for the analysis," I adopted binomial probability laws to rigorously measure the proportion of STPs that might be expected to produce positive results on a significant site. The artifact and feature distributional analyses carried out above were intended to determine the proportion of a site occupied by the respective constituent. This proportion was taken as the binomial probability, P, of encountering a success in an STP located randomly within a site. This probability is referred to here as the "encounter probability" for an STP, testing a particular constituent of an archaeological site.

If a sample of STPs, of total number N, were placed within a site exhibiting an encounter probability of P (with respect to some archaeological constituent), then the probability of obtaining exactly X successful test pits in a sample of N can be calculated from the binomial probability law as:

$$P(X) = (N! / X!*(N-X)!) * P**X * Q**(N-X)$$

where "!" indicates the factorial of a number, "Q" indicates the complement of P (1.0 - P), and all other notation is standard FORTRAN symbolism (i.e., * indicates multiplication and ** indicates exponentiation; see Greig-Smith 1964:13; Hoel 1971:95). In other words, if the proportion of space occupied by artifacts or features on a site is known, then it should be possible to predict, by binomial probability law, the range of outcomes that may be expected from an STP sample on a site, in terms of the number of successful STPs that might be obtained. For features, application of binomial probability is straight forward, if one assumes that a floor plan is either feature or sterile at any given location.

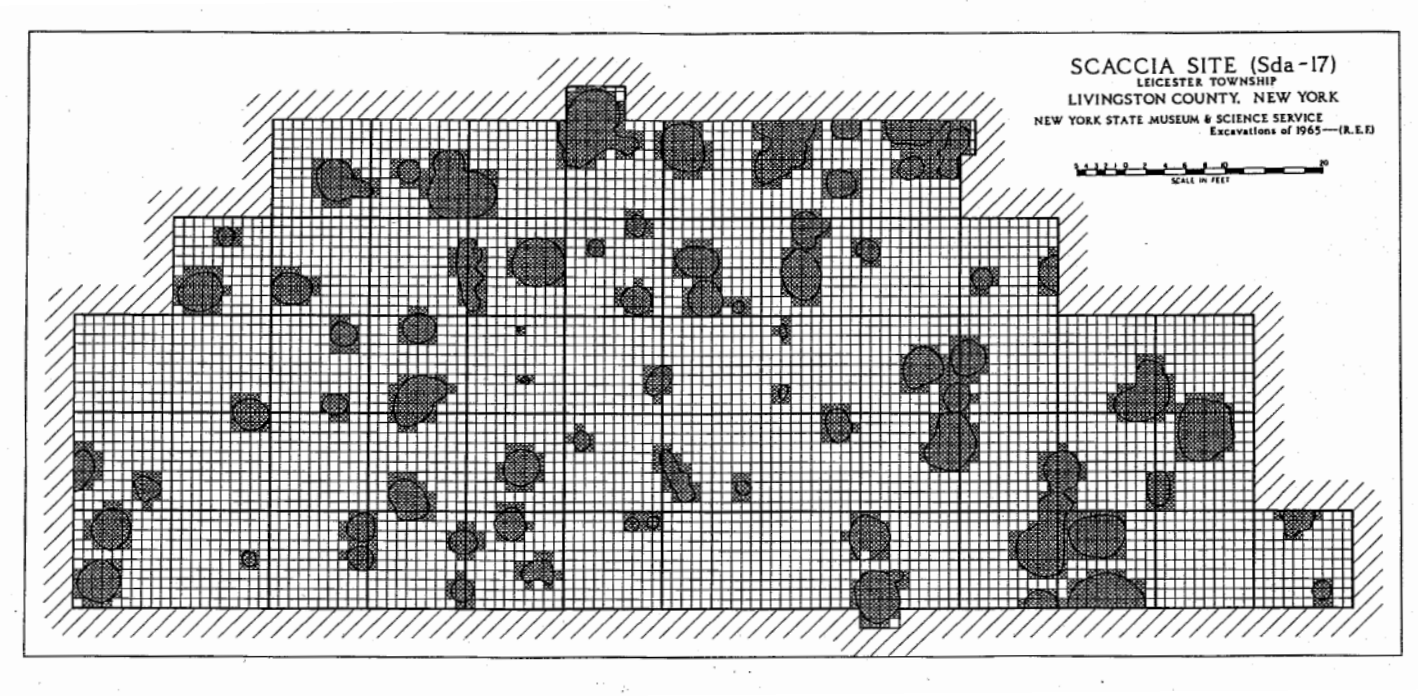


Figure 2.2. Illustration of the procedure employed to ascertain the proportion of hypothetical STPs on a site that would intercept a feature. Shown is the Scaccia Site floor plan subdivided in to a 30.5-cm grid. Adapted from Ritchie and Funk 1973: Figure 11.

For artifact scatters, however, the application of binomial probability could be questionable, as empty space is relative to the point locations of artifacts and the locations and sizes of STPs used to intercept them.

Alternatively, a Poisson distribution might be used to model artifact distributions; however, the Poisson assumes that artifacts are randomly distributed within a site, which they are not. Rather, artifacts are clustered into activity loci surrounded by empty space (Thomas 1986). Therefore we are really concerned about encountering positive STPs (inside clusters) versus sterile STPs (in the empty space), so that binomial probability is probably a better model than Poisson. Other reasons for using it are simply operational: it is consistent with the feature analysis and it is mathematically much simpler than Poisson.

To evaluate how well a binomial distribution models the results of samples taken from actual artifact scatters, I performed a controlled test. The test compared binomial predicted results with computer-simulated results. For a test case, I used the main artifact cluster at the Potts Site, Locus B, viz., a contiguous block extending from South 26 m to South 34 m and from East 11 to 22 m (Figure 2.3). For this area, the amount of empty space relative to a 33-cm STP was calculated rigorously by individual meter squares as outlined above in "Preparation of artifact count data." This calculation resulted in a figure of .46. Hence, the binomial probability, P, of a successful test pit, was 1.0 minus P, or .54. In theory then, 54% of all STPs sampled in this area would be successful. Variation from this figure, sample to sample, would be predictable by binomial probability law. As a test of this prediction, samples of 30 STPs were drawn at random from this area and the outcome of each sample was observed. With a 54% chance of success, a sample of 30 should have, on average, produced 16.5 successes.

Repeated samples of 30 STPs were simulated by computer. For each sample, or trial, 994 artifacts in the area were randomly distributed within their respective meter squares and their locations were stored in computer memory. Each of 30 STPs was then located at random in the excavation area, each was checked for artifact interception, and the total number of successful STPs out of 30 was tallied. Figure 2.3 illustrates such an experiment for a sample size of 100. This experiment was repeated 10,000 times, and the success rates of the 10,000 samples were tabulated. The resulting distribution is plotted in Figure 2.4, along with a corresponding distribution calculated by the binomial probability law, using P=.54.

Note that the shapes of the two distributions are similar, though the simulation results tended to be slightly more successful than those predicted by calculation. The discrepancy probably results from the STPs and artifacts being compartmentalized by unit in the meter square tabulations, then randomized during STP simulation. The results were close enough, though, that binomial probability could be accurately used (within a percentage point) to model the sampling of empty space in artifact distributions through the use of STPs.

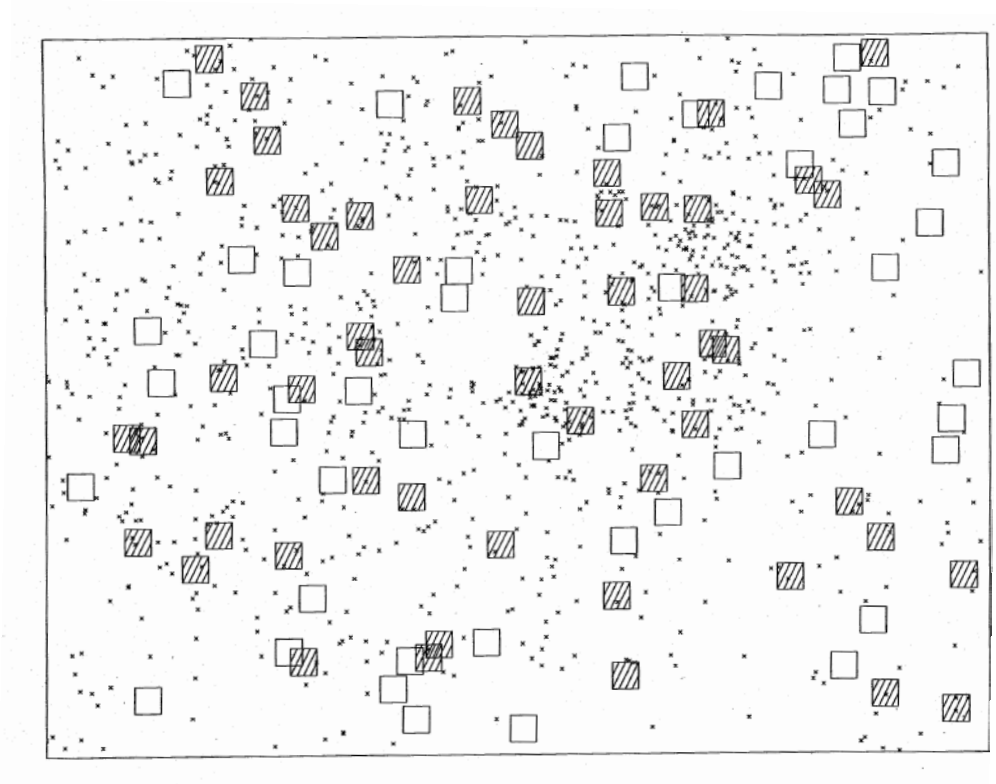


Figure 2.3. Example of a sampling simulation for the main artifact cluster at the Potts Site, Locus B, showing a sample of 100 randomly located 33-cm STPs. Artifacts are indicated by "x"s; successful STPs are shaded.

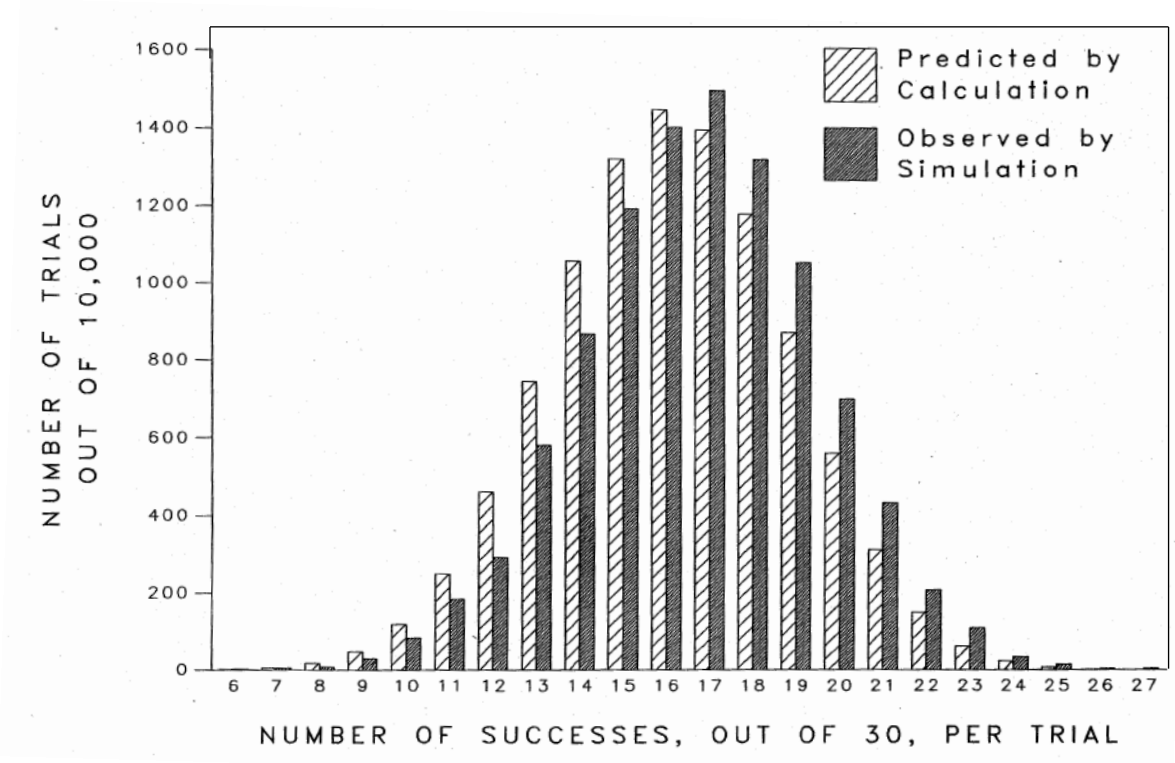


Figure 2.4. Comparison of the results of 10,000 sampling simulations on the main artifact cluster at the Potts Site, Locus B, with results predicted by the binomial probability law. Shown are the numbers of expected outcomes versus observed outcomes for the drawing of repeated samples of 30 33-cm STPs.

RESULTS OF ANALYSIS

Results of Artifact Distribution Analysis

The distributions of actual and hypothetical STPs on the five sites chosen for artifact analysis were established as outlined above in "Preparation of artifact count data." These STP counts were then aggregated into three classes—empty (zero-count), low density (one to three count), and high density (four or more). The resulting STP distributions are presented in Figure 2.5. The single component sites analyzed here exhibit relatively high proportions of empty space in terms of artifact distributions. Namely, the amount of empty space was generally between 50% and 80%. These figures are somewhat higher than Thomas's modeled figure of 50% empty space for open-air, single occupation sites (1986). This is probably because "empty" here is relative to 30/33-cm STPs within an artifact scatter, while Thomas's definition of empty refers to a broader spatial resolution. Certainly at the atomic scale, matter is 99%+ empty space, so that the smaller the test unit, the more empty space there will be. In sum, based on the above analysis, minimally 50% empty space (at 30-cm resolution) can be expected from even the densest of single component sites, with a mode being around 67%.

High-density STP yields, i.e., those containing four or more artifacts, should be considered rare on single component sites. Among the sites analyzed here, Christianson yielded the highest proportion of high-density STPs, at 17%. Indian Crossing ranked next at 13%, and the remainder fell below 5%. In sum, it would be optimistic to expect one in six high-density STP yields from a single component site in the Northeast. Many sites are likely to produce exclusively low-density yields, and would appear from STP results as "low density scatters."

Results of Feature Distribution Analysis

The percentages of 30-cm STPs intercepting features on 10 selected sites were determined as outlined above in "Preparation of feature distribution data." Results are presented in Figure 2.6. The probabilities plotted correspond theoretically to the chances, out of 100, of intercepting a feature with a 30-cm STP on the given site. Divided by 100, these figures would represent the encounter probabilities for features—P.

The distribution of features across sites was, in general, sparser than the distribution of artifact clusters in the other sample of sites analyzed. The chances of encountering a feature ranged generally from 10% to 30%. Sites exhibiting more features tended to be either multi-component or recurrently occupied, or both, e.g., O'Neil (36%), Nahrwold (27%), and Roundtop (22%). Even in the most intensively utilized of site areas—House 1 of Nahrwold—the chances of encountering a feature did not much exceed 50% (Ritchie and Funk 1973: Figure

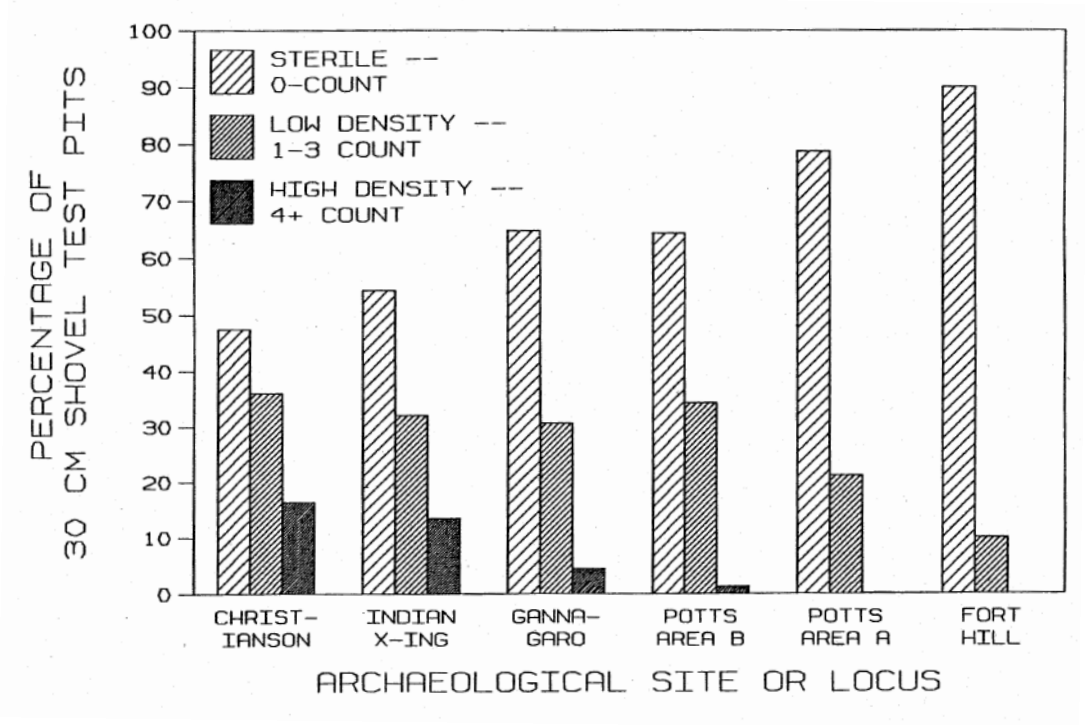


Figure 2.5. The relative distributions of 30-cm STPs (actual and/or hypothetical) according to counts of artifacts recovered, for a sample of prehistoric archaeological sites in the Northeast.

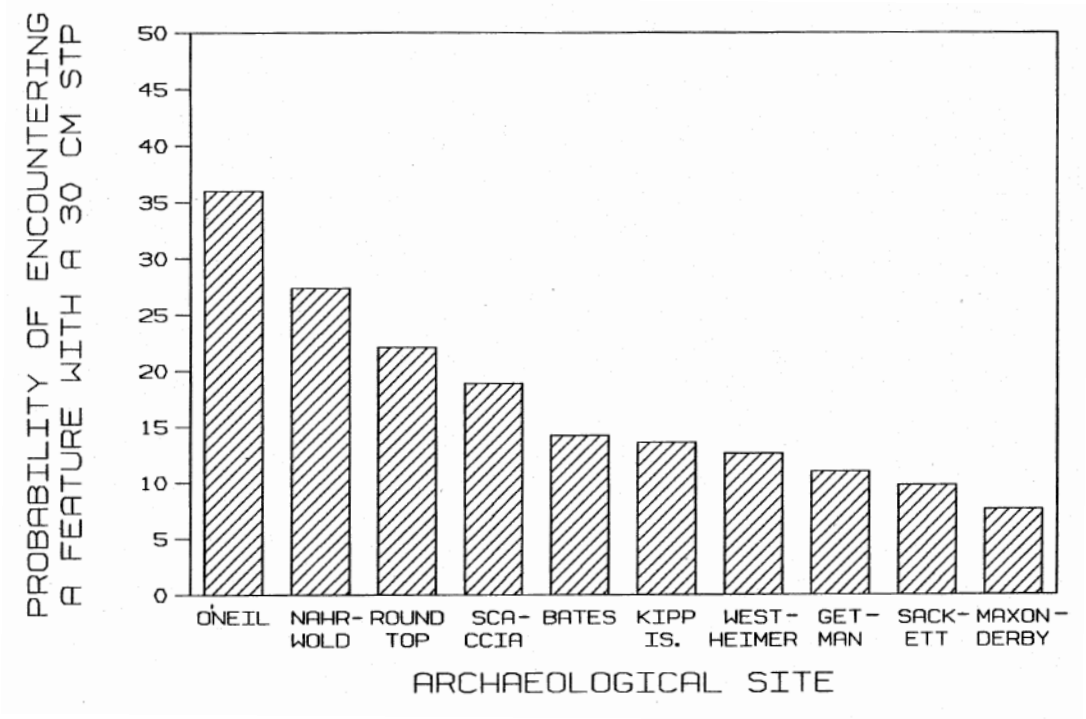


Figure 2.6. The distribution of chances of encountering a feature with a 30-cm STP within a variety of prehistoric archaeological sites in the Northeast.

27). Scaccia represented the upper end of the range of feature content for single component sites; its encounter probability was .18. Maxon-Derby—lacking storage pits—represented the lower end of the range at .08.

The modal feature encounter probability, for single component sites, was approximately .15. This corresponds, for example, to the figure of 15% at the Hatchery West Site, for the proportion of surface area covered by features (Binford et al. 1970; McManamon 1984: Table 4.1). For worst-possible-case estimation, a figure of .10 may be used as an estimate of the probability of encountering a feature with an STP on a site of minimal occupation intensity.

DISCUSSION AND INTERPRETATION

Statistical Implications of Binomial Probability

As outlined in Table 2.1, CRM field testing amounts to testing a null hypothesis at three logical levels: (1) that nothing exists in the project area; (2) that a single find made is stray or isolated; and (3) that multiple finds made represent an insignificant low-density scatter. At each level, negative evidence is taken from a managerial or compliance point of view as confirmation of the null hypothesis. In scientific terms, however, "absence of evidence does not constitute evidence of absence," so that project reviewers and survey team must ask themselves: "did we look hard enough?"

This basic question can be broken down more analytically into several questions as introduced in "Rationale for the analysis." First: what is the range of STP results expectable from a low-density but significant site in terms of the number of successful STPs that might beobtained in a survey sample (as well results involving all-zero-counts and single finds)? Second: what is the minimum sample size (number of STPs) necessary to confidently test a site? Third: if a particular sample result is obtained, what estimate can be made about the site being tested? And finally: how much confidence can there be in an estimate such as the latter? These questions are answered below through the application of binomial probability.

STP results for an anticipated site and archaeological constituent can be predicted from the binomial distribution curve for expected numbers of successful test pits, as was shown in Figure 2.4 for the Potts Site, Locus B. The area under the curve on either side of the midpoint represents the chances of obtaining a range of successful STPs (X) out of a sample—in this case of 30 STPs. From Figure 2.4 it is evident that fewer than 500 times out of 10,000 (5%), 11 or fewer successful STPs will be obtained and fewer than 5% of the time 22 or more will be obtained, out of a sample of 30. In other words, on a site that is 46% empty space with respect to an archaeological constituent (P=.54), if samples of 30 STPs were repeatedly excavated, 90% of the time between 12 and 21 STPs in a sample

would be successful.

This range of expected sample results (i.e., P(X)) can be calculated rigorously for any P and N from the formula listed above in "Statistical Methods." The range will vary for different values of P, i.e., sites or constituents characterized by different intensities of occupation, and for different values of N, i.e., STP sample sizes. A selection of such 90% probability ranges for N from four to 50 and for P from .10 to .50 is presented in Table 2.3. The values tabulated are the range of successful STPs that may reasonably be expected for a given P and N. For example, if a survey employs 10 STPs to test a site that is 50% empty space (P=.50), then one could reasonably expect from two to eight STPs in the sample to be successful.

Table 2.3 can be used to determine minimum sample sizes necessary (i.e., the table row) for assessing STP outcomes at the first two levels of testing for various encounter probabilities (table columns). For example, at P=.10 (the first column), one could reasonably expect all zero-count results for sample sizes up to 28 STPs. At N=29, however, one can reasonably expect to obtain at least one successful STP, so if zero are obtained, then one can be reasonably sure that P is actually less than .10 (see "Level 1 testing" below). Likewise, if P=.10 is assumed and only a single find is made, i.e., there is only one positive STP, then such an outcome could be reasonably expected for sample sizes up to N=45. At N=46, one could expect to have at least two positive STPs from a distribution where P equals .10 (see "Level 2 testing" below). Thus, Table 2.3 could be used, at test levels 1 and 2, to falsify a null hypothesis that no site or an insignificant site is present. At Level 1—site identification—this involves obtaining a sufficient number of exclusively zero-count STPs to claim that a site could not be present (e.g., 29 for P=.10). At Level 2, a stray find test would involve obtaining only a single success from a sample large enough to claim that a substantial artifact scatter could not exist (e.g., 46 at P=.10).

For Level 3 testing, that is, evaluating multiple STP finds to determine the intensity of prehistoric activity, the assessment becomes more complex because a range of STP outcomes can be expected from a range of sites with varying constituent densities. The problem amounts to testing two competing hypotheses or evaluating sample results against two separate probability curves, namely: H(0), the null hypothesis, holds that an insignificant low-density scatter is present, and H(1), the alternative hypothesis, holds that a site with a significant distribution of the archaeological constituent is present (see Hoel 1971: 160-163).

This problem is illustrated in Figure 2.7 which plots the chances of obtaining varying numbers of successful STPs (increments on the X axis), out of a sample of N=13 STPs, for two hypothetical sites with differing encounter probabilities (P). The curve with the mean to the left represents H(0), the null hypothesis, with P=.10. The curve to the right represents H(1), the alternative hypothesis where P=.30. Based on the results of the site analyses, these figures correspond to the range of probabilities for feature encounter on typical prehistoric sites in the Northeast (Figure 2.6). The question at Level 3 is that if 13 STPs are dug and successes are obtained in X of them, then does the site being tested conform more to H(0) or to H(1)?

To evaluate sample results against these curves, the researcher must select an optimal, though arbitrary cutoff point along the X-axis between the two overlapping curves (see Hoel 1971: 160-163). In Figure 2.7, such a cutoff could be placed between two and three successful STPs. Then if three successes are obtained, one can assume that the site conforms to H(1) and is significant and thereby falsify the null hypothesis, claiming the site does not represent the curve on the left (and is not insignificant). This is because the sample results fall within the upper or right tail of the H(0) curve to the left. Nevertheless the area under this tail totals .134, so there is a 13% chance that the site could actually represent the H(0) curve and not the H(1) curve. If this were the case, the error in judgment would be referred to as a Type I error and the probability .134 would be referred to as an alpha probability. In CRM terms this would represent a case where the consulting archaeologist argues that the site is significant and recommends further work, only to find out that the site contains meager data. Thus a Type I error in CRM would be analogous to a "false alarm".

On the other hand, if only two STPs are successful, then the archaeologist could argue that the site conforms to H(0) and is insignificant, and does not represent the H(1) curve for a significant site. This is because the sample results fall within the lower or left tail of the H(1) curve to the right. Nevertheless the area under this tail total .203, so there is a 20% chance that the site could actually represent the H(1) curve and not the H(0) curve. If this were the case, the error in judgment would be referred to as a Type II error and the probability .203 would be referred to as the beta probability (ibid.). In CRM terms this would represent a case where the consulting archaeologist argues that the site is insignificant and recommends no further testing, only for the construction crew to uncover significant remains later on. Thus a Type II error in CRM would be synonymous with "writing off a site."

In the above example, neither the alpha probability of .134 nor the beta probability of .203 are statistically significant (at the .05 level), so that the cutoff between two and three successful STPs yields ambiguous judgment if either two or three successful STPs are obtained. The archaeologist has the option of moving the cutoff to the left, between one and two positive STPs. In that case the alpha probability for a Type I error would be .379 (statistically

Table 2.3. Ninety-percent Probability Ranges for Key Binomial Probabilities.

N of STPs	Probability of a Successful Test Pit (P)								
Excavated	.10	.15	.20	.25	.30	.35	.40	.45	.50
4	0- 2	0- 2	0- 2	0- 3	0- 3	0- 3	0- 3	0- 3	0- 4
5	0- 2	0- 2	0- 3	0- 3	0- 3	0- 4	0- 4	0- 4	1- 4
6	0- 2	0- 2	0- 3	0- 3	0- 4	0- 4	1- 4	1- 5	1- 5
7	0- 2	0- 3	0- 3	0- 4	0- 4	1- 5	1- 5	1- 5	1- 6
8	0- 2	0- 3	0- 4	0- 4	0- 5	1- 5	1- 5	1- 6	2- 6
9	0- 3	0- 3	0- 4	0- 4	1- 5	1- 6	1- 6	2- 6	2- 7
10	0- 3	0- 3	0- 4	0- 5	1- 5	1- 6	2- 7	2- 7	2- 8
11	0- 3	0- 4	0- 5	1- 5	1- 6	1- 7	2- 7	2- 8	3- 8
12	0- 3	0- 4	0- 5	1- 6	1- 6	2- 7	2- 8	3- 8	3- 9
13	0- 3	0- 4	0- 5	1- 6	1- 7	2- 7	2- 8	3- 9	4- 9
14	0- 3	0- 4	1- 5	1- 6	2- 7	2- 8	3- 9	3- 9	4-10
15	0- 4	0- 5	1- 6	1- 7	2- 8	2- 8	3- 9	4-10	4-11
16	0- 4	0- 5	1- 6	1- 7	2- 8	3- 9	3-10	4-10	5-11
17	0- 4	0- 5	1- 6	1- 7	2- 8	3- 9	4-10	4-11	5-12
18	0- 4	0- 5	1- 7	2- 8	2- 9	3-10	4-11	5-12	6-12
19	0- 4	1- 6	1- 7	2- 8	3- 9	3-10	4-11	5-12	6-13
20	0- 4	1- 6	1- 7	2- 8	3- 9	4-11	4-12	5-13	6-14
21	0- 5	1- 6	1- 7	2- 9	3-10	4-11	5-12	6-13	7-14
22	0- 5	1- 6	2- 8	2- 9	3-10	4-11	5-13	6-14	7-15
23	0- 5	1- 6	2- 8	3- 9	3-11	4-12	5-13	6-14	8-15
24	0- 5	1- 7	2- 8	3-10	4-11	5-12	6-14	7-15	8-16
25	0- 5	1- 7	2- 8	3-10	4-11	5-13	6-14	7-15	8-17
26	0- 5	1- 7	2- 9	3-10	4-12	5-13	6-15	8-16	9-17
27	0- 5	1- 7	2- 9	3-11	4-12	5-14	7-15	8-16	9-18
28	0- 6	1- 7	2- 9	3-11	5-12	6-14	7-15	8-17	10-18
29	1- 6	1- 8	2- 9	4-11	5-13	6-14	7-16	9-17	10-19
30	1- 6	2- 8	3-10	4-12	5-13	6-15	8-16	9-18	11-19
31	1- 6	2- 8	3-10	4-12	5-14	7-15	8-17	9-19	11-20
32	1- 6	2- 8	3-10	4-12	5-14	7-16	8-17	10-19	11-21
33	1- 6	2- 8	3-11	4-12	6-14	7-16	9-18	10-20	12-21
34	1- 6	2- 9	3-11	5-13	6-15	7-17	9-18	11-20	12-22
35	1- 7	2- 9	3-11	5-13	6-15	8-17	9-19	11-21	13-22
36	1- 7	2- 9	3-11	5-13	6-15	8-17	10-19	11-21	13-23
37	1- 7	2- 9	4-12	5-14	7-16	8-18	10-20	12-22	14-23
38	1- 7	2- 9	4-12	5-14	7-16	9-18	10-20	12-22	14-24
39	1- 7	2-10	4-12	5-14	7-16	9-19	11-21	12-23	14-25
40	1- 7	3-10	4-12	6-15	7-17	9-19	11-21	13-23	15-25
41	1- 7	3-10	4-13	6-15	8-17	9-19	11-22	13-24	15-26
42	1- 8	3-10	4-13	6-15	8-18	10-20	12-22	14-24	16-26
43	1- 8	3-10	4-13	6-16	8-18	10-20	12-23	14-25	16-27
44	1- 8	3-11	5-13	6-16	8-18	10-21	12-23	14-25	17-27
45	1- 8	3-11	5-14	7-16	9-19	11-21	13-23	15-26	17-28
46	2- 8	3-11	5-14	7-16	9-19	11-21	13-24	15-26	17-29
47	2- 8	3-11	5-14	7-17	9-19	11-22	13-24	16-27	18-29
48	2- 8	3-11	5-14	7-17	9-20	11-22	14-25	16-27	18-30
49	2- 9	3-12	5-15	7-17	10-20	12-23	14-25	16-28	19-30
50	2- 9	4-12	6-15	8-18	10-20	12-23	14-26	17-28	19-31

Note: Numbers tabulated are the minimum and maximum sample outcomes, i.e., successful STPs, that could be expected 90% of the time a sample were selected.

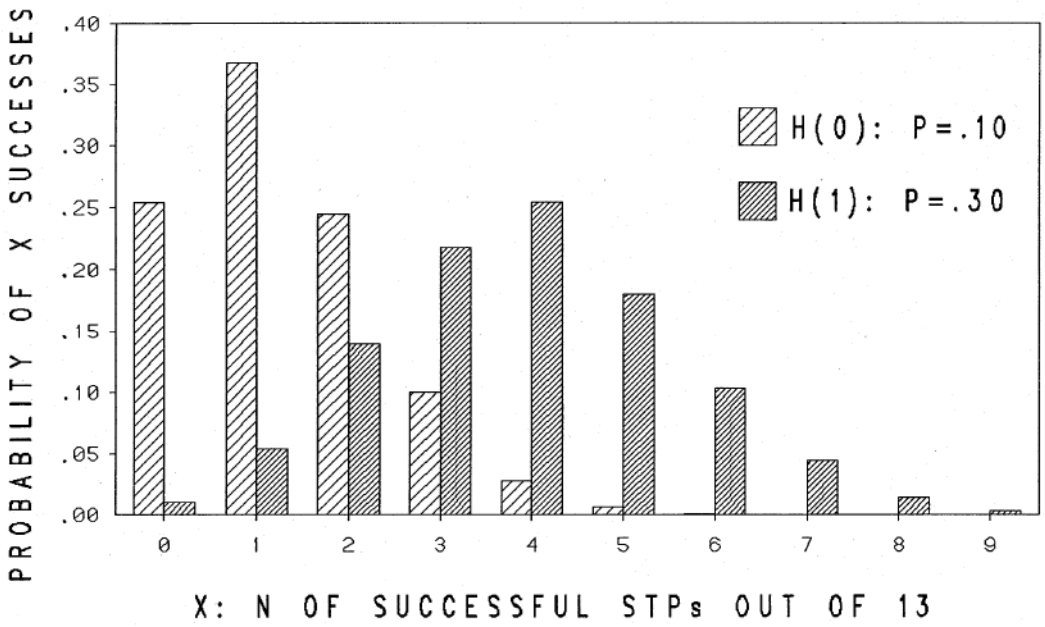


Figure 2.7. Illustration of hypothesis test showing two competing binomial probability curves, H(0) and H(1) (Adapted from Hoel 1971: 161, Figure 1).

insignificant) while the beta probability for a Type II error would be .064 (nearly significant). This would mean that the danger of writing off a potentially significant site would be minimized, while the chances of "crying wolf" would be increased. On the other hand, a cutoff between three and four positive STPs could be set, in which case the alpha probability would be .034 (significant) but the beta probability would be .421 (insignificant). This would mean that the danger of forcing a client to fund more work unnecessarily would be minimized, while the chances of writing off a significant site would be increased. Thus, the setting of a cutoff depends on whether reducing the chances of a Type I error or a Type II error is a priority. One of these is increased while the other is decreased when the cutoff is shifted.

From an archaeological perspective, the Type II error is the greater concern because of the danger of dismissing a significant site. I have compiled beta probabilities of Type II errors in Table 2.4 for sample sizes from 4 through 13—typical STP clusters. The first column is the sample size (N) or total number of STPs. Grouped by sample size in the second column are the possible sample results, viz., possible number of successful STPs (X). Each data column represents a different encounter probability from .10 to .50. The beta probabilities tabulated in the table cells represent the chances that X or fewer successful STPs would be obtained from a sample of N at the given encounter probability. This represents the area under the H(1) curve in the lower tail of the distribution to the left of and including X (1.0 is the entire area). In terms of hypothesis testing, if only X successes are obtained and the site is deemed not significant (i.e., H(1) is rejected), then beta represents the chances of being wrong and the site actually being significant. For example, with a sample of 13 and an assumed encounter probability of .40, if only two STPs are successful, then one can be fairly confident that the site does not have a .40 encounter probability (i.e., is not significant) because the chances of being wrong are only .058. On the other hand, if 5 STPs are successful and the site is dismissed, the chances of being wrong are over 50/50. Table 2.4 will be further referenced below in evaluating Level 3 testing.

Implications for Field Testing

Level 1 Testing: Site Identification. Simply put, field test results at Level 1, defined in Table 2.1 as site identification, consist of either negative evidence (all sterile STPs) or else any positive find. If anything is found, then the null hypothesis (H(0); that nothing is present) is falsified and testing is elevated to Level 2. But if nothing is found, and site absence is concluded, then the question arises: "did the survey team look hard enough?" Since sample results amount to the simple case of X=0, the only parameters in question are P and N. If P is assumed, such as .15 for feature encounter or .35 for artifact encounter (as established above), then the only parameter to evaluate becomes N, sample size, or total number of STPs placed on the anticipated site.

The minimal number of STPs required to establish reasonable negative evidence at the 95% confidence level can

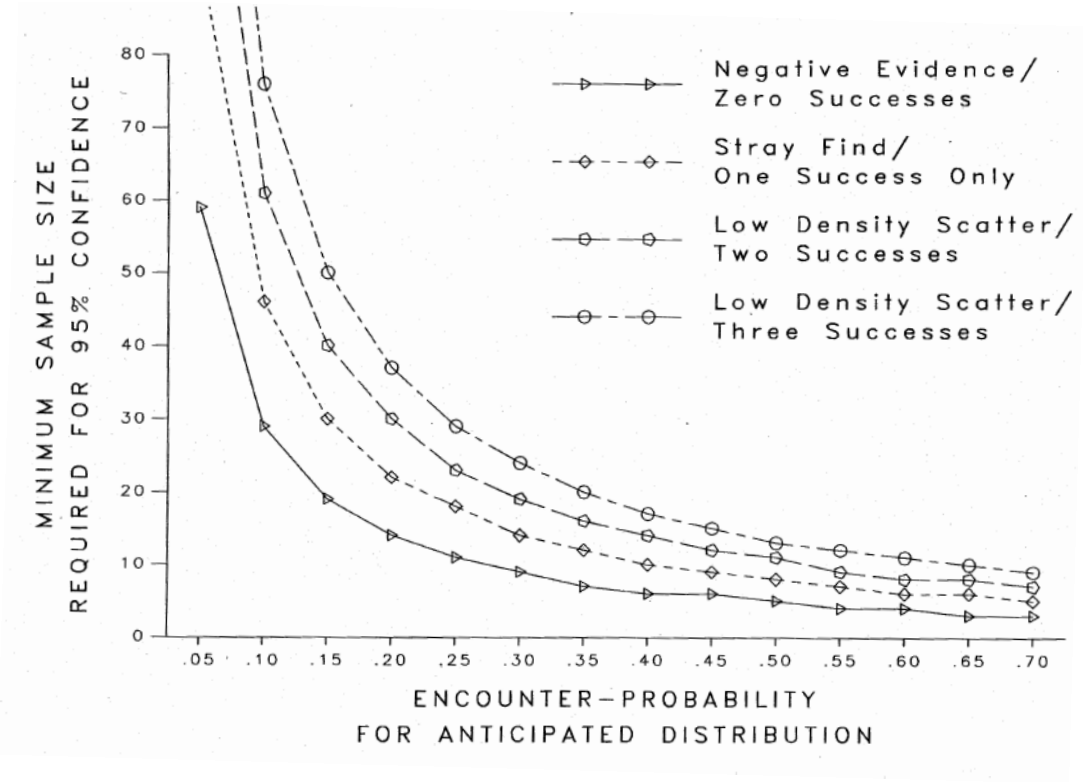


Figure 2.8. Minimum sample sizes required to claim that results of zero, one, two, or three successes are significantly lower than would be expected from a site exhibiting a given encounter probability for an archaeological constituent.

be determined from Table 2.3 or 2.4. For example, if P=.30, which would be a typical artifact encounter rate or a feature encounter rate at the high end of the range, then the .30 column of Table 2.3 shows that N=9 is the first sample size where a zero count is no longer expected within the 90% two-tailed probability range (5% in the lower tail). Likewise in Table 2.4, the .30 column shows that for X's=0, N=9 is the first sample size to yield a beta probability (again the lower tail of the probability curve) of less than .05. Even if P is set at .50 for the high end of the artifact encounter range, the minimal number of STPs required to demonstrate negative evidence is 5, taken similarly from Tables 2.3 and 2.4.

I have plotted these minimal sample sizes in Figure 2.8 (the vertical axis) for a range of encounter probabilities (the horizontal axis), with the first line representing Level 1 testing or demonstration of negative evidence. From this line it can be seen that at P=.15, the typical encounter probability for features on single component sites, the minimal sample size required is 19, that is, to demonstrate with 95% confidence that no features are present. For a typical artifact encounter rate of P=.35, a minimum of seven all-negative STPs is required. As noted above in Table 2.3, if P=.10 is assumed, then the minimal sample size is 29. This would be the case for a sparsely occupied site, in terms of features or artifacts (lithic flakes) and on most sites in terms of recovering diagnostic artifacts.

Level 2 Testing: Stray Find Verification. Frequently in CRM survey a find is made in a single STP—typically a single artifact. If a collection of independent STPs is dug on a site and a single find is made, then the likelihood that this represents a stray find can be determined from Table 2.3 or 2.4. Specifically, the minimal number of STPs required to claim a stray find, at the 95% confidence level, can be determined. For example, if P=.50, which would be an optimistic (high end) artifact encounter rate for a single component site, then the .50 column of Table 2.3 shows that N=8 is the first sample size where a count of one (X=1) is no longer expected within the 90% probability range. Likewise in Table 2.4, the .50 column for X's=1 shows that N=8 is the first sample size to yield a beta probability of less than .05. Alternatively, one can refer to Figure 2.8, the second line ("Stray Find") and look up the vertical axis intercept (minimal N) for the line at any given P on the horizontal axis.

Usually if an isolated find is made, most survey teams will test it expediently with a surrounding cluster of "verification test pits" or "VTPs" which I will here refer to as a verification test cluster (VTC). Such a test is defined in

Table 2.4. Beta probabilities for Type II Errors for Small Samples.

N of STPs Excavated	Max Positive	Probability of a Successful Test Pit (P)				
(N)	STPs, 0->X	.10	.20	.30	.40	.50
4	0	.656	.410	.240	.130	.062
	1	.948	.819	.652	.475	.317
5	0	.590	.328	.168	.078	.031
	1	.919	.737	.528	.337	.188
	2	.991	.942	.837	.683	.500
6	0	.531	.262	.118	.047	.016
	1	.886	.655	.470	.233	.109
	2	.984	.901	.744	.544	.344
	3	.999	.983	.930	.821	.656
7	0	.478	.210	.082	.028	.008
	1	.850	.577	.329	.159	.062
	2	.974	.852	.647	.420	.227
	3	.997	.967	.874	.710	.500
8	0	.430	.168	.058	.017	.004
	1	.813	.503	.255	.106	.035
	2	.962	.797	.552	.315	.145
	3	.995	.944	.806	.594	.363
	4	.999	.990	.942	.826	.637
9	0	.387	.134	.040	.010	.002
	1	.775	.436	.196	.071	.020
	2	.947	.738	.463	.232	.910
	3	.992	.914	.730	.483	.254
	4	.999	.980	.901	.733	.500
10	0	.349	.107	.028	.006	.001
	1	.736	.376	.149	.046	.011
	2	.930	.678	.383	.167	.055
	3	.987	.879	.650	.382	.172
	4	.998	.967	.850	.633	.377
	5	.999	.994	.953	.834	.623
11	0	.314	.086	.020	.004	.001
	1	.697	.322	.113	.030	.006
	2	.910	.617	.313	.119	.033
	3	.981	.839	.570	.296	.113
	4	.997	.950	.790	.533	.274
	5	.999	.988	.922	.753	.500
12	0	.282	.069	.014	.002	.001
	1	.659	.275	.085	.020	.003
	2	.889	.558	.253	.083	.019
	3	.974	.795	.493	.225	.073
	4	.996	.927	.724	.438	.194
	5	.999	.981	.882	.665	.387
	6	.999+	.996	.961	.842	.613
13	0	.254	.055	.010	.001	.001
	1	.621	.234	.064	.013	.002
	2	.866	.502	.203	.058	.011
	3	.966	.747	.421	.169	.046
	4	.994	.901	.655	.353	.134
	5	.999+	.970	.835	.575	.291
	6	.999+	.993	.938	.772	.500

Table 2.1 as Level 2 testing.

Simply put, field test results at Level 2 consist of either a single find or else any additional finds. If additional finds are made in the VTC, then the null hypothesis (H(0), that the single find is stray or isolated, is falsified and testing is elevated to Level 3. But if nothing is found, then the single find is declared as stray or isolated and the alternative hypothesis—that prehistoric activity took place, is discounted. However, if the find is in a location that is favorable for a site, then the question arises: "did the survey team look hard enough?" Since sample results amount to the simple case of X=1, the only parameters in question are P and N. If P is assumed, such as .35 for artifact encounter, then the only parameter to evaluate becomes N, sample size, or number of VTPs plus the original findspot STP.

The typical, standard VTC consists of four VTPs placed at cardinal directions to the findspot STP—typically at 2-m intervals. Quite often such a VTC will yield negative results. In such a case, the probability of obtaining exactly one success in the VTC, namely only the original find spot, is equal to the probability of obtaining all subsequent negative VTPs, given that the first is positive, which is Q**4. In the case of a typical artifact encounter probability such as P=.30, the chances of obtaining all negative VTPs would be .70**4 or .24. Thus the VTC would miss one in four single component sites. The only rationale for using the four-VTP cluster, apparently, has been the fact that there are four cardinal directions. Otherwise, the VTPs are easily placed, and the number of additional units to excavate is manageable and not burdensome. The statistical reliability of the 5-VTP cluster, however, is marginal and sample size of VTCs should be increased to a level sensitive to assessing single component sites.

In the preceding example, if four more VTPs were added to the first four—being placed at 45-degree angles (NE, NW, SW, and SE)—then there would be a total of eight VTPs. In that case, the chances of obtaining all subsequent negative VTPs on a site where P=.30 would be .70**8 or .058. Thus, one could be 94% confident that the distribution being tested does not represent P=.30, but something less. However, if a lower encounter probability is assumed, such as P=.20, then eight negative VTPs would have a reliability of only .80**8 or .167, or 83% confidence, so that 17% of the time, dismissals based on negative results would be wrong.

A more reliable VTC would be one with 12 VTPs in addition to the original findspot, yielding N=13. In the latter example, at P=.20, 12 negative VTPs would have a reliability of .80**12 or .069, or 93% confidence. Thus a 13-VTP cluster would be sensitive and reliable in assessing the presence of a single component site with a somewhat low artifact density. I am proposing an arrangement for such a

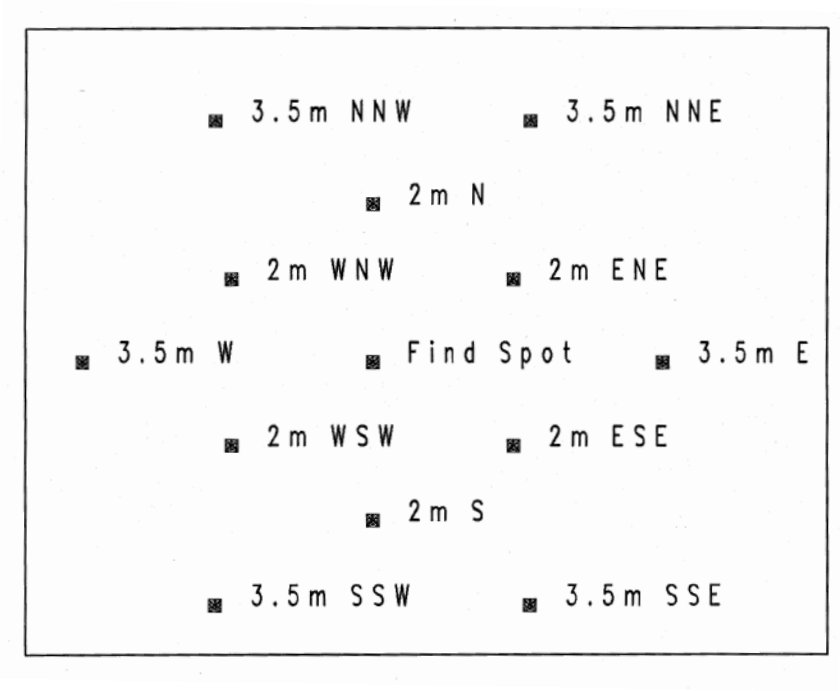


Figure 2.9. Proposed arrangement for a 13-STP verification cluster.

cluster in Figure 2.9. While such a cluster is not easy to lay out, field crews could carry a cluster plan in their packs and follow it when the need arises. More of a concern would be the additional labor overhead required to implement such VTCs. This could be minimized by digging the cluster in stages—first the inner ring of VTPs, then the outer ring only if no finds are made in the inner ring.

The above VTCs have addressed the find of a single flake in an STP. However, if a sample of independent STPs is dug on a site and a single feature, such as a fire hearth, is found (where the typical encounter probability is .15), then the minimal sample size to claim that this is a stray would be N=30 (Table 2.3, .15 column, cell value 2-8, or Figure 2.8, second line at P=.15). In other words, a total of 30 STPs must be dug, with only a single feature occurring, before one can confidently claim that the site is a "single episode occupation," e.g., an isolated overnight camp. If P=.10 is assumed, then the minimal sample size would be 46.

Level 3 Testing: Lithic Scatter Evaluation. If Level 2 verification testing produces additional evidence, then the initial find was not a stray, but part of an artifact distribution. Additional STPs must be placed throughout the potential site area in order to obtain a sample large enough to evaluate the distribution. Such additional testing may yield no further evidence, in which case the count of successful STPs remains at two (the original find-spot and one VTP). Another possibility is that only one additional find is made, in which case the count of successful STPs would be three. Such results would be considered meager and the distribution would typically be dismissed as a low-density lithic scatter.

But the question remains: "did the survey team look hard enough?" The answer depends on the total number of STPs excavated on the potential site. If 100 STPs are dug and only three are successful, then the dismissal is probably justified. On the other hand, if three STPs are successful but only a total of five is dug, then a significant distribution probably exists. In between these two extremes is a range of ambiguous results where it is uncertain what is represented by X successes out of N STPs. The field test must be treated as a hypothesis test as outlined above. Accordingly, H(0), the null hypothesis, holds that a low density lithic scatter is present, and H(1), the alternative hypothesis, holds that a distribution is present comparable to that of a significant site. If only two or three successes are obtained, then most likely H(1) will be rejected in favor of H(0). Then the question remains: what is the beta probability of a Type II error; i.e., what are the chances that a significant distribution is actually present?

Figure 2.8 plots the sample sizes necessary (vertical axis) to achieve a beta probability of .05 for success counts of two (the third line in the graph) and three (the fourth line) for different encounter probabilities (the horizontal axis). For example, if H(1) assumes a typical encounter probability of P=.35, and if two successful STPs are

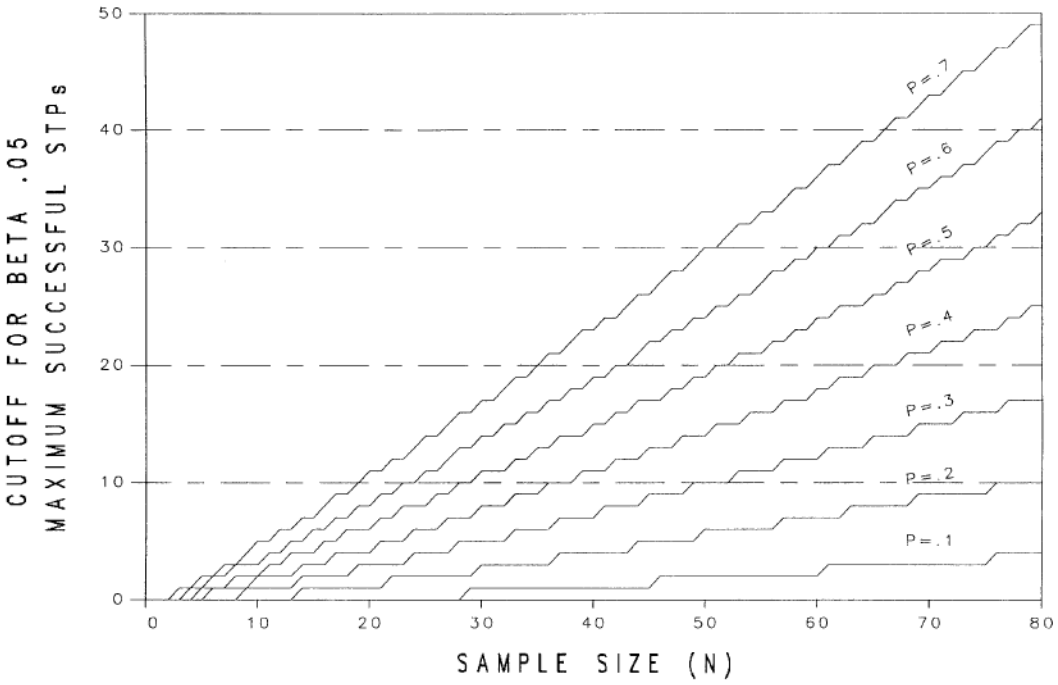


Figure 2.10. Cutoff for beta probability of .05, being the maximum number of successful STPs possible out of a sample to permit rejection of the alternative hypothesis (H(1)) that the encounter probability is P.

obtained, then the sample size (N) must be 17, i.e., at least 17 STPs must be dug before one can reject H(1) with 95% confidence. If three successful STPs are obtained, then the sample size must be 20. If H(1) holds that P=.20, the lower end of the range for artifact encounter rates, then if two successes are obtained, the sample size must be 30. If three successes are obtained, then the sample size must be 37. In sum, between 17 and 37, or more, STPs must be dug before one can dismiss a lithic scatter on the basis of meager results—the total depending on the intensity of the site that is being rejected.

If more than meager results (two or three successes) are obtained, then even more STPs need to be dug, before the distribution can be discounted. Figure 2.10 shows the maximum number of successful STPs that can be obtained (vertical axis), or the alpha-beta cutoff, for varying total sample sizes (horizontal axis) and varying hypothetical (H(1)) encounter probabilities (lines plotted), at a beta probability of .05. In other words, along each line, the value on the vertical axis, or fewer, successes may be obtained in order that H(1) can be rejected with 95% confidence. Even then, there is a 5% chance for a Type II error, viz., that the dismissed distribution actually conforms to H(1) and is substantial. For example, if 30 STPs are dug (N), and H(1) presumes an encounter probability of P=.30 (the third line), then only five or fewer successful STPs can be obtained in order to reject H(1). If H(1) holds that P is .20—again the low end of the range for artifact encounter rates, and 30 to 37 STPs are dug, then only three or fewer successes must be obtained to reject H(1). Conversely, if 10 successes are obtained and H(1) is P=.30, then the sample size must be 50, or if 15 successes are obtained, the sample size must be 70, in order to reject H(1). If P=.20 is presumed for H(1), and 10 or 15 successes are obtained, then the necessary sample sizes are literally off the chart. If, for example, 30 STPs are dug and 10 successes are made, then the only H(1) that can be rejected reliably is one that holds that P=.50 (the fifth line on the graph). In sum, if 10 or more successes are made, then unless hundreds of STPs are dug, the site must be minimally accepted as a single component site, albeit with a sparse, but substantial artifact density (P=.20).

Estimation and Site Assessment. So far this discussion has addressed sample results, which would be marginal, meager, or even mediocre, and the methods to evaluate these. However, if substantial sample results are obtained, then different methods of evaluation are needed. In probability terms, such results would not fit in the lower tail of the H(1) distribution curve, but rather within the main part of the curve. In statistical terms, such results cannot be evaluated by hypothesis testing, because H(1) cannot be rejected. Rather, methods of estimation must be used. The goal of such methods is to describe the distribution encountered in terms of its intensity of artifacts or features.

The problem of estimation, in statistical terms, amounts to trying to predict the population encounter probability, P, on the basis of a sample proportion figure, p, which is

equal to X/N, or the count of successful STPs divided by the total number of STPs. Inferential statistics permit such estimations and allow for the placement of confidence intervals around the estimates (Hoel 1971: 137-155).

The variation in X expectable if one were to make repeated samples of N from a population—in this case all the potential STPs on a site—is referred to as the sample standard deviation, or sigma. This is equal to the square root of: p*q/N, where p is X/N and q is 1.0-p (Hoel 1971:149). Assuming that sigma is normally distributed, then a confidence interval can be calculated around p, based on sigma. A range of two sigma on either side of p will yield a confidence interval with 95% confidence. By inference there is a 95% likelihood that the sample's confidence interval will capture the actual population proportion, P, because 95% of potential samples taken would fall within this range of P by the laws of probability.

As an example, if 30 STPs were dug on a site (N=30) and 10 of them were successful (X=10), then the sample p would be 10/30 or .33. Sigma would then be the square root of (.33*.67)/30 or .086. Two sigma would be 1.96*.086 or .169, and this interval around p would be .33 +/-.169 or .16 to .50; this would be the 95% confidence interval around p (.33). In other words, there would be a 95% likelihood that the actual encounter probability for the site being tested lies between .16 and .50. This happens to be the range of artifact encounter probabilities measured for the collection of single component sites analyzed above (Figure 2.5).

Rather than accepting the confidence interval delivered by the survey team, a project reviewer or researcher may request that the confidence interval fall within a desired range. Such an issue would be one of estimate accuracy and as might be expected is dependent on sample size, N; i.e., to increase accuracy, N must be increased (see Hoel 1971: 154-155). The acceptable range or desired confidence interval—actually one half of this on either side of p—is referred to as "e" or the error of the estimate. The width of this interval will narrow as N is increased. The sample size required to achieve e is given by the formula:

$$n = z^{**2} * p * q / e^{**2}$$

(Hoel 1971: 154; see "Statistical methods" above for FORTRAN notation). Here "z" is the number of standard deviations (sigma) desired to produce the needed level of confidence, e.g., two sigma (1.96) for 95% confidence. Thus, the z-squared term would be 1.96*1.96 or 3.84.

As an example: a survey team might excavate 30 STPs on a site and find features in six of them, or 20%. Thus, p, the sample estimate, would be .20. It might be desirable to estimate population P, at 95% confidence, within an accuracy or error of +/-.10 around p. This would produce a 95% confidence interval of .10 to .30, which happens to be the typical range of feature encounter probability on the collection of prehistoric sites analyzed above (Figure 2.6). In order to achieve this level of accuracy in the estimate (e=.10), the sample size, N, must be a certain minimal number. This can be calculated from the above formula as:

n = 3.84 * .2 * .8 / .10**2 or 3.84*1.6/.01 which equals 61.

Thus, an additional 31 STPs would need to be excavated (presumably producing consistent results of .20) in order to achieve the desired level of accuracy. This example is provided for mathematical illustration only and is not intended as suggested policy.

Field Test Design. To ensure identification of significant sites, a survey team must consider a number of critical parameters. These control the determination of sample size (i.e., number of STPs), and the evaluation of sample results, and include site size, STP interval, intensity of various archaeological site constituents, STP size, and screen mesh. Site size and STP interval together will govern sample size, N, at least during site identification. Constituent intensity, STP size and screen mesh together will determine encounter probability, P. In turn, N and P together will produce the model binomial distribution for the anticipated site, against which sample results will be evaluated.

Sizes of model sites in the Northeast can be estimated following Thomas (1986). Three arbitrary site types that might be modeled include: the single-occupation camp (20 m diameter), the base camp (50 m diameter), and the village (100 m diameter). A project archaeologist must anticipate the type of site he/she expects to encounter in a given project area segment, so that an appropriate STP interval can be used. The landform being tested must also be considered, for example whether it is a large flood plain or a small knoll. STPs will presumably be placed in a systematic grid, so that the number of STPs expected to fall within a site will be equal to the site area divided by the areal frequency of STPs (e.g., the square of the interval). If STP transects are used, then the number would be the site diameter divided by the interval. An interval must be selected that will yield the sample size, within any site area, required for site detection. For example on the Scaccia Site which is 40 m long (Figure 2.2), if an STP transect were placed along the site, the interval would need to be 4 m to yield nine STPs necessary to ensure site detection at an encounter probability of P=.30. If a small landform is being tested, then a 9-STP or 13-STP cluster could be placed on the landform, as outlined above regarding verification tests.

In addition to site size, the intensity of archaeological constituents within a site must be anticipated. Constituents critical to the survey process include artifacts, features, and tools or diagnostic artifacts. The intensity of

each constituent is measured here as the proportion of a site floor area occupied by the constituent, relative to a given STP size. This figure is equal to the encounter probability for the constituent. It was determined above that the encounter probability for artifacts on a typical single component site was .20 to .50 with a mode of around .33 to .35 (for 30-cm STPs). The sparsest site analyzed, Fort Hill, exhibited an encounter probability of .10; this could be taken as a worst-possible-case estimate. The proportion of site floor areas covered by features was found to range between .10 and .30 with a mode of .15. Intensities of tools were not analyzed, but a conservative figure of one per square meter can be assumed, so that P would be roughly .10. All the above figures will vary depending on circumstances that a project archaeologist must assess. For example, a Contact Period village would exhibit a low artifact density, whereas a site with a lithic source nearby could be expected to contain a large amount of debitage. A site located on hardpan could be expected to contain a minimal number of features—probably only hearths—whereas a site located on excessively drained sand could be expected to contain a large number of storage pits, and possibly burial shafts.

The other parameters that require consideration are STP size and screen mesh, which will vary depending on circumstances (McManamon 1984:261). There are both quantitative and qualitative trade-offs between employing many small STPs versus fewer large ones. Quantitatively, there is a trade-off between P and N. Many smaller STPs will yield a larger sample size, N, thereby increasing statistical confidence and the chances of intercepting features. Smaller STPs, however, yield lower probabilities of artifact interception—proportional to the inverse-square of the STP dimension, e.g., a 25-cm STP has 69% of the encounter chances of a 30-cm STP (.0625/.09). In terms of artifact recovery, screen mesh would also affect encounter probability, because there are generally many more small flakes than larger ones in lithic work areas. According to binomial probability (see Figure 2.8), the required sample size, N, increases geometrically with decreasing encounter probability, so that the effects of varying N and P with STP size tend to cancel out one another, i.e., what really matters is the total amount of area sampled, at least for artifact encounter. Qualitatively, larger units are generally preferable. Depth penetration is dependent on STP size. In general, an STP may be excavated twice as deep as it is wide. Hence, for example, if STPs must penetrate one meter of alluvium, then they should be 50 cm wide rather than, for example, 25 cm. Other factors involve survey logistics. If maneuverability is limited by vegetation, then fewer larger units would be preferable. Relative rates of completion of smaller versus larger units must be considered (McManamon 1984:268). Each STP must be located, opened, recorded, and closed, so that larger samples of small STPs require more survey "overhead" per unit volume of soil examined. Once an STP size is chosen, an appropriate artifact encounter probability must be anticipated and employed in the interpretation of STP results. For purposes of this paper, the 30-cm STP was assumed because, as stated earlier, it is probably the actual dimension of most STPs at the subsoil depth.

Sample Sizes in Practice. Sampling intensities in CRM survey, for example in Massachusetts during the 1970s, were generally inadequate and were governed more by project area size and budgetary constraints than by sampling theory (Hasenstab and Lacy 1984: Figure 2; Wobst 1983). Site identification was essentially opportunistic, i.e., surveys were intended to "sample" project areas, not to identify sites with confidence. Over the last 20 years since the RAASC study, test intervals and sample sizes have improved somewhat, but remain inadequate for providing 95% survey confidence. In order to do so, vastly larger sample sizes are required. For example, in 1916 Warren Moorehead set out to locate the Contact Period village of Carantouan, reputedly located atop Spanish Hill at Tioga Point, Pennsylvania (Moorehead 1918:121). After placing over four hundred test pits atop the several-acre hilltop, field director Donehoo concluded: "the soil at no place gave evidence of any long occupation, or even of a short occupation by a large number of people" (1918:131). Hence, the folk legend of the village's location was formally falsified. This anecdote represents a "seat-of-the-pants" site assessment by an experienced archaeologist before the advent of probability sampling in Archaeology. Such sample sizes are unheard of today, but probably represent more what is required to provide confident site identification and assessment.

Potentially Overlooked Site Types

The above analysis has attempted to show that many sites that could be potentially significant are likely overlooked during archaeological survey and dismissed as "lithic scatters" because of STP testing in combination with their low intensity of occupation. Conversely, STP survey tends to emphasize multi-component, recurrently occupied habitation sites in likely locations. The survey system is therefore oriented toward revealing "more of the same" types of sites and perpetuating our current knowledge of prehistoric lifeways.

Classes of sites that are likely overlooked and dismissed consist of single-component sites in isolated, and perhaps unique locations. Such sites might include Paleo-Indian camps, Archaic upland special-purpose procurement sites, Middle Woodland ceremonial sites, and Late Woodland and Contact Period villages. It is especially the special-purpose and ceremonial sites that have potential

of expanding our knowledge of prehistory, and we should be careful to identify these if they are encountered. Following are examples of such sites.

Paleo-Indian camps are often on landforms that may have been strategic during the post-Pleistocene period but were subsequently ignored for the remainder of prehistory. Such camps more often than not were briefly occupied, diffusely settled, and low in artifact density. One example would be the Hannemann Site in Montague, Massachusetts, which covers roughly an acre of Pleistocene sand dune, is low density, and was discovered by an amateur from artifacts eroding out of a dirt road cut (Binzen et al. 2003; Hasenstab 1986b). This site would likely have been dismissed based on a standard STP survey. Another example would be the Hawk's Nest Site in Illinois (Amick and Loebel 2002), located on a low rise overlooking a fossil wetland. This site was dismissed upon initial STP survey as a lithic scatter, but was only later recognized as a Paleoindian camp through an accidental find of a diagnostic artifact and follow-up intensive investigation by the co-Principal Investigator.

Another example of a site overlooked by STP survey would be the Stubbs Earthwork near Cincinnati, Ohio—a reported Middle Woodland ceremonial site (Cowan et al. 2000). This site, in a large open field, was the subject of a CRM survey for a proposed public school. STP survey revealed a very low scatter of artifacts. It was only at the end of the survey that a backhoe trench revealed a wide arc of large post molds. Upon further investigation, this appeared to be what investigators interpret as a wood henge ceremonial enclosure. Were it not for the fortuitously placed trench, this site would have been dismissed as a lithic scatter.

Late Woodland villages are likely victims to STP survey dismissal. One example would be the Tillsonburg Village in southwestern Ontario (Timmins 2002). This Middle Ontario Iroquois (ca. AD 1400) village is unusual in being unpalisaded, sprawled out, and low density. Eventual complete stripping of the site revealed ten longhouses distributed over ten acres of ground. This does not conform to the standard notion of the compact village and raises the question: how many "Tillsonburgs" have been overlooked thus far?

Another example would be King Philip Fort, a Pequot Contact Period fortified settlement on the Mashantucket Reservation in Connecticut (McBride 1993). Documentary evidence described the fort being built in 1675 during King Philip's War and used for two and a half years. The site was supposed to be somewhere on the modern reservation. An archaeological survey identified a 19th-Century farmstead site with traces of Native American artifacts. The STP survey results were interpreted as showing previous low-intensity use by Native Americans. It was not until full-blown Phase-III excavation took place on the farmstead site that the settlement pattern of a Native American fortification became apparent in the subsoil; this turned out to be the 1675 fort. Were it not for the historic farmstead, King Philip Fort would never have been discovered.

Late Woodland and Contact Period villages are typically sparse in features and artifacts, yet they constitute the chief archaeological data base for their respective time periods and should not be overlooked by STP surveys. Reasons for their low internal densities are several. First, these villages were dependent on a horticultural economy and were therefore occupied for short periods (10 to 50 years) because of soil exhaustion and firewood depletion. They usually were placed in remote locations, for defensive purposes, and were then abandoned. Hence, only one set of house post molds, fire hearths, and pits are usually observed on these sites.

Artifacts are typically of low density within villages. Heidenreich explains that "longhouses, including the hearth areas, were cleaned out periodically, and garbage disposed of in predetermined places" (1971:147-148). Such "places" were middens on later sites. Middens may have been located over bank edges and could have been lost to erosion. On earlier sites, refuse was usually disposed of in abandoned subsurface storage pits (Ritchie and Funk 1973: 167). Hence, many village sites may be unobtrusive from the surface, even when plowed. The Bates site, for example, was discovered only because gravelling operations disturbed its cemetery. Ritchie and Funk note that:

> None of the topsoil was darkly stained by Indian refuse nor were the usual evidences of occupation, flint chips, burned rocks, etc., present in any great amount.... However, test pitting revealed that a considerable number of pits, probably storage pits ... contained, as usual, the bulk of the community refuse [1973:228].

Contact Period villages generally exhibit lower artifact densities than their prehistoric counterparts, probably because of the replacement of native lithic and ceramic industries by brass and copper (William Finlayson, personal communication, 1984). Both the Contact sites analyzed above—Gannagaro and Fort Hill (Figure 2.5), conform to this pattern. Thus a low artifact encounter probability can be expected—perhaps P=.10 to .20. In sum, a wide range of interesting archaeological site types is likely to be overlooked by standard STP survey. Other methods of site assessment—besides STPs and meter squares—are needed.

"DEAD-FURROW" TRENCHING: AN ALTERNATIVE TECHNIQUE FOR FEATURE DETECTION

It's been shown above that the conventional technique of using shovel test pits (STPs) is inadequate for confidently assessing the presence or absence of sub-plowzone features on presumed "lithic scatter" sites. This is because of the relative sparseness of features on single-component sites; typically the site floor plans are 15% feature, 85% "empty space." Either huge numbers of STPs must be implemented to intercept features, or else some other technique of feature detection must be employed.

To date, most other techniques for detecting features tend to be expensive, time-consuming, and/or destructive to the plowzone of the site. These include geophysical probing using high-tech instruments, e.g., magnetometry, resistivity, and ground penetrating RADAR (GPR), all of which are expensive and the success of which is dependent on local soil and weather conditions. The more popular method is bulldozer stripping of plowzone, but this is destructive of the artifact distribution in the plowzone. Soil coring is a non-destructive alternative, but it is insensitive to detecting subtle differences in horizontal patterns of the soil, e.g., living floors; it only examines vertical or stratigraphic differences.

I suggest here a long known but little used alternative technique referred to as "dead-furrow" trenching (Bowen 1982). Those familiar with surface collection of plowed fields may recall the deep furrow at the edge of the field left open due to the lack of an adjoining swath from which to turn in adjoining soil. If this "dead furrow" were to be cleaned out with a flat shovel to the subsoil surface, one would be able to detect sub-plowzone features and to see and feel differences in the soil in the linear dimension of the trench. Patterns such as living floors, hearth perimeters, and pathways could be thus detected. The dead-furrow trenching technique involves deliberately plowing a site at spaced intervals so that the dead furrow is left open along the edge of every swath. After cleaning out the bottoms of the dead furrows, a "venetian-blind" view of the site's settlement pattern is obtained. Bowen (1980) did this on a Mississippian village site in Ohio and was able to plot the whole village settlement pattern including house floors, palisade, and middens.

Dead Furrow Use at Westfield MCI.

I employed dead-furrow trenching on a CRM investigation of the proposed Massachusetts Correctional Institution facility in Westfield, Massachusetts within the Connecticut River valley (Hasenstab et al. 1990). The site, now known as "Westfield MCI" (19HD109) was situated on a high terrace of the Westfield River. As such, it was flat, open, plowed, covered with a plowzone of fine sandy loam, but underlaid with a subsoil of Pleistocene outwash in the form of layered coarse sands. It was an ideal situation for employing dead-furrow trenching as the topsoil was easily shovel skimmed and intrusive features were readily apparent in the subsoil.

Figure 2.11. Use of the dead-furrow trenching technique at the Westfield MCI Site in western Massachusetts. Shown is crew member Mark Will flagging 5-m segments.

Phase I surface collection on the site revealed a sparse scatter of artifacts that would be dismissed as a lithic scatter. However, placement of hand-excavated exploratory trenches revealed the presence of features below the plowzone. I advocated the use of dead-furrow trenches to assess the overall feature distribution on the site and the project sponsors agreed.

An interval between parallel trenches of five meters was chosen to allow maneuvering of the plow, yet provide good coverage of the site's subsoil surface. Flags were placed at 5m-intervals on either end of the site to guide the farmer who re-plowed the field. He then ran plow swaths with his tractor, dragging a moldboard plow every five meters (Figure 2.11).

Each dead furrow was flagged in 5-m segments for recording purposes and the trench base was then cleaned out with a flat shovel to subsoil surface. All apparent soil anomalies were drawn onto a 5-m-segment floor plan

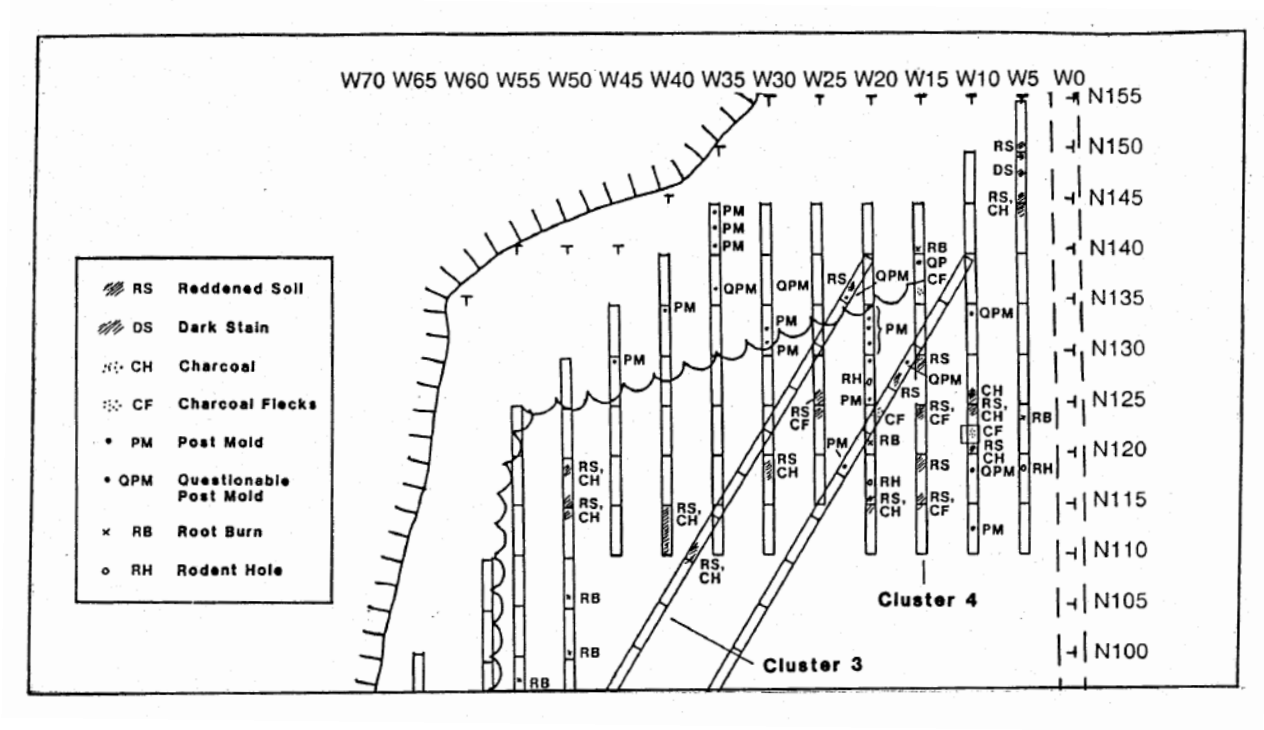


Figure 2.12. Plan of dead-furrow trenches implemented at the Westfield MCI Site in western Massachusetts, showing soil stains encountered.

form and described. These forms were compiled in the lab to produce a site-wide distribution plan (Figure 2.12).

Potential features were exposed using a backhoe fitted with a smooth blade, clearing plowzone from a two-by-two meter area around each feature, or more if necessary. Feature floor plans were delineated and mapped. A sample of the most promising features was selected for excavation. Each excavated feature was bisected in plan view and one half of the feature was excavated to its base by skim shoveling. All feature matrix was water screened through fine mesh to recover paleobotanic remains.

In all, 24 soil anomalies or potential features were mapped in the trench survey (Hasenstab et al. 1990:32-38). Of these, five turned out to be non-cultural (e.g., tree stump burns). Another four were possibly cultural and fifteen were probably or confirmed cultural features. All told, 11 features were excavated (Hasenstab et al. 1990: 116, Table 2). Collectively the features produced six radiocarbon dates that were all prehistoric, representing Middle Archaic, Terminal Archaic, and Middle Woodland occupations. Paleobotanic remains recovered included starchy seeds (Chenopodium and Amaranthus) as well as grasses probably used to line the storage pits. One of the features contained a diagnostic, Susquehanna style projectile point representing Terminal Archaic. In sum, what originally appeared as a lithic scatter turned out to be a habitation site with post molds and features containing radiocarbon samples, paleobotanic remains, and diagnostic artifacts.

At Westfield MCI, the survey ultimately contributed toward a management decision to not proceed with the development project, so that, to date, the site remains preserved with minimal disturbance having been made to the plowzone and subsurface. Thus the dead-furrow trenching technique allows for "surgical" or "smart" sampling of the subsurface, in contrast to bulldozer stripping which destroys artifact distributions in the plowzone. The technique is also cheaper, quicker, and less logistically disruptive than plowzone stripping.

The technique has some limitations, though. One is that the use of the moldboard plow—the type used to create dead furrows—is being phased out by the USDA. Thus it may no longer be standard agricultural practice in a given area, so one would have to specially commission a farmer to do it. At the same time, there are probably many used moldboard plows available that could be purchased at a minimal cost.

Another limitation is that the technique is only appropriate where features are visible at the base of plowzone or subsoil surface; it would not be appropriate in alluvial or colluvial settings. In such cases I would advocate the use of a small backhoe or a "Ditch Witch" to cut slit trenches into the sediments.

Finally, dead-furrow trenches are optimal for open-air, stoneless soils; they would be impossible to use in a forested site and would be difficult to clear in rooty or

stoney soils. In such cases I would simply advocate hand excavation of shovel-width (25-cm) trenches, in lieu of the conventional meter square or two-by-two meter unit. For the same amount of soil excavated and screened, a 4-m trench will yield four times the length of a meter square and a 16-m trench will yield 16 times the length of a two-by-two, thus increasing the chances of feature interception as a function of length.

Where conditions allow, however, dead-furrow trenching can be a useful technique. It is vastly under-recognized yet has tremendous potential for evaluating settlement patterns in an inexpensive, rapid, and effective manner.

SUMMARY AND CONCLUSION

I have shown above that a wide range of single-component, low-density, yet significant prehistoric archaeological sites would all too often appear as "lithic scatters" when tested with standard field test techniques, namely, the use of shovel test pits (STPs). This is because on such low-density sites, STPs have a marginal probability of intercepting features or diagnostic artifacts that are necessary to establish site significance. Conversely, STP-based surveys are only sensitive to detecting and recognizing only the most obtrusive of archaeological sites. To identify the lower density sites, either greater numbers of STPs need to be used, or else alternative techniques of field testing need to be adopted.

I have analyzed a sample of low-density yet significant sites in terms of the amount of empty space in their floor plans and the chances of obtaining negative STP results. Conversely, I've established the chances of obtaining a positive STP, and have determined the range of "encounter probabilities" (P) for the archaeological constituents that make up a site, namely, features, artifacts (e.g., lithic flakes), and tools or diagnostic artifacts. For features, P was found to range from .10 to .30 with a mode of .15. For artifacts P was found to range from .10 to .50 with a mode of .30-.35. Tools and diagnostics were not analyzed; however, based on published data, a baseline of one per meter square, or P=.10 can be assumed for modeling purposes.

Using these encounter probability figures, along with binomial probability laws, I have established requirements for minimal sample sizes, i.e., numbers of STPs, which need to be excavated on a potential site in order to identify and evaluate the site with confidence—in this case 95% confidence. I've done this for three logical levels of testing which I define on the basis of sample results and the null hypotheses being tested. The required minimal numbers (N) vary depending on the assumed encounter probability (P).

At "Level 1," if all negative STPs are obtained with respect to any or all of the archaeological constituents, then a minimal number must be dug to support the null hypothesis that nothing is present. At P=.10, which is the lower end of the range of encounter probabilities for both features and artifacts, and probably a typical rate for tools and diagnostics, this minimal number is 29 (or, essentially, 30). For P=.15, which is a typical rate for features, the number is 19. For P=.35, which is a typical rate for artifacts, the number is seven.

At "Level 2," if a single find is made, then a minimal number of verification STPs, or "VTPs," must be dug, and all be negative, in order to dismiss the find as a stray or isolated one. This applies to all three constituents—artifacts, features, and diagnostics. For P=.10, the number is 46, and for P=.15 it is 30. I argue that the traditional use of the 5-VTP cluster for evaluating stray finds is statistically unreliable; it would write off significant sites 24% of the time. Rather, a 9-VTP cluster would be moderately reliable at evaluating most constituents, so that if a 5-VTP cluster is negative, then four additional VTPs should be dug at 45-degree angles to the first four. Ideally, a 13-VTP cluster should be used to provide 95% confidence for most constituents. This would consist of an inner ring of six VTPs place in a hexagon at 60-degree angles. If that tests negative, then an additional outer ring should be placed at 30-degree angles to the first.

At "Level 3," if multiple finds are made, then a larger number of STPs must be dug to claim that the distribution is indeed a low-density scatter. If P is assumed at .35, and two finds are made, then N must be at least 17. If P=.20 is assumed and three finds are made, then N must be at least 37. In sum, roughly 20 or 30 STPs are needed to discount a site from being a typical single component site if meager results are obtained, i.e., only two or three positive STPs.

In sum, the number 30 appears above as a minimal number in several hypothesis test contexts, so it is probably a good number for archaeologists to plan and budget for when testing a site. A mere handful of STPs, e.g., a half dozen, lacks any sort of reliability and should be considered unacceptable. In order to achieve requisite numbers of STPs on potential sites, archaeologists need to use shorter test intervals, particularly when using linear transects of STPs to test rights of way or landforms such as terraces or ridgelines. If a small base camp is anticipated, then the interval should be five meters or less. If a small landform is being tested, such as a knoll, then I would advocate use of the 13-STP cluster spread over the landform.

Unfortunately the kinds of sample sizes I am advocating have not typically been used. As a result, we have probably been overlooking a whole range of interesting and significant sites. Among these would be Paleo-Indian

camps, special-purpose uplands sites, ceremonial sites, and Late Woodland and Contact Period villages.

