A technological organization analysis of Paleoamerican occupation, adaptation, and settlement at the Potter Site in the White Mountains of New Hampshire

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Signature……………………………Bruce Raymond Rusch………………..……………….

Abstract

In the New England Maritimes region, and especially New Hampshire, small lithic sites or scatters represent the most prevalent Paleoamerican site type identified on the landscape in the course of cultural resource management (CRM) and research activities. Correspondingly, distributed across this same landscape are a considerably far fewer number of significant large sites. Several different functional interpretations have been ascribed to these larger sites; all based on some version of the assumption that the large sites are accumulations of individual small sites either by aggregation or sequential visits.

On present-day route 2 in the Moose River valley of the state of New Hampshire, a Paleoamerican site is situated with an area of 2 ½ acres, 11 excavation units (1m x 1m or greater) and containing approximately 15,900 lithic artifacts, that is known as the Potter site. This attribute depiction suggests similarities between Potter and the few other large regional sites broadly associated with the Vail/Debert and Gainey/Bull Brook time horizons or more specifically; Bull Brook, Whipple, Nobles Pond, Debert, Dedic/Sugarloaf, and Vail. These regional sites manifest in terms of the significant number of "hotspots" or loci, the rarity of its large size, earliest fluted point styles, low number of lithic material sources, rich artifact assemblages, site positioning overlooking a remnant of a glacial pond, and a chokepoint topography.

The research question addressed in this doctoral thesis is: was Potter a single large seasonal hunting aggregation, single occupation marshaling event, seasonal episodic reuse interpretation or alternatively, a seasonal social aggregation site type, or perhaps something altogether different?

The goal of this study was to evaluate the Potter site's inhabitant's lifeways, using flaked stone tool analysis modeling, in contrast to the rare number of large sites types identified regionally and to determine a response to the question; what kind of a site was Potter? Also, while in doing so, increasing the current understanding of the range of Paleoamerican horizon adaptations in the White Mountains of New Hampshire.

Quantitative and qualitative, or more specifically formal and informal heuristic lithic analysis methods, were applied to the excavated site flake stone tool and debitage artifact assemblage to determine a response to the research questions. Each site locus was individually evaluated to infer behavior traits that comprise the site's overall activities and settlement patterns yielding the interpretation of Potter as a seasonal episodic reuse site.

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Abbreviations and definition of terms

Abbreviation	Definition
AMS	Accelerator mass spectrometry (AMS) is a more recent radiocarbon dating method that is considered to be a more efficient way to measure the radiocarbon content of a sample.
^{14}C	Radiocarbon dating method.
b2k	Before A.D. 2000. Part of G ICCO 5 timescale.
cal BP	Calendar years before present.
CMW	Central Midwest region.
CRM	Cultural resource management.
EGL	Eastern Great Lakes region.
ET	Effective temperature.
LGM	The last glacial maximum.
GN	Grid North.
LIS	Laurentide ice sheet.
MANA	Minimum analytical node analysis.
MANs	Minimum analytical nodes.
MINs	Multiple item nodes.
NADW	North Atlantic deep water.
NEM	New England Maritimes region.
NH	State of New Hampshire, United States of America.
NOD	Number of occupation days.
OSL	Optically stimulated luminescence dating method.

OSI	Occupation span index. OSI is a smoothed measure of mean per capita occupation span.
PD	Person days.
SCRAP	The state of New Hampshire conservation and rescue archaeology program
SINs	Single item nodes.
STP	Shovel test pit. 50 cm^2 sampling excavations.
Tool index value	Defined as the product of the number of different tool types multiplied by the quantity of each of these tool types.
THC	Atlantic thermalhaline circulation.
TN	True North.
USDA	United States department of agriculture.
USGS	United States geological survey.
XRF	X-ray fluorescence is a non-destructive analytical technique used to determine the elemental composition of materials. (PMI / XRF Analyzers - JWJ NDT. https://www.jwjndt.com/product-category/pmi-xrf-analyzers/)
YDC	Younger dryas chronozone. (12,900 to 11,600 BP)
27 CO 60	Designation of the Potter site. USA characterization of sites per state, based on County, and the number of sites in sequence. 27 represent the state of New Hampshire, CO stands for Coos County, and 60 is the site number in the sequence of discovery.

Definition of terms

"Settlement trait": any element of human culture, material objects, or human practices that relate to the people who were involved in the formation, occupation, and abandonment of a site and reflect their social and technological organization, subsistence behavior, and normative settlement patterns.

“Settlement Pattern”: a practice or a customary (normative) way of operation, behavior, or convention relating to the use of a landscape, tool-making technology, life, and work at a campsite, mobility, and occupation of a geographic area.

“Archaeological record”: a term used to denote all archaeological evidence, including the physical remains of past human activities, which are recorded and used in an attempt to analyze and reconstruct the past.

“Archaeological assemblages”: a group of different artifacts found in association with one another, that is, in the same context.

“Caching”: a store of goods or provisions, such as stone tools, to be used upon return to a particular geographic region and are concealed in a safe and accessible hiding place. Before complete abandonment of a site, this storage method was often used to avoid the necessity of transporting provisions, tools, and tool manufacturing materials on seasonal rounds.

“Quantitative or formal mathematical model”: is an expression that describes a system by a set of variables and a set of equations that establish relationships between the variables and constants.

“Qualitative or heuristically developed model”: models constructed with experience-based techniques for problem-solving, learning, and discovery.

"Locus": in archaeology, a specific point in space such as a discrete excavated unit or archaeological context.

“Site loci”: a descriptive term delineating concentrations of artifact clusters that may be representative of several separate activity areas, within a designated archaeological site. Loci are the plural of locus.

“Lithic or stone tools” can be classified as either formally curated lithic tools or informal tools. Formally curated lithic tools are stone tools that were specifically designed and manufactured for transportability, versatility, flexibility, reliability, long use-life, efficiency, and maintainability. A curated tool was likely to have been transported and used at multiple site locations. Informal tools are defined by the amount of effort expended in the manufacture of the tool. Informal tools are unstandardized or casual with regard to form; in addition, this tool type is believed to have been manufactured, used, and discarded in the same place over a relatively short time duration.

"Paleoamerican": is a classification term given to peoples who entered and subsequently inhabited the American continent during the final glacial episodes of the late Pleistocene period. Paleoamerican is the range of cultures dating to approximately 10,600 to 12,900 years ago that adapted to the various environments of the terminal Pleistocene and early Holocene periods.

"Technological organization": is the selection and integration of strategies for making, using, refurbishing, transporting, and discarding tools and the materials needed for their manufacture and maintenance.

"Pleistocene": is the epoch from 2.588 million to 12,000 years BP covering the world's recent period of repeated glaciations.

"Shovel-test pits": are the excavation of small test units, typically 50 cm square, at regular intervals along survey transects used in archaeological site sampling.

"Debitage": refers to all the waste material produced during lithic reduction and the production of chipped stone tools. This assemblage includes, but is not limited to, different kinds of lithic flakes, shatter, production errors, and rejects.

"Biface fragment": is a fragmentary piece of lithic material with flaking on both major surfaces resultant from the tool manufacturing or production sequence.

"Channel flake": a long longitudinal flake removed in the fluting process of a lithic projectile point or knife. Flake scars originating from opposite directions typically meet to form a ridge on the dorsal or exterior surface of the flake and are perpendicular to the direction of the channel flake removal.

“Preforms”: are the rough, incomplete, and unused basic form of a stone tool formed by lithic reduction. They represent an intermediate stage between the initial core and finished tool. They are larger and thicker than the intended tool and lack the final trimming and sharpening that is present in the completed artifact.