At least on the latter two classes of sites, surveys need to be sensitive to identifying features, including post molds of ceremonial and habitation structures. Features are also important in plowed contexts, assuming that they extend below the plow zone, because they have the best potential for yielding diagnostics—pottery having been pulverized in the plow zone and projectile points having been removed by collectors. Unfortunately, STPs are not effective at recognizing or even intercepting features. Neither are their larger counterpart, the meter squares, which are typically used to evaluate sites identified with STPs. They are susceptible to being placed in the empty space portions of sites. Intercepting features with STPs and/or meter squares is literally a "hit or miss" proposition.

To increase the likelihood of feature interception on potential sites, I advocate the use of trenches. Trenches are non-destructive, as compared with plowzone stripping by bulldozer. They are more effective at intercepting features than are meter squares, by a factor of their length; e.g., a 10-m trench is ten times as likely to intercept a feature than is a meter square. The easiest, quickest, and cheapest form of trench to place is the so-called "dead-furrow" trench, made with a moldboard plow. In contexts where plowing is not possible or effective, I recommend other techniques. In stratified contexts I advocate a small backhoe or else a "Ditch Witch." In dense woods or underbrush I would simply hand excavate a shovel-width trench (25 cm), rather than placing meter squares. This will increase feature interception by a factor of four, for the same amount of soil excavated (assuming a 4-m trench).

Other methods could be used to increase the recovery of diagnostic artifacts, such as plowing and surface collection or mechanical screening. Most archaeologists are aware of those methods and I have not analyzed them here. The main point is: we need to increase our chances of intercepting features and diagnostic artifacts, or else a wide range of significant sites will continue to be dismissed as "lithic scatters." In that way, we can expand our knowledge of prehistoric lifeways, rather than simply uncovering "more of the same."

ACKNOWLEDGEMENTS

Data for distributional analyses performed here were provided by a number of Northeast archaeologists. Jonathan Lothrop formerly of S.U.N.Y. Binghamton provided me with computer listings and maps of the results of their 1982-83 excavations at the Potts Paleoindian Site. George Hammell of the New York State Museum supplied me with data from the Rochester Museum's 1977 survey of the Gannagaro Site. Chuck Vandrei formerly of S.U.N.Y. Buffalo furnished results of the Christianson Site survey. Mitchell Mulholland of U Mass Archaeological Services performed the data base management to generate the Indian Crossing data file. Finally, I would like to thank my advisors Dena Dincauze and Martin Wobst, as well as Peter Thomas, for reviewing, editing, and commenting on earlier draft of this paper.

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CHAPTER 3

WHERE THERE'S SMOKE, THERE'S FIRE: CRITERIA FOR EVALUATION OF SMALL LITHIC SITES IN THE NORTHEAST

Timothy L. Binzen

In archaeological resource management, small lithic sites are often encountered during Phase 1 locational surveys when a small amount of chipping debris is recovered from one or two test pits. It has been common to consider a Phase 1 survey as a presence/absence test, and once the presence of Native American artifacts has been demonstrated, further investigation can be left to a Phase 2 site examination. However, there is a growing trend for small lithic sites to be categorically written off on the basis of Phase 1 surveys, in the belief that they are not potentially eligible for the National Register because of their small size, low artifact density, and the absence of diagnostic artifacts or subsurface features. Unfortunately, if Phase 1 testing is not stringent, the size and research potential of a site may not be recognized.

Archaeologists negotiate solutions between the demands of development and the need to protect our archaeological heritage, and decide the fate of small lithic sites. It is risky for one category of Native American site to be dismissed as having limited research potential, unless the limited nature of that potential is demonstrated empirically on a site-by-site basis.

CRITERIA TO MAKE THE CASE FOR PHASE 2 SURVEY AT A SMALL LITHIC SITE

The main objectives of a Phase 2 survey of an archaeological site are to determine the spatial boundaries of the site, to assess stratigraphic integrity, to locate features and artifact-bearing deposits, and to evaluate the research potential and significance of the site. This information helps archaeologists and construction project proponents determine whether or not the site is eligible for inclusion in the National Register of Historic Places, and thus whether it merits avoidance or mitigation measures for construction impacts. When a small lithic site is found during an initial Phase 1 survey, a decision must quickly be made: Can this site be written off as potentially ineligible for the National Register? Or should a Phase 2 survey be recommended, to determine National Register eligibility? To make this decision regarding the appropriateness of a Phase 2 survey, it is no longer sufficient to demonstrate just the presence of Native American cultural materials. It would be useful to have standardized criteria to apply to small lithic sites to make the appropriate recommendation.

It is suggested that a small lithic site should meet at least two of the following criteria at the end of the Phase 1 survey, in order to make the case for a Phase 2 site examination. The suggested criteria are:

1) the presence of a temporally diagnostic artifact, such as a projectile point, to place the site in a regional chronological context;
2) the presence of a potentially dateable subsurface feature, such as a hearth or refuse pit, that is in association with lithic artifacts;
3) the recovery of a medium volume of lithic artifacts (Suggested threshold: $\geq$5 pieces of chipping debris recovered from at least one shovel test pit);
4) the recovery of artifacts from multiple test pits;
5) the recovery of artifacts from undisturbed subsoil (as opposed to the plowzone or topsoil);
6) the presence of more than one lithic material in the artifact assemblage; or
7) the existence of other previously recorded Native American sites in the vicinity.

In the current environment, it is a challenge to make the case for a Phase 2 survey at a small lithic site if only one of these criteria is met. Ironically, the amount of testing that is conducted in many Phase 1 surveys is stretched to the point that insufficient samples are obtained from small lithic sites. Over the long term, writing off small lithic sites will not serve the interests of archaeological research and preservation.

THREE CASE STUDIES FROM MASSACHUSETTS

The title of this paper is "Where There's Smoke, There's Fire." This statement alludes to the assertion, which is supported by field experience and anecdotes from the world of archaeological resource management, that small archaeological sites containing only a few pieces of chipping debris, in the absence of features, tools or diagnostic artifacts, are actually quite rare. (Any such site

Current Approaches to the Analysis and Interpretation of Small Lithic Sites in the Northeast, Edited by Christina B. Rieth, New York State Museum, The State Education Department, Albany, New York 12230. New York State Museum Bulletin 508

presumably resulted from a brief episode during the –pre-Contact period when a person paused to modify or re-sharpen a stone implement.) Often it is the case that additional testing results in the discovery of additional artifacts and the re-interpretation of the site. Archaeological sampling must reach a certain statistical level before it can be said that a site probably does not contain features or diagnostic artifacts. The level of statistical confidence will vary according to overall site size and artifact density. One objective of a Phase 2 survey should be the excavation of a sufficient representative sample of the site to minimize the likelihood that major artifact concentrations or feature clusters have been "missed." The assumption should be that features do exist (or once existed) at small lithic sites, and it is a matter of conducting sufficient testing to locate them. How many times have archaeologists said after a survey, "If we hadn't put that Phase 1 test pit right in that exact spot, we might never have found that little site." Or: "Those bracketing test pits were really worthwhile." Or: "That site seemed kind of borderline after the Phase 1 survey, but the Phase 2 really found a lot."

The following case studies from Massachusetts are examples of small lithic sites that were not written off on the basis of Phase 1 survey, and provided valuable information when Phase 2 surveys were subsequently conducted:

The Boulder Trail Site is located in Billerica in northeastern Massachusetts. The site occupies a wooded bluff adjacent to the Concord River. The site was identified during a survey for a proposed water treatment plant. Phase 1 testing produced a total of 12 gray rhyolite flakes from four of the six Phase 1 test pits excavated at the site. Arguably, this was an example of the sort of small lithic site that ought to be written off. In this case, however, a Phase 2 site examination was conducted. Additional lithic artifacts were recovered from nine Phase 2 test pits, and from both of the 1 x 1 m excavation units. A total of 137 flakes were recovered, in addition to a pair of Brewerton Eared-Notched projectile points. All the artifacts were made from the same form of gray rhyolite. The site apparently represents a single occupation by people of the Late Archaic Laurentian tradition (approximately 4,000 to 5,000 years ago) who modified the points during a brief stay. Points of this type are relatively uncommon in northeastern Massachusetts, and the Boulder Trail Site provided further evidence of lithic tool styles of the Laurentian Tradition being expressed in locally available lithic materials in the sub-region. The site was found eligible for listing in the National Register and was placed in a preservation restriction to ensure its protection during construction of the water treatment plant.

The Little Bay Site is located in Fairhaven in southeastern Massachusetts. The site was identified during a Phase 1 survey for a proposed recreational trail on the upper part of Sconticut Neck, a wooded coastal promontory that projects into Buzzards Bay. The Phase 1 survey obtained a lithic assemblage of 21 pieces of chipping debris from eight Phase 1 test pits. There was one rhyolite flake, and the remainder of the debitage was made from quartz. No diagnostics or tools were found, although a small feature was recorded in one test pit. Despite the low density and unspectacular nature of the Phase 1 assemblage, a Phase 2 survey was recommended. The additional testing produced an assemblage of 590 lithic artifacts, including quartz and rhyolite chipping debris, 14 projectile points or point fragments, edge tools, and cores. More than 20 subsurface features were recorded, including shell refuse pits and post molds. Over 22 square meters were excavated within the narrow easement of the proposed trail. The site has provided evidence of a long-term Native American occupation on Sconticut Neck that occurred during the Late Woodland period (approximately 500 to 1,000 years ago).

The Bowed Birch Site, located in Erving in western Massachusetts, provides a final example of a small lithic site. The site is situated on the northern bank of the Millers River, and overlooks a series of rapids. In the pre-Contact period, the Native American path called the Mohawk Trail followed the north side of the Millers River. The east-west trail enabled travel and the transport of lithic materials between the Hudson River valley and eastern Massachusetts.

The Bowed Birch Site was identified during a Phase 1 survey for a highway relocation project. Phase 1 testing produced only five chert flakes, 18 quartz flakes and one rhyolite flake from six test pits. Again, this seemed to be a "borderline" site of low artifact density. Nonetheless, a Phase 2 survey was recommended. The site ultimately produced base fragments of Small Stemmed quartz projectile points, scrapers, choppers, edge tools, and tabular grinding stones, in addition to a hammerstone, an anvil stone and a spoke-shave. Chipping debris included varieties of black, brown and gray chert, some of which had been heat-treated, as well as quartz and rhyolite. A rim sherd from an unusual granitic stone vessel was recovered. The evidence suggests that some tools made from imported chert were modified at the site, while many expedient edge tools were manufactured on-site from locally available quartz.

While large, multi-component sites in the Millers River basin have been recorded at the Connecticut River confluence and the intersection with a major north-south trail in Athol, the great majority of sites recorded in the basin

to date are small, short-term campsites where stone implements were modified and sharpened. Intriguingly, the sites tend to be located on the north side of the river, near the trail, and frequently contain varieties of chert sourced to New York and rhyolite from eastern Massachusetts. The sites may represent brief stopovers by Native people who followed the trail through the region. Because the great majority of known sites on the Millers River can be classified as small lithic sites, a major loss of archaeological information would be incurred if they were categorically written off.

WHY DO SMALL LITHIC SITES MATTER?

The case studies illustrate how a site that seems to have limited research potential after a Phase 1 locational survey may actually contain much more information than the initial survey indicated. Why do small lithic sites matter? Their ubiquity shows that they are an important part of the texture and variety of human activities in the greater landscape that occurred during the ancient period. To categorically dismiss these sites could mean ignoring a set of evidence for activities (e.g. short seasonal occupations, satellite workstations, resource-specific gathering and hunting locations) that were crucial to human subsistence throughout the pre-Contact period. Small lithic sites often provide opportunities to investigate single-component, task-specific assemblages, which can be impossible to discern within large, complex, multi-component sites. Ignoring small lithic sites may be prejudicial, favoring the preservation and investigation of multi-component sites, whose locations are more predictable.

TECHNIQUES FOR THE EVALUATION OF SMALL LITHIC SITES

It is clear that if a small lithic site is to receive due consideration, the argument for Phase 2 survey will have to be made as often as possible, and some "Phase 2-level" data will have to be produced by the Phase 1 survey. The first means to this end is the excavation of verification test pits or bracketing pits placed at reduced intervals around "positive" Phase 1 test pits that have produced artifacts. It will make it less likely for a single positive Phase 1 test pit, excavated at a broad interval, to be dismissed as an "isolated occurrence" or "spot find." When planning a Phase 1 survey, it is important to include verification test pits in the overall testing strategy.

Frequently, Phase 2 testing involves a Cartesian grid that is laid out over the site. Test pits are excavated to determine site boundaries. Larger excavation units are placed next to Phase 1 test pits that contained artifacts or features, in the inferred central area of the site, to allow the recording of soil profiles, to excavate features, and to assess integrity. While this method can be very effective, it has limitations. "Filling in the checkerboard" provides information about relative artifact density in different areas of the site, but as in the game of "Battleship," it is possible to be very near a desired target (such as a concentration of features) without intercepting it. The method may not provide data concerning the intra-site, organizational patterns of feature locations, or explain localized variability in soil profiles. To address these goals during a Phase 2 survey, it may be appropriate to configure some of the excavation in long, narrow, linear trenches rather than in squares. The use of long, linear trenches increases the likelihood of intercepting features and allows the recording of much longer soil profiles.

CONCLUSION

It is common for a Phase 1 survey to encounter a single lithic artifact or a very low volume of artifacts in a single shovel test pit. Frequently, such a discovery is written off by the Phase 1 survey as a "small lithic site" or "isolated occurrence" with minimal research value, and additional testing is not recommended. Recent experience in Massachusetts has shown that when the case for additional testing (in the form of a Phase 2 survey) can be made successfully, it is often found that small lithic sites possess greater research value and complexity than had been assumed initially. Small lithic sites are considered important because they often represent single occupations or tasks that are less easily discerned within large, multi-component archaeological sites. In this paper, criteria have been suggested to enable field researchers conducting Phase 1 surveys to produce data demonstrating that a lithic artifact truly is "isolated" or, alternatively, that a small lithic site merits further examination in a Phase 2 survey.

CHAPTER 4

STRATEGIES FOR INVESTIGATING AND INTERPRETING SMALL PREHISTORIC SITES AND LOW DENSITY ARTIFACT DISTRIBUTIONS: EXAMPLES FROM THE HUDSON DRAINAGE

Edward V. Curtin, Kerry L. Nelson and Jessica E. Schreyer

Archaeologists investigating settlement systems seek to understand the full range of variation among regional archaeological data (Binford 1964; Struever 1968; Plog et al. 1977; Snow and Starna 1986). This goal has led increasingly to the consideration of both small sites and off-site artifact distributions. In an earlier era, archaeologists' preference for large site over small site research was due both to the abundance of artifacts at large sites, and the common view that large sites provide for a more complete reconstruction of past cultures than is possible using small sites. Off-site distributions have often been ignored as even more limited, or epiphenomenal with respect to human adaptation and cultural norms. Thus, we have archaeological survey categories such as "stray finds" and "lithic scatters" that semantically (and erroneously) refer to unpatterned or disorganized human behavior.

Since the late 1960s, the marginalization of small site and off-site data has been balanced in the archaeological literature by the discussion and promotion of "non-site," "siteless" or "distributional" archaeology (Dunnell and Dancey 1983; Ebert 1992; Foley 1981; Isaac and Harris 1975; Kerber 1994; Thomas 1975). The siteless survey and distributional archaeology perspectives are explicitly regional in scale, and oriented to the widespread interest in human mobility, collector and forager strategies, and curated and expedient technologies (following Binford 1983). These perspectives draw attention to the actual spatial distribution of prehistoric artifacts, as well as or in preference to sites. For example, after describing sites as "conspicuous concentrations of objects or features that occur within a restricted area" often plotted on maps to show environmental associations, Isaac and Harris (1975:1) remark that "there are clear limitations to this method because if we stop to think about it, we soon realize that all traces of prehistoric activity are not concentrated in the patches of material that we can… call sites…". Ebert (1992:70) pushes the envelope further, stating "What we need is an antisite archaeology, an archaeology that has nothing to do with sites, at least at the methodological level."

DISTRIBUTIONAL AND SMALL SITE ARCHAEOLOGIES

Distributional archaeology seems a convenient, generic term with which to refer to the study of artifact distributions outside of sites, or artifact distributions regardless of site boundaries. However, the term distributional archeology refers specifically to an explicit perspective and methodology developed by Ebert (1992). The use of the term requires care and the recognition that Ebert uses this perspective to argue against the identification and use of archaeological sites as units of analysis. Ebert identifies the artifact as the unit of analysis, and considers variables related to artifact density and distribution, specifically the item variance to mean ratio per unit area at different spatial scales, and for different artifact classes, to make inferences concerning a range of behavioral and non-behavioral assemblage formation processes.

Ebert (1992) argues that traces of hunter-gatherer activities overlap in space over time, leaving spatial patterns reflecting this history rather than more synchronic episodes of behavior. He takes the position that artifact concentrations recognized as sites by archaeologists are more likely the result of the superimposition of various activity and residential areas over time than they are single occupation sites susceptible to functional analysis as such by archaeologists.

Ebert (1992) also notes that archaeologists have a problem with temporal resolution. Prehistorians in particular depend upon radiocarbon dates and artifact types having age ranges much longer than the occupation of a hunter-gatherer camp, or for that matter, the human life-span. He argues, however, that variation in artifact distributions over space can be meaningfully understood in terms of long-term variation in land-use, especially if the concept of time is more geological and less dependent upon notions of an individual or a small group of people being responsible for the creation of the observed archaeological record at a specific time and place.

Despite Ebert's (1992) well-argued position and coherent

Current Approaches to the Analysis and Interpretation of Small Lithic Sites in the Northeast, Edited by Christina B. Rieth, New York State Museum, The State Education Department, Albany, New York 12230. New York State Museum Bulletin 508

data analyses, it is not likely that archaeologists will abandon the notion of sites. It is more likely that research on the characteristics of sites will be undertaken cognizant of the assemblage formation and time-frame issues that Ebert has raised, and that this research will temper interpretations regarding whether sites are single component or multi-component, multiple activity or unifunctional, residential or limited activity, or complex palimpsests of a highly varied archaeological record.

Ebert (1992) argues that complex palimpsests are what archaeologists can recognize most often. We note in this regard that the spatial scales Ebert identifies as most often reflecting the spatial clustering of artifacts in his data, 100-x-100 to 250-x-250 m (1.00-6.25 ha/approximately 2.50 to 15.50 acres), pertain to very large artifact clusters indeed, and therefore likely reflect multiple occupations, varied functions, and without greater resolution, archaeological palimpsests. The observation of spatial clustering within much smaller areas is necessary to isolate single occupation hunter-gatherer residential and activity sites. Despite criticism, however, distributional archaeology has great value as middle range research, and significantly influences hunter-gatherer archaeology by explicating numerous significant issues that must be addressed. Most importantly, distributional archaeology requires that site-oriented archaeologists carefully consider the characteristics of both "sites" and the surrounding landscape, while posing regional scale as well as site-based research questions.

We propose, in fact that hunter-gatherer research must view past human behavior at multiple spatial scales within a region, regardless of artifact clustering trends, and that an explicit orientation to small site archaeology needs to be part of the research program. This orientation must be coupled with the view that larger sites are potentially complex phenomena that may reflect multiple occupations, varied activities and functions, and often, functional variation over time, even when associated with single phases of occupation. For example, many large, so-called single component sites have varied histories and may show evidence of activity in sequential, episodic frames of reference that cannot be distinguished by temporally diagnostic artifacts or radiocarbon dating. In other words, some apparent single component sites are composites of smaller sites occupied over relatively short periods of time (measured in terms of archaeological phases or compared to geological time). The greater the site size (if relatively unconstrained by topography), the more likely this will be true (Whallon 1973). Temporal resolution within large, single component sites obviously is a very thorny problem for which we have no discussion in this article. Suffice it to say that the concept of formation complexity will always be necessary to understand large sites in any but the most preliminary way.

Small site research was pioneered in part to address the issue of complexity and palimpsest patterns within larger sites. The idea is that small sites generally are reoccupied less often than large sites, and so, patterns reflecting activity are less distorted by human agents in small than in large sites (Sterud 1977; cf. Dillehay 1973; Moseley and Mackey 1972). However, there are two other prominent reasons to focus on small sites. First, small sites make up a significant part of the archaeological record, such that their neglect severely biases and distorts any conclusions drawn from regional site comparisons and analyses (Plog et al. 1978). Second, small sites often are functionally different than large sites. One example is the difference between larger, residential sites occupied on a multi-season or year-round basis, and smaller sites occupied over seasonal or shorter periods for limited activities, such as food procurement or to monitor game or tend fields (Binford 1978; Ward 1978). Rieth (2002) has recently shown how data from numerous small sites can be compared to more fully characterize local-level subsistence and settlement patterns.

Southwestern archaeologists have long been attuned to the biases created by incomplete and unsystematic samples, particularly those that either under-represent small sites, or (often at the same time), provide a basis to "winnow out" from further consideration information from sites that appear to be small, multi-component palimpsests, or have simple assemblages that defy placement in a normative, culture history-based classification. Plog (1989) was vocal in drawing attention to the bias against small, difficult to classify sites in the construction of a normative, but inaccurate view of southwestern prehistory.

We summarize the issues of distributional and small sites archaeology in this way: the archaeology of hunter-gatherers and other small scale societies is necessarily understood at a regional scale due to the mobility strategies such societies use to procure sufficient food and other important resources. Residential sites typically are moved over the course of an annual cycle. In addition, much activity actually takes place outside of residential sites in locations associated with a variety of procurement, processing, and intermittent downtime activities. These activities leave a material record of manufacturing residues, broken and exhausted artifacts, lost items, and often, items cached in activity rather than residential places. In order to understand the roles of these activities in land use and regional adaptations, we must study their cumulative material record. Thus, archaeologists need non-site or distributional archaeology, whether they approach it with Ebert's method or some other way. We later consider some of these concepts in more detail, particularly as reflected in the work of Binford (1983).

Despite issues with the site concept, localized artifact concentrations will continue to figure prominently in the

larger regional analysis. Archaeologists will want to understand whether these concentrations represent single occupation residential or activity sites, multiple occupation or activity sites, or more gradual accumulations of artifacts residual from overlapping foraging patterns and other aspects of mobile adaptations.

As we have noted, the study of single occupation or short term residential and activity sites requires a different spatial scale, and presumably different data collection techniques, than distributional archaeology has proposed as relevant to regional analyses. However, both scales are necessary to develop a perspective differentiating on-site and off-site behavior. Approaches to intrasite spatial analysis of artifact concentrations that are cognizant of the issues of multiple occupation and variable, episodic activity performance, such as described by Newell and Dekin (1978) and Versaggi (1981), represent promising alternatives to *Distributional Archaeology's* rejection of the site concept.

Ultimately, it seems necessary to study both extensive, low-density artifact distributions and the range of artifact concentrations. Working on various aspects of the relationship between settlements, activity sites, logistical mobility, and foraging ranges, archaeologists in the Northeast have begun to consider a variety of information including concepts of the scale of residential and activity space, artifact density and dispersion data, and the spatial contexts of artifacts with regard to use wear and breakage patterns (Cowan 1990; Curtin 1999; Thomas 1986; Versaggi 1987; Versaggi et al. 2001:129-133).

SMALL SITE SIZE: EMPIRICAL AND MIDDLE RANGE CONSIDERATIONS

The conceptualization and definition of small sites remain subjective without reference to empirically-stated ranges of site size. An understanding of the relevance of empirical data based upon appropriately scaled behavioral contexts, such as single occupation hunter-gatherer sites, dwellings, and activity areas is preferable to undigested data. A theory-guided understanding allows judgments with regard to whether the observed "small site" may represent one or more actual sites as they would be observed in ethnographic time. This understanding provides a perspective on the likelihood that a low-density artifact distribution represents a single, briefly occupied "site," or overlapping evidence of many activities performed over time.

Several comments exist in the archaeological literature with regard to small site size in New York State and the northeast, including the accumulated experience of Ritchie and Funk (1973), a survey of Late Archaic (6,000-3,800 B.P.) and Transitional (3,800-3,000 B.P.) period site data by Curtin (1999), and a comparison of single occupation archaeological and ethnographic sites by Thomas (1986). In reiterating these observations, we focus on hunter-gatherer sites, as many small sites are believed associated with hunting and gathering adaptations, or otherwise reflect mobility strategies involved with resource procurement. We note that many late prehistoric (400-1,100 B.P.) residential sites may be similar in size to some hunter-gatherer residential sites, although nucleated, late prehistoric village sites often are significantly larger, especially after about 600 B.P.

In their comparative settlement pattern study, Ritchie and Funk (1973) cite a size of up to about 1,000 sq m (in their terms, 1/4 acre) as the size of small Archaic sites in New York State. Moreover, in a sample of 58 Archaic and Transitional period sites described in the published and CRM literature, Curtin (1999:106) found that modal site size was less than 1,000 sq m, and that more than half of the sites were less than 2,000 sq m. Considering only sites less than 2,000 sq m, the mode was less than 100 sq m. About 22 percent of the total sample of 58 was less than 100 sq m. These data are undoubtedly skewed to overrepresent large sites due to a large site bias in the older literature. Nonetheless, small sites are well represented in the sample, such that there is a sense that small site size is the norm, and as site size increases beyond about 1,000 sq m, only multiple occupation sites are involved. This perspective is supported by site size and complexity data discussed by Versaggi (1987), which overlap the data set studied by Curtin.

Finally, Thomas (1986) has found that 1,000 sq m is the approximate maximum size estimate of single occupation archaeological sites containing multiple dwelling and activity areas. His research also shows that single occupation residential sites as small as about 60 sq m occur as archaeological phenomena. A scale of about 20 to 50 sq m corresponds to the areas occupied by individual dwellings and surrounding activity space. Shelters and activity areas considered separately correspond to even smaller areas. Thomas has compared samples of archaeologically and ethnographically documented sites using common definitions of settlement space, finding a relatively strong concordance, but with archaeological sizes tending to exceed ethnographic sizes at every scale (presumably since archaeological distributions, distorted over time, generally are more extensive).

Thus, based upon the experience of seasoned archaeologists, a broad range of empirical data, and middle range theory, the concept of small sites most often will refer to areas of approximately 1,000 sq m or less. Intrasite analyses may be necessary to address the potential issue of multiple occupations, especially as size approaches or exceeds 1,000 sq m.

FUNCTIONAL VARIATION: HUNTER-GATHERER LAND USE MODELS

Archaeologists long have been interested in relating functional variation to site size. However, mobility as well as work affects the distribution of artifacts among various places within the larger region, complicating functional inferences based upon artifact assemblage variation. A number of different kinds of places, including residential and different kinds of activity sites are necessary for mobile adaptations. A wide variety of artifacts are moved among these places, both for immediate and anticipated uses.

Thus, the direct interpretation of small site function from artifact assemblages has proved problematic. This issue was addressed by numerous studies in the 1960s and 1970s. Since the 1970s, many North American archaeologists (Amick and Carr 1996; Anderson et al. 1996; Andrefsky 1994; Bamforth 1986, 1991; Curtin 1999; Ebert 1992; Odell 1996; Pagoulatos 1988; Sassaman 2001) have applied versions and revisions of the collector-forager model of hunter-gatherer land-use strategies developed by Binford (1980, 1983; see also Bettinger 1987). Ebert (1992) provides a detailed application of Binford's concepts in a distributional analysis.

Some of the fundamental questions of functional interpretation have involved (1) distinguishing between different kinds of residential sites, including different seasonal residences; and (2) identifying special purpose or activity sites in distinction to residential sites. For example, with reference to Archaic period (3,800-10,000 B.P.) settlement patterns, Ritchie and Funk (1973:337-338) distinguish between large sites located on relatively large water bodies and small sites typically located in upland or back-country settings. The former were classified as spring-summer camps where population segments aggregated due to rich seasonal resources. The latter were thought to represent fall-winter residences where small family groups dispersed in response to a seasonal decline in food resource abundance. Ritchie and Funk (1973:5) note some general variables that can be related to intersite variability, including *size* (areal extent); *intensity*, or the density of cultural material such as "artifacts, debitage, fire-cracked rocks, refuse bones, etc.;" and *stability* or length of occupation, which is a product of size and intensity. This position states that the longer a site is occupied, the larger it should be, and the more artifacts and waste materials it should have. Ritchie and Funk (1973) represent site size, the number of implements, and the amount of waste such as debitage and fire cracked rock as positively correlated. Other variables used in their analysis include *activities*, inferred from artifact type frequencies; *heterogeneity* or the number of activities represented in the artifact assemblage; and the "*ratio of male to female activities*," as indicated in accordance with assumptions regarding gender-associated artifact classes, such as ceramics, stone tools, and cores. These kinds of assumptions have been critiqued more recently (e.g., Gero 1991; Sassaman 1992). Although they do not discuss the ratio between male and female activities further, Ritchie and Funk (1973:5) note that the larger the site, the more activities represented, and the more localized the activity areas within the site.

In other models, site size has been recognized as a diacritical distinction between residential sites and specialized activity sites, such as hunting camps. The settlement model proposed for the Dalton phase (ca 10,000 B.P.) in Arkansas by Morse (1971) and Goodyear (1974) provides such a distinction. In this model, large sites are considered to be relatively permanent base camps, typically few in number within any particular drainage. Small sites are considered to be resource extraction sites such as hunting camps. Small sites are relatively frequent and occur throughout the inferred local group territory. Base camps were considered to have relatively more artifacts and a wider variety of artifacts than hunting camps or other activity sites. Schiffer (1975) however, argues that hunting sites would not be archaeologically visible as such due to very light artifact density resulting from brief occupation episodes and the transport of usable material culture away to other sites. As an alternative, Schiffer (1975) proposes that all of the recognized Dalton sites were residential sites, and that size, artifact assemblage, and artifact density variation result from seasonal variation in group size and the frequency of reoccupation. Schiffer (1975:109) feels that actual hunting and butchering sites are represented by 'presently undetectable single occupation sites widely distributed in the environment. Many so-called "isolated finds," not usually designated as sites, may be clues to the former presence of a hunting and butchering camp.'

To Schiffer (1975), as to Ritchie and Funk (1973), the major dimension of variation is among residential sites, and size is positively correlated with artifact frequency and assemblage diversity. A similar conclusion is reached by Yellen (1977) in his report of ethnoarchaeological research in Botswana among the !Kung San (Schiffer [1975] cites an earlier version of Yellen's [1977] monograph). Yellen (1977) found that (1) !Kung camps vary in size by the number of dwellings and the length of occupation; and (2) manufacturing and maintenance activities occur within camps, while locations used outside of camps are devoted to resource procurement. Population aggregation and dispersal are seasonal, affected by the rainy and dry seasons, respectively. Large, rainy season camps are occupied over a relatively long season, while the small dry season camps are moved frequently. Offsite, resource extraction activities leave little behind, and

Yellen (1977) considers them to be essentially archaeologically invisible. He notes that the likelihood that an activity will occur, or that an artifact will be deposited in archaeological context increases with the length of occupation, again indicating positive correlations between site size, the frequency of artifacts, and artifact assemblage diversity.

Binford's (1977, 1979, 1982) interpretation of functional variation addresses the issue from a variety of perspectives and at varying spatial scales. In a seminal contribution, Binford (1980) identifies two major mobility strategies: foraging, in which people move residential sites to resource rich patches within an extensive territory, and collecting, in which people occupy optimal settlement locations with respect to the distribution of critical resources, some of which occur in geographically disparate locales. Collectors dispatch procurement parties to acquire and move resources from these various distant locations to settlements. Binford (1980) refers to the two associated mobility patterns as residential and logistical mobility, respectively.

Collecting and foraging strategies may vary or alternate depending upon seasonal and spatial resource variation. In addition, either collecting or foraging strategies may predominate over time as adaptations to changing environments (Anderson et al. 1996). Moreover, there may be directional change toward logistical mobility if population density (and the spatial packing of group territories) increases over time, restricting the opportunity for residential mobility (Sassaman 2001). Herr and Clark (2002) adapt the concepts of residential and logistical mobility to early, Southwestern horticultural communities, noting that mobility patterns vary according to a number of circumstances. It is worth noting that in either hunting and gathering or horticultural systems, logistical mobility patterns may involve similar site types associated with mobility away from sedentary or semi-sedentary residential sites when temporary residences and bulk storage of processed or harvested resources are required.

Binford (1980) identifies two site types within the forager land-use pattern: (1) *residential bases,* where people essentially dwell around facilities such as hearths and shelters, and concentrate a large portion of manufacturing, implement maintenance, and resource consumption; and (2) *locations:* places where resources are procured, but other activities are uncommon. The forager land use pattern thus is similar to the land use patterns described by Schiffer (1975) and Yellen (1977).

Although collectors also use residential bases and locations, at least part of the population typically spends relatively long periods away from the residential base. Accordingly, collectors create a variety of other kinds of sites: *field camps*, which are best described as temporary residences used by task groups on extended trips away from the residential base; *stations*, established by task specific groups for information gathering, including hunting stands or ambush locations; and *caches*, places where materials are temporarily stored, whether in or around the regular facilities or activity loci of stations and field camps, or in specially constructed facilities, such as pits. At stations, people may socialize, work at crafts, and perform downtime activities while reducing boredom, but the resulting assemblage does not tend to reflect site "function," since these are activities that also are likely to occur in residences and field camps. The actual activity of information gathering leaves no discrete signature.

The term caching as used by Binford has different meanings in different contexts. While Binford (1980) has drawn attention to the caching of resources such as meat procured and processed in high bulk, he has also referred to the caching of ordinary artifacts when they are not in use, including seasonal caching of such things as kayaks and dog sleds, as well as the caching of smaller objects in a variety of places such as hunting stands and resource procurement locations (Binford 1979). These usages differ from other common connotations in archaeology, such as the storage or hiding of valuable items, or the aggregation of certain manufactured items temporarily in facilities such as pits prior to exchange. The archaeological signature of items cached by the Nunamiut of Alaska's Anaktuvuk region could be as simple as an artifact found near a prominent rock, in a crevice, or on the surface in a frequented location (Binford 1979).

In addition to a model that draws a contrast between mobility strategies, Binford (1977) also defines different technological strategies. Expedient technologies feature simple tools made with relatively little effort that are applied to tasks immediately at hand. Expediently manufactured stone tools typically have very general shapes and few specific formal characteristics. Utilized flakes are often considered to be examples of expedient tools, especially if they are made on site, used and then discarded at the site of use. Curated technologies refer to technologies in which artifacts are designed to accommodate maintenance and rejuvenation over an extended period of time. Projectile points, with well-defined formal characteristics, standard haft elements, and bifacial blades amenable to repair and resharpening are typically considered to be good examples of curated artifacts. Relatively intensive development and use of curated technology is associated with logistical mobility because the operation of task groups away from home is facilitated by the kind of ready, dependable tools represented by curated technology. Trips into the field away from home-base sources of supply typically require "gearing up" for the expedition. Logistically mobile task groups equip themselves and put gear into good working order for the trip (Binford 1977,

1979; Torrence 1983).

Although archaeologists often employ the concepts of curated and expedient technologies when making functional interpretations, they less often discuss the prior provisioning of short-term use sites as a source of interassemblage variation. Binford (1978) emphasizes the importance of the provisioning of temporary sites, and to some extent, the larger landscape with what he refers to as insurance gear. Insurance gear can be thought of as artifacts and materials left in places distributed widely across the landscape in anticipation of use in the future. Insurance gear may left in well-known places, specifically cached along travel routes, or used to provision temporary use stations or locations as site furniture, a class of artifacts that belong to the place and are used communally, rather than being owned individually and subject to frequent transport. In the past, knappable stone was something that the Nunamiut provisioned locations with around their territory. As one informant reported, the Nunamiut used to leave lithics for making stone tools "all over the place so if you needed them they would be around" (Binford 1979:257, quoting Simon Paneack). Returning to the concept of caches, the Nunamiut routinely cache functionally mundane artifacts in anticipation of future use: "caches are continually being made…and in turn stories are continually being told" creating a "running inventory of what is in the passive state and where it is located" (Binford 1979:257). This kind of caching is so important that Binford (1980) considers it a general component of the collector land use strategy.

Site furniture is especially interesting to consider. In the Nunamiut case, sites away from the residential base typically were provisioned with furniture such as hearth stones, anvils, and *kaotah*: long heavy stones used as hammers and massive scrapers (Binford 1979:263-264). Site furniture typically stays at the site, and upon the arrival of parties at a repeatedly used site, an initial activity involves "pulling up" site furniture from buried contexts. Binford (1979) regards the latter activity as an important factor in the *size effect*, the occasionally cited sampling bias favoring the occurrence of larger artifacts in surface collections (Baker 1978; Schiffer 1987:268). Baker (1978) also finds that systematic retrieval of artifacts from soil matrix contexts by prehistoric people is a probable pervasive factor in the size effect. However, as House and Schiffer (1975) point out, even when artifacts are distributed evenly within a soil matrix, large and medium size artifacts are found in higher proportions within their size classes near the surface than are small artifacts. Given these considerations, the operation of the size effect within specific strata, whether topsoil, plowzone, or buried contexts, would only be obviated or reversed in specific and limited circumstances. Constructing a hypothetical set of such circumstances seems contrived, but could include a change in site function in which the use of large and medium size artifacts suddenly ceased. Even with such a change, the stratum would need to continue to develop as a relatively thick stratum, the "pulling up" behavior would need to cease, and the stratum would have to remain buried below any subsequent plowzone.

These considerations point to a condition affecting the study of small sites and off-site archaeological contexts: there is a class of material culture, site furniture, removed from residential bases to small, activity sites and resource extraction locations, where it remains thereafter to serve the users of that site or procurement location (hammerstones, anvilstones, nutting stones, cores, large bifaces, and wood-cutting tools could represent site furniture within low artifact density, resource procurement areas). As a factor of its communal function and intended long use-life, site furniture may often be larger than curated and expedient artifacts, and when buried is likely to be dug up and reused upon reoccupation of the site. Even after site furniture is eventually abandoned for good, it is likely to be well-represented on ground surfaces, along with other relatively large artifacts, such as projectile points and large flakes.

Given the provisioning behavior associated with site furniture and insurance gear, archaeologists should expect to find a great deal of the material culture associated with mobile adaptations outside of residential sites. Binford (1979:258-259), for example, found that in an inventory of Nunamiut men's artifacts, 5 percent was in houses within the village of Anaktuvuk, in more or less active use; 9 percent was cached in the village as accessible but essentially passive gear; 13 percent was used to furnish various other sites (and in a passive state at the time of the inventory); and 27 percent was "cached" or intentionally left or placed around various field locations (Binford 1979:258-259).

Binford (1980) asserts that the difference between his and Yellen's (1977) conclusions regarding site types and the distribution of material culture outside of residential sites is caused by the different, respective collector and forager mobility strategies of the Nunamiut and !Kung. The degree to which Nunamiut material culture is distributed outside of residential bases is not expected for the !Kung. However, some degree of off-site artifact distribution among resource procurement locations is expected for foragers. Binford (1980), citing Thomas (1975) and personal communication from Robert Foley (cf. Foley 1981), refers to the distribution of residual artifacts among resource procurement locations as a "nonsite" distributional pattern. Moreover, this is the distribution Schiffer (1975) calls a pattern of "isolated finds." Thus, the archaeological record will show variable complexity depending upon the kinds of mobility strategies operating at different times within a region. An increas-

ing proportion of artifacts outside of residential sites will occur with increasing logistical mobility due to the provisioning of places with site furniture and insurance gear. No doubt there will be considerable variation in terms of how much material culture would occur in residential sites compared to other places. However, long term use of certain locales as resource procurement locations, stations and caches could shift a high proportion of material culture away from residential sites, and concentrate higher numbers of certain items, including larger artifacts and raw materials (cores, bifacial cores, and bifaces-in-process) outside of residential sites. Archaeologists should expect that in at least some circumstances, relatively numerous artifacts and high frequencies of non-debitage items will be found in non-residential contexts. In some cases, the proportion of certain artifact classes, especially curated artifacts and "site furniture" found outside of residential sites may be very high.

The Waldenmaier and Dunn-Prescott archaeological projects recently conducted in the Hudson valley of eastern New York State (Figure 4.1) provide a perspective of part of the regional record created by populations relying upon high residential or logistical mobility. The balance of this chapter analyzes chronological and functional patterns present in each study area. The concepts of collector and forager strategies, residential and logistical mobility, "gearing up," curated and expedient technologies, and site and landscape provisioning are fundamental to understanding the observed artifact distribution patterns.

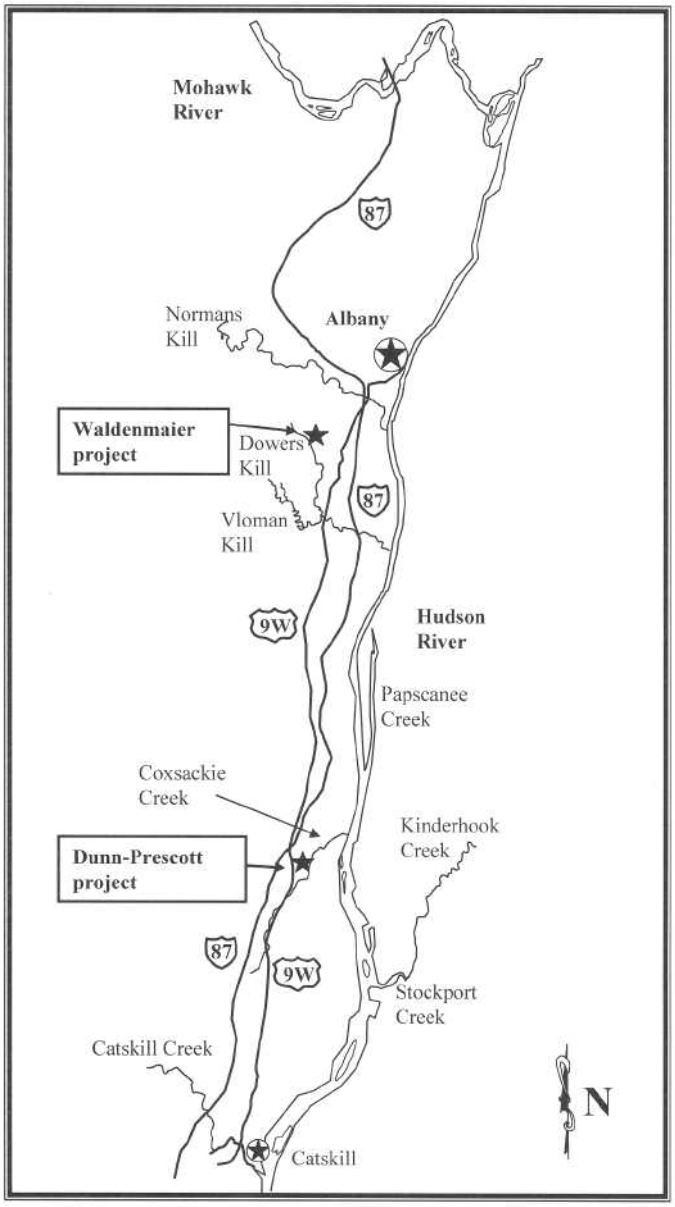

Figure 4.1. Waldemaier and Dunn-Prescott study areas in eastern New York State.

THE WALDENMAIER SITES

Waldenmaier Sites 1, 2, and 3 are located on low rises grouped around the head of a swale draining to the Dowerskill, a tributary of the Vloman Kill, which is a tributary of the Hudson (Figures 4.2-4.3). This upland setting 180-190 feet above sea level is approximately 4 miles west of the river. The sites vary in terms of size, artifact density, and content. Sites 1 and 2 are concentrations of debitage, utilized flakes, and the occasional formally manufactured chipped stone implement, such as a narrow-bladed point tip from Site 1, and a reworked, possible Kanawha point (estimated age 8,000–8,500 years) from Site 2. Most artifacts are made of chert, although a few quartz flakes were found at Site 2.

Site 3 is a low artifact density area across the swale from Site 2 and a short distance west of Site 1. It contains dispersed artifacts including chert, quartz and quartzite debitage, chert projectile points, and other chipped stone implements (Figure 4.4). Although it is more or less bounded within the larger survey area, we nonetheless consider Site 3 to be a non-site artifact distribution due to its characteristics. While we regularly use terminology such as non-site, off site, and low-density artifact distribution for phenomena such as Waldenmaier Site 3, the term "site" facilitates cultural resources management inventory and discussion (cf. Dunnell and Dancey 1983), and became attached to this location during the initial survey.

As we evaluated these sites in terms of archaeological significance, we took the following into consideration. Although chronological evidence from Sites 1 and 2 was weak, Site 3 was associated with a Late Archaic period, Normanskill projectile point (3,800-4,200 B.P.), providing

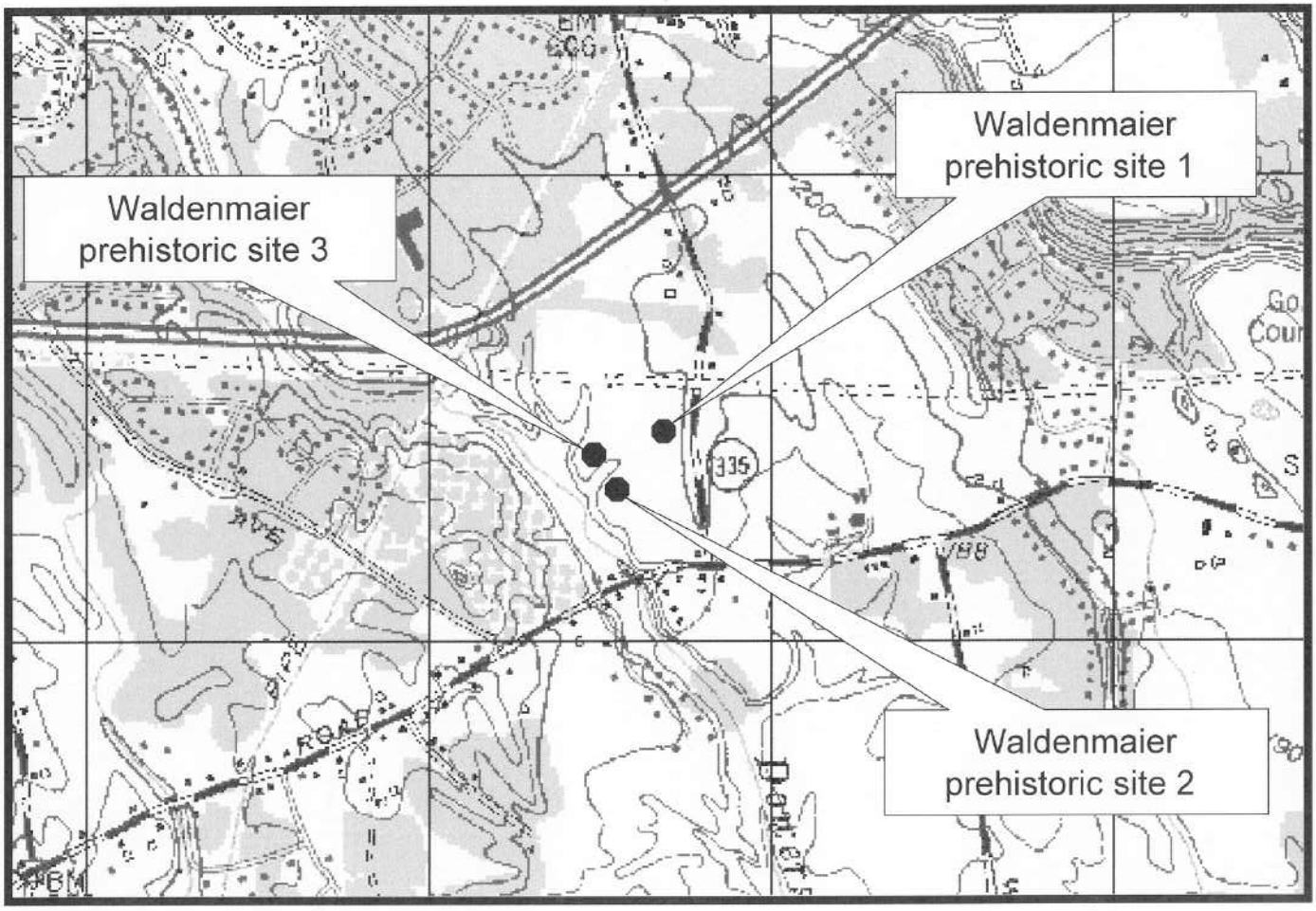

Figure 4.2. The topographic setting of the Waldenmaier sites.

a temporal association, however preliminary. Site 3 also had a high ratio of implements to flakes. This contrasts with Sites 1 and 2, where most artifacts are debitage, and implements or implement fragments are rare. This finding seems to fit situations discussed in the previous section of this chapter: some artifact concentrations may be dominated by waste materials with very few implements, especially if they are residential sites established in a pattern of high residential mobility. Also, some areas with relatively low artifact density nonetheless may have a relatively wide diversity and high frequency of implements for the reasons that resource procurement locations may contain discarded or lost curated artifacts as well as insurance gear and site furniture. These patterns contrast with residential sites associated with lower residential mobility, where the amount of waste material, implement frequency and assemblage diversity would be more positively correlated (cf. Ritchie and Funk 1973; Schiffer 1975; Yellen 1977), and field camps, which are typically dominated by spent and highly fragmented, curated tools and late stage lithic debitage resulting from repair and maintenance (Binford 1979; 1980; cf. Sterud 1977). The last issue is discussed in more detail presently. It is not clear whether the patterns observed at Waldenmaier Sites 1, 2 and 3, might be associated with the use of stations for monitoring resources, since the content of stations is expected to be highly variable and replicated in other kinds of sites, since it primarily reflects artifacts involved in socializing (including group meals) and down-time craft activity (such as biface reduction).

The Phase 2 survey of the Waldenmaier sites involved plowing and surface collecting each site, and excavating variable numbers of one-by-one meter units. At the end of the Phase 2 survey, Sites 1 and 2 were viewed as having provided about as much information as they could, short of producing temporally diagnostic artifacts. Since there is a potential that Sites 1 and 2 are the residential sites from which at least some of the foraging trips into Site 3 originated, evidence of temporal association seemed quite important. An expedient method of trying to obtain

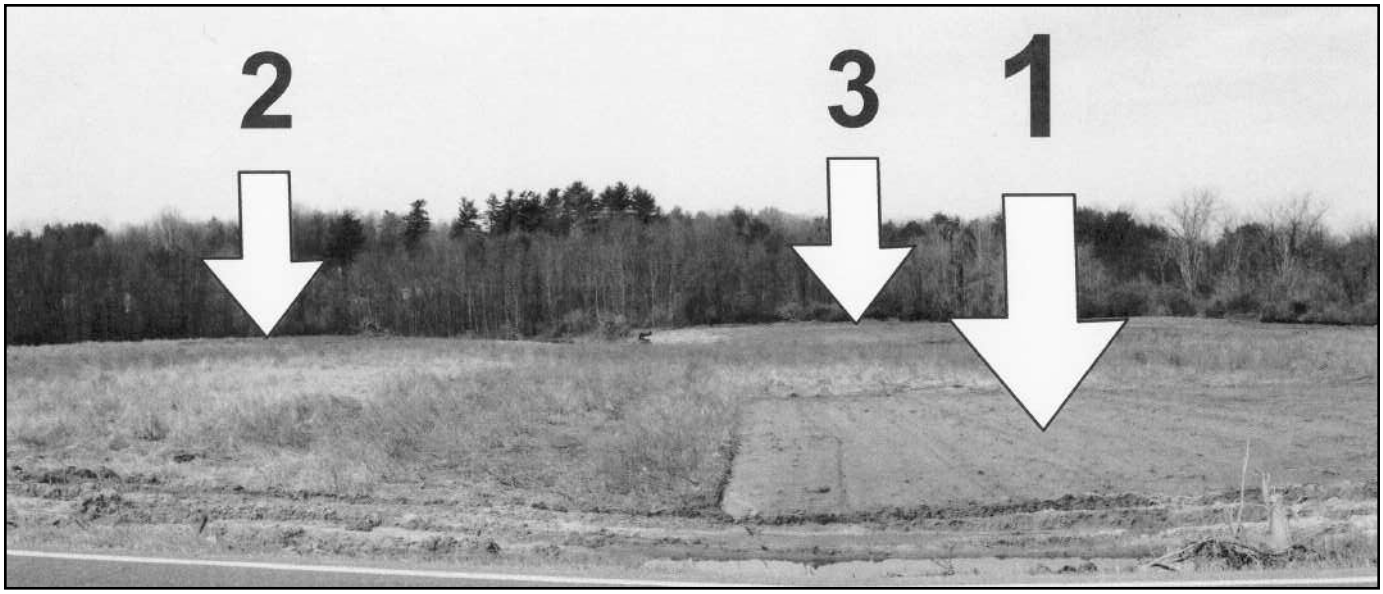

Figure 4.3. Panoramic view of the Waldenmaier sites, looking west.

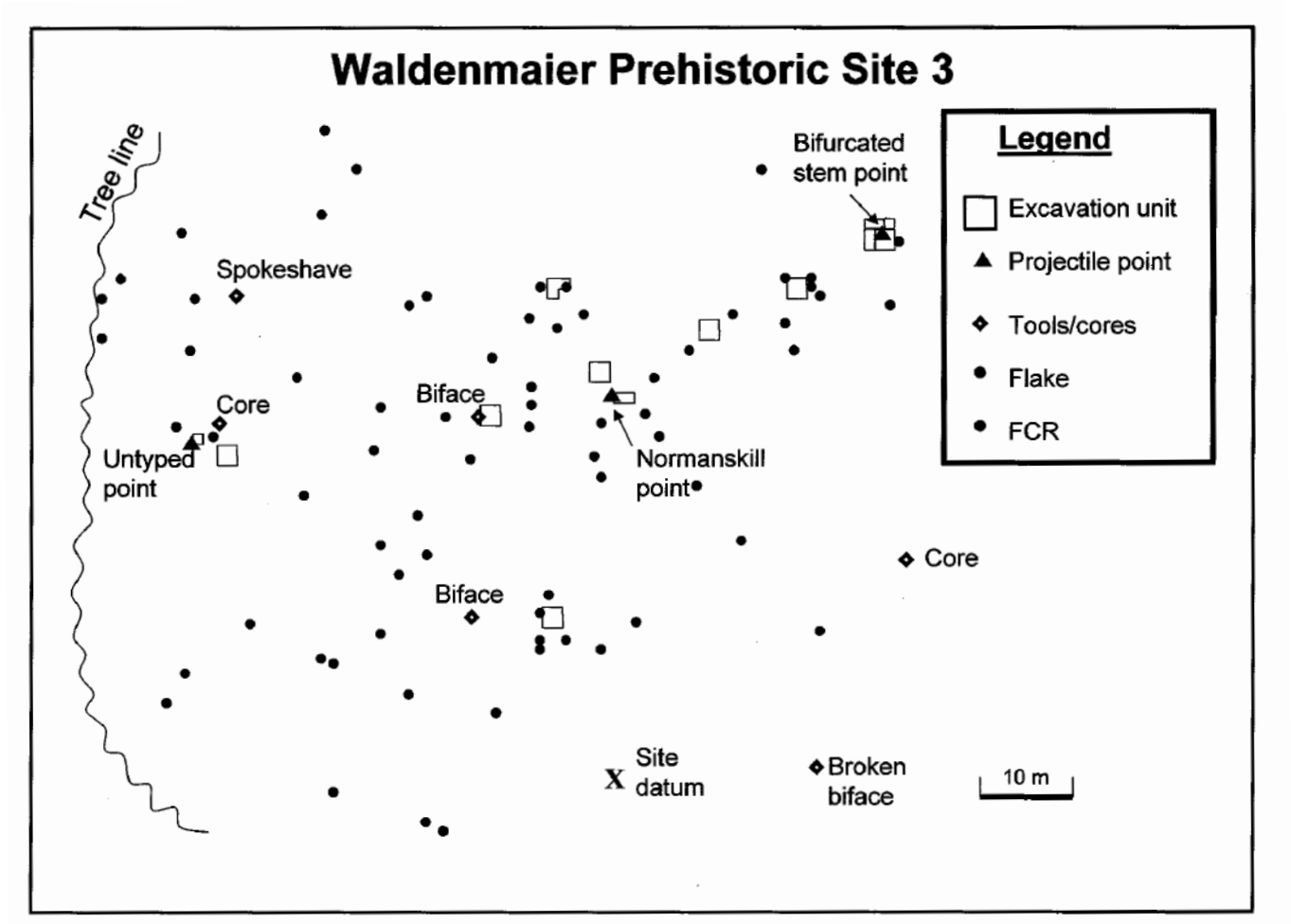

Figure 4.4. Artifact distribution, Waldenmaier prehistoric site 3.

this information through replowing, redisking, and recollecting these sites was apparent. Additional surface collection of Sites 1 and 2 was included in the data recovery plan for Site 3.

By the completion of the Phase 3 investigation, two intensive, controlled surface collections had been obtained for all three sites. In addition, the excavated sample size had been increased in Site 3 so that reasonably comparable samples existed for all three sites. We felt that multiple, controlled surface collections and controlled excavation data were necessary to achieve the goals of comparing these three sites in terms of size, artifact density, age and function. Given shallow artifact deposition, surface collection is a good method to identify site extent. Surface collection also provides good visibility in the search for temporally diagnostic and functionally distinctive artifacts. Relative artifact density variation on the surface also can provide a clue to site structure. At the same time, we sought to characterize the Waldenmaier sites with regard to the implications of lithic technology for relative mobility and sedentism. Debitage size grades are an important source of information on this aspect of lithic technology, so it was essential that we recover screened samples of debitage. The screen used was 1/4 inch mesh hardware cloth. Screened samples reduce the bias in favor of large artifacts typical of surface collections.

The analysis of the combined Phase 2 and 3 data illustrate intersite variation. Table 4.1 shows the variation in site size, number of artifacts recovered from the surface, and surface artifact density. One striking characteristic is the strong difference in artifact density between Site 3 versus Sites 1 and 2. Artifact density is approximately five to eight times greater in Sites 1 and 2 than Site 3. This is a graphic indication of the categories we have discussed above as artifact concentrations in the case of Sites 1 and 2, and low-density artifact distributions, such as Site 3. This example also provides a scale for the concept of small sites, if the artifact concentrations are equated with residential or activity sites. For this project, the range of small site size is 300 to 1,150 sq m. Low-density artifact distributions, on the other hand, are more variable, and theoretically, unbounded with respect to size. The size of this particular low-density distribution is about 2,000 sq m.

Considering that single occupation hunter-gatherer sites are thought to cover about 1,000 sq m or less, Sites 1 and 2 occupy different ends of the range of small site variation. Both sites form part of the tail of a hypothetical small site size distribution, where the frequency distribution is skewed strongly to the left, and the mode is less than 100 sq m (Curtin 1999). Site 3 is larger, but shows a very dispersed, low-density artifact distribution, and thus has not been classified as a site in a functional sense.

We have also examined artifact density in terms of subsurface artifacts. This is probably a more precise measure since screening through 1/4 inch mesh hardware cloth reduces a considerable bias against small artifacts. Table 4.2 shows the number of square meters excavated at each site, the number of artifacts recovered in excavation, and the artifact density, expressed as the number of artifacts recovered per square meter excavated (the plowzone and immediate sub-plowzone are the artifact producing contexts at these sites). The sites show the same rank order in terms of artifact density, with Site 1 having the highest density, Site 2 the second highest, and Site 3 the lowest.

Table 4.3 shows the debitage size grades from the surface collections and the subsurface samples. It is useful to note that the percentage of the largest size grade, >1.5 cm, is always higher in the surface collection than in the excavated, screened sample. This illustrates the point made earlier, that surface collections have a large flake bias, and excavated, screened samples are needed to make accurate comparisons in terms of lithic technology.

Another important observation with regard to the debitage size grades is that the debitage from these sites tends to be relatively large, with debitage >1.5 cm in the range of 41-48 percent in the excavated sample. These percentages contrast with the percents from Lamoka phase logistical camps at the Osterhoudt site (SUBI-505, Loci A and B), where flakes larger than 1.5 cm ranged from 6.1 percent to 10.3 percent (Curtin 1999; see Sterud [1977] for a similar statement with regard to the nature of the Osterhoudt Loci A and B assemblages). One possible interpretation of the Waldenmaier data is that much of the debitage originated in early stage reduction. While this may be true, cores and large bifaces are not common in these assemblages. Cortex was present on flakes only at Sites 2 and 3, where it occurred only on 2-4 percent of the flakes in some of the samples. The extent of cortex was always less than 50 percent of the dorsal surface, another strong indication of core reduction before transport to these sites. Each of these measures provides support for

Table 4.1: Waldenmaier Site, Surface Artifact Density

Site	Site Size in Sq M	Number of Artifacts	Density (Artifacts per Square Meter)
1	300	100	.33
2	1150	234	.20
3	2000	86	.04

Table 4.2: Waldenmaier Site, Subsurface Artifact Density

Site	Sq M Excavated	Number of Artifacts from Excavation Units	Density (Artifacts per Sq M)
1	12	336	28.00
2	20	233	11.65
3	40	229	5.72

Table 4.3: Waldenmaier Site, Flake Size Grades

Site	Context	Flake Count	Flake Size Grades in Percent of Flake Count			
			<0.5 cm	0.5-1.0 cm	1.0-1.5 cm	>1.5 cm
1	Surface	100	.00	18.00	28.00	54.00
1	Excavation Units	333	.00	14.41	44.44	41.14
2	Surface	226	.00	3.10	18.58	78.32
2	Excavation Units	231	.87	10.39	40.69	48.05
3	Surface	71	.00	8.45	21.13	70.42
3	Excavation Units	217	.46	20.28	35.48	43.78

the argument against the interpretation of these sites as workshops involved with the initial stage of stone reduction. Thus, the stone material was transported to these sites already somewhat reduced, and probably prepared for large flake removal. The low incidence of biface fragments suggests biface manufacture was not the goal of the stone working. Perhaps the generation of expedient tools was.

The evidence of an expedient tool assemblage is summarized in Table 4.4, which compares the percents of utilized flakes between the sites. In the surface collection, utilized flakes comprised about 11-12 percent of flakes at Sites 1 and 2, and nearly 17 percent at Site 3. Utilized flakes tend to be relatively large, so the large artifact bias works to increase the percents in the surface collection compared to the excavated data. The large artifact bias may account at least in part for the higher utilized flake percentages in the surface collection compared to the subsurface sample. Other factors may include small samples (71-333 flakes per sample), and spatial sampling bias. With regard top the last factor, we tended to locate excavation units in clusters of flakes observed on the surface, but the surface and subsurface distributions of classes such as utilized flakes and debitage size grades probably are distributed somewhat independently of surficial flake clusters. In retrospect we recognize this bias, but in conducting fieldwork on small sites, one must sample several artifact class populations simultaneously, while avoiding the risk of excavating outside the site altogether.

The percent of utilized flakes runs from 1.30 to 3.69 in the excavated data, with the highest percent again associated with Site 3. The difference of 1.30 to 2.70 at Sites 1 and 2, respectively, may in part reflect variation in available large flakes, as large flakes are somewhat more common at Site 2 than Site 1. The final point to make regarding flake utilization illustrates precisely the relationship between flake size grades and flake utilization. Sixty-nine of the 70 utilized flakes found at the Waldenmaier sites are >1.5 cm. The single smaller flake falls in the next smaller size grade, 1.0-1.5 cm.

Table 4.4: Waldenmaier Site, Percent of Flakes Utilized

Site	Context	Flake Count	% Utilized
1	Surface	100	11.00
1	Excavation Units	333	2.70
2	Surface	226	11.95
2	Excavation Units	231	1.30
3	Surface	71	16.91
3	Excavation Units	217	3.69

The Phase 3 investigation also yielded additional points, providing information on the chronology of Site 3. This work recovered a Late Archaic period Lamoka point (ca 4,000-4,500 B.P.), an Early Archaic bifurcated base point (ca 8,000-9,000 B.P.), and two fragmentary specimens including a probable second bifurcate base point and another Late Archaic (Lamoka or Normanskill) point. This extends the chronology of Site 3 from the Late Archaic identification that had been made based upon the single Normanskill point found during Phase 2.

These data and interpretations show the differences between the artifact concentrations and the low-density distribution. Most of the projectile points, point fragments, bifaces, scrapers, cores, utilized flakes and rough stone tools were found in Site 3. Sites 1 and 2 are relatively small and have denser artifact concentration, while Site 3 is relatively large and has low artifact density and high artifact dispersion. These differences seem to relate to understanding Sites 1 and 2 as places where activity was concentrated, stone material was accumulated and worked upon, suitable flakes were generated for expedient use, and numerous of the larger flakes were utilized. These two sites show some similarity, and are interpreted as temporary camps relying primarily upon expedient technology. Similar sites sometimes are classified as residential sites in settlement systems characterized by high residential mobility (Sassaman 2001).

Moreover, small sites with concentrations of debitage, utilized flakes, and curated tools have been recognized as relatively common in parts of the Southeast and Far West (Ebert 1992; Sassaman 2001), indicating the importance of this site type to hunter-gatherer land use strategies.

The contrast with Site 3 is strong, and the dispersed,

low-density nature of the artifact assemblage suggests the presence of a large, repetitively used resource procurement area. The long-term use of this site is indicated by the projectile point types, which demonstrate multiple periods of use over a span of about 4,500-5,000 years. This assemblage is functionally diverse in terms of showing strong representation of both curated and expedient tools, and some items, such as the anvilstone and cores, which may have been left in places where they would be useful on future foraging trips. Based upon the representation of curated and expedient technologies, and the presence of larger objects that might be classified as a kind of site furniture, we recognize functional diversity with regard to the organizational strategies used at Site 3.

Thus, with Waldenmaier Sites 1, 2, and 3, we observe two very different kinds of artifact assemblages distributed relatively discreetly across the landscape, but in close physical juxtaposition. The repetitive nature of these patterns is apparent both in the similarity between Sites 1 and 2, and in the presumed long-term formation of the Site 3 assemblage through a series of overlapping, low artifact density locations. If typical repetitive patterns of hunter-gatherer behavior truly are reflected in these data, then other examples of both patterns should be observed elsewhere. This hypothesis has been tested in the area of the Dunn-Prescott project.

THE DUNN-PRESCOTT PROJECT

The Dunn-Prescott Archaeological Project has been conducted since 1999 as part of the development of the Greene County Business Park in Coxsackie, New York. The study area is a section of dissected lake-plain along Coxsackie Creek, 1.5 miles west of the Hudson River. Fieldwork was completed in January, 2003, and analyses of the data have been ongoing since that time. Because the analysis is not complete as of this writing, our conclusions are preliminary, as noted in the following discussion.

Fieldwork and Data Collection Strategies

The Dunn-Prescott survey area comprised about 200 acres that has been developed into the business park and adjoining green space. The initial archaeological survey was conducted primarily as a surface survey of plowed transects that were about 3 m wide and 15 m apart. Portions of the project area that could not be plowed and disked were shovel tested with transects 15 m apart. The testing interval within transects was 10 m.

The result of the Dunn-Prescott Phase 1 survey was the documentation of an extensive artifact distribution of variable, but generally low-density at this observational scale. This distribution occurred so widely that no part of the project area could be eliminated from further consideration. At the same time, no locations of sufficient high artifact density to define individual sites could be discerned.

While the extensive artifact distribution was not itself an artifact of the field methodology, the inability to define artifact concentrations and site boundaries may well have been a product of the narrow Phase 1 transects. As a result, the Phase 2 survey reconsidered the entire project area, but used plowed transects about 15 m wide and 15 m apart. Again, areas that could not be plowed were shovel tested.

The result of the second survey program was the identification of some 40 areas termed artifact concentrations based upon tendencies for artifacts to occur in spatial clusters of various sizes in certain places. The operational definition for concentrations was the occurrence of two or more contiguous five-by-five meter surface collection units containing two or more prehistoric artifacts each. The threshold for identification is sufficiently low that it is significantly more likely that areas that are not concentrations would be included than that actual artifact concentrations would be excluded. This procedure is intended to identify hypothetical concentrations that can be tested subsequently with regard to whether they are spurious or genuine. Moreover, the grid squares referred to in the definition are strictly a frame of reference for this process. Artifacts were actually piece-plotted during the survey, so that the spatial relationships between artifacts inside and outside of hypothetical concentrations are preserved for future study by others with different methods and assumptions.

A second step of the investigation involved excavating one-by-one meter units to enhance information recovery and provide a test to evaluate the characteristics of artifact concentrations including how they withstand scrutiny. The subsurface testing provided another perspective on whether artifacts can be recurrently recovered in the concentrations. In many cases, this is an important aspect of identifying whether the concentrations really exist, particularly since the definitional threshold is so low. At the same time, in so large a project area with so many concentrations, the ability for one meter excavation units to confirm more than a general trend is limited. Accordingly, we did not test all of the concentrations at this phase of investigation. Rather, we tested about half of them with one or two excavation units, simply to acquire data to evaluate trends and develop the scope of Phase 3 data recovery.

During the Phase 2 survey we identified a large number of artifact concentrations. We eliminated two concentrations from further consideration as spurious due to low artifact yield and spatial isolation from conducive topographic and water associations, as well as other artifact concentrations. We felt that other concentrations

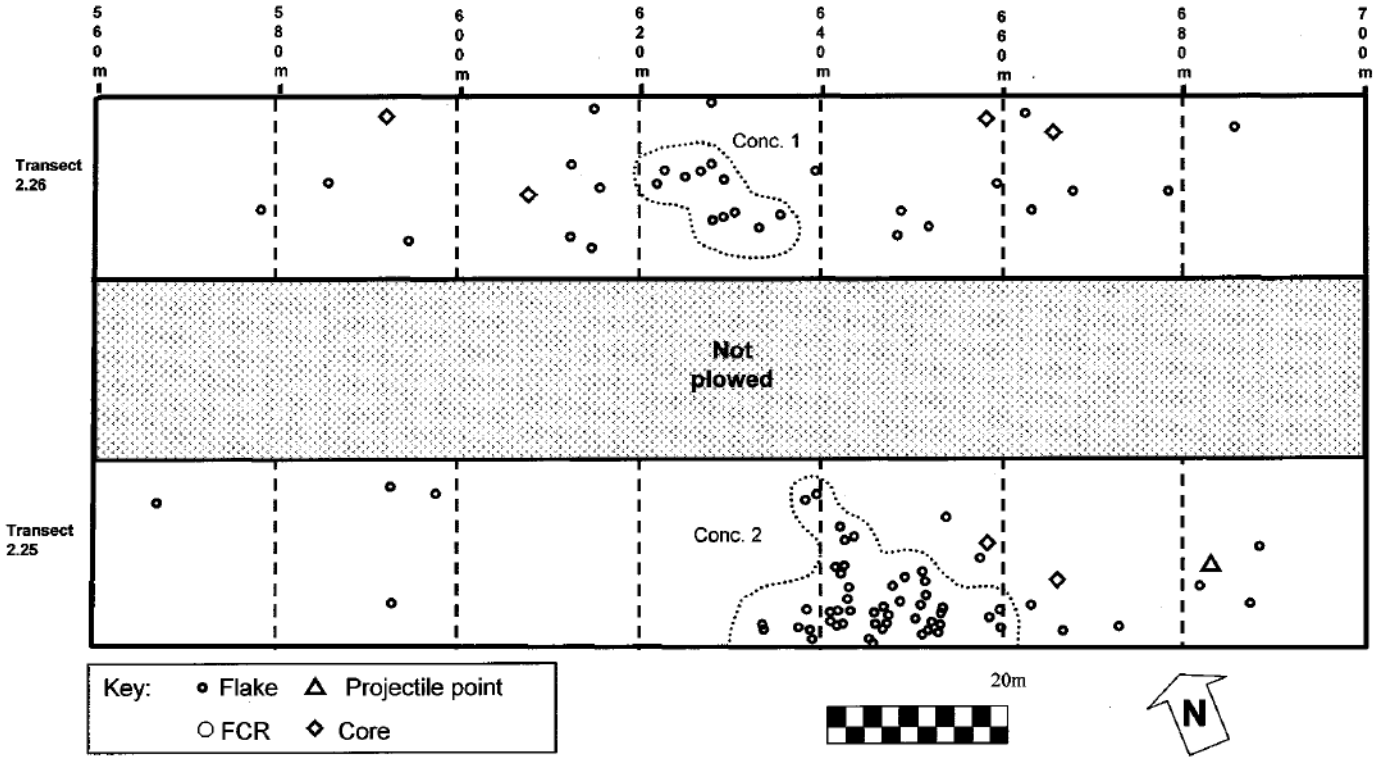

Figure 4.5. Example of artifact density inside and outside of artifact concentrations.

might be spurious as well, but retained them for the Phase 3 investigation. We also documented the extensive low-density artifact distribution outside of the concentrations, and determined that formally manufactured artifacts such as projectile points occurred much more frequently outside of artifact concentrations than inside of concentrations. The concentrations appeared to be similar to those at Waldenmaier, dominated by debitage with a variable incidence of utilized flakes and few curated tools. With the developing sense that these distributional patterns were crucial to understanding local, prehistoric, hunter-gatherer land use strategies, we proposed that the Phase 3 investigation would attempt to recover additional information from the artifact concentrations, compare the concentrations to each other, and compare the conclusions reached about the concentrations to the functional variation observed in the low-density distribution outside of the concentrations. Thus, the impact mitigation procedure would involve additional fieldwork at the artifact concentrations, as well as additional analysis of the Phase 2 data from outside of the concentrations. Although the artifacts outside of the concentrations are spread thin (Figure 4.5), the study area is so extensive that the off-site distribution provides abundant information.

The Phase 3 archaeological program involved a multistage research design with the following operations. An additional, intensive surface collection was performed at each of the concentrations within the potential area of impact. Next, an excavated sample was taken. Finally, the topsoil was stripped to search for archaeological features. This general procedure varied on rare occasions due to circumstances. For example, one concentration was hand-excavated instead of mechanically stripped. Another concentration in a wooded area could not be plowed, so a more extensive excavation program was employed. Finally, decisional criteria were employed that allowed variation in the extent of excavation based upon relative success in the recovery of artifacts. However, these criteria also required multiple attempts to recover subsurface data from each concentration. The minimum excavation within a concentration was 3 sq m, the target mean was 8, the maximum was 64, and the actual mean was 9-10.

Artifact Distribution Patterns

We have considered the differential distribution of artifacts among concentrations and between the concentrations and the low-density artifact distribution in terms of several variables, including extent or size of the artifact concentration, artifact density within concentrations, and the percentages of various artifact classes inside and outside of concentrations.

As defined previously, the minimum possible size of a

concentration in this study is 50 sq m and the minimum possible surface density within concentrations is .08 artifacts per square meter. These are not the theoretical minimums of behaviorally meaningful areas, such as hearths, small shelters, or knapping stations, which are smaller than 50 sq m and may have a lower artifact density than .08 per square meter on the surface. However, a consistent definition is useful to focus attention on locations where artifacts are relatively frequent. Although we found no occasion for exceptions, exceptions would be desirable if very small, high artifact density areas were identified.

Although by this study's definition, site size must be at least 50 sq m, actual size varied considerably above the minimum. The maximum size of an artifact concentration measured on the surface was 1,000 sq m. The size of the concentration in the wooded area that couldn't be plowed is 3,000 sq m. This appears to be a single component Late Archaic site, but it may represent multiple occupations during the River Phase of the Late Archaic (ca 3,800-4,000 BP). The majority of concentrations identified during Phase 2 and Phase 3 are 50-100 sq m. We note at the same time that certain small, relatively low-density concentrations were not replicated during Phase 3, while in some locations, multiple concentrations were found in proximity where only one had been apparent during the Phase 2 survey. We suspect that the failure to replicate some concentrations, and the appearance of new, relatively low-density concentrations during the Phase 3 investigation result from the low threshold selected to define artifact concentrations. This illustrates the ephemeral nature of the data and is a matter of ongoing analysis.

Artifact density indicates the intensity of activity within the concentrations. While the minimum possible surface density in this study is .08, there is no definitionally-determined minimum subsurface density, except perhaps .00. Surface density recorded during Phase 3 is often .08 to .16, but in some of the larger and denser concentrations surface density varies from .28-.37. Subsurface density of .00 was actually recorded in one instance, and in several others, varied from .50 to 1.50. In these cases, the convergence of subsurface and surface data supports the identification of spurious concentrations.

Nonetheless, for practical purposes, surface and subsurface artifact density are continuously distributed variables, making elusive any specific density threshold to confirm a spatial concentration of artifacts. Half of the concentrations with subsurface samples have subsurface densities of 15.6 to 107.4 per sq m. The other half has densities of 9.3 artifacts per sq m or less. In comparison, Waldenmaier Sites 1 and 2 have subsurface densities of 11.6 and 28.0, while Site 3 has a density of 5.7. Thus, many of the concentrations at Dunn-Prescott approximate or exceed the artifact density of the concentrations studied in the Waldenmaier project, while a minority have densities similar to Waldenmaier Site 3, which has been interpreted as a non-site, low-density artifact distribution.

At Dunn-Prescott, the larger and denser artifact concentrations have variable characteristics. A small number produced multiple, temporally diagnostic artifacts. Notable among these are (1) a concentration containing Middle Woodland (ca 1,000-2,000 B.P.) pottery in several feature and soil matrix contexts; (2) an extensive concentration containing several Normanskill points; and (3) a large, dense concentration containing a variety of Middle Archaic points (ca 7,000-8,000 B.P.). Several other concentrations span the subsurface density range of about 15 to over 100 artifacts per sq m, but are otherwise similar in having few identified implements other than utilized flakes and the occasional projectile point fragment. Thus, many of the Dunn-Prescott concentrations are similar to Waldenmaier Sites 1 and 2, although some have pottery or more frequent projectile points, apparently indicating a greater diversity among sites and more variation in land use at Dunn-Prescott.

One of the most surprising aspects of the artifact distribution identified during the Phase 2 survey is the tendency for various categories of artifacts to occur outside of concentrations (the Phase 3 data represent a more intense sampling of only the concentrations, and therefore resulted in an increased recovery of formal tools from those contexts). Of the 242 implements on the surface during Phase 2, 89 percent of projectile points, 75 percent of bifaces, 80 percent of cores, and 89 percent of hammerstones were found outside of the concentrations. Meanwhile, the majority of utilized flakes and unifaces, 55-57 percent, were found inside of concentrations.

These data are subject to revision, as additional lithic analysis is being conducted. One purpose of the additional analysis is to correct identifications, such as when projectile point fragments have been identified as biface fragments, or retouched flakes have been identified as utilized flakes. Another purpose is to examine all flakes from the Phase 2 survey with low power magnification in order to understand more thoroughly the intensity with which the assemblage outside of the concentrations was actually utilized. The preliminary results of this analysis indicate that the strong tendency for points, bifaces, cores and hammerstones to occur outside of concentrations is accurate. The proportion of utilized flakes occurring outside of concentrations may actually increase as a result of ongoing analysis. Unifaces are rather infrequent and it is not yet clear whether the preliminary trend will change.

An important result of the distributional analysis is the recognition of similar patterns in the data from the Waldenmaier and Dunn-Prescott projects. The ranges of concentration size and artifact density seem similar, although there is more variation in the larger Dunn-Prescott data set. In both data sets, the tendencies for

concentrations to be dominated by flakes, for points, bifaces, cores and hammerstones to occur outside of concentrations among low density artifact distributions, and for utilized flakes to be well-represented in both contexts is striking, indicating fundamental, recurrent patterns. As at Waldenmaier, the low- density artifact distribution at Dunn-Prescott appears to reflect diverse organizational strategies involving curated and expedient technologies, as well as site furniture and insurance gear. In a complex way, the low-density distribution is functionally quite diverse. Based upon the variety of artifacts found in so many places within the low-density artifact distribution, a variety of hunting and gathering activities occurred. Thus, this landscape appears not to be the locus of a single resource procurement activity, such as deer hunting or grass and reed harvesting, but rather, a variety of activities probably performed by different kinds of task groups at different times.

Chronology of Prehistoric Land Use

The chronology of the Dunn-Prescott survey area is understood primarily through projectile point typology. Most of the projectile points recovered during the Phase 2 survey were found outside of the concentrations, although the more intensive Phase 3 investigation of the artifact concentrations recovered additional projectile points. Thus, it is now possible to discuss the chronology of individual concentrations as well as the project area as a whole. However, these two aspects of chronology are linked, for there is the potential that the artifact concentrations are the residential sites associated with at least a portion of the activities performed in the surrounding landscape. Therefore, the projectile point chronologies of the concentrations and the larger landscape should be correlated to some significant extent.

In order to develop the chronology we have relied upon the Ritchie (1971) typology, as well as the literature on the Early and Middle Archaic periods developed after the publication of the Ritchie typology. Important additional sources include Anderson and Sassaman (1996), Cassedy (1983), Chapman (1985), Cross (1999), Dincauze (1976), Funk (1998), Justice (1987), McNett (1985) and Sherwood et al. (2004). We have observed that Early and Middle Archaic projectile points may be overlooked in surface collections because these types are not as familiar as those described by Ritchie (1971). We note the comments of several archaeologists concerning (1) the misidentification of Middle Archaic stemmed points as Terminal Archaic or Early Woodland stemmed points (Cassedy 1983; Dincauze 1972; Funk 1991b); (2) the failure to recognize the long, Archaic triangular projectile point tradition, seen by some to span the Early through Late Archaic (Miller 1998); and (3) the possible temporal correspondence between Northeastern triangular points and the ca 10,000 B.P. Dalton phase of the Southeast (Funk 1991a).

We offer two other perspectives on chronology, particularly as our understanding of the Dunn-Prescott project area depends upon the use of normatively defined artifact classes. In our dependence upon projectile point typology, we eschew two tendencies sometimes seen in similar studies. One is the assumption that shorter intervals of time should be associated with fewer types, such that the "sites" occupied for the shortest period of time should be represented by single projectile point types. As a result, we do not assume that concentrations associated with multiple projectile point types are necessarily multiple occupation sites. We evaluate this issue in terms of the types found together, and in view of the size and complexity of the site. The diversity of the archaeological record reflects in part the diversity of the cultures and communities whose material evidence has been left behind. We therefore are influenced by Plog's (1989) notion that the archaeological record will reflect the interaction of communities and individuals with a variety of geographical, social, and political connections, and will show "weak patterns" among some normative aspects of material culture, even within small sites.

The other tendency we eschew applies to areas larger than artifact concentrations as we have defined them for this study. It is the idea that the multiplicity of projectile point types recovered from the surface in large areal surveys is necessarily indicative of a large number of unrelated visits to the project area over a long period of time. We agree that the time frame often is long, and that some visits post-date others by a long time. In that sense they are unrelated. Where we differ from the traditional perspective is in our assumption that even on a scale of geological time, many of these visits are related through continuity of land use and associated knowledge, since populations, over time, begin to use portions of the landscape in traditional ways and for habitual purposes, often returning to the same places as opposed to others. In addition, anthropogenic environmental changes condition places for subsequent use, whether intensification of existing use, or changed uses based upon changes in flora and fauna. Thus, it is more likely that there will be long-term continuity in use (although not necessarily the same use) than there will be long series of unrelated visits. Given the use of projectile points to frame the chronology, and the assumption that some degree of long-term land-use is typical rather than unusual, we view most periods of use of the Dunn-Prescott survey area as long intervals, such as 500-1,000 years. While these intervals themselves are not unusual in chronologies, we stress that, more than just being estimates, they reflect the actual period of use.