Part I

Background, setting and the archaeological issue

This segment of the study focuses on the background, setting, and archaeological issues to be addressed in the investigation and analysis of the Potter site, a Paleoamerican occupation in the White Mountains of New Hampshire. Topics addressed include an introduction to the research problem, objectives of the study, a history of Paleoamerican research in New Hampshire, hypotheses, and archaeological context. To provide a framework for a number of the behavioral choices made by the inhabitants of the Potter site, a reconstruction of the Paleoenvironmental conditions at the time the occupation occurred are developed and discussed.

Following an introduction to the region and its archaeological scope, the investigation's research problem and objectives, as well as the history of Paleoamerican research in the state of New Hampshire, is provided in Chapter I. The studies null and alternative hypothesis is presented in addition to a synopsis of the analysis methodology that will be used to test the hypothesis.

Chapter II introduces a late Pleistocene to early Holocene environmental reconstruction for the New England-Maritimes (NEM) and New Hampshire territory based on pond core sampling from the wider region and nearby the Potter site. The reconstruction begins with the broader Northeastern regional Paleo-climatic environment that depicts the post-glacial regional geological and vegetation responses. This broader (NEM) reconstruction is followed by a narrower New Hampshire postglacial geological and vegetational response as well as the state's postglacial faunal composition.

Chapter III presents the Potter site archaeological context delving into the site background and excavation history. The Potter site regional geographic and geological terrain are presented to provide an understanding of the contextual positioning of the site and surrounding areas. Following the contextual positioning, the sampling strategy employed for ground-truthing or direct research observation of the site is depicted. Also presented in the chapter is the entire excavated flaked stone artifact finds. The total site flaked stone artifact assemblage is enumerated first by the material and specimen type and quantity, then by locus, material type and quantity, and finally by artifact assemblage by locus, material type, and percentage or frequency. Subsequent to the detailing of the assemblage, both horizontal and vertical spatial distributions of the flaked stone assemblage for the entire site and individual loci is illustrated.

Chapter I

Introduction and research hypothesis

1.1 Introduction

"Excavated sites are the archaeologist's bread and butter. His view of the past is necessarily restricted to these discrete, isolated points in the landscape. It is a stationary view, whereas past behavior – especially that of hunters and gatherers – was highly mobile. Each site, therefore, presents a limited, biased picture of a whole range of activities, depending upon its unique position within a regional system of behavior" (Binford 1983:109).

The Northeast archaeological region can be defined as a peninsula that incorporates the six New England states of the United States, New York east of the Hudson River, Québec Canada South of the St. Lawrence River, and the Gulf of St. Lawrence in addition to the maritime provinces (see Figure 1). This geographic grouping is often referred to as the New England-Maritimes region or (NEM).

In the Northeast evidence of Paleoamerican people has been more difficult to recover than in other adjacent regions of the country for numerous reasons. For example, over the years there has been a significant number of Paleoamerican recoveries made in the adjoining Eastern Great Lakes (EGL) and central Midwest (CMW) regions located to the West of the NEM. These site recovery successes are attributable to the EGL and CMW regions being more densely populated, heavily developed, having undergone more intensive cultivation, in addition to executing more targeted research surveys (Ellis 2011).

Unlike the EGL and CMW, much of the Northeast landscape is rugged and forested with much lower population densities, less modern development, and where a lesser amount of agricultural cultivation has taken place, making the finding of any rare early sites literally like finding a needle in a haystack (Ellis 2011). Many of the late Pleistocene and early Holocene sites in the Northeast represent fortuitous discoveries that were not found through targeted research (Lathrop 2016 et al.).

Figure 1.1 New England-Maritimes region comprised of the six New England states, New York east of the Hudson River, Québec Canada South of the St. Lawrence River, and the Gulf of St. Lawrence in addition to the maritime provinces. This geographic grouping is referred to as the New England-Maritimes (NEM). (Garrett 2015, retrieved from https://slideplayer.com/slide/4611886/.)