Based upon the projectile point chronology, we see that the Dunn-Prescott study area was incorporated into

mobile land use strategies by the late Paleoindian or Early Archaic period (ca 10,000 B.P.). The recognition these factors— a long chronology including the Early and Middle Archaic, the assumptions made concerning the weak normative aspect of projectile point chronology, and the geological time scale appropriate at the survey area spatial scale— enables a coherent cultural history. In relating this history, we also make some functional interpretations.

The earliest artifacts recovered from the Dunn-Prescott project area appear to include reworked, lanceolate points, triangular points, and broad side-notched points with early attributes such as edge beveling and burin-fractured bases. These artifacts are assumed to predate 9,500 B.P. There is more confidence about subsequent periods. Human use of this landscape certainly had begun, at the latest, by the later part of the Early Archaic, as indicated by the presence of Kirk/Palmer corner-notched (ca. 9,000-9,500 B.P.) and various bifurcate base (ca. 8,000-9,000 B.P.) points. Early Archaic use of this area appears to have involved food or other resource procurement locations. By the Middle Archaic period (ca. 7,000-8,000 B.P.), use of the northern part of the project area intensified when small residential or activity sites were established, and resource procurement locations continued to be used in the landscape surrounding settlement space (Figure 4.6). Numerous Neville/Stanley, Neville-like, Neville Variant and Stark/Morrow Mountain II points are associated with this period in the Dunn-Prescott project area. The Neville, Stark and other stemmed Middle Archaic points have been found in small flake concentrations ranging up to about 1,000 sq m in size, as well as outside of concentrations.If residential sites indeed are indicated by the Middle Archaic flake concentrations, the settlement system probably involved a forager strategy and high residential mobility. A lower incidence of residential mobility would have resulted in

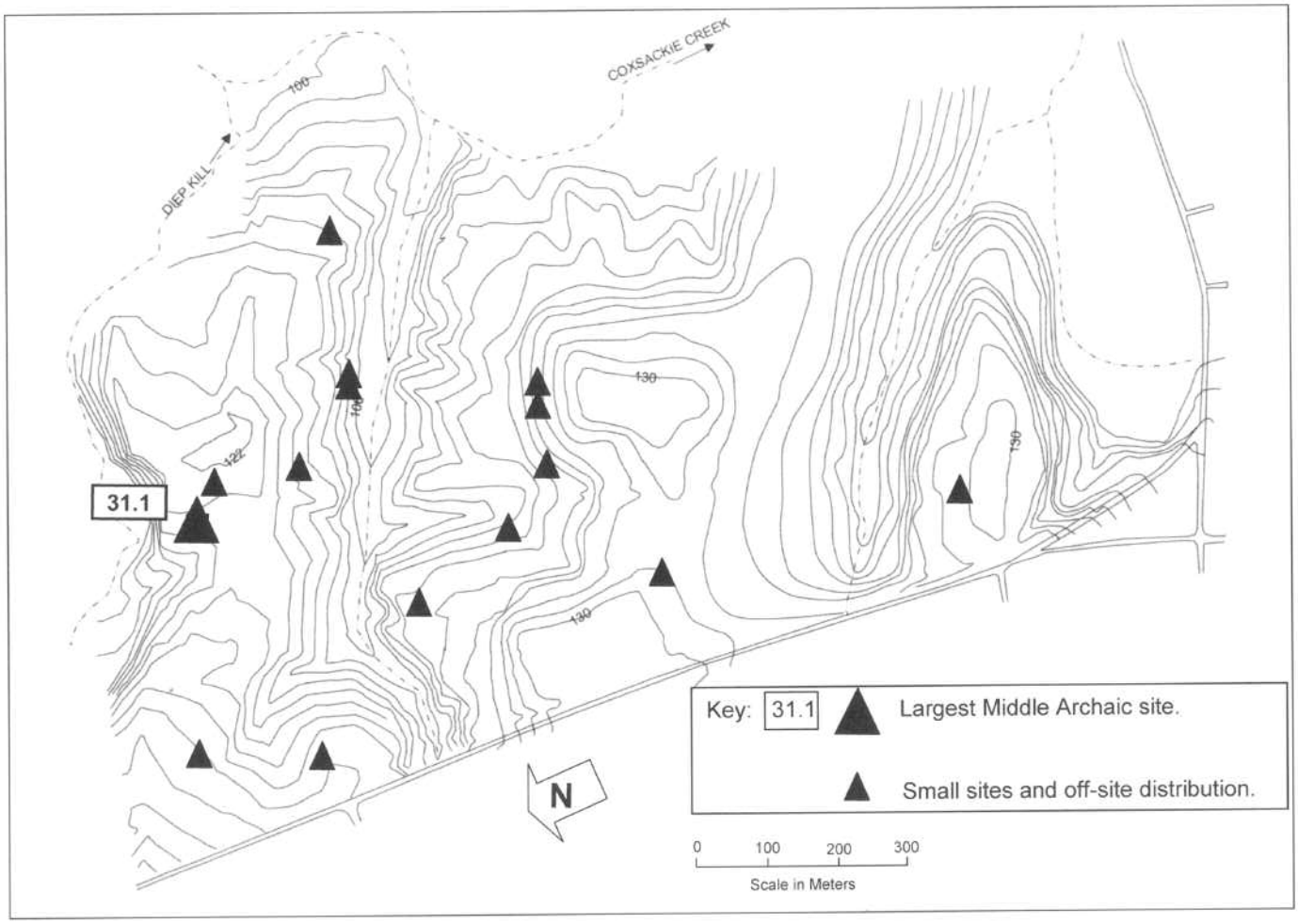

Figure 4.6. Middle Archaic stemmed projectile point distribution, Dunn-Prescott project.

more waste material, as well as substantial features and larger, more diverse implement assemblages. The recognition of a forager strategy with high residential mobility is not unusual for the Middle Archaic period, and has been discussed as a fundamental part of the Middle Archaic subsistence-settlement system in parts of the southeast (Amick and Carr 1996; Sassaman 2001).

The Middle Archaic appears to be the most sustained period of human use of this landscape, at least until it was transformed into farmland in the eighteenth or nineteenth century. After the Middle Archaic, land-use may have been more sporadic. A large site (ca. 3,000 sq m) associated with the Late Archaic period was established in the southern part of the project area, and Late Archaic projectile points are thinly distributed north of this site (Figure 4.7). This site may have been a logistical field camp, as opposed to a residential site. Its size in fact suggests that it may have been a series of overlapping logistical camps. This interpretation is made based upon the following data: projectile points dominate the artifact assemblage; artifact density is relatively low at 7.6 artifacts per sq m, and flake size is relatively small, with only 25.0 percent of flakes >1.5 cm. This suggests that the lithics introduced into the site were already substantially reduced and shaped, and thus probably were a portable assemblage of formally manufactured, curated implements (such as projectile points). Another logistical camp appears to have been established in a different location during the Middle Woodland period. Again, the artifact assemblage seems rather limited to indicate a longer-term residential settlement, while the relatively low frequency of large flakes (26.0 percent), suggests a previously reduced and manufactured, portable lithic assemblage. While pottery isn't considered portable, it could have been manufactured on site from local clay, or provided for use over a series of visits, without the intention of moving

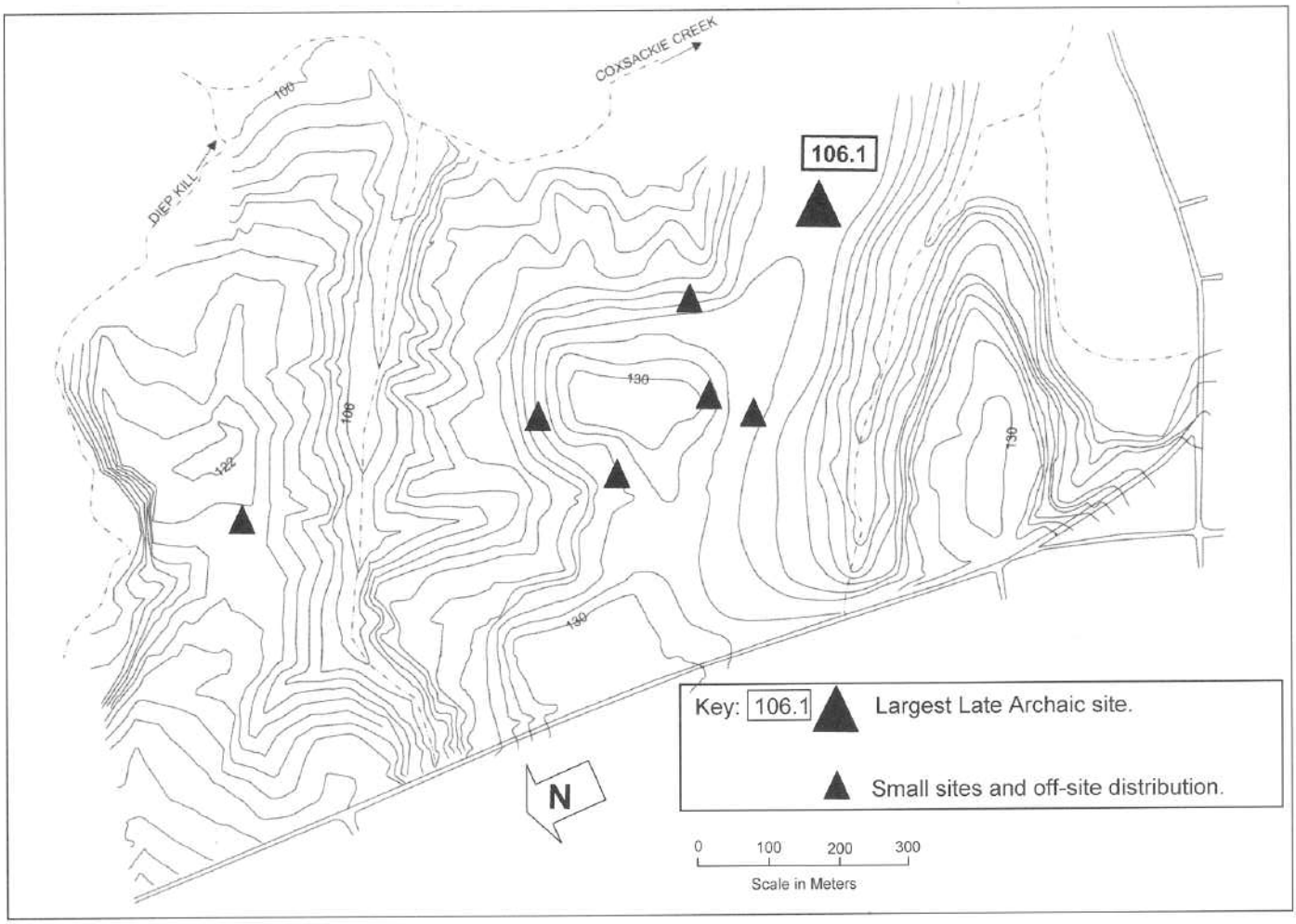

Figure 4.7. Late Archaic, Lamoka and Normanskill point distribution, Dunn-Prescott project.

it again to another location. None of the other concentrations are associated with the Middle or Late Woodland periods. Hunting or foraging in later times may be indicated by a possible Jacks Reef Corner-notched point found outside of the artifact concentrations.

Although we can provide a synopsis of land use in the Dunn-Prescott locale during prehistoric times, this area is too small to fully illustrate the settlement systems with which it was involved. The Dunn-Prescott study area provides a frame through which parts of these systems may be viewed. The full variety of land use and settlements at different periods could be indicated by additional surveys of other areas within the upper Hudson region.

CONCLUSION

Our investigation into low-density artifact distributions and small sites dominated by lithic debitage has been stimulated by a variety of survey results requiring that we attempt to understand these phenomena in a systematic way. Although this research really is in an initial stage, we have recognized several seemingly significant artifact distribution patterns.

Perhaps the most fundamental of these patterns involves the recurrence of two types of distribution. One type consists of relatively small artifact concentrations that have little content other than debitage. Formally manufactured implements are infrequent or absent. Instead, with few exceptions, implements were expediently manufactured or opportunistically available, and consist of utilized flakes. These characteristics are no doubt somewhat overstated, as there were probably formally manufactured, curated tools present in many cases. However, for the most part, these were removed when people left the site, leaving little trace other than the occasional projectile point fragment. At the same time, the characterization of this distribution type is generally accurate, because if curated tools had been significantly more abundant and used at these sites, more would have been broken and discarded.

The other type of distribution is an extensive, low-density artifact distribution with high ratios of large artifacts, projectile points and other formally manufactured artifacts to debitage. In fact, much of the assemblage of points, bifaces, unifaces, utilized flakes, and rough stone tools expected to form the durable material culture of local hunters and gatherers are found in the low-density distributions, rather than in artifact concentrations. This is not universally true, because some kinds of artifact "concentrations" represent site types such as semi-sedentary base camps where large numbers and a great variety of implement types accumulate. However, a large portion of the local archaeological record is composed of the kinds of distributions discussed in this article: small flake concentrations and extensive, low-density artifact distributions.

Regarding the Dunn-Prescott project specifically, three aspects of the research results are understood to date. First, the two types of distributions described above, which were spatially juxtaposed at the Waldenmaier survey area, were replicated repeatedly across the Dunn-Prescott survey area. Second, there seem to be other kinds of distributions present in this survey area, which have been interpreted tentatively as field camps associated with logistical mobility strategies. These may actually represent different kinds of field camps, oriented to different kinds of resource procurement, signified by variation in artifact density and material culture, such as the prevalence of either projectile points or pottery. With the observation of possible logistical field camps, we note the third point of interest. The ability to apply a chronology based primarily upon projectile point types to appropriately scaled spatial and temporal contexts allows the observation of change in the use of the landscape. The observed change is not simply in terms of the portion of the landscape used at different times, but in how the landscape was used, based upon the relationships between artifact concentrations and the areas surrounding them. It is possible that what has been observed at Dunn-Prescott is not simply the establishment of a logistical field camp during the Late Archaic, but a settlement system shift from high residential mobility to logistical mobility. This pattern appears to have characterized the Middle to Late Archaic transition in portions of the Southeast (Amick and Carr 1996; Sassaman 2001).

Unfortunately, archaeologists know too little about the Archaic in the Hudson valley for us to comment further on the issue of a possible reorganization of settlement and land use patterns between the Middle and Late Archaic periods. It is necessary to have a great deal more survey and excavation data in order to address this problem. However, we make a final point with regard to the importance of small site and off-site data. Our experience indicates that much of the local Early and Middle Archaic archaeological record may reside in small, nondescript flake concentrations while another significant portion occurs outside of concentrations in off-site, resource procurement locations. In order to learn more about this, archaeologists will need to investigate small sites and low-density artifact distributions more often and more thoroughly.

ACKNOWLEDGMENTS

We thank Chris Rieth and Chuck Fisher for inviting our participation in the small sites conference and this vol-

ume. We are indebted to the efforts of our field and lab crews, and to Tim Lloyd and Scott Padeni for directing portions of the Dunn-Prescott field work. We gratefully acknowledge the support and interest of the clients and planners involved with the investigations reported here, including Lee Rosen of Rosen Development, Sandy Mathes and the Greene County Industrial Development Agency, Peter Markou and the Greene County Economic Development Agency, and Steve Wilson of Clough, Harbour and Associates LLP. We also thank Bob Kuhn and Doug Mackey of the New York State Office of Parks, Recreation and Historic Preservation for consultation on archaeological significance and data recovery issues.

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CHAPTER 5

DEBITAGE ANALYSIS: LITHIC REDUCTION OR LITHIC PRODUCTION?

Niels R. Rinehart

Over the last several decades, archaeologists have developed methods for the identification and analysis of debitage, here defined as the flake and shatter products of flintknapping. Although the methods of debitage analysis in North America are many, two goals dominate. Either, the goal of the analysis is to identify stages of bifacial reduction, or determine whether a formal or informal industry was used. A formal industry includes tools requiring a greater amount of work such as bifaces and prepared cores. An informal or expedient industry includes the reduction of unstandardized cores producing unretouched flake tools. Archaeologists in North America implement one or both of these goals to answer questions in which they typically define debitage as resulting from the production of tools made in response to material constraints (Andrefsky 2001a; Cowan 1999; Parry 1989, Parry and Kelly 1987).

In using both goals, archaeologists define debitage within the context of the assumed finished product: the completed tool. Since archaeologists often use debitage as a medium with which to infer the tools, they therefore understand debitage as only an indirect means of inference for learning about the past. Debitage assemblages are therefore not considered as objects of study in themselves from which we can make cultural inferences. Both goals usually result in the construction of typologies for debitage. These typologies typically include categories for individual flakes as well as categories for the industries we believe produced the flakes (formal versus informal).

Although debitage typologies serve particular questions, if we move beyond these typologies I believe we can locate other forms of variation in debitage assemblages. Debitage is the most prevalent artifact at lithic scatter sites. If we can move beyond the two goals of typing reduction stages or differentiating between the use of a formal or informal industry, then perhaps we can ask different questions of these sites, questions that illustrate aspects of culture besides the reaction to material constraints. These questions might help us to make inferences about the social context in which past flintknappers worked.

Several archaeologists have described a general lack of theory in debitage analysis, citing a gap between the data and the theories that guide our interpretation of the data (Carr and Bradbury 2001; Wenzel and Shelley 2001). We have become so focused on creating different methods for classifying flakes, that we have not devoted enough effort to thinking about the inferences we can actually make with those identifications (Carr and Bradbury 2001). Stark (1999) describes a similar gap in archaeology, writing that we are more sophisticated in our analytical techniques than we are in advancing the theories with which we use these techniques.

This paper is not meant as a critique of either the two goals outlined above, nor of the importance for considering the effects of material constraints on the production of lithics. In addition, I do not present new methods for identifying debitage. There are so many methods available, resulting in a debate that is largely unproductive (Sullivan 2001:205). Instead I will describe ways we can use many of the non-typological methods of debitage analysis already available. By taking different approaches to non-typological methods of debitage analysis, I believe we can locate more variation in the production of lithic materials than we are currently able to see given the two goals of identifying reduction stages and/or lithic industry. From locating a greater level of variation, we can ask new questions and make new inferences about factors that may have affected the choices made during the production of lithic materials. These factors would include material constraints, but might also account for more of the social context surrounding the production of lithics. In this way, we might derive new roles for lithic scatter sites in our pursuit of learning about the past.

I begin by investigating why the finished tool has dominated discussions about lithics, and how this focus has shaped the established assumptions and goals of debitage analysis. I review how archaeologists typically use debitage as part of constructing their inferences about different cultural reactions to material constraints. This discussion outlines ways in which we typically restrict our use of debitage and lithics to locating adaptations to natural factors. I follow this with a review of different approaches to understanding production process that look beyond material contexts for technology, to social contexts. It is through these approaches I believe we may identify variation in production processes that may help us interpret social organization and other issues of agency in the past.

Current Approaches to the Analysis and Interpretation of Small Lithic Sites in the Northeast, Edited by Christina B. Rieth, New York State Museum, The State Education Department, Albany, New York 12230. New York State Museum Bulletin 508

BACKGROUND

Although archaeologists in North America have pursued other research interests for decades, the biface and its production still dominate the analysis of debitage. The importance attached to bifacial tools stems from the desire to create cultural historical schemes through the presence of diagnostic artifacts. Therefore, the focus is on those artifacts that appear to vary the most over time and are the easiest to identify (Chilton 1999d:45). As an example of the long shadow the biface continues to cast over debitage analysis, the cover of a recent edited volume of essays on debitage (Andrefsky 2001a), portrays the reduction trajectory of a biface from the extracted raw material to the finished projectile point.

Archaeologists in North America typically assess the analytical worth of debitage assemblages in terms of how readily we can infer the tool in the production of which the debitage is thought to have been produced. Alan Sullivan (2001:194) traces this dominance of the finished tool to William Henry Holmes and the very roots of archaeology on this continent. Holmes (1894:134) writes that from the "fragments, flakes, and chips broken from the specimens shaped and cast aside as waste, much is learned about the nature of the work done". We infer the goals of that work through comparisons with debitage assemblages that modern flintknappers produce. Archaeologists typically assume that if a modern assemblage is similar to an ancient one, that both modern and ancient flintknappers were making the same tools. It is through these comparisons that archaeologists test and evaluate the various methods of debitage analysis (Bradbury and Carr 1995:103).

There is, however, a great deal that separates flintknappers today from those of the distant past. First, modern flintknappers do not use stone tools to meet the material requirements of life, such as food and clothing. Second, aesthetics have undoubtedly changed over the millennia. Thirdly, flintknappers today have a wide range of raw materials at their disposal and are likely to choose the best cryptocrystalline materials they can find. As a flintknapper once told me, "I don't like to knap any of the 'ites'". Finally, modern knapping processes largely stem from the work of three men: Ishi, Francois Bordes, and Don Crabtree (Whittaker 1994:59). The modern assemblages we use to compare with collections of debitage produced over a period of more than two million years are derived from the work of these three individuals.

Goal I - Stage of Biface Manufacture

- Method IA – Cortex
- Method IB – Striking Platforms
- Method IC – Flake Size
- Method ID – Dorsal Flake Scars
- Method IE – Flake Curvature
- Method IF – Type of Load Application

Goal II – Formal vs. Informal Technology

- Method IIA – Identify Assemblage Patterns Based on Attributes
  - A1 – Flake Size Category
  - A2 – Flake Size Category and Weight
  - A3 – Flake Weight, Length, and Thickness
  - A4 – Breakage Patterns
- Method IIB – Identification of Tool Types from Attributes
  - B1 – Biface Thinning Flakes
  - B2 – Notching Flakes
  - B3 – Channel Flakes
  - B4 – Retouch Flakes
  - B5 – Bipolar Flakes

Figure 5.1 Outline describing Goals and Methods of Debitage Analysis

METHODS AND GOALS IN DEBITAGE ANALYSIS

Detailed reviews of the different methods for debitage analysis are readily found in the literature (Andrefsky 1998, 2001b, Bradbury and Carr 1995). These methods assume that flake types have meaning and that there is a relationship between the stage of reduction or lithic industry and the flake assemblage. Following these assumptions, the goals of debitage analysis in North America are the determination of reduction stage and/or lithic industry. It is thought that we can attribute variation found in the debitage to variation in one of these two goals (Sullivan 2001:194). Equipped with these goals of identifying the stage of reduction or lithic industry, archaeologists then attempt to answer different questions about the cultures they study.

Goal I (Figure 5.1) of debitage analysis is to assess the stage of tool manufacture that resulted in different assemblages. These stages are typically arranged in a trajectory moving from early to middle to late stages in the production process (Ahler 1989:86). In these methods, the intended tool is almost always interpreted as bifacial (Andrefsky 1998:107; Gilreath 1984; Henry et al. 1976; MacDonald 1994; Mauldin and Amick 1989; Morrow 1984; Stahle and Dunn 1982; Tomka 1989). These methods include assessing differences in striking platforms

(Andrefksy 1998:88; Magne and Polotylo 1981; Morrow 1984), flake size (Ahler 1989:89; Andrefsky 1998:96; Shott 1994:80; Stahle and Dunn 1982), the amount of cortex (Andrefsky 1998:112; Johnson 1989:127), the number of dorsal flake scars (Bradbury and Carr 1995:108 citing Magne 1985), flake curvature (Gilreath 1984 in Andrefsky 1998:107), and the assumed hammer types used in the production of the bifacial tools (Andrefsky 1998:114, Henry et al. 1976).

Goal II (Figure 5.1) is to determine whether a formal or expedient industry was implemented at the site. A formal industry consists of tools that "have undergone a great amount of effort in production" (Andrefsky 1998) and includes both bifaces as well as prepared cores. The latter tool type is defined as a shaped stone nucleus, typically used to produce long, narrow blades (Rasic and Andrefsky 2001). Unstandardized core reduction and the use of unretouched flake tools on the other hand, characterize expedient or informal tools. In an expedient technology there is little distinction between what are considered tools and what is considered waste (Parry and Kelly 1987). This technology is "casual with regard to form" and is wasteful of lithic materials (Andrefsky 1998:213).

Goal II is divided into two basic methods. Method IIA (Figure 5.1) divides an entire assemblage by size class and identifies diagnostic signatures in ancient assemblages that have been replicated in modern experiments. From this research, investigators have found that bifacial reduction produces an exponential curve whereas platform core reduction produces an irregular pattern on a x/y graph (Patterson 1990). Similar methods pursue this goal by dividing the assemblage according to size category and weight (Ahler 1989), breakage patterns (Sullivan and Rozen 1985), as well as by flake weight, length, and thickness (Andrefsky 1998:124). In Method IIB (Figure 5.1), the analyst identifies types of tools used at a site through interpreting one or two characteristics on individual specimens. The types of debitage derived from these approaches include biface thinning flakes (Raab et al 1979), notching flakes (Daugherty et al 1987), channel flakes (Witthoft 1971), and others.

Archaeologists have tested these methods, critiquing the shortcomings of each (Andrefsky 1998, 2001b; Bradbury and Carr 1995). However, these tests critique the "usefulness" of each method by looking at debitage assemblages produced by modern flintknappers. To test the different methods, archaeologists assess how accurately the methods illustrate the reduction stage or lithic industry represented by the debitage assemblages created by the modern flintknapper in the production of a tool (Bradbury and Carr 1995:103). In this sense, although many of the methods are effective in achieving either Goal I or Goal II, the goals present a narrow choice of predetermined scales since the analysis of debitage only reflects the creation and maintenance of tools. As Andrefsky (1998:134) writes: "[d]ebitage attributes and combinations of attributes may vary depending upon constraints associated with tool production, tool use, tool maintenance, and tool discard." As described in greater detail below, by focusing exclusively on the tools and their assumed functional importance, we limit our understanding of the actual process of their production and the cultural significance of those processes. By analyzing debitage only as a result of tools produced in response to material constraints, we limit our ability to look at the social context of that production.

ASKING QUESTIONS ABOUT EFFICIENCY

Archaeologists typically use the results derived from the goals of assessing the stage of bifacial reduction and/or the use of either a formal or informal industry, as a means with which to answer questions. These questions are usually rooted in concepts of efficiency, here defined as entailing "characteristics that allow [the production of] the maximum amount of appropriate cutting edge relative to transport costs" (Rasic and Andrefsky 2001:66). The theoretical framework in which these concepts of efficiency are often placed is referred to as technological organization. Archaeologists in North America ground this framework in both evolutionary and optimal foraging theory (Carr 1994:2; Nelson 1991:59), and interpret technology as optimizing the expenditure of time and energy (Wenzel and Shelley 2001:110). Although archaeologists define technological organization as a framework incorporating both economic and social variables (Carr 1994:2; Nelson 1991:57), technological strategies are viewed as ultimately resulting from environmental constraints (Nelson 1991:58).

Following this line of thinking archaeologists utilizing technological organization believe that material constraints determine tool use. These determinants on tool use include, among others, the requirements imposed by different levels of mobility, the proximity of raw materials, and the intensity and flexibility of use required of the tools. By deriving the reduction stages and/or tool industry from a debitage assemblage, one can then infer different types of tool use, from which the different responses to constraints are then inferred. The archaeologist therefore works backwards from the debitage assemblage to the tools, and then from the tools, infers the reactions to material constraints (Figure 5.2a and Figure 5.2b). Since there are two levels of inference, there are two levels of abstraction and possible error.

Studies of technological organization have long focused on locating different levels of mobility (Carr 1994:2). Therefore, determining varying levels of mobility

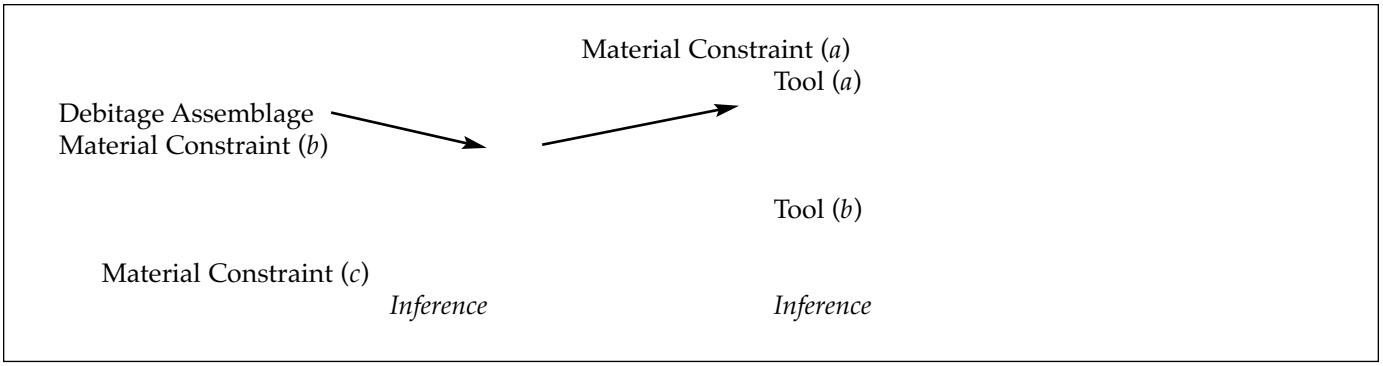

Figure 5.2a Direction of Archaeological Inference from Debitage Assemblage to Tool, to Material Constraint.

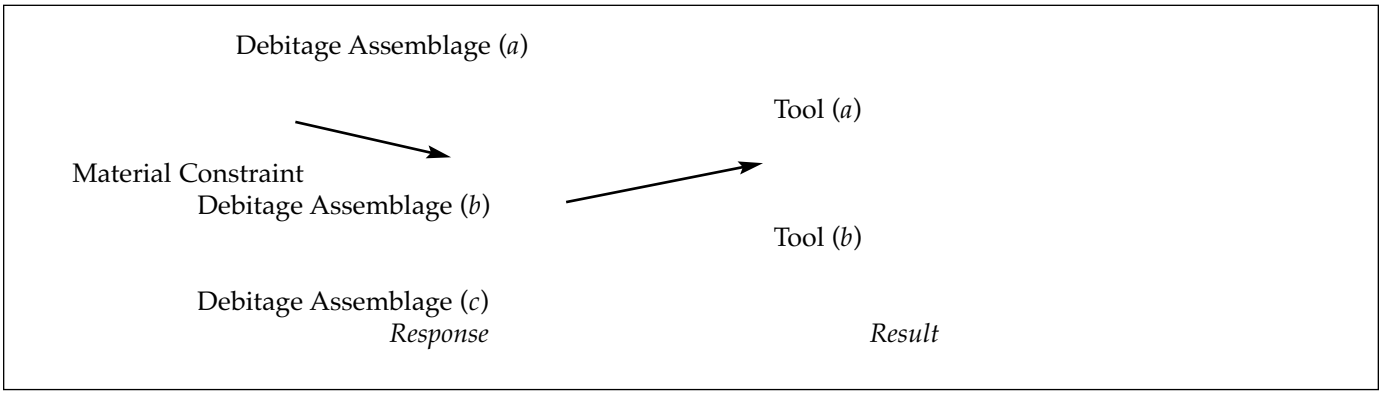

Figure 5.2b Assumed Direction of Past Production Processes Resulting in Debitage Assemblages.

is a common question asked of lithic assemblages by North American archaeologists (Wenzel and Shelley 2001:106). In his description of collectors and foragers, Lewis Binford (1980) defines different levels of mobility as a reaction to the constraints imposed by the distribution of resources. The level of mobility then determines the type of lithic industry used. More mobile hunter-gatherers are thought by many archaeologsits to have used formal tools since these tools are more portable, multifunctional, and multiuse (Parry and Kelly 1987; Tomka 2001:208). Sedentary peoples are thought to have used informal tools since these peoples were not faced with the same constraints as mobile peoples. According to these models, a sedentary group could therefore afford to use a more expedient lithic industry (Andrefsky 1998; Parry and Kelly 1987; Parry 1989).

Rasic and Andrefsky (2001) consider the influence of mobility on tool use in models defining tool flexibility and the projected intensity of usage through a comparison of bifacial and standardized cores in northwestern Alaska. When the specific task is not known, Rasic and Andrefsky (2001) believe a biface is the better choice since a biface is more flexible. In addition, a biface can function as a core, producing a variety of flakes. The idea is that a bifacial technology is better suited to longer forays. Blade cores on the other hand, are more specialized, producing standardized products that serve a limited function. As a result, Rasic and Andrefsky (2003) believe a blade technology is better suited to activities that are specific and predictable. Steve Tomka (2001) describes the potential intensity of usage as a determinant. According to Tomka (2001), formal tools are capable of more intense use whereas an expedient technology produces tools that are suited to less intensive episodes of use. The proximity and quality of raw materials are also cited as key determining factors in the selection of informal versus formal technologies, as well as the level of reduction (Andrefsky 1994). According to these ideas, people will likely use rarer lithic materials in a formal technology. When materials are abundant, however, an informal technology is the likely response.

Although it is important to consider the influence of material constraints, these studies do not account for the social context in which choices defining the production of tools were made. Rather these interpretations describe people in the past as making purely functional choices

about tools in response to material or natural constraints. The choices made within the context of these constraints shaped the resultant debitage assemblages. In all these readings of lithic technology, it is assumed that people were always efficient in the manufacture of tools. Given this assumption, how are we to archaeologically identify inefficiency?

Although efficiency is an important factor affecting technological decisions, we restrict our understanding of past cultures by only considering this factor. Pierre Lemonnier (1986:164) writes that purely material arguments for the making of choices is limited if the argument does not consider the social dimensions of those choices. He writes that the technical logic behind choices made by one group may differ from what another group considers more efficient. In addition, one group may interpret the decisions of other groups as mal-adaptive (Lemonnier 1986:156, 1993:1).

Examples from the ethnographic and archaeological literature illustrate the existence of different concepts of efficiency. Lemonnier cites his work with the Anga of New Guinea (1986, 1992). Although Anga material culture appears homogenous and they occupy a contiguous geographic area, there are many differences in their technical systems, separating the 12 different Anga groups. These differences persist despite the knowledge of the options and choices available. He describes these "discontinuities of material culture...[as]...the raw material for the anthropology of techniques" (Lemonnier 1986:159). Although the differences are not arbitrary, they do not have functional explanations from a purely materialist perspective. Lemonnier (1986) describes different Anga peoples organizing the burning of plants to clear fields, the construction of barriers to prohibit wild pigs from entering the cleared fields, and then the planting of the fields, in different patterns. Each group has the same end in mind, but organize how they go about achieving that goal differently. The methods may be equally effective, or even one method may be more effective than the other but still different methods persist.

Examples from other parts of the world include the Kalinga on the island of Luzon in the Philippines (Stark 1999). Here the Lubo potters know that the Dalupa-style pots are easier and take less time to make. When questioned as to why they do not adopt this more "efficient" style, they answered that they made pots the way they made them because of who they were and where they were from. The making of Dalupa-style pots was not in their cultural vocabulary although the Lubo potters understood that the Dalupa-style pots were simpler to manufacture.

From these examples we can see that people view efficiency differently. It follows that different groups did not always construct their world in terms of efficiency as we might conceive of it. These groups were acting within their society's logical frameworks. I believe we might locate some of this cultural variation in the production of lithic materials, if we analyzed lithics both with other goals besides the identification of reduction stages and the presence of formal versus informal industries, and from perspectives other than as a reaction to material constraints.

PROCESS AND TECHNOLOGICAL STYLE

Since the beginnings of the discipline, anthropologists have been interested in material culture. However, although the ethnographic literature abounds with detailed descriptions of material culture in the form of finished products, one rarely finds ethnographic information describing the sequence of events resulting in completed artifacts. The processes through which different peoples produced material culture are seldom described. In addition, anthropologists have given little attention to the social importance of the techniques of production. According to Pierre Lemonnier (1986, 1990, 1992, 1993) anthropology has not succeeded in embedding technological processes within a broader, symbolic system, and "we thus never find any attempt to relate techniques, in the most material aspects, directly to the characteristics of the societies which developed them". Lemonnier analyzes the techniques themselves in the belief that technology can reflect deeper systems of meaning beyond illustrating efficient responses to material constraints. He bases these ideas on the understanding that we put meaning into our surrounding world and that this meaning exists both in technical objects and practices. As a result, he defines artifacts as "social productions" (Lemonnier 1986, 1990, 1992, 1993).

Lemonnier defines technology as all aspects of the process of action upon matter and as "the material expression of cultural activity". A technological system is the existing artifacts, the order and processes of their production, the physical relations between techniques, and the social meaning of these techniques. By looking at technology as Lemonnier defines it, we can look at choice to derive different interpretations for why certain techniques were used and not others (Lemonnier 1986, 1992, 1993). Since changes in technology and society are symbiotic, an analysis of technology may offer us new insight into social organization and therefore social boundaries (van der Leeuw 1993:240). Since material culture is often manipulated differently along these social boundaries (Stark 1999:24), process may be more indicative of social identity and status than the end product (Chilton 1998:134; Lemmonier 1986; 1993:19). We may also find choices of process to be more illustrative of technological

organization than the end product.

The study of the sequences of events that comprise the production of objects has a long history among French anthropologists and archaeologists (van der Leeuw 1993). These scholars have identified research on this topic as chaîne opératoire (operational sequence). A study of chaîne opératoire seeks to reconstruct the organization of a technological system and is "the series of operations which transforms a substance from a raw material into a manufactured product" (van der Leeuw 1993:240). The operational sequence is the chain of events that results in the production of a finished object.

Lechtman (1977) defines the sum total of the steps involved in the production process as technological style. She sees technological style as the outcome of repetitive acts conducted within the production process. According to Stark (1999) the consequences of these acts appear in aggregate as material cultural patterning. Therefore technological style is essentially the sum of the processes through which objects are manufactured. It is the total of the different mundane and repetitive activities involved in the processes of production. These ideas bring to mind Bourdieu's (1977) theory of habitus, defined as learned behaviors that are expressed materially.

Tradition as well as environmental factors together result in the formal variation that exists between artifacts (Stark 1999:27). People make the choices that comprise technological style, within both material and social contexts (Wobst 2000). These contexts form a structure that is always in motion, such that actions or processes occur within a flow of events. Structure is therefore forever in process, both shaping and being shaped. The objects that are produced in the past form the precedent for those that are produced after. These concepts of a dynamic structure are found in Anthony Giddens' (1979) concept of enstructuration.

PROCESS IN LITHIC PRODUCTION

By investigating technological style in lithic production, I believe we may identify levels of variation in social organization that we have not found before. We have typically restricted our investigations of lithics and debitage to the interpretation of reactions to material constraints. I believe through incorporating ideas of process and technological organization, we can consider the social context of lithic production. We may then move beyond present conceptions of site typologies and lithic scatter sites and on to a more nuanced understanding of past lifeways.

Martin Wobst (2000:43) lists several reasons why few archaeologists have attempted to read social action from lithics. He discusses the ladder of difficulty that archaeologists have drawn beginning with "easier" questions about subsistence and leading up to "tougher" questions about agency and the mind. Many believe there is not enough data available at Paleolithic sites to ask the "hard" questions. As a result, archaeologists have dealt almost exclusively with natural variables, leaving little room for social action in ancient lifeways. Given these restrictions, it is no coincidence that many archaeological studies investigating process involve ceramics. Ceramics are the product of an additive technology and therefore "embod[y] many of the choices made in the production sequence" (Chilton 1999c:2). Lithics on the other hand, are the result of a subtractive technology so many diagnostic traces of the production process are removed from the finished tool. Lemonnier (1993:11) believes pottery is likely more subject to process since he believes there is a wider range of possible procedures.

But can we apply a study of process and technological style to debitage and if so how? Lemonnier (1990:29), a cultural anthropologist and not an archaeologist, believes that attempts to use material remains by archaeologists investigating issues such as social organization and individual behavior, are short on evidence and therefore, in his estimation "rather inappropriate". He believes there is not enough data and that if it is hard for an ethnologist to study process, it must be next-to-impossible for an archaeologist (Lemonnier 1990:30). Sellet (1993:109) writes that to study an operational sequence, we must have the finished object as well as all the by-products of production. This level of completeness is impossible for an archaeologist to achieve, particularly since we can never know if we have "everything". Magne (2001:24) recognizes that intent in flintknapping is poorly understood and the goals of modern flintknapers differ from those of the past. However, he believes there are only so many ways to "break rocks" and therefore little variation in process.

Despite these reservations, Gunn (1977) was able to locate distinct patterns of individual flintknapping techniques on finished bifaces. Although his research is restricted to bifaces and does not include debitage, the study illustrates that it is possible to locate differences in technological style in lithics and that there are different ways to "break rocks". I believe our ability to interpret the social context of lithic production is not as dependent on the amount of data available as it is on our method and theory. With the appropriate method and theory, we can ask questions of lithics and debitage about social organization and agency.

Sellet (1993:106) defines *chaîne opératoire,* and its application to lithic analysis, as a recreation of the "chronological segmentation" of the process. To recreate this chronology, Sellet (1993) suggests different methods including refitting and what he terms a diacritical study. Refitting might be ideal, but it is seldom practicable. He defines a

diacritical study as the identification of flake removal scars from cores and bifaces. The researcher can then identify variation in process from these scars. This method is potentially useful but does not account for debitage assemblages. Seldom more than a small percentage of total collections from lithic scatter sites include formal tools, particularly if those sites that have been plowed.

We need to investigate several questions. Is process in the production of lithics chronologically segmented? If so, is it possible to locate this chronology in assemblages of debitage? I believe that attempting to uncover reduction stages and/or to separate assemblages between those resulting from formal or informal industries ultimately fragments a process that was, at least in the past, rarely conducted in set stages. As Sullivan and Rozen (1985:758) write, process in lithics typically occurs not in stages, but within a continuum. Magne (2001:24) however, writes that flintknapping techniques have remained fairly consistent over the millennia to the present day. Therefore he believes we can use replicative experiments to locate distinct stages of reduction within debitage assemblages. Yet given Gunn's (1977) success in identifying levels of variation, can we assume that the reduction stages interpreted from modern flintknapping experiments existed in the past? In addition, even if there is little variation in technique in terms of how the rock is struck, much has undoubtedly changed in the intentions of modern versus past flintknappers. These differences have likely affected the processes of flintknapping and the resultant debitage assemblages. Finally, given the equifinal nature of the assumed connections between specific flake types and reduction stages, it is likely not possible to place any single piece of debitage within a chronology of reduction (Sullivan 2001:195).

Perhaps as opposed to inferring process in debitage assemblages from the identification of chronological segments, we should view these assemblages as the aggregate of processes resulting from patterned behavior. Stark (1999) defines technological style as the sum of the processes in the operational sequence, as well as the material outcome of the production steps throughout that sequence. An assemblage of debitage is the aggregate of the actions taken in the production of lithic materials and therefore should represent the technological style of the flintknapper(s). If we assume the production of lithic materials is repetitive, then it is likely patterned so that we should be able to use debitage assemblages to interpret technological style. Since lithics are potentially always in process, this approach considers lithic production as dynamic. Accounting for this dynamism is important since the possible transformations of lithic materials are potentially countless.

Several authors cite the presence of a mixture of reduction stages and/or types of lithic industries in assemblages as a problem in the analysis of debitage (Ahler 1989:89; Bradbury and Carr 1995:111). Yet, it is because we want to locate reduction stages and/or distinct industries that we see "mixture" as a problem. No doubt numerous assemblages, particularly those from plowed lithic scatters, are palimpsests from possibly thousands of years of occupation. Yet to what extent are assemblages "mixed" only because they do not fit within our typologies? What nuances are we missing by defining assemblages according to these categories? The concept of a mixed assemblage (possibly excepting the influence of a plow) assumes that people practiced one technology in one time and at one place. Yet there is no reason why different lithic technologies could not have been used, perhaps with seasonal variation (Rasic and Andrefsky 2001:78) or by multiple knappers. I believe the apparent mixture of reduction stages or lithic industries we see in debitage assemblages may actually be patterned cultural variation. It is through the discovery of these regularities that we can then begin to infer links between meaning and process (Lemonnier 1990:33) in the production of lithic materials.

METHODOLOGY

There is no cookbook for locating technological style in debitage assemblages. Rather, the approach taken is dependent on the questions asked. How did cultures differ in the choices they made during the production of lithic materials? How might these choices have affected, and therefore be reflected, in debitage assemblages?

To identify process through the analysis of debitage, it is necessary to avoid methods that classify flakes and shatter according to typologies. Such typologies mask much of the diversity in material culture that we as archaeologists are interested in (Chilton 1999d:44). Debitage typologies as described in this paper, are laden with assumptions about process and goals. Although these typologies may be important as heuristic devices, they ultimately both reify stages of reduction as well as categories of lithic production to either formal or informal technologies. In addition, it is impossible to create universal debitage types since the factors affecting production are too numerous to measure or to control for (Johnson 2001:17).

Instead of typologies, approaches that rely on the identification of attributes can provide us with scales of reference and may help us locate technological style in debitage assemblages. Attribute analysis is defined as "the descriptive comparison of specific artifact features" (Chilton 1998:146). These attributes are selected without the belief that they have any inherent meaning. Rather meaning is assigned based on the questions the

researcher is asking (Chilton 1999d:44). Through the identification of artifact features, we can place assemblages within a continuum and then compare them, locating variation. By deriving continua from an attribute analysis of New England ceramics, Elizabeth Chilton (1998, 1999a, 1999b) was able to illustrate a level of cultural variation not visible with a more standard typological approach.

When defining attributes, it is essential to consider several factors. Since no single attribute on an individual flake can clarify its origin (Carr and Bradbury 2001:134), and since the origins of individual pieces of debitage are ambiguous (Sullivan 2001:197; Sullivan and Rozen 1985:773), it is necessary to view debitage within the context of an assemblage, and not as individual flakes. We should also implement a suite of methods for identifying attributes (Bradbury and Carr 1995; Magne 2001:23) enabling us to infer different levels of variation.

In Figure 1, a variety of attributes are listed under Goals I and II (Figure 5.1). The use of these attributes is dependent on the questions asked as well as budget/time constraints. We can identify individual pieces of debitage according to attributes such as size category, weight, length, width, thickness, as well as cortex, and dorsal scar counts amongst others. Sullivan and Rozen (1985) identify flakes according to attributes defined by breakage patterns including complete and broken flakes, flake fragments, and debris.

As discussed earlier, Patterson (1990) charts the different quantities of centimeter size categories in debitage assemblages produced by modern flintknappers on an x/y axis. With these graphs he identifies differences between the assemblages resulting from modern reproductions, illustrating the production of formal (bifacial) versus identified individual pieces of debitage according to these attributes, we may divide the collection(s) into any number of groupings. Within these different groupings we can then compare the assemblages according to whatever attribute(s) we select. Possible questions for comparison might include how do raw materials compare when charted by size category? How do raw materials vary according to different breakage patterns? Does patterned variation exist in the length versus the width of debitage when compared by different size categories or raw materials? There are numerous possibilities for arraying the data. We can then use these results to make intra and inter-site comparisons.

If the results from an ancient tool assemblage did not fall into one of these diagnostic patterns, then Patterson and others would presumably identify it as mixed. In this discussion, however, we are interested in that mixture, defining it as the aggregate of all the actions taken in the production of lithic materials at a particular location. I believe that given the assumption that the production of these materials was repetitive, we can identify patterns within the assemblages resulting from differences in the quantities of different attributes. Equipped with this information, we can compare assemblages.

Since different processes may or may not be constrained, and sometimes events are random, we may find correlations and other times we might not. Past cultural processes might indeed produce the patterns we find. However, these patterns could result from several social logics and therefore be "poly-determined" (Lemonnier 1990:29). In addition, although differences in technological style might indicate cultural boundaries, variation might also result from functional differences. Different patterns of debitage attributes could also result from the physical properties of raw materials. Modern flintknappers seldom work with lower-grade materials. We therefore lack a good understanding of how these materials break when compared to higher-quality cryptocrystalline rocks (Magne 2001). Also, we should not segment any analysis by artifact category and only look at debitage (Wobst 2000:46). It is important that we see debitage assemblages in terms of other materials and artifacts found at each site. If possible, microwear analysis of flakes/tools and lithic sourcing should accompany this research.

FUTURE RESEARCH

One goal of my research is to investigate the potential for spatial differences in the use of upland areas in Massachusetts and New York. The dominant artifact type found in these locations is debitage from lithic scatter sites. How can I identify differences in technological style from debitage (as well as other recovered artifacts) that might illustrate these spatial differences? I hypothesize that differences in technological style found in debitage assemblages will reflect differences between upland and river-based occupations, as well as variation between sites in upland areas. I hope to find these differences by dividing debitage assemblages by size categories as well as other attributes including flake length, width, breakage patterns, etc. Taking into consideration the possible equifinalities discussed above, I believe these differences in technological style will appear in relation to several variables. What are the possible relationships between the production of different raw materials and their sources? How do possible differences in the production of different materials relate to their use? How do these factors relate to site location? What is the scale of variation found between these different factors and what spatial relationships might exist? Is it possible to differentiate cultural and functional boundaries from possible variation found in the technological style in the debitage assemblages?

CONCLUSION

Adams and Adams (1991:8) write that "typologies are tools made for a purpose, and as long as they can be shown to work for that purpose they require no more abstract justification than does a crowbar." Typologies for flake types, reduction stages, and formal versus informal tool production serve particular questions. However, I believe we can see more in lithic scatter sites if we try to move to different ways of viewing debitage. I believe that variation exists and has existed in the production of lithics across space and time. This variation is the result of choices made in regards to different contexts including, social context, the context of material constraints, and the context of past choices. We need to consider these different aspects although in reality it is impossible to separate them.

Gunn's (1977) study identifies variation in the production of bifaces. The extent to which we can locate variation in debitage assemblages resulting from differences in production is unknown. However, if we assume the production of lithics is repetitive, we should theoretically be able to see patterns in the aggregate of lithic production found in debitage assemblages.

Lithic analysts define mixture in debitage assemblages as resulting from signatures interpreted as indicating the presence of both a formal and informal industry and/or more than one stage of bifacial reduction. But what is "mixture"? By using the term "mixed" we assume the dominance of a small range of variation in the production of lithics through two million years of stone tool production. Perhaps what we identify as mixture is actually a finer grade of variation than we are currently able to interpret given our typologies. Perhaps this mixture is actually patterned behavior resulting from a richer array of technological styles than we have hitherto considered. In my dissertation research, I will analyze several debitage assemblages by attributes. I will then use these attributes to place the assemblages within continua in addition to the analytical goals of identifying reduction stages and lithic industry reviewed in this paper. I believe I will then be able to identify these finer grades of variation. As a result of this research I hope to be able to make inferences about social organization in the pre-Contact history of western Massachusetts and eastern New York.

The approach of chaîne opératoire has great potential for lithic analysis (Sellet 1993:111; Magne 2001:30) and may help us ask questions of debitage other than how lithics reflect reactions to material constraints. Since debitage is the dominant artifact type at lithic scatter sites, a more varied approach to debitage analysis would go a long way towards enriching our understanding of these sites.

ACKNOWLEDGMENTS

I am grateful to Elizabeth Chilton for her guidance and comments as well as the introduction to theories of process and operational sequence. I would also like to thank H. Martin Wobst and Mitch Mulholland for their guidance and instruction. In addition I am grateful to George Martin for his teaching of flintknapping and Philip Perazio for introducing me to many of the issues surrounding upland 'lithic scatter' sites. And finally, I am grateful to Lauren for sitting through all my talk of debitage (there's a lot more yet to come!).

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SMALL LITHIC SITES AND THEIR CONTRIBUTIONS TO LOCAL AND REGIONAL SETTLEMENT SYSTEMS

CHAPTER 6

THE SIMPLE AND THE COMPLEX: TWO MIDDLE ARCHAIC SMALL UPLAND LITHIC SITES IN NORTH STONINGTON, CONNECTICUT

Brian D. Jones

INTRODUCTION

Despite decades of research, northeastern Archaic settlement organization remains poorly understood. It is commonly assumed that the region's hunter-gatherers followed a generalized foraging strategy defined by a pattern of residential mobility that brought small groups of mixed age and gender to seasonally-available resource patches (Cowan 1999; Ritchie and Funk 1973; Snow 1980). Short-term seasonal aggregations focused on fishing locations are usually assumed, and the importance of fall seasonal aggregation has been emphasized (Walthall 1998). Recent excavations at the Mashantucket Pequot Reservation and its immediate surroundings suggest that these assumptions are too general. Evidence of substantial pit-house lodges and the harvest of starchy wetland plant resources (especially cattail and water plantain) is documented at the Sandy Hill site (9,000 – 8,500 B.P.; Jones and Forrest 2003) and at the Preston Plains site (5,000 – 4,000 B.P., unpublished data, Mashantucket Pequot Museum and Research Center). The data are suggestive of long-term winter occupations of these sites, despite ethnographic and other evidence suggesting such sites should be rare (Walthall 1998). In addition, the area's Archaic (9,000 – 2,700 B.P.) small upland sites are very heterogeneous and I argue that it is unlikely that the majority were used as residential camps. Instead, these small, but often artifact-dense sites may represent a variety of logistically-oriented field camps and hunting stations occupied briefly by a subset of the residential group. Nearly all seem to have been reused, creating variously complex palimpsests of archaeological debris spanning millennia that may easily be mistaken for seasonally occupied residential sites (Binford 1982; Dewar 1986; Dewar and McBride 1992).

Small lithic sites are understood to be those which are constrained to less than about 100m^2. While the central artifact density of many of these sites may be quite high (hundreds of flakes per square meter of 1/4-inch screened sediment) and they often contain diagnostic artifacts and other tools, these characteristics will seldom be noted during initial reconnaissance at five to twenty-meter shovel test pit intervals. Instead, they are most often first indicated by a small number of apparently stray flakes from just one or two shovel test pits. Sadly, many sites are written off without further investigation because they are not expected to have significant research potential. Most of these small lithic sites develop into rather complex assemblages of tools and tool-making debris in the course of more intensive data recovery investigations.

This paper describes two small Middle Archaic upland sites. While one clearly represents a very brief episode of use focused on tool repair, the other might be taken to represent a longer-term residential camp, based on the density of artifacts recovered. Analysis of these two sites instead suggests that they likely represent briefly occupied logistical hunting stations or field camps (sensu Binford 1980). Both sites are located within rugged near-moraine uplands recently developed by the Mashantuckets into a 36-hole golf complex (Figure 6.1). Middle Archaic site 102-83 rests on a saddle-like landform surrounded on three sides by wetlands. The site consists of a small scatter of quartzite and quartz debitage, two diagnostic projectile points and a single simple flake tool. Middle Archaic site 102-57 perches on a bluff-like terrace overlooking a 100-acre wetland basin, now a dammed lake. The site produced over 10,500 biface manufacturing flakes nearly entirely of quartzite as well as a large number of bifaces and preforms. These sites raise questions about the functional variability of small Middle Archaic site types and about their place in the broader settlement and subsistence systems in which they played a part.

THE TYPOLOGY OF SMALL LITHIC SITES

Newell and Constandse-Westermann undertook a detailed classification of site types in their 1996 examination of ten Feddermesser sites produced by bow-hunters of the northwest European terminal Pleistocene forests. Their study examined seventy North American hunter-gatherer societies in terms of fourteen site types and eighty-four attributes (Newell and Constandse-Westermann 1996: 373). Table 6.1 summarizes data pertinent to the sites discussed in this essay, which may include small residential camps, field camps, hunting stations or kill sites in forested environments. In addition to these small site types it is assumed that potentially large

Current Approaches to the Analysis and Interpretation of Small Lithic Sites in the Northeast, Edited by Christina B. Rieth, New York State Museum, The State Education Department, Albany, New York 12230. New York State Museum Bulletin 508

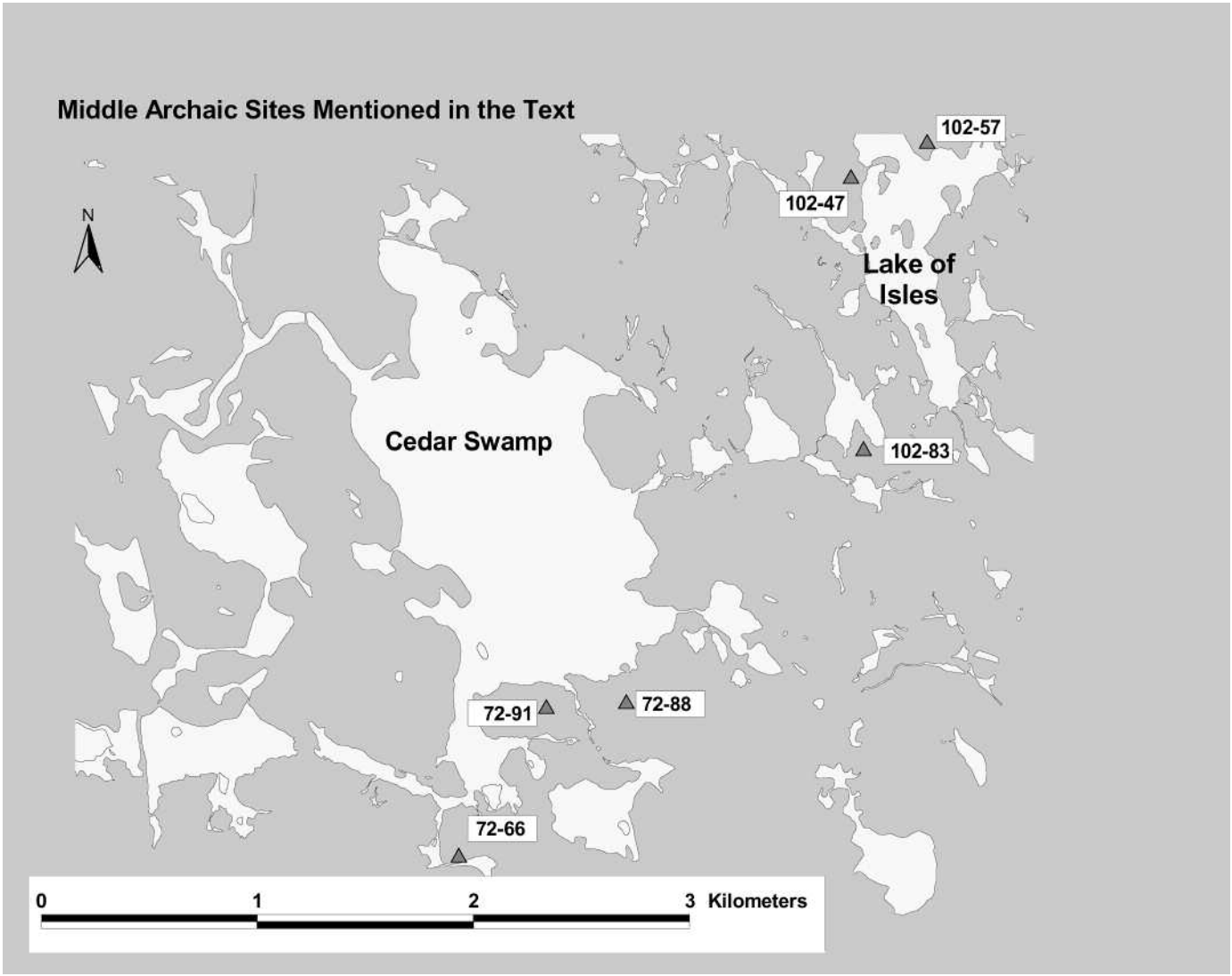

Figure 6.1. Middle Archaic sites mentioned in the text shown with adjacent wetland formations.

winter seasonal camps, short-term aggregation camps, and seasonally-based multi-family residential sites were used. No incontrovertible evidence for these larger Middle Archaic site types currently exists in the vicinity of Mashantucket. The lack of seasonal camps is most likely a result of the reduced availability of cattail marshes in upland settings during the period of lowered water tables associated with the mid-Holocene hypsithermal (Jones 1999; Webb et al. 1993). Mashantucket's Early and Late Archaic presumed winter camps are associated with wetland marsh habitats and have produced botanical evidence for the harvest of starchy wetland root crops such as cattail, water plantain and water lily (Perry and Jones 2002).

Newell and Constandse-Westermann's site typology is based largely on Binford's classification scheme which defines the *residential base* as "the hub of subsistence activities, the locus out of which foraging parties originate and where most processing, manufacturing, and maintenance activities take place" (Binford 1980: 9). A *field camp* is "a temporary operational center for a task group… [where it] sleeps, eats, and otherwise maintains itself while away from the residential base" (Binford 1980: 10), and *stations* are information gathering areas such as "ambush locations or hunting stands from which hunting strategy may be planned but not necessarily executed" (Binford 1980: 12). Interestingly, Newell and Constandse-Westermann concluded that all of the Feddermesser sites analyzed corresponded most closely to non-residential hunting stations. The authors suggested that the more complex residential sites lay buried beyond the reach of archaeologists, primarily in floodplains or beneath dense urban

Table 6.1. Site Types and Potential Associated Attributes from the Ethnographic Record of North America (condensed from Newell and Constandse-Westermann 1996: Figure 2)

	Net Dry Rack	Fish dry/smoke	Hide scraping stump	Hide drying frame	Skin/bark tent	Elevated cache	Meat /fish dry rack	Hide staking area	Fish weir/trap	Expedient shelter	Outside cook hearth	Drop & Toss zone	Grnd/undgrd cache	Caim/cache	Inside hearth	Dog yard	Bone dump	Surface hearth	Smudge hearth	One-man tents	Shooting blind	Tool cache	Wind break	No features/facilities	Snare anchors	Game drive fence	Butchering area
Spring and autumn small residential camp	X	X	X	X	X	X	X	X	X																		
Field camp					X	X	X	X		X	X	X	X	X	X	X	X	X	X	X							
Transit camp					X	X				X																	
Hunting station							X	X			X	X					X	X			X	X	X				
Kill-Butchering site							X		X		X	X	X	X										X	X	X	X

zones in ideal geographic settings (Newell and Constandse-Westermann 1996: 384).

A better understanding of Archaic settlement and subsistence organization in northeastern North America requires the examination of a variety of site types, including the small briefly occupied locations that likely comprise the overlooked majority of the archaeological record. If the existing record appears to indicate a pattern of shifting seasonal residence, how were the residential sites supported? Clearly numerous satellite resource-extraction locations exist for each residential camp. But how do these differ from the residential sites themselves, especially those briefly occupied by small social groups during seasons of disbursement? Are there clear, redundant signatures of short-term logistical support sites that discriminate them from presumably more complex residential bases? Table 6.2 provides one possible outline of such differences. Summarized are potential site activities, the expected archaeological signatures of those activities and the general probability of the signature's occurrence within the overall site assemblage at residential versus logistical camps.

The archaeological signatures presented in Table 6.2 are based on a few simple assumptions. The primary function of most logistical sites is assumed to be game hunting. Therefore these sites are expected to have a high incidence of hunting-related activities such as weapon repair and manufacture and field dressing of game. Because of the temporary nature of most of these sites, artifact density is anticipated to be relatively low for each episode of use. Residential sites are likely to have been used over a period of days, weeks or even months and are therefore expected to contain denser, more heterogeneous archaeological assemblages. Residential sites should reflect a higher incidence of plant and small game gathering because this is expected to have happened within a relatively short distance of the camp (Binford 1982). Residential sites were also places where most plant and

Table 6.2. Archaic Site Activities and Anticipated Archaeological Signatures

Activity	Archaeological Signature	Likelihood of Occurrence	
		Residential Site	Logistical Site
hunting	broken projectile points	High	High
hunting tool repair/production	preforms and debitage, scrapers?	Moderate	High
flake tool production	large flakes and spent cores	High	Moderate
game dressing	choppers and flake knives	Low	High
plant collecting	flake knives?	High	Low
plant processing	utilized flakes, manos, nutting stones, leaching pits?	High	Low
meat processing	flake knives and utilized flakes, small post molds from racks	High	Moderate
hide processing	scrapers, post molds from racks	High	Low
plant cooking	earth ovens, roasting platforms (fcr)	High	Low
meat cooking	hearths	High	Low
food storage	pits	Moderate	Low
heavy woodworking	groundstone tool fragments	Moderate	Low

meat processing and cooking occurred so features should be common. Presumably time-consuming activities such as hide preparation, acorn leaching and ground stone tool repair and manufacture occurred primarily at residential sites as well. Based on these assumptions it is anticipated that logistical camps can be differentiated from most residential sites based on artifact and feature content – even when sites contain a comparable density of remains because of heavy site reuse.

The lack of evident features at Middle Archaic sites in and around Mashantucket suggests that these are primarily non-residential hunting stations. Based on Table 6.1, such sites may produce small outside surface hearths, temporary drying and hide working structures and simple wind breaks and blinds. Few of these ephemeral site features are likely to survive long in the post-depositional environment. Even small residential camps are expected to provide at least some evidence for the multiple racks, cooking and smoking features, and shelters that once existed (Binford 1990). More difficult to assess is the difference between logistical field camps and short term residential sites, both of which are likely to contain some evidence of housing, food processing and cooking features, and a relatively diverse array of tools. The following section provides more detailed site analysis in the attempt to better understand how these sites might have functioned, and their possible role in the broader settlement scheme.

Figure 6.2. Quartzite Neville variant drill, expedient projectile point and possible utilized flake from site 102-83.

SITE 102-83

Site 102-83 rests at an elevation of 260 feet on a gently sloping saddle-shaped terrace about 10 feet above the surrounding wetlands. This site is an archetypal "small lithic scatter." During reconnaissance six flakes were recovered from a single shovel test pit. When the site was further investigated seven years later, a new shovel test pit excavated near the original findspot resulted in a small number of additional finds. When a five-meter array produced only sterile test pits, four two-meter offsets were excavated. Two of these contained additional artifacts and a shift to data recovery began. After two short seasons at this location, a total of sixteen square meters were excavated, resulting in nearly complete site recovery. Four hundred seventy-three quartzite artifacts (77% of the total) were recovered, along with 108 (18%) other and thirty-three unidentified lithic types (5%). Despite evidence of soil reddening and possibly burned stone, no discrete features were located. Two quartzite Middle Archaic artifacts were recovered – a Neville Variant projectile point reworked as a drill, and a small Neville-like point. The only other tool was a possibly utilized quartzite flake (Figure 6.2). The multinodal spatial distribution of artifacts indicates three brief quartzite knapping episodes (with maximum flake densities of 25, 38 and 42 flakes per 50 cm^2 quad) and two of quartz (Figure 6.3). The site represents a short-term activity area. Assuming an estimated rate of flake production of one every two seconds, 20 minutes of quartzite knapping are accounted for. In the typology of sites outlined above it most clearly resembles a hunting station where some tool repair occurred.

SITE 102-57

Site 102-57 sits at an elevation of 310 feet overlooking the dammed wetland basin now known as Lake of Isles 50 feet below. Soil at the site is extremely stony, although the surface is, and presumably was, relatively flat and comfortable. The site is bounded by a large erratic to the west, but is otherwise in an exposed setting. It does, however, provide an excellent view of the wetland basin – a factor presumed to have been important to its Middle Archaic occupants. A single quartzite flake was located during phase I reconnaissance. Subsequent testing at five-meter intervals then resulted in two adjacent pits containing 108 and 45 quartzite flakes respectively, clearly indicating that the site had the potential to provide much more information. The block excavation of this location encompassed fifty square meters. After data recovery was concluded, the site contained over 10,500 quartzite, 400 quartz and just 12 artifacts manufactured from other materials. One is a chert Terminal Archaic Wayland Notched point that is clearly intrusive. The most abundant tool classes are bifaces and preforms (Figure 6.4) and Middle Archaic projectile points and fragments (Figure 6.5). Utilized

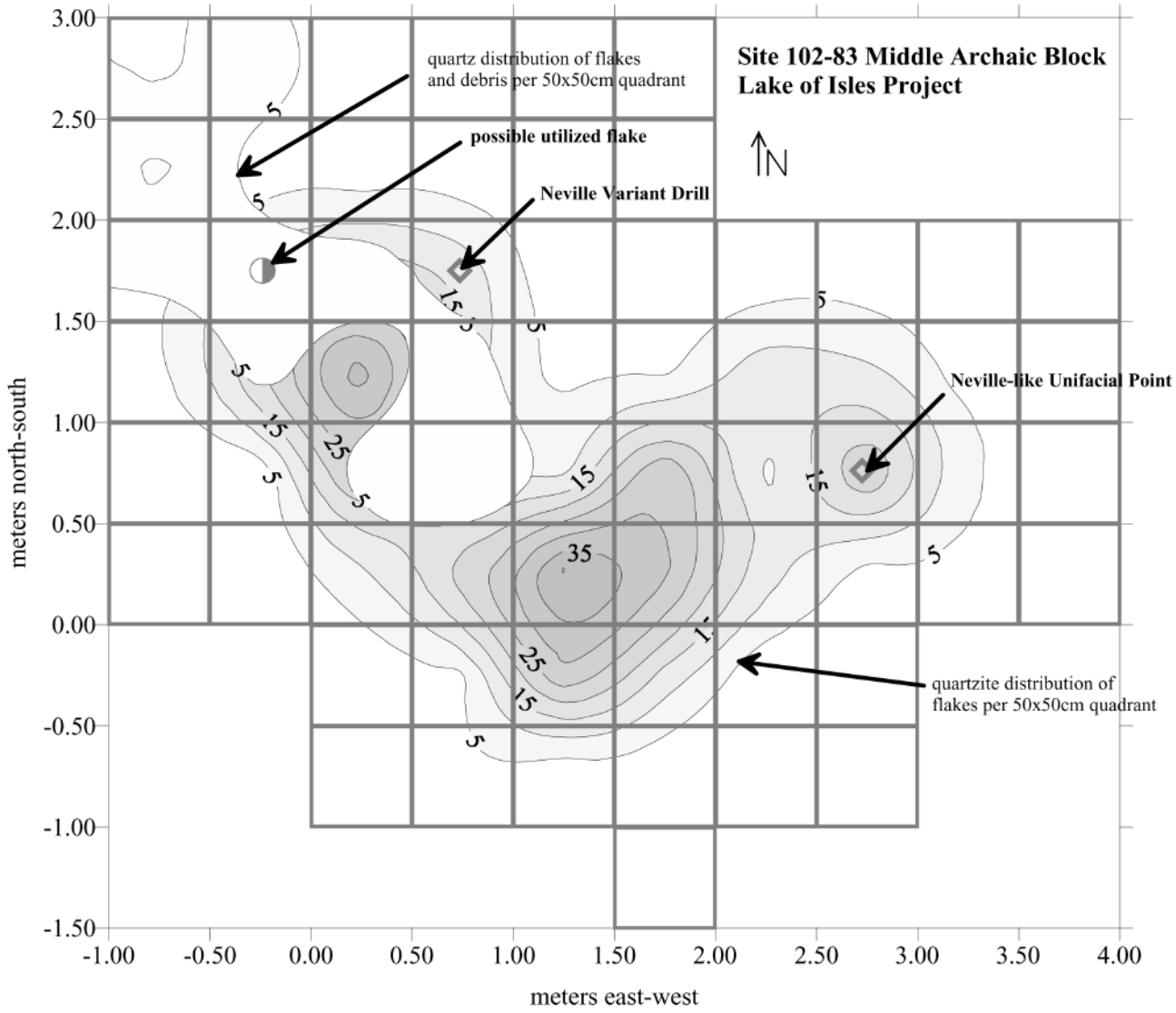

Figure 6.3. Site 102-83 quartzite and quartz artifact density per 50x50cm quadrat and tool locations.

flakes and scraping tools total thirteen artifacts, while core fragments total seven (Table 6.3). No hearths or other evident features were found at this site. The overall tool and tool-fragment density is $0.9/m^2$.

The abundance of debitage indicates that the site was used for focused quartzite knapping. While some core fragments and early-stage robust flakes and debris exist, quartzite debitage is dominated by small, late-stage biface-manufacturing flakes. Figure 6.6 represents the density of quartzite debitage per 50 cm^2 quad across the excavated block. It was assumed that the site consisted of a single high-density quartzite locus. After a second season in the field, however, it became apparent that the site was more complex than initially perceived.

The patterning of the quartzite distribution clearly indicates that a number of separate knapping episodes took place at the site. A detailed examination of the distribution resulted in the interpretation of probable individual knapping events is summarized in Figure 6.7. This interpretation of the quartzite distribution was based on peaks and valleys in the density plot and attempted to separate possible overlapping knapping episodes that would appear as extending lobes. Fifteen possible separate knapping events were defined by the varying density of quartzite. Figure 6.7 provides total artifact counts per zone, as well as an estimate for the time required to produce this number of flakes. The time estimate is again based on the simple assumption that 2 seconds were

Figure 6.4. Middle Archaic preforms and bifaces from site 102-57.

Figure 6.5. Middle Archaic projectile points and fragments from site 102-57.

Table 6.3. 102-57 Middle Archaic Tools

Tool Type	Count
Bifaces	12
chopping tool	1
concave scraper	1
flake knife	2
Preforms	11
projectile points	9
retouched flakes	2
scrapers (general)	2
Steep-bitted scraper	1
utilized flakes	4

required to produce each flake recoverable by 1/4-inch mesh screen. In fact this number may be a conservative estimate because many artifacts represent flake fragments and thus less time would be needed. Although over 10,500 quartzite flakes were found, the total estimated time spent knapping at this site was perhaps less than six hours. It is thus reasonable to suggest that the site was produced by one or two knappers in a single day. However, the complex distribution of knapping events more likely indicates a number of superimposed episodes, separated by days, years, decades or centuries. An observation supported by two Middle Archaic points.

To better understand the degree of potential site reuse I have compared the distribution of artifacts from the more clearly single component site 102-83 in Figure 6.8a. To approach a similar number of artifacts, thirty times the quartzite assemblage of site 102-83 was needed. To test if it is reasonable to interpret site 102-57 as a palimpsest of repeated small sites such as 102-83, thirty quartzite distributions of that site were randomly placed across the excavation block of site 102-57 (Figure 6.8b). The artifact distribution resulting from this artificial superpositioning is more diffuse than that observed at site 102-57, lacking its very strong concentrations. This experiment suggests that while site 102-57 probably resulted from more than a single episode of site use, it is unlikely that the site is composed of dozens of short-term, low-density components such as observed at site 102-83.

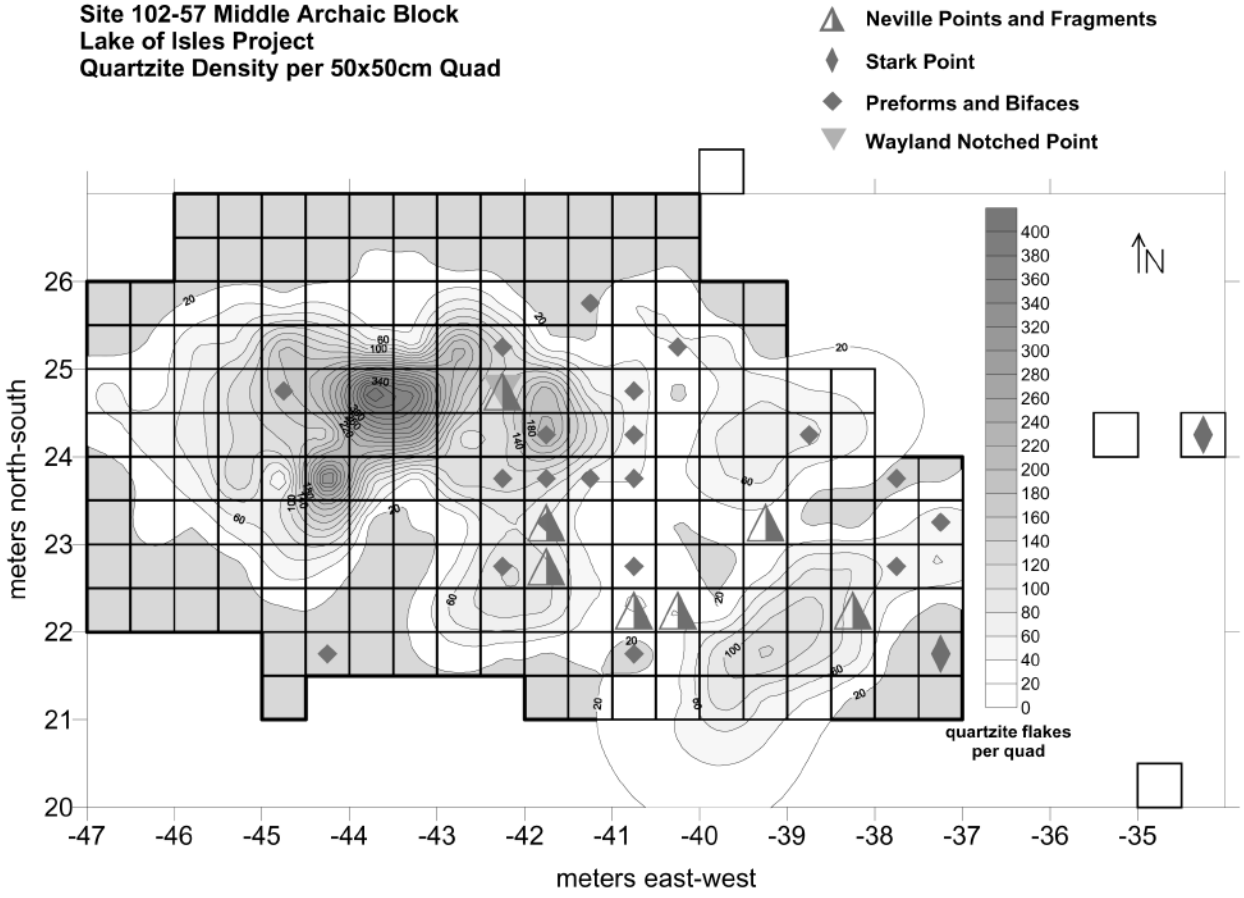

Figure 6.6. Site 102-57 quartzite artifact density per 50x50cm quadrat and tool locations.

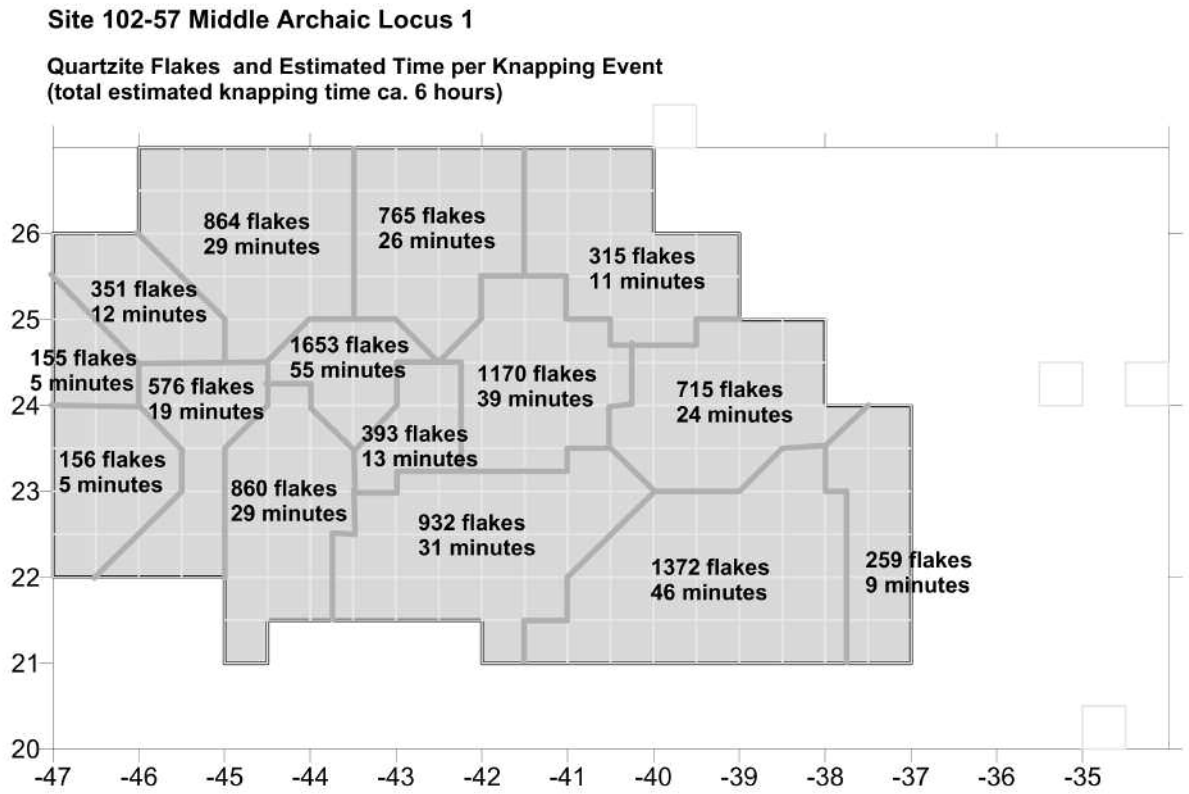

Figure 6.7. Site 102-57 quartzite flake totals per reconstructed knapping zone and estimated expenditure of time per zone estimated at a production rate of one flake per two seconds.

Site 102-57 probably does not represent a single component event. Because bifaces dominate the tool assemblage (72%), because of the lack of evident cooking hearths, and because of the site's relatively exposed setting, I feel it should be interpreted as a palimpsest of a small number of hunting stations or field camps. The site was used for the production and repair of hunting gear, and perhaps field dressing of game. There is no clear evidence of features that might suggest the site functioned as a residential base, despite its relatively high artifact density.

THE BIGGER PICTURE

In this section, I briefly review four nearby Middle Archaic sites and compare them to those discussed above. Such comparisons may help us to better understand the place of sites 102-83 and 102-57 in the broader settlement organization. Data from these sites are summarized in Table 6.4. Site 102-47 represents another small ($28m^2$) excavation block that contained a tool kit comparable to that of 102-57. The site is located across from 102-57 in a comparable terraced location. It was also the location of relatively intensive biface manufacture, although flake tools (flake knives and a variety of scraper forms) are also well represented. The most striking difference between the two sites is the dearth of projectile point fragments from 102-47. A single Stark point was found just outside of the main excavation block in a shovel test pit during initial site reconnaissance. Despite the recovery of twenty-seven bifaces, not a single additional projectile point fragment was recovered during subsequent data recovery excavations.

Middle Archaic sites 72-66, 72-88 and 72-91 have been summarized previously in the literature (Jones 1999). These sites are located approximately three kilometers southwest of the Lake of Isles sites along terraces above the 500-acre wetland known as Cedar Swamp at the core of the Mashantucket Pequot Reservation. Site 72-66 is in a relatively sheltered location adjacent to a spring at 210 feet, while sites 72-88 and 72-99 are located on relatively expansive sandy terraces at an elevation of 160 feet (Figure 6.1). All three sites exhibit a similar quantity and variety of flaked stone tools to the smaller Lake of Isles sites, but their distribution is more disbursed resulting in lower overall artifact densities. Of note is the remarkably low density of debitage at the three Cedar Swamp sites. Field recovery methods were comparable for all of the sites discussed, so the data indicate much less intensive

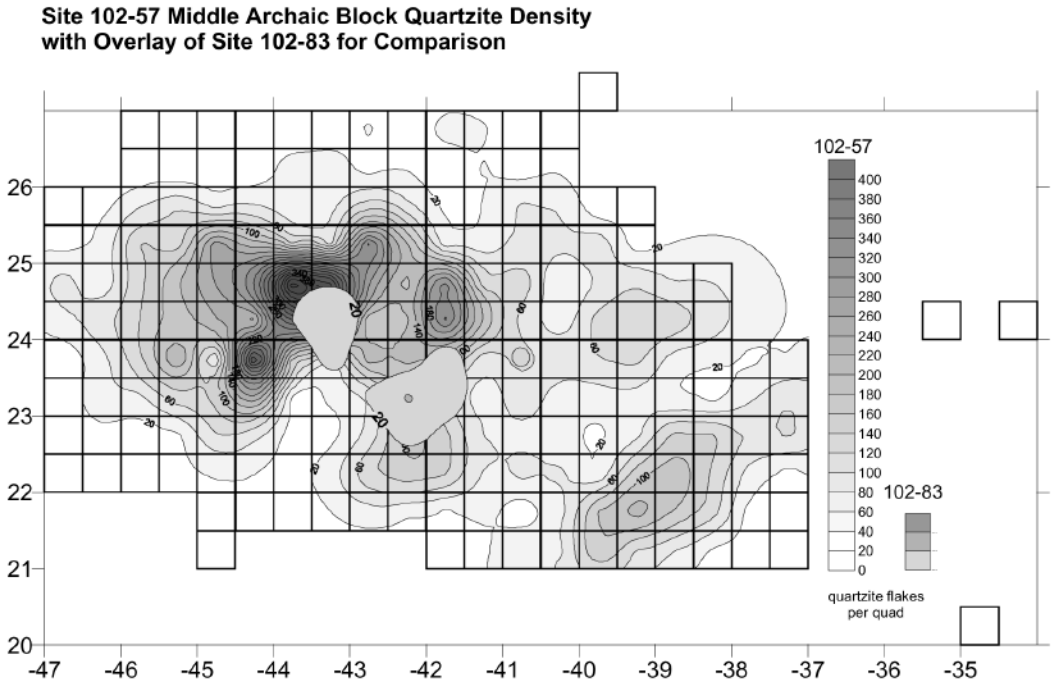

Figure 6.8a. Quartzite distribution of the small single component site 102-83 mapped over the distribution of quartzite from site 102-57 for comparison. Note the difference in artifact density between the sites.

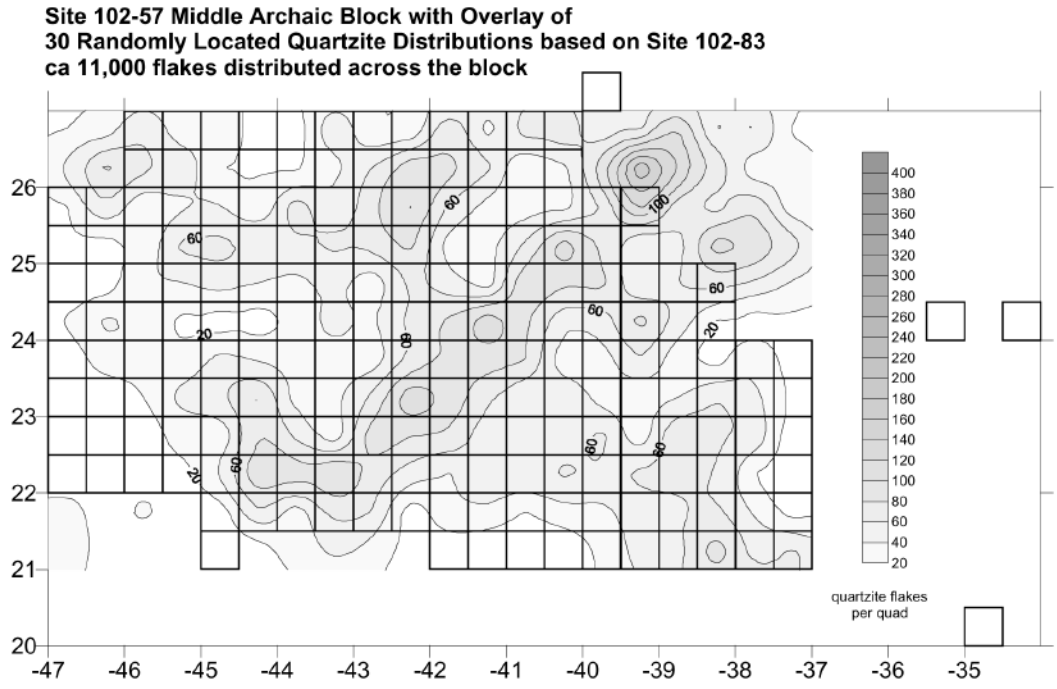

Figure 6.8b. Thirty overlain randomly placed distributions of quartzite based on observations from site 102-83. The total quartzite density is mapped over the excavation block of site 102-83 for comparison. Note the overall lack of artifact clustering and lower individual artifact densities per 50x50cm quadrat expected to result from random site superposition.

Table 6.4. Intersite Tool Comparisons, Frequency and Density per Square Meter

Site	102-47		102-57		102-83		72-66		72-88		72-91	
Square meters	27.5		49.75		16		109		126		163	
Flake tools	15	0.54	12	0.24	1	0.06	14	0.13	14	0.11	17	0.10
Points/frags	1	0.04	9	0.18	1	0.06	16	0.15	22	0.17	33	0.20
Bifaces/preforms	27	0.98	23	0.46	0	0.00	16	0.15	6	0.05	6	0.04
Drills	0	0.00	0	0.00	1	0.06	0	0.00	0	0.00	3	0.02
Chopping tools	3	0.11	1	0.02	0	0.00	1	0.01	0	0.00	1	0.01
Cores/frags	0	0.00	7	0.14	0	0.00	0	0.00	2	0.02	1	0.01
Debitage	2456	89.3	10,900	219.1	581	36.3	130	1.19	396	3.14	1477	9.06

knapping at these three locations. Biface fragments and preforms are also much less common at these sites than they are at 102-47 and 102-57 (102-83 had no unfinished bifaces). Interestingly, the three Cedar Swamp sites express relatively high densities of discarded projectile points. These sites were interpreted as reoccupied warm weather residential camps or logistical hunting stations (Jones 1999: 116).

The comparison of these six sites provides additional food for thought. The two major differences between the upland Lake of Isles sites and the wetland-oriented Cedar Swamp sites are site size and debitage density. The wetland sites are best described as expansive, low-density sites with little emphasis on bifacial tool manufacture, while the upland Lake of Isles sites are better described as tightly organized, high-density locations focused on biface manufacture.

To better understand the possible domestic versus logistical functions of these six sites I compared the density of flake tools to that of pooled bifaces and preforms. A surprising pattern emerged. Figure 6.9 shows the density of flake tools per meter along the X-axis and the density of bifaces/preforms along the Y-axis. A very strong positive correlation between flake tools and bifaces/preforms is indicated (r^2=0.98). Most of this correlation is accounted for by retouched and utilized flakes (r^2=0.93), less by flake knives (r^2=0.68) and not at all by scrapers (r^2<0.01). Sites 102-83, 72-91, 72-88 and 72-66 cluster at the low end of this trend line where sites have relatively few flake tools and bifaces/preforms. The two upland knapping stations 102-47 and 102-57 both express high numbers of bifaces/preforms and flake tools. Importantly, no such correlation is observed between the density of discarded projectile point fragments and flake tools (r^2=0.27). The conclusion that must be drawn is that biface production and flake tool use are strongly correlated, contrary to popular perceptions that the presence of flake tools typically reflects "domestic" and perhaps gender-specific activities. Assuming that biface manufacture was in fact focused on the production of projectile points, it seems flake tools were primarily used as secondary tools for the repair and manufacture of hunting-related gear. If these upland sites were hunting-oriented logistical locations, they were probably used to field dress game, which could also help to explain the abundance of flake tools.

The differences between the sites suggests that the wetland-oriented Cedar Swamp locations were places where projectile points were commonly discarded, but not often manufactured, while the upland-oriented Lake of Isles sites 102-47 and 102-57 were places where gearing up activities occurred during hunting down-time. The temptation is to assume that the Cedar Swamp sites represent residential areas to which hunters returned and where they discarded spent hunting gear. Unfortunately, there is little direct evidence that this was the case (i.e. none of the wetland-oriented sites produced hearth features). In fact, all of these sites, including the single component site 102-83, may simply represent points along a continuum of the potentially infinite variety of logistical site types that may exist. Like residential sites, these are anticipated to vary widely depending on the duration of occupation, season of use, whether a quarry was recently visited to obtain raw materials, whether a hunt was successful, the size of the task group, the amount of "down time" on site, and any number of other historically contingent factors. Most of these sites were likely reoccupied, and may have served different social or food-gathering functions, further complicating any separation of residential and logistical site use.

As the forager-collector continuum artificially dichotomized our understanding of subsistence and settlement organization, so too do site typologies simplify and condense the chaotic variety of real sites formed in the living past. It is worth reminding ourselves that the constraints we place on the archaeological record are always simplifications and abstractions of reality – necessary paradigmatic evils that allow us to impose structure and organization on the complex banalities of the poorly understood past. Abstractions also allow us to communicate with our peers in a shared language. The danger is, that when that language becomes commonplace, we risk mistaking our

simplifications for reality.

CONCLUSION

The two small upland sites focused on above appear to represent the traces of relatively short-term Middle Archaic hunting-oriented activity. Site 102-83 is a single component site with evidence of limited knapping activity probably associated with expedient tool repair. Site 102-57 is larger, more artifact-dense, and probably resulted from a few episodes of use, some of which included intensive biface knapping a short time after a visit to a quarry. Although Binford (1990) has warned that many small lithic sites may reflect temporary residential locations, the lack of hearths noted here suggests that the first (102-83) is a hunting station, while the second (102-57) could represent a more complex hunting station, a field camp used for overnight stays, or a palimpsest of both field camps and hunting stations. Neither provides convincing evidence that it was used residentially. Other Middle Archaic sites adjacent to nearby Cedar Swamp have a more dispersed artifact distribution and lack evidence of intensive on-site biface manufacture—despite the common presence of discarded projectile point fragments. In terms of overall tool content they are otherwise comparable to the smaller upland sites discussed above and similarly lack clear features. They could represent warm weather residential sites produced by family-sized groups of mixed age and gender, but they may also simply express further variation within the continuum of logistical site types. The differences between residential and logistical sites are often subtle and are obfuscated by variation within each class of sites and redundant site use.

We should not write-off small lithic sites because they appear to represent a single, relatively simple mode of land-use. In fact, all of the sites presented here are quite distinctive, each representing a single facet of a complex

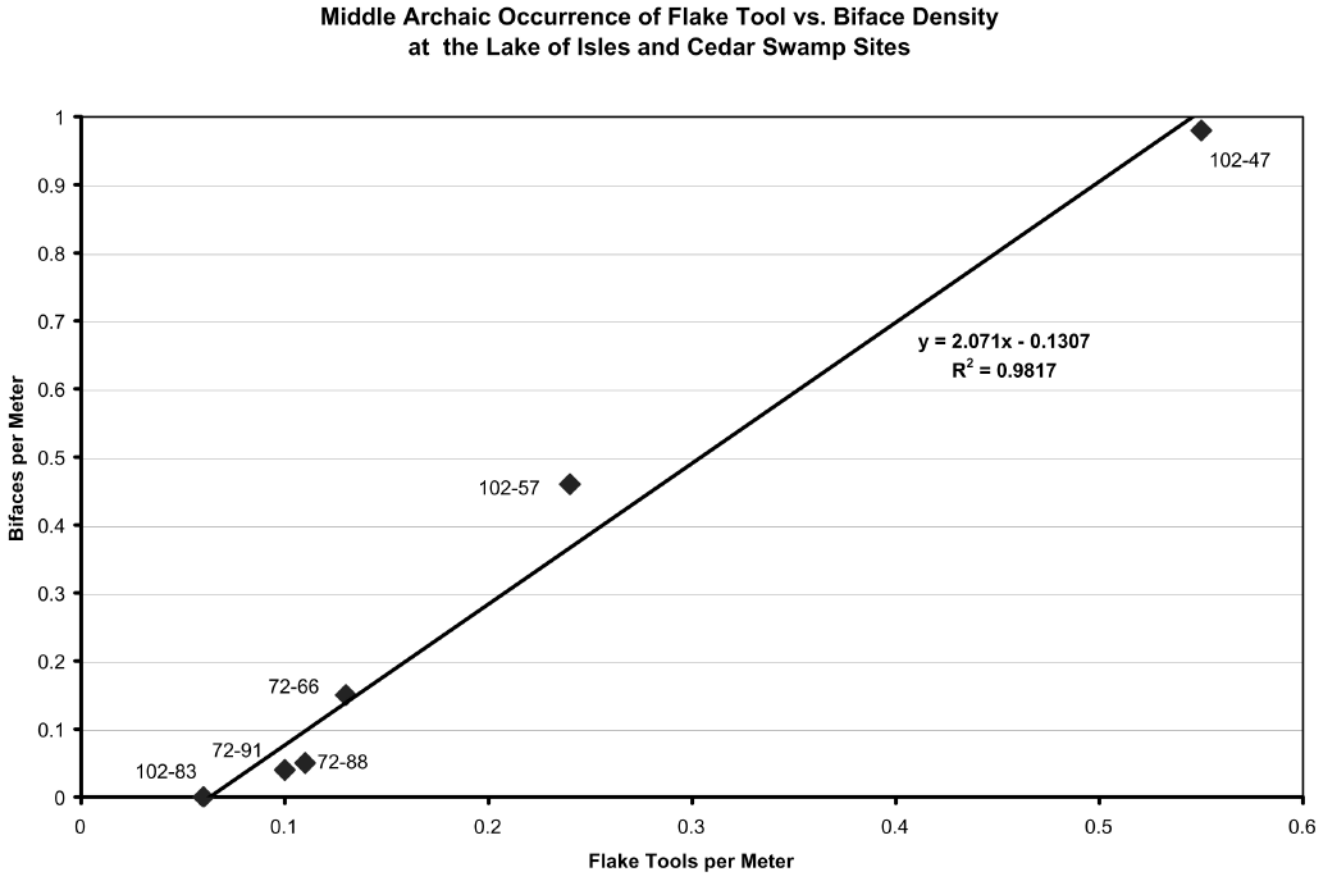

Figure 6.9. A comparison between the flake tool and biface (preforms and bifaces) density from the six sites examined. There is a strong correlation evident between the presence of bifaces and flake tools, suggesting an unexpected positive relationship between these tool classes.

multi-faceted whole relating to various food quest and social organization strategies. In truth, we currently lack a well-developed body of theory to help discriminate between such fundamental site types as hunting stations, field camps and short-term residential camps and we still know very little about Archaic social organization and seasonal land-use patterns. Some suggestions for the discrimination of these site types have been made here, but they are rudimentary. In the meantime, small lithic sites at risk of destruction should be excavated because determination of their potential to yield significant new information may not become clear until fieldwork is complete and analysis is well underway.

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CHAPTER 7

IN SMALL THINGS TOO FREQUENTLY OVERLOOKED —PREHISTORIC SITES IN THE POCONO UPLANDS

Philip A. Perazio

Over the past decade, the results of a number of CRM investigations, supplemented by personal research, have revealed that the upland Pocono region, in northeastern Pennsylvania, was the setting for a variety of prehistoric Native American occupations. Archaeologists had previously largely ignored the region, even though a significant amount of fieldwork has been conducted on large, valley floor sites in the immediately adjacent Upper Delaware Valley. The Pocono sites are represented archaeologically by small sets of primarily lithic artifacts scattered across the region at environmentally specific and spatially quite limited locations. A predictive model to identify likely site locations is being developed using a combination of statistical analysis of site data in the Pennsylvania Archaeological Site Survey files and systematic field investigations in project areas ranging from a few to many hundreds of acres. A preliminary version of the model has been notably successful in differentiating settings with high and low site potential. In addition, ongoing, detailed examination of individual site collections is beginning to reveal the wealth of information available in such small, briefly occupied sites; information which is often difficult to extract from large, multi-occupation sites.

THE LITHIC SCATTER DEBATE

The question of how to evaluate the research potential, and hence the National Register eligibility, of so-called lithic scatter sites is becoming ever more pressing due to governmental management and fiscal considerations. The danger exists that large numbers of archaeological sites may be placed into this category, that will, become an administrative wastebasket.

The concept of lithic scatter site as some sort of meaningful category is highly problematic, and should be abandoned altogether, as some have suggested (Barber 2001). In practice, the term lithic scatter usually refers to spatially small sites, having a limited artifact inventory typically numbering in the hundreds rather than thousands, and few or no cultural features. Effectively, this category is employed as a catch-all to encompass one end of a spectrum across which archaeological sites may be spread based on size and/or relative quantities of artifacts and features. While these variables may provide a quick and easy way of classifying sites, they are typically employed with little or no consideration of what may be signified in terms of the human beings and cultures that produced them.

As is well established in the archaeological literature, each archaeological site represents a component of a once living cultural system (Binford 1980, 1982, Flannery 1976). The aim of archaeological research is to understand these systems. The employment of categories that do not facilitate this aim is useless at best. At worst, it can obscure the connections between individual constituents and the whole. As a result, the research potential of the smaller sites is devalued. This, in turn, opens the door to bureaucratic measures that systematically remove small sites from protection by cultural resource regulations.

The aim of the current essay is to demonstrate some, but certainly not all, of the ways in which data from archaeological sites can be used to address important research questions, regardless of the size of the site or the relative quantities of artifacts or features it may contain. The value of each site in addressing these questions lies in its contribution to the collective data set, despite the fact that, individually, some sites may be less impressive than others. According to National Register Criterion D, a site is eligible for listing if it has contributed or has the potential to contribute to important research. The size of a site, or the amount of 'neat stuff' it contains does not enter into the equation.

The question of whether small sites that have been plow-disturbed can be considered to have less research value than those that have not will not be addressed here. For a more thorough discussion, see Miller (this volume). While certainly important in a practical sense when considering what sorts of analyses may be appropriate in a given case, the broader question of how small sites, whatever their condition, may contribute to archaeological research, should be examined first. Once that can be answered with some level of confidence, the manner in which the particular condition of a site may affect our ability to realize its research potential can be considered within an appropriate framework.

A major weakness that frequently exists in the evaluation

Current Approaches to the Analysis and Interpretation of Small Lithic Sites in the Northeast, Edited by Christina B. Rieth, New York State Museum, The State Education Department, Albany, New York 12230. New York State Museum Bulletin 508

of small sites is the lack of well- developed historical/cultural contexts within which particular sites may be compared to the existing state of knowledge in order to determine its research potential. In part, this is due to a longstanding bias among archaeologists in favor of studying large, often stratified sites, usually in floodplain settings. Despite the formal recognition of the importance of studying settlement patterns and systems, dating back to the 1960's with the emergence of Processual or New Archaeology, and even a decade earlier with Gordon Willey's (1953) Viru Valley study, in fact, the smaller elements of prehistoric settlement systems have been relatively neglected. We are now suffering the consequences of that neglect.

Construction of the necessary contexts requires large data sets from which cultural patterns may be discerned. Fortunately, several decades of CRM investigations have provided at least the beginnings of the necessary database. If scientific research can be viewed as proceeding in a cyclic fashion, moving through periods of hypothesis formulation, data collection, and hypothesis testing, in an endlessly repeating spiral, it would seem that we are currently in need of bolstering the hypothesis formulation and testing portions of the cycle.

The particular class of research question to be explored here is how the spatial distribution of occupations with respect to environmental variables may provide information on the ecological and economic adaptations of prehistoric human populations. It must be emphasized, however, that the search for broad patterns in site location and environment, even when brought to some level of detail, cannot be viewed as the final goal of research. The characterization of the 'typical' patterns of behavior permits identification of that which is not typical. Anomalies are at least as informative as the typical pattern (Gould 1980). However, it is not possible to identify the anomalous without first defining what is 'normal'. Sites that appear unremarkable given our present state of knowledge might stand out in sharp relief when viewed against a sufficiently detailed and robust model of human occupation in a region.

STUDY AREA

My research has, in some sense, been prompted by cost considerations. Faced with the need to design efficient and effective research strategies for CRM investigations of sometimes quite large, mostly wooded tracts of land in the Pocono uplands, I had to develop a method of differentiating between areas of higher and lower probability for the presence of prehistoric sites. Given my own theoretical bent, I embarked on an effort to identify a set of environmental variables that could be used as predictors of the presence or absence of prehistoric sites. This is a model of at least some of the factors that prehistoric Native Americans took into account when deciding where to place their occupation sites and conduct resource procurement activities.

The study area under examination consists of two sections of the Appalachian Plateaus Physiographic Province - the Glaciated Low Plateau and Glaciated Pocono Plateau, and limited to those portions falling within the Delaware River Drainage in northeastern Pennsylvania (Sevon 2000; Figure 1). The Upper Delaware Valley is located immediately to the east. This region encompasses ancient plateaus that have been dissected to varying degrees. It contains a high proportion of wetlands in a wide range of sizes. Another characteristic is that there are no bedrock sources of knappable stone nearby. Chert, jasper, and other materials for the stone tool manufacturing must be brought in from elsewhere or the tools themselves must be imported.

Despite there having been a fair degree of archaeological attention paid to the Upper Delaware Valley over the years, the adjacent Pocono Uplands have been largely ignored in terms of any sort of analysis or synthesis of data. In its 1985 review of Pennsylvania prehistory, the Pennsylvania Historical and Museum Commission (PHMC) specifically excluded the northeastern portion of the state, outside of the major river valleys, because there was insufficient information to support any meaningful characterization. The situation has improved only slowly since then. It is generally assumed that the settlement systems of human populations occupying the Delaware Valley floor also encompassed the adjacent Pocono Uplands, at least seasonally. This lack of integration of the uplands and lowlands in regional research is an example of the big site/floodplain bias described above.

DATABASE

The existing archaeological database for the state is summarized by the Pennsylvania SHPO in the computerized Pennsylvania Archaeological Site Survey or PASS file. It consists of a combination of data from a variety of sources including that derived from CRM investigations, academic research, and amateur reports of site discoveries. Given this eclectic origin, and the limited resources that the SHPO's office can devote to error check the data, there are many problems, some obvious, others not. For example, there are a considerable number of fields with missing data. Consequently, attempts to generate statistics for comparative purposes must often contend with unequal sample sizes. A recent review of selected drainages by members of the Pennsylvania Archaeological Council, partly funded by a grant from the PHMC, highlighted

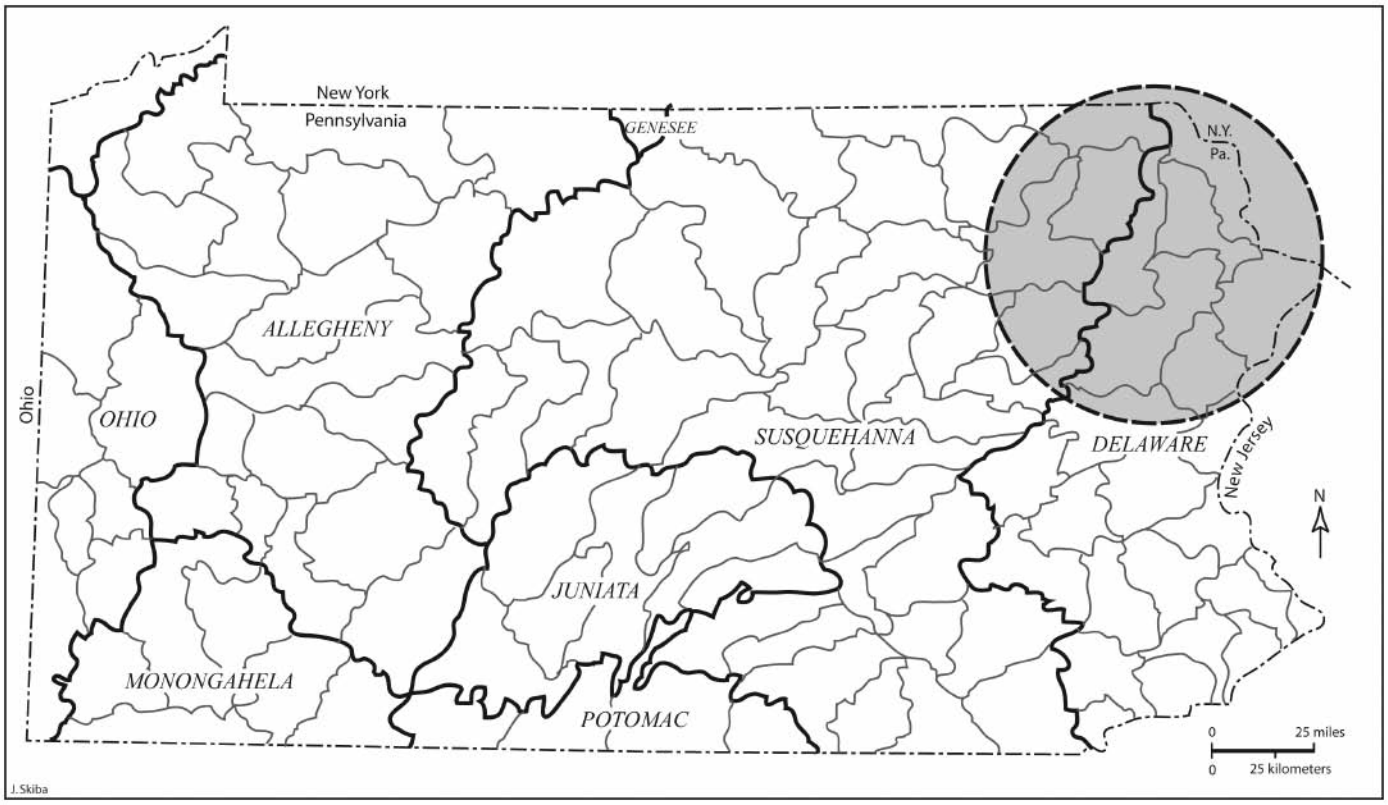

Figure 7.1. Site Locations.

some of the limitations of this database (Chiarulli et al 2001). Nevertheless, it provides a point of departure. As the following analysis demonstrates, statistically identifiable patterns are discernable in the Pocono data. Perhaps due to the relatively number of recorded sites, the problems inherent in the database are overcome at this level of analysis.

The PASHPO has provided me with copies of their electronic files for all recorded sites within my defined study area, and I gratefully acknowledge their assistance.

What follows is a summary of the results obtained through analysis of the PASS file data with respect to a number of environmental variables that have proven to be of value in assessing the probability of prehistoric site occurrence. This is my second attempt at analyzing the Pocono site data. The first essay, in 1994, was undertaken using a more limited data set. The results of that analysis have been presented at a number of regional conferences (Perazio 1994, 1996, 1998), and, as will be discussed below, have been used to help design a number of CRM investigations in the Pocono region. The results of those investigations, in conjunction with the recent, expanded analysis of the PASS file data, are beginning to provide the basis on which more detailed questions about prehistoric settlement patterns can be framed.

It should be noted that cave and rockshelter sites (n=60) have been excluded from the analysis, since their locations are determined at least in part, by factors other than those being examined here. In addition, one site listed as a quarry has also been removed for similar reasons. The presence of a quarry is questionable, since, as indicated previously, the bedrock in this region does not contain any knappable lithic materials. Perhaps this is an error in coding.

Chronology

The chronological assignments attributed to the sites in the sample are summarized in Table 7.1. Slightly over half the sites are undatable. For the remainder, only broad chronological periods are used here, since further subdivision would result in very small sample sizes, rendering any apparent patterns in other variables suspect due to statistical insufficiency. Consequently, aside from examining the sample as a whole, data for all Archaic sub-periods, roughly 9,000 years to 1,000 years BC (including Terminal Archaic / Transitional) and all Woodland subperiods, roughly 1,000 years BC to 1,500 years AD, were combined and analyzed together. Since more sites have both Archaic and Woodland components than have exclusively either one or the other, period-specific patterns

Table 7.1. Pocono Uplands Site Probability Model; Chronology.

COMPONENTS (one or more)	NUMBER OF SITES
Undatable	151
Paleoindian	5
Archaic Only	31
Woodland Only *	43
Archaic and Woodland	57
Protohistoric	1
TOTAL	**288**
All Archaic	88
All Woodland	100

* The chronological assignment of eleven of these sites is based on the presence Triangular points alone.

would likely be obscured by including data from sites occupied during both periods. Therefore, only sites with components exclusively of Archaic or Woodland age were used for chronological comparisons. It should be noted, however, that the fact that there are more sites at which both periods are represented than either one alone suggests a strong element of continuity in the human use of this region through time.

One specific problem with chronological assignments in the PASS file data should be noted. A number of sites are judged to have Woodland components solely based on the presence of Triangular points. Since it has now been firmly established that points with this shape were also manufactured during Middle Archaic times, roughly 6,000 to 3,000 years BC (Custer 1996, 2001; Stewart and Cavallo 1991), at least, and there is at present no reliable way of segregating Archaic from Woodland Triangles, the use of this type for chronological ascription is problematic. However, for consistency, and pending more detailed investigation, the PASS file attributions have been retained.

Distance to Water-Horizontal

The means and standard deviations for distance to nearest water source are surprisingly large, especially for the Archaic-only sites, leading to the suspicion that some invalid data representing extreme cases is included. Taken at face value, some Archaic sites are found at considerably greater distances from water than are Woodland sites (Table 7.2). However, when only those sites within 100m or less from water are considered, the Archaic and Woodland distributions are quite similar. Is there, perhaps, something distinctive about the outlying Archaic sites? Were some Archaic sites positioned to exploit critical resources regardless of their distance from water, and were these resources less important to Woodland populations?

Although larger than the generally accepted 100m, the one standard deviation value for all sites of 185m will be provisionally accepted as the high probability limit for horizontal distance to water.

Distance to Water-Vertical

The range of values for vertical distance to water appears even more extreme than that for horizontal distance (Table 7.3). Based on sites I have personally investigated, the mean of 15.5 meters for all sites seems reasonable. However, one standard deviation would encompass situations in which sites are more than 100 meters in vertical distance from water. The Archaic-only and Woodland-only data is even more extreme. There may be something wrong with much of the data entered for this variable.

Table 7.2. Pocono Uplands Site Probability Model; Distance to Water - Horizontal.

ALL DISTANCES (m)	n	MEAN	STA DEV	MAX
All Sites	281	69.8	115.5	1207
Archaic Only	29	95.2	180.4	700
Woodland Only	21	44.8	54.2	160

W/IN 1 STANDARD DEVIATION OF MEAN	n	%	1 STA DEV
All Sites	257	91	185
Archaic Only	26	90	276
Woodland Only *	15	71	99

Note: the low ends of all 1 standard deviation ranges are negative.

LESS THAN OR EQUAL 100m	n	%	MEAN	STA DEV
All Sites	232	83	32.6	31.3
Archaic Only	24	83	29.2	35.5
Woodland Only *	18	86	27.8	36.1

* 1 Standard deviation is only 1m less than 100m.

Table 7.3. Pocono Uplands Site Probability Model; Distance to Water - Vertical.

	n	MEAN	STA DEV	MAX	MIN	+/-20m	%
ALL	256	15.5	86.3	780	-990	212	82
ARCHAIC-ONLY	23	35.7	88.6	420	-20	19	83
WOODLAND-ONLY	19	65.8	176.7	780	0	11	58

	n	MEAN	STA DEV	1 STA DEV
ALL	256	15.5	86.3	101.8
ARCHAIC-ONLY	23	35.7	88.6	124.3
WOODLAND-ONLY	19	65.8	176.7	242.5

Note: This data is suspect, mostly derived from 20-foot interval contour (USGS) topographic maps.

Until the data can be reviewed in detail, the estimate of 20 meters will be used to define the high probability value. This encompasses 82% of the values for the entire sample of recorded sites.

Slope

For the total site sample, the range of values within one standard deviation of the mean, including slopes of up to approximately 14%, encompasses most prehistoric sites (Table 7.4). In Pennsylvania, the SHPO does not require examination of slopes greater than 15% for the presence of prehistoric sites, aside from rockshelters. So, the existing data may be an artifact of this policy. However, a considerable number of the recorded sites are the result of amateur reports rather than CRM investigations. Since non-professionals are not bound by the SHPO guidelines, the observed pattern may reflect reality.

Woodland sites are found on a considerably broader range of slopes than are Archaic sites. This suggests that moderate ground slope was of less importance to Woodland than to Archaic peoples in this area, at least in some instances.

Aspect

This variable records the orientation of the ground slope with respect to cardinal directions (Table 7.5). It is thought to reflect choices made with regard to exposure to sunlight and protection from prevailing winds.

In all cases, the totals for aspects ranging from northeast through south are greater than for the other half of the compass, and in nearly all cases, the ranks for numbers of sites facing each direction in the former are greater than for the latter. However, the easterly to southerly facing sites represent only slightly more than about 60% of the total, suggesting that aspect may not be as critical to site location as some of the other variables included in the model.

Of some note, however, the subtotal percentages for each grouping of 'All Sites' falls approximately midway between those of the Archaic and Woodland sites. The orientation of Woodland sites appears to be less strongly focused on the east and south than are the Archaic sites. This suggests that other factors were of greater importance for Woodland occupations.

In general, the preference for aspects centered to the east-southeast may indicate a preference for good morning sun and/or protection from northerly and westerly winds.

Both the slope and aspect data suggest a wider range of tolerance for variation in these characteristics by Woodland than by Archaic peoples. This contrasts with the horizontal distance to water data, which indicates wider tolerance by the earlier groups.

Table 7.4. Pocono Uplands Site Probability Model; Slope.

	n	MEAN	STA DEV	1 STA DEV
All Sites	275	5.4	8.5	13.9
Archaic-Only Sites	28	5.3	6.1	11.4
Woodland-Only Sites	21	7.7	14.7	22.4

SLOPE WITHIN 1 STANDARD DEVIATION	n	%
All Sites	249	91%
Archaic-Only Sites	25	89%
Woodland-Only Sites	19	90%

Soil/Habitat Potential

Since soils develop over long periods of time, the characteristics of any soil type may be expected to persist for some time after the particular conditions which gave rise to them are no longer present. In this sense, soil is a fossilized representation of past environments. Therefore, soil types are used here as surrogates for plant and animal communities likely to have been available for humans during the prehistoric period, but substantially altered during historic times.

The county soil surveys for five of the six counties encompassing portions of the current study area have evaluated the relative potential of each soil type to

Table 7.5. Pocono Uplands Site Probability Model; Aspect.

ALL SITES		
NE	38	
EAST	48	
SE	41	
SOUTH	32	
Subtotal	**159**	**61%**
SW	15	
WEST	13	
NW	21	
NORTH	23	
Subtotal	**72**	**28%**
OTHER	30	11%
Total	**261**	**100%**

ARCHAIC-ONLY SITES		
NE	4	
EAST	6	
SE	3	
SOUTH	2	
Subtotal	**15**	**65%**
SW	1	
WEST	1	
NW	0	
NORTH	3	
Subtotal	**5**	**22%**
OTHER	3	13%
Total	**23**	**100%**

WOODLAND-ONLY SITES		
NE	4	
EAST	1	
SE	3	
SOUTH	3	
Subtotal	**11**	**58%**
SW	0	
WEST	2	
NW	2	
NORTH	2	
Subtotal	**6**	**32%**
OTHER	2	11%
Total	**19**	**101%**

provide suitable habitat for certain broad groupings of plants and animals. Although not as detailed as one would like, these habitat groupings can provide general characterizations of the kinds of biological resources likely to have been available to human populations in areas containing particular types of soil.

The groupings used in the PASS files to categorize each site's pedological setting are not those that I find most useful. These are: SOIL Type 1, the soil type on which the site is located; SOIL Type 2, the most common other soil type within 500m; and SOIL Type 3, the second most common other soil type within 500m. The distinction between SOIL 1 and SOIL 2 is problematic since the soil on which a site is located may or may not be the most abundant within 500m. Hence, the soil types recorded under SOIL 2 and SOIL 3 will vary depending on the soil on which the site is located, potentially resulting in apparently different data under essentially identical conditions. Nevertheless, these are the data currently available.

Each soil type is rated for its suitability to support each plant or animal community grouping. The ratings range from Good, to Fair, to Poor, and finally Very Poor. For the purpose of this analysis, each rating was given an equivalent numeric value, from four to one, respectively. Summary data was then generated (Table 7.6).

The data for all prehistoric sites shows that for the three soil categories (i.e., SOILS 1-3) three habitat groupings - wild herbaceous plants, hardwood trees, and woodland wildlife consistently have the highest ratings, in the Fair to Good range (Table 7.7). These are followed by coniferous trees and openland wildlife. The consistently lowest ratings go to wetland plants and wetland wildlife. The low scores for these two groups are a bit puzzling. In my experience, a substantial wetland is located nearby in most cases. This apparent discrepancy will be one of the topics subject to further investigation.

The numbers of sites located on or near soils with high potentials for key habitats indicates that it was important in the majority of cases (~61%) to have these plant and animal resources nearby (i.e., within 500 meters of the site location) (Table 7.8). The percentages of sites with high habitat potential soils at or near the site (i.e., SOILS 1-3) are quite similar. However, these are not all the same sites. Comparisons between pairs of soil categories reveal lower numbers of sites with high scores in different categories. Furthermore, only about a quarter of all sites have high ratings for key habitat types in all three-soil categories. This indicates that not all of the most abundant soils in a site's vicinity have high potentials for the same resources, suggesting that resource diversity and/or ecotonal situations were also important.

The existence of a fairly clear pattern encompassing sites of all prehistoric periods is consistent with the interpretation that the resources represented by these soils were important, perhaps to varying degrees, in site location decisions by Native Americans throughout prehistory. The question remains, however, what proportion of the total acreage in the study area contains these types of soils? If that is approximately 61%, then chance alone might yield the observed distribution. I do not, at this

Table 7.6. Pocono Uplands Site Probability Model; Soil / Habitat Potentials - Detailed Scores.

ALL SITES	SOIL 1 (n=259)		SOIL 2 (n=267)		SOIL 3 (n=269)	
	MEAN	STA DEV	MEAN	STA DEV	MEAN	STA DEV
GRAINS	2.1	1.2	1.72	1.05	1.72	1.04
GRASSES	2.5	1.3	2.16	1.21	2.2	1.18
HERBACEOUS PLANTS	3.5	0.7	3.40	0.75	3.44	0.7
HARDWOOD TREES	3.2	0.8	3.15	0.77	3.1	0.8
CONIFERS	2.9	0.8	2.90	0.77	2.84	0.78
WETLAND PLANTS	1.6	0.7	1.54	0.8	1.53	0.74
OPENLAND WILDLIFE	2.8	1.0	2.55	0.91	2.54	0.9
WOODLAND WILDLIFE	3.1	0.8	2.98	0.71	2.94	0.72
WETLAND WILDLIFE	1.2	0.6	1.3	0.74	1.24	0.67

SCORES: Good = 4, Fair = 3, Poor = 2, Very Poor = 1.

time, have the capability of addressing this question since the soils data available to me is countywide, and I cannot segregate the data from the Glaciated Low Plateau and Glaciated Pocono Plateau.

Archaic-Only and Woodland-Only Sites

Although the general pattern seen for all sites is still evident, there appears to be a difference in the pattern of habitat selection between sites having only Archaic and only Woodland components (Tables 7.9 and 7.10). For SOIL 1, the soil type on which sites are located, there are more high scores for Archaic (five scores of three or more) than Woodland (two scores of three or more) sites. For Soil 2, the numbers are: Archaic four, Woodland two; and for Soil 3: Archaic three, Woodland one. This suggests a more diverse and productive environment surrounding Archaic than Woodland sites, at least in the cases in which the two are not found together. In addition, when compared to the Archaic-only sites, the Woodland-only sites have slightly reduced mean scores across all three-soil groupings in all habitat categories except wild herbaceous plants, in which the difference is minimal (0.07). The significance of this pattern is uncertain, but may indicate that Archaic occupations in the uplands tended to be concerned with the exploitation of a greater variety of resources than was the case during Woodland times.

Soil Drainage

For the on-site soil (SOIL 1), all are relatively well drained (Table 7.11). However, Archaic site soils appear a bit drier than the soils on which Woodland sites are located. By contrast, the soils surrounding Woodland sites are slightly drier than those in the vicinity of Archaic sites. The drainage of soils surrounding Archaic sites is nearly a whole point lower than those on which the sites are located. This may indicate that while Archaic sites tended to be set on well drained soil near wetlands, Woodland sites were located in generally drier environments.

Table 7.7. Pocono Uplands Site Probability Model; Highest Ranking Habitat Types.

	All Sites /Archaic Sites / Woodland Sites
Rank 1	*Wild Herbaceous Plants* - "... native or naturally established grasses and forbs, including weeds, that provide food and cover for wildlife." “Examples ... are goldenrod and beggarweed.”
Rank 2	*Hardwood Trees* - "Hardwood trees and the associated understory provide cover for wildlife and produce nuts or other fruit, buds, catkins, twigs, bark, or foliage that wildlife eat.” “Examples of native plants are oak, aspen, cherry, apple, hawthorn, dogwood, hickory, blackberry, winterberry, and blueberry."
Rank 3	*Woodland Wildlife* - Woodland wildlife includes "... wild turkey, ruffed grouse, woodcock, thrushes, woodpeckers, squirrels, gray fox, raccoon, deer, and bear."
Ranks 4 & 5	*Openland Wildlife* -"... include pheasant, meadowlark, field sparrow, cottontail rabbit, and red fox." and *Coniferous Trees* - “... cone-bearing trees, shrubs, or ground cover plants that furnish habitat or supply food in the form of brows, seeds, or fruit-like cones.” “Examples ... are pine, spruce, fir, and cedar.”

Source: Soil Survey of Monroe County, Pennsylvania. (Lipscomb : 1981).

Table 7.8. Pocono Uplands Site Probability Model; Sites on And/or Near High Habitat Potential Soils.

Soils w/ scores of 3 or 4 for herbs, hardwoods, and woodland wildlife	n	%
SOIL 1	163	63
SOIL 2	162	61
SOIL 3	159	59
SOIL 1 & 2	110	-
SOIL 1 & 3	107	-
SOIL 2 & 3	114	-
SOIL 1-3	72	-

SUMMARY OF ARCHAIC VS. WOODLAND PREFERENCES

The comparison of Archaic-only and Woodland-only sites has suggested several differences in environmental preferences between the two. Archaic sites tend to have a stronger association with southerly and easterly aspect, moderate ground slope, and juxtaposition of well drained soils on site and wetter conditions in the immediate surroundings than do Woodland sites. In addition, Archaic sites appear to be set in generally more diverse and biologically productive habitats. Although for the horizontal distance to water is similar for the two periods, some Archaic sites seem to be located at greater distances from water than Woodland sites.

Taken together, these apparent differences suggest that Archaic and Woodland peoples were utilizing the Pocono Uplands in somewhat different ways. However, it must be remembered that a substantial number of sites are recorded as having both Archaic and Woodland period components. In these cases, similar site selection decisions were apparently being made. The deviations from the norm may provide a view of nuances in change through time, which would be invisible if we concentrated solely on the dominant patterns.

The one variable that experience has shown to be critical in most cases is that of micro-topography. Small landforms, sometimes only a few meters across and often less than a meter above the surrounding terrain, have repeatedly proven to be the ultimate deciding factor regarding the presence or absence of upland Native American sites in the Poconos. The model gets you to the neighborhood, but the micro-topography indicates the specific location. The existence of these landscape features is generally not revealed in the standard reference materials used to gather environmental information for

Table 7.9. Pocono Uplands Site Probability Model; Soil / Habitat Potentials - Archaic-only Sites.

	SOIL 1 (n=37)		SOIL 2 (n=24)		SOIL 3 (n=20)		ALL SOILS
	MEAN	STA DEV	MEAN	STA DEV	MEAN	STA DEV	MEAN
GRAINS	2.74	0.99	1.91	0.97	1.74	0.93	2.13
GRASSES	3.32	1.0	2.55	1.14	2.32	0.95	2.73
HERBACEOUS PLANTS	3.47	0.7	3.11	0.87	3.32	0.75	3.30
HARDWOOD TREES	3.21	0.92	3.32	0.72	3.32	0.75	3.28
CONIFERS	2.58	0.9	3.05	0.72	2.84	0.76	2.82
WETLAND PLANTS	1.68	0.82	2.0	1.23	1.89	0.99	1.86
OPENLAND WILDLIFE	3.37	0.96	2.82	0.91	2.47	0.77	2.89
WOODLAND WILDLIFE	3.11	0.88	3.27	0.7	3.11	0.66	3.16
WETLAND WILDLIFE	1.26	0.81	1.77	1.31	1.47	0.9	1.50

Table 7.10. Pocono Uplands Site Probability Model; Soil / Habitat Potentials – Woodland-only Sites.

	SOIL 1 (n=16)		SOIL 2 (n=18)		SOIL 3 (n=17)		ALL SOILS
	MEAN	STA DEV	MEAN	STA DEV	MEAN	STA DEV	MEAN
GRAINS	1.94	1.12	2.06	1.14	1.59	0.87	1.86
GRASSES	2.5	1.26	2.47	1.37	2.0	1.32	2.32
HERBACEOUS PLANTS	3.31	1.01	3.18	0.95	3.62	0.49	3.37
HARDWOOD TREES	3.13	0.96	3.06	0.75	2.94	0.43	3.04
CONIFERS	2.75	0.93	2.71	0.69	2.82	0.39	2.76
WETLAND PLANTS	1.75	1.06	1.94	1.09	1.41	0.51	1.70
OPENLAND WILDLIFE	2.75	1.0	2.88	0.93	2.59	0.87	2.74
WOODLAND WILDLIFE	2.94	0.85	2.88	0.7	2.88	0.49	2.90
WETLAND WILDLIFE	1.63	1.09	1.41	0.8	1.0	0	1.35

Table 7.11. Pocono Uplands Site Probability Model; Soil Drainage.

	SOIL 1			SOIL 2			SOIL 3		
	n	Mean	Sta Dev	n	Mean	Sta Dev	n	Mean	Sta Dev
ALL SITES	259	4.3	1.0	268	4.23	1.09	269	4.17	1.06
ARCHAIC -ONLY	21	4.74	0.8	24	3.67	1.43	20	3.53	1.41
WOODLAND - ONLY	16	3.94	1.21	18	3.92	1.42	17	4.24	0.83

SOIL 1	GOOD DRAINAGE (1 STA DEV)	%
ALL SITES (>3)	191	74
ARCHAIC-ONLY (>3.9)	20	95
WOODLAND-ONLY (>2.7)	13	81

DRAINAGE (as described in county soil surveys)	ASSIGNED SCORE
Well Drained & Somewhat Excessively Drained	5
Moderately Well Drained	4
Somewhat Poorly Drained	3
Poorly Drained	2
Very Poorly Drained	1

Phase I studies (e.g., county soil survey, USGS 7.5 minute topo quad). Only large-scale topographic maps and/or detailed visual inspection (preferably with the foliage down) will reveal these features. Consequently, this variable is not included in the general model, but is considered an additional 'layer', to be added after the model has accomplished the large-scale delineation of areas with elevated site potential.

THE REVISED MODEL

Based on the above-described analysis, a new version of the Pocono Uplands site probability model can be defined (Table 7.12). It differs from the original in several respects. First, it is based on a considerably larger sample of sites. This permits more confidence in the derived statistics, especially those for the entire sample, but keeping in mind the caveats expressed at the outset.

For several variables, in the revised model the parameters for high probability are somewhat wider than they were in the original. Horizontal distance to water now extends to 185 meters rather than 100 meters. Vertical distance is now up to 20 meters from 12 meters. Slopes of up to 14% are now included, increased from 10%. Finally, soil drainage has been expanded to encompass moderately well drained soils. On the other hand, high probability aspect range has been reduced a bit by eliminating southwest-facing slopes. High value for openland wildlife habitat has also been eliminated.

A major component that would have to form part of a completed model is an assessment of whether all of these variables were given equal weight in the decision process or some where more important than others. Some indications of differential importance have been noted between Archaic and Woodland sites. In addition, the apparently favored easterly and southerly aspect occurs in less than two thirds of the recorded sites. Other variables, princi-

Table 7.12. Pocono Uplands Site Probability Model; Pocono Upland Model – High Probability Variables.

	HIGH PROBABILITY VALUE	
VARIABLE	ORIGINAL MODEL	REVISED MODEL
DISTANCE TO WATER (H)	</= 100m	</= 185m (1 STDEV)
DISTANCE TO WATER (V)	</= 12m	</= 20m
SLOPE	</= 10%	</= 14% (1 STDEV)
ASPECT	NE-SW	NE-S
SOIL DRAINAGE	Well or Excessively Well	Excessively Well to Moderately Well
WILD HERBACEOUS PLANTS	Good or Fair	Good or Fair
HARDWOOD TREES	Good or Fair	Good or Fair
WOODLAND WILDLIFE	Good or Fair	Good or Fair
OPENLAND WILDLIFE	Good or Fair	-

pally habitat potential may play a more significant role. However, these differences have yet to be systematically quantified.

TESTING THE MODEL

The development of a model of prehistoric site probability, as any scientific investigation, is a cyclical process involving hypothesis creation, data collection, and hypothesis testing. The new model, described above, will require testing and evaluation. As an initial step in that process, a review of an existing data set was undertaken to, in effect, create a baseline from which further work could proceed.

The data employed is the set of 16 CRM investigations that I have personally directed within the study area since 1991. These investigations include properties ranging from large housing developments encompassing hundreds of acres to examinations of township sewer projects consisting of multiple, but quite small individual locations sometimes measuring under a quarter acre. These projects were both the impetus for developing the Pocono Uplands Site Probability Model, and the practical context in which it has been progressively elaborated and refined. In each particular application, adjustments were made based on previous experience. Therefore, the criteria used to define areas of high, moderate, and low probability underwent evolution over time. One component of my long-term research design is to go back over each project and re-evaluate the probability assessments against a common set of standards. However, for the present purpose, since the criteria employed have been generally similar, the data from each investigation has been taken at face value.

The results present a fairly clear pattern (Table 7.13). In a total area of 266 acres (106 hectares), 40% percent was judged to have high probability, and 60% moderate or low probability. This includes only those portions of each property that could be legitimately tested, excluding severely eroded or disturbed areas, wetlands, and areas with slopes of over 15%. The testing intensities vary somewhat with the site probability assessment, in accordance with Pennsylvania SHPO guidelines. It should be noted that the average numbers of tests per acre for both moderate and low probability areas are above the minimums specified in the guidelines.

The distinctions between high, moderate, and low probability were made on a judgmental basis. Essentially, portions of any given study area characterized as having most or all of the high probability values for the model's variables were classified as high probability, those with somewhat fewer variables having high values as moderate, and the remainder as low. A further refinement of the model may be to define consistent criteria for each probability rank.

Of 15 sites identified, 14 were found in high probability areas, one in a moderate probability area, and none in areas with low probability. This extreme segregation exists despite the fact that both in acreage and numbers of tests, the totals for low and moderate probability areas exceed those of high probability areas. Further re-enforcing the success of the model in identifying areas where sites are likely to be found, the single site identified in a moderate probability area was located in a sampling unit bordered to the north, northeast, and east by units assessed as having high probability. Given the arbitrary position of the sample unit boundaries, it is legitimate to conclude that this site was, in fact, on the edge of a high probability area. Consequently, the Pocono Uplands model may be considered to have a perfect score in identifying those settings where prehistoric Native American sites are likely to be found, and, perhaps almost as important, in defining environments where sites are unlikely to exist. While not a statistically rigorous random sample, the 16 CRM investigations included here encompass a widely dispersed set of locations. These areas were subjected to investigation due to the haphazard positioning of a variety of recent development projects. No discernable factors exist that would likely bias the observed pattern of site distribution across the landscape. Therefore, within admittedly wide levels of tolerance, the data from these CRM investigations may be considered a legitimate test of the model.

The success of the current model in delineating high probability areas is a beginning, not an end, in the process of investigating prehistoric Native American settlement patterns in the Pocono Uplands. Given that the total sur-

Table 7.13. Pocono Uplands Site Probability Model; Project Summary.

SITE PROBABILITY	ACREAGE	%	SHOVELTESTS	TESTSPER ACRE	SITES
HIGH	105.6	40%	1,535	15	14
MODERATE	96.1	36%	1,033	11	1
LOW	64.5	24%	532	8	0
TOTAL	266.1	100%	3,100		15

Includes data from 16 CRM Phase I investigations.

face area encompassed by the identified sites is only a tiny fraction (probably less than half an acre) of the slightly more than 100 acres of high probability areas investigated to discover them, it would appear that there is still much variation, perhaps not all of it environmental, that is not being explained. Micro-topography is one significant additional variable. However, some apparently suitable landforms have been tested with negative results. Also to be remembered is that the database upon which the model was constructed has many flaws. An important future component of my research is to error check the database, using original site forms, CRM reports, standard cartographic sources, field inspection, and an examination of existing collections. Once most of the 'bugs' have been worked out of the database, the numbers can be run again, with, it is hoped, more precise results.

More generally, this exercise illustrates that there is much to be learned from small, upland sites. However, our ability to identify and address questions regarding such sites is dependent on having a substantial sample from which to draw data. Despite its flaws, the PASS file database provides a starting point. In no sense, however, does it represent a sufficient basis to understand Pocono prehistory.

CONCLUSION

This presentation has focused on the topic of site location and environment, the settlement patterns in the region. Research in the Poconos has also begun to reveal a significant amount of variation in site contents. Again, interesting anomalies are being revealed as norms are defined. In this way, questions regarding the articulation of settlement systems can be addressed. Without a representative sample of site types, none of this is possible. In the Poconos, we are a long way from beginning to characterize the parameters of a representative sample.

To come full circle with the problem posed at the outset, eligibility determinations are driven by research questions. If we don't put in the effort to develop explicit research questions we'll continually be stuck in the same rut. Individuals working in isolation cannot undertake such an effort. There must be a coordinated effort. This requires an allocation of resources. You don't get something for nothing, at least not within a reasonable time frame.

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CHAPTER 8

THE USE OF LITHIC RESOURCES IN A COASTAL ENVIRONMENT: QUARTZ TECHNOLOGY ON LONG ISLAND, NEW YORK

David J. Bernstein and Michael J. Lenardi

Preservation of all but the most durable archaeological materials (stone and pottery) is rare throughout most of the coastal Northeast, especially in southeastern New York and southern New England (Figure 8.1). Lithic tools and manufacturing waste are virtually always the most abundant, or in the majority of instances, the sole artifacts found on pre-contact (before A.D. 1500) sites. To illustrate this point, it is instructive to consider that between 1989 and 2000 the State University of New York at Stony Brook conducted 326 cultural resource management archaeological surveys on Long Island. These investigations differed widely in scope and intensity, but all involved the excavation of shovel test pits. Slightly over a quarter (86) of the 326 surveys carried out during this twelve year period discovered prehistoric sites, varying in size and complexity from multi-hectare villages to finds of single projectile points (Figure 8.2). For purposes of this paper, what is most important to note is that all 86 of the discovered sites produced lithic artifacts, and that over 60% (53) produced nothing but lithics. All but a few of the sites (e.g., the villages and single projectile point finds) can probably be characterized as small lithic sites or "scatters." Interestingly, given the island setting, only six (7%) of the sites contained shell deposits, and just ten had identifiable prehistoric features of any kind.

Despite the abundance of lithic artifacts at coastal sites in the region, relatively little research on prehistoric stone tool technology, especially that involving the use of quartz, has been undertaken. The principal work in this field (Barber 1981a) was published well over two decades ago, and little new additional research has been reported since then. Archaeological research in coastal New York has, throughout its history, concentrated on the analysis and interpretation of shell-bearing sites (Bernstein 2002; Ceci 1990; Claassen 1995; Funk and Pfeiffer 1988; Gwynne 1982; Harrington 1909, 1924; Lightfoot et al. 1987; Ritchie 1959; Salwen 1962, 1968; Silver 1991; Smith 1950; Wyatt 1977), and the study of lithic artifacts from these coastal locales has typically focused on issues of projectile point style and typology (especially when relevant for dating), or raw material sourcing. While these studies have undoubtably generated much important information on

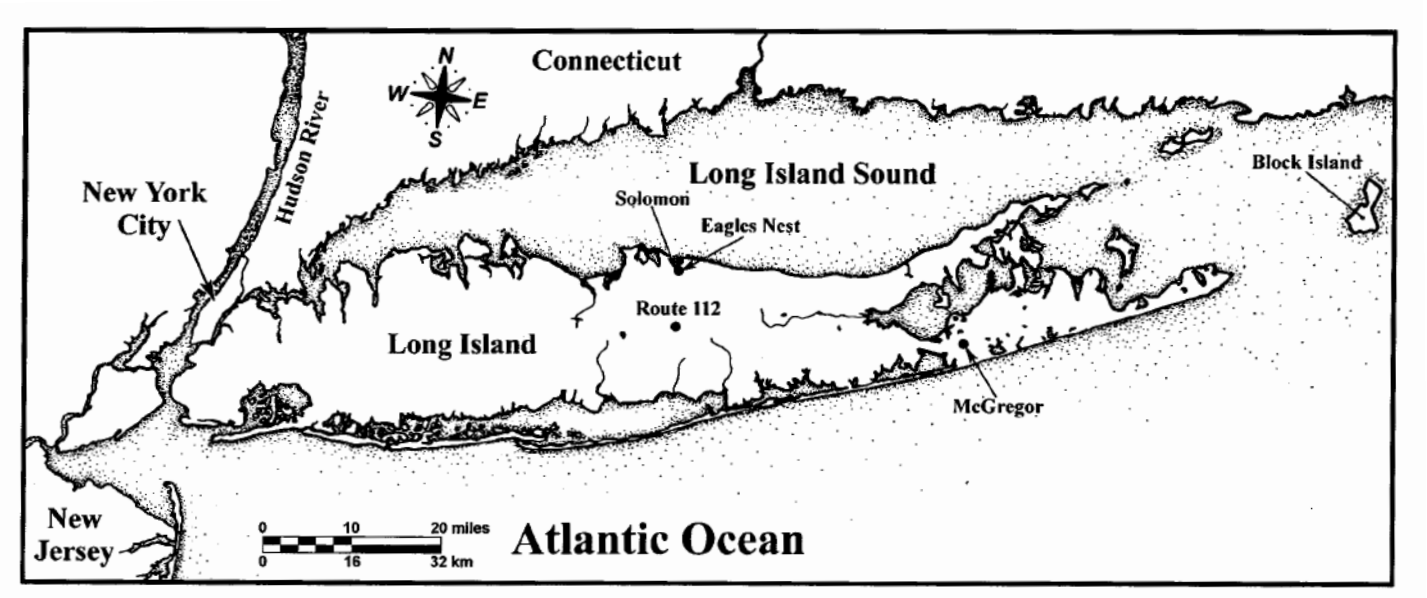

Figure 8.1. Map of the Long Island Sound region showing locations mentioned in the text.

Current Approaches to the Analysis and Interpretation of Small Lithic Sites in the Northeast, Edited by Christina B. Rieth, New York State Museum, The State Education Department, Albany, New York 12230. New York State Museum Bulletin 508

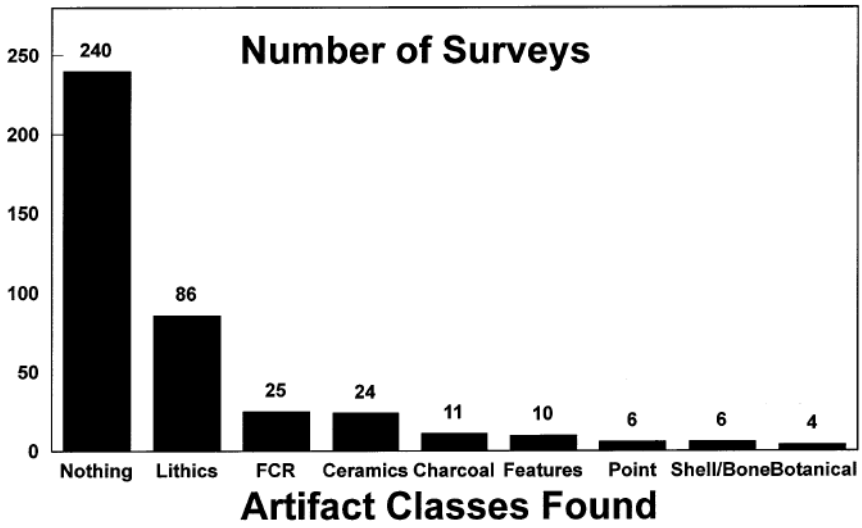

Figure 8.2. Summary of results of subsurface surveys (326) conducted by SUNY-Stony Brook from 1989 to 2000. More than one type of material may have been found on any single survey, thus total exceeds the number of surveys.

coastal lifeways, they typically neglect to consider in any detail the most abundant type of material found at coastal sites in this region, quartz lithics. Needless to say, this omission has serious implications for how past patterns of resource use and settlement are reconstructed. Unfortunately, quartz has proven hideously difficult for archaeologists to analyze, and this at least partially accounts for the lack of attention that assemblages of these materials have received both in the region under discussion in this paper and in other parts of the world. A few brave souls have attempted wear analysis of quartz tools, an enterprise that has so far produced mixed results (Broadbent and Knutsson 1975; Derndarsky and Ocklind 2001; Flenniken 1981; Sussman 1988). None of these studies involved quartz assemblages from eastern North America. Along the Eastern Seaboard, better success has been achieved with reconstructing and understanding production techniques and raw material use (Barber 1981b; Bernstein et al. 1996; Boudreau 1981; Luedtke 1981; Petraglia 1993; Ritchie 1981), but despite its ubiquity at coastal sites the study of quartz tools and debitage has lagged behind that of other materials.

QUARTZ TECHNOLOGY ON LONG ISLAND, NEW YORK

The prehistoric lithic industry on Long Island and much of coastal New York and southern New England was one based most frequently on the reduction of locally abundant glacially transported quartz cobbles (Figure 8.3). For at least five thousand years (and quite possibly longer), the primary lithic manufacturing procedure, repeated at countless thousands of sites along the coast and nearby islands, involved the reduction of fist-sized cobbles of quartz or quartzite to produce a series of bifacial, and less frequently, unifacial forms (e.g., Bernstein 2002; Gramly 1977; Lavin 1991; Lenardi 1998; Lightfoot et al. 1987; Pfeiffer 1992; Ritchie 1959; Wyatt 1977). Even though other raw materials (e.g., chert, argillite, felsite, rhyolite) appear in small numbers at coastal sites, on Long Island quartz quite often comprises over 95% of the assemblage, regardless of temporal placement. Overall, the regional stone tool tradition is remarkable for the relative lack of variation it shows over time. Well known styles of projectile points (e.g., fluted, notched, triangular, stemmed) typically used as chronological markers (Ritchie 1971), that are made of chert in the interior Northeast are duplicated in quartz at coastal sites (Figure 8.4). When these bifaces are removed from quartz tool assemblages, it is virtually impossible to detect meaningful differences among similarly sized collections dating to different time periods. Variation in lithic assemblages, regardless of age, is dependent primarily on one important but mundane factor; distance to the source of raw material. Simply put, sites near the beaches and eroded headlands (especially on the north coast of Long Island) that expose major deposits of high quality cobbles generally yield evidence for the complete, or near complete, manufacturing of stone tools (Lenardi 1998). Assemblages (tools and debitage) from these coastal sites indicate little concern on the part of the prehistoric knapper to considerations of raw material availability and conservation. In contrast, sites located away from abundant sources of cobbles have

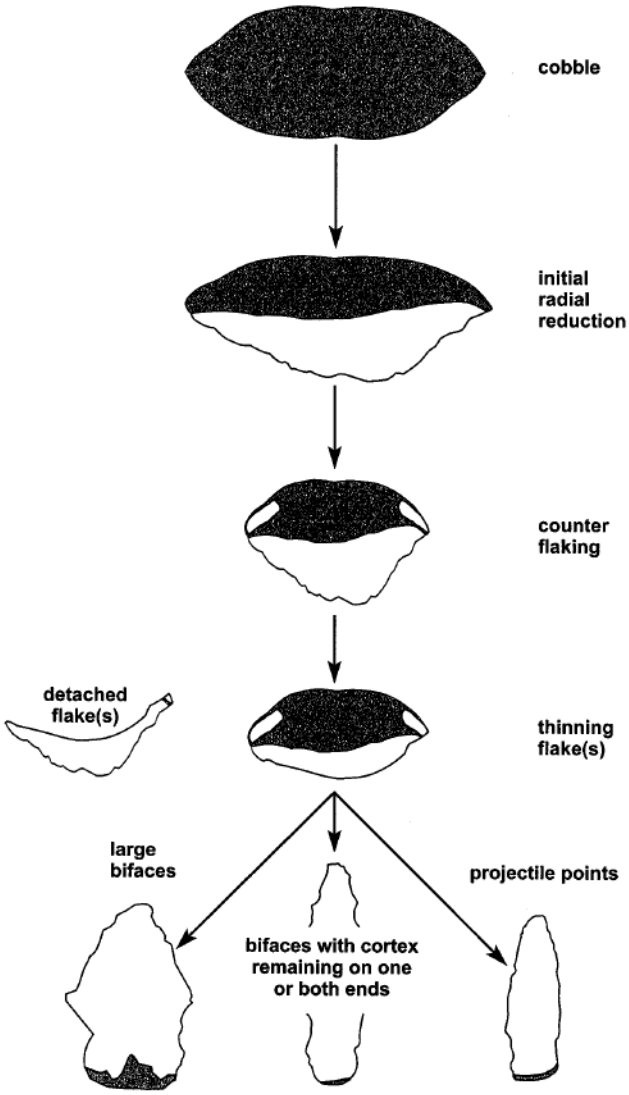

Figure 8.3. Idealized quartz cobble reduction sequence.

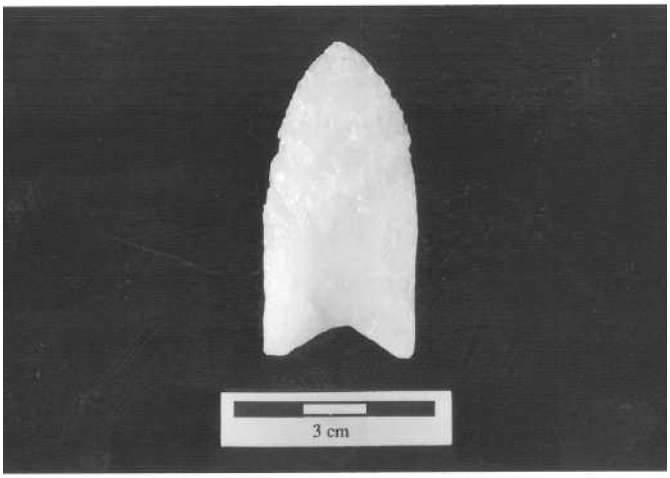

Figure 8.4. Fluted projectile point from Long Island.

assemblages characterized by evidence for curation (e.g., re-use and re-sharpening of bifaces) and conservation of raw material (Bernstein et al. 1996). These supply related patterns are consistent over time, extending back at least as far as the middle Holocene.

LITHIC ASSEMBLAGES FROM LONG ISLAND SITES

A few examples from Long Island will serve to demonstrate the influence of the distribution of lithic resources on technological and settlement strategies. Although only data from sites on Long Island are treated, we suspect that these observations are applicable to other regions of coastal southern New England. Three of the sites (Eagles Nest, Solomon, Route 112) are securely dated to the Late Archaic period (ca. 4000-1000 B.C., Table 8.1). The fourth (MacGregor) can not be dated due to its lack of both organic materials for radiocarbon dating and temporally diagnostic artifacts. Shell deposits are absent from each of the four sites, and the only preserved organic material is wood charcoal from hearth features (present at Solomon and Eagles Nest). At three of the sites (Eagles Nest, Solomon, Route 112), the lithic assemblages reflect the typical reduction of fist-sized quartz cobbles. A much different technology is represented at McGregor.

All four of the lithic assemblages discussed in this paper were recovered using the same collection procedures. Each results from the use of 1/4 inch mesh screen. As noted above, small numbers of non-quartz or quartzite (e.g., chert, felsite, argillite) artifacts were found at three of the sites (Eagles Nest, Solomon, and Route 112). These pieces are not included in the analyses presented below, but they are considered in the original reports treating the three sites.

Eagles Nest

Eagles Nest, overlooking Mount Sinai Harbor on the north shore of Long Island (Figure 8.1), is a large camp or village comprising 3-4 ha (Bernstein et al. 1993; Lenardi

Table 8.1. Prehistoric Chronology for Long Island and Southern New England

Period	Approximate Dates
Late Woodland	A.D. 1000-1500
Middle Woodland	A.D. 0-1000
Early Woodland	700 B.C.-A.D. 0
Terminal Archaic	1000-700 B.C.
Late Archaic	4000-1000 B.C.
Middle Archaic	6000-4000 B.C.
Early Archaic	8000-6000 B.C.
Paleoindian	10,500-8000 B.C.

1998). Based on a series of radiocarbon dates and the consideration of artifact typology, the major occupation of Eagles Nest is placed in the Late Archaic period (Table 8.1). The lithic assemblage analyzed for the present study comes from two large excavation blocks (4m x 6m and 4m x 2m, respectively [32 m^2 total]) placed in heavily utilized sections of the site. All but a small percentage (approximately 1%) of the lithics from Eagles Nest are made from locally obtained quartz or quartzite cobbles. As discussed further below, these items are locally ubiquitous.

Solomon

Solomon is part of an occupation of at least 4 ha located on the eastern bank of Crystal Brook at its confluence with Mount Sinai Harbor on the north shore of Long Island (Figure 8.4) (Bernstein et al. 1997; Gwynne 1982). A portion of the site was excavated in 1997 in advance of residential construction. Two spatially discrete components (Late Archaic in the southern portion of the site and Woodland in the northern) were delimited at Solomon. The lithic artifacts analyzed for this study come exclusively from the 13m^2 excavated in the earlier of the two occupation zones. Based on a radiocarbon date from a feature containing wood charcoal, this aceramic component dates to the end of the fourth millennium B.P. (Bernstein et al. 1997:141).

Stemmed and notched projectile points, often considered "diagnostic" of the Late Archaic, were also recovered in this portion of the Solomon site.

Route 112

The Route 112 site (Figure 8.1), interpreted (based on the lithic assemblage and environmental information) as a small hunting station bordering an ancient wetland, is the most intensively studied site from the interior of Long Island (Bernstein et al. 1996). It is located on the outwash plain between the two major Long Island moraines (Harbor Hill to the north and Ronkonkoma to the south), thus the cobbles typically utilized for making stone tools are absent in the vicinity of the site. The nearest major source of exposed cobbles is no closer than 8 km to the north along the shores of Long Island Sound. No organic materials or features were found at Route 112, despite the fact that virtually the entire site was excavated. Both 1/4 and 1/8 mesh screens were used during excavation, however, for reasons of comparability, only the 1/4 mesh sample is used in this study. Inclusion of the quantitative data from the 1/8 mesh sample does not change the reconstruction of raw material use and lithic manufacturing behavior at Route 112 (Bernstein et al. 1996).

McGregor

All three of the sites discussed above yielded evidence for the use and/or manufacturing of lithic tools from quartz cobbles. However, there is another kind of site that also warrants study; small quarries where glacial erratics were reduced. Prior to a few years ago when the McGregor site was discovered during a survey conducted in advance of utility construction (Bernstein et al. 2000), only one of these had been reported for Long Island (Lightfoot et al. 1987:65, 148), and in general they appear to be fairly rare throughout coastal New York and southern New England. The McGregor site is a small quarry and workshop located away from the shoreline (1.3 km north of Shinnecock Bay) where a quartzite glacial erratic was reduced (Figure 8.2). Virtually the entire site was excavated, a task, which necessitated the excavation of only five 1 x 1 meter units and six, shovel test pits.

DISCUSSION

Selected descriptive data for the four lithic assemblages are shown in Table 8.2. Very minor amounts of other raw materials (e.g., chert, felsite, argillite) are present in these collections, but they are not included in this analysis. The figures in Table 8.2 are based on relatively simple observations made on the quartz lithics recovered at each of the sites. Quartz artifacts (both tools and debitage) are extremely difficult to analyze, and the sophisticated techniques (e.g., use-wear, MAN computations, attributes of striking platforms) often used on other kinds of raw materials (chert, obsidian, etc.) are not generally successful with quartz. However, a few simple observations made on large assemblages have provided some preliminary data of interest.

For the Long Island materials, debitage consists of both unmodified flakes and pieces of block/shatter. The latter are angular fragments of quartz that do not show flake scars or distinctive bulbs of force. This class of quartz debitage has elsewhere been variously termed "miscellaneous debitage" (Flenniken 1981), "shatter" (Boudreau 1981), "block flakes" (Barber 1981b), and "pressure/shatter flakes" (Barber 1981b). Cortical flakes have their entire dorsal surface covered with cortex. Cortex is completely absent on the non-cortical flakes. Very large flakes are defined as those whose weight is greater than two standard deviations above the mean weight for all of the flakes from the three sites (cf. Kuhn 1991:88-89). This index is computed for the flake assemblages from each of the three sites where cobble reduction is represented (McGregor is therefore excluded).

It is instructive to compare the two coastal occupations (Eagles Nest and Solomon on Mount Sinai Harbor on Long Island's north shore) with an inland site (Route 112) located approximately 8 km to the south (Figure 8.1). As discussed above, both Eagles Nest and Solomon are multicomponent sites, but only the Late Archaic components

Table 8.2. Quantitative data for Long Island lithic assemblages.

	Eagles Nest	Solomon	Route 112	McGregor
Tools	211	92	101	0
Unmod. flakes	3818	3007	3741	681
Block-Shatter	150	155	339	84
Cores	13	26	0	3
Tools/Cores	16.2	3.5	101	0
Mean weight of all flakes (grams)	1.30	1.43	0.86	5.89
Mean weight of 100% cortical flakes (grams)	2.36	2.63	1.26	3.81
Mean weight of non cortical flakes (grams)-	0.78	0.92	0.58	4.41
Percent very large flakes	3.6	3.8	1.4	NA
Percent very large 100% cortical flakes	7.1	8.0	1.0	NA
Percent very large noncortical flakes	2.9	3.0	1.2	NA

are treated for this paper. The lithic assemblages at the coastal sites reflect different approaches to raw material use and tool maintenance than the inland Route 112 site. At coastal sites, raw materials were expended and tools manufactured with little attention to concerns of availability and conservation. Lithic resources (quartz cobbles) are present nearby in unlimited quantities and this is reflected in the composition of the lithic assemblages. The most obvious manifestation of this dichotomy is the presence of significant numbers of quartz cores at the coastal occupations and the complete absence of this artifact class at the inland Route 112 site (Table 8.1). As one would expect, the weight of unmodified flakes (classified as debitage) is greater at the coastal sites as well (Figure 8.5).

In contrast to the situation at the two coastal sites, the lithic assemblage from Route 112 is characterized by evidence for curation, a technological strategy important for insuring the availability of tools in settings where raw materials (e.g., cobbles) are scarce or lacking (Carr 1994:36). Curation can be recognized most directly in the Route 112 assemblage by the fact that many of the projectile points from the site have been worked down to small nubs (2-3 cm) (Figure 8.6). These bifaces were repeatedly used and re-sharpened until they were broken or could no longer function as efficient hunting implements, a strategy Kuhn (1991:77) has termed economizing. Projectile points found at coastal sites near sources of raw materials typically show less evidence for prolonged rejuvenation and greater evidence (e.g., lateral snapping) for breakage during early stages of manufacture. Unlike the situation at interior sites, the failure costs (Carr 1994) at coastal sites are very low; the only resources being risked are time and pride.

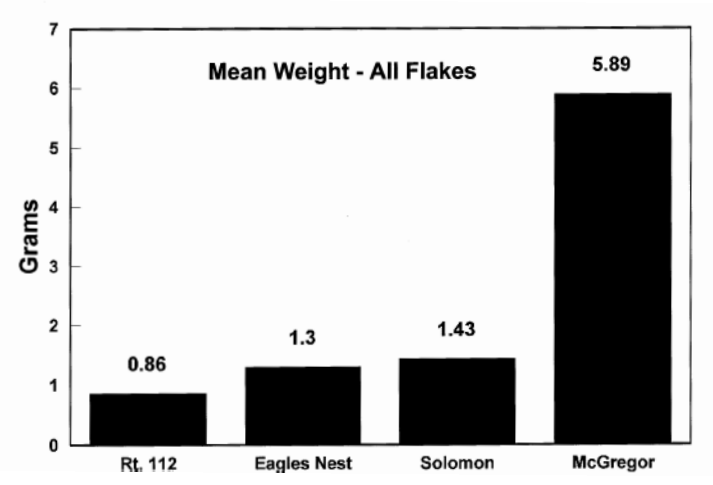

Figure 8.5. Comparison of weight of flakes from the four sites discussed in text.

The different premium placed on lithic raw materials at coastal versus inland sites is also reflected in the assemblages of debitage. As can be seen in Table 8.1, very large (those whose weight is greater than two standard deviations above the mean weight for all of the flakes in this cortex category from the three sites) flakes occur with much greater frequency at the coastal sites (Eagles Nest and Solomon) (Figure 8.7). This trend is pronounced for cortical flakes (seven or eight times greater), illustrating the emphasis placed on early stage cobble reduction at the coastal sites and the relative absence of this activity at the inland Route 112 site (Figure 8.8).

As discussed above, McGregor is a small quarry site containing a heavily reduced quartzite glacial erratic and debris from its reduction (Figure 8.9). The raw material exploited here was different than that typically found at Long Island sites, virtually all of which have abundant waste resulting from the working of quartz cobbles. The McGregor quartzite is grainier in texture and not as hard as the quartz (clear, milky, rose, etc.) that comprises the cobbles. Therefore, edges produced with pieces from the erratic are not as sharp as those from other sites. The quartzite is also less prone to shatter than the quartz.

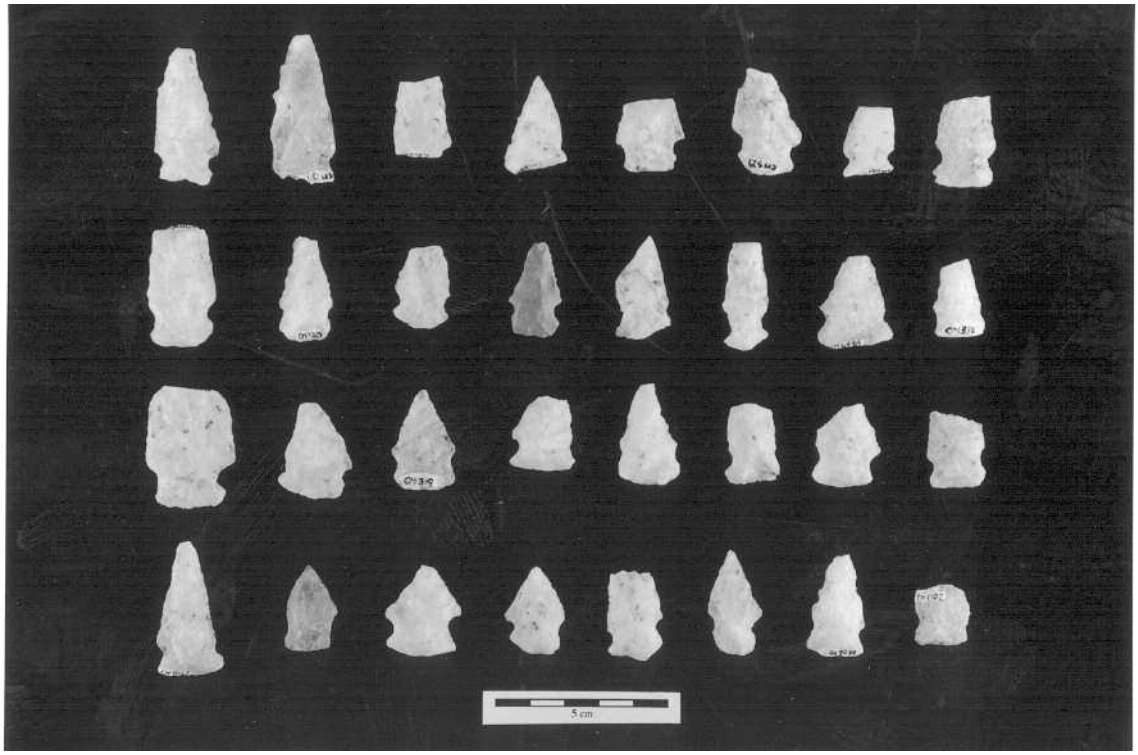

Figure 8.6. Projectile points from the Route 112 site.

The lithic assemblage at McGregor is markedly different than that found at sites where cobbles were utilized. No formal tools (whole or fragments) or utilized flakes were found at the McGregor site (Table 8.1), indicating that the only activity undertaken here was the extraction of large chunks of fairly low quality quartzite. The weight of the debitage pieces from McGregor is, on average, more than four times as great as the debitage from the other sites (Figure 8.5). This difference is especially pronounced for the noncortical pieces (Table 8.1). This further suggests that tools were not being fully manufactured here, but rather that the extraction of stone to be worked into its final form elsewhere is the sole reason for the site's existence.

Although much more extensive work must be done in the interior reaches of Long Island, preliminary results suggest that there exist hundreds, if not thousands, of small sites such as McGregor and Route 112, located away from the coast that were camps or stations used for brief spans and for a limited range of activities (Lightfoot 1988:38). These restricted purpose sites were the settings for specialized endeavors (e.g., quarrying, hunting, nut collecting), and their archaeological assemblages are therefore characterized by a low diversity of artifactual remains (Lightfoot et al. 1985:20). In some cases (e.g., Route 112) they are visible archaeologically as quartz lithic assemblages dominated by heavily curated, bifacially-worked tools and debitage from the later stages of tool manufacturing and/or repair (Johnson 1989). In other cases (e.g., the McGregor quarry), they may contain evidence for even a more restricted range of activities.