That said, the Paleoamerican sites that are found represent important localized pinpoints of hunter-gather behavior as portrayed in Binford's (1983:109) observation noted above that makes settlement pattern system inferences possible. The Potter site is one of those important pinpoints that can provide insight into the early peopling of the White Mountains of New Hampshire.

The Potter Site (27 CO 60), named so in honor of the landowner, is located along Route 2 on the eastern side of the town of Randolph in the Moose River valley of the state of New Hampshire (Figure 1.2). Most map figures and photos used in this study were unpublished. Preparation of the graphics and photos used were made by the excavation crew and team members who participated in working the site. Those published are appropriately attributed.

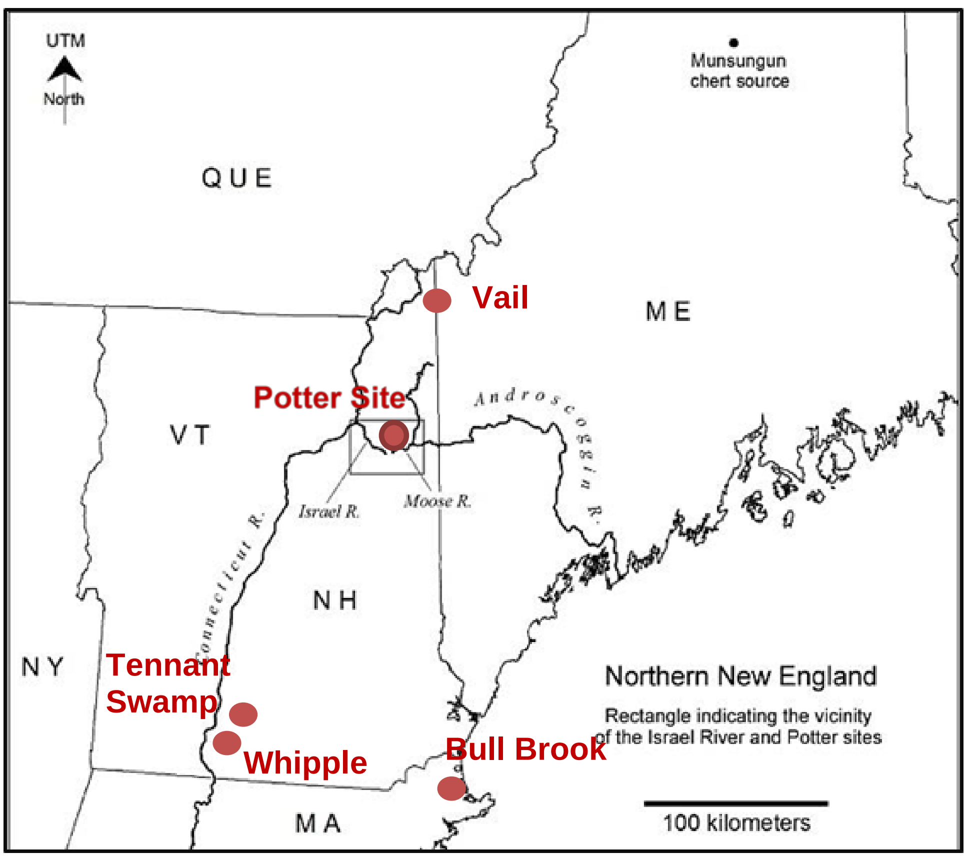


Figure 1.2 Potter site's location along Rte., 2 in the town of Randolph, New Hampshire in the Moose River valley including reference sites (Masters 2012)

The Moose River valley lies in a section of the Presidential Mountain range, in the central region of the White Mountains of New Hampshire. The site setting is on the northeastern slope of the Presidential Range of New Hampshire's White Mountains.

Following the discovery of the Potter site in 2003, the State Conservation and Rescue Archaeology Program (SCRAP), established under the New Hampshire Division of Historical Resources, undertook a summer field school to explore the site. Between this initial field school and today, there have been more than 800 shovel test pits dug and 11 larger (one meter or greater) excavation units identified and excavated on the site. The estimated boundaries of the site, established by a sequential number of sterile shovel test pit (STP) samplings around the perimeter, covers approximately 2 ½ acres (Boisvert et al. 2018).