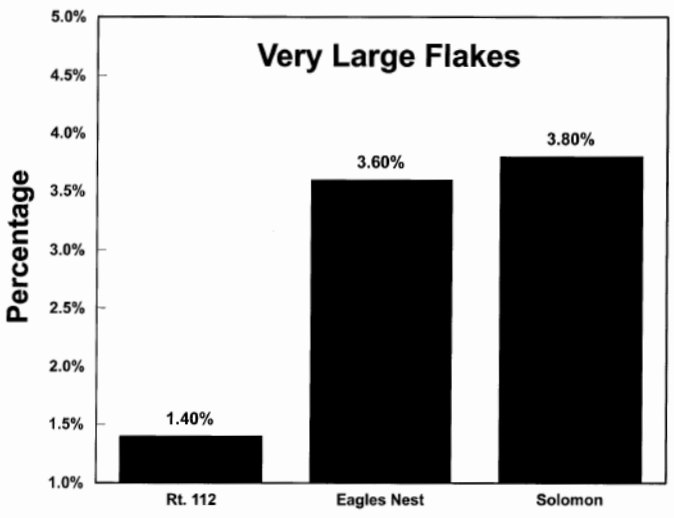

Figure 8.7. Comparison of very large flakes from the three sites with cobble reduction.

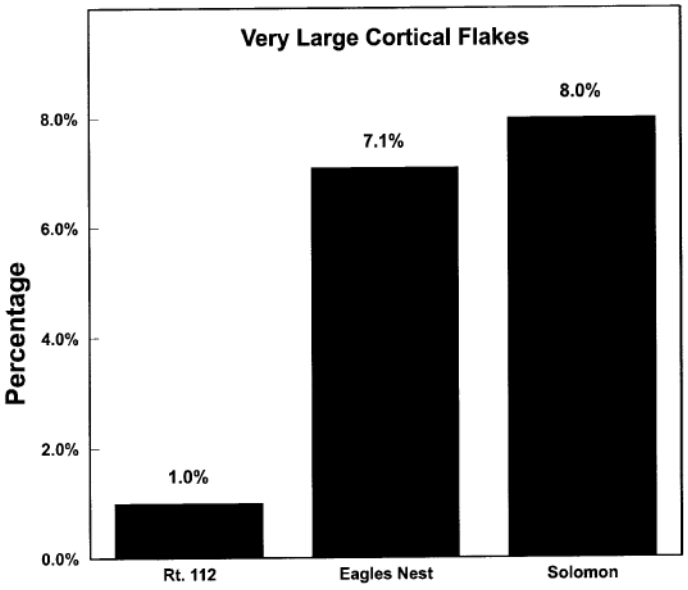

Figure 8.8. Comparison of percentages of very large cortical flakes from the three sites with cobble reduction.

Although not specifically discussed in this paper, smaller, even less dense manifestations of prehistoric activity are also present in the interior, as they are on the coast. These locations contain very small numbers of lithics, usually one to five pieces, and represent activities such as hunting and tool maintenance that took place away from the main settlements. Hundreds of these have been identified during cultural resource management surveys.

CONCLUSION

In conclusion, we would like to stress that it is as important to consider the distribution and abundance of industrial raw materials, including stone, as it is food resources when formulating models of past coastal adaptations by hunter-gatherer-fishers. On Long Island and the surrounding region, the abundant lithic raw materials exposed on the beaches and those present as isolated glacial erratics may have been of equal or greater importance to people in their construction of settlement and resource use strategies as the distribution of shellfish beds or prime fishing locations. In many coastal settings, not just Long Island, only two kinds of data are available for the overwhelming majority of archaeological sites; lithics and site location. To reasonably identify and assess variability among coastal sites where there is no organic preservation and little apparent artifact diversity, the use of resources other than food need to be incorporated into our reconstructions of past human behavior.

This paper has explored some potentially useful approaches to the study of sites with a low density and diversity of prehistoric materials, a situation that typifies much of the coastal New York and southern New England. In addition, it is our hope that this effort might revive an interest in the study of quartz lithics, particularly assemblages from smaller sites. It is ironic that the material that occurs with the greatest frequency at sites in the coastal region has received only minimal scholarly attention, while rarer materials have been intensively studied.

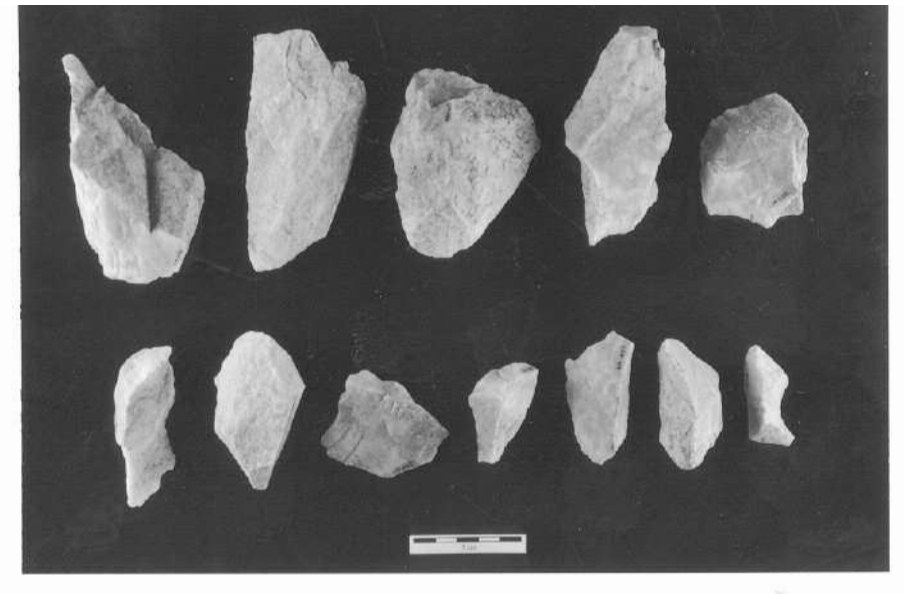

Figure 8.9. Debitage from the McGregor site.

ACKNOWLEDGMENTS

We would like to thank a number of individuals who have contributed to our research on lithic resource use and technology. Foremost among them are former Stony Brook students Bradley Beightol, Catherine Stinsman, Stephen Zipp, and Carelton Griffith who spent long hours analyzing the lithic assemblages from the sites discussed in this paper. Numerous other students as well as employees of the Institute for Long Island Archaeology participated in the excavation of the four sites. The efforts of Daria Merwin, Jennifer Esposito, Michele Morrisson, and Lynn Harvey-Cantone are especially appreciated. John Shea of the Department of Anthropology at SUNY-Stony Brook has, over the years, provided valuable insights on prehistoric quartz technology and lithic use in general. In addition, he performed a series of replicative exercises that illuminated the principles of cobble reduction. The artifact photographs that appear in this chapter were taken by Marylou Stewart. Others who have assisted our research include Adam Yablonsky, Nina Versaggi, Gary Gentile, and Philip Solomon.

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CHAPTER 9

GLACIAL MICRO TOPOGRAPHICAL LAND USE PATTERNS IN UPSTATE NEW YORK

Sara A. Grills

Prehistoric sites in the Upper Susquehanna River Valley are located in a variety of topographic contexts. As with other national trends, archaeologists typically focus on the location of sites across major landforms, such as valley floors, valley walls, and uplands (Funk 1993). However, other unique topographical features, like glacial kettle holes or other micro topographical landforms, also have influenced prehistoric land use patterns. In particular, small lithic sites oriented to these micro topographical features often are overlooked as evidence of specialized land use patterns within the Upper Susquehanna River Valley.

One reason these small sites are peripheral to most settlement models is because these models typically focus on large residential sites, such as base camps and villages. Smaller, more ephemeral sites are usually absent in these models. Equally problematic is a focus on major landforms, such as valley floors, valley walls and uplands, which tend to eliminate diversity by producing an "average" use for the large landforms. While these models have yielded positive and significant results, they minimize the importance of small lithic sites within the overall land use pattern. Often these small sites are lumped into the catchall category of resource processing areas or seasonal camps, blurring any potential interpretive diversity. This lumping of sites precludes development of interpretive contexts based on the specific topographical settings of these small lithic sites.

In general, most hunter-gatherer land use models are based in some part on focal/diffuse subsistence and settlement models (Cleland 1976) or forager/collector land use strategies (Binford 1980). These models depict organized patterns centered on large residential bases located within a primary valley. From these bases small work or task groups embark on short-term expeditions aimed at the daily foraging of resources. These smaller groups would forage within a catchment area that would include the valley bottoms, valley walls, and uplands. While on these brief resource procurement excursions, work groups would locate a resource, collect that resource, and possibly begin processing the resource, thereby creating the site archaeologists classify as small lithic scatters. These sites tend to suggest a high level of redundancy and lack of differentiating context. However, these models rarely examine the specific micro topographical setting for these lithic scatter sites. By closely examining these small lithic-based sites that are associated with specific micro topographic features and subsequently incorporating these sites within the larger cultural and natural landscapes archaeologists can diversify and enhance the interpretive contexts for hunter-gatherer subsistence and settlement systems. The present study focuses on kettle holes as one specific type of micro topographic feature within a small area at the uppermost reaches of the Susquehanna River Valley as an example of the utility of focusing on the small-scale landforms as a potential context for significance.

GLACIAL TOPOGRAPHY OF THE UPPER SUSQUEHANNA RIVER VALLEY: THE ENVIRONMENTAL SETTING

The Upper Susquehanna River Valley provides an environmental laboratory for examining prehistoric land use related to micro topographical features. The landscape is dotted with micro topographical landforms created by the final glacial retreat approximately 12,000 years ago (Matsch 1976). As glaciers retreated, they left a path of both macro and micro topographical changes to the landscape (Tallcott 1970). The micro topography left in the wake of glacial retreat can have a major impact on the character of the landscape, creating moraines, kame terraces, kames, eskers, drumlins, and kettles. The term, micro topography, can be misleading since it suggests relatively small phenomena. While these features may appear to be small within large physiographic settings, the impact of micro topography is significantly larger when considered from a human scale (Feder 2001). It is this smaller human scale that archaeologists must consider in order to fully understand the appeal a particular land form may have had for prehistoric hunter-gatherers. When utilizing this scale, glacial micro topographical formations become very significant.

The rolling hills and general topography of the Upper Susquehanna River Valley are associated with several different glacial processes, which produced features such as moraines, kame terraces, kames, eskers, drumlins, and

Current Approaches to the Analysis and Interpretation of Small Lithic Sites in the Northeast, Edited by Christina B. Rieth, New York State Museum, The State Education Department, Albany, New York 12230. New York State Museum Bulletin 508

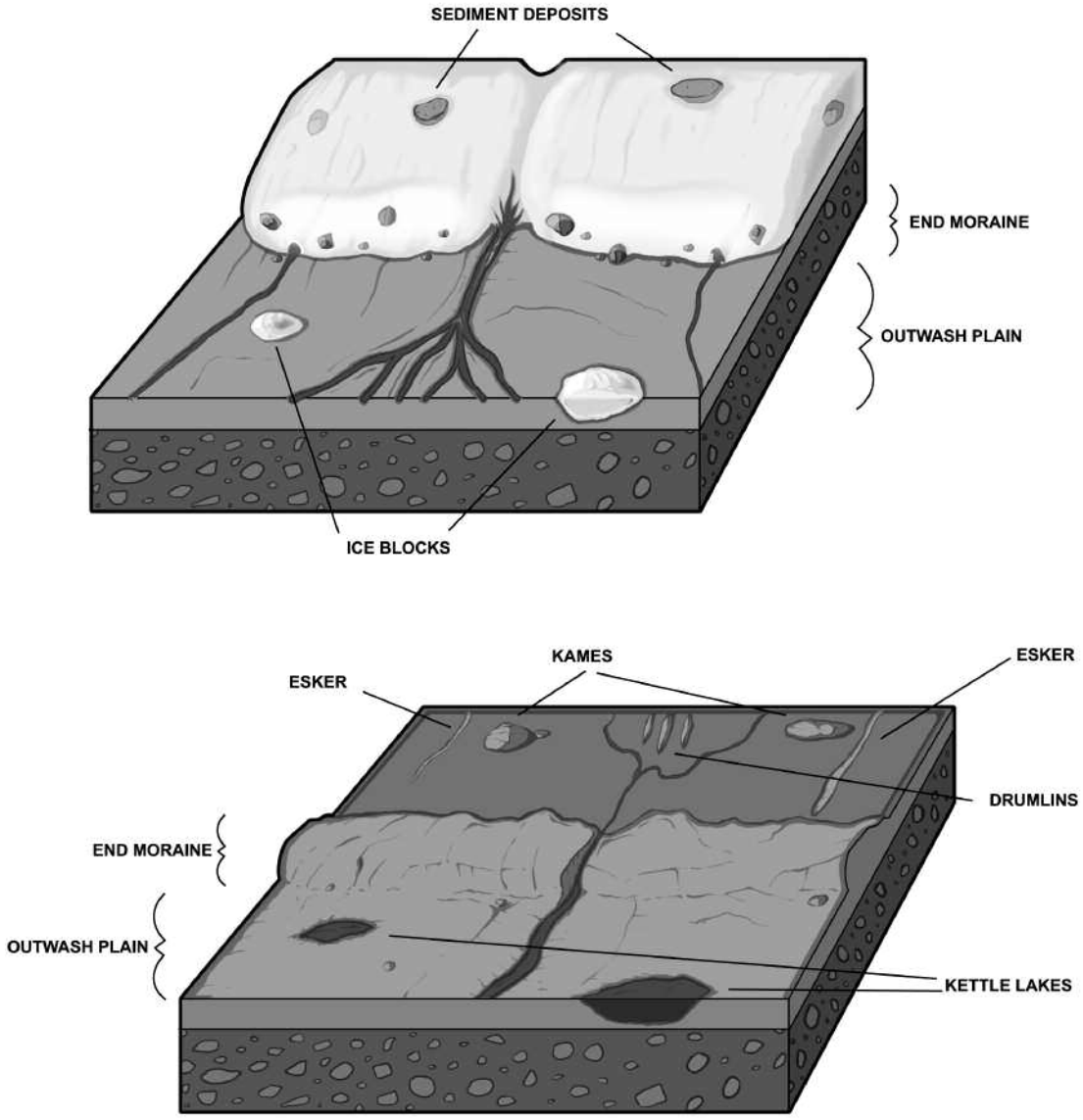

Figure 9.1. Glacial Micro Topographic Feature Formation.

kettles (Cornwall 1970; Drewry 1986; Tallcott 1970; Flint 1971). Examples of these types of topographic features can be seen throughout the Upper Susquehanna River Valley. Many of these glacial features are created by the presence of a stagnant glacier within the valley (Flint 1971:199-226) (Figure 9.1).

The sites presented as case studies in this chapter fall within the section of the Upper Susquehanna River Valley between Otsego Lake and Portlandville, an area where kettle holes are the dominant micro topographical feature (Fairchild 1925: 77) (Figure 9.2). The evidence suggests that a possible blockade of the valley, during the final glacial retreat may have created the numerous kettle holes located within this area (Fairchild 1925:77). Kettle holes were created during the last retreat of glaciers, when large chunks of ice detached from the main body of the glacier and were covered by the receding glacial till and debris. Over time, the ice melted and the surface material collapsed creating the sunken area known as a kettle hole (Cornwall 1970:24; Flint 1971:212). The size of a glacial kettle hole is based on the initial size of the detached chunk of ice. Many of these kettles initially retained melt water, dotting the Upper Susquehanna River Valley with ponds set back from the river's channel. Even relatively dry kettle holes may become flooded during times of high water table. These unique landforms provided rich micro-environments that would have supported diverse flora and fauna that probably differed

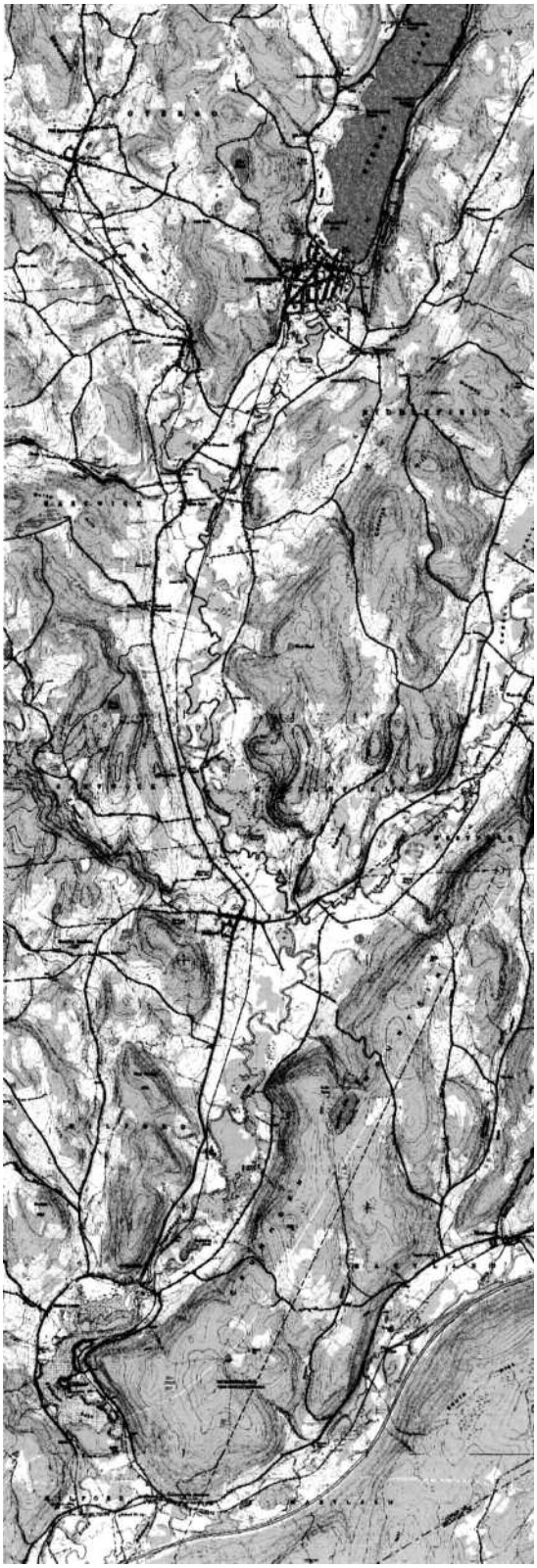

Figure 9.2. USGS, 1943 (1994) Cooperstown, 1943 (1994) Milford and 1943 (1982) West Davenport Quad Maps showing Upper Susquehanna River Valley.

from the surrounding terrain. These points on the landscape and the catchment area around them must have influenced prehistoric subsistence and settlement strategies. It is likely that prehistoric hunters-gatherers used these glacial features in ways much different from the surrounding physiographic regions.

While this discussion focuses on kettle holes, any glacially created micro landform may have created attractive loci with potentially distinct natural resources that would have impacted human decisions on how to utilize their landscape. Another important aspect of glacial land formation within the Upper Susquehanna River Valley that affects the interpretation of the kettle-side sites, is the deposition of glacial till. As the glaciers retreated, they released their load of rock, creating moraines (ground, end, and lateral), kames, and kame terraces. An important component of the Upper Susquehanna valley till is large quantities of chert cobbles. In addition to creating us micro landforms, these glacial till features also provided abundant lithic raw materials.

SITE ATTRIBUTE ASSESSMENT

An analysis of the artifact assemblage from these small lithic sites should shed light on their function within a hunting-gathering landuse system. A useful heuristic device is to consider the types of tools within a spectrum from expedient ad hoc flake tools to highly curated formal bifacial tools (Andrefsky 1998). One tool selection strategy relies primarily on expedient flake tools created from locally available and relatively abundant chert cobbles within the glacial till fields. An assemblage of this type might be expected at ephemeral foraging sites where sharp-edged flakes could be quickly and easily produced from glacial chert cobbles (Grills 2003; Odell 1996; Versaggi 1996). The second tool strategy focuses on a highly curated assemblage of primarily bifacial tools. These sites are characterized by biface fragments and debitage associated with bifacial tool production and maintenance. This tool strategy is often associated with specialized camps. Large quantities of naturally occurring chert cobbles are available throughout the Upper Susquehanna River Valley; these cobbles provide a readily accessible raw material for the expedient productions of flakes or blocky tools (Cobb and Webb 1994; Grills 2003). The lithic assemblages associated with expedient technologies are sometimes difficult to identify as cultural because of poor quality chert, which often results in blocky debitage produced by bipolar reduction methods. Sites with expedient tools often represent an ephemeral land use strategy that is commonly overlooked by investigations focused on large residential sites in valley contexts and traditional lithic tool kits, primarily composed

of bifaces and associated formal tools. However, a detailed debitage analysis of these assemblages yields important data for interpreting specialized land use.

Exploring the nature of sites located around micro topographical features, in this case, kettle holes, requires analysis of common characteristics in the most abundant data set, the debitage assemblage. The classification typology used by the Public Archaeology Facility (PAF) is based on types and subtypes which differentiate formal and technological variations within the lithic assemblage (Pope 1998).

The PAF typology initially separates the chipped stone artifacts as formal tool type or debitage/core. Formal tools, including drills, gravers, hoes, projectile points, etc., are then further described by specific characteristics (i.e., a projectile point may be catalogued as fluted, bifurcated based, Brewerton, etc.). Bifacial tools are categorized as Stage 1 (flake blank with bifacial edges), Stage 2 (preform, early thinning has begun) or Stage 3 (unfinished point, thinned, and roughly shaped) (Whittaker 1994:157-158).

The debitage/core assemblage is categorized by specific characteristics. These include: cortical flake, non-cortical flake, bifacial edge flake, core flake, blade flake, non-cortical chunk, cortical chunk, shatter, flake core, core fragment, bifacial thinning flake, non-cortical flake fragment (distal, medial, proximal), bipolar core, bifacial core, blade core, and discoidal core. Artifact raw material and color are also recorded.

All chipped stone artifacts are described by size (>2", 1"-2", 1/4"-2", <1/4"), subtype (non-cortical, bifacial edge, bipolar core, blade, etc.), and whether the artifact has been subjected to heat. All flakes greater than 1/4" in diameter are described by raw material, condition (broken, whole, fragment), utilization (defined as a flake in which one edge has at least 4 small negative flake scars in a uniform pattern and/or polish), heat treatment (i.e., color change or pot lid flakes), dorsal scars, and the presence or absence of cortex (Sullivan and Rozen 1985). All flakes greater than 1/4" are described by the number of dorsal scars (0-2, >2), and cortex type (surficial smooth, surficial rough, marginal smooth, marginal rough, and no cortex). All flakes greater than 1/4" that are in a whole or broken condition are characterized by platform cortex, dorsal scar index, platform type (cortex, flat, faceted, point, and collapsed) and platform angle (obtuse, 90 degrees, acute <45 degrees, acute 45-90 degrees, and indeterminate).

THE SITES

To explore the role of kettle holes, I will focus on four sites located within the Upper Susquehanna Valley, in Otsego County. These sites are: Otsego 1 and 2, Ingles 1, and Ingles 6, all of which occur within 9.6 km of the outlet of Otsego Lake, which forms the headwaters of the Susquehanna River (Grills 2001a; Grills 2001b, Grills and Versaggi 1999; Kudrle 2001; Kula 1990). All of these sites are located within 3.2 km of each other, and are adjacent to glacial kettle holes (Figure 9.3; Table 9.1).

Otsego 1 Site

The Otsego 1 Site sits on a small terrace over looking a glacial kettle hole and is located approximately 731 m northwest of the confluence between Oaks Creek and the Susquehanna River (Figure 9.4). The site is located within an active agricultural field at an elevation of 377 m ASL. The terrace rises about 17 m above the elevation of the Susquehanna River. The site is located approximately 30 m off the edge of the kettle hole and is relatively small covering an area of approximately 506 m^2. Otsego 1 was identified during a reconnaissance survey (Grills 2001a). One shovel test pit contained prehistoric material and surrounding radials were excavated at a 7.5 m interval. Eight 1x1 m units were excavated during the site examination; these units were placed systematically and judgmentally within the site limits. Excavations recovered a total of 378 prehistoric artifacts: 14 during the Phase 1 survey, and 364 during the site examination. Forty-five of the 353 flakes recovered showed evidence of utilization. The tool assemblage included one retouched bifacial tool, one unifacially retouched tool, one end-scraper, one graver on a flake, one burin on a retouched flake, and one unclassified straight stemmed projectile point that appears to be Archaic (Grills 2001b) (Figure 9.5).

The debitage analysis of the Otsego 1 Site included attribute analysis of flake size, dorsal scar count, cortex type, and platform type. The flake size analysis showed

Table 9.1. Summary of Sites

Site Name	Site Size	Count of Artifacts	Distance to Susquehanna River
Otsego 1	22.5x22.5 m	378.00	731 m (northwest)
Otsego 2	22.5x22.5m	137.00	495 m (northwest)
Ingles 1	1.5 ha	222.00	91 m (west)
Ingles 6	4.2 ha	36.00	760 m (west)

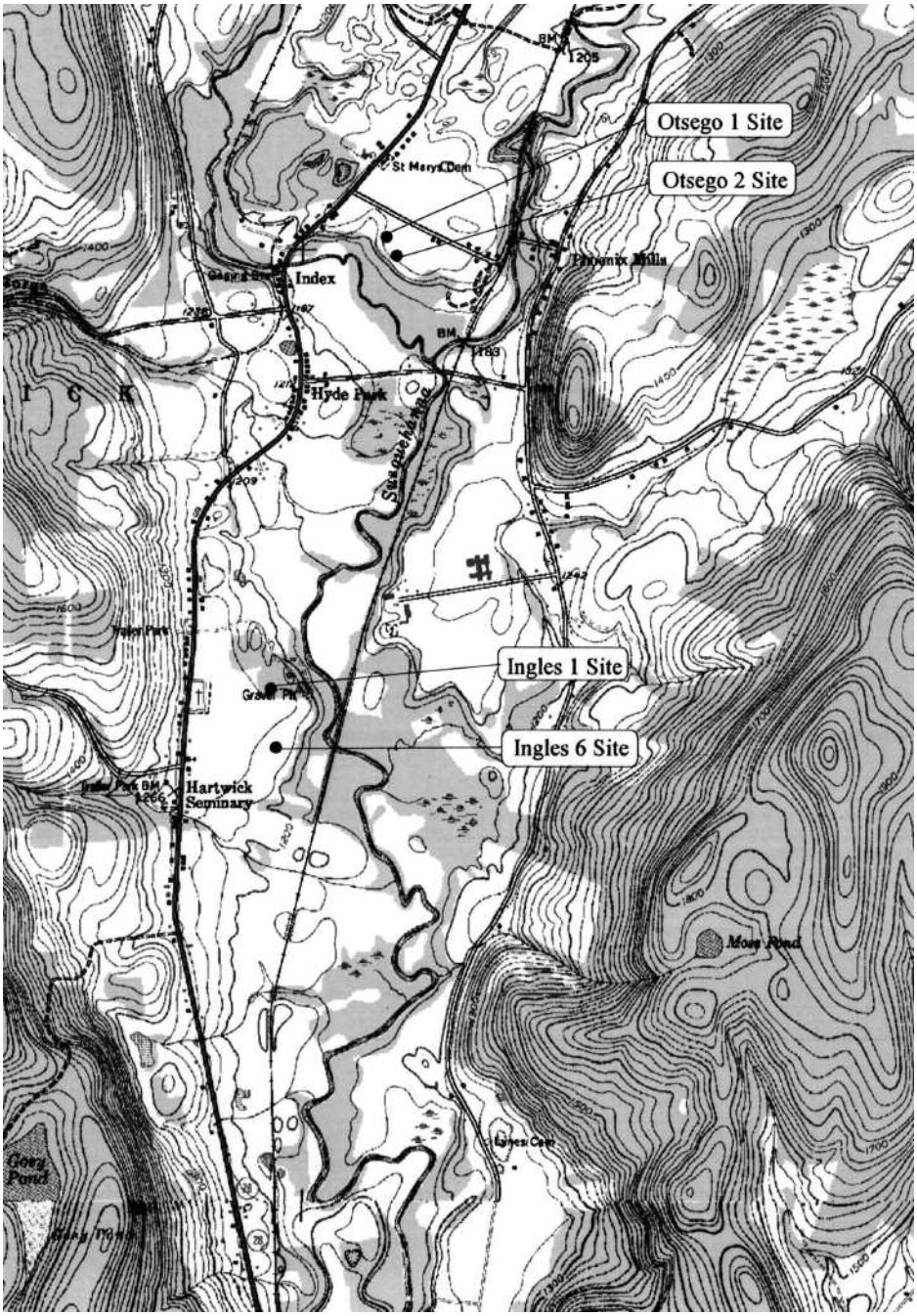

Figure 9.3. USGS 1943 (1994) Cooperstown Quadrangle Map with the locations of the sites marked.

that dominant sizes within the assemblage, indicate early stage reduction was occurring at the site (Grills 2001b:17). The dorsal scar counts within this assemblage did not clearly indicate either early or late stage reduction from the site. The cortex type is important since it can address the type of raw material used, as in the difference between the local chert cobbles or a quarried chert. For the Otsego 1 assemblage the "higher incidence of smooth cortex indicates use of locally obtained chert" (Grills 2001b:17). The platform type showed that again an "expedient core technology where local cobbles are reduced to flakes suitable for use as tools" was dominant for the Otsego 1 assemblage (Grills 2001b:18).

The site examination identified two features (Figure 9.6). Both were defined as hearths, characterized by a shallow white ash lens associated with some fire-reddened

Figure 9.4. Photograph of from Otsego 1 Site towards kettle hole.

Figure 9.5. Un-typed Projectile Point from Otsego 1 Site.

soil. There was no stratification within either feature; the absence of stratification suggests the features represent a single use event rather than repeated use. These features were located to the east of the glacial kettle hole. Wood charcoal recovered from Feature 1 was sent to Beta Analytic Inc. for radiocarbon dating, which produced a conventional radiocarbon age of 3830+/-80 BP. The 2 sigma calibrated result of 2480 to 2030 BC was derived with a 95% probability (Grills 2001b:20). The result of radiocarbon dating from Feature 1 places the feature and associated artifacts in the Late Archaic period, which confirms the initial age assessment of the stemmed point (Grills 2001b:19-20). However, the point did not resemble a known type.

The presence of utilized flakes and formal chipped stone tools suggests a mixed assemblage, one that is dominated by expedient tools, but also contains some curated items. Debitage characteristics indicate that tool manufacturing and maintenance occurred on the site as well as the production of flakes to be used as expedient tools. The combination of expedient and formal tools, as well as hearth features, indicates that this site may have been more than an ephemeral resource processing area since spent or broken curated tools usually are not expected on these site types. The debitage analyses suggest that people

Figure 9.6. Feature 1, Otsego 1 Site.

were mainly sharpening bifacial tools, rather than making new bifaces. They were also using locally abundant chert cobbles to produce expedient tools.

The artifacts and features support an interpretation of a single or limited-use resource procurement and processing site. The proximity of this site to the glacial kettle hole rather than Oaks Creek suggest that the kettle hole was what attracted people to the site.

Otsego 2 Site

The Otsego 2 site is located in the same agricultural field as Otsego 1 and was found during the same reconnaissance survey (Grills 2001a). Again, the site overlooks a glacial kettle hole, but the Otsego 2 site is situated 135 m off the edge of the kettle hole (see Figure 9.7). This site, like Otsego 1, is relatively small covering an area of approximately 506 m^2 and lies at an elevation of 377 m ASL. Otsego 2 is located 495 m west of the confluence of Oaks Creek and the Susquehanna River. A positive shovel test pit was identified and surrounding radials were excavated at a 7.5 m interval. Six 1x1 m units were excavated during the site examination; these units were placed systematically and judgmentally within the site limits. Excavations recovered a total of 137 artifacts: 10 artifacts from the reconnaissance survey, and 127 during the site examination. The assemblage included three utilized flakes and one unifacially retouched piece (Grills 2001b).

As with Otsego 1, the debitage analysis of the Otsego 2 Site included attribute analysis of flake size, dorsal scar count, cortex type, and platform type. The flake size of the debitage from Otsego 2 shows early stage lithic reduction occurring at the site. The dorsal scar analysis "suggests some final stages of manufacture and late stage reduction of flakes. There is also a large number with less than two, which could indicate the production of flakes possibly for use as expedient tools" (Grills 2001b:31). The cortex analysis suggests a higher use of local chert cobbles than quarried chert. The platform type "is describing an expedient core technology where local cobbles are reduced to flakes suitable for use as tools" (Grills 2001b:32).

Here, the presence of utilized flakes and the unifacially retouched tool rather than bifacially worked tools, suggests a lithic assemblage that is dominated by expedient tools. Cortical flakes and cortical chunks comprise 35% of the assemblage, which indicates that people were reducing natural chert cobbles probably to produce sharp-edged flakes and blocks for use as expedient tools. Like Otsego 1, the proximity of Otsego 2 to the kettle hole rather than Oaks Creek indicates the importance of this feature to the site's function.

Ingles 1 Site

The Ingles 1 Site is located in the Town of Hartwick, south of where Otsego1 and 2 are located. The site consists of seven spatially distinct loci scattered around the edges of five kettle holes. The total site size is 1.5 hectares (Figure 9.8). Each loci consists of either one or more artifact clusters. The sizes for each loci range from 4459 m^2 at Locus 7, to 446 m^2, at Locus 3 (Figure 9.9). The site is located approximately 91 m west of the Susquehanna River and lies at an average elevation of 372 m ASL. Archaeologists from PAF recovered 124 artifacts from the Phase 1 testing and an additional 98 artifacts from the Phase 2 excavations.

Lithic debitage was the dominant artifact type found, with 6% of the debitage being utilized. Of the total debitage 26.5% consist of blocks, which suggests an expedient cobble reduction similar to Otsego 1 and 2. The formal tools recovered from the site consisted of two gravers and one "strike-a-light", a tool with a battered edge presumed to be part of a fire-starting kit. According to Kula (1990:13), "the gravers are roughly made and may have been manufactured at the site, then discarded after use.

Figure 9.7. Photograph from Otsego 2 towards kettle hole.

Figure 9.8. Photograph of Ingles 1 setting.

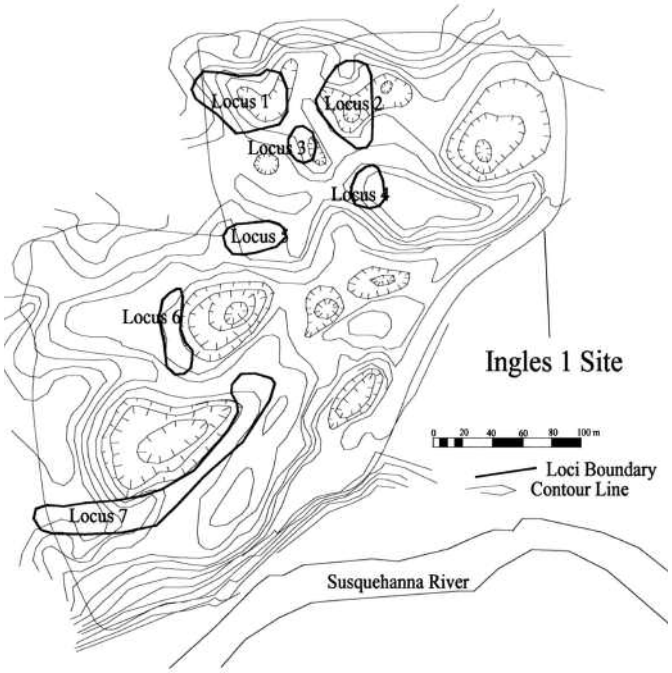

Figure 9.9. Map of Ingles 1 Loci with the micro topography marked.

One was made from a pebble."

The highly expedient nature of the assemblage and the lack of features support a site interpretation as a ephemeral resource procurement and processing location. The orientation of the loci around the rims of the glacial kettles rather than the nearby terrace adjacent to the Susquehanna River indicates that these micro-topographic features were an attraction to prehistoric people and the focus of the site's activity.

Ingles 6 Site

The Ingles 6 Site is also located in the Town of Hartwick, 760 m west of the Susquehanna River. The site contains three spatial distinct loci covering an approximate area of 4.2 hectares and lies at an elevation of 366 m ASL (Figure 9.10). The site was identified during a reconnaissance survey performed in 1999, by the Public Archaeology Facility. The site lies along a ridge above a kettle hole and is currently used as an agricultural field. Phase 1 excavations recovered 36 artifacts from the reconnaissance survey from 48 shovel test pits (Grills and Versaggi 1999; Kudrle 2001). Flakes are the dominant artifact type; 28 of the 36 artifacts are non-cortical flakes. A retouched unifacial piece was the only formal tool recovered from the site; however there was one utilized flake.

A lithic scatter dominated by expedient artifacts is not always an expected site type on the Susquehanna River valley floor, where base camps and villages produce a highly curated or mixed assemblage. Again, the presence of a kettle hole creates a non-river focus for the site's function and a reason for its presence and configuration at this location.

SUMMARY

Detailed lithic analysis of the assemblage from these sites suggests several common characteristics for small lithic resource procurement or processing sites associated with glacial kettle holes. These characteristics include non-traditional tool kits consisting predominantly of expedient tools, large percentages of debitage derived from locally available glacial cobbles, and late stage debitage resulting from sharpening bifacial tools that were not discarded at the site. The proximity of these sites to the micro-topographical features rather than the larger geographical features, such as the river or uplands, provides the focus for the sites' activities.

CONCLUSION

Why did prehistoric groups select certain types of landforms for activity and settlement while ignoring other areas? What was it about particular location that was appealing? I have argued that Native American groups were attracted to the resources associated with micro topographical features within broader landscapes. Micro topographical features provided locations within a general physiographic region where short-term resource procurement and processing could occur without ranging far from the residential base. Specialized resource procurement or processing sites can have a persisting spatial association with nearby micro topographical features that are visible "landmarks" on the adjacent landscape. The sites created by these activities probably represent subsets of a larger residential community, such as work groups involved in general foraging or specialized procurement.

Archaeologists continue to debate the changes in prehistoric land use and settlement between upland and lowland contexts (Funk 1993). However, this recent analysis has shown that micro topographical glacial features within major valleys had an equally important influence on prehistoric hunter-gatherer groups. Landforms, such as kettle holes, represent fixed and visible points on the landscape that offered a micro-environment rich in potential food resources, other raw materials, and water.

The small lithic sites discussed in this chapter have shown a clear connection between an expedient lithic reduction system, an expedient artifact assemblage, and a

glacial landform feature that probably held water. These glacially formed features probably attracted animals on a predictable basis that would have encouraged repeat visits by hunter-gatherers.

The common site characteristics within the debitage assemblages illustrate activities associated with daily foraging tasks as well as specialized camps. The resulting lithic assemblages represent use of these small features for opportunistic activities as well as planned or scheduled foraging. The expedient assemblage recovered at the sites provides us with a different assemblage than would be expected at the residential bases on the valley floor. Locally available chert cobbles rather than quarried blanks were the main raw material source for the production of expedient tools. This reduction system produces debitage assemblages that include blocks and chunks as well as flakes. It is incumbent on archaeologists to recognize these non-bifacial reduction products as important indicators of specialized land use systems.

Incorporation of micro topography into land use models highlights an under-recognized component of complex land use strategies that is not directly represented within the standard land-form division of flood plains, valley walls, and uplands. Recognizing the importance of these specialized sites will contribute to locating a broader and more diverse modeling of hunter-gatherer mobility, settlement and subsistence strategies as manifested land use patterns within valley systems.

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CHAPTER 10

PLACING STONE TOOL PRODUCTION IN CONTEXT: INTERPRETING SMALL LITHIC SITES IN THE UPPER SUSQUEHANNA RIVER VALLEY

Brian R. Grills

Anthropologists have used many theoretical frameworks to explore the development and changes in lithic technology. Researchers frequently use the lithics recovered from archaeological excavations to explain prehistoric behavior, such as mobility, social strategies, subsistence, and risk. Addressing the complicated interpretative issues of prehistoric behavior using the remains of chipped stone production has had varying success. An overriding bias surrounding bifacial or formal technology has developed within the research of lithic technology, which traditionally overlooked the importance of expedient or informal technology. Varying factors influenced the selection of specific forms of lithic technology and thus prehistoric groups created and utilized varying types of tools in response to subsistence needs. Much of the current research on lithics links the degree of group mobility with the development of lithic technology (Andrefsky 1991; Bamforth 1986, 1990, 1991; Binford 1979; Montag 1998; Parry and Kelly 1987; Sassman et al. 1998).

The excavation and subsequent analysis of dozens of small, temporally unaffiliated lithic sites in the Upper Susquehanna River Valley have shown that most of the lithic assemblages from these sites appear to differ from the generally understood models of the organization of lithic technology. Current models for the organization of lithic technology in the Eastern Woodlands revolve around an unwavering foundation built on two major concepts. The first is that the type of lithic technology is directly related to mobility. The second is that raw material plays a significant role in the form of tool production.

This study will reevaluate the currently accepted models that link mobility and the organization of lithic technology within hunter-gatherer groups and examine the role of raw material in the structure of lithic production. The reevaluation will include the results of a regional debitage analysis formulated to test the ideas of mobility and the organization of lithic technology. This analysis will also evaluate the role of expedient technology in hunter-gatherer groups and the formation of small lithic sites.

RESEARCH PROBLEM

Since the passage of the National Historic Preservation Act of 1966 there has been a surge in the number of archaeological investigations conducted in the United States. A significant number of the sites located during these investigations are classified as lithic scatters. The questions tackled by researchers, cultural resource consultants, and state reviewers are how are lithic scatters important to our overall understanding of both Native populations and their use of the prehistoric landscape. Too many times these small ephemeral lithic scatters are glossed over by the archaeological community as being unimportant because of the lack of information, which can be gained from a few dozen flakes. However, these same lithic scatters are part of a pattern of land use, which must be incorporated into our understanding of prehistoric peoples. This study will illustrate how these lithic scatters can be incorporated into a broader regional model of land use and the technological organization of chipped stone technologies.

This study sampled sites located in different geographic contexts within and adjacent to the Upper Susquehanna River Valley (B. Grills 2003). These contexts reflected differences in the types of artifacts deposited at these separate sites. This study was organized based on the three geographic contexts defined by Robert Funk (1993): valley floor, valley wall, and uplands. Each one of these areas offered various access to critical resources such as "water, food, firewood, and industrial raw materials" (Funk 1993:65). These geographic contexts exhibit a distinct physiographic and environmental character, which I propose influenced prehistoric land use strategies as well as the organization of lithic technology. Table 10.1 presents a summary of the geographic contexts and the sites sampled for this study.

Defining the Organizational Approach

The ability of anthropologists to study the behavioral patterns of prehistoric peoples is limited by the survival of the archaeological residues of those behaviors. At most sites within the Upper Susquehanna River Valley, the only archaeological material remaining is the debris of chipped stone technologies. Lithic debitage, usually flakes, shatter, or discarded tools, often comprise the only evidence of an occupation. Researchers are thus challenged to create a theoretical framework to unlock the hidden information that these discarded pieces of stone hold. The underlining premise of these approaches is the

Current Approaches to the Analysis and Interpretation of Small Lithic Sites in the Northeast, Edited by Christina B. Rieth, New York State Museum, The State Education Department, Albany, New York 12230. New York State Museum Bulletin 508

Table 10. 1 Summary of geographic contexts defined by Funk (1993) and sites sampled

Geographic context	Available Habitats	Elevation Range ASL	Site Name	Site Type	Cultural Affiliation
Valley Floor	Outwash Plains/terraces, floodplain terraces, moraines, gravel bars, islands, isolated knolls/ridges, swamps/bogs, lakes, tributary alluvial fans, colluvial. lobs, rockshelters	300-330 m (1000-1100 ft)	Apalachin Creek	Resource collection/processing	Late Woodland (AD 1270-1395)
			Thomas Creek	Resource collection/processing/ possible base camp	Early Woodland (700 BC-AD 0)
			Thomas Creek	Resource collection/processing/ possible base camp	Middle Woodland (AD 100-800)
Valley Walls	Lateral moraines, ridges/benches/terraces, alluvial fans, near springs	sloping 330-457 m (1100- 1500 ft)	Otsego I	Processing Site	Late Archaic (2480-2030 BC)
			Otsego II	Processing Site	Unknown
			Ingles I	Processing Site	Unknown
			Park Creek I	Processing Site	Unknown
			Park Creek II	Processing Site	Late Woodland (1280-1405)
			Park Creek II	Processing Site	Late Woodland (AD 1305-1460)
			Raish	Processing Site	Middle Woodland (AD 250-700)
Uplands	Summit knolls/ridges, saddles, stream headwaters, near bogs, swamps, rockshelters, near springs	457-900 m. (1500-3000 ft)	Carl II	Processing Site	Unknown
			Ford I	Processing Site	Unknown
			Gaige V	Processing Site	Unknown
			Meade I	Processing Site	Unknown
			Saddlemire	Processing Site	Unknown
			Shedina II/Pride I	Processing Site	Unknown
			Van Gasbeck I	Processing Site	Unknown
			Van Heusen II	Processing Site	Unknown

belief that prehistoric technological processes can answer questions concerning the behavior of prehistoric peoples.

The organizational approach is,

> ...the study of the selection and integration of strategies for making, using, transporting, and discarding tools and the materials needed for their manufacture and maintenance. Studies of the organization of technology consider economic and social variables that influence those strategies (Nelson 1991:57).

Nelson's definition has been cited as effectively stating the focus on which the organizational approach to technology is based (Carr 1994:1). Many other researchers have presented definitions and descriptions concerning the organization of technology (Binford 1977,1979; Kelly 1988; Koldehoff 1987; Nelson 1991; Torrence 1989). In these definitions, technology is viewed as a solution to "physical and social environments" (Carr 1994:1).

The study of technological organization has been used to reconstruct mobility and settlement patterns (Andrefsky 1991; Bamforth 1986, 1990, 1991; Binford 1979; Kelly 1988; Montag 1998; Parry and Kelly 1987). The early work of Binford (1977, 1979, 1980) focused on mobility and the principles of organization within a hunter-gatherer group. For example, Binford (1980) constructed the "Idealized Economic Zonation" model, which provides a behavioral context for interpreting various types of land use and archaeological residues. Some researchers have tied differences in lithic technology to these zones. These works strongly influenced researchers by highlighting mobility as a major influence on many behavioral aspects of society, including the organization of lithic technology. Mobility is certainly not the only variable linked to lithic technological organization. Many studies have addressed a variety of social topics, including political economy and gender (Carr 1994:2).

The fact that research into the technological organization approach has become so focused upon mobility is a criticism of this type of study. Bamforth (1991:217) states that technological strategies are interactions between many social factors and the environment, not just a single

characteristic. Bamforth is not the only researcher to echo this criticism (Kelly 1992; Torrence 1989a). The recognition that mobility and technological organization have a strong relationship, along with other social factors can be used to form a foundation for future studies, but that should not be viewed as the only influencing variable.

Mobility is considered as a given factor in the daily lives of prehistoric hunter-gatherers. From this platform environmental issues, such as raw material availability and geographic context, will be brought into the discussion, along with variables such as tool function and risk.

Behavioral Influences on Technological Organization: Mobility and Raw Materials

During the last quarter of the 20th century several studies were published in which shifts in technology were directly linked to sedentism and the increase in horticulture. Some theorists have argued that following the development of horticulture in the Eastern Woodlands, populations generally ceased their use of an easily portable and maintainable bifacial technology referred to as curated or formal (Goodyear 1979; Parry and Kelly 1987; Shott 1986). Curated tools have been generally associated with groups whose main mode of subsistence was highly mobile hunting and gathering. Odell (1996) notes that the high rate of mobility of that lifestyle would seem to warrant a tool kit that was easily carried and durable.

The use of bifacial tool types and formalized cores has been noted as having several drawbacks (Young 1994:145). Bifacial tool production requires a certain amount of training, skill, and time to perfect the reduction and detailed thinning (Parry and Kelly 1987). The quality of raw material is also a limiting factor in the production of bifaces (Andrefsky 1998; Goodyear 1979; Odell 1996). The more flaws present in the stone the less predictable flake removal becomes negating one reason for using the bifacial technique. In addition, the working edge of a retouched tool is never as sharp as the un-retouched edge of a flake (Young 1994:145).

In contrast to curated bifacial technology was a more informal expedient technology. Expediency is reflected in raw material procurement, reduction techniques, and the use and discard of flake tools. Expedient technologies of the Eastern Woodlands have been associated with the removal of flakes from both bipolar and amorphous cores (Cobb and Webb 1994:212). The bipolar technique is accomplished by placing the core upon an anvil and striking it with a hammerstone. This method allows an individual to maximize flake production with limited skill and effort in lithic poor areas (Andrefsky 1994; Cobb and Webb 1994). The amorphous cores are created through the removal of flakes from multiple directions. With both types of reduction, the goal appears to be the intentional removal of flakes for utilization rather than the production of blanks to be shaped into formal tools (Cobb and Webb 1994:212).

Several different variables have been presented as reasons for a shift from formal technological dependency to expedient technology. Researchers, such as Parry and Kelly (1987), have proposed that increasing sedentism lessened the need for portable tool kits. This in turn would decrease the necessity for multipurpose bifacial tools whose manufacture and maintenance were both labor intensive and required considerable skill. It has been argued that people in sedentary villages turned to secondary sources of raw materials, such as glacial and river cobbles (Montag 1998). Andrefsky (1994) notes that secondary sources of raw materials are "somewhat" of a diagnostic characteristic of the shift to expedient technology. Due to the nature of the thick layer of cortical material which is difficult to remove, production techniques require bipolar or another hard hammer percussion technique. Natural joints or planes in the cobble structure have been considered to be flaws, thus making the raw material inferior in quality, compared to most mined chert gathered from outcrops. Secondary sources are useful in the production of expedient tools because of their widespread geographic distribution. Andrefsky (1998) and Teltser (1991) have noted that the organization of lithic technology has focused on the importance of raw material quality in making the choices between an expedient or curated method of manufacture.

The necessity of high quality raw material has been overplayed in the literature (e.g., Johnson 1986). Koldehoff (1987) notes that the objective in using the bipolar technique was to produce flakes by individuals with little training in flint working. This allowed for the production of expedient tools, which required little modification to perform a wide range of household tasks.

The circumstances that dictate the use of either formal or expedient technology are not clear. Sassaman (1992) and Versaggi (1996) have noted the use of both types of technologies among mobile hunter-gatherers is dependent on the task at hand and even the composition of the work groups. The reduction trajectories may also create multiple expedient technologies in an assemblage (Cobb and Webb 1994:213). Variation in the production continuum may exhibit the shift from amorphous core to bipolar core reduction as seen at Mississippian sites in southwestern Illinois (Koldehoff 1987). These two technologies are interdependent and the ability to shift between the two is linked to other factors beyond just mobility and availability of high quality raw material.

Managing Risk and the Technological Responses

Archaeology has generally approached the subject of "risk" in the context of subsistence (Bamforth and Bleed 1997:114). The research in stone tool production has

approached risk under a different label. Generally, different types of lithic technologies are defined as being more predictable or reliable as an explanation of why a certain tool type is selected (e.g., Andrefsky 1993, 1998; Bamforth 1988). The tool type universally proposed as being a risk reducer is the biface. Bifaces have been shown to have three properties, which make them flexible enough for any situation. First, bifaces are multi-functional. The bifacial technology allows the tool to be easily transformed into a variety of tool types to accomplish specific tasks. Second, bifaces are maintainable. Worn tool edges can be quickly reworked and sharpened to fulfill a need. Finally, bifaces are portable. The biface has multi-functional and maintainable properties that would have provided prehistoric hunter-gatherer groups, working away from residential areas, a tool that could be adapted to unpredictable situations.

Typically, within logistically organized hunter-gatherer groups, work parties would be hunting, trapping, or fishing in areas a far distance from base camp for extended periods. During this period the risk associated with procurement and processing activities was extremely high. In order to reduce the risk associated with equipment failure the right type of tools would be needed. Odell (1996) notes that formal bifacial tools were the best for this situation because of their versatility, predictability, and portability. Therefore, hunting and gathering parties which planned to be away from the base camp or village would equip themselves with highly portable bifacial cores and/or preforms which could be transformed into any number of tool types.

Work parties sent out on day trips to gather resources within the foraging radius of residential base would have had a lower level of risk. There would be little need to carry formal tools. A large percentage of the work party members may have been women, children, and the elderly. The specialized skill of bifacial reduction may not have been present or needed by these groups. It has also been suggested by researchers (Cobb and Webb 1994; Montag 1998; Sassaman 1992; Versaggi 1996; Versaggi et al. 2001) that there is a gender issue surrounding the making of bifacial tools. Thus, within a single hunter-gatherer residential unit, work parties completing different types of tasks within and away from base camps were utilizing both formal and expedient tools as appropriate to the risks of their tasks (Sassaman 1992).

This brings the argument back to managing the risk involved in obtaining resources for a group. Parry and Kelly (1987) have argued that prehistoric mobile populations used formal core reduction techniques to produce a versatile and portable technology. However, when subsistence strategies shifted towards horticulture the need for formal technology was no longer necessary.

The argument that shifts in technological organization was a reaction to a shift to horticulture presents problems, which have not been discussed widely in the literature. One problem is that researchers typically define resource procurement as only food related (e.g., mobile hunting parties vs. sedentary horticulturalists). I believe this issue needs to be broadened to encompass activities, which were as important as food acquisition and still required stone tools to accomplish the task, such as the procurement of non-food raw materials. This means examining land use patterns and the geographic context in which stone tools are utilized.

Environment and Variable Subsistence Activities

Prior to the Parry and Kelly (1987) paper, which greatly influenced the perspective of the organization of technology, attempts were made to look at the regional diversity of sites and stone tool use (Jefferies 1982). Jefferies (1982) recognized diversity in the lithic assemblages recovered from sites in Lookout Valley on the Cumberland Plateau in northwestern Georgia. His research area was divided into three separate physiographic zones: floodplain, valley upland, and upland plateau (Jefferies 1982:102). This study is important because it sought to examine the nature of the relationships between debitage attributes, site location, and the occurrence of certain types of stone tools within different geographic contexts. Jefferies concluded that there was significant diversity in the assemblages based upon the site location upon the landscape. He believes the varying reduction stages and the production trajectories represented by the assemblages from each geographic context caused these differences.

A more recent study also examined the dichotomy, which exists between uplands and flood plain lithic assemblages in the Susquehanna Valley of New York. Montag (1998) found that the organization of lithic technology was not solely dictated by mobility of hunter-gatherers versus the growing sedentism of the Late Woodland groups. Her research demonstrated that formal bifacial technology was not abandoned by sedentary horticulturalists. In fact the results from her study show that formal bifacial technology was quite prevalent in the upland geographic context. In the village context the lithic assemblages appeared to signal expedient technology with the presence of both bipolar cores and flakes as well as a predominance of expedient tools. The upland assemblage had a paucity of cortical flakes and a high percentage of bifacial thinning flakes suggesting a late stage reduction trajectory. Montag (1998) concluded that this separation of techniques added a level of behavioral complexity to the way lithic technology and prehistoric groups were organized, a point that has been overlooked by earlier lithic studies.

Montag's (1998) study has shown that the validity of accepted models of lithic technological organization is questionable when assemblages are placed in their geo-

graphic context. As suggested by this study, lithic assemblages are linked with the geographic context in which they are found by the type of tasks being performed and the level of mobility and risk associated with them. These tasks were done to fulfill the requirements of the group and/or the individual, such as the harvesting of grasses, reeds, bark, and wild foods; the collection of berries and nuts; the hunting and trapping of game animals; or fishing. These forays into the surrounding countryside added a dimension of mobility and risk that would require the use of a portable, risk reducing tool kit to complete the task.

The present models of the organization of lithic technology have been built upon certain assumptions of decreasing mobility and a logistical shift to horticulture. Criticisms have been raised concerning the focus on single variables, such as mobility, in attempts to reconstruct prehistoric technological organization. Critics have called these interpretations "subjective, intuitive and sometimes contradictory" (Kelly 1992:56). Mobility is an important variable, but not the only one. In association with other variables, such as risk, raw materials, and geographic context, researchers have begun to rethink how multiple variables influence prehistoric social behavior and also the technological organization of the lithic industry.

The diversity of lithics within the Upper Susquehanna River Valley can be linked to different physiographic zones. The region supported prehistoric peoples who were hunter-gatherers to varying degrees. The prehistoric settlement patterns and the landscape played a crucial role in their approach to mobility, risk management, and the environment. How prehistoric groups managed these variables should be reflected in part in their lithic assemblages.

PHYSIOGRAPHIC CONTEXT OF THE UPPER SUSQUEHANNA VALLEY

The emphasis placed upon mobility, raw materials, risk management, and geographic context vary among lithic researchers. Due to the fact that lithic studies using comparative samples of sites are draining on resources, many "main stream" regional theories are based upon a few sites from regions with little contextual commonalities.

The Susquehanna River's source is Otsego Lake, Cooperstown, New York, running south through Pennsylvania, eventually draining into the northern end of the Chesapeake Bay at LeHavre de Grace, Maryland. The river is divided into six subbasins: the Upper Susquehanna, Chemung, Middle Susquehanna, West Branch Susquehanna, Juniata, and Lower Susquehanna. This study will focus on the Upper Susquehanna subbasin (Figure 10.1). This subbasin consists of 24 principal tributaries, which originate in the uplands above the valley floors. The sources for these smaller waterways are lakes, marshes, and seasonal streams, many of which are in the uplands (Versaggi 2000:1).

The Upper Susquehanna is the principal drainage of the Allegheny Plateau. The plateau consists primarily of shales, sandstones, and limestones. Narrow valleys are quite numerous throughout the region with upland divides reaching heights of 900 m (3000 ft) ASL (Funk 1993:43). The glacial influence in this region is reflected in the formation of deep "U" shaped valleys in which the Susquehanna and its principal tributaries flow. The valley bottoms also were developed through post-glacial fluvial processes. Landforms, such as moraines, kame deltas, and outwash terraces, were formed as glacial ice retreated north approximately 12,000 B.P. These landforms would later become the focal points of prehistoric occupation within the Upper Susquehanna drainage (S. Grills, this volume).

The physiographic context of the Upper Susquehanna offered the hunter-gatherer groups a diversity of resources. The landscapes supported diverse seasonal flora and fauna from the floodplains to the uplands. This study uses the three geographic contexts defined by Robert Funk (1993), which are valley floor, valley wall, and uplands/interfluves (Figure 10.2). Table 10.1 presents a summary of the phyisographic zones and the sites sampled from these contexts for this study. Each one of these areas offered various critical resources such as "water, food, firewood, and industrial raw materials" (Funk 1993:65). Valley floors are at low elevations between 300-330 m (1000-1100 ft) ASL. The topography is generally flat with some gentle slopes formed by glacial deposits and modified post-glacially by meandering streams and rivers and floodplain development. Valley walls range in elevation between 330-457 m (1100-1500 ft) ASL. The topography ranges from gently to steeply sloping. Tributary creeks may form narrow floodplains in the flatter areas. The uplands are characterized by their height above the valley floor, which ranges in elevation between 457-900 m (1500-3000 ft) ASL. The topography is rugged with many abrupt changes in elevation. These areas are where the headwaters of most of the streams are found while ponds and bogs are located in the basins. These three areas have a distinct physiographic and environmental character, which was utilized by prehistoric groups.

DEBITAGE ANALYSIS AND RESULTS

The archaeological analysis of stone tools is one path to understand patterns of behavior. Data collected on lithics generally fall into two general categories, technological

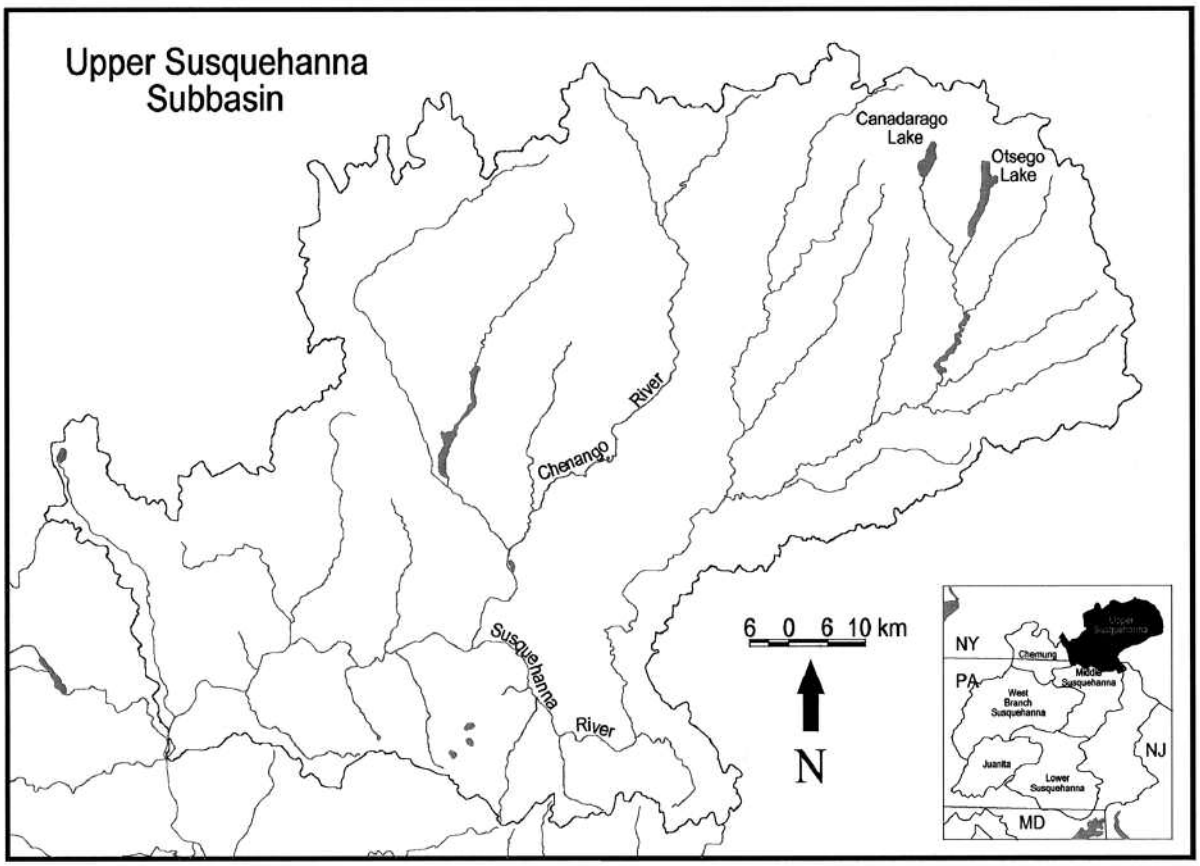

Figure 10.1. The Upper Susquehanna River sub-basin.

and functional. Technological data provide information on the techniques and stages of lithic reduction that were part of tool production and maintenance. Information regarding procurement of lithic raw material is recorded during the analysis in order to address specific raw material sources and identify strategies for the acquisition of these resources. The widespread use and availability of Onondaga chert in New York makes it difficult to understand these acquisition patterns (Carmody 1999).

A functional analysis focuses on the type of tools being used in relation to the tasks being preformed. The shapes and sizes of formal tools are generally used to infer functional information, despite the fact that utilized flake tools represent a significant portion of the lithic assemblages (Gero 1991; Odell 1980; Pope 1998; Young and Bamforth 1990). Given the poor preservation of non-lithic materials on most sites, micro-wear traces are sometimes the only means available to identify and evaluate certain types of processing activities (Pope 1998:31).

Lithic Analysis and Classification

The general classification system used for the analysis of this assemblage was initially developed by Pope (1998). The typology used is modeled after the type-subtype classification system described by Odell (1982, 1996). This system of analysis was designed to efficiently gather formal and technological information necessary to distinguish and interpret variation in chipped stone industries. The strength of Odell's typology is that it facilitates description and interpretation of tool manufacturing activities relative to particular raw materials, tool use, and discard for particular cultural and social contexts (Odell 1996:20-1; Pope 1998:20).

The basic classificatory elements of the typology are types and subtypes. Following Odell (1982, 1996), Pope (1998) uses the type and subtype classification to differentiate formal and technological variation. Initially artifacts are identified and classified in a hierarchical structure: unifacial tool, bifacial tool, core, flake, chunk/shatter, and other. These classifications enable specific artifact types and subtypes to be organized into groups that reflect particular technologies (Pope 1998).

The technological analysis was structured to characterize both the tool manufacturing process and the byproducts of production (Pope 1998:29). Mass analysis has been shown to be an efficient method for obtaining size attributes of large data sets which can vary significantly with technology and stage of manufacture (Ahler 1989; Collins

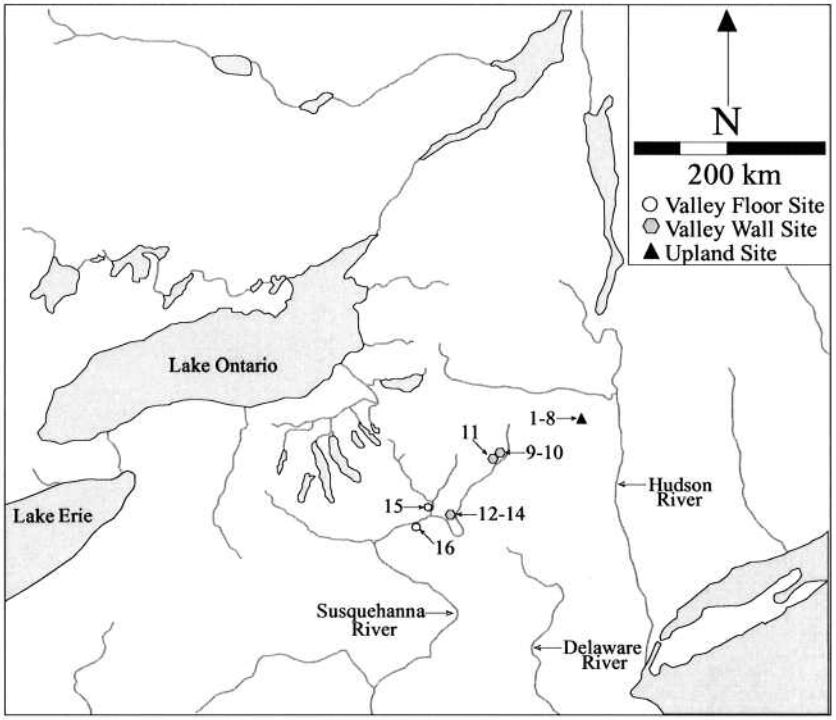

Figure 10.2. Approximate locations of the sites within the three physiographic contexts.

1975; Pecora 2001; Stahle and Dunn 1982, 1984). The size categories serve as sub-samples for which meaningful technological attributes can be recorded (Pope 1998:29). When combined with selected flake attributes the size-graded data (referred to as aggregate or mass analysis) has been used with success to model production strategies, primarily for bifacial technologies (Amick 1985; Behm 1983; Johnson 1989; Patterson 1987; Sullivan and Rozen 1985).

Lithic Raw Materials

The lithic raw material is considered an important attribute. Differences in raw material types are one of the most basic and easily observed physical variables in a lithic assemblage. When raw material types are identified they can help inform researchers about prehistoric exchange networks (i.e., non-local chert traded/brought into an area), functional choice (i.e., one chert/source may work better for a specific tool type than another chert/source), and the possible reduction technique (i.e., glacial cobble and the use of bipolar reduction).

New York has three major chert-bearing rock units, which converge in the Hudson Valley region. Two of these are the chert-bearing limestones, called the Onondaga and Helderberg formations, which are part of the greater Devonian limestones. The third rock unit is the chert-bearing Normanskill shale, part of the Ordovician shale formations (Cassedy 1992; Grills 2002; Hammer 1976). Geographically the Normanskill chert outcroppings are confined to the Hudson Valley and eastward. The Onondaga cherts outcrop in a broad band across southern New York, starting west of the Hudson Valley and stretching as far west as the Niagara Peninsula, near Buffalo (Cassedy 1992; Grills 2002; Hammer 1976; Lavin and Prothero 1992). The eastern Onondaga formations extend south into northern New Jersey, Pennsylvania, and Tennessee (Hammer 1976:48). Helderberg chert outcrops west of the Hudson River along the Allegheny Plateau between the Onondaga and Normanskill formations (Cassedy 1992; Grills 2002).

The Normanskill, Onondaga, and Helderberg chert formations make up the majority of the raw material types within lithic assemblages found in New York. Prehistoric sites located in southern, central, and western New York can be expected to have Onondaga chert as the most common type used by prehistoric groups (Cassedy 1992). Sites in eastern New York are more likely to have Normanskill chert present within lithic assemblages. Onondaga source areas have been identified in the Buffalo area (Prisch 1976), Normanskill chert in the Coxsackie-Catskill area (Lavin and Prothero 1992), and Helderberg chert in eastern Green County (Cobb and

Table 10.2 Raw Material Types Identified from the Three Physiographic Zones.

Raw Material	Valley Floor		Valley Wall		Upland		Total	
	n	%	n	%	n	%	n	%
Onondaga	1252	98.1	1033	98.8	339	69.9	2624	93.3
Normanskill	0	0.0	0	0.0	5	1.0	5	.2
Esopus	0	0.0	7	.7	134	27.3	141	5.0
Jasper	3	.2	0	0.0	2	.4	5	.2
Cherty Limestone	11	.9	0	0.0	4	.8	15	.5
Quartzite	.0	0.0	0	0.0	3	.6	3	1
Unidentified	10	.8	6	.6	3	.6	19	.7
Total	**1276**	**45.4**	**1046**	**37.2**	**490**	**17.4**	**27.12**	**100.0**

Webb 1994). The reason for the lack of identified quarry sites may be tied to the availability of these raw materials in secondary stream and gravel deposits (Lavin and Prothero1992).

The lithic materials examined for this study were almost completely made up of Onondaga chert (Table 10.2). However, the sampling of upland sites outside of the Susquehanna drainage contained some varying raw material types. These upland sites yielded an unidentified siltstone. Based upon existing descriptions of siltstone and shales, which were utilized by prehistoric groups, I believe that this stone is an Esopus shale chert (Fix 1988). Esopus shales were formed during the Devonian period and are formed in close association with the Onondaga limestones. The formation is most dense within the southern and eastern areas of New York state. Moving west the Esopus shale is not present beyond Otsego County, New York (Fix 1988). The shale grades from a very fine-grained black to a coarse grained dull charcoal material. The outcrops of Esopus provided an unflawed, highly workable raw material, though it tends to be softer than other regionally available cherts (Fix 1988).

Sampling and Cataloging

All assemblages were size-sorted through a series of four, size grade nested screens: 1/2 inch, 1 inch, 2 inch, and 3 inch square mesh. Counts and weights were recorded for each size grade by provenience. Within the assemblages, attributes were recorded for all size grades. Flakes were broken into like attribute groups. Total counts and weights were recorded for each group of like attributes. The resulting lithic catalogs were entered into a relational database management program (Paradox) to facilitate subsequent analysis.

Mass Analysis Results

Size and weight are important variables for examining the production of stone tools. Ahler (1989) and Schott (1994) have argued that the distribution of debitage within different size grades in combination with average weight can be a sensitive indicator of different types of reduction. Flake size grade is considered a good discriminatory characteristic of bifacial reduction stages (Andrefsky 1998:100). Debitage sizes generally become smaller as a piece moves through the reduction trajectory. Flake weight is an easy and reliable way to determine reduction stage. Mauldin and Amick (1989:77) have shown that debitage weight correlates with flake size. Based upon these previous studies, I expect that assemblages with higher quantities of small debitage will indicate later stage reduction. Assemblages with larger debitage would be an indicator of primary reduction. Using the results of these previous studies, differentiation within the size variable was expected among the physiographic zones. When the percentages of each size grade were calculated, debitage that was less than a 2 inch and greater than a 3 inch (Size Grade 4) was the most common size in the sites sampled for all physiographic zones (Figures 10.3 and 10.4). Size counts alone were not yielding clues to help characterize reduction strategies. The dominance of size 4 debitage in all of the assemblages was interesting. This strong pattern could reflect later stages of lithic reduction on all sites, or the pattern could indicate limitations in the size of the core.

Bradbury and Franklin (2000) note the importance in considering the size of raw material prior to reduction, moving beyond the old adage that "a flake can be no bigger than the core." Their replication experiments found that "package size" or the initial size of the raw material prior to reduction would directly affect the size of debitage being produced. The study by Bradbury and Franklin (2000) also brought to light how the cortical composition of an assemblage would be affected by package size. Andrefsky (1998) noted that cortex will aid in recognizing the reduction stage. Bradbury and Franklin (2000) have concluded that this is not necessarily true. They state that the percentage of cortex on the dorsal surface is a good indicator of the initial package size (Bradbury and

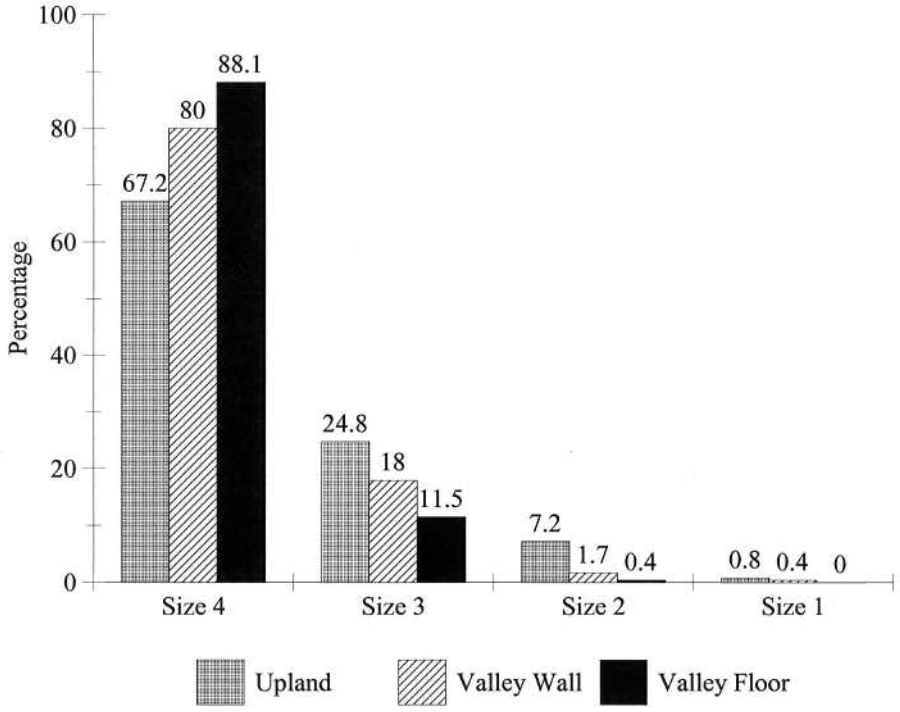

Figure 10.3. Percentage of flake debris from each physiographic zone.

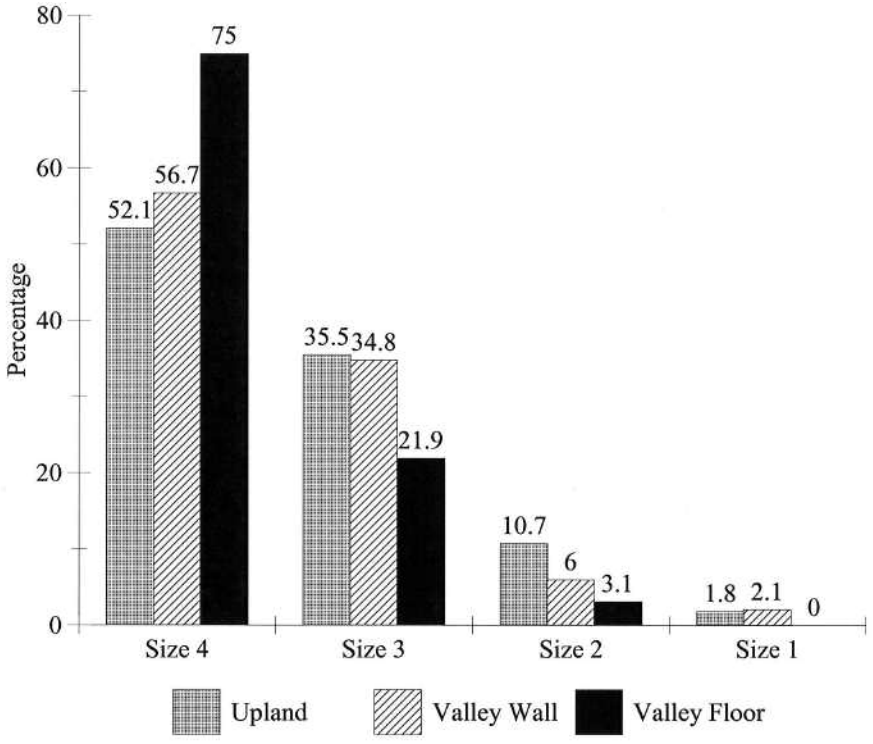

Figure 10.4. Percentage of non-flake debitage by size grades from each physiographic zone.

Franklin 2000:48-50). The fact remains that either initial package size or stage of reduction could explain the differences in the size variable.

To further explore how package size might affect the assemblages within the different contexts, I turned to average weight of non-flake debitage. This includes pieces categorized as cortical and non-cortical chunks, shatter, and cores.

The mean weights are used here to estimate the size of the initial packages selected to produce the assemblages. The Valley Floor has the smallest mean weight (2.8 g). Moving away from the Valley Floor the mean weights substantially increase. Valley Wall sites show an increase of over three times the weight of raw material in the assemblage (8.7 g). The Upland zone decreases in weight, but remains approximately two times the amount observed on the Valley Floor (5.3 g). Based solely on these mean weights, at least two possible explanations could account for these patterns. First, zones with higher mean weights may represent an early point in the reduction sequence. If this is true then flake debitage attributes should reflect a similar trend towards early stage reduction. Second, the raw material could require a reduction process, such as bipolar reduction, which results in blocky chunks and shatter both of which are heavier than flakes. The extremely low mean weights calculated for non-flake debitage at Valley Floor sites shows either middle and late stage reduction may be occurring or a small raw material source was being used. The package size of the raw material at valley wall sites is larger than that used at flood plain or upland sites.

The mean weights of non-flake debitage and cores in the valley wall sites were both substantially higher than either the uplands or valley bottom sites. Examining non-cortical chunk mean weight from the three zones (Figure 10.5) shows that the valley wall debitage is approximately two times heavier (6.3g) than non-cortical chunk from the valley floor (3.3g) and upland sites (3.9g). This leads to the conclusion that the package size of the raw materials used at the valley wall sites was larger when compared to the package size at either the valley bottom or uplands. If true, this pattern should be repeated for debitage.

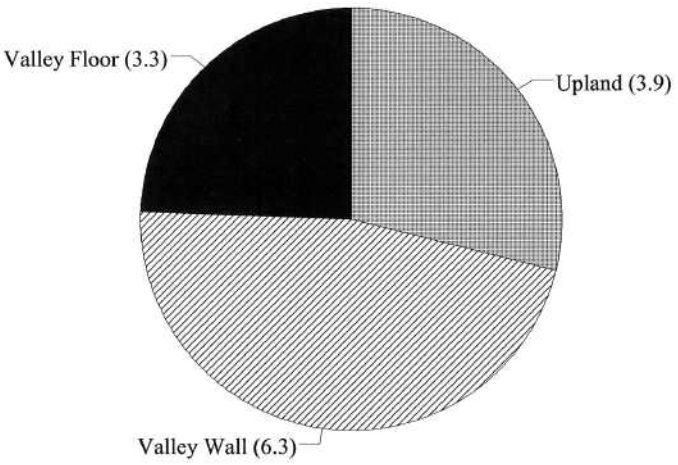

Figure 10.5. Mean weight of non-cortical chunks by physiographic zone.

The flake debitage was then examined to determine if my conclusions about package size were correct (Figure 10.6). The mean weights of cortical flakes revealed that the upland sites had an extremely high average flake weight of 4.5 g, as compared to the valley wall (2.3 g) and valley bottom (1.2 g). This result does not compare with the non-flake debitage, where the valley wall sites had heavier mean weights. The heavier mean weight of cortical flakes appears to signal that larger flakes are being removed from the raw material package in the uplands. Larger flakes can also denote a larger initial package size. The valley bottom appears to confirm that either a smaller package size is being used or later bifacial reduction is occurring. When comparing the non-cortical flake average weights (Figure 10.6) the valley wall has an average weight of 1.2 g. This is double the 0.6 g calculated for the valley bottom, but only a fraction above the uplands with a mean weight of 1.1 g. The valley bottom disparity in the non-cortical mean weight and large upland cortical weight are likely influenced by flakes that are abnormally heavy. These outliers are likely influencing the mean weights of non-cortical debitage.

To compensate for the extreme outliers, median weight was calculated. Figure 10.7 presents the median weights of non-cortical and cortical flakes from each physiographic zone. Since mass analysis does not consider the individual weights of flakes, the raw data needed for calculating the median were missing. In this case the average weights of flakes, which showed the same attribute combinations were calculated. For instance, the average weight was calculated for flakes that were non-cortical, with >2 dorsal scars, and a <90° flat platform. Average weight is greatly influenced by outliers, but general trends will still be present. Median weight is less influenced by extremes. The results show that median weights were lower for all physiographic zones regardless of cortex variable. The results show that the average weight at all sites was definitely influenced by outliers of heavier debitage, especially the upland cortical flake weight, with a median equaling the valley floor zone (0.9 g). The median weight of cortical flakes at valley wall sites stands out as being significantly different from either of the other zones. It is unclear from the mass analysis what may be causing this pattern. I propose this may be an indication that a different type of reduction process is in use at the

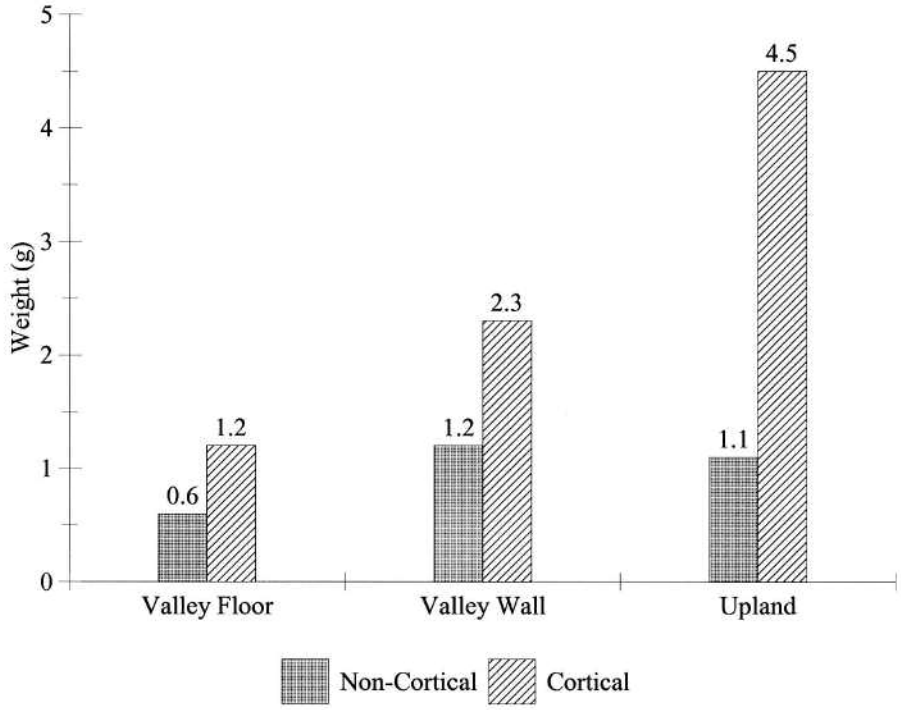

Figure 10.6. Mean weight of flake debitage by physiographic zone.

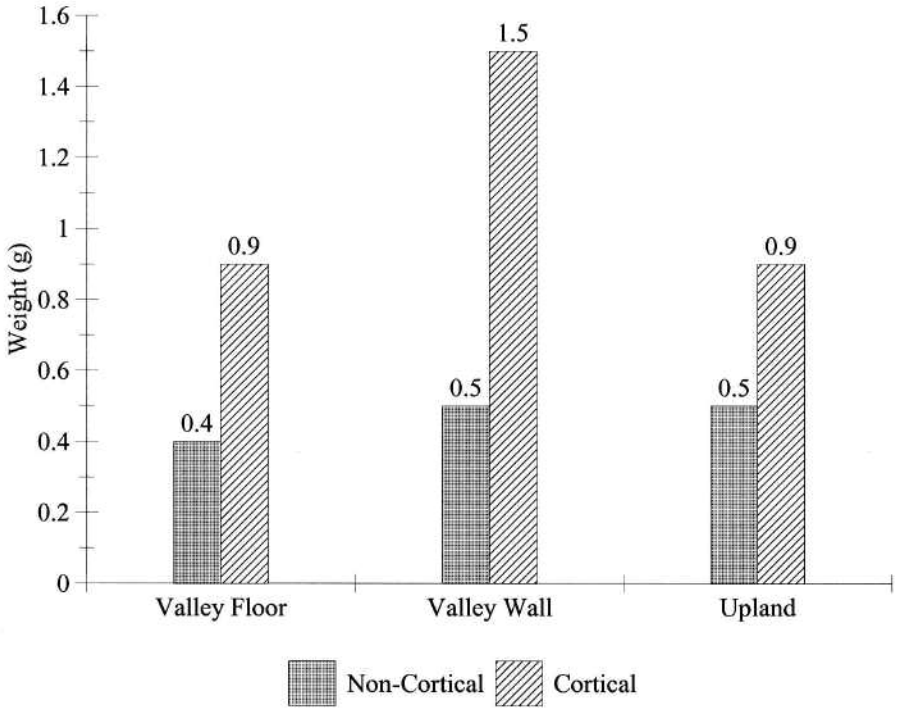

Figure 10.7. Median flake weights calculated from the average weights of attribute classes.

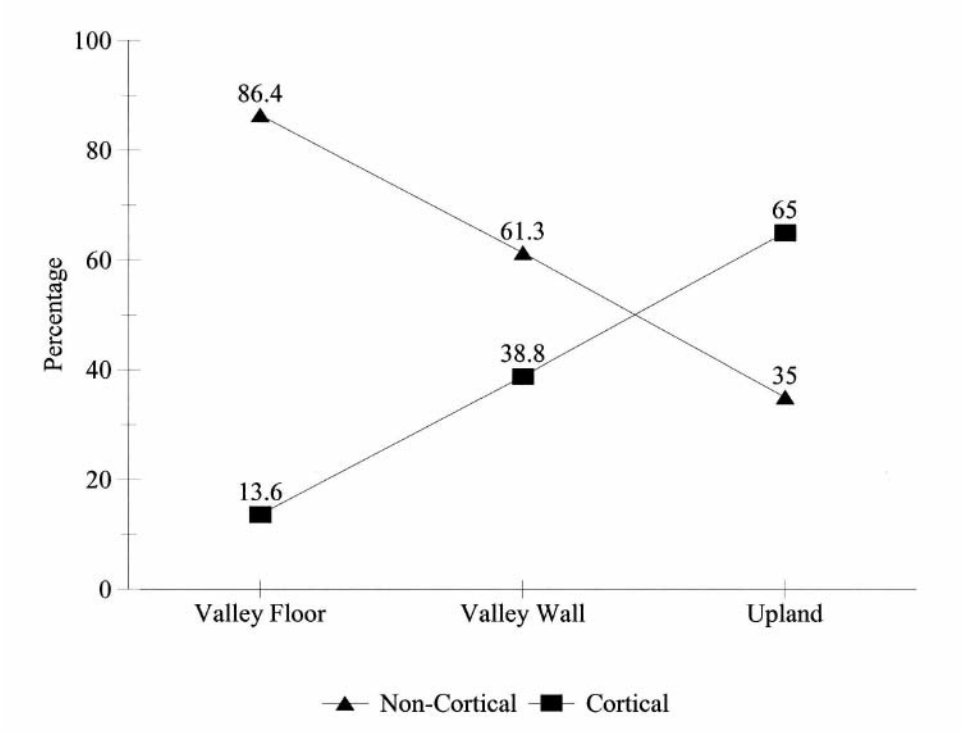

Figure 10.8. Percentage of cortical and non-cortical flake debitage by physiographic zone.

valley wall sites. This question may be answered through the flake attribute analysis.

The median weights for non-cortical flakes appear to be the same across all of the physiographic zones. This pattern is interesting in that it shows that size grade is not a differentiating factor in flake assemblages, especially within the 3 to 2 size range. The reason for this also remains unclear but it appears that package size is a viable factor that could produce this pattern. The raw material used in this region generally is glacial cobbles collected from the outwash terraces and river/stream beds. Though cobble size varies widely, there may be a technical reason influencing the selection of a certain size of chert cobble. The mean and median weights have produced some interesting results. The weights appear to show that there are distinct differences among the three physiographic zones, at least within the cortical category. The calculation of flake weights is only one dimension of this mass analysis. Figure 10.8 presents the percentages of cortical and non-cortical flakes present in each of the physiographic zones. In calculating raw counts, there is a statistical difference between the three physiographic zones (X^2=157, *df*=2, p<0.001). The trend shows a decrease in the amount of non-cortical flakes moving away from the valley floor and an increase in cortical flakes. The reason for this probably is related to the stage of production occurring at these sites. It appears that early stage reduction is less common on valley floor sites and more common in the uplands. Conversely, late stage reduction flakes are more common on valley floor sites and less common in the uplands. However, only the attribute analysis will confirm this interpretation.

Mass analysis has shown that differences do exist between the three physiographic zones. The cause for these differences is not clear. A detailed analysis of the flake debitage is required in order to understand the type of reduction strategy being employed within the physiographic zones. To address this question, the flake debitage was examined using attribute analysis.

Attribute Analysis

The attribute analysis is used to signal to the researcher the type of reduction process being employed and the dominant reduction stage in the assemblage. Attributes include platform type, platform angle, dorsal scar count, and cortex. The attribute variables employed could comprise a daunting total of 140 different possible attribute combinations. The catalog lists a total of 2,002 flakes. The attribute analysis examined a total of 1,114 flakes, including only whole and broken flakes and excluding flake fragments, which had no platform present for analysis. The following section discusses each attribute combination and the patterns, which are present. I will discuss how the reduction process is sometimes masked when examining single flake attributes. This will lead to the use of flake attribute combinations through the creation of

Table 10.3 Mean Weight of Non-Flake Debitage by Physiographic Zone

Dorsal Scar Count	Valley Floor		ValleyWall		Upland		Total	
	n	%	n	%	n	%	n	%
<2 Dorsal Scars	69	15.8	219	42.6	92	56.4	380	34.1
>2 Dorsal Scars	368	84.2	295	57.4	71	43.6	734	65.9
Total	**437**	**39.2**	**514**	**46.1**	**163**	**14.6**	**1114**	**100.0**

dorsal and platform packages. Examining flake attributes in this way will build the patterns of reduction and begin to model organization of lithic technology in the three physiographic zones.

The dorsal surface of the flake (the opposite being the ventral surface) has been extensively examined by archaeologists to better define the stage of reduction and type (Andrefsky 1998; Gilreath 1984:3; Johnson 1987:193; Magne 1985). By definition the dorsal surface either contains flake scars, cortex, or both. Researchers count these flake scars or the ridges that are produced by the removal of flakes from the piece (Andrefsky 1998:105-6). Lyons (1994:33) and McDonald (1994:68) both showed that earlier stage flakes had less dorsal scars than later stage flakes. Others have been cautious to note that the dorsal scar attribute can be difficult to measure and may not be a good indicator (Baumler 1988:262; Shott 1994:80).

In this study dorsal scars were counted, this did not include small flake removals that resulted from platform preparation, breaks, modification after detachment, and shattering. The dorsal scar counts were recorded for each flake either as "<2" or ">2". Table 10.3 presents the dorsal scar counts and percentages present in each of the assemblages. The data reveal a correlation between the physiographic zone and dorsal scar counts (Table 10.3 and Figure 10.9). The number of flakes with >2 dorsal scars peaks on the valley floor and diminishes on sites in the uplands. The opposite trend occurs with <2 dorsal scar flakes counts. Statistically these are significantly different and not random (X^2=118, *df*=2, p<0.001).

The dorsal scar variable appears to show that more later stage reduction is occurring on the valley floor sites and earlier stage reduction in the uplands. Researchers have noted that dorsal scar counts can be influenced by the size of the objective piece (package size), flaking technique used, raw material type, and the type of artifact

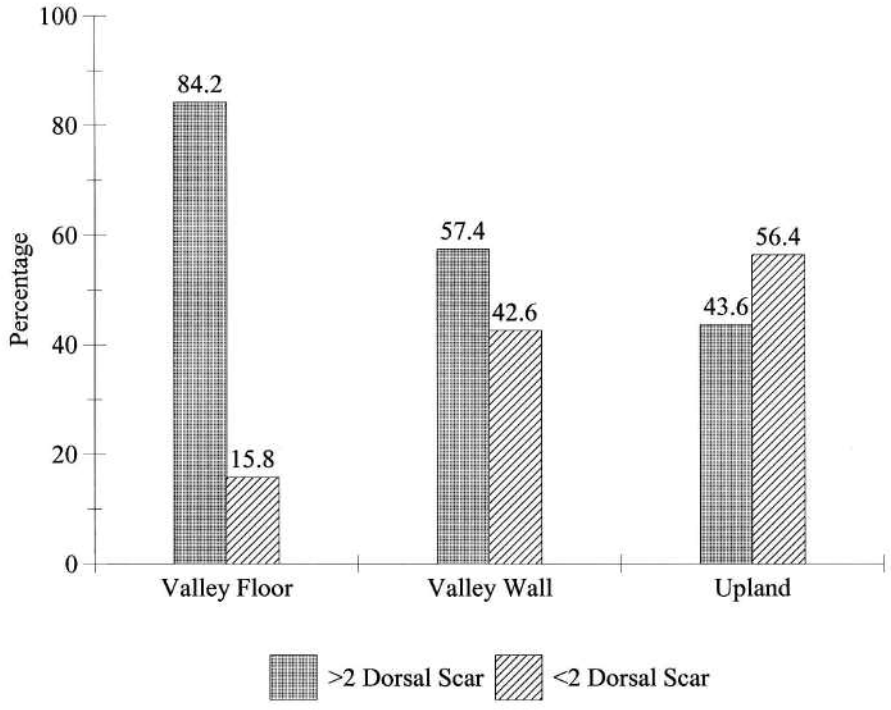

Figure 10.9. Percentage of dorsal scar counts by physiographic zone.

being manufactured (Andrefsky 1998:106). The two influences most likely to affect the patterning observed in the data are the package size and flaking technique. Dorsal scar counts alone cannot measure these details. It is necessary to combine the attributes to observe the patterns of reduction at the different locales.

The second attribute recorded in the analysis is cortex. Cortex is used by researchers to indicate reduction stage in tool production (Johnson 1989; Morrow 1984). Andrefsky (1998:101) defines cortex as "either chemical or mechanical weathering of the stone surface". Chemical weathering is a result of exposure to moisture and/or heat causing the chemical composition of the rock to change. Mechanical weathering changes the texture of the stones surface, most commonly by being rolled in river/stream beds becoming polished smooth. A flake specimen with weathering present on the dorsal surface is said to have cortex present.

The analytical system used for this study records three types of cortex (none, smooth, and rough). Flakes with no cortex present on the dorsal surface are marked as "none". The "smooth" cortex type accounts for the stone, which has undergone mechanical weathering due to rolling in river and streams. The "rough" cortex type denotes stone that appears to have been mined or excavated from outcrops. Surface roughness most likely is caused by chemical erosion of the limestone exterior, though this would not apply to cherts that derive from shale. The cortex types are divided, based upon the percentage of cortex present on the dorsal surface (<50% vs. >50%). This system includes five categories for cortex based upon type and quantity.

If late stage reduction is occurring in an area, then a lower percentage of debitage with cortex would be present. The results for the cortex attributes appear to show this trend (Table 10.4). The valley floor assemblage had the lowest percentage of flakes with any type of cortex present. Figure 10.10 displays less-cortex on the valley floor and an increasing amount as sites move into the uplands.

Cortex in this instance is a good indicator of raw material sourcing. Within the assemblage, 32.5% of the flakes have smooth cortex present. This indicates that cobbles, mechanically weathered in stream or riverbeds, were being utilized as the main source of raw material. The extensive glacial activity, which shaped the Susquehanna River Valley is the original source of these chert cobbles. During the retreat of the ice, glacial till was deposited and washed into terraces located on the valley walls. These cobbles would erode out in small upland streams where native peoples could easily collect them for primary reduction. The small percentage of rough cortex (1.8% in the uplands and 0.2% on the valley wall) is insignificant. It is difficult to make any firm comments on such a small quantity of flakes. One explanation may be that a high density of cobbles was located in streambeds, making the need to excavate raw material from an outcrop unnecessary. Another reason may be the fact that Onondaga did not outcrop in these areas at all and cobble chert was the only alternative. Chert cobbles are easily collected in streambeds and on the surface of tilled fields on the valley walls and uplands.

Research has recognized that striking platform attributes can discriminate reduction stages and tool types produced (Cotterell and Kamminga 1987; Dibble and Whittaker 1981; Frison 1968; Hayden and Hutchings 1989; Magne and Pokotylo 1981). Different types of platforms have been associated with hammer type, the type of objective piece, and the stage in bifacial reduction. Striking platforms are defined as the surfaces that are impacted by a "percussor" (e.g., hammer or billet) to detach a flake. Platforms are prepared by rubbing, abrading, crushing, chipping, or grinding. This allows the toolmaker to isolate the platform for striking (Andrefsky 1998:92-93).

A simple nominal scale of four platform types was adopted for this study. The first type is the cortical platform, defined as a platform with an unmodified cortical surface. The early stage reduction of a river cobble would be the chipping and removal of the cortical surface. This would produce flake debitage with cortical surfaces (Andrefsky 1998:93).

The second type is the flat platform, characterized by a smooth flat surface, which has been impacted to detach a flake. Andrefsky (1998:94) states that in most cases flat platforms are the result of non-bifacial tool production usually from unidirectional cores. Andrefsky notes that small debitage with flat striking platforms may have been removed from a flake blank or an objective piece with a

Table 10.4 Cortex Types by Physiographic Zone.

Cortex Type	Valley Floor		Valley Wall		Upland		Total	
	n	%	n	%	n	%	n	%
>50% Smooth	15	3.4	123	23.9	49	30.1	187	16.8
<50% Smooth	44	10.1	77	15.0	54	33.1	175	15.7
>50% Rough	0	0	1	.2	3	1.8	4	.4
No Cortex	378	86.5	313	60.9	57	.35.0	748	67.2
Total	**437**	**39.2**	**514**	**46.1**	**163**	**14.6**	**1114**	**100.0**

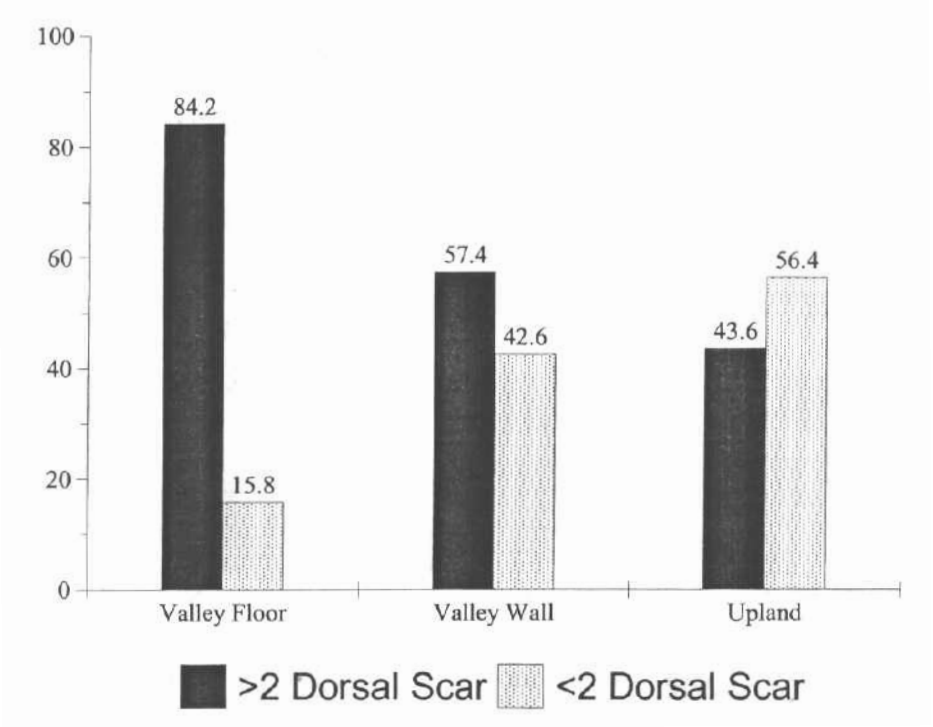

Figure 10.10. Percentage of cortex types by physiographic zone.

flat surface which is undergoing bifacial reduction.

The third type is the faceted platform, also called a complex striking platform. This platform type generally has an angular surface created by the removal of several striking platforms. Researchers believe that the additional care and preparation of this platform type is indicative of later stage bifacial reduction. A tool-maker will prepare a platform to remove a precise flake shape, thus achieving a better tool (Andrefsky 1998:96).

The final type is the collapsed platform. This platform is created when the energy of the percussor either crushes the platform or creates an "eraillure" flake, which partially destroys the platform surface. The result is that a platform exists but the researcher is unable to define the platform as either flat or faceted. This is not indicative of a certain stage in the reduction process, but has been generally associated with the bipolar reduction technique.

The data for the platform types produced results, which had been predicted previously by the flake attributes already discussed. Table 10.5 presents the counts and percentages for each platform type within the three physiographic zones. The valley floor and upland dichotomy appears again when comparing faceted and cortical platform types (Figure 10.11). Faceted platforms from the valley floor make up 30.9% of the flake assemblage, 13.0% on the valley wall, and only 5.5% of the upland assemblage. The percentages work in the opposite direction for cortical platforms, starting with the uplands (36.2%), then the valley wall (16.7%), and finally to the valley floor (4.8%). Following this trend it shows that late stage bifacial reduction is occurring on the valley floor to a large degree but becomes less prominent on sites on the valley walls and in the uplands. The cortical platform data show that primary reduction of raw materials was more common away from the valley floor, possibly near areas where raw materials are readably available in surface areas.

An interesting result of the platform analysis was the flakes with flat platforms. All three physiographic zone

Table 10.5. Platform Types by Physiographic Zone.

Platform Angle	Valley Floor		Valley Wall		Upland		Total	
	n	%	n	%	n	%	n	%
Flat	271	62.0	344	66.9	94	2.5	709	63.7
Cortical	21	4.8	86	16.7	59	36.2	166	14.9
Faceted	135	30.9	67	1.4	9	5.5	211	18.9
Collapsed	10	2.3	17	3.3	1	.6	28	2.5
Total	**437**	**39.2**	**514**	**46.1**	**163**	**14.6**	**1114**	**100.0**

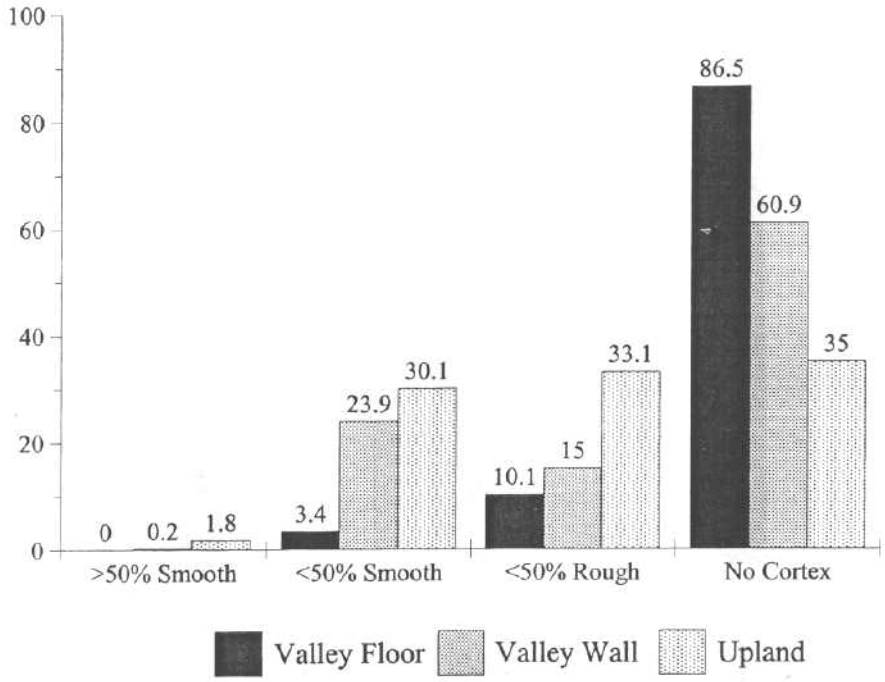

Figure 10.11. Percentage of platform types by physiographic zone.

assemblages have flat platforms as the most common type. Does this attribute reveal anything? As discussed above, flat platforms are prevalent during the production of non-bifacial tools, reduction of unidirectional cores, or on small debitage from an objective piece with a smooth surface. The mass analysis indicated that the valley floor had the highest percentage of size 4 (<3) flakes. Late stage bifacial reduction and resharpening tasks would create small flake debitage, which would not reveal dorsal scars from early reduction stages. Alternatively, either non-bifacial tool production or the use of unidirectional cores may be occurring on valley wall and upland sites. This will be explored further when examining formal and expedient tool types from the three physiographic zones.

The last flake attribute used in the analysis is platform angle. Researchers (Dibble and Whittaker 1981; Shott 1993) have used platform angle to help determine reduction stage. The belief is that later stage bifacial reduction will produce platform angles, which are more acute than platforms from earlier stages. However, Andrefsky (1998) finds platform angle measurements wholly unreliable for many reasons. Traits such as small platforms, rounded platforms where no angle exists, or rounded dorsal flake surfaces, are a few of the problems inherent with platform angles, making measurement difficult and inaccurate.

Originally this analysis simply recorded five nominal measurements (<45°, >45° to <90°, 90°, >90°, and indeterminate). I later combined the <45°, and >45° to <90° into a single <90° measurement because I felt the attribute measurement techniques were too subjective to accurately determine if a platform angle was less than or greater than 45°. The results of this platform attribute (Table 10.6 and Figure 10.12) show that <90° was the most prolific platform angle in all physiographic zones (85.8%). This percentage is high due to the variability of acute platform angles associated with bifacial thinning and resharpening. I do not feel that this high percentage was a product of lumping of angles into a <90° category. Approximately 95% of the angles recorded were between >45° to <90°, most likely due to the lack of an objective measuring technique.

The three other platform angle types are quite small in comparison to the <90° platform angle. The indeterminate platforms are insignificant in this analysis making up only 0.8% of all the flakes in the assemblages. The results for the >90° and 90° platform angles show a trend of gradual increase moving away from the valley floor into the uplands. This is similar to attribute trends of dorsal scar counts, cortex type, cortex percentages, and platform types, presented above. The pattern signals a very real difference between the three physiographic zones. Two questions remain: what type of reduction process and/or reduction stage are represented in the assemblages; and are there specific attributes which signal reduction stage better than others?

The methodology used in the analysis allowed for both

Table 10.6. Platform Angle of Debitage by Physiographic Zone.

Platform Angle	Valley Floor		Valley Wall		Upland		Total	
	n	%	n	%	n	%	n	%
< 90 Degrees	402	92.0	432	84.1	123	75.5	957	85.9
90 Degrees	27	6.2	56	10.9	22	13.5	105	9.4
> 90 Degrees	7	1.6	23	4.5	18	11.0	48	4.3
Indeterminate	1	.2	3	.6	0	0	4	.4
Total	**437**	**39.2**	**514**	**46.1**	**163**	**14.6**	**1114**	**100.0**

flake and non-flake debitage to be examined. The mass analysis reviewed the sizes, counts, and weights of the debitage to formulate initial ideas about differences between the three assemblages. Initially, I examined the percentage of flake size. The most common was >3″ to <2″ (size 4) in all three zones. The debitage weights were more informative. This found that the upland assemblages had a median weight, which was significantly higher than the valley wall and the valley floor. Heavier flakes appeared to represent early stage reduction and lighter flake debitage signaled later stages of bifacial thinning and sharpening.

The analysis of the flake attributes highlighted the most interesting differences between the assemblages. Single attributes such as cortex and dorsal scar counts most clearly showed the differences, which exist among the three physiographic zones. Platform type and platform angle, as individual attributes, were not so clearly defined in the assemblages. This required the use of platform and dorsal packages to combine attributes and contextualize the presence of the attribute types within the assemblages. By doing so, the data produced an expected trend in the reduction stage most common within the different physiographic zones.

Technological Decisions: "Tool Formation Processes"

The production and use of stone tools has been a major focus of hunter-gatherer research. The remains of these tools and production waste are most often the only

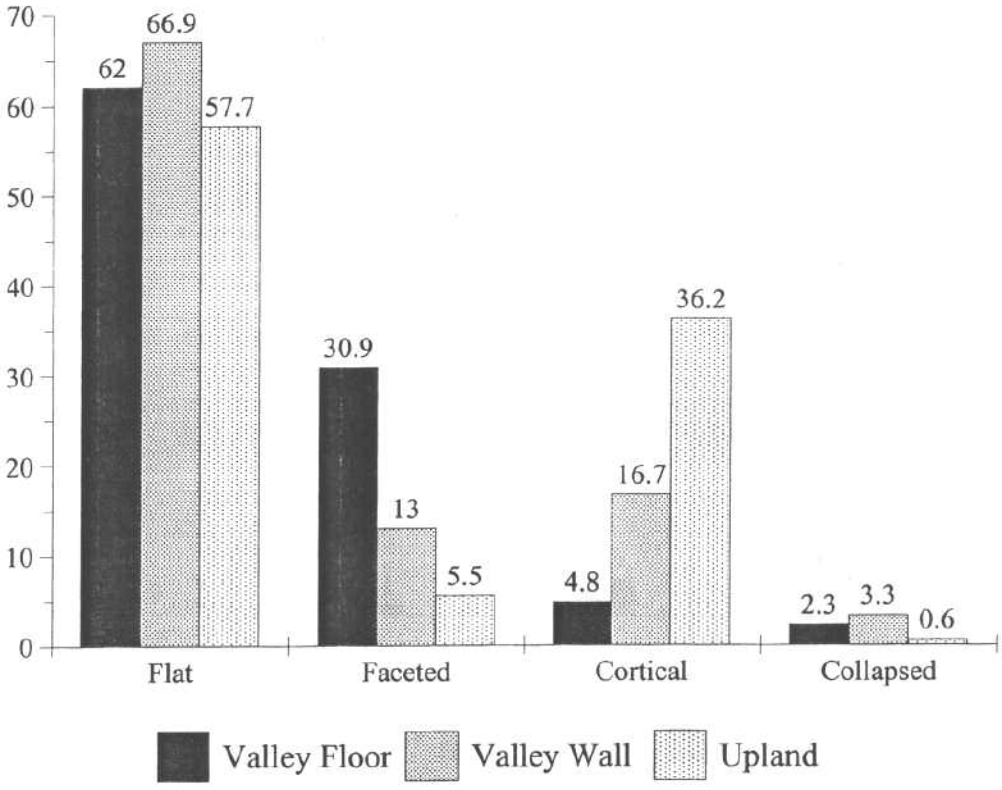

Figure 10.12. Percentage of platform angle by physiographic zone.

archaeological material recovered by archaeologists for these types of societies. Archaeological literature (Hayden 1987; Hayden et al. 1996; Nelson 1991; Parry and Kelly 1987; Shott 1986; Torrence 1983, 1989) has generally focused upon the importance of bifacial technology to mobile hunter-gatherers.

Stone tools are produced under specific requirements for the completion of tasks and the ultimate survival of the group. Traditionally, researchers have considered adequate task performance; material availability and their relative costs; available technologies; and the economics of various production alternatives, as the classical constraints in problem solving through technological means (Hayden et al. 1996). Hayden et al. (1996) details the principal constraints on tool design and the relationship to other design considerations as: task, material, technological, socioeconomic, and prestige/ideological. These in turn will affect the toolmaker's choice of production/reduction strategy.

The debitage analysis defined cobble cherts as the principal source of lithic material used in the production of tools. The cobble cherts are prolific in the Susquehanna Valley due to the glacial deposits. Raw material for this region was not in short supply. Though plenty of raw materials were readily available in the valley, the cobble form would affect the techniques used in reduction. These general techniques were bifacial or bipolar reduction.

Nassaney (1996) discusses the reduction of unmodified cobbles in the production of core and biface. Core tool reduction uses a bifacial technique to shape the cobble into a final hafted biface. Flake tool manufacturing utilizes the bipolar technique in the removal of flakes to either be unifacially or bifacially retouched into formal tools. Both manufacturing sequences ultimately end with the production of formal bifacial tools. The regional focus of Nassaney's study was predicated on a formal bifacial reduction model. Expedient tools are only briefly noted in either of the reduction processes since these tool types played a lesser role.

Other regional analyses of tool production have begun to focus on expedient technologies. Koldehoff (1987) discusses the flake tool technology from Cahokia in the Central Mississippian Valley. The objective of Cahokia flake tool industry was to produce flakes, which could be used for tools. The flaking techniques required less skill, time, and energy. This meant that flake tools could be produced by more people for the completion household tasks.

Tool production trajectories were developed by prehistoric groups based on the requirements of their tasks. The use of formal bifacial tools or expedient flake tools was not clear-cut. Both tool production techniques were utilized to some extent. The question remains: what determined the decision to utilize a formal or expedient production technique? I believe the answer is tied to land use patterns and task requirements in the different physiographic contexts.

Formal and Expedient Tool Use in the Upper Susquehanna Valley

Formal is a term to describe tools that have undergone various stages of production, including either re-sharpening or hafting. The tools have the quality of flexibility, can easily be rejuvenated, and have the potential for redesign. Expedient tools are defined as tools, which are used for a specific task and then discarded without modification or curation. Although these are often flakes, they are not the only type of debitage to be utilized in this informal manner. Any debitage, such as shatter, which has an appropriate edge may be expediently utilized for a specific task and then discarded.

For this study I have defined formal tools as any piece, which exhibits any evidence of reduction or manipulation beyond its removal from the initial package. This category includes bifaces (e.g., projectile points and knives), unifaces (e.g., scrapers), flake tools (e.g., burins and gravers). I have defined expedient tools as pieces, which exhibit no reduction or manipulation after its removal from the initial package other than edge damage created during utilization.

Formal and expedient technology plays a crucial role in the technological organization of the Upper Susquehanna Valley. Table 10.7 presents the tool ratios of the three physiographic zones. These ratios show an increase in the importance of expedient tools moving away from the valley floor.

The attribute analysis shows that late stage bifacial reduction was occurring at a higher rate than either of the assemblages from the valley wall or uplands. The formal tools make up 26.1% of the valley floor tool assemblage. The valley wall reflects a significant decrease in the percentage of formal tools (4.1%). There is an increase of 3.1% in formal tools identified from the uplands. The types of formal tools must also be considered.

Figure 10.13 presents the breakdown of formal tools from the three physiographic zones. Bifacial tool types account for 87.8% of the valley floor formal tool assemblage. This includes bifaces, in various stages of production and projectile points. The remaining 2.2% of the formal tools are unifacial scrapers and retouched pieces. The valley wall reflects a decrease in bifacial formal tools (60.9%). In this assemblage there is an increase in formal tools clearly produced through the modification of flakes, accounting for 21.7% of the formal tools. These modified flake tools are not present in the valley floor assemblage. In the uplands, only 25% of the formal tool assemblage is bifaces. The remaining 75% are unifacial scrapers and

Table 10.7. Formal and Expedient Tool Ratios by Physiographic Zone.

Physiographic Zone	Formal Tool: Expedient Tool Ratio
Valley Floor	1:3
Valley Wall	1:24
Upland	1:13

unifacial or bifacial retouched pieces. No flake tools are present in the uplands assemblage.

Expedient tools have a separate role in the organization of lithic technology in the Upper Susquehanna Valley (Figure 10.14). The expedient tools from the valley floor consist of 73.9% of all tools in the assemblage. Utilized flakes make up 96.6% of the expedient tools in the valley floor assemblage. The remainders are utilized non-flake debitage, such as chunk and shatter. This result was expected based upon the flake analysis, which showed that late stage bifacial reduction was the most common production stage. This would result in higher numbers of flakes suitable for expedient tasks. The valley wall has a large expedient tool assemblage (95.9%). There is a shift from what is found on the valley floor. The reliance upon flakes as expedient tools begins to decrease (87.2%). Non-flake debitage accounts for 12.8% of the expedient tool assemblage. The pattern of reliance upon non-flake debitage as expedient tools peaks in the uplands (92.8%). Utilized flakes decreases to 58.1% and non-flake debitage increases to 41.9%.

The pattern of an increasing reliance on expedient technology when moving away from the valley bottom is not consistent with generally held ideas about the importance of formal bifacial technology in areas away from base camps and village locations for sedentary groups. The use of formal tools away from base camps may not be as clearly defined. In the Upper Susquehanna, rich readily available raw material resources neutralize the assumption that mobility drives tool production and ultimately the form of lithic technological organization. Many constraints, such as task, material, technology, and socioeconomic factors, are involved in what types of tools are produced, utilized, and ultimately deposited in the archaeological record. The production of formal and expedient tools from cobble chert is the most common reduction sequence in the Upper Susquehanna Valley. The physiographic zones were exploited for the raw

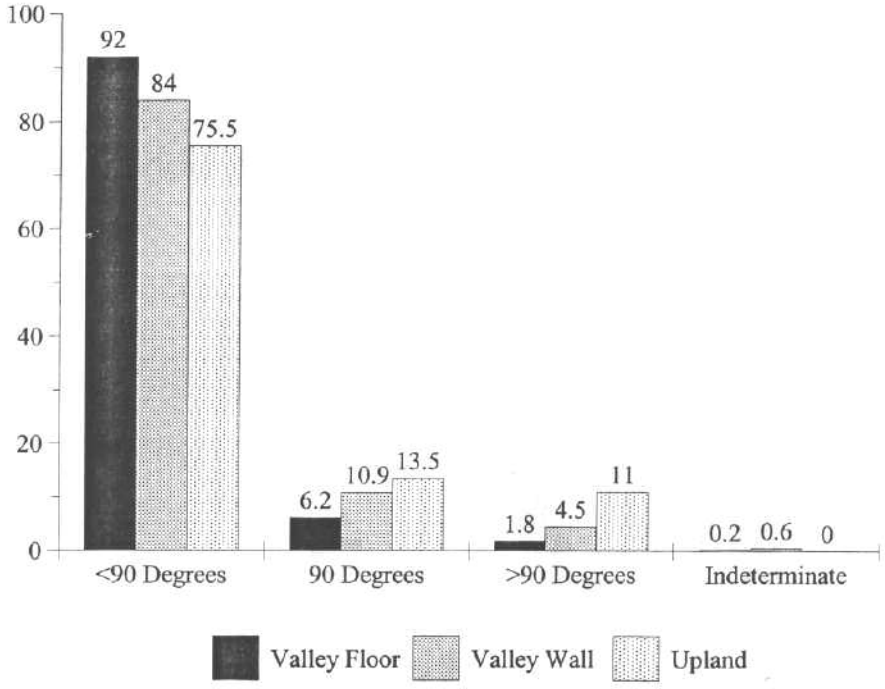

Figure 10.13. Percentage of formal tool types by physiographic zone.

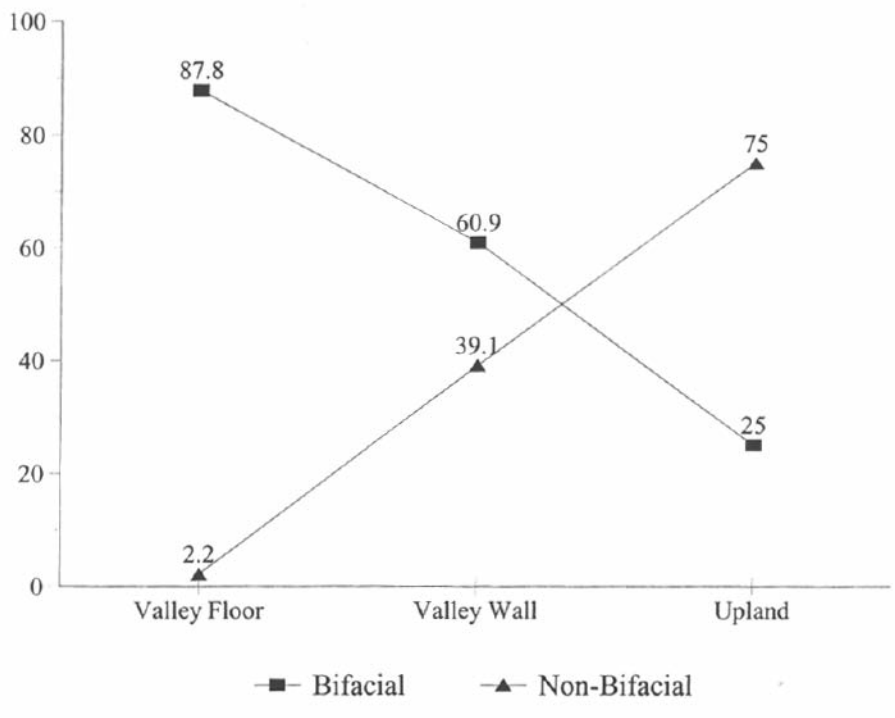

Figure 10.14. Percentage of expedient tool types by physiographic zone.

materials needed for the survival of prehistoric native groups. Each zone offered different opportunities, which is reflected in the tool diversity of these assemblages.

CONCLUSION

This study derived from the need to better understand the differences in small lithic assemblages recovered in the Upper Susquehanna Valley. For over 30 years, archaeological surveys conducted in this region have supplied data on lithic assemblages. This research has covered different geographic contexts, ranging from the valley floor, valley wall, and the uplands. The different uses of these physiographic zones by prehistoric Native Americans are reflected in the production and use of chipped stone tools.

Technological organization is defined by people and their task specific decisions regarding tool production. The requirements and constraints of their environment and social strategies are the defining elements of lithic tool production and use. The degree of mobility of hunter-gatherer populations has been discussed as a major issue in defining lithic production. Mobility models have been critiqued for being too focused on one aspect of hunter-gatherer organization. The interactions of social factors, political, and environmental factors, not a single characteristic, play different roles that ultimately affect the chipped stone industry.

Research conducted on the Upper Susquehanna Valley by the late Robert Funk and others has shown that this region has a rich prehistoric past. The physiographic zones defined by Funk (1993) served as the analytical bases for this research. The diverse populations who lived in this region maximized their chances for survival through the utilization of everything the valley had to offer. This included the hunting, gathering, and foraging of needed raw materials and food resources in all areas of the valley, top or bottom. The environment and the social choices made by people exploiting it helped to organize lithic tool production.

This lithic analysis shows that diversity of lithic assemblages from different physiographic zones does exist. Certainly factors other than mobility and sedentism are at play. The raw materials available and the tools needed to adequately perform the collection and processing activities differed.

The variability in lithic assemblages is directly related to different forms of land use and the type of sites that result. Several studies in the past two decades have linked land use and the site type concept to model hunter-gatherer organization in the Northeast (Custer 1996; Funk 1993; Raber 1995; Versaggi 1987, 1996; Versaggi et al. 2001). According to Versaggi (2000), "research in the Upper Susquehanna Valley identified a logistically organized settlement pattern anchored by smaller seasonal base camps rather than large sedentary residential sites."

Throughout the year there was a fission and fusion of groups inhabiting seasonal bases on the valley floor, single and multi-task camps along the valley walls, and small resource processing locations in the uplands (Versaggi 1996).

Small groups would move out from base camps to hunt and forage. Seasonal changes would concentrate occupation in different areas of the valley. In early spring, the groups would leave for the anadromous fish runs on the valley floor. At the same time small forays would move to the wetlands, along the base of the valley wall or in the uplands, to hunt migratory birds and waterfowl. The summer was spent collecting berries. During the fall nut and acorn collection and processing occurred. Groups would either move to the uplands to hunt, returning the following spring, or remain for the entire year (Miroff 2002).

Food collection and processing were not the only tasks that groups were sent out to complete. Micro-wear analysis has shown that upland sites may have targeted plant resources, especially non-edible reeds and bark, used in weaving and basket making. Land use patterns consisted of year round foraging or occupation of the valley floor, with some groups moving into the uplands during the winter (Versaggi 2000).

I propose that the results of this lithic analysis compliment the basic land use patterning of the Upper Susquehanna Valley as developed by Versaggi (1987, 1996, 2000) and Funk (1993). The lithic assemblages from the valley floor had a large percentage of late stage and resharpening debitage. These hunting parties attempted to reduce their risk with the use of bifacial tools. This signals the preparation of formal tools for hunting and processing of game animals.

The valley wall lithic assemblages show a decrease in the percentage of late stage reduction debitage and a gradual increase in early stage reduction debitage. I propose that this is a result of multiple tasks being performed in this physiographic context. The glacial development of the valley walls created an environment for both game animals and plant resources (B. Grills 2003). The presence of chert cobbles in the glacial till gave prehistoric groups a plentiful supply of lithic raw material. Much of this material could be easily split with a bipolar technique. This produced sharp angular blocks with sharp edges. The edges of a block could be used immediately or the block could bifacial reduced or retouched into a formal tool type. Therefore, both primary and secondary reduction stages are present in the debitage assemblage. There is also a general decrease in the percentage of formal tool types and an increase of expedient tools, especially utilized chunk and shatter.

The upland assemblage appears to reflect short-term single task processing of either food or non-food resources. The upland environment provided a variety of seasonal resources, which attracted daily foragers and hunters. The uplands provided wetlands, ponds, and small lakes for water mammals and waterfowl, with many headwaters forming in these areas. These water resources also provided a habitat for non-edible reeds and grasses. The uplands also offered cover for aggregating deer and other mammals. The upland assemblage has the highest percentage of debitage associated with primary reduction, conversely the lowest percentage of late stage reduction is from this assemblage. The expedient tool types were the most common. There were only three bifacial tools identified in the assemblage. Two of these were broken projectile point fragments. These tools were probably not produced in the upland context, but prepared in the lower valley wall or valley floor context.

Previous lithic analysis in the Upper Susquehanna Valley (Card 2002; Montag 1998) has discussed the importance of mobility as a characteristic of lithic patterning. Both of these studies appear to contradict the findings of this analysis. Card (2002) discusses the White Site in Chenango County, New York, an Owasco period site located in an upland context. This site had a large percentage of formal tools and debitage associated with late stage reduction. However, the White Site is a unique type in that it appears to have been an upland residential base during the Late Woodland. Montag (1998) compares two Owasco sites, the Boland Site, in the valley floor context in Broome County, New York, and the Hudson Lake Site (Locus 7), located in the uplands of Otsego County, New York. Montag argues that expedient technology was the focus at Boland Site and a highly curated formal technology was employed at Hudson Lake (Locus 7).

Though my results from this analysis were different, I do not believe that the studies conducted by Card (2002) and Montag (1998) were flawed. These previous studies focused on a small sample of sites from a single time period, the Late Woodland Owasco period. My own analysis was in a sense "timeless", in that I was interested in discovering an explanation for the broad trends affecting the organization of temporally unaffiliated lithic scatters in all physiographic zones of the Upper Susquehanna Valley. Rather than focusing on two extremes (uplands, valley floor) within a single slice of time, I broadened the study to an entire valley context without a time constraint. Future research can reintroduce the time dimension.

The purpose of the *Current Approaches to the Analysis and Interpretation of Small Lithic Sites in the Northeast* colloquium was to bring researchers together in an open forum to introduce and discuss the archaeological value of small lithic scatters. This frequently overlooked site type can enhance our knowledge of land use patterns in the Northeast. This paper has shown that by moving from the site-to-site comparison, to a broader regional

approach, the patterning of small lithic scatters is not as clearly defined by single characteristics, such as mobility. The needs to hunt, gather, and forage were always a consideration for survival. To optimize the valley resources prehistoric peoples organized the production of lithic tools according to the practicalities of the environment and society.

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MANAGING AND EVALUATING NATIONAL REGISTER SIGNIFICANCE OF SMALL LITHIC SITES

CHAPTER 11

THE MANAGEMENT AND PRESERVATION OF LITHIC SCATTERS: TWO STRATEGIES

Laurie W. Rush, Amy Wood, and Margaret Schulz

The Fort Drum survey has generated thousands of shovel tests that are positive for prehistoric lithic material. Further investigation has resulted in positive identification of over two hundred lithic scatters across four geographic landforms. Lithic material on Fort Drum has been sourced to quarries from across New York State and to at least four counties in two additional states. These deposits also clearly represent over 11,000 years of human occupation east of Lake Ontario. The value of these resources has been in the information they have yielded through lithic sourcing and the analysis of their distribution across the landscape. The nature of small lithic scatters makes them vulnerable to destruction through archeological evaluation. Protecting them is problematic due to their size and lack of associated context in the landscape. However, Fort Drum is experimenting with protection methods like re-vegetation, site hardening and installation of concrete obstacles. This paper discusses Fort Drum strategies for data recovery, documentation, and resource management while describing the disproportionately valuable contribution lithic scatters have made to the regional archeological record.

Prehistoric lithic scatters are commonly encountered during large acre surveys in the American northeast. For cultural resource managers, the lithic scatter presents a series of challenges that require proactive management responses. Challenges include identifying and defining the size, frequency, and distribution of these site types. Another challenge is making a case to a non-archeologist who may also be a project proponent that these sites are valuable. Proactive management responses can range from off limits posting to physical protection to Phase III data recovery. This chapter reviews the challenging aspects of these resources and suggests two fundamental approaches for successful management used at Fort Drum.

CHALLENGES

The Fort Drum Cultural Resources program is currently managing over 800 known archeological properties across 107,000 acres, inventory survey goals of 2000 acres per year, and consultation for construction projects valued in the millions. Given these parameters, it is logical to ask where lithic scatters would fit and what their priority might be. These small sites pose problems in definition, can be tiny and difficult to find more than once, and are distributed across vast expanses of land. It also can be extremely difficult to make the case for expending resources to investigate and protect these types of assets to the non-archeologists and Soldiers who support Cultural Resources in the United States Department of Defense. In fact, fitting some lithic scatters under the legal driver of Criterion D, new knowledge, for potential eligibility and the protections that status affords, is one of the biggest challenges of all.

Development of a successful prehistoric sensitivity model at Fort Drum has resulted in over 3000 shovel tests that were potentially positive for stone tool debris in the past five years. Prior to that time, the scarcity of positive shovel tests resulted in any prehistoric find, as small as one flake, being classified and numbered as a Fort Drum archeological site. The increased success now demands that more difficult choices be made. Fort Drum is not alone in problems of definition. The range of paper topics at the recent New York State Museum lithic conference demonstrated that in New York the definition of a lithic scatter can range from one piece of debitage to a site complete with hearths and post molds.

At Fort Drum, currently, to qualify as a site, there must be at least five pieces of culturally altered debitage present. However, all of the positive finds are documented and entered into the survey database even if they do not qualify for a site number. Fort Drum has the additional complication of quarry sites and naturally occurring tool-quality lithic material present in significant amounts. It can be very difficult to distinguish between culturally altered and naturally fractured lithic material at some locations.

The magnitude and logistics of the survey pose problems of their own. The 3000 positive tests were out of a total of 109,748 shovel tests recorded (Figure 11.1). In an ideal world, the archeologist should be able to return to the field, precisely identify each of the 3000 locations, and continue investigation or confirm protection at any point in time. When the situation is complicated by active military training activities across the acreage and shifting deltaic sand deposits in the most archeologically sensitive

Current Approaches to the Analysis and Interpretation of Small Lithic Sites in the Northeast, Edited by Christina B. Rieth, New York State Museum, The State Education Department, Albany, New York 12230. New York State Museum Bulletin 508

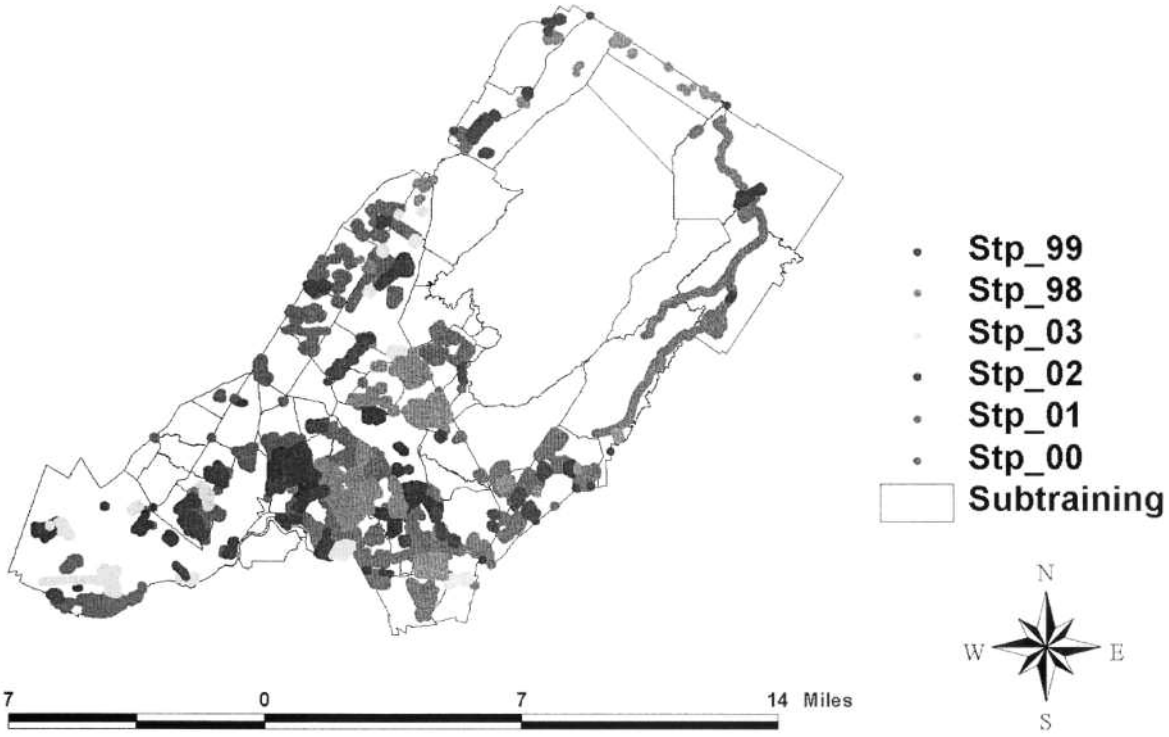

Figure 11.1. Shovel Test Map, Fort Drum, NY, 1998- 2002.

portions of the installation it is not difficult to imagine that some lithic scatters may no longer be located where we thought we left them. By nature, if a strict definition of lithic scatter is used, it will be a very small archeological site with few objects and no features. Lithic scatters on the surface could be subject to erosion or reburial or complete dispersal in the face of even minor ground disturbances.

The most difficult challenge of all is making the case for protection and preservation. At Fort Drum, removal of acres from availability for military training for the purposes of archeological protection requires a military order from the Garrison Commander. Needless to say, these requests must be backed up by substantial documentation, a sound argument, and an ability to convey the need to a highly intelligent Soldier who makes serious land management decisions on a daily basis. The only way to successfully advocate for archeological site protection on an active military base is to choose sites wisely and to concurrently demonstrate a willingness to understand and support the military mission of the installation.

MANAGEMENT STRATEGIES

The two approaches in use at Fort Drum are information management and in situ preservation. Both approaches depend on sound fieldwork combined with rigorous documentation methods. As part of standard practice at the installation, both approaches are also continuously subjected to evaluation and improvement (Figure 11. 2).

Effective management of lithic scatters begins with high standards for data collection in the field. The discussion really begins with the thousands of shovel tests excavated at Fort Drum every field season. Predictive

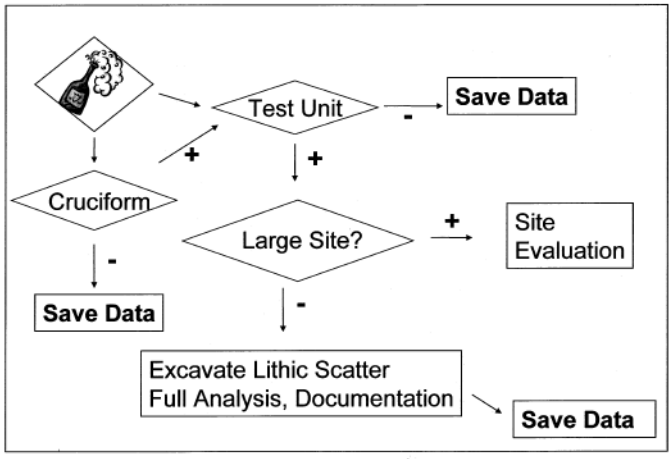

Figure 11.2. Flow chart depicting management strategies for lithic scatters at Fort Drum.

modeling aside, it is with a positive shovel test or surface find that discovery of a new lithic scatter begins. Clearly, for the discovery to be meaningful, it has to be associated with a location on the installation accurate to less than a meter. Fortunately, within the past five years, available GPS and GIS technology is making it possible to collect and maintain data at this level.

Location data collection begins with set up of the survey. The beginning and endpoints of the survey are set in and recorded using sub-metric accuracy GPS. Baseline and transect azimuths are calculated and recorded as well. The shovel test grids are automatically entered into the GIS coverage using custom software developed at Fort Drum by Colorado State University contractors. However, in the field, shovel test and transect intervals are achieved using pace counts so some accuracy is lost in real world practice. However, there are two ways to regain accuracy. First, the final grids are edited against orthographic photos of the project areas. Using the beginning and end points, transect intervals can be shortened or lengthened to adjust for the pace count. Visible write offs can be compared to features in the photos as well. More important, all positive shovel tests are flagged and cruciformed. The finds that indicate that a site is present are then GPS'd individually. Not only does the GPS provide a location for the find at sub-metric accuracy, but also the GPS'd positive shovel tests in any grid can be locked in and used to rubber sheet the remaining grid coverage more precisely.

Each shovel test in the Fort Drum survey is given a unique identification number that links it to a relational database system (Figures 11.3 and 11.4). The component databases include overall project data, soils information, and the artifact catalog. As a result, all lithic discoveries on Fort Drum are part of the permanent data collection no matter how the archeologists choose to categorize them. At any point in time, it is possible to review previous survey data and examine artifacts. Positive shovel tests can be subjected to additional shovel testing or test excavation units. As long as the acreage is not compromised by construction or significant ground disturbing activity, further evaluation is always an option. For anyone interested in using a detailed GIS based documentation system as a management tool, it is important to note that the Fort Drum survey customized data management code is in the public domain and can be down loaded from the Colorado State University Center for the Environmental Management of Military Lands Website.

Should a positive shovel test or survey discovery meet the criteria for identification and numbering as an archeological site on Fort Drum, it is added to the Fort Drum site database as well. This status plots the site into the Fort Drum archeological site coverage, connecting the location with a detailed list of site attributes. Most archeological sites on Fort Drum are subjected to test excavation unit evaluation for potential National Register eligibility.

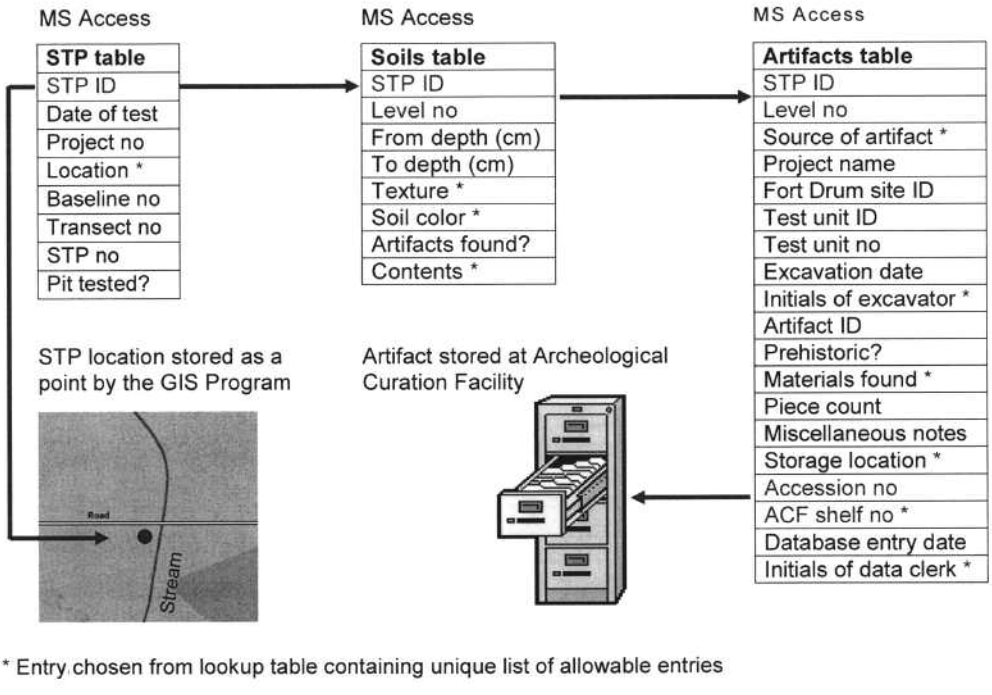

Figure 11.3. Relational database management structure at Fort Drum.

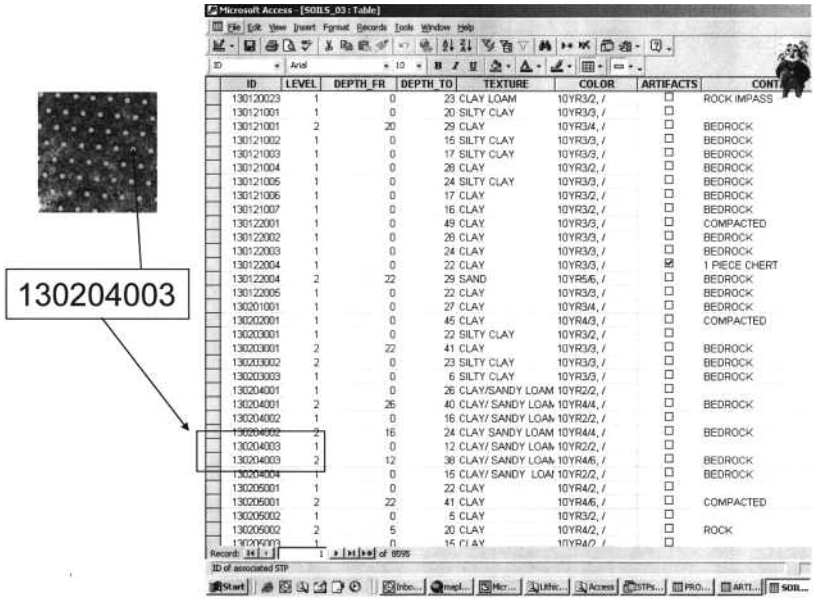

Figure 11.4. Sample shovel test data table. A comparable system is in place for test unit excavation data.

Sometimes in the case of small lithic scatters, the evaluation process becomes a form of inadvertent mitigation through total data recovery (Figure 11.5). In the military setting, this solution, inadvertent as it may be, is elegant. The result is that the lithic scatter data is completely collected with the objects catalogued, curated, and available for further research. Associated soil samples are collected as well. From a management point of view, this solution means that the acreage can be made available for ground disturbing activity because the site is gone. The only dis-

Figure 11.5. Photograph of a test excavation that resulted in total data recovery for a lithic scatter.

Figure 11.6. Example of "Off Limits" signage in the Fort Drum training areas. These signs are enforceable military commands.

advantage to this solution from an archeological perspective is that the standard of always leaving half a site has been violated, denying the potential benefits of future technological improvements in excavation and analysis. However, leaving the site in situ and losing it through accidental means is a much greater loss.

Clearly though, *in situ* preservation is a critical alternative option. One obvious and commonly used form of in situ protection is designation and posting of off limits areas. These areas are posted using signs that say "Off Limits by Order of the Commander." (Figure 11.6). These signs are a form of enforceable military order and are quite respected in the training areas. The off limits system does pose its own set of problems. The first is the challenge of making a serious case for taking acres away from military training. Second, "Off Limits" provides no protection against site destruction from natural processes. Third, should an archeologist ask a Garrison Commander to set aside land for a small lithic scatter, the program runs a risk of taking the Commander to the "Off Limits" area and being unable to find a site to show on a given day. This approach could put an entire cultural resources program in the position of losing credibility. Fourth, if the Cultural Resources program develops effective public outreach, interest in archeological sites begins to grow. Despite good intentions, "Off Limits by Order of the Commander" signs can become the equivalent of "Dig Here for Artifacts."

The Fort Drum Cultural Resources program is in the enviable position of being able to experiment with alternative physical means of site protection. One mission of the Army's Integrated Training Area Management (ITAM) program is to protect archeological sites. The Land Rehabilitation and Maintenance (LRAM) program within ITAM offers heavy equipment, manpower, and expertise in site stabilization through vegetation and protective materials. Active re-vegetation of archeologically sensitive sandy areas not only protects known sites, but the treatment also may stabilize other lithic scatters that are probably present in these same areas but were missed during the surveys.

In heavily used areas with sites of concern, one treatment is blanketing with filter fabric, fabric warning signs, and layers of sand and gravel fill (Figure 11.7). These layers offer physical protection strong enough to withstand military vehicles (Warden and Rush 2002) and form a no dig barrier marked by the Garrison Commander's enforceable restriction. A layer of chain link fence can be

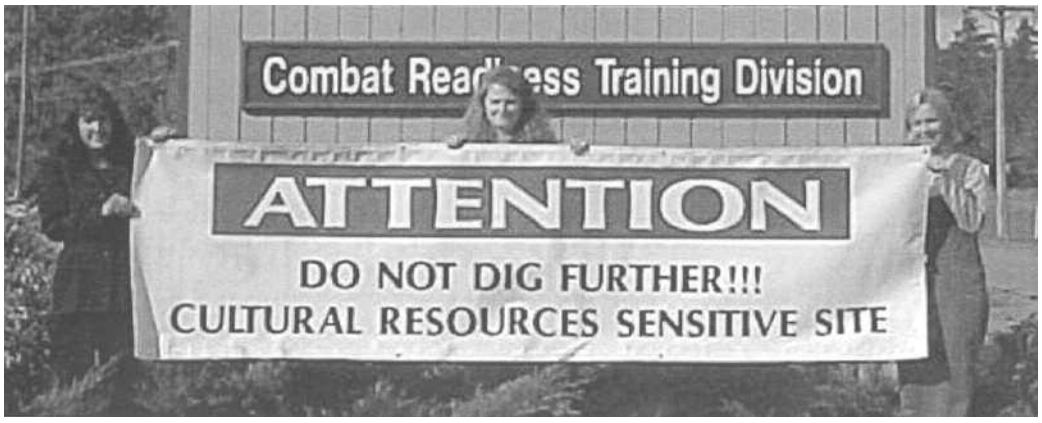

Figure 11.7. Example of a fabric warning sign that can be buried as a layer of site protection.

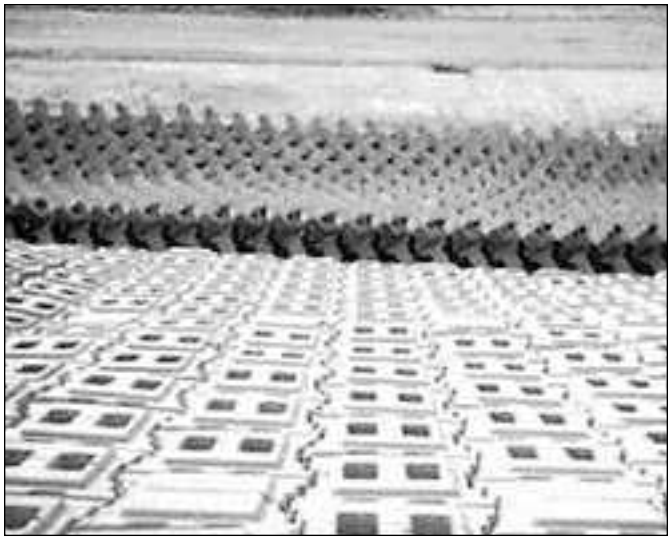

Figure 11.8. Two types of A-Jacks® concrete forms that can be installed as site protection.

added to this system if there is concern about deliberate attempts to dig in the vicinity. If a layered site is finished with some form of natural landscaping, it could blend into the landscape, making it difficult for potential looters to locate. However, land managers with access to the GPS site coordinates would be able to immediately relocate the site at any time.

A second form of treatment is the use of concrete forms called A-Jacks® (Figure 11.8). These objects offer an excellent solution because they are easy to install and actually enhance military training by teaching soldiers to avoid obstacles in the environment. Once the A-Jacks® are in place, a site would be protected from vehicular traffic and would be a bit more difficult to loot. The large object also provides an excellent re-location aide to the archeologist not only for site monitoring but also if further evaluation might be desired at some point. One disadvantage of using A-Jacks® individually is that just like posting, they fail to offer protection from erosion or other natural site destruction processes. In active dune areas, the presence of concrete structures might affect Aeolian deposition patterns.

POTENTIAL BENEFITS OF DATA RECOVERY

Given that the significance of lithic scatters lies in their potential for new knowledge, data recovery for these resources has a wide range of possible benefits. Evaluation of lithic scatters at Fort Drum has led to lithic sourcing, residue analysis, some environmental reconstruction, and to development of a powerful predictive model for prehistoric site location.

Using lithic scatter data, Fort Drum GIS analysts were able to visually depict a relationship between elevation and site distribution. After further analysis, it became clear that site location may have been related to fossil beach lines associated with glacial lakes in the Lake Ontario Basin (Rush et al. 2003). Further analysis with

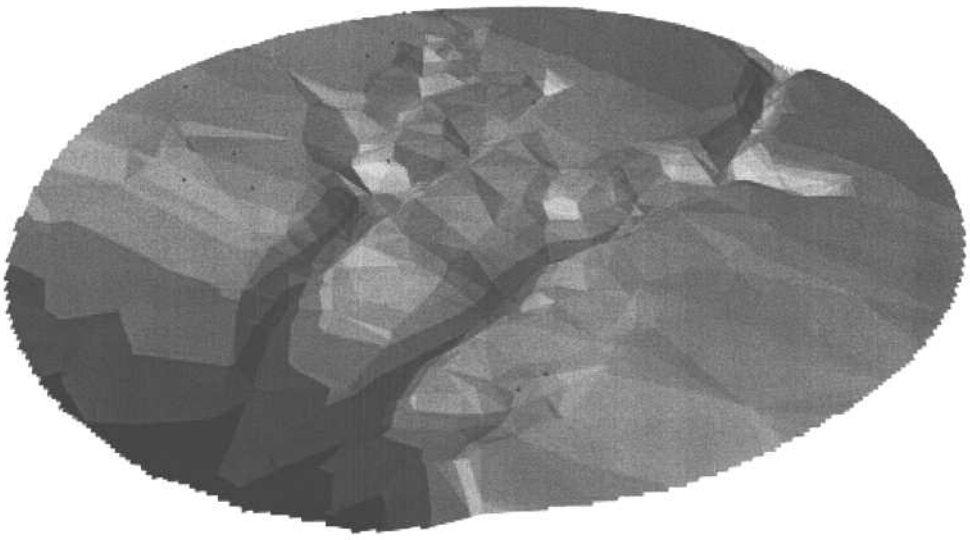

Figure 11.9. Distribution of prehistoric archeological sites across a sensitive landform, side view. Analysis of distribution of known lithic scatters on Fort Drum led to development of a predictive model that increased the percentage of positive shovel tests by several orders of magnitude.

landscape renderings now enables slope and aspect to be included in further predictive modeling (Figure 11.9). Comparison of locations with identical elevations, slopes, and aspects offered opportunities for additional field survey and site discovery. The presence of additional sites has strengthened the beach line hypothesis.

If a lithic scatter is properly excavated and associated samples collected, additional analytical possibilities include wear analysis, flake and debitage ratios, and spatial distribution of artifacts across the scatter. One example of a significant discovery on Fort Drum derived from analysis of a lithic scatter was the identification of a French gunflint, sourced to the Loire Valley in the central part of France. A second example of a significant contribution made by the excavation of a lithic scatter is the identification of two triangular pointed reamers from a deposit related to the waterfront context of the fossil beach of Glacial Lake Iroquois (Figure 11.10). The fact that triangular pointed reamers are identified as tools related to wooden boat building (Cassidy et al. 2004) also supports the current Fort Drum working hypothesis that the paleo occupants of the area had mastered sophisticated maritime technology.

Lithic sourcing on Fort Drum has also provided a new perspective on the potential relationships between early people of Fort Drum and those from other regions of the eastern North America. Jack Holland, of the Holland Lithics Laboratory at the Buffalo Museum of Science, has sourced complete projectile points as well as flakes on Fort Drum to the Flint Ridge chert quarries of central Ohio near the Ohio River. Holland has also confirmed sources of additional lithic artifacts found on the Installation to quarries at Normanskill, New York in the Hudson Valley, Divers Lake, New York, in Genesee County, Otsego Lake, New York near Cooperstown, and Nedrow, New York just south of Syracuse .

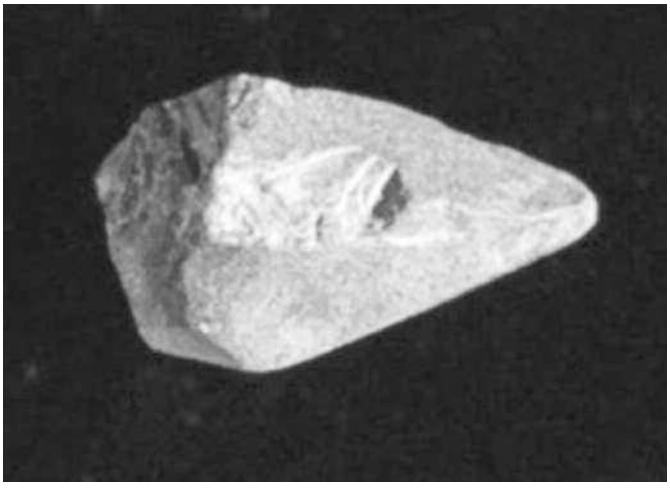

Figure 11.10. Triangular pointed reamer.

Lithic source information becomes a core element for understanding site significance. When entered into the Geographic Information Systems, optimal pathways can be developed that connect the sources with the artifact's recovery location. At some sites there are opportunities for comparison with dates and analysis of other elements of artifact assemblages. The combination of these sources of information at Fort Drum offers opportunities to develop sophisticated hypotheses about trade and migration pathways in and out of eastern Lake Ontario and the Black River valley. For example, lithic analysis at Fort Drum is showing a trend of source material entering the area from the East beginning with fluted points made from Normanskill chert from the Hudson Valley. Approximately 2000 years ago, the trend shifts to sources from the south and west with the appearance of the Ohio chert and material from Divers Lake.

CONCLUSION

The keys to effective decision making for, and evaluation of, small lithic scatters are found in sound field methods and the associated data management. From the moment of discovery, even for a scatter as minimal as a flake in a shovel test, it is critical to record the site location, nature of the find, and site attributes accurately. With locations in the GIS coverage and the associated artifacts analyzed and curated properly, lithic scatters are able to provide the contributions to knowledge intended by Criterion D whether or not they remain in situ. When in situ preservation is determined to be the appropriate course of action, documentation of precise locations is still critical. In addition, archeologists need to think beyond off limits posting in terms of physical protection.

ACKNOWLEDGEMENTS

The authors wish to acknowledge the U.S. Army, Tenth Mountain Division, Fort Drum Garrison Command, U.S. Army Northeast Regional Office, and the Colorado State University Center for the Environmental Management of Military Lands for their support of cultural resources on Fort Drum.

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CHAPTER 12

THE EVALUATION OF LITHIC SCATTERS FOR THE NATIONAL REGISTER OF HISTORIC PLACES: A CONSIDERATION OF THE CURRENT STATUS IN NEW YORK

Cynthia Blakemore, Nancy Herter and Douglas P. Mackey

In New York State the term lithic scatter has been applied to a wide range of site types. What these sites have in common is a perceived lack of research potential because they lack one or more of the following characteristics: integrity, diagnostic artifacts and large artifact assemblages. Thousands of lithic sites discovered under the auspices of Cultural Resource Management (CRM) have been determined ineligible for the National Register of Historic Places at the Phase I level of archaeological investigation and destroyed by development without being adequately studied. The result is that our understanding of past Native American lifeways is biased. Our paper will begin by exploring the early history of the discipline of archaeology to gain an understanding of why certain site types are more likely to be considered National Register eligible under Criterion D than others. We will then explore ways to better address the significance of these small sites. The final section will present examples of the types of sites that have led the authors to consider the need to reevaluate how these light density lithic sites are initially interpreted. Several sites are discussed, each significant in its own way, yet they all share one characteristic; their initial identification suggested that only a light lithic scatter was present.

CURRENT STATUS OF LITHIC SCATTER EVALUATIONS

Most archaeology in New York State is conducted as the result of historic preservation and environmental legislation such as the National Historic Preservation Act (NHPA), the State Historic Preservation Act (SHPA), and the State Environmental Quality Review Act (SEQRA). Sections 106 of the NHPA and 14.09 of the SHPA require that Federal and State agencies take into account the effect projects may have on properties listed or eligible for listing on the National Register of Historic Places. Most archaeological sites are determined eligible for the Registers under Criterion D; that is they have yielded or are likely to yield information important in prehistory or history. If a site does not meet the criteria for listing it is determined not eligible and no further evaluation are required. A site type typically not considered eligible for listing on the State and National Registers of Historic Places is lithic scatters.

For the purposes of this chapter, a lithic scatter is defined as a site with low densities of chipped stone dominated by debitage. Such sites are commonly interpreted as short-term resource processing sites where stone tools were manufactured and discarded. Lithic scatters have historically been identified as possessing low research potential because they are assumed to lack one or more of the following characteristics: features, diagnostic artifacts, or large artifact assemblages. In New York, hundreds of sites have been determined ineligible for the Register at the Phase I level and destroyed by development without being adequately sampled and studied.

This common practice is now being questioned. As the *National Register Bulletin: Guidelines for Evaluating and Registering Archaeological Properties* (National Park Service 2000:21) points out:

> Overlooking the significance of small sites may skew our understanding of past lifeways as those sites not only receive less research attention, but also are destroyed without being recorded thoroughly because they are "written off" as ineligible for listing in the National Register. Such losses point up the need to continuously reexamine historic contexts and allow new discoveries to challenge our ideas about the past.

We are now realizing that it is important that historic contexts, and therefore site significance, should be updated and changed to keep pace with current research and a new understanding of the place of such sites in our overall understanding of prehistory. The result of our past actions regarding this type of site, is that our understanding of past Native American lifeways is biased toward habitation sites and special function sites characterized by large-scale stone tool manufacturing.

Historic Trends

While the research issues central to our discipline have changed through time, the focus in cultural resource management on artifact rich sites, such as villages and large quarry sites has remained constant. This is apparent

Current Approaches to the Analysis and Interpretation of Small Lithic Sites in the Northeast, Edited by Christina B. Rieth, New York State Museum, The State Education Department, Albany, New York 12230. New York State Museum Bulletin 508

when one looks at the reasons sites are dismissed at the Phase I level of archaeological investigation. In a review of recently submitted CRM reports, the most common reasons for dismissing sites include low artifact densities, low artifact diversity, lack of diagnostic artifacts and lack of features. It is clear from this list that the framework by which eligibility decisions are made has been informed heavily by larger-scale habitation sites and that these sites are the yard stick by which all sites are measured. Unfortunately, this has led to the under examination and interpretation of sites identified as lithic scatters.

To better understand our dismissal of lithic scatters, we must refer to the early history of our discipline. Our preoccupation with large, rich archaeological sites and our concept of research potential and significance has its roots in the research questions and issues pertinent to our field in the nineteenth and twentieth centuries.

Some of the earliest objectives in American archaeology were the creation of large, representative museum collections and the systematic description and classification of archaeological phenomenon. Much of the fieldwork that took place in the nineteenth and the early twentieth centuries was sponsored by museums to obtain museum quality pieces and large collections (Graham 1887; Read 1887). With this goal, sites considered most worthy of investigation were those capable of producing large, diverse artifact assemblages. Research associated with these collections focused on describing and classifying the material and the cultures they were associated with. Ephraim G. Squier's *Aboriginal Monuments of the State of New York* (1849) and William Beauchamp's monographs describing the artifacts of New York State Indians typify this period termed the Classificatory-Descriptive Period (1840-1914) by Willey and Sabloff (1980). These works are dominated by large-scale habitation and ceremonial sites such as Oakfield Fort and Buffam Street (Squier 1849).

During the first half of the twentieth century chronological control became the focus of research. Stratigraphy and seriation were the primary methods adopted to create these chronologies. Following the inception of radiocarbon dating in 1948, previously developed relative chronologies were corrected and refined with absolute dates. William Ritchie, in *The Archaeology of New York State,* first published in 1965, provided a cultural historical framework that is still used today to organize and interpret archaeological data in New York State. This framework is based largely on data from artifact and feature rich archaeological sites that was subject to studies of seriation, stratigraphy and radiocarbon dating.

Once chronological frameworks were developed the focus shifted to settlement pattern studies. In their seminal work, *Aboriginal Settlement Patterns in the Northeast,* Ritchie and Funk regard large Late Woodland village sites as well suited to settlement studies because they contain relatively deep subsurface features that survive plowing (Ritchie and Funk 1973:iii). The place of smaller sites within the overall settlement pattern, including sites that we would define today as lithic scatters, were not considered.

A review of the history of New York State archaeology reveals that for 150 years large base camps and village sites were central to addressing the important research questions of their day. A corollary is that the field methods we use currently were developed to study large, complex site and are often not well suited to the study of small sites.

Forces outside the discipline of Archaeology have affected and continue to affect our perception of research potential. As most archaeology is currently conducted utilizing private and public funds under the auspices of cultural resource management, we as a discipline are constantly required to justify the need for archaeology to non-archaeologists, such as developers and government officials. We can easily articulate the importance of large sites because through 150 years of intense study we understand their research potential. Large numbers of artifacts, diagnostic artifacts and features clearly convey their significance to non-archaeologists with little need for further explanation.

Currently, archaeologists do not have an easy means of conveying the significance of small sites to the general public because we have not developed regional contexts that address them well. These contexts are crucial because they provide a social and environmental framework in which to assess research potential. Since archaeological sites never existed in isolation, neither can they be interpreted in isolation but rather must be examined within specific contexts as part of the overall cultural pattern, including settlement, subsistence and socio-political systems.

Most CRM archaeologists still assess research potential using criteria based on artifact numbers, density and the presence of features, while not addressing other factors such as distribution of small sites over the landscape, the actual function of artifacts at these small sites or whether such sites are abundant or rare in a specific area, and what this may mean.

In the end, we as a discipline are a product of our past and the field methods and theories we use daily. These are clearly biased towards large sites. As a result, these methods and theories are often inappropriate for the study of small sites and predispose us to view them as having little research potential.

CURRENT AND FUTURE DIRECTIONS

Since it is clear that small sites have the potential to inform our understanding of past lifeways, we must now examine how to better evaluate the eligibility of low-density

lithic scatters for the National Register. As we move forward, it will take a cooperative effort between consulting archeologists, the academic researchers utilizing CRM data, and the State Historic Preservation Office (SHPO), the reviewing agency providing comments on eligibility, to develop research designs suitable for the study of lithic scatters.

As the reviewing agency, the SHPO's role is to ensure that effects of a project on these sites are considered. This requires identifying and gathering sufficient data to evaluate National Register eligibility. This two-part process has typically been defined as Phase I and Phase II, with each phase having separate goals. Phase I, or site identification, requires adequate field- testing. In New York State efforts have been made to seek consistency in testing of project areas initially with the implementation of the New York Archaeological Council Standards in 1994, and more recently with the SHPO's increased efforts to ensure the Standards are applied equally.

One purpose of consistent testing is to insure that we are not testing only those areas where large artifact rich sites are routinely identified. Scatters are located in a diverse range of environmental settings including many that have not previously been considered sensitive since they are unlikely to contain large sites. Therefore, it is important to insure that they are not missed due to sampling bias. Over the past few years the implementation of the 15 meter or less testing interval throughout various environment settings has resulted in the identification of large numbers of small sites.

Phase I investigation is key to the identification of sites. Currently, there are two main survey techniques utilized; surface reconnaissance and shovel testing. Our experience at the New York SHPO suggests that small sites are best identified through surface survey rather than shovel testing. In project areas where surface survey and shovel testing are both employed, it is not unusual to see sites identified only in those portions of the project area subjected to surface survey nor for site limits to correspond to the boundary between surface survey and shovel testing. As discussed by Carr (this volume), the surface reconnaissance method is being looked at as a useful approach by the Pennsylvania SHPO as well.

Clearly the exposure of broad expanses of surface area is the key to improving artifact recovery rates. However, we need to also recognize factors that diminish recovery rates. These include extreme weather conditions, "background noise" in the form of soil inclusions, the time of day, crew fatigue, crew experience, and the time allotted to the effort. When any of these conditions are not optimal, there is a potential loss of data.