With a site area of 2 ½ acres, 11 excavation units (1m x 1m or larger) and approximately 15,900 lithic artifacts, the sites principals, supervisors, and excavators speculated that Potter had a number of similarities to the rare large Bull Brook (Eldridge and Vaccaro 1952; Byers 1954, 1955; Jordan 1960), Vail (Gramly 1982, 2009), and Whipple (Curran 1987) regional sites. Potter is thus a significant addition within the region that has led to many theorizing about what category the site should be placed in and what role it played in the Paleoamerican landscape. The investigation team speculated that Potter could potentially be a large single occupation marshaling area as characterized by Dincauze (1993), or perhaps a single occupation communal gathering for herd hunting (Robinson et al. 2009), or even a seasonal social aggregation site type (Curran 1987; Dincauze 1993; Robinson and Pelletier 2005). The similarities noted between Potter, Whipple, Bull Brook, and Vail, as well as a few other rare significant Paleoamerican regional sites, is found in the shared number of noteworthy site characterization traits enumerated below (Boisvert 2012; Dincauze 1993; Gramly 1982, 2009).

1. A significant number of loci or artifact “hotspots,”
2. a rarity of substantially sized sites in the region,
3. having an assemblage of the earliest fluted projectile point styles,
4. a low number of lithic material sources,
5. rich artifact assemblages in quantity and variety,
6. site positioning overlooking a remnant of a glacial pond,
7. and a chokepoint topography for game harvesting.

As can be seen from the diversity of ideas and interpretations surrounding the characterization of the Potter site type and its position within the regional archaeological landscape, there is a strong need for a more considered overview and analysis. This thesis aims to fill this gap in knowledge and understanding. To accomplish this challenge, the research study that follows is organized into 16 chapters assembled into six parts. Part I introduces the background, setting, and archaeological issues to be addressed. Part II provides the methodology to be used for the investigation including the analytical framework, archaeological approach, and settlement pattern modeling. Parts III and IV present the Potter and comparative site archaeological data for analysis. Part V evaluates the Potter and comparison site analysis of the data using quantitative and qualitative modeling methods. In closing, part VI proffers discussion, inferences, and conclusions regarding the studies’ goals and hypotheses.

Each of these parts or divisions brings together the salient information required to investigate the Potter site’s research objectives and hypothesis, thus illuminating the site inhabitant’s settlement pattern behavioral actions and lifeways.

1.2 New England-Maritimes Paleoamerican site types

In the New England-Maritimes region, and especially New Hampshire, small lithic sites or scatters represent the most prevalent Paleoamerican site type identified on the landscape in the course of cultural resource management (CRM) and academic research activities. Some of these small Paleoamerican sites have been found to contain artifact evidence of short-term habitations, including specialty activities such as food preparation and stone tool production (Piles and Wilcox 1978; Rieth et al. 2008; Shen 2001; Custer 1988; Barber 2001).

Barber's (2001) regional synthesis classifies small lithic sites or scatters as having the following attributes: 1) a surface or subsurface scatter of debitage, 2) sites that are less than 30 m^2 in area, 3) artifact numbers less than a total of 50, and 4) where lithic tools and bifaces are rarely found.

Respectively, across this same landscape, there are distributed a far lesser number of significant defined large sites. Several different functional interpretations have been ascribed to these large sites; all based on some version of the assumption that the large sites are accumulations of individual small sites either by aggregation (a number of social units such as families or hunter groups at the same time) or single sequential visits (Dincauze 1996; Walthall 1998).