When small sites are identified, they are often dismissed with minimal testing. This usually consists of four radial tests at "close-interval", which generally vary between 5 m to 7.5 m. If no additional material is encountered, the site is dismissed as unimportant without any further discussion. Phase I testing, which is geared toward answering the question of site presence or absence, is often inadequate for answering questions regarding National Register eligibility. We would like to suggest that Phase II level testing is routinely needed to adequately assess eligibility.

Phase II Site Evaluation is geared to providing information about site boundaries, integrity and significance. Data gathering at the Phase II level is routinely accomplished through close interval shovel testing or test unit excavation or both. When lithic scatters have been identified through surface survey, it may be more productive to conduct a second or even a third surface survey in combination with subsurface testing methods. The English Heritage Survey has conducted studies of the excavation of scatters, which have shown that perhaps only one to five percent of the artifacts contained in the plowzone are visible on the surface at any given time (English Heritage 2000:3). It is our experience that multiple surface surveys in conjunction with subsurface testing is the most efficient means of recovering a representative artifact sample, exploring both low and high artifact density areas and establishing site boundaries.

Traditionally, artifact counts have frequently been used to determine significance. However, numbers alone are meaningless and a systematic, thorough artifact analysis is necessary for an understanding of site function. When conducting an artifact analysis, universally accepted terminology should be considered to facilitate cross-site comparisons and artifact tables should be utilized to summarize and present data. It is equally important to produce artifact distribution and artifact density maps so that intra-site spatial patterning can be fully explored.

Small sites are also routinely dismissed with the argument that they lack integrity and/or diagnostic artifacts. *The National Register Bulletin: Guidelines for Evaluating and Registering Archaeological Properties* suggests that in regards to small sites it is, "important to consider significance before considering integrity" (National Parks Service 2000:22). An important component of integrity is the information potential of a site. Sites whose vertical and horizontal integrity has been impacted by past land use and construction activities may be considered eligible if they can be used to address important research questions. Research questions can often be framed on several levels depending on the data present. Patricia Miller (this volume) provides examples of this in her definition of four levels of research questions that can be addressed using data from lithic scatters in plowzone contexts.

Finally, there are several reasons why a lack of temporally diagnostic material should not be used to dismiss sites. First, it may be that sites lack diagnostics because

collectors have previously removed large numbers of them. Talking to landowners and knowledgeable local people may reveal pre-existing artifact collections and should be a regular feature of any Phase I investigation. Second, more study may reveal that what we today consider non-diagnostic artifacts, such as some classes of lithic debitage, are distinctive for certain time periods because they reflect changing technology. Third, temporal association can sometimes be inferred by placing sites within the pre-existing settlement system based on material similarities. An example of this would be site that produces substantial amounts of an exotic material such as jasper. Based on our knowledge of lithic utilization patterns, such a site in New York is likely to be associated with the Paleo-Indian period, even if no diagnostic tool types are recovered.

As evident from the papers in this volume, there is an increasing awareness of the need for rethinking the past and present approaches to small sites. We are confident that a more thorough collection and analysis of the data from these sites, and the development of new contexts that address them, are important steps toward ensuring a more complete understanding of the local and regional prehistoric settlement-subsistence systems.

Examples of Significant Sites Identified as "Lithic Scatters"

The following discussion of specific examples of sites from our region illustrates some reasons for this increased concern. One area that caught our attention at the New York SHPO office consisted of three adjacent projects in Seneca County (Figure 12.1). In each of these projects the Phase 1 investigation identified a number of "isolated" flakes, tools and flake scatters. In the first project (Pierce

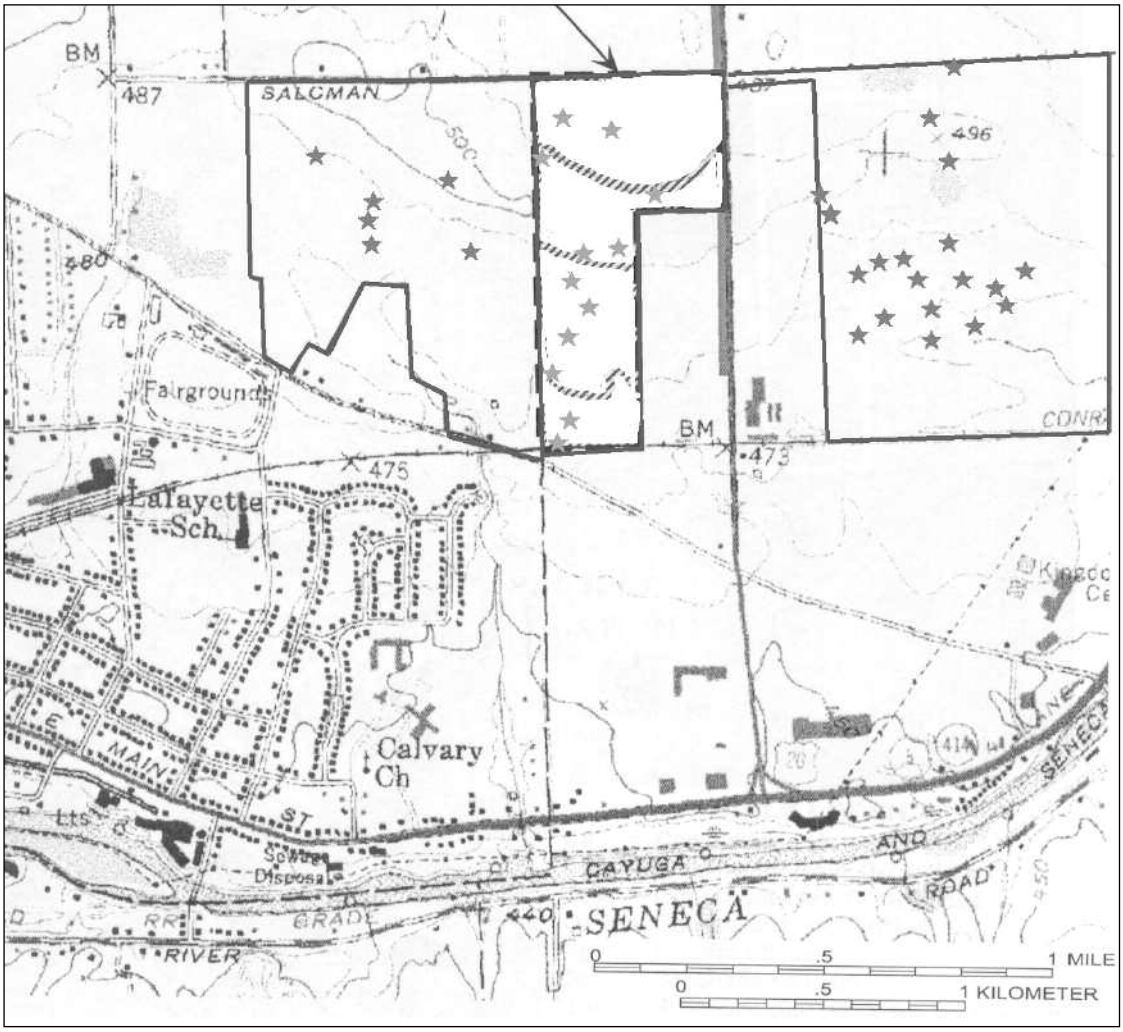

Figure 12.1. Location of three adjacent project areas that contained scattered lithics.

1998) each of these finds were considered individually and determined to not be National Register Eligible (NRE) and no further consideration was recommended. When the second project was completed (Schieppati et al 2000) a similar situation was identified and a similar not NRE finding was made. However, we began to consider that perhaps the occurrence of the scattered flakes and tools was part of a much larger and more difficult to identify pattern. This pattern was verified during an adjacent third project (Schieppati et al 2002) and it became apparent that there was a need to examine this distribution at a larger or regional scale to understand and interpret this pattern. We began to ask questions during our review: Why are there so many isolates in this area? What do they represent? Do they suggest that prehistoric occupation was more intense than previously thought, but less focused on the production of lithic tools? What other activities may have taken place in this area, and how do we examine what they may have been? Why is ration of tools to debitage so high?

As a result of questioning our assumptions, we were forced to re-evaluate the not NRE decisions. It became clear that additional investigation and evaluation of such resources would be necessary before we could confidently state that they could posses little research value. While each individual find might be unlikely to produce significant data, as a group these finds had raised questions; now it would be necessary to examine whether this type of site has the potential to answer those questions. Based on these potential research questions the SHPO recommended Phase II investigation.

A second interesting case involves a series of three sites identified during Phase 1 for a project in Bennington, Vermont (Mackey 1996). Shovel testing at the first two sites, Vt-Be-205 and Vt-Be-206, resulted in the identification of a small number of positive tests that each produced a single flake. While several of these tests were contiguous, others were not. In retrospect, given this light density of material there is a high probability that each site would have been interpreted as a sparse scatter and little attention would have been paid to these sites. However, at each site, the recovery of a small piece of charcoal and a piece of fire cracked rock from one test suggested the presence of a feature and additional work was recommended.

The results were surprising. At Vt-Be 205, four features were identified. Feature 1, was an extensive pit hearth feature, full of cracked rock, and organic material (Figure 12.2). Features 2 and 3 were small pit features, possibly storage pits (Figure 12.3). Feature 4 actually turned out to be two conjoined features, one consisting of a pit and pile of Fire Cracked Rock (FCR), while the other part was a pit, similar to Features 2 and 3 (Figure 12.4). Additional work identified several types of features and suggested

Figure 12.2. Feature 1 at Vt-Be-205. Bennington Acres Project.

Figure 12.3. Feature 2 at Vt-Be-205. Bennington Acres Project,

Figure 12.4. Feature 4 at Vt-Be-205. Bennington Acres Project

Table 12. 1. Distribution of material recovered by Phase I shovel testing at Vt-Be-208, Bennington Acres Project, Town of Bennington, Bennington County, Vt.

Test	Fire Cracked Rock	Flakes	Cores	
86	1			
87	3			
89		1		
94	1	2		
95		2		
98		1		
99	3			
103	2			
108	3	11		
111		I		
112	1			
115	4	2		
116	7			
118		3		
123	2	1		
124	9	6		
125	5	2		
127	1	6		
128		1		
132		2		
133	2			
135	2			
136	1			
142	3			
Totals	50	41	1	**92**

Tests excavated with material –n=24
DENSITY - 3.83 items per test
1.71 Flakes per test
1.84 FCR per test

Total Tests excavated –n=55
DENSITY - 1.64 items per test
0.73 flakes per test
0.89 FCR per test

that a complex of activities took place at the site.

The second site, Vt-Be-206, was also identified by only a single flake and one piece of charcoal. However, subsequent investigations identified at least one complex feature. This feature contained a pit and heavily burned FCR (Figure 12.5). Here again, a seemingly isolated flake was the only clue to a more complex site.

Figure 12.5. Feature 1 at Vt-Be-206. Bennington Acres Project.

Both Vt-Be-205 and Vt-Be-206 provided evidence of substantial activity that was not focused on activities that resulted in the production and discard of a large amount of lithic debris. Despite this, each site produced complex features and was identified as NRE.

The third site in this complex, Vt-Be-208, was of a different character, as Table 12.1 indicates, Phase 1 investigation identified 92 items, 50 pieces of FCR and 41 flakes, in 24 positive shovel tests. A total of 56 tests had been placed in this area with approximately 42 percent of them producing at least one item. While the total of 92 items suggest that this would not have been viewed as a sparse scatter, when one looks at the density of material across the entire site, it becomes clear that with the exception of a few tests the artifact density per test was very low at 1.6 items per test (Table 12.1).

Due to the predominance of FCR in the shovel tests (more FCR than flakes) it was deemed appropriate to open a number of larger units to search for features. The density of lithic material recovered was very low in the majority of these units (Figure 12.6). Of the fifteen units excavated nine produced less than 10 flakes, one produced between 11-50 flakes, one produced between 51

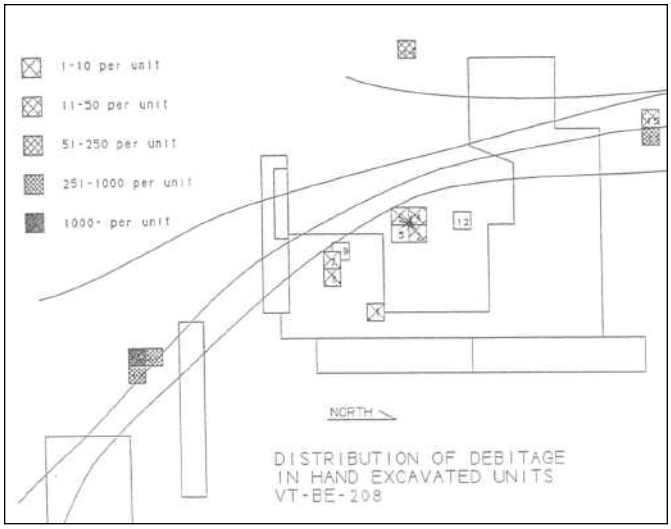

Figure 12.6. Distribution of lithic material by 2 meter units at Vt-Be-208.

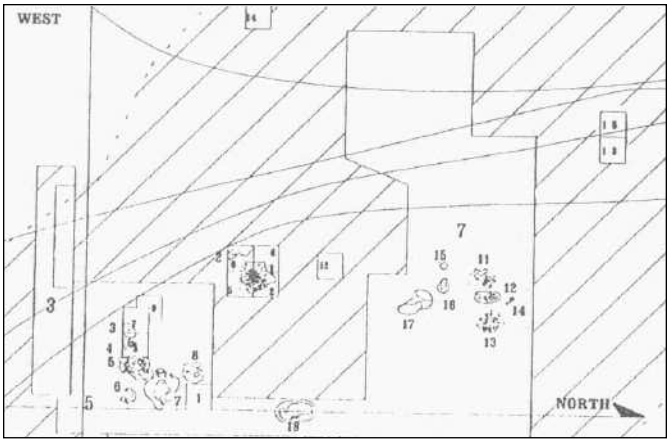

Figure 12.7. Location of identified features at Vt-Be-208, Bennington Acres Project.

and 250 flakes, three produced between 251-1000 flakes and one unit produced more than 1000 flakes. The central part of the site, which would eventually produce 19 features (Figure 12.7), consisted of the nine units with less than 10 flakes, while all the other units were identified as being located in narrow and peripheral middens. The three highest density units were adjacent to each other and located in a midden deposit on a slope into a relict river channel.

Similar Vt-Be-205 and Vt-Be-206, the features at Vt-Be-208 indicate a complex of activities as several distinct feature types, and groupings of features were present. Feature Cluster 3 contained at least six discrete features. Some of the features consisted of very deep basins, filled with greasy black soil that had a high organic content, and large amounts of heavily burned FCR (Figure 12.8). Two other feature types were also present, often in pairs, suggesting they represent a series of related activities. One of these paired feature types consisted of piles or a tight scatter of FCR (Figure 12.9). These features were typically at or above the subsoil interface. The second type of paired feature consisted of small pits. These features consisted of relatively sterile dark stains. It appears that the contents of these pits were intentionally removed and natural erosion resulted in their filling. In all cases these pits were located adjacent to FCR piles, suggesting that the FCR may have been created and served its purpose within these pits prior to being discarded outside the pit.

This site is clearly the location of a complex of activities, and was described in Vermont papers as one of the 10

Figure 12.8. Basin Type Feature, Vt-Be-208 Bennington Acres Project.

Figure 12.9. Cracked Rock/Pit type feature, Vt-Be-208. Bennington Acres.

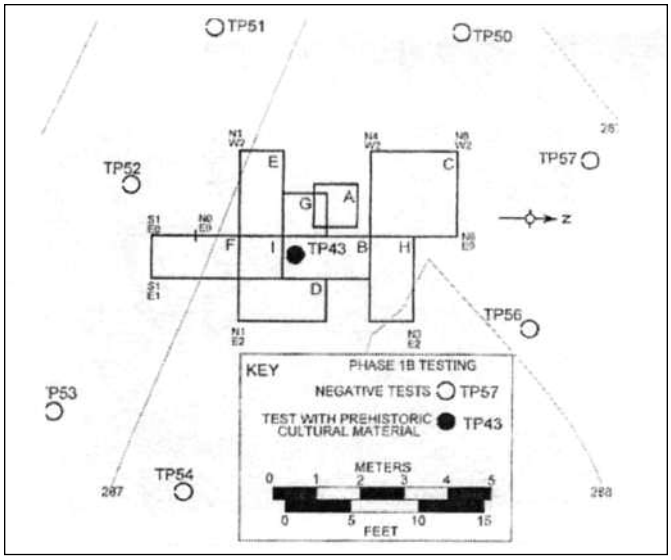

Figure 12.10. Shovel Test and Unit Excavations at the Pepsi Site, Albany County, New York.

most important sites excavated in the state, yet the lithic density was extremely low and would likely have been interpreted as a not NRE light density lithic scatter had we relied solely on information from waste flakes recovered during Phase I investigation.

The Pepsi Site, near the Albany Airport, was the location of another important site first identified by a very limited lithic presence. The Phase I investigation (Mackey 1996b) utilizing a 15 meter grid of shovel tests produced only one test with material. Test 43 produced nine flakes. A series of seven additional tests placed at four to seven meter intervals around the original find, failed to produce even one more flake (Figure 12.10). Despite this, the relatively high number of flakes in the initial test indicated the need for further investigation. This investigation resulted in a series of larger unit excavations that revealed an extremely tight clustering of lithic material.

A review of the distribution of material recovered showed a very tight clustering of material over an area of less than 12 square meters, with a peak at the center and

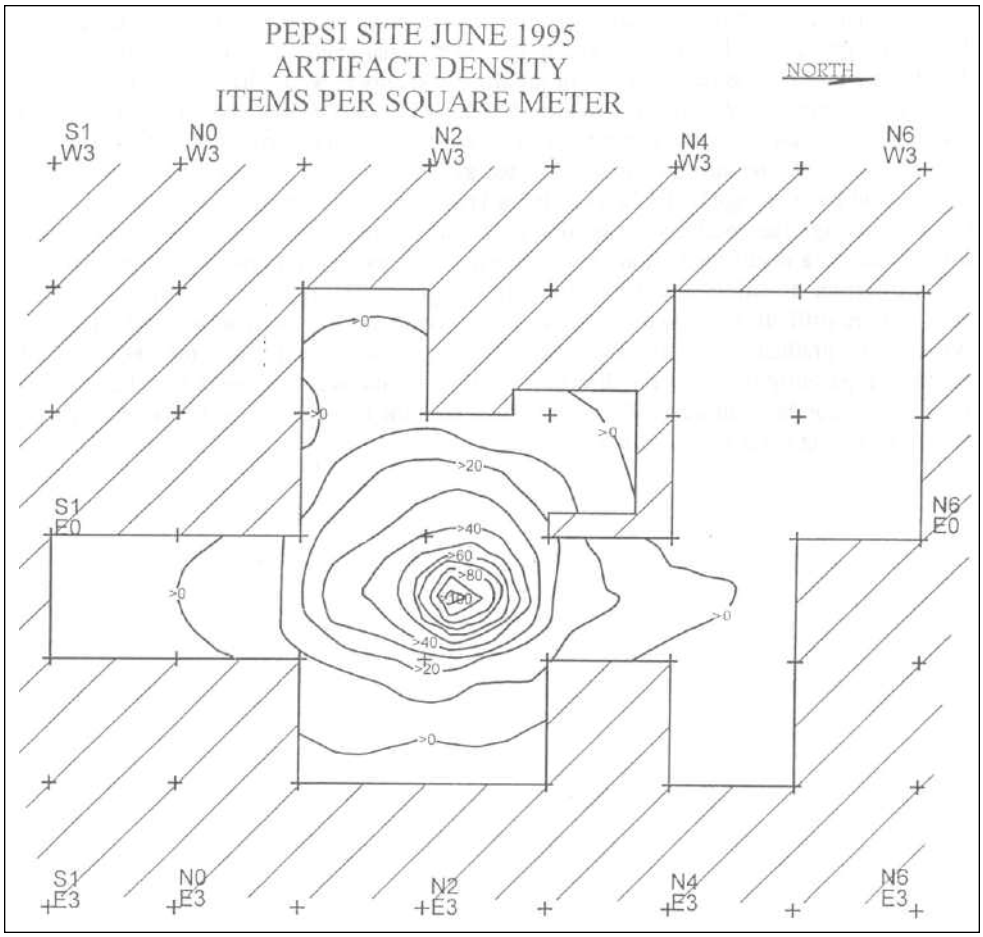

Figure 12.11. Restricted area of high-density lithic debris, Pepsi Site.

an even dispersal that quickly dropped off away from the central point (Figure 12.11). Over 85% of the material recovered came from an area of approximately two and one-half square meters. Beyond that limited area, the density of material quickly dropped.

The vertical distribution of material was also interesting. Material was recovered to a substantial depth, extending to a third stratigraphic level (Figure 12.12). The majority of the material was recovered from the upper portion of the third strata at a depth that would likely have reached deeper than the plow zone had this site been plowed. Therefore, even if this site had been first investigated through the use of surface inspection of plowed transects, it is likely the site would have been initially recognized as a light scatter.

Overall, the Pepsi site provided data that raises several questions regarding lithic scatters.

1. The identification of this site was based on luck. The site was so small that had the original 15-meter grid been shifted two meters in any direction the site would not have been discovered. Had that grid been shifted even one meter, it is likely that Test 43 may have produced only a single flake and this resource would not have been identified as NRE.
2. The increased density of material at depths that reach below the plow zone suggests that sparse scatters in surface exams may be indicative of more substantial sites at depth.
3. The site appears to represent a single activity, one person, one sitting. As such it presents a unique occurrence or activity that can be closely studied. Identifying such unique activity areas is a rare occurrence at large, heavily utilized sites. There are likely many more of these single use sites that have been overlooked in the past.

The last site to be considered provides one more example of why we must re-evaluate how lithic scatters are interpreted. Recent work at the Perch Lake Mounds has

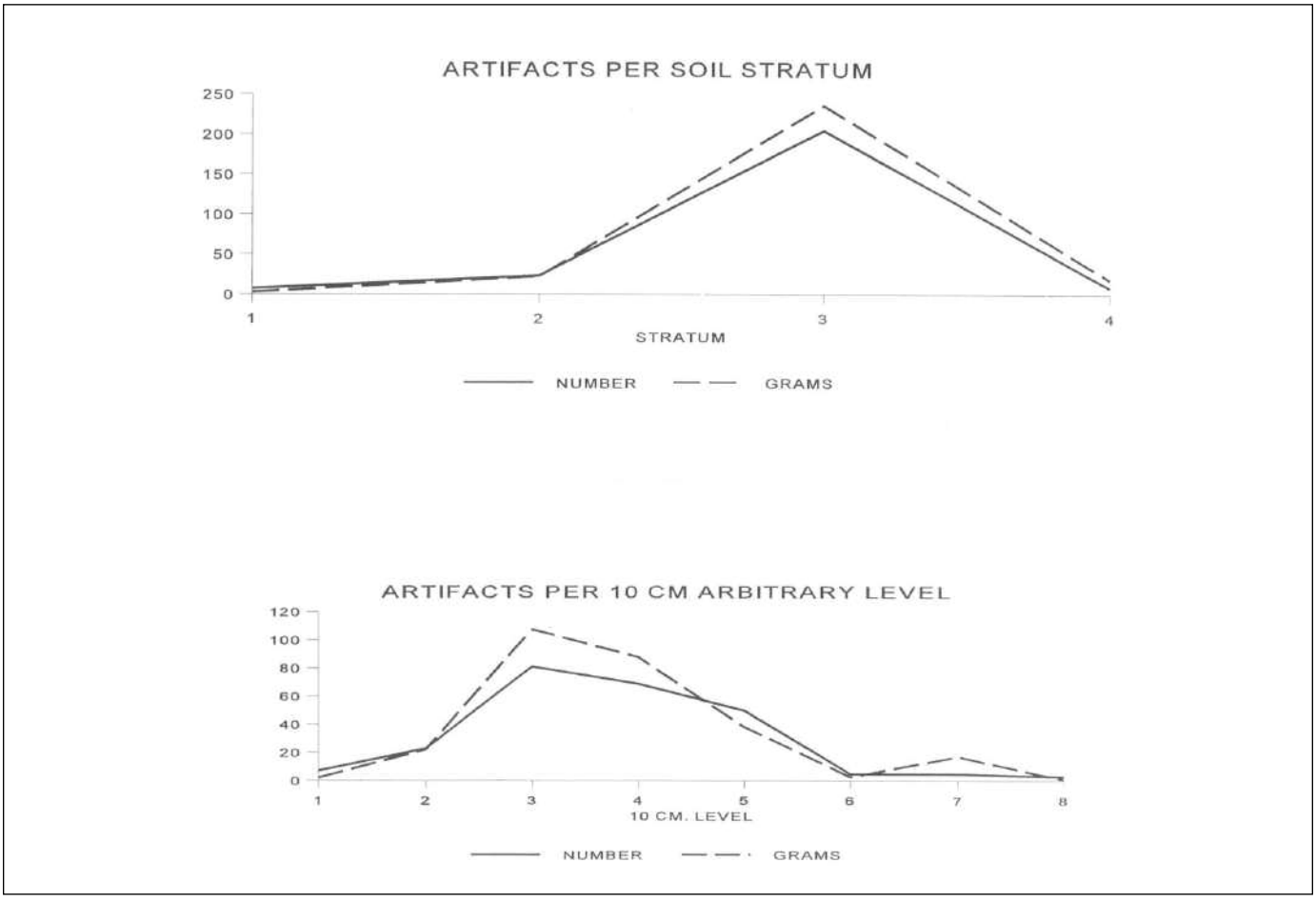

Figure 12.12. Vertical Distribution of lithic material at the Pepsi Site, Town of Colonie, Albany.

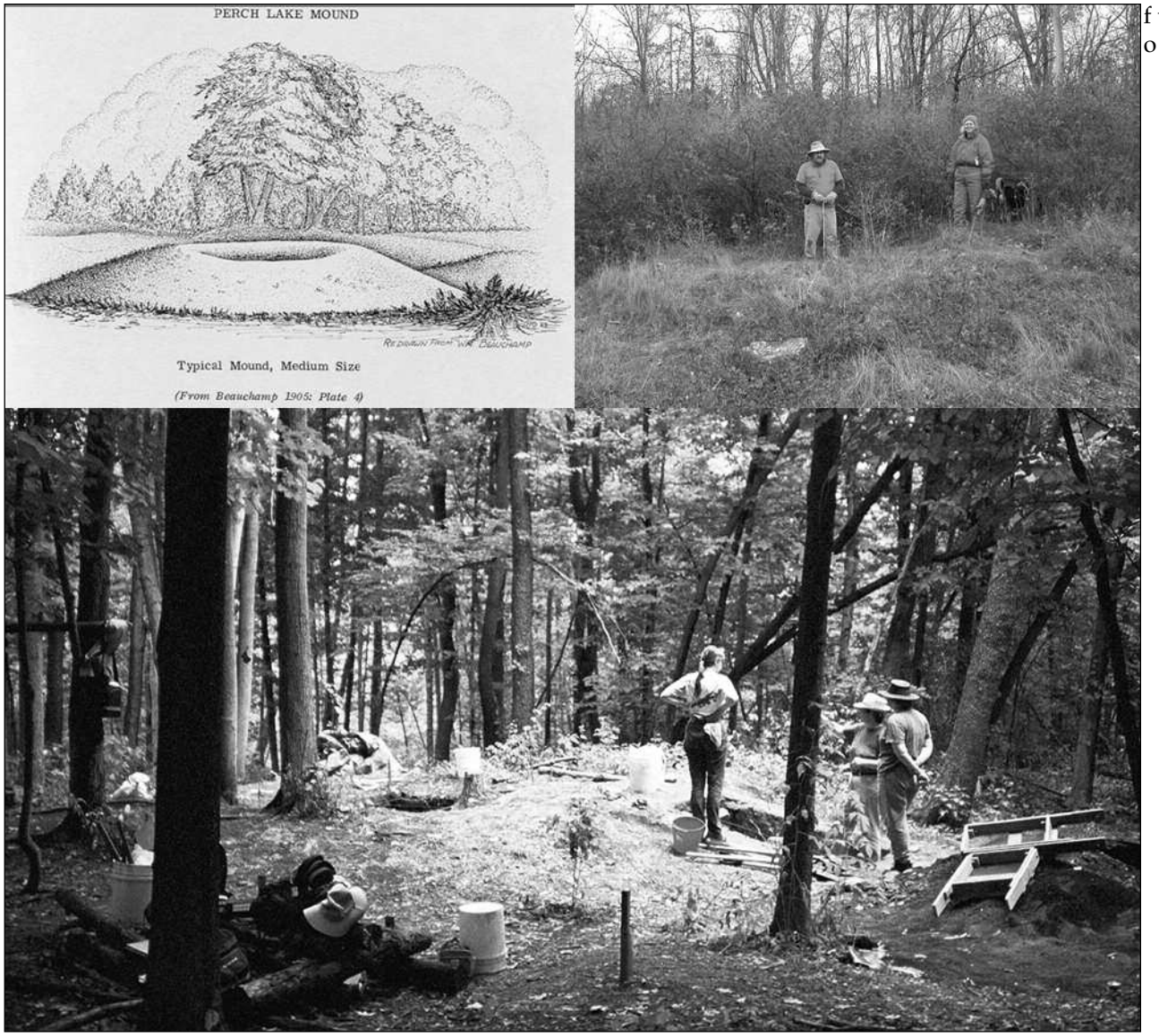

Figure 12.13. Several views of Perch Lake Mounds.

shown that these substantial features are likely to produce almost no lithic material (Abel et al. 2001; Coates et al. 2001; Ritchie 1969). These large features have been documented for over 100 years (Figure 12.13) (Beauchamp 1905; Thomas 1894). They consist of large earthen structures, surrounding substantial hearth/oven features. There is no doubt that these were important locations to the culture that built them, or that they were utilized over a long period of time. Whatever the product of this activity was, it clearly must have been important to that culture.

Yet despite the excavation in the summer of 2002 of four – one by two meter units within one of the mounds (PLM C-2) and numerous 50 by 50 centimeter tests placed on a 10 meter grid surrounding the mound, only a handful of lithic items were recovered. Based on these results, the site would likely have been identified as a very sparse scatter and received little attention. Conversely, had a single test been placed directly within the relatively confined area of dense charcoal and cracked rock at the center of PLM C-2 the site would have been easily recognized. This points out the importance of careful consideration whenever a scatter of flakes is identified. At PLM C-2 the entire mound would fit between tests on a standard 15 meter test grid, while the central and most easily recognized portion of the feature is only about two meters across. Similarly features and even dense artifact clusters, can easily be missed by standard survey methodologies, with the only evidence encountered consisting of very light

density scatters that identify the extreme fringes of archaeological deposits.

Fortunately, these features had been identified and described before plowing impacted many of them. Additionally, those that are currently being studied are located within a New York Sate Department of Environmental Conservation Wildlife Area, and are therefore not subject to continual plowing. However, had past activities reduced these mounds to a point where they are not easily recognizable (as has happened to many other mounds across the eastern United States) and the area been tested through a standard 15 meter testing interval it is likely that they would not be recognized as significant sites. Based on the sparse lithic material recovered, it is likely that the site currently being excavated would have been dismissed as either isolated flakes, or as a sparse lithic scatter. We need to recognize that despite the paucity of lithics, these were very important structures that required substantial input and a commitment of resources by their builders. The lack of lithic material must be attributed to the fact that lithics were not important to the function of these features and not be seen as a reason for determining that the site is not NRE. In fact, these sites are clearly NRE despite the lack of lithic material.

CONCLUSION

As evident from the papers in this volume, it is clear that the time has come for us to re-evaluate our long standing models for assessing National Register eligibility and the need for more in depth examination of sites that are not large and artifact rich. The sites typically considered eligible for the National Register represent only certain aspects of prehistoric cultures and unless we begin to attempt to understand the other sites that made up the complexes of prehistory, we will never be able to fully understand the cultural systems that produced them.

As shown by the papers in this volume, there is an increasing awareness of the need for rethinking the past and present approaches to small sites. We are confident that a more thorough collection and analysis of the data from these sites, and the development of new contexts that address them, are important steps toward ensuring a more complete understanding of the local and regional prehistoric settlement-subsistence systems.

In conclusion, we are all aware of the analogy of the archeological record to a jigsaw puzzle, where we try to complete the puzzle one piece of data at a time. To date we have concentrated our efforts on those sections that relate to "culture history" and settlement pattern data. While these sections are still incomplete, we have a good understanding of how these pieces fit together. However, there remain large sections of the image that are incomplete. Those sections, which like the broad blue sky, mountains and forests give depth and meaning to the overall picture, are often the most difficult pieces to work with. We need to examine such pieces closely, searching for the details of color and texture to better fit them into the overall image. As we move forward, our goal is to encourage archeologists to meet the challenge of piecing these "background" pieces into the overall picture, providing a more complete and ever evolving understanding of prehistoric populations.

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CHAPTER 13

A SUMMARY OF EXISTING DATA FROM PENNSYLVANIA UPLAND SITES

Patricia E. Miller

The issue of the National Register eligibility of plow-disturbed archaeological sites has been a serious concern in Pennsylvania since the revision of the Section 106 guidelines. Revision of these guidelines eliminated the No Adverse Effect determination for sites only eligible under Criterion D. In order to provide background information and context for considering the issue, the Pennsylvania Historical and Museum Commission funded a project to summarize the existing data on plow-disturbed sites. A major component of the project was the review of archaeological reports to gather information on the methods and findings of previous work. The project also included a review of settlement pattern studies to provide an overview of how these sites have been used to develop models of prehistoric behavior. Studies related to the integrity of plow-disturbed sites were also summarized. The study provided a good representation of the characteristics of plow-disturbed sites in both upland and terrace settings, and a better understanding of the site information that has been gathered to date.

RESEARCH ISSUES AND DATA REQUIREMENTS

To be considered eligible for the National Register of Historic Places under Criterion D, an archaeological site must contain important information that contributes to our understanding of history or prehistory. Four levels of archaeological research that potentially can be addressed using data from plow-disturbed sites are discussed below.

Level 1 - What types of environmental settings were used by prehistoric populations; where are prehistoric archaeological sites located?

To address these basic questions of prehistoric site distributions, only data on site locations is needed. Such data are frequently used in non-temporally specific predictive models such as those used to stratify the landscape for large-scale cultural resource management (CRM) surveys. Both dated and undated sites provide information to address these research questions. Given the size of the Pennsylvania site database, which includes over 16,000 sites, it could be argued that in many areas of the Commonwealth sufficient data is available to address Level 1 questions or that such questions no longer constitute important research issues. However, in some areas of the Commonwealth site data are extremely limited and insufficient to develop an understanding of prehistoric site locations.

Level 2 - What environmental settings were used during various periods of prehistory and how did group mobility and land use change over time? What were lithic material preferences as reflected in diagnostic point types?

These research questions have been addressed in settlement pattern studies that tabulate temporally specific site frequencies in various topographic settings and use the site distributions to infer patterns and changes in resource use. To address these research questions, data are needed on the locations of sites and on their age. Temporally specific artifact sub-assemblages are not required. Diagnostic points are needed to address questions related to lithic material preference. Because site-specific data other than chronology is not needed, large site samples, such as those provided by the Pennsylvania Archaeological Site Survey (PASS) files, can be used. A total of 7,474 sites with defined prehistoric components is included in the electronic database of recorded sites. However, the PASS file data is not evenly distributed spatially or temporally. The number of datable components varies by county and by watershed. In addition, some temporal periods are not well represented. A conclusion of the Pennsylvania Archaeological Council's recent study of three watersheds with relatively high quality site data was that the Paleoindian through Middle Archaic (16,000 – 6000 B.P.) and the Early and Middle Woodland (3000 – 1000 B.P.) are poorly known (Chiarulli et al. 2001). Thus, whether Level 2 research questions are important in National Register terms varies by location and prehistoric period.

Level 3 - Questions at this level relate to the economic and technological aspects of adaptive strategy and changes in strategy over time. Included are questions related to the type and degree of group mobility; resource use, including lithic materials; tool technology; and, although not entirely an economic activity, trade and exchange.

Current Approaches to the Analysis and Interpretation of Small Lithic Sites in the Northeast, Edited by Christina B. Rieth, New York State Museum, The State Education Department, Albany, New York 12230. New York State Museum Bulletin 508

Research questions at this level are often grounded in ethnographic models of adaptive strategies such as Binford's (1980) foraging model. Other models are generated inductively from existing archaeological data (e.g. Custer and Wallace 1982; Gardner 1987). In addition to information on site location and age, these research questions require as much data as possible to interpret site function, season and duration of occupation, subsistence and lithic use. The interpretations rely on the definition of temporally specific artifact assemblages, features, and activity areas. Sites that meet these criteria are often considered eligible for the National Register.

A key variable in addressing issues related to adaptive strategies, as opposed to settlement patterns, is site function. As revealed in the settlement studies summarized above, a number of functional types are commonly used to reconstruct mobility and land use patterns. Functional types are generally based on models of adaptation derived from ethnographic data. Types include village, hamlet, base camp, special-purpose camp, short-term camp, hunting camps, and encampment. Base camps include multi-season camps, micro-band camps, and macro-band camps. Often, the site characteristics that are used to define functional types are not presented. In some cases, assigning site function is as simplistic as identifying sites with many projectile points as hunting camps. Site size and artifact density are used to determine site function where little other site-specific information is available. As noted above, in many cases, topographic setting is implicitly or explicitly used to assign site function, but this practice introduces circularity to the settlement model. ,

Data on the proportion, function, and variety of tools increase the basis for the interpretation of site function. Sites with a variety of tools, indicating a variety of activities, suggest base camps whereas smaller, more limited tool assemblages indicate special-purpose camps. Microwear analysis also contributes to the reconstruction of site activities. The primary difficulty in the use of tools to define site function is the difficulty in identifying chronologically specific sub-assemblages at multi-component sites.

The presence or absence of features at a site also provides data on site function. Sites that are demonstrated to have no evidence of subsurface features are generally interpreted as short-term camps, recognizing that shallow hearths may have been present but destroyed by plowing. The type of features, e.g. postmolds, earth ovens, middens, at a site adds to the interpretation of site function. On multi-component sites, features used to interpret site function must be datable.

The identification of temporally distinct activity areas and other intrasite patterning can provide a greater understanding of group size, frequency of site reoccupation, and, possibly, length of occupation. Associations of tools with features or patterns of hearths, cooking features, and postmolds can provide information on the number of social units present at the site and the organization of activities. On multi-component sites, the degree to which intrasite patterning provides information is related to the confidence with which features can be dated and chronologically specific artifact sub-assemblages can be isolated.

Level 4 **-** These research questions relate to the social, political, and religious aspects of adaptive strategy.

To address research questions at this level, a site must produce strong evidence of residential patterning, burials, and/or artifacts related to status and ritual. Such data may be present at large upland villages such as those associated with the Monongahela of western Pennsylvania. Because sites with this type of information are rare, there is general consensus that such sites are significant.

SITE FORMATION AND INTEGRITY

For National Register-eligibility a site must also have integrity, defined as the "ability of a property to convey its significance" (National Park Service 2000). Integrity for archaeological sites relates primarily to the preservation of data and is also related to the types of research questions defined. In general, integrity may be demonstrated by the presence of spatial patterning of features and artifacts, as well as lack of serious disturbance to the deposits (National Park Service 2000).

Specifically, the National Register Bulletin *How to Apply the National Register Criteria for Evaluation* (1998) identifies seven aspects of integrity–location, design, setting, materials, workmanship, feeling, and association–but emphasizes that three aspects–location, design, and materials –are most applicable to archaeological sites that are being evaluated under Criterion D. According to the National Register Bulletin *Guidelines for Evaluating and Registering Archaeological Properties* (2000), archaeological sites almost always have integrity of location. The design of prehistoric archeological sites relates to the intra-site patterning of artifacts, features, and activity areas. Integrity of materials refers to the presence of intrusive artifacts or features, the completeness of the artifact/feature assemblage, or the quality of artifact or feature preservation.

For most surface sites behavioral interpretation is complicated by the fact that numerous episodes of occupation are superimposed. This includes sites that are defined as single component, but which may contain multiple reoccupations within a single temporal period. As a result, the artifact patterns from earlier occupations are disturbed by trampling and other activities of later occupations.

Spurious high artifact density areas may be created by the overlapping edges of activity areas or may result from a single manufacturing event that masks other activities. Tools and other chronologically non-diagnostic artifacts cannot be assigned to a particular occupation. Thus, especially for multi-component sites, the cultural processes of site formation may significantly affect the archaeological property's integrity of design and materials.

Erosion may affect the integrity of location and design of plow-disturbed sites on slopes. Erosion results from the down-slope movement of soils over time and is most severe in agricultural fields where the lack of vegetation contributes to instability of the soils.

Plowing may affect the integrity of design by altering both the horizontal and vertical distribution of artifacts. Experimental studies have attempted to demonstrate the effects of plowing on the distribution of artifacts. The experiments indicate maximum horizontal displacements of 3.56 m to 16 m with the maximum displacement in the direction of plowing (Lewarch and O'Brien 1981; Odell and Cowan 1987; Roper 1976; Trubowitz 1978). Another demonstrated effect of plowing is to move smaller objects downward more than larger objects (Baker 1978; Lewarch and O'Brien 1981).

Knoerl and Versaggi (1984) outlined the potential effects of plowing at various analytical levels. At the attribute level, plowing may create additional edge-damage. However, this damage can generally be distinguished from wear traces. Plow blades may break artifacts. Feature destruction is defined as the most serious effect of plowing, although the importance of data from sub-plow contexts has been repeatedly demonstrated.

In summary, although plowing clearly affects the distribution of artifacts, in addition to partially destroying subsurface features, plowing does not appear to completely destroy the archaeological patterning on surface sites. Overall, researchers concluded that general patterns of artifacts were preserved. Indeed the effects of multiple re-occupations of a site may have a more serious effect on spatial patterning than does plow disturbance. And because integrity relates to the site's ability to convey its significance and significance is related to research issues, plowing affects integrity only so far as addressing the research issues requires a precise knowledge of artifact distributions. The National Park Service (National Park Service 2000) also supports the conclusion that plowed sites may be National Register-eligible, stating that:

> One of the most common questions asked about archeological sites and integrity is: Can a plowed site be eligible for listing in the National Register? The answer, which relates to integrity of location and design, is: If plowing has displaced artifacts to some extent, but the activity areas or the important information at the site are still discernable, then the site still has integrity of location or design. If not, then the site has no integrity of location or design.

ANALYSIS OF EXISTING DATA ON PLOW-DISTURBED SITES

Data collection for the project focused on plow-disturbed sites in the Commonwealth that have been investigated through Phase II or III level studies. The collection of existing data involved the full range of plow-disturbed archaeological sites, from small, sparse scatters to large, high-density sites, excluding only villages, for which there is general agreement on issues of significance.

During the course of the study more than 250 cultural resource management reports were examined and data from 190 sites were entered into a Microsoft Access database. Included were reports from the early 1980s, when field efforts appeared to be generally more limited than the current standards. Village sites with dense artifact concentrations, features, and intrasite patterning were not considered, since these sites are generally agreed to provide significant information. Lithic quarries, mounds, and other special site types were also excluded from the analysis. Information was collected on the characteristics of each site–types of artifacts, the presence or absence of features–as well as on the field methods that were used. The researchers noted whether intrasite patterning had been identified at the site and what methods were used to make the determination. The report author's conclusions, if any, regarding site function were also noted. The study provided a good representation of the characteristics of plow-disturbed sites in both upland and terrace settings, and a better understanding of the site information that has been gathered to date. A number of statistics on the archaeological characteristics of plow-disturbed sites in Pennsylvania were tabulated using data from the study.

The total number of diagnostic points recovered from plow-disturbed sites ranged from zero to 143, except for one site where data from a collector brought the total to 821. Based on the point types, radiocarbon dates, and presence or absence of ceramics, the minimum number of temporal periods represented at each site was calculated (Figure 13.1). Untyped notched and stemmed points were assigned to the Late Archaic to Early Woodland Periods (6000 to 2300 B.P.), which was treated as a single, distinct period. The number of temporal periods ranged from one to eight, with one temporal period identified at 53 of the sites. However, these single component sites may have more, unrecognized components. About half of the determinations were based on less than 100 artifacts. The number of temporal periods could not be determined for 49 of the 190 sites.

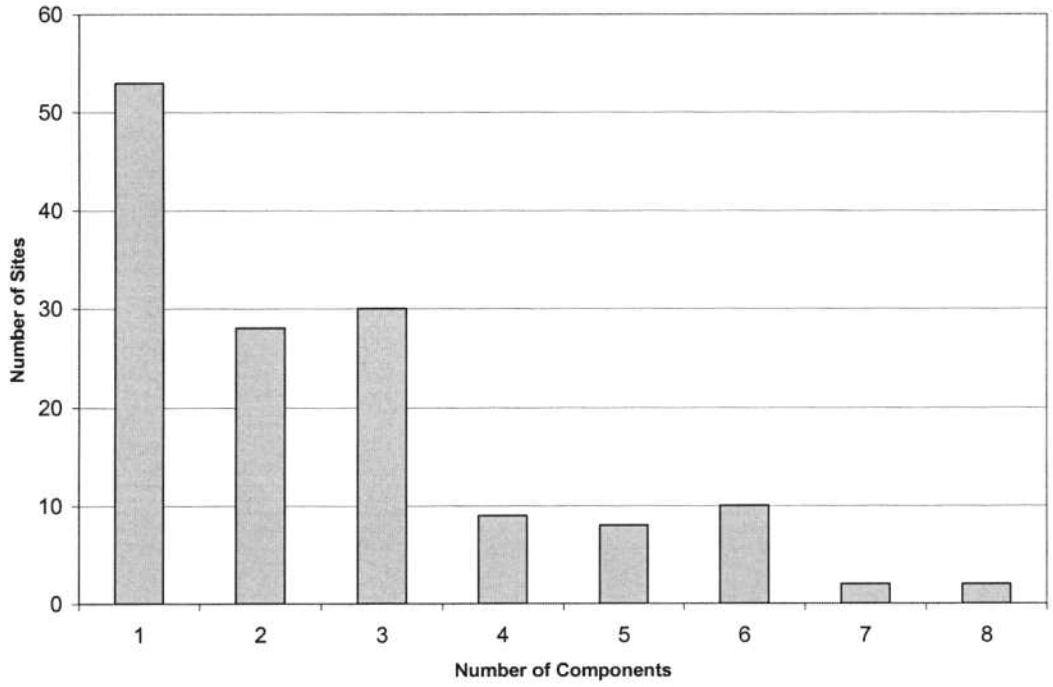

Figure 13.1. Number of Sites with Single and Multiple Components.

Tools other than points were found at 144 of the 190 sites, comprising from less than 0.01% to 100% of the assemblage (Figure 13.2). The one site with 100% tools consisted of three artifacts, a biface and two points. Approximately half the sites with tools had proportions of 2% or more.

Ceramics were present at only 21 sites and the number of ceramics per site was generally low. Ceramics were usually interpreted as indicating habitation sites of relatively long term, although one site with ceramics was interpreted as ephemeral, three as temporary or short-term camps, one as a special-purpose camp, and

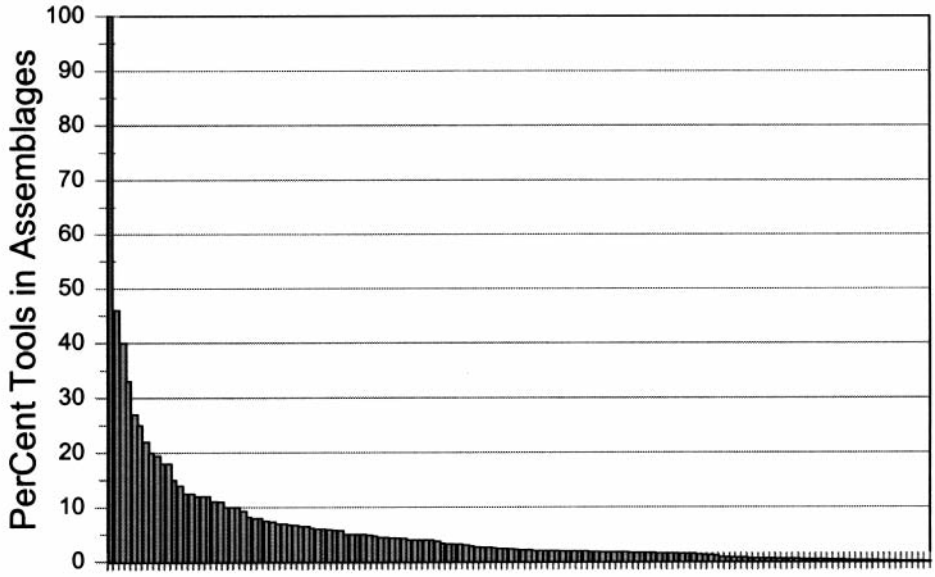

Figure 13.2. Per Cent Tools for 190 Sites.

two as hunting camps.

Features such as hearths, storage pits, and postmolds were found at 55 of the 190 sites. Features numbered from one to 80 per site (Figure 13.3). Of the 72 sites where mechanical stripping of the topsoil was performed, 35 revealed features. Only 15 of these sites were on terraces or other setting near water, suggesting that features are more common on upland sites than was generally thought.

Analysis of intrasite patterning was fairly limited in the Phase II reports that were reviewed; the most intensive analyses were in Phase III reports. No spatial analysis was undertaken for 111 of the 190 sites, but these were generally sites with few artifacts or where Phase II testing was extremely limited (Table 13.1). At 64 of the 111 sites, less than 100 artifacts had been recovered. At 22 sites, some level of analysis was undertaken, but revealed no intrasite patterning. Analysis of artifact distributions at 33 sites revealed evidence of artifact clusters or high-density areas that were often interpreted as knapping clusters. Fifteen sites were reported as having functionally discrete activity areas. Four of these sites had data recovery levels of effort. Three of the 15 sites were from a single temporal period, but activity areas were defined at sites with as many as six components. Finally, analysis of intrasite patterning at nine multi-component sites revealed some evidence of temporally discrete sub-areas; at seven of these sites a functional interpretation of the sub-areas was made.

Table 13.1. Intrasite Patterning Identified in Reports

Total Sites	**190**
No analysis	111
Analysis, but no patterning	22
Clusters, high-density areas	33
Functionally discrete activity areas	15
Temporally discrete subareas	9

For most of the sites in the sample, some conclusion regarding site function was presented, although in most cases little attention was paid. The information provides insights into how site function has been variously defined by researchers. Only 11 plow-disturbed sites were interpreted as base camps or seasonal base camps and one was interpreted as a Late Prehistoric (1000 to 350 BP) hamlet (Table 13.2). Eleven of the 12 sites had features, including pit features. Site 36Sn21 had 80 features and was interpreted as a Late Archaic (6000 to 3800 BP) base camp and possible Late Woodland village (1000 to 350 BP) (Miller 1995). Site 36Me105, produced 56 features, including postmolds (Baker and Baker 1990; Koetje 1998). Artifact densities were relatively high on all 12 sites, a variety of lithic materials were present, and tool proportions ranged from less than 1% to 22%. Five of the sites were on terraces, but the remaining occupied a variety of topographic settings, including low slopes, upland flats,

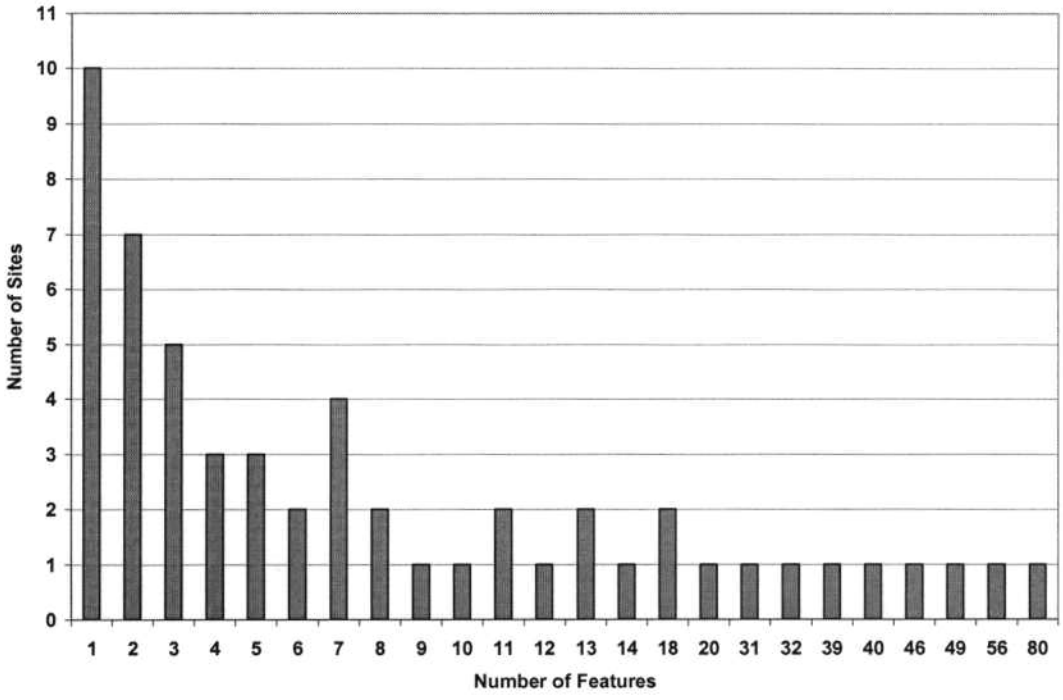

Figure 13.3. Count of Sites by Number of Features.

Table 13.2. Functional Site Types and their Characteristics

Site Type	Artifact Density	Features	Lithic Material Variability	Tools	Number in Database
Base camp/Hamlet	High	Present	High	0.1-22 %	12
Ephemeral sites	Low	Absent	Low	Few or None	43
Lithic reduction stations	High	Absent	Low	0-7%	18
Special-purpose camps	Variable	Variable	Variable	0-14%	33

and ridge tops. Other habitation site types that were reported included camps and short-term camps.

Sites with few or no tools were generally interpreted as ephemeral camps if the artifact density was low and as lithic reduction stations or short-term camps if the density of artifacts was higher. In all, 43 sites were interpreted as ephemeral. There is some evidence to suggest that this category is something of a throw-away and is overused. Sites with relatively high proportions of tools were also interpreted as ephemeral camps; 17 of the 43 had tool proportions greater than the mean for all sites. Test unit densities were generally less than 15 artifacts per unit; however, one site classified as ephemeral produced 272 artifacts from the two test units excavated there. Four of the sites had pit features, which suggests a longer than ephemeral occupation.

Eighteen sites were interpreted primarily as lithic reduction stations. For 15 of these, a single lithic material comprised 80% or more of the assemblage. Tool proportions were 7% or less, although artifact densities were often relatively high. Only one of the sites interpreted as a lithic reduction station had features; 11 pit features were present on that site.

Twenty sites were interpreted as hunting or foraging camps and thirteen sites were special-purpose camps, with the purpose undefined. About half had features and the total number and density of artifacts varied widely. The sites occurred in a wide variety of topographic settings.

Finally, 10 sites were temporary or transient camps. These sites were mostly on stream benches or terraces and produced as many as 700 artifacts.

To summarize the state of the existing data in Pennsylvania, one would have to conclude that there is much more that needs to be done. Much of the fieldwork done in the 1980s and early 1990s on plow-disturbed sites was limited and as a result so too were any conclusions. Of the 190 sites, 34 had no surface collection, fewer than ten test units, and fewer than 50 shovel tests. In contrast, more recent data recovery levels of effort have indicated that temporally discrete sub-areas can be defined in at least some plow-disturbed sites. These significant sites have contributed to our understanding of prehistoric behavior.

DISCUSSION AND RECOMMENDATIONS

> Overlooking the significance of small sites may skew our understanding of past lifeways as those sites not only receive less research attention, but also are destroyed without being recorded thoroughly because they are "written off" as ineligible for listing in the National Register. Such losses point up the need to continuously reexamine historic contexts and allow new discoveries to challenge our ideas about the past. [National Park Service 2000]

This simple statement from the National Parks Service Bulletin on archaeological properties likely represents the upper limit of consensus on the National Register-eligibility of upland sites within the Commonwealth. The root of the problem likely lies in the fact that virtually all-archaeological sites provide some level of important information, but not all sites can be considered significant. To reach a consensus regarding significance, the concepts and assumptions underlying interpretations of plow-disturbed sites should be examined and debated. It is also recommended that protocols for fieldwork and data analysis methods be developed to assure that, once agreement is reached on what constitutes a significant site, significant sites can recognized.

It is necessary to discuss and debate the assumptions that are used in the interpretation of data from surface sites with multiple components. For example, can temporally distinct sub-assemblages be isolated on such sites based on the assumption that the distribution of diagnostic artifacts reflects the boundaries of the occupation? Does the temporal clustering of features have any relevance to the age of artifacts that are found around them? Discussion should also focus on how specific site characteristics reflect site function. For example, do a large number of points in an assemblage necessarily indicate a hunting camp? Although negative evidence such as the absence of tools or features is useful in the interpretation of site function, does this negative evidence always or ever constitute significant information? Under what circumstances can social organization be incorporated into functional typologies?

A fieldwork protocol should be developed; outlining minimum standards for providing sufficient data for determining which research questions can be addressed. The protocol must provide for the recovery of a sufficient number of artifacts to determine with reasonable certainty whether the site is datable, how many components are present, and whether intrasite patterning is present. Best strategies for mechanical stripping to identify features should also be developed. Artifact sample size also has implications for assessing assemblage variability, a characteristic that is used to interpret site function. Thus, the fieldwork protocol should establish goals for the number of artifacts to be recovered from a site. This approach is somewhat at odds with current practice, which generally involves doing more work on high-density sites and less work on low-density sites. The opposite approach is recommended.

Once sufficient data has been gathered from a site, analytic techniques should be directed towards the identification of intrasite patterning and site function, factors that have direct bearing on site significance. Researchers should be encouraged to draw conclusions regarding site function on the basis of specific, explicitly stated site characteristics. The use of mapping programs and the overlaying of maps of tools, debitage, and features to identify activity areas should also be encouraged. The largest possible sample of features with wood charcoal should be dated through radiocarbon analysis as part of the significance evaluation to identify what periods are represented and to aid in the identification of temporal patterning and site function. The identification of temporally specific site function provides a framework for fieldwork and data analysis that will lead to an increased understanding of adaptive strategies and the prehistoric use of the full range of environmental settings.

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CHAPTER 14

SMALL LITHIC SITES: LINKING SIGNIFICANCE WITH CONTEXT

Nina M. Versaggi and Christopher D. Hohman

INTRODUCTION

As many of the papers in this volume have demonstrated, the practice of CRM has contributed to an explosion in the numbers of small lithic sites discovered by archaeologists in the Northeast. The sheer numbers of these sites and their appearance of redundancy have challenged archaeologists and reviewers to re-visit the contexts within which prehistoric sites are usually evaluated for significance. It is no surprise that researchers and managers have found that traditional models of chronology, subsistence, and settlement are not always adequate for framing National Register eligibility arguments. These models tend to favor sites with large, diverse artifact assemblages that include diagnostic points, and pottery. Unique characteristics, such as features, are also an important criterion in traditional models of significance. Most lithic scatters do not fit within these parameters. Small lithic sites tend to result from specific types of prehistoric land use, much of which did not always involve a long- or short-term overnight stay. In addition, activities conducted at these sites did not always include the hunting tasks that produce diagnostics. Small lithic sites cannot be ignored, yet what characteristics make such sites significant?

In the rush to get projects sampled and reports submitted, few researchers have had the time to digest the volumes of data on lithic scatters, and produce interpretive models that account for their existence. Are we adequately managing these cultural resources if sampling protocols, eligibility parameters, and preservation plans are lacking for sites comprised solely of small clusters of lithics? These concerns prompt a series of questions, many of which have formed the basis of papers presented in this volume. First, what constitutes a "significant" lithic scatter? Second, can we afford to preserve or investigate hundreds of these sites? And third, can we justify decisions for evaluating and managing these resources based on past protocols rather than more forward-looking models that anticipate the research needs of future archaeologists?

Small lithic sites require a more explicit research and management strategy than currently exists. However, recognizing the research significance of lithic scatters and managing their preservation are two very different tasks. Defining research importance requires an assessment of the types of data present, and the potential for these categories of data to link to current research questions. Managing the preservation of lithic scatters demands confidence in the amount of field and analytical evaluation that has occurred, clear linkages to convincing interpretive contexts, and preservation priorities. As shown in this volume, many archaeologists are testing the research potential of small lithic sites and are building strategies for sampling and interpretation. There is no question that lithic scatters can provide rewarding research regarding hunter-gatherer organization and mobility when linked to regional landscapes and land use. Constructing solid research contexts within which to interpret lithic scatters is key to formulating a justifiable management approach.

We would like to discuss three main points in this chapter. First, in order to effectively address the potential significance of upland lithic scatters, archaeologists must adequately evaluate them in the field. Second, archaeologists need to develop more innovative context-based arguments for significance that link with regional research designs. Finally, archaeologists should explore a broader use of the thematic or multiple properties district concept when addressing the significance of small sites. The concept of significance forms the basis for these three points and the following discussion will address significance in more detail.

THE CONCEPT OF SIGNIFICANCE

The concept of site significance has been discussed and debated widely since the 1970s (Raab and Klinger 1977; Glassow 1977; Lyncott 1980; Tainter and Lucas 1983; Briuer and Mathers 1997; Hardesty and Little 2000; Noble 2001; Schull 2001; Austin et al. 2002). Early approaches to assessing the significance of archaeological sites ranged from a focus on the unique, to "value" considerations, to the development of explicit research designs (Rabb and Klinger 1977: 632-633). Understandably, the earlier discussions were grounded in the context of processual archaeology, since this was the dominant archaeological paradigm at that time. It was common to see significance debates revolve around the need to measure variables

Current Approaches to the Analysis and Interpretation of Small Lithic Sites in the Northeast, Edited by Christina B. Rieth, New York State Museum, The State Education Department, Albany, New York 12230. New York State Museum Bulletin 508

and test hypotheses during the process of evaluating sites (Glassow 1977:415). This focus changed slightly with subsequent paradigmatic shifts in archaeology and cultural resource management, such as reducing the reliance on empiricism and linking significance to the interests of contemporary Americans and Native American communities (Tainter and Lucas 1983; Leone and Potter 1992). More recently, guidelines issued by the National Park Service, National Register Division (Little et al. 2000) clarify some of the new challenges facing evaluators of archaeological significance. One of these areas is "the importance of small or overlooked sites" (Little et al. 2000:21). http://www.cr.nps.gov/nr/publications/bulletins/arch/pt4.htm). The NPS recognized that "overlooking the significance of small sites may skew our understanding of past lifeways..." (Little et al. 2000: 21), and acknowledged the need to continuously update contexts used to evaluate significance.

In the Northeast, small lithic scatters are a perfect example of "overlooked sites" that would benefit from a reexamination of contexts for evaluating significance. National Register criterion D ("has yielded, or may be likely to yield information important in prehistory or history") is the only applicable reference for evaluating the significance of small lithic sites. While some researchers have criticized this criterion as being based on ambiguity (Tainter and Lucas 1983:710), it is an elastic concept that allows a diverse assessment of a site's potential and provides researchers with the leeway to be creative with significance contexts (Seibert 2002:37). In fact, criterion D offers the only possibility for discussing the potential for small lithic sites to contribute to research contexts, since the other three criteria require that a site already demonstrate specific requirements.

"Significance" has become a legally defined term within archaeology, and its legal definition is tied to the four criteria for National Register eligibility. Significance has become defined as single or multiple sites that have the potential to produce certain types of information that can be linked to current research questions in the discipline. In this context, significance is somewhat relative to the observer, and the degree of value or importance assigned by an observer to a site can be expected to vary through time and by region. As such, significance is qualitative rather than quantitative, and shifts in the perception of what is important will change as the discipline matures (Tainter and Lucas 1983:714). "Changing perceptions of significance are simply a matter of the normal course of all social sciences and humanities as they evolve and develop new areas of study" (Little et al. 2000:29). Most researchers would agree that significance is a value-laden term that requires a winnowing process as part of the management of cultural resources. How value is assigned, and whose values are used, constitute another forum for debate as non-Native Americans and Native Americans view the importance of the past in different ways. For this chapter, we will focus on the archaeological dimension of significance. The means by which we assign the label of significance to a site or class of sites should be firmly grounded in anthropological and archaeological models current to the study of prehistory and history. While theoretical concerns form the foundation for assessments of significance, adequate field identifications and evaluations are equally important to the process.

ADEQUATE FIELD EVALUATION

When is a site a site? Many states and CRM firms have rules of thumb for answering this question (e.g., one artifact; more than two artifacts per shovel test pit; artifacts in the initial test and at least one of four radials; artifacts in the initial test as well as one at a certain interval before and after the initial test pit, etc.). However, the quest to find the large, diverse, and unique often left small clusters of low-density lithics as the throw-away by-products of the site identification process. Many single artifact discoveries as well as some low density clusters became lumped within a category known as isolated or stray finds. For other small lithic sites, a priori assumptions about their lack of significance resulted in decisions that affected their formal evaluation. In other words, many of these sites do not even reach a Phase 2 site evaluation step before they are dismissed as insignificant. At a minimum, most practitioners of CRM have recognized the importance of radial testing around single lithic discoveries as a first step in an evaluation process. Those researchers who have gambled on the potential data present on these sites are often rewarded when "stray finds" produce interesting data once expanded testing is done (see Blakemore et al. and Jones, this volume for case studies that illustrate this point).

There have been numerous examples at the Public Archaeology Facility (PAF) where STPs with a flake or two expanded into more dense distributions at closer testing intervals, or produced features and diverse artifact assemblages when a few units were excavated. This lesson was learned early when PAF staff conducted a reconnaissance survey for proposed sewer lines in Owego, Tioga County, New York. A single transect of Shovel Test Pits (STPs) on the Susquehanna floodplain across from the village identified three lithics in two STPs spaced 20 m apart. PAF argued for a site examination and the small lithic site ballooned into a multi-component occupation with multiple clusters and features (Versaggi et al. 1982). The data recovery results continue to provide researchers

with information on the Transitional (1500–200 B.C.) through Late Woodland (A.D. 900-1600) periods, which are fueling models of steatite use, regional diversity, and political alliances on the Allegheny Plateau (Versaggi and Knapp 2001; Versaggi 2003).

Research on upland land use strategies has benefited immensely from identification of small lithic sites. These "overlooked" and "redundant" site categories have emerged as informative aspects of regional land use activities conducted beyond the residential base. Many of these appeared as stray lithics scattered along lengthy pipeline corridors. Reconnaissance surveys in the early 1990s for the New York segments of the Tennessee Gas pipeline identified numerous small lithic sites in both western and eastern New York. One segment produced several small lithic scatters in the uplands of Chautauqua County, on a physiographic divide between the Erie Lowlands, minor Finger Lakes, and the Allegheny Valley (Versaggi et al. 1993; Versaggi and McDonald 1994). STPs at 15 m intervals identified 10 prehistoric sites within a 4.8 km (3 mi) long corridor. Site examinations were conducted at all 10 sites using 5 m grids of shovel test pits and a small sample of 1 m^2 units.

Although the total artifacts from Phase 1 testing were unimpressive, Table 14.1 shows a significant increase, almost four-fold, after the Phase 2 site examination. The ratio of Phase 1 to Phase 2 artifacts indicates that for every one artifact found during reconnaissance, an additional 6.5 to 43.7 artifacts result from the extra testing. The sites shared one interesting characteristic – their lithic assemblages all contained naturally occurring chert blocks, some of which were utilized and retouched. As much as 50% of the total artifacts on a given site consisted of these blocks. It was clear that if a curated set of tools was carried into these uplands, they were not used to the point of discard or loss. Chert blocks defined a unique artifact type, and along with utilized flakes, they formed a highly expedient tool assemblage. The site examinations also uncovered two features, all of the jasper debitage, and almost all of the block tools. These important parts of an upland context would have been missed if these sites were labeled stray finds, and investigations stopped after reconnaissance. As a result, four sites from this project were declared eligible for the National Register based on their characteristics in relation to the rest of the upland sites - the four all exceeded the average for many of the variables recorded for this site sample. For the remaining six sites not determined eligible, we have an artifact assemblage derived from close interval shovel testing, and a sample of excavation units. Thus, a sample from these sites is preserved for future analysis as paradigms and techniques for data analysis shift (Table 14.1).

After the Chautauqua survey, our attention shifted to eastern New York and a 25 km (16 mi) pipeline segment (Versaggi et al. 1993; Jones et al. 1992); crews found 51 lithic scatters in these uplands. The sites are within a day's walk of Fox Creek, a major tributary of the Schoharie Creek, where many residential base camps and villages are known. However, access to these uplands involved a trek that was not easy, suggesting that the items needed from the uplands could not be gathered within easy reach of any residential sites in the creek valleys. As with Chautauqua, all of these sites contained an almost exclusively expedient artifact assemblage, and again large chert blocks were a major component of the tool assemblage. These expedient tools suggest that foraging and processing tasks were performed, requiring only "tools of the moment."

A detailed micro-wear analysis supplemented the lithic classification (Pope 1996; Versaggi et al. 2001). The results showed that while some of the block tools were used to process meat, antler, or bone, many tools showed pronounced polishes attributed to processing wood and other plants. In particular, some tools matched polishes

Table 14.1. Characteristics of Chautauqua County Upland Sites

Site	Size (m^2)	Total Artifacts	Ratio of Artifacts: Site size (m^2)	Ratio of Phase 1: Phase 2 Artifacts	Other Information
Beaver Marsh I*	1400	212	1:6.6	1:7.5	Early, Late Woodland
Beaver Marsh II	675	19	1:35.5	1:2.8	
Peterson*	350	24	1:10.3	1:3.8	
Reed	250	8	1:31.25	1:1.7	
Boardman*	425	40	1:10.6	1:4.7	Jasper
Timberlands	450	16	1:28.1	1:0.6	Jasper
Gill I	350	8	1:43.7	1:0.7	
Gill II	25	3	1:8.3	1:0	
Gill III	125	5	1:25	1:4	
Sventech*	275	42	1:6.5	1:7.4	Jasper
Averages:	432.5	37.7	1:20.6	1:3.9	

*Site declared National Register Eligible

created by processing silicious plant stems. These are typically reeds and grasses, the types of raw materials used for textiles, cordage, baskets, and mats. Those tools that exhibited wood or bark wear traces may have been used to cut basket staves from trees. We classified these sites as resource processing areas created by daily foraging groups attached to larger residential bases. A model for hunter-gatherer division of labor provides a context for interpreting these locations as areas used for processing plant resources commonly used in the manufacture of non-lithic tools and non-pottery receptacles, an interesting context that removes a primarily "food focus" from the land use pattern (Versaggi 2002). Based on this information, the Tennessee Gas Archaeological District was created. Seven of the 51 sites contained the data potential to contribute to research tied to these concepts. However, 46 of the 51 sites received some degree of site examination before this call was made. The data derived from site evaluations produced an assemblage of information that can be used in future research. As Table 14.2 shows, only one of the seven sites produced artifacts numbering in the hundreds. The remainder had relatively low counts of lithics. In contrast to the Chautauqua example, the ratio of Phase 1 to Phase 2 artifacts did not show a significant increase, although modest increases were noted. The main point for this example is that sheer counts are not important to significance. The additional analysis conducted during the site examination in combination with the construction of the context for interpretation produced the significance argument for this group of lithic scatters (Table 14.2).

These examples are just a few of the case studies that document the importance of pursuing some form of site evaluation for small lithic scatters. A brief review of the "grey literature" of CRM in New York found that several other researchers have had similar experiences when further investigating apparent isolated lithics (Cassedy 1990, 1991; Hartgen 1998, 1999; Pratt and Pratt 1998). The lessons are clear: when we ignore what looks like an isolated find, we continue to devalue lithic scatters by comparing them to larger residential sites rather than constructing an appropriate field testing strategy and analyses with which to evaluate their true data potential. When we make an effort to evaluate small density finds, the potential is there for informative and significant data to emerge. Lithic scatters cover a small area (some as little as 10 m2), and it is not costly or time-consuming to conduct additional field evaluations. Often, extra shovel test pits at a close interval (e.g., 1-7.5 m), or a couple 1 m2 units are sufficient for assessing data potential. Within a CRM context, any extra testing has the potential to cause cost overruns or confuse clients already stressed by the compliance process. However, nowhere does it require that evaluation must occur as a separate or expensive Phase 2. It should be possible to conduct a little extra testing during the reconnaissance and achieve an intermediate evaluation that would help with subsequent decisions about a site. While it is a gamble to test more during Phase 1, there are real potentials for cost and time-savings from this approach. What is clear is that we cannot adequately assess the significance of this class of site if we persist in tossing aside low densities of lithics found during reconnaissance. This point is not just one that is voiced in New York, but resounds throughout the archaeological community in the Eastern U.S. Conferences in Pennsylvania, Virginia, and Florida have all addressed the significance of lithic scatters and other small, redundant sites in various physiographic contexts (Austin et al. 2002; PennDOT Byways 2002; Carr 2004; Perazio 2004; Rieth 2004).

CONTEXT-BASED ARGUMENTS FOR SIGNIFICANCE

Part of the frustration archaeologists experience in assessing the significance of lithic scatters is that standard subsistence and settlement models often are inadequate frames of reference for interpreting small sites. American archaeology has always had a strong bias in favor of the large, stratified, artifact-rich deposits that helped define regional sequences in many parts of the country. Small lithic sites do not fit well into these frameworks. Eligibility determinations are dependent on how well we frame the argument and construct the interpretive con-

Table 14.2. Characteristics of the Tennessee Gas Archaeological District

Site	Size (m^2)	Total Artifacts	Ratio ofArtifacts: site size (m^2)	Ratio ofPhase 1: Phase 2 Artifacts
VanGosbeck I	55	9	1:6.1	1:0.29
Van Heusen II	175	57	1:3.1	1:0.68
Gaige V	150	29	1:5.2	1:1.64
Shedina/Pride	750	94	1:8.0	1:1.54
Ford I	385	56	1:6.9	1:2.29
Saddlemire I	1275	266	1:4.8	1:2.2
Carl II	150	31	1:4.8	1:4.2
District Averages:	420	77	1:5.6	1:1.83

text. Does the absence of traditional interpretive elements, such as features and formal tools, mean that lithic scatters are insignificant? That conclusion is likely unless innovative approaches to constructing contexts are employed. It is also likely that strict adherence to traditional arguments for significance will contribute to the mismanagement of lithic scatters in that this perpetuates a perception of resource redundancy (Cobb and Versaggi 2001). Why do we need to mitigate (or even preserve) yet another lithic scatter when so many exist? Aren't they all the same? These arguments hold some sway if significance arguments do not keep pace with changing anthropological paradigms that yield new research frameworks, and advanced analytical tools that give us new data.

For instance, the evidence from the Tennessee Gas National Register District suggested that these non-camps are the residues of specialized task groups. It is possible to gain a glimpse of this invisible aspect of labor and material culture through the procurement and processing activities represented by the expedient assemblages that dominate small lithic sites (Sassman 1992; Versaggi et al. 2001). However, if small sites with expedient technologies are ignored in the preservation and management process, we create a glaring hole in our interpretations of landscapes and land use. We remove any chance of seeing a complex component of technology and group organization in the archaeological record. Sometimes, the significance of single lithic scatters is hard to argue. However, archaeologists are more often viewing sites within landscapes and this approach can be linked to National Register district concepts as an organizational tool and alternative avenue towards assessing the significance of single, "redundant" sites.

THE DISTRICT CONCEPT

As noted above, assessing the eligibility of single lithic scatters, especially at the Phase 1 level, tends to yield negative results. The majority of lithic scatters lack diagnostics, features, and formal tools, all of which are traditional characteristics favored for National Register eligibility. However, when a single lithic site is evaluated in relation to a geographic context or a group of similar sites, different assessments of significance may result. For instance, a collection of sites and their geographic context can combine for unique data potential that would qualify for consideration as an archaeological district. The National Park Service's National Register division offers guidelines for identifying and proposing multiple property and thematic archaeological districts (Little et al. 2000). According to Seibert (2002:47), these types of districts are a useful tool for addressing the significance of redundant resources and the National Register "emphasizes the importance of developing historic contexts, including research and sampling designs, that identify and prioritize 'redundant' site types at statewide and regional levels." Development of appropriate contexts for assessing the research importance is central to the whole eligibility argument, but probably even more critical to the district concept. Imbedded in this requirement is the construction of research designs that identify what types of sites will be targeted for preservation/investigation, what types of data must be present on these sites, what research questions these sites can address, how to investigate and sample them, and which ones should be preserved rather than mitigated through excavation.

When surveying small project areas where one or two lithic scatters are found, can we justify assessing their research potential as low when a larger project area might contain several more sites clustered around unique landforms? We have a responsibility to the resource to collect some amount of additional information on those single sites for future researchers. The development of a research context for small lithic sites is glaringly absent in the Eastern U.S. and this missing set of research protocols probably contributes to most of the confusion and frustration with managing many small sites, particularly lithic scatters. Perhaps constructing a thematic or multiple property district for these lithic sites by region would force a more formal dialogue about the research importance of some and the redundancy of others.

We will illustrate the three main points of this paper with a case study from the Richardson Hill Project, where a series of seven sites were found on a drainage divide between the Susquehanna and Delaware valleys in Delaware County, New York (Figure 14.1).

RICHARDSON HILL SUPERFUND PROJECT

In 2001, PAF performed a Phase 1 survey in the uplands surrounding an EPA superfund project (Hohman 2001). Crews excavated 257 shovel test pits at 15 m intervals along multiple transects bordering the contaminated Herrick Hollow Creek. This creek is a tributary of Trout Brook, which feeds into the West Branch of the Upper Delaware River (Figure 14.1). A series of wetlands dot this drainage divide, which sits at an elevation of about 427-549 m (1400-1800 ft). The Phase 1 testing found that only 10 of the 257 STPs (4%) contained prehistoric lithics, distributed among seven spatially distinct areas. For six of these seven areas, the initial STP produced only 1-5 lithics; the seventh yielded an unusually dense 44 lithics (Table 14.3).

At first glance, it was tempting to focus on the one dense site and label the remaining six as "isolated finds." However, it is PAF policy to conduct "4-around" radial

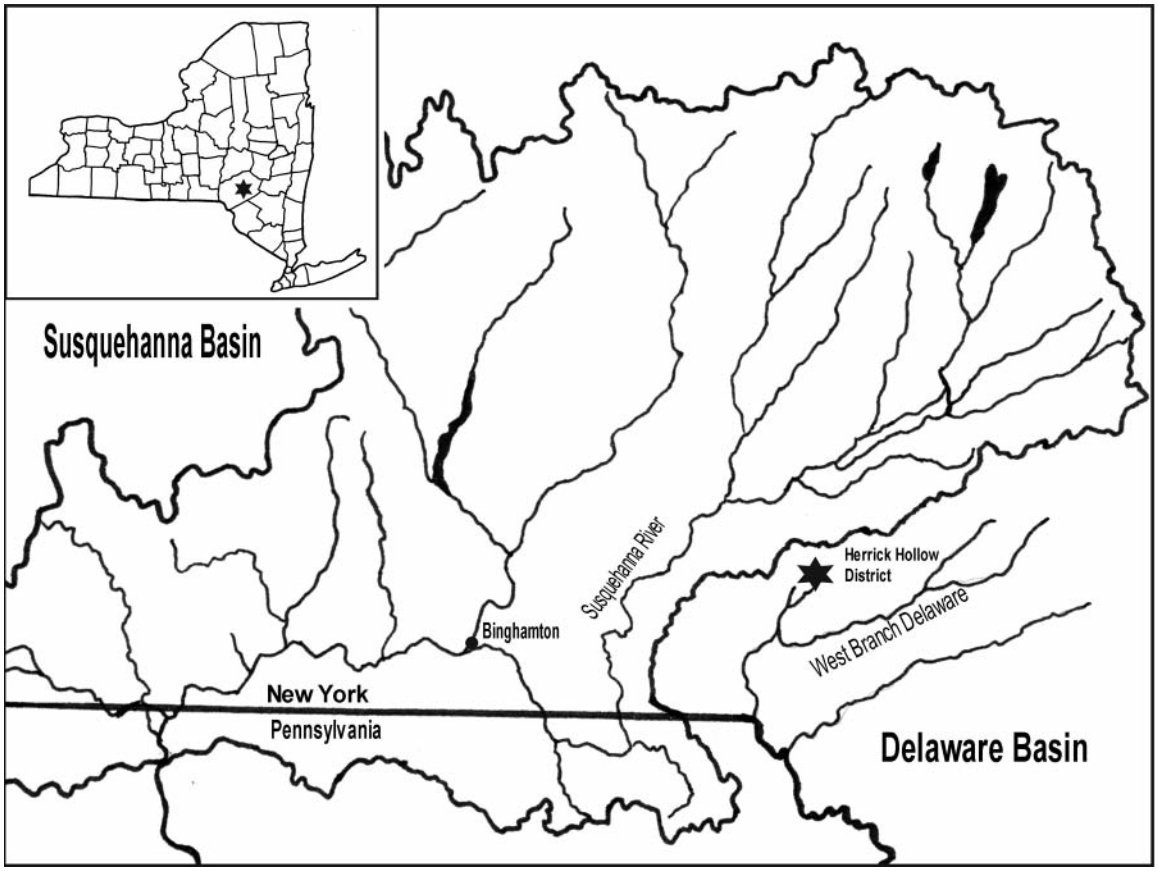

Figure 14.1. Location of the Herrick Hollow project in Delaware County, New York.

testing during reconnaissance for every prehistoric find, no matter how small. This extra testing quickly dispelled earlier characterizations about isolated finds. Radial STPs in each of the seven areas contained additional prehistoric debitage as well as pottery. Three areas remained at low frequencies of 2-5 artifacts as typified in Table 14.3; three others had 12-18 lithics, as well as an astounding 26 pottery sherds in one STP. The last area (HH1) produced 48 lithics centered around a large glacial boulder, a very visible piece of prehistoric "site furniture" (Photographs 14.1 and 14.2; Figure 14.2). We designated the seven areas as the Herrick Hollow sites and recommended them for Phase 2 site examinations to assess their National Register eligibility. We anticipated that this drainage divide might constitute an important landform, possibly with as much significance as the sites themselves. We decided to treat the seven areas as a complex of sites that had the potential to be considered as an archaeological district. We argued successfully for full consideration of the light density sites as well as those with more artifact diversity in our site examination. We used two strategies during the Phase 2: STPs excavated at 5 m intervals to determine site boundaries and assess artifact variability; and judgmentally placed 1 m^2 units to investigate features or unique artifact clusters (Hohman 2002; Hohman and Versaggi 2003). Most of the site examinations involved only 20-30 additional STPs and 4-6 units per site, not a considerable amount of work. These excavations continued to surprise us as each small site expanded into more complex clusters of artifacts. Of particular note was our apparent "luck" with where we started the reconnaissance transects. Most of the sites showed tight spatial clustering. If a reconnaissance STP had fallen 2-5 meters away from its actual location, the sites would have either been missed or would have hit low-density areas, contributing to the initial

Table 14.3. Herrick Hollow (HH1-HH7) Phase 1 STPs and Lithic Totals

Sites	# 15 m STPs	# Lithics	# Extra STPs	Total Lithics
HH1	1	44	4	48
HH2	4	5	2	18
HH3	1	1	4	2
HH4	1	1	4	18
HH5	1	1	4	5
HH6	1	3	4	12
HH7	1	2	4	2

Photograph 14.1. Herrick Hollow I site.