For clarification purposes, the phrase “significant large sites” referred to above has a specific connotation. In archaeological vernacular “significance” has become a legally defined term with its definition tied to the four criteria for National Register eligibility (Little et al. 2002). Within this framework, the definition of “significance” has evolved to be interpreted as single or multiple sites that have the potential to produce types of information such as mobility, toolkit compositions, dietary diversity, and site organization that can be linked to current research questions in the discipline (Versaggi and Hohman 2008). Generally, when measured in terms of the number of loci, site size varies more-or-less continuously, with the larger sites often cited as having eight or more loci. Large sites broadly associated with the Gainey/Bull Brook Phase time horizon include Bull Brook (n = 36 loci, Eldridge and Vaccaro 1952), Nobles Pond (n = 14, Seeman 1994:281; Seeman et al. 2008:2743), Debert (n = 11, although see Davis 1991), Udora (n =11, apparently multi-component, Storck and Spiess 1994:121), Sugarloaf/DEDIC (n = 11 multi-component; of the 11, n = 8 Paleoamerican component, Chilton et al. 2005; Gramly 1998), and Vail (n = 8, Gramly 1982). The above-noted sites are located in the EGL and NEM regions. Other Northeastern sites that may have fewer loci, lower artifact densities or are placed in a later Paleoamerican horizon than the Gainey/Bull Brook Phase can also be considered to be of significance. Examples of these are Whipple (n=3, Curran 1984:8; Spiess et al. 1998:205) and Michaud (n=9 lithic artifact concentrations, Spiess and Wilson 1987).

In this study, Potter is evaluated and compared, in terms of the large site classification taxonomy (to be defined further on), and the functional behavioral interpretations of four other regionally classified large sites of the Paleoamerican horizon. Individually these are Bull Brook, and Vail, who fall into the traditional large site category, as well as Tenant swamp and Whipple, which regarding the number of loci but not the number of artifacts is also considered to be significant regional Paleoamerican sites.

Most sites excavated in the New England-Maritimes region comprising the Paleoamerican, Archaic and Early Woodland horizons are considered to be the product of mobile hunter-gatherers (Burke 2009). All five of the sites that are evaluated and compared, i.e., Whipple, Bull Brook, Vail, Tenant swamp, and Potter are members of the Paleoamerican horizon and share this depiction. As mobile hunter-gatherers, to one degree or another, they are influenced by cultural sub-horizon, region, social affiliation, environment, adaptations, season, and other factors including kinship networks and social-political organization.

The focus of this study is an investigation and analysis of the Potter site, a Paleoamerican occupation in the White Mountains of New Hampshire and the inhabitant's lifeways to determine what type of site it was and where it resided within the paleo-horizon regional system of settlement patterns and cultural behavior.

1.3 Significant large site interpretive taxonomy

Dincauze (1996) offered a large site interpretive taxonomy that is based on the assumption that large site types are accumulations of individual small sites either by aggregation or single sequential visits. Where a hunter-gatherer aggregation site "is a place in which affiliated groups and individuals come together resulting in the concentration of individuals and groups that are otherwise fragmented" (Conkey 1980:612). As part of this taxonomy at least five different functional interpretations of site types have been proposed by Dincauze (1996).

1.3.1 The episodic reuse interpretation.

At both large and small eastern Paleoamerican sites, it is commonly observed that the relative elevation of the sites is greater when compared to the surrounding terrain. This observation in conjunction with a treeless tundra-like environment suggests a site function of an elevated lookout or camp for game hunting. As a result, one archaeological interpretation for large sites is episodic reuse or accumulations of sequential visits at places favored for intercepting migrating caribou (Dincauze 1996; Funk 1973; MacDonald 1971; Witthoft 1952).

1.3.2 The seasonal hunting aggregation interpretation

The concept of a seasonal aggregation for communal herd hunting was one of the first aggregation models. Support for this interpretation derived from the increasing evidence for caribou among the prey represented by calcined bone at a few sites such as Whipple and Bull Brook (Spiess et al. 1984). Ethnographic analogies are frequently cited in support of this hunting interpretation, often based on early-historic period seasonal caribou hunters in the subarctic and arctic barren grounds (e.g., Funk 1973; Gramly 1988).