Photograph 14.2. Herrick Hollow I site.

sense that this was an underutilized landform. Equally sobering was the fact that if this project involved only a small acreage parcel and only the Herrick Hollow VI site was found, it would have been difficult to argue for expanded excavations and work may have stopped at reconnaissance.

The Phase 2 found that site sizes varied from 20 to 600 m^2, qualifying most as small (Table 14.4). Diagnostics (Photographs 14.3 and 14.4) indicated that cultural affiliations included Early Woodland (1000-500 B.C.) Meadowood (HH1 and part of HH6), Late Woodland (A.D. 900-1300) Owasco (HH2-6), and Late Archaic (3000-2500 B.C.) Brewerton (HH7). Unlike the expedient reduction systems found on the two pipeline studies discerned

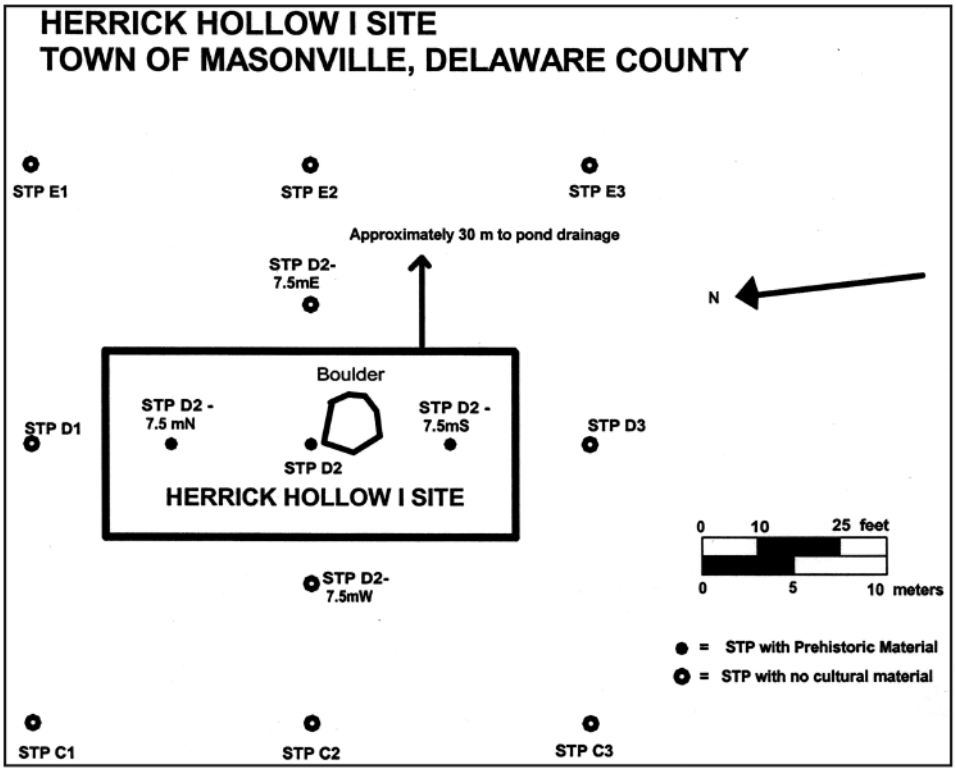

Figure 14.2. Herrick Hollow I site showing reconnaissance testing around boulder.

Photograph 14.3. Meadowwood bifaces from the Herrick Hollow I site.

Photograph 14.4. Late Woodland Levanna points from the Herrick Hollow III site.

previously, a lithic reduction system centered on the production and maintenance of bifaces was evident at all seven sites. The tool assemblage ranged from points and bifaces to scrapers and utilized flakes. The lack of naturally occurring chert nodules indicated that raw materials were brought to this location. Pottery was common on some of the sites and diagnostic rims suggested the early part of the Owasco Late Woodland (Photograph 14.5). Features were also found during the Phase 2. In all, we proposed the Herrick Hollow sites as an archaeological district warranting mitigation, either through avoidance or data recovery (Hohman 2002; Hohman and Versaggi 2003). Avoidance was not possible, and EPA and SHPO authorized a Phase 3 data recovery. Because a National Register District was designated, we had flexibility to conduct some varying degrees of data recovery on each site, no matter how small (Table 14.4).

The Phase 3 excavations continued to produce new information about these lithic scatters. Additional diagnostic lithics and pottery confirmed cultural affiliations assigned during the Phase 2 and added new temporal components to some sites. The lithic assemblage expanded to include more tools, both curated and expedient. In addition, several other features were identified. The characterization of the lithic assemblage as mostly the result of bifacial reduction continued, but the number of expedient

Table 14.4. Herrick Hollow (HH1-HH7) Phase 2 Results

Sites	Size (m^2)	#5 m STPs	# Lithics	# Units	# Lithics
HH1	264	24	32	5	1368
HH2	600	54	38	11	144
HH3	195	31	10	6	88
HH4	36	21	0	6	139
HH5	90	26	2	6	190
HH6	100	21	2	6	110
HH7	20	24	0	4	9

Photograph 14.5. Late Woodland Owasco pottery from the Herrick Hollow III site.

flake tools increased, making these artifacts an important functional part of the assemblage. No house patterns were found but the boulder in HH1 (Photographs 14.1 and 14.2), and the artifact scatter around it attests to the interpretation that this natural feature constituted an important structural component of the site either as a seat for a knapper, or as part of a temporary lean-to structure.

Returning to the original points of this paper, our reconnaissance level field decisions to continue evaluating these initial areas lead to a gradual expansion of the data recovered and an argument for Phase 2 site examination. The Phase 2 results were evaluated within the context of this unique landform, an upland drainage divide, and this contributed to a proposal for the Herrick Hollow National Register Archaeological District. The proposed district included not only the sites with diagnostics and features, but also the small lithic scatters separate from these more productive areas. Except for HH1, none of this expansion was expected after the reconnaissance survey. However, each site yielded its own combinations of data potential, which we linked to research questions current to the field of anthropology and archaeology.

Research Questions

The Herrick Hollow sites can address a variety of research questions related to traditional topics, such as chronology and land use, as well as anthropological themes, such as political economy, frontiers, and cultural or ethnic borders. For instance, earlier research by the senior author has discussed the distribution of Early Woodland sites in parts of the Glaciated Allegheny Plateau, where sites of this time period are poorly represented (Versaggi 1999, 2003). One exception is a group of known sites that extend down the Susquehanna to about Oneonta. Herrick Hollow is still a good 32 km south and west of Oneonta, so what does this upland Meadowood site mean within this region? We can tap into the anthropological literature on cultural borders and frontiers to address this question using the archaeological data to interpret the site type and function. We can also use the literature on ethnic boundaries and overlap to discuss the potential that very different groups coexisted during the same general time period in this region, with drainage divides being neutral or sacred territory. For the Late Woodland, we can build on existing models that stress the continuation of hunter-gatherer land use strategies by agricultural groups. Models of households and community patterns fit well with the concept of land use strategies beyond the residential base (Montag 1998; Card 2000; Miroff 2002). There are even symbolic references to gendered activities that were performed within and beyond the village walls. Analysis of lithics, their distributions, and their geographic context can make significant contributions to this research.

CONCLUSIONS

In conclusion, we propose that lithic scatters provide us with an opportunity to explore aspects of prehistoric community organization that is mobilized in places beyond the residential base. Such approaches value the daily foraging activities habitually performed by prehistoric groups and recognize other cultural and regional dimensions of variability that are worth examining. However, we are not proposing that all lithic scatters will contain the data potential to warrant determinations of eligibility. Our point is that if we don't look for the potential, we certainly won't find it. We stress that linking small lithic sites with regional research designs and innovative interpretive contexts will foster better site management as well as archaeological research. It is imperative that

archaeologists continue the process of adequately evaluating lithic scatters in the field and building contexts for interpretation and evaluation. However, we propose that the most important step in the process will be the consideration of multiple property districts based on small lithic sites. These districts require that research questions be posed, that protocols for the collection of data be set, that sampling issues be considered, and that criteria for preservation decisions be established. It will be at this point that the hard issues concerning the significance and management of small lithic sites will be faced.

ACKNOWLEDGMENTS

We would like to thank Dr. Christina Rieth and Dr. Charles Fisher for organizing this important conference and inviting us to participate. A version of the paper was presented by the senior author at the March 2002 PennDOT Byways Conference. The discussions from that conference contributed to advancing thoughts in this paper. We would like to thank Stacy Tchorzynski from the Anthropology Department at Binghamton University for searching the literature on the concept of significance. Her assistance is much appreciated.

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CHAPTER 15

THE CONTRIBUTION OF PREHISTORIC ARCHAEOLOGICAL SITES IN PLOWZONE CONTEXT TO OUR UNDERSTANDING OF PAST CULTURAL BEHAVIOR AND THEIR ELIGIBILITY TO THE NATIONAL REGISTER OF HISTORIC PLACES

Kurt W. Carr

INTRODUCTION

The following presentation is partly the result of many discussions with my colleagues at the Bureau for Historic Preservation. The opinions expressed are those of the author and are not necessarily those of the Bureau for Historic Preservation, Pennsylvania Historical and Museum Commission. If you are interested in the official version, you should consult the current printing of *Cultural Resource Management in Pennsylvania: Guidelines for Archaeological Investigations.*

The eligibility of stratified prehistoric sites or villages with extensive and patterned features or burial mounds or quarries is rarely debated. However, the majority of prehistoric sites in Pennsylvania do not have these qualities. They are frequently situated in a plowzone context, lack features, and have multiple components of varying antiquity. A subset of these, datable plowzone sites (regardless of size, artifact density or artifact variety), frequently can be placed into a settlement system and contribute to our understanding of changing cultural adaptations. Based on diagnostic artifacts, datable plowzone sites have been used in this fashion in numerous settlement system studies. Using the National Register criterion, this fact demonstrates that they have made a contribution. But are they important? These sites represent 60% to 80% of the archaeological record and thus a substantial portion of our archaeological database. I maintain that settlement pattern research cannot be conducted without these sites and therefore that embodies importance. Although datable plowzone sites need to be evaluated individually for National Register eligibility, these sites have generally contributed, and will continue to contribute, to our understanding of past cultural behavior. This chapter discusses the research significance and National Register eligibility of a class of archaeological sites that are sometimes characterized as "lithic scatters" but in this context are more accurately termed prehistoric sites in a plowzone context. The term "lithic scatter" is ambiguous, and it denotes site size and artifact density that are not necessarily intended. (Also see Barber 2001 for additional comments on the shortcomings of the term "lithic scatter".) The goal of this chapter is not to argue that all plowzone sites are eligible to the National Register but to demonstrate that a sub set, datable plowzone sites, have frequently made a contribution their to our understanding of past lifeways and their eligibility needs to be seriously considered within a research context.

The 1999 changes in the Advisory Council Regulations eliminating the "no adverse effect" option for mitigation plans for archaeological sites have added additional responsibilities to federal agencies for causing adverse effects to archaeological resources. Therefore, federal agencies are more critical of the eligibility of archaeological sites. Generally, there is little debate concerning the eligibility of deeply stratified sites or Late Woodland (1100 – 400 B.P.) sites with patterned features. The debate in Pennsylvania and the Middle Atlantic region on National Register eligibility seems to lie with sites disturbed by modern plowing or intensive logging. Recently, Miller (2004) has examined 190 examples of this site type. These sites were characterized based on a variety of traits including chronology, artifact variation, artifact patterning and the presence of features. In the paragraphs below, I will describe the National Register process in Pennsylvania, briefly characterize settlement pattern archaeology in the region and illustrate how plowzone sites are used in this research. Using Miller (2004), I will define different categories of plowzone sites, develop an argument for their eligibility to the National Register of Historic Places, suggest standard methodologies for determining their eligibility to the National Register and suggest mitigation measures and procedures. The programmatic agreement is the standard "106" streamlining option, and one could be developed for plowzone sites if construction delays with federal projects become a problem.

THE NATIONAL REGISTER PROCESS

In Pennsylvania, and the nation in general, there are very few archaeological sites actually listed in the National Register for Historic Places. For example, as of March 2004, Pennsylvania has thirty-four sites listed for their prehistoric component compared to 3098 individually

Current Approaches to the Analysis and Interpretation of Small Lithic Sites in the Northeast, Edited by Christina B. Rieth, New York State Museum, The State Education Department, Albany, New York 12230. New York State Museum Bulletin 508

listed historic structures or districts. There are various advantages to listing archaeological resources; however, they require an effort not chosen by the archaeological community. For example, listing begins to establish standards for eligibility requirements, and it makes the process more open and predictable. Further, listing allows for grant funds in the Certified Local Government program. Listing in the National Register publicizes the significance of archaeological resources and serves to educate the public. Finally, the National Register program is the keystone of the preservation movement in the United States. The preservation of archaeological resources in general would be enhanced if more sites were actually listed in the Register.

In the Middle Atlantic region and specifically Pennsylvania, the consideration for the eligibility of archaeological sites to the National Register of Historic Places is usually the result of federal construction projects and compliance with the National Historic Preservation Act and the regulations (36 CFR Part 800) of the Advisory Council on Historic Preservation. However, rather than actual listing, federal agencies develop a consensus determination of eligibility with the State Historic Preservation Office (SHPO) and other consulting parties. A determination of eligibility (DOE) is submitted by federal agencies to the SHPO for sites, which may be affected by their undertakings. The DOE documentation makes an argument for or against eligibility, and the SHPO comments on this document. If the SHPO agrees with the determination of the federal agency, a consensus has been reached (36CFR800.4(c)(2)). If the SHPO does not agree (or other consulting parties do not agree), the agency needs to reconsider its opinion or consult with the Keeper of the National Register for a final determination on eligibility before the project can continue. A determination of eligibility is one of the only decisions made in the "106 process" by the federal agency that can be overturned by another agency (i.e. the Keeper of the National Register).

The National Historic Preservation Act and the regulations of the Advisory Council on Historic Preservation *only* consider archaeological sites for management or protection or mitigation if they are eligible to the National Register of Historic Places. The National Register has four criteria and the eligibility of archaeological sites is usually considered under criterion D:

> Properties may be eligible for the National Register if they have yielded or may be likely to yield, information important in prehistory or history.

Continuing from the National Register Bulletin: *Guidelines for Evaluating and Registering Archaeological Properties* (Little et al.2000:28):

Criterion D has two requirements, which must both be met for a property to qualify:

1. The property must have or have had, information to contribute to our understanding of human history or prehistory, and
2. The information must be considered important.

Integrity is a significant component in determining eligibility, although integrity is evaluated after significance (Little et al 2000:36). The National Register identifies seven aspects or qualities used to evaluate integrity: location, design, setting, materials workmanship feeling and association (Little et al 2000:35). The first four are most relevant to prehistoric archaeological sites. Most sites have integrity for location, setting and materials. The aspect of design, having to do with artifact patterning, is frequently questioned with plowzone sites. These sites are frequently criticized as having "no integrity". Obviously, the prehistoric culturally determined artifact patterns have been altered by modern agriculture. However, there is a huge body of literature that demonstrates that cultural patterns are preserved after decades of plowing (Dunnell 1988; Shott 1995). There have been several experimental studies (Ammerman 1985; Boismier 1997; Lewarch and O'Brien 1981; Roper 1976), which have established that plowing moves artifacts but does not destroy cultural patterns. Culturally determined patterns are dispersed but clearly evident and useful in archaeological research. Further, beginning with Redman and Watson (1970), Binford (1970) and Gardner (1974), controlled surface collections have been used to identify a variety of cultural patterns in plowzone sites ranging from living areas to specialized activity areas. Adovasio (1990) has even identified small chipping clusters in plowzone sites.

Further, plowzone sites have also been labeled as "redundant data" (exp. Coppock and Stiteler 2002:87). The argument goes that there are so many of them, we do not need to document every one and therefore they are not eligible to the National Register. I would agree that it is not necessary to excavate every one, but we need to document and preserve a representative sample of the different types. Settlement pattern studies are based on the analysis of patterns and not individual sites. For example, Custer (1984) and Gardner (1987) used numbers of upland sites to illustrate an intensification of the adaptation during Late Archaic (6000 – 3000 B.P.) times in the Middle Atlantic region. Carr (1998) used the increased number of upland sites yielding bifurcate points to signal a significant shift in the Middle Archaic (9000 – 6000 B.P.) adaptation compared to Paleoindian/Early Archaic times (15,000 – 9000 B.P.). In these cases, an increase in the number of upland sites compared to riverine sites was used to identify patterns and changes in the adaptations. Anthropological archaeology focuses on identifying pat-

terns in the archaeological record and obviously, single sites or small numbers of sites cannot be used to document regional changes in settlement patterns and cultural adaptations.

The National Register and Criterion D are intentionally broad so that each state can individually decide what is important. Who is in a better position than the SHPO or other consulting parties to decide what types of sites make a contribution to history or prehistory in Pennsylvania? The SHPO has the longest and most consistent history of making these decisions. Since the formation of the Pennsylvania SHPO, there has been only one instance of where the Keeper of the National Register disagreed with the Pennsylvania SHPO on the issue of eligibility and this did not involve archaeological resources.

Generally, archaeological sites are significant for the data they contain which will enhance our understanding of past cultural behavior. The data from archaeological sites are used to address research problems. We are not simply collecting artifacts to "preserve the past for the future". Archaeology, using National Register criterion D, must be problem oriented. The data from sites must be used to answer questions about the past. This means that archaeologists doing Phase II projects (DOE's) must be familiar with local research and develop research questions. What are the possible questions that could be asked of a site found during a Phase I survey? Without research questions, field and laboratory methods may be inappropriate to address research issues and therefore to accurately determine the eligibility of a site.

Until recently, because the data could, in theory, be "recovered" through an archaeological investigation, effects to archaeological sites were termed "no adverse effect" in the jargon of the Advisory Council on Historic Preservation. With the recent change in the Advisory Council regulations (1999), effects to archaeological sites can be determined "adverse". With an adverse effect determination, federal agencies are required to develop a Memorandum of Agreement, consult with the Advisory Council, and discuss the project with consulting parties such as the archaeological public and Native Americans. This new process may have increased the responsibility of federal agencies but it will improve the management of archaeological resources.

The National Register was created by the National Historic Preservation Act of 1966 and sometimes it seems to be confused with the National Historic Landmarks program. The Landmarks program is a listing of our nation's most significant historic resources. Section 106 of the National Historic Preservation Act was different from other environmental laws of the 1960's. It followed a different philosophy. The act and subsequent regulations did not prohibit the destruction of resources or set limits on impacts to the cultural environment. Section 106 requires federal agencies to "consider the effects" of its activities on cultural resources and consult with the Advisory Council when the effects are adverse. The act required federal agencies to do this in the planning process and not during design or construction. It is a consultation process, not a regulatory process. 36CFR800 are regulations developed by the Advisory Council on Historic Preservation to outline this consultation process. For the 106 process to work, there was a need to develop a list of resources that required consideration by the federal agency in the project planning phase. The National Register was developed as a planning tool. The National Register is not limited to resources, which have national significance. To be listed, resources can have national, state or local significance and, in fact, most are listed as locally significant. The National Register was not intended as a list of nationally important sites or as a national honor roll (that is the purpose of the National Historic Landmarks program). It is simply a list of sites that require consideration in the project planning process.

At the Bureau for Historic Preservation (BHP), which serves as the SHPO in Pennsylvania, a committee of archaeologists reviews the eligibility of archaeological sites to the National Register. Do they make a new contribution and is it "important"? To some degree, any archaeological site makes a contribution, but is that contribution new and important? To partially address this issue, the BHP staff committee evaluates the archaeological knowledge for the region and all sites are discussed in the context of one of the 104 watersheds in the state. Watersheds are used as the sampling unit to assess the level of knowledge for the region around the site in question. We could have chosen a variety of arbitrarily defined regions but watersheds are relatively small, naturally defined territories which, when used in combination with one another, are most likely to approximate territories used by prehistoric peoples. It is generally agreed that physiographic zones affected prehistoric adaptations and site distributions (exp. Gardner 1987 or Raber 1985), however, these would be too large to be used as sampling units. Watersheds are essentially natural subdivisions of the physiographic zones. Further, as noted by Grossman-Bailey et al. (2003) "rivers were the central core of prehistoric territories and boundary/buffer zones were found in drainage divides". This is in contrast to the Euro-american concept where rivers "are seen as natural boundaries between political entities and borders that must be crossed with difficulty by bridges or ferries".

Watersheds are considered the smallest territorial unit, which may have been regularly used by a prehistoric group. However, it is assumed that the vast majority of prehistoric groups included several watersheds in their settlement pattern. Figure 15.1 illustrates the 104 water-

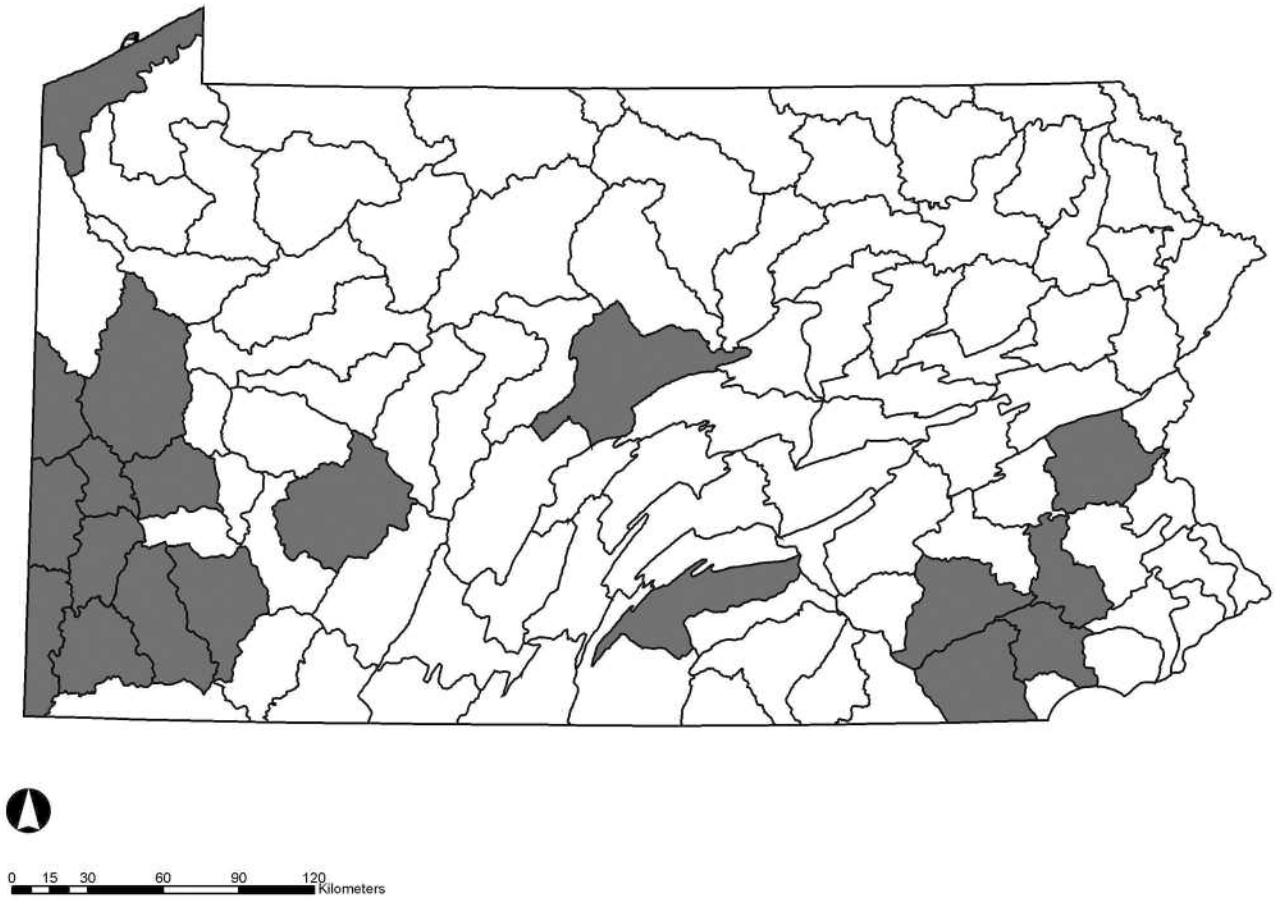


Figure 15.1. Location of Sites and Watersheds.

sheds in Pennsylvania and highlights those that have a relatively high degree of settlement pattern data. In the BHP National Register Committee, the general level of knowledge for the watershed is assessed, and the site is evaluated on whether it would contribute new knowledge to the understanding of past cultural behavior. Variables such as the number of datable sites in the shed, the number of surveys conducted in the shed, the number of datable upland sites in the shed and the number of sites excavated in the shed are considered in this analysis (Carr and Keller 1998). Other questions include the following: What is known of the settlement patterns for the shed and what kinds of stratified sites have been excavated within the shed? The site is compared to other sites in the watershed from the same time period, and its potential contribution is evaluated. Can the site be dated? Is there a culturally determined horizontal pattern to the artifacts? Can these patterns be dated and do they represent contemporary activities or separate occupations? Has the presence or absence of features been established through appropriate testing? What is the source of lithic material — local or non-local? What is the nature of the tool assemblage - curated vs. expedient and the range of tool variation? What is the nature of the lithic reduction sequence by lithic material types? The answer to these questions in relation to other sites in the watershed is essential to the eligibility of the site in question.

Unplowed or stratified sites are almost always considered eligible because their culturally determined patterns of artifacts and/or features are relatively undisturbed, and they offer an opportunity to examine a wide variety of research issues. Excavated stratified sites are also very rare when considered on the watershed or sub-drainage basis. Late Woodland sites with patterned features such as postmolds and fire features are also usually considered eligible because of the relatively unique context of these sites. The features frequently contain organic remains, which can be radiometrically dated and they also provide information on diet and ecology. Quarry sites, with their data on prehistoric technology and rockshelters with organic preservation are also usually considered eligible.

Between 1994 and 2002, the National Register committee for archaeology at the BHP determined 39% of all sites (historic and prehistoric) brought before the committee to

be eligible (Table 15.1). The BHP has determined datable plowzone sites eligible when they contribute significant information to our understanding of past cultural behavior. By datable, they can be assigned to a specific archaeological phase (exp. LeCroy) or time period (exp. Middle Archaic). This would include sites with a radiometric date or a temporally diagnostic artifact such as a projectile point or a pottery sherd. Since 1994, 71 datable plowzone sites have been evaluated, and 51 (72%) have been determined eligible. When the BHP made a cursory examination of the datable plowzone sites determined not eligible, it seemed that "sliver takes" or administrative issues were the reasons for determining these sites not eligible. Over the same period, the BHP evaluated 67 non-datable plowzone sites, and none were determine eligible.

PREHISTORIC SITES IN A PLOWZONE CONTEXT

The eligibility of stratified prehistoric sites or villages with extensive and patterned features or burial mounds is rarely debated. These types of sites have a relatively good context with little post-depositional artifact movement, which facilitates the analysis of temporally discrete artifact assemblages. However, approximately 60% of the sites in Pennsylvania do not have these qualities. They are usually situated in a plowzone context, lack features, have multiple components of varying ages or cannot be dated at all. Actually, 84% of all sites located by compliance surveys fall into this category, although we do not believe that the results from compliance surveys are representative of all archaeological sites in Pennsylvania. These sites range in size from a few flakes to thousands of artifacts, including tools, and diagnostic pieces covering 10,000 years of prehistory. Although, they may include pottery, sites with high frequencies of pottery are usually associated with patterned features, which are not part of our definition. These sites are most frequently associated with upland or non-riverine settings, but they are common in the riverine environment just outside of the Holocene floodplain of major streams. In these older geomorphologic settings, they are typically not stratified. They may be concentrated in a few square meters or distributed over many hectares. In terms of cultural behavior, they may represent a single isolated stone tool modification event at a location that is never used again or a macro band base camp that is used every year for 10,000 years.

They all share the characteristic that the artifacts are deposited at or near the ground surface and are not covered by significant amounts of alluvium, aeolian sands or colluvial deposits. Further, they have all been subjected to plowing (or intensive logging), which has altered their horizontal and vertical artifact patterning and their prehistoric cultural context. These sites are difficult to analyze because of the agricultural plowing and, frequently, they contain overlapping habitations resulting from thousands of years of re-occupation. On the other hand, some are very small with low artifact densities. They seemingly represent a small number of lithic reduction events or tool disposal events that may or may not be datable.

We have chosen the term "plowzone sites" because these are the types of sites that are frequently a problem in determinations of eligibility. Compared to the term "lithic scatter", plowzone sites is an objective and practical term. Other terms such as "small camp" or "bivouac" were also considered. These definitions (Beckerman 2003) usually involve places where people lived for limited periods of time and deposited small numbers of artifacts representing a limited amount of artifact diversity. These definitions are subjective and there is little agreement on the meaning of small – 20 artifacts, 200 artifacts or 2000 artifacts. In addition, repeatedly used small camps or specialized sites or sites with limited functions may eventually appear as large archaeological sites. These may be initially misinterpreted as locations of longer-term occupations or habitation sites. The terms small camp or bivouac have behavioral implications that are difficult to validate. The identification of these types of behavior requires a significant field and laboratory effort and it is difficult to imagine that archaeologists would agree on the criteria needed for their identification. A plowzone site can easily be identified in a Phase I survey. It is a definition, which emphasizes archaeological context rather than cultural behavior.

The chronologic placement of plowzone sites may result from one or more temporally diagnostic artifacts.

Table 15.1. Summary of Archaeological Determinations of Eligibility between 1994 & 2002

	Sites Determined Eligible	Sites Not Eligible	Totals
Historic Archaeological Sites	18 (25%)	53 (75%)	71
Non-datable Plowzone Prehistoric Sites	0	67 (100%)	67
Datable Prehistoric Sites	51 (72%)	20 (28%)	71
Stratified Prehistoric or Siteswith Patterned Features	24 (89%)	3 (11%)	27
Totals	93 (39%)	143 (61%)	236
Prehistoric Totals	75 (45%)	90 (55%)	165

Projectile points are the most frequent method of dating these sites and it is acknowledged that some projectile point types such as broadspears, bifurcates or Jacks Reef Corner notched, cover a relatively short period of time. Other projectile point types, such as the Laurentian group or the Bare Island type seem, to cover much longer periods of time. Most of these sites have been collected by avocational archaeologists, and some unknown numbers of projectile points have been removed from the assemblages. Obviously, the latter results in a biased dating of the site, although it emphasizes the importance of recording avocational collections. However, the remaining diagnostics date at least one occupation at the site and can be used to chronologically place the site within a settlement system.

Some of these sites were occupied once and some were occupied more than once but during the same phase (e.g. Orient Fishtail) and some were occupied by multiple phases (LeCroy, Vosburg and Meadowood). Based on Miller's (2004:25) analysis of plowzone sites, 38% of the sites in her sample were single component (occupied by a single phase), 25% were undated and 37% were multi-component. Although, 38% as single component sites seems high and one wonders how these sites would date after additional testing. Obviously, the single component sites are the easiest to interpret. I assume the vast majority of these were occupied repeatedly during the same phase, but similar activities were conducted during each visit. Multi-component sites with spatially separated components would be somewhat more difficult to interpret. The sites with multiple overlapping occupations (intra or inter phase) and high artifact densities are probably the most difficult to interpret. However, small multi-component sites with low artifact densities and low artifact variation are frequently relatively easy to interpret. It is probably safe to predict that they do not represent any type of base camp but rather some type of activity which did not involve the frequent use of stone tools (and thus the debitage resulting from the maintenance of these tools). For example, both Versaggi et al (2001) and Rieth (2004) have identified certain of these small, low density and low artifact variation sites as being procurement sites for basketry materials associated with female activities.

It is estimated that at least 60% of all prehistoric sites in Pennsylvania are situated in a plowzone context and not stratified or associated with extensive numbers of features. These sites represent a substantial portion of the prehistoric archaeological record. And as such, they are a significant component in the documentation of prehistoric adaptive systems. It would be devastating if they were dropped from the archaeological database. They are the most common prehistoric site encountered in state and federal construction projects (84% see Table 15.1) and therefore their research contribution and eligibility to the National Register of Historic Places is significant to understanding the prehistoric record and consequential to federal agencies.

The management of plowzone sites is a national concern and several states have developed contexts for their interpretation or eligibility determinations (see Austin 2001). California (Jackson et al.1988) and Minnesota (Anfinson 1994) have defined different types of "lithic scatters" and developed programmatic agreements to swiftly get federal agencies through the "106" process. In the Minnesota agreement, developed in 1995, datable sites are generally considered eligible to the Register, and the project is given a "no adverse effect". In the California agreement, the sites receive a standard treatment, such as systematic shovel test pits, and then they are determined not eligible and the project receives a "no effect" in the "106 process". Archaeologists get the data they consider important, and the project is allowed to proceed. However, we believe this type of process (save the data, but the site is not eligible) represents the slippery slope of illogical thinking. If archaeologists consider the data important enough to expend taxpayer dollars, it must be eligible to the National Register. The 106 process is complicated enough without adding this inconsistency. The National Historic Preservation Act and the regulations of the Advisory Council on Historic Preservation are only concerned with eligible resources.

THE USE OF PLOWZONE SITES IN SETTLEMENT SYSTEM ANALYSIS

Plowzone sites may contribute important data to a variety of research problems (exp. subsistence, technology, community patterning), but they primarily contribute to settlement system research. The first major use of settlement pattern studies began with Gordon Willey's, *Prehistoric Settlement Patterns in the Viru Valley* (1953:1) where he described settlement patterns

> as a strategic starting point for the functional interpretation of archaeological cultures that reflect the natural environment, the level of technology on which the builders operated, and various institutions of social interaction and control which the culture maintained.

At the simplest level, settlement system studies investigate the patterning of sites as they are distributed across the landscape (Trigger 1970:239). Using an ecological approach, settlement systems are used to document cultural adaptations and changing settlement systems are used to chronicle cultural evolution. In North American archaeology, Struever (1968) used settlement patterns to demonstrate significant changes in the cultural adapta-

tion of Early Woodland Black Sands society (3000 – 2100 B.P.) and Middle Woodland Hopewellian (1900 – 1600 B.P.) society in the Illinois Valley. Judge (1973) described the Paleoindian (11,500 – 10,000 B.P.) settlement pattern for the Rio Grande Valley and developed a cultural ecological explanation for changes in this pattern. In the Middle Atlantic, Ritchie and Funk (1973) described the settlement patterns of New York State by time period and finished with a diachronic overview of the state. Later, emphasizing cultural ecology, Gardner (1987) and Stewart (1980) used the settlement pattern of plowzone sites to demonstrate significant changes in prehistoric adaptations in the Piedmont and Ridge and Valley zones. In Pennsylvania, beginning with Turnbaugh (1975) and followed by Stevenson (1982), Snethkamp et al. (1982), Custer (1988), and Stewart and Kratzer (1989) there has been a considerable use of both large and small plowzone sites in settlement system studies. More recently, Custer (1996), Carr (1998), Means (1999), Raber (1995), Chiaruli et al. (2001), and Perazio (2003) have conducted a variety of settlement systems analyses and documented cultural change at a variety of levels. All of these studies have used plowzone sites to enhance our understanding of past cultural behavior.

Typically, settlement system analyses in the Middle Atlantic region assign sites to functional types, analyze changes in their distribution through time and describe the evolution of new functional site types. The basic assumption is that human groups strive to practice the most efficient adaptation. These studies are predicated on "the assumption that human behavior is economically rational" (Bettinger 1987:137). Certainly, optimal foraging theory (exp. Beckerman 1980) takes this approach. Ecological setting, the range of artifact variation, distinctive artifact assemblages and/or feature types are the factors used in defining site types by time period. Frequently, datable plowzone sites are characterized by lithic material types, lithic reduction sequences, curated versus expedient tool types and the presence of features. Some of these studies, such as Ritchie and Funk (1973), relied heavily on extensive excavations and controlled testing of sites to identify site functions. Obviously, intensive fieldwork increases both the temporal control and the reliability of site function analysis. Conversely, the research conducted by Stewart and Kratzer (1989) employed Phase I testing methods to identify the ecological setting of prehistoric sites and used this data to develop general predictive site location models for the region. They were not concerned with functional or temporal differences; they simply wished to develop predictive models for site locations to be used in Phase I surveys.

The types of studies conducted by Carr (1984), Custer (1996) and Gardner (1987) only depended on a few sites sampled through controlled surface collections or systematic subsurface testing to determine site function. However, they compensated for the lack of fieldwork by using large numbers of sites from county or regional surveys. Based on regional surveys, they used diagnostic artifacts combined with a topographic setting, and inferred the local ecology and how the site functioned within the settlement system. Carr (1998), Custer (1996), and Grossman-Bailey (2001) used large data sets from state site files to analyze regional settlement systems. In general, these studies combine data from extensive excavations in riverine settings with minimal sampling or excavation from large numbers of sites in upland settings. Custer (1996) and Miller (2002) identified a wider variety of artifact types from sites in riverine settings in the Ridge and Valley zone and classified these sites as base camps compared to the limited tool variety from sites in upland settings. The non-riverine or upland sites were classified as extractive camps. As discussed above, Versaggi et al. (2001) and Rieth (2004) went so far as to identify some of these as related to the collection of basketry materials by females. Although the data is equivocal, it is very reasonable to assume that these sites existed in prehistory. This approach is not without problems, as discussed by Miller (2004) or East (2002). Miller (2004) has noted that site function based on presumed resources available in a given topographic setting suffers from circular thinking. However, this reasoning has been used to identify patterns in site distributions, which have been used to explain some basic changes in adaptations reflected in the archaeological record of the Middle Atlantic region. Duncan (2001:95) makes the argument that we need to intensify our efforts in the analysis of these sites. Upland sites and particularly small upland sites are especially significant to the interpretation of large village sites.

Most recently in Pennsylvania, Custer (1996), Stewart (1998) and Wall et al. (1996) have used Binford's (1980) concept of forgers and collectors to describe hunter-gather settlement and mobility patterns. Without going into a detailed discussion of these two adaptive strategies, the forager strategy is characterized by a high degree of mobility with human populations moving to the resources. The main site type is the residence camp characterized by a wide variety of tool types. The artifact assemblage is characterized by a formalized and curated tool kit. Although the residence camps would function as habitation sites, they would be relatively small but common throughout the region. In the collector or logistical strategy, small work groups bring the resources to base camps. The most common site type in this system is the field camp with artifacts representing a limited number of functions. Base camps would generally be larger, less common and restricted to certain ecological settings compared to the forger strategy. These camps are characterized by the use of expedient tool assemblages. In his

description of Late Woodland sites in the Lower Delaware Valley, Custer (1996:292) has proposed that they were practicing a foraging strategy and that the region is characterized by many small procurement camps. This is in contrast to the Susquehanna Valley during the Late Woodland, which is characterized by large agricultural villages and a collecting strategy.

Reinbold et al. (2000) used a similar approach in the analysis of 36Ly290, located in the Ridge and Valley province at the base of the escarpment leading up to the Appalachian Plateau. Here, the authors used lithic types to analyze the relationship between these two zones and how it changed between the Archaic (9000 – 3000 B.P.) and Woodland periods (3000 – 300 B.P.). They also used Binford's concepts of forager and collector strategies to characterize the Middle Archaic and the Late Woodland components of this site. Based on their characterization of the Middle Archaic as consisting of a variety of formalized tools, one of their hypotheses proposed that during Middle Archaic times, 36Ly290 acted as a residence camp. During the Middle Archaic, this interior region was exploited using a forager strategy and Archaic residential sites should be common. The Late Woodland occupation was also characterized by a variety of tool types but they were of an expedient nature. Reinbold et al. (2000) suggested that this interior region was exploited using a collector strategy during Late Woodland times. Small special purpose field camps were used to support large base camps probably located along the Susquehanna River. This represents a change in the adaptive strategy from Middle Archaic times. Why and exactly how this occurred are significant research problems for the region. However, for a variety of reasons, their results were not conclusive and more data is needed to address this issue.

The above referenced studies obviously contribute to a description of prehistoric usage of the landscape. The fact that humans made and used stone tools or that lithic types moved between physiographic zones or that humans used expedient and or curated technologies has been received by some as "pretty lame research" or "So what!!!" For example, Beckerman (2003) has characterized "current settlement pattern research as a theoretical dead end". Archaeologists spend much time attempting to demonstrate these activities in the past but the real contribution is not the specifics of documenting a bifacial core technology for Paleoindian times as opposed to a polyhedral core technology during Middle Archaic times. The real contribution is in identifying the reasons for the change. To document these changing human settlement systems, we need to be able to describe the entire settlement pattern for a time period and region and not just the floodplain sites. If we exclude plowzone sites we will be excluding well over half of the archaeological record from a puzzle, which is already missing most of its pieces.

A TYPOLOGY OF PLOWZONE SITES

Anfinson (1994), Austin (2002) Carr and Keller (1998) and Jehle and Carr (1983) discussed the research potential of plowzone sites and/or developed different categories of plowzone sites. Most recently, Miller (2004; see also Miller, this volume) analyzed over 190 plowzone sites found in the Pennsylvania Bureau for Historic Preservation's survey reports file to gather general descriptive information on the nature of these sites so their range of variation could be measured and described. Each of the sites in her analysis had been tested in some systematic fashion (i.e. controlled surface collections, shovel test pits, larger standardized excavation units, and the mechanical removal of the plowzone or some combination of these methods). Mainly, using the variables of temporally diagnostic artifacts, horizontal artifact patterning and the presence of features, Miller (2004) (Table 15.2) defined four levels or categories of research issues, which were applicable to plowzone sites.

Level 1 research issues analyze prehistoric site locations irrespective of time or function. For example, they could be involved in developing general predictive models for prehistoric site locations that could be used in directing a Phase 1 cultural resources survey.

Level 2 research issues analyze dated sites and include settlement pattern analysis by time period. Site function is, at best, based on ecological models rather than artifacts or features.

Level 3 research issues include the analysis of settlement systems using functional settlement site types based on intensive excavations, artifact analysis and more controlled dating including predominantly single component sites or sites with some features. Miller (2004) identified three sub-categories of research issues, each utilizing more controlled dating of artifact assemblages.

Level 3a issues use multi-component sites with horizontally identifiable temporal sub-assemblages.

Level 3b research issues utilize single component sites with site function based on negative evidence such as the confirmed absence of features, low proportion of tools and low artifact density.

Level 3c research issues utilize single component sites with site function based on features, tools, tool use wear patterns and or activity areas.

Level 4 issues include a variety of social, religious, and political issues resulting from the analysis of artifact patterning, special features, and distinctive artifacts.

Obviously, prehistoric sites in a plowzone context have

Table 15.2. Proposed Typology of Plow-Disturbed Sites (from Miller 2004)

Undatable	Datable				
	Multicomponent		Single Component or Predominantly Single Component		
	Temporally specific assemblages and site functions cannot be determined *Data:* No intrasite patterning; no datable features, no chronologically distinct subassemblages or activity loci	Temporally specific assemblages and site functions can be determined *Data:* Intrasite patterning of chronologically diagnostic artifacts, and/or datable artifact subassemblages, and/or features, and/or activity loci	Site function interpretable based on negative evidence *Data:* Confirmed absence of features, low proportion of tools, low artifact density	Site function interpretable from data *Data:* Any or all of: features, tools, tools with use wear, activity areas	Social, religious, and/or political characteristics of occupants can be inferred *Data:* Burials, residential patterning, and/or artifacts related to status differentiation
Site location only	Site location and age	Site location, age, and function			Social, religious, political
Level 1 issues	Level 2 issues	Level 3 research issues			Level 4 issues
Type 1	Type 2	Type 3a	Type 3b	Type 3c	Type 4

a wide variety of characteristics and can address a variety of research issues. Artifact densities and artifact variation vary and they may represent a wide variety of cultural activities. Although Miller (2004) was outlining research issues, Table 15. 2 can also be viewed as a hierarchy of significance for plowzone sites. This table places plowzone sites on a continuum with small undatable sites at one end and predominantly single component sites with some features and artifact patterning at the other end. Multi-component sites fall in the middle, and the ability to determine site function and the presence of features are important variables in defining the different levels of research issues.

Level 1 research issues involve an analysis of all prehistoric sites (regardless of age) which would contribute to our understanding of how prehistoric peoples generally distributed themselves across the landscape. Sites that could only be used in this type of research have never been determined eligible to the National Register in Pennsylvania. However, according to the National Register Bulletin on *Guidelines for Evaluating and Registering Archaeological Properties by Little et al* (2000:15) these could be determined eligible "within a research framework which specifies the important information potential of such sites. In a very interesting analysis, Versaggi et al. (2001) developed a model explaining small, low-density sites characterized by expedient tool assemblages as female controlled collecting areas for materials used in the production of baskets and matting during the Archaic. These sites did not contain temporally diagnostic artifacts but they were similar in lithic material and tool types to sites dating to the Late Archaic period in the region.

Level 2 research issues use dated but multi-component sites in temporally specific settlement systems research resulting in an examination of the evolution of settlement systems within a region. These types of sites could be large or small in size or artifact density, but horizontally identifiable temporally discrete sub-assemblages have not been identified. This type of research has documented significant, phase level shifts in cultural adaptations. Based on the literature discussed above, this is probably the most common use of plowzone sites.

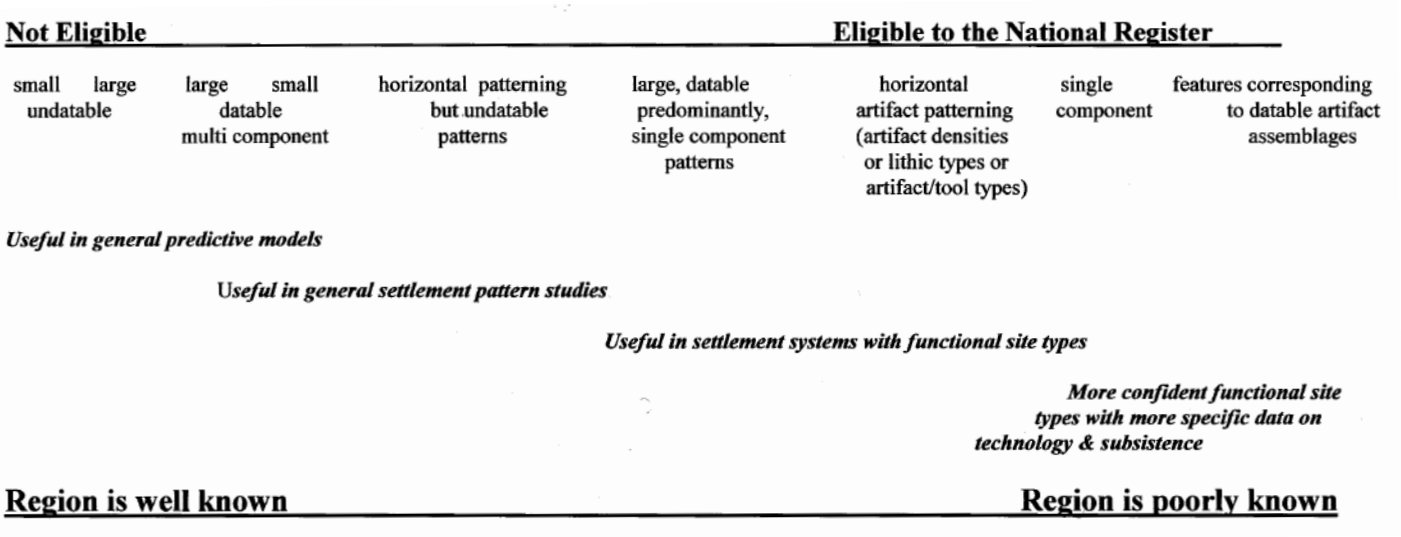
The Level 3 issues add function to dated settlement types based on a functional interpretation of artifact patterning, specific feature types and improved temporal control. This level of analysis is highly desirable and substantially increases the reliability of these models. However, it is usually associated with extensive and intensive fieldwork. Level 4 issues involve a variety of artifact types, artifact patterns and prehistoric features and address a wide variety of relatively complex research issues. Invariably, these involve sites with artifact assemblages that have not been significantly disturbed since the artifacts were originally deposited. There is rarely any debate over the eligibility of Level 4 sites.

Table 15.2 could be used as a scale for measuring eligibility to the National Register with the addition of a third dimension, the state of existing knowledge for a region. This is accomplished in Table 15.3. For example, Level 1 research issues utilize undated sites to develop general models for prehistoric site locations. For the major physiographic zones or watersheds in Pennsylvania, we have reasonably good models for predicting site locations. Therefore, undated sites are usually not going to generate data, which will reveal important and new information about the past. Undated sites are usually not eligible to the National Register of Historic Places. However, for most of the Commonwealth, we do not have a good understanding of Level 2 issues such as the evolution of settlement systems. Consequently, the Bureau of Historic Preservation (BHP) has determined that datable prehistoric sites usually contribute important information to our understanding of past cultural behavior and are therefore eligible to National Register. Essentially the line for eligibility used by the Pennsylvania SHPO is currently drawn between Level 1 and Level 2 research issues. In our opinion, Level 2 research issues contribute important data to prehistory and are therefore eligible to the National Register. In areas where there are very few sites recorded in the Pennsylvania Archaeological Site Survey files (such as Sullivan County or the uplands of Columbia County), simple site location information may be significant. Conversely, in some watersheds of the state, where large numbers of datable sites are recorded in the database, (such as the Conestoga watershed in Lancaster County or the Chartiers Creek in Allegheny and Washington counties), the line demarcating significant and eligible data could be drawn between Level 2 and Level 3 issues.

DATA NEEDS FOR DETERMINING THE NATIONAL REGISTER ELIGIBILITY OF PLOWZONE SITES AND POTENTIAL MITIGATION MEASURES

At the BHP, the current policy for determining the eligibility of prehistoric archaeological sites is generally the line between Level 1 and Level 2 research issues as defined by Miller (2004). Approximately 40% of all determinations of eligibility (28% of all prehistoric DOE) by the SHPO involve Level 1 research issues and are generally considered not eligible. A determination of not eligible means that a federal agency can move ahead with their project without any further concerns for cultural resources. This is a desirable situation for the federal agency and the SHPO. We all have limited resources and the sooner we reach a significant decision point the better.

Table 15.3. Categories of Plowzone sites on a Continuum of Eligibility.



However, frequently, the problem with these sites, as detailed by Bergman and Doreshunk (2002) or Klein (2002) is that insufficient information is gathered for a characterization or a determination of significance.

> In fact, it is more likely that the perceived poor quality of such sites results from inadequate field and analytical methodologies. In other words, it is not plowzone sites that are flawed, but rather the investigative techniques used to interpret them. (Bergman and Doreshunk 2002).

Frequently, there are debates between the SHPO and agencies over the level of work conducted when finding a site during the Phase I investigation, the need for a Phase II or the Phase II level of effort. Increasingly, federal agencies desire to make a determination of eligibility at the Phase I level. This is certainly possible but it will usually require a greater effort than the current generally accepted Phase I survey methodology.

Based on Miller's (2004) discussion of the research potential of plowzone sites, it would seem that the minimum data requirements for determining if a plowzone site makes a contribution (or has the potential to make a contribution) to our understanding of past cultural behavior and therefore is eligible to the National Register are covered in the following:

1) The recovery of temporally diagnostic artifact types or artifact assemblages.
2) The recovery of artifacts to identify site function.
   a. The recovery of a representative sample of the horizontal patterning of artifacts to identify activity areas or individual components.
   b. A confident determination concerning the presence or absence of features to add to the determination of site function, chronology and or subsistence.

In Klein's (2002:4) discussion of determining the significance of upland sites, he recommended a similar set of data requirements.

This all needs to be placed in a research context for the watershed. The study of the site should enable significant research in the watershed to be addressed. The field effort needs to be followed by a rigorous analysis of the artifacts, which for example, would include a functional analysis, an analysis of the lithic technology, a analysis of ceramic technology, lithic sourcing and an analysis of the distribution of various artifact types across the site. The results of these analyses need to be mapped and their horizontal patterning scrutinized. The above list involves the recovery of a representative sample of artifacts including tools, lithic types and technological types (flakes and cores). Further, field methods need to involve the recovery of a representative sample of the horizontal distribution of these materials. Within the context of Phase I and Phase II compliance surveys, what methods will get us this information quickly and cost effectively? What is the appropriate level of effort necessary to find temporally diagnostic artifacts and tools, establish horizontal artifact patterning and confidently determine the presence or absence of features? The information recovered in Phase I shovel test pits at 15-meter intervals or surface survey does not reliably identify these characteristics. Therefore, additional testing is necessary to gather sufficient information to make a determination of eligibility. Klein (2002) and Shott (1995) discuss the various methods needed to

recover a representative sample of artifacts and they agree that an excavated sample representing 3% to 10% of the site is the most accurate mechanism to characterize a site's potential. The BHP has used 5% as a standard for Phase II investigations. Excavated units, such as shovel test pits, 1x1's or 2x2's would recover a representative sample of temporally diagnostic, functional and technological artifact types. As the initial stage of Phase II fieldwork, we would suggest beginning with shovel test pits at 5-meter intervals to recover information on artifact densities. This could be followed by a stratified random sample of one meter or two-meter units equaling a total of 5% of the site area. This should enable the analysis of the horizontal artifact patterning. However, excavated units can cost $500 to $1000 per square meter and large sites would become very costly.

An alternative to excavated units is the use of controlled surface collections and these have the advantage of sampling the horizontal artifact variability of the entire site at a lower cost. However, artifact recovery counts are not as high as with using excavation units, and experimental work has demonstrated that controlled surface collections are biased in a variety of ways (Ammerman and Feldman 1978, Tainter 1979). The biases could be partially corrected by conducting multiple controlled surface collections (Ammerman and Feldman 1978). Assuming the site can be plowed, the data requirements listed above can be addressed through controlled surface collections using 3 to 8 meter collection units (Odell and Cowan 1987, Roper 1976) depending on artifact densities or mapping individual artifacts (exp. using a total station). Multiple controlled surface collections are a good and accurate measure of artifact variability and horizontal patterning although there is no agreement on the exact number of surface collections needed to evaluate a site's potential. I would recommend at least two collections, with plowing, disking and a sufficient rain washing (or artificial watering of 3/4 of an inch) between each collection. Further, excavated units (after the completion of the controlled surface collections) could be used to further identify or evaluate the presence of rare artifacts, investigate activity areas and to increase artifact counts.

However, what if no diagnostics were produced from this approach? Should additional units be excavated? In addressing this issue, and based on the 190 sites in the SHPO files, Miller (2004) noted that tools and diagnostic artifacts represent 1% to 5% of the total artifact assemblage. Statistically, this means that at least 100 artifacts need to be collected to insure the recovery of tools or diagnostic artifacts. From a large site or an artifact dense site, the above list of information could be easily accomplished by multiple controlled surface collections, or a standard percentage of one-meter units. On a low-density site, this number would be more difficult to achieve, possibly requiring numerous controlled surface collections and large numbers of one-meter units. There would be many sites that do not contain these numbers and how can this be efficiently determined?

As an example, on small sites, of less that 800 square meters, a 5% sample (40 one meter units) would be a large but appropriate effort. For sites larger than 800 square meters, a 5% sample may be expensive for sites dealing with Level 2 and Level 3 research issues. Possibly a combination of controlled surface collections and excavated units could be used. Excavating a 5% sample for a Phase II within an APE of less than 800 square meters and for sites over 800 square meters, multiple controlled surface collections would be combined with an arbitrary number of one meter units (n=10/acre?). We would suggest that if two controlled surface collections or a 5% sample using excavated units did not adequately address the above data requirements, the site would be considered not eligible.

Finally, these methods would need to include the exposure of subsoil to identify features. Frequently, features are present but in widely scattered and small clusters. Miller (2004:38) found that whenever the plowzone was mechanically removed, features were found nearly 50% of the time. A convenient method for finding features is the careful mechanical removal of the plowzone followed by shovel scrapping to the top of the PZ/B horizon interface. The plowzone above these features may contain data significant to their interpretation and, obviously, it is important to recover a representative sample of artifacts from above the locations of the features prior to the mechanical removal of the plowzone. Therefore, this is further justification for multiple controlled surface collections and systematic one-meter units rather than immediately progressing to the extensive removal of the plowzone. Klein (2002) and Shoot (1995) recommend removing 25%- 40% of the plowzone to demonstrate the presence of features.

In summary, we would recommend the following procedures for determining the eligibility of plowzone sites.

1) A 5% excavated sample consisting of close interval shovel pit testing and the use of astratified random sample to place one meter or two meter units across the site.

2) This would be followed by a systematic search for features in the form of the mechanical removal of 25% to 40% of the plowzone. This is probably most effectively completed by removing the plowzone in transects, so as to maximize horizontal exposure. We suggest that the removal of the plowzone be conducted in stages, beginning with a minimum of 25% of the plowzone being

removed. If no features were uncovered, an additional 15% would be removed to confidently measure the probability of the presence of features. This procedure may be complicated or impractical in heavily wooded areas.

We would recommend the above is preferable for all sites but especially for small sites and sites in wooded areas where controlled surface collections are not practical. For large sites in areas, which have been subjected to agricultural plowing, we would recommend the following:

1) Multiple controlled surface collections, (n=2)

2) Minimum numbers of one meter squares (n=10)

3) And the mechanical removal of the plowzone to determine the presence of features (n=25% to 40% implemented as in the above).

As a cautionary note, we offer the following. Using our definition of plowzone sites, this type of prehistoric manifestation is found in all prehistoric environments and represents many different functional settlement types. The methods used for their analysis should be individually developed and directed by research problems. The above should be considered guidance.

Considering the 1999 changes in the Advisory Council's regulations, if delays in the "106 process" become a problem, the programmatic memorandum of agreement (PMOA) is the standard "section 106" streamlining option, and one could be developed for plowzone sites. The plowzone sites PMOA would proscribe the above treatments as a mechanism for determining the eligibility of plowzone sites. Federal agencies applying these treatments would not need to develop a Memorandum of Agreement or consult with the Advisory Council on Historic Preservation. This agreement would include standard procedures for consulting with the archaeological public and Native Americans.

Finally, it has been my experience that the above field and laboratory procedures frequently collect the majority of the significant data that a plowzone site has to offer. A common practice in Pennsylvania is to complete the above suggested Phase II testing procedure, determine the site eligible but recommend no further field work and agree that mitigation has been completed. In some cases, we recommend additional units to investigate activity areas or to elucidate specific temporal components or the additional removal of plowzone to excavate features. Although the above procedures may seem inordinate, the Phase II methodology recommended in Pennsylvania, frequently results in mitigation and shortens the "106 process". Further, I feel the additional work is necessary because that is what is required to fully appreciate these sites. To some degree, in many regions in Pennsylvania, we have reached a level where current standard procedures are inadequate to address current research questions. The additional work is essential in southeastern Pennsylvania for example, or we are wasting our efforts.

CONCLUSION

The above discussion has clearly demonstrated that plowzone sites have been used in significant research and "contributed to our understanding of history and prehistory", thus fulfilling the first part of the National Register Criterion D requirement. The second part of the National Register requirement is that the data must be important. Plowzone sites are the most common site type in Pennsylvania. They are ubiquitous on the landscape but, in our opinion, they are absolutely essential in the study of changing prehistoric settlement systems. In the above discussion, it has been demonstrated that datable plowzone sites have been used in numerous settlement system research projects in the Middle Atlantic region. This research has been instrumental in contributing to our understanding of past cultural behavior. Although datable plowzone sites need to be evaluated individually or as part of multiple property nominations, in general, these sites have contributed and will continue to contribute to our understanding of prehistory. Therefore, they meet National Register Criterion D and can be listed in the National Register of Historic Places. Further, plowzone sites or a sample of plowzone sites, need to be preserved for future research. Our methods of excavation and analysis will undoubtedly improve and some of these need to be preserved for that time.

Some archaeologists and many federal agencies view the eligibility of a large number of plowzone sites as a dilemma (Beckerman 2003). Most archaeologists agree that the information from these sites must be recorded because it is essential to settlement systems analysis. Nevertheless, many archaeologists believe these sites are not eligible to the National Register. However, this may result from a misunderstanding of the National Register program. There is a general impression that the National Register functions only as a "golden list" of our nation's best resources. How could a plowzone site, with a few flakes and one diagnostic projectile point be eligible the National Register!?!? However, for the purposes of the National Historic Preservation Act, the National Register is first and foremost a planning tool. It is a simple list of places that are worthy of consideration and preservation. Could the discipline withstand the loss of all datable plowzone sites? I am confident that the answer is no - and therefore these sites are eligible. This should not be interpreted as meaning that temporally diagnostic artifacts

equate with eligibility. The Pennsylvania SHPO uses diagnostic artifacts to look closely at research needs within a watershed and the potential for the site to make a contribution to research.

A second misunderstanding, is that this practice would slow down or add a considerable expense to the "106" process and place a substantial burden on federal agencies. However, datable plowzone sites have been the standard for eligibility in Pennsylvania for the past ten years, and agencies have adapted well. I would argue that this is the way the 106 process is supposed to operate, with significant data being given adequate consideration in the planning process.

In conclusion, datable plowzone sites have been extensively used in Pennsylvania archaeological research. Individually, these sites are unimpressive and difficult to analyze, but they are absolutely essential to settlement systems research. This research has made important and significant contributions to our understanding of past cultural behavior. Generally, datable plowzone sites have been found eligible to the National Register of Historic Places and have been afforded protection and management under Section 106 of the National Historic Preservation Act. If these sites are not considered eligible, the data will be lost. This has presented a challenge for federal agencies but it will sharpen the discussion among archaeologists concerning the significance of these sites and, in the long run, will make a more effective contribution to our understanding of past cultural behavior.

ACKNOWLEDGEMENTS

My introduction to settlement pattern archaeology began with Fred Kinsey in the Upper Delaware Valley. We had spent several summers digging outstanding sites in the floodplain and it occurred to us that there must have been something going on in the uplands. We looked for two weeks and only found a few flakes but we were sure that there was more. In graduate school, Bill Gardner introduced me to cultural ecology and settlement systems archaeology. Although, he was sometimes considered the great "impressionist", he set the model for these types of studies and he was the first major proponent for preserving plowzone sites within the 106 process in the Middle Atlantic region. I would also like to credit Vic Carbone because he gave me my first real understanding of the significance of this research. Since then, I have always fascinated how different time periods and different regions have been characterized by different types of site distributions. The analysis of these regional and temporal patterns relates significantly to explaining and predicting human behavior. I would like to thank Mike Barber, Chris Bergman, Jay Custer, Mike Kline, Paul Raber, Mike Stewart and Bob Wall, along with many others, for demonstrating that fact, and the cultural significance of that fact, all over the Middle Atlantic region. Many of these individuals have commented on this presentation and contributed to its refinement.

My colleagues at the BHP - Chan Funk, Jim Herbstritt, Mark McConaughy, Doug McLearen, Mark Shaffer, Noël Strattan and especially Steve McDougal, have all had a role in reviewing and helping me finalize this document. They asked hard questions about the contribution of these sites. Along with Jean Cutler, the Director of the BHP, they have been "on the front lines" supporting these resources on a daily basis. Chris Bergman, June Evans, Doug McLearen, Pat Miller, Roger Moeller and Erika Siebert have reviewed versions of this paper. Any errors in fact or interpretation are mine alone.

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CHAPTER 16

FUTURE CONSIDERATIONS FOR THE ANALYSIS AND INTERPRETATION OF SMALL LITHIC SITES IN THE NORTHEAST

Christina B. Rieth

In the Northeast, small lithic scatters represent one of the most common site types excavated by archaeologists (Dean and LoRusso 2001; McSweeney et al. 2005:11; Merwin 2006; Means 1999; Perrelli 2001; Rieth 1998; Seib et al. 2004; Witek 1992:30-42). The archaeological signatures of these sites include small concentrations of lithic artifacts, the absence of diagnostic artifacts, and occupations that are of limited size and concentrations of features. As Carr (this volume) and others (Beckerman 2003; Blakemore et al., this volume; Miller, this volume; Versaggi and Hohman, this volume) point out, these sites are often not considered eligible for the National Register of Historic Places and are perceived as having limited research potential.

The chapters in this volume highlight the importance of small lithic sites in Northeast settlement and subsistence studies. Supplemental information about managing, evaluating, and interpreting the research potential of these sites within a cultural resource management framework has also been presented.

The chapter author's argue that small lithic sites are important to our understanding of the past and the research potential contained within these sites makes them eligible for the National Register of Historic Places. However, financial and development constraints make it impossible to save and preserve every archaeological site. Priorities must be established and decisions must be made as to what can and should be saved for current and future generations. So then, how do archaeologists determine which sites should be saved and which sites should not be preserved for future generations? The following sections address this question by summarizing some of the potential alternatives for historic preservation presented in this volume. In addition, the importance of reevaluating current field and lab methodologies to maximize the information potential of these sites is also discussed.

REDUNDANCY OF ARCHAEOLOGICAL DATA

One important dilemma facing archaeologists in the study of lithic scatters concerns the redundancy of archaeological data and the all too often asked question "Don't we already have enough information about lithic scatters?". Implicit in this question is the belief that we know all there is to know and that the excavation of additional sites will reveal no new information to refine our understanding of this site type. The chapters in this volume demonstrate the variability and the untapped research potential inherent in what is often perceived as a common and mundane site type.

The chapters by Brian Grills (this volume), Versaggi and Hohman (this volume), Rush et al. (this volume), Jones (this volume), Perazio (this volume), Miller (this volume), Rinehart (this volume), and S. Grills (this volume) provide new information about the exploitation of upland and backcountry regions of the Northeast. The settlement characteristics of these sites vary within and between regions suggesting that that not all-lithic scatters result from the same sets of activities. The chapters by Carr (this volume), and Versaggi and Hohman (this volume; see also Versaggi 2002) also question the belief that these sites were male hunting camps suggesting that small lithic sites may have been utilized by other segments of the population for foraging and resource procurement activities.

Traditional models of Native land-use suggest that the floodplains of primary and secondary waterways were ideal spots for the establishment of residential and base camps. While there is much archaeological evidence confirming this practice, the chapters by Hasenstab (this volume), Curtin et al. (this volume), Carr (this volume), and Blakemore et al. (this volume) show that lowland areas were used for a variety of functions some of which may have had little to do with the establishment of long-term residential camps and more to do with resource procurement. The increasing importance of small lithic sites has caused Northeast archaeologists to re-evaluate traditional settlement-subsistence models and rethink how Native groups occupied and exploited the local landscape (Ritchie 1969; Ritchie and Funk 1973; Witek 1992:31-42).

Finally, differences in the use of small lithic sites are also visible across culture-historic periods. The chapters by Jones (this volume), Perazio (this volume), and Versaggi and Hohman (this volume) suggest that the use of these small lithic sites may have changed over time as ideological, social, and economic practices evolved.

Many archaeologists argue that given the limited size

Current Approaches to the Analysis and Interpretation of Small Lithic Sites in the Northeast, Edited by Christina B. Rieth, New York State Museum, The State Education Department, Albany, New York 12230. New York State Museum Bulletin 508

and artifact assemblages found at small lithic sites, it is difficult to deduce any meaningful interpretations from these sites. As has been argued for other site types in the Northeast, archaeologists need to continuously seek and use creative methods to analyze these sites (Wurst et al. 2000). Of particular importance in understanding these sites is the need to tie these sites into research contexts that will provide a framework against which National Register significance can be evaluated.

ARCHAEOLOGICAL CONTEXT AND THE ANALYSIS OF SMALL LITHIC SITES

The absence of specific research contexts for these small sites is problematic when determining National Register eligibility. Following Little et al. (2000:25), archaeological contexts are defined as "a body of thematically, geographically, and temporally linked information that provides for an understanding of a property's place or role in prehistory or history". In this way, archaeological contexts serve as a framework against which the attributes of the site can be analyzed and recovered information can be used to understand and interpret the activities of past populations.

An archaeological assessment of significance is dependent upon the site's potential to provide evidence about the past and/or its potential to represent a particular resource. From a research perspective, an important part of determining archaeological significance involves evaluating the cultural resource within a body of existing knowledge and specific research questions. These research questions should be timely and reflect our current understanding of the past within the discipline.

Little et al. (2000:14-15) argue that a single archaeological site may be evaluated against multiple historic contexts depending upon the data set recovered, the chronological and regional affiliation of the site, the property's role in regional, state, and national history, as well as the research interests of the excavator. Given the large number of contexts that may apply to a single property, selection of an appropriate context is needed to justify the significance and importance of sites recommended eligible for the National Register of Historic Places.

In the Northeast, detailed archaeological contexts for small lithic sites do not exist making determinations of National Register eligibility difficult at best (Barber 2001:85-90; Carr, this volume; Miller, this volume; Versaggi and Hohman, this volume). Beckerman (2003:8-14) indicates that the absence of research contexts has lead to three problems in developing meaningful interpretations of small sites. These problems include (1) interpretations are based largely on assigning sites to a specific type rather than interpreting the behavioral patterns of the system; (2) not all behavior is patterned with random behaviors creating artificial patterns that have little meaning; and (3) archaeology is reliant on sampling with the amount and type of sampling varying between projects.

Barber (2001) and others (Beckerman 2003; Carr, this volume) have pointed out that one of the greatest problems with the lithic scatter concept is that it has turned into a tool used to pigeon-hole a group of artifacts into a particular site type while providing little or no information about the range of behaviors occurring at the site. Interpreting site behavior is a fundamental goal of archaeological research. Settlement studies, such as Binford's (1980) analysis of forager and collector site use made important contributions to our understanding of settlement behavior among aboriginal groups. In the Northeast, Ritchie's (1969) demonstration of changes in site use over time remains the classic model of settlement pattern research throughout the region.

Ritchie's (1969; Ritchie and Funk 1973) settlement research defined a limited number of site types each type exhibiting specific settlement features, function, and interpretive criteria. These site types were associated with specific tasks relating to our interpretation of the seasonal and year-round activities of the group. Sites that did not easily fit into these limited categories were either dismissed or were placed into the closest category to minimize diversity between site types.

Instead of developing new interpretive contexts, Northeast archaeologists perpetuate existing models by fitting small lithic sites into existing models of settlement behavior. The end result is a stagnant model that is unable to account for the range of behaviors embodied in these small sites. Consequently, these site types are viewed as unimportant aspects of prehistoric settlement systems contributing little or no information about the past.

If we are to develop new research questions and contexts, we must first synthesize what we know and identify areas where we lack information. Because archaeology is a dynamic discipline and professional archaeologists define what is significant information, it is important to regularly update contextual information to assist in evaluating and listing sites on the National Register (Little 2001; Seibert 2002).

Tainter (1979:463) argues that a source of this confusion may result from the logistics of cultural resource management surveys. "Where…a few ephemeral surface scatters are located in small or irregularly shaped land …it can be difficult to envision such remains as parts of a larger system, especially if the archaeology of the surrounding area is not well known". Under such circumstances, evaluation of the settlement and subsistence strategies often occurs at the site level especially when larger regional studies are not available.

Beckerman (2003) points out that other problems,

including the fact that current archaeological contexts do not account for random activities, exist. Although archaeologists look for patterns in the archaeological record, human nature allows for independent decision-making that may not result in patterned behavior. Although individual decision-making is important when interpreting the past, evidence for these decisions are often overlooked or considered unimportant. Beckerman (2003) suggests that independent decision-making may also be masked creating false patterns in the archaeological record.

Cowan (1999:598) argues that availability, abundance, qualities, and geographical distributions of necessary raw materials in the region also effect decision-making. In his study of prehistoric mobility and settlement in western New York, Cowan found that the types of lithic materials recovered from small flake scatters varied across culture-historic periods. Variability in lithic assemblages correlated with mobility patterns and subsistence resources leading Cowan (1999:605) to conclude, "the people who made and used stone tools tailored the designs and production methods of their tools to facilitate larger economic and social goals".

Finally, most of the cultural resource management studies completed in the Northeast rely on archaeological sampling. Sampling allows for a representative portion of the site to be excavated in lieu of a lengthy excavation of the entire site. Although most archaeologists would argue that sampling is an important aspect of the Section 106 process, there is some debate as to what constitutes an adequate sample and how much of the site needs to be sampled before a site can be determined not eligible for the National Register of Historic Places (Blakemore et al., this volume; Hasenstab, this volume; Little et al. 2000; Miller, this volume).

Blakemore et al. (this volume) and others (Dewar and McBride 1992:227-231; Lightfoot 1986:484-500; McManamon 1981:195-227) suggest that other problems including determining the relationship between surface and subsurface deposits may be present in the sampling process. Remnants of buried sites are often brought to the surface and dispersed as a result of plowing and other agricultural activities. If several sites coexisted in the same area, remnants of these sites may remain as a diffuse scatter that could be disentangled through a more extensive evaluation of subsurface deposits (English Heritage 2000:3).

Northeast archaeologists are beginning to look for new and creative ways of addressing the question of archaeological context when interpreting small lithic sites. Versaggi and Hohman (this volume) argue that the district concept might be an appropriate means of defining the archaeological context of these small sites. Archaeological districts are defined as "a grouping of sites, buildings, structures, or objects that are linked historically by function, theme, or physical development or aesthetically by plan" (Townsend et al. 1993:9-10). Archaeological districts may contain both contributing and non-contributing elements arranged in a contiguous and non-contiguous manner.

The district concept has an advantage in that it allows many small lithic sites to be evaluated under a common theme while limiting further excavation to only those sites that are determined to be contributing elements of the district (Little et al. 2000:43-44; see also Little 2001). This approach has the added benefit of acknowledging the importance of small sites while not requiring that a lengthy excavation of every site be undertaken. In New York, the district concept has been successfully applied to small lithic scatters identified within the Hancock (Versaggi and Hohman, this volume), Tennessee Gas Pipeline (Jones et al. 1996; Versaggi 1993; Versaggi and MacDonald 1991), and Hale Eddy Prehistoric Archaeological District (Knapp 2003). The results of these projects allowed groups of lithic scatters from a single valley corridor to be grouped under a common research theme that transcended different culture-historic periods.

Multiple property submissions provide another means of dealing with small lithic sites (Little et al. 2000: Appendix B; Seibert 2002). Multiple property submissions are documents that consist of a group of individual properties that share a common theme or prehistoric/historic context. The properties are grouped with other properties of a similar type and are designed to allow additional properties to be added in the future (Townsend et al. 1993:10-11). Unlike archaeological districts, the nomination process for multiple property submissions requires that archaeologists include specific information about archaeological significance, prehistoric and historic research themes, geography, associated property types, identification and evaluation methods, and a list of bibliographic references about the properties (Seibert 2002; Townsend et al. 1993). Such information is useful in defining archaeological research contexts and assists in determining significance within the National Register evaluation process.

Thematic contexts for the analysis of small lithic sites have been developed beyond the Northeast. Thematic contexts are often defined for state and nationally significant resources. The development of thematic contexts requires that specific historic and geographic contexts be defined along with a discussion of the areas in which future resources may be found.

A key component of many thematic and multiple property studies is the establishment of a programmatic agreement for dealing with the identification of new sites. Programmatic agreements, such as those currently being developed by the Commonwealth of Pennsylvania (Perazio, personal communication 2005), provide a viable

means of linking the thematic contexts of these small sites so that the evaluation process can be streamlined. As described in Carr (this volume) and Gmoser (2002), the development of programmatic agreements provides archaeologists and State Historic Preservation Offices the opportunity to establish necessary field and lab procedures for the evaluation of these sites. In instances where sufficient data isn't available to support National Register determinations, further work is often eliminated.

The Minnesota and California State Historic Preservation Offices have developed thematic contexts for the treatment of small lithic sites (Carr, this volume; Gmoser 2002). In Minnesota, once testing is complete, small lithic sites are considered eligible for the National Register and construction projects are allowed to proceed with a "no adverse effect" determination (Anfinson 1994:1). Jackson et al. (1988:1-3; see also Gmoser 2002) describe how these sites are progressed under a programmatic agreement in California. Like Minnesota, once sufficient testing has been completed, sites are determined to have "no adverse effect" allowing the construction project to go forward.

STANDARDS FOR RESEARCHING SMALL LITHIC SITES

Miller (this volume) describes important criteria for advancing the study of small lithic sites in the future. Among the most important criteria are (1) the development of a fieldwork protocol that can be used to outline archaeological standards for data collection and (2) the development of data analysis methods that could be used to more carefully assess the National Register eligibility of small lithic sites. In addition, criteria for the selection of important remains need to be developed.

Adequate assessment of the National Register eligibility of small lithic sites requires that archaeologists use appropriate field survey and testing procedures to evaluate these sites. The methods used by archaeologists to recover artifacts are dependent upon the size of the area under investigation, the existing land-use patterns, and the objective of the proposed project (English Heritage 2000:3). Lightfoot (1986:484-504) in an analysis of testing programs on Long Island, argues that often the testing strategies employed by Northeast archaeologists are not sufficient to detect and evaluate small surface scatters and deeply buried sites. The size of test units and probes, testing interval, and dense vegetation that masks surface visibility are commonly cited as limitations in finding small lithic sites (Carr, this volume; Lightfoot 1986).

Discussion of the use of appropriate field methods must first begin with a discussion of how lithic scatters are formed. Throughout prehistory, chipped and ground stone tools were used for a variety of purposes including butchering, woodworking, plant processing, and for the maintenance of other tools (Binford 1980). Manufacture of these tools required that large cobbles be reduced to smaller formal and expedient tools. The manufacturing process resulted in the production of both tools and large quantities of debitage. As tools were broken or no longer needed, they were discarded on the ground surface (English Heritage 2000). Natural and cultural processes resulted in these artifacts being buried. Subsistence practices of both Native and Euro-American groups may have resulted in the repeated disturbance and deposition of lithic material on the land surface during agricultural activities (English Heritage 2000:3).

Recent excavations of lithic scatters have shown that often only a limited portion of the artifact assemblage appears on the ground surface at any time (Downum and Brown 1998:111-112). Flooding, soil erosion, bioturbation, frost, plowing, and other geologic processes may cause different portions to the site to be exposed at different times throughout the year (English Heritage 2000:3). To adequately recover information about the relationship between surface and subsurface deposits and make informed National Register recommendations, a testing strategy that employs a variety of methods needs to be implemented. Carr (this volume) and others (Blakemore et al., this volume; Lightfoot 1986; Miller, this volume; see also Downum and Brown 1998:111-114) argue that a testing strategy employing both controlled surface collection, subsurface testing using a minimum number of test probes, units, or trenches closely spaced, as well as the mechanical stripping of the plowzone will provide the most effective means of investigating both surface and subsurface deposits.

Lightfoot (1986:489) argues that increased testing may have the positive effect of increasing the probability of detecting small lithic sites, however the labor output needed to test sites may lead to increased project costs. As described for Pennsylvania (Carr, this volume), completion of more rigorous examination during Phase II excavations, often produce sufficient data to determine that the site is eligible for the National Register and a recommendation that no further work is needed eliminating a costly mitigation project.

In addition to field techniques, archaeologists need to apply more rigorous lab analysis procedures to the investigation of archaeological materials. In addition to general classificatory data, archaeometric (trace element analysis) and analytical techniques (ie. edge- and use-wear analysis, refitting studies) have been used in the investigation of small lithic sites. In the Northeast, as demonstrated by Abel (2000:181-215), Miroff (2002:193-208), Pope and Will (2002), Rieth (n.d.), and Versaggi (2002), archaeometric and analytical techniques often provide

data that can be used to enhance general classificatory data by providing information about the origin and use of the tool. While these techniques are often applied to formal tools, studies applied to expedient tools and debitage offer equally important information about the potential diversity contained within the lithic assemblage.

According to Kvamme (1998:127-141), a more rigorous examination of debitage recovered at small lithic sites can offer equally important conclusions about the people who occupied the site, the activities that they performed, and the larger manufacturing process. In his investigation of the spatial structure of debitage recovered from lithic sites in Colorado, Kvamme argues that an examination of the cortical and non-cortical flakes revealed important information about the spatial arrangement of flaking debris in relationship to knapping activities.

Finally, criteria for the selection of important remains need to be developed to assist in determining National Register eligibility of small lithic sites. Drawing on guidelines developed by English Heritage (2000:7) to assist in the management of small lithic scatters in England, sites containing the following criteria should be considered important by managers: (1) The scatter contains clear boundaries that make it recognizable as a discrete site;(2) The quality of artifacts is such that it can be suggested that buried deposits have only recently been disturbed with less durable artifacts possibly being present; (3) Architectural remains may be present and associated with artifacts; (4) Portions of the site remain undisturbed; (5) The deposits may be confidently dated or interpreted; and (6) The artifacts suggest diversity within the scatter.

Once a site has been determined eligible for the National Register, a number of options may be available to cultural resource managers including preservation in place through avoidance, mitigation, and/or a combination thereof. The decision to preserve a site in place or mitigate the site prior to construction will depend upon the goals and needs of the project. Although preservation in place is often preferred, complete or partial mitigation of the site might be required if primary and secondary impacts are likely to reduce the research potential of the site.

CONCLUSION

Small lithic sites represent an important site type used by the prehistoric populations of the Northeast. The archaeological signatures of these sites often include limited artifact assemblages, small size, and few, if any, features. It is the job of Northeast archaeologists to take these limited remains and derive information about the behaviors of past populations from them.

To adequately interpret these small sites, Northeast archaeologists need to develop new research contexts by which to interpret these sites. These contexts should draw on current theoretical interpretations about the use of these sites and their relationship to larger regional settlement and subsistence models. Research contexts relating to the use of these sites as gender (Carr, this volume; Rieth n.d.; Versaggi 2002) and resource specific task sites will undoubtedly contribute to our understanding of the past behaviors of these groups.

The incorporation of more rigorous field survey and testing procedures and lab analyses are important measures in assessing the importance of these sites. Innovative techniques for mitigating these sites, including the use of the district concept, multiple property submissions, and thematic contexts, may also prove useful in making future National Register determinations.

ACKNOWLEDGEMENTS

Conversations with Ellen Cesarski, Nina Versaggi, Douglas Mackey, Scott Cardinal, Doug Perrelli, Daniel Mazeau, Barry Dale, David Staley, Michael Lenardi, Laurie Miroff, and Tim Knapp helped to refine my understanding of these sites and their utility in reconstructing past settlement and subsistence patterns. All errors are my own.

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