1.3.3 The macro band camp interpretation.

MacDonald (1982) proposed that the large sites in eastern North America could have been camps of very large bands of hunters because environmental factors were more amenable to greater group size and evidence of population growth. In conjunction with the population growth argument, Fitting (1977) argued for large populations and "tribal" social complexity. The MacDonald (1982) large site interpretation is based upon the variable's population growth because of environmental factors and complexity. Whereas, the interpretation in the seasonal hunting aggregation (1.3.2), is based on communal behavior for the purpose of organized game procurement. The organization implied in 1.3.2 is for a single aggregation event and then dispersal after the hunt while McDonald's (1982) and Fitting's (1977) interpretation implies a continuation for some extended time period of the aggregation for purposes of societal structuring. That is not to say the macro band camp did not organize for communal hunting.

1.3.4 The social aggregation interpretation.

An anthropological interpretation of the large sites sees them as reunion events or areas for the seasonal gathering of otherwise dispersed groups marshaling for information sharing, mate selection, and taking advantage of seasonally abundant resources (Curran 1987; Curran & Grimes 1989). This interpretation goes further than the aggregated hunting camp characterization to include the fulfillment of a variety of basic human needs (Dincauze 1996). Among these needs facilitated by periodic aggregations are information exchange, dispersal and resource territory positioning, scheduling decisions, and mate selection (Moore 1981). Planning aspects for such aggregations might include consideration of interception of migrating game (Dincauze 1996).

1.3.5 The pioneering model

Dincauze (1996) proposes in another paradigm that the large northeastern sites were marshaling areas for people who had crossed the recognized frontier of their traditional territory and settled into focal places used for the gathering, arranging and allocating of resources and information, preparatory to dispersing in smaller groups into a new region. These pioneers represent the first human groups considering settlement in their new respective areas. The first pioneers moving into terrain uninhabited by other humans are to be considered as a distinct class of human explorers (Dincauze 1996). Stretched by information constraints and low population densities, risks are exaggerated by lack of information, unfamiliar space, and distance to social support.

While useful as a descriptive tool that encompasses most of the large site types, the Dincauze taxonomy (1996), may not be exhaustive and perhaps Potter could fall into an as yet undefined or uncharacterized arrangement. However, for this study Potter’s hypothesized large site classification will be tested to the defined taxonomy unless it becomes unsupportable.

As examples of the application of Dincauze’s taxonomy (1996), Curran (1987) from her experience at the Whipple site proposed that large sites were utilized as central gathering places in the annual subsistence settlement rounds. In Curran’s (1984, 1987) large seasonal round periodic gathering site “reunion” type model, the importance of low density, highly dispersed populations revolved around social issues such as access to potential mates, information sharing, and seasonally abundant resource identification (Curran & Grimes1987; Anderson 1995).

In the marshaling site model for Bull Brook Dincauze (1993, 1996) focused on the role of large gatherings sites as part of the staging preparation for pioneering populations moving into a new landscape while also noting that the largest Paleoamerican sites were the earliest. When characterizing the Bull Brook site Robinson and Pelletier (2005) synthesized both of these models and hypothesized that the site was a large single occupation of communal hunting bands located there to intercept the fall migration of woodland caribou moving from Jeffrey’s Ledge to the wooded interior.

1.4 Significance of the study

The quantity of sites with Paleoamerican components in New Hampshire and knowledge of their cultural adaptations, as meager as it is, is slowly but steadily increasing. Detailed analysis and documentation are required to characterize and fit these newly added finds, cultural adaptations, settlement patterns, and placement within the New-England Maritimes regional system of Paleoamerican horizon behavior. The Potter site with its rich artifact assemblage represents just this type of opportunity.

The significance of this study is that today there is only very rudimentary and imperfect data and models from which to infer Paleoamerican settlement pattern systems in the Northeast. Modeling and analyzing the Potter site artifact record will add clarity and understanding of the settlement organization data obtained from this site. Beyond this site, the information derived can contribute to refining our understanding of broader regional patterns and allow for the development of more detailed models that in the future might be hypothesis tested.

Further, results generated by the analysis of this site enable additional characterization data, concerning Paleoamerican settlement organization in the White Mountains of New Hampshire. These results can then be incorporated into the ongoing studies of human migration and settlement into the New England-Maritimes region by residentially or logistically mobile foragers as well as first entrants (Boisvert 2013; Goodby 2014 et al.; Kitchel 2016; Rockwell 2014; Rusch 2012). While focusing on a geographically specific study, results of this work may find applicability to other regions that emerged from the last glacial maximum (LGM) where Paleoamericans established lifeways during the Younger Dryas fluted point episode. Through the use of lithic analysis in an organization of technology framework, employing both quantitative and qualitative methods as opposed to qualitative models only, a more in-depth inferred interpretation of settlement traits and patterns could be advanced.

1.5 The research problem

To investigate and analyze the Potter site's inhabitant's lifeways in contrast to the infrequent number of large sites types identified regionally, the research problem to be resolved through this study is the determination of responses to the following issues.

(1) When and to what extent the occupation the Potter site (27-CO-60) occurred during the late Pleistocene to early Holocene Paleoamerican period – full-time, seasonally, sporadically, or some combination thereof.

(2) Because of its remarkable and relatively large artifact assemblage, can the site be classified as one of those few, but large aggregation sites as characterized by Dincauze (1996)? Should the

Potter site be classified as a marshaling site type that was used for an into-region pioneering population dispersion (Dincauze 1996), or as a large periodic social gathering site based on seasonal rounds of small and dispersed populations (Curran 1984, 1987)? Alternatively, should it be classified as a onetime cooperative herd hunting aggregation (Robinson et al. 2009; Robinson and Pelletier (2005), or as an episodic reuse site of accumulations of subsequent visits at places favored for intercepting migrating caribou (Dincauze 1996; Funk 1973; MacDonald 1971; Walthall 1952)?

(3) If not one of these site characterizations, what does this site represent regarding settlement pattern organization and scope of activities pursued during an occupation of the Moose River valley?

(4) How, precisely, did Northeastern Paleoamerican groups move across the White Mountains landscape – through systems of residential mobility, logistical mobility, or both?

The goal of this research is to resolve these issues and in doing so the current understanding of the range of Paleoamerican horizon adaptations in the White Mountains of New Hampshire.

1.5.1 Research objectives

In resolving these research problems in addition to augmenting the gap in the modest regional database of interpretations of Paleoamerican adaptations during late Pleistocene and early Holocene in New Hampshire's White Mountains, the focus of this study is an investigation and analysis of a Paleo-cultural occupation and their lifeways. Aspects of this investigation include occupation horizon, settlement patterns, mobility strategy, ecosystem, subsistence economy, foraging strategies, domestic activities, and material deposition patterns using technological organization analysis.

Investigation of the Potter site (27-CO-60) is organized into four broad research categories, i.e., temporal aspects of Paleoamerican occupation; mobility patterns and seasonal inferences; settlement pattern adaptions and site/loci land use activities; and technological organization. Detailed below are the specific aspects of these categories to be researched in this study.

(1) Temporal aspects of site habitation include an occupation date range for the site and individual locus, length of stay at each locus, whether the site is representative of a single occupation or a palimpsest including assessing if individual loci were reoccupied.

(2) Settlement pattern adaptations consist of the inhabitant's mobility strategies, i.e., logistical, residential or combinations, seasonal foraging range, subsistence economy including its ecosystem, available resources, and foraging adaptive predation behavior.

(3) What the land-use domestic activities conducted at the site loci were, i.e., habitation, resource procurement, resource processing, tool production, or quarrying activities.

(4) What was the technological organization of the site occupants and how did it address the Paleoamerican adaptations at Potter?

1.6 History of Paleoamerican research in New Hampshire

In 1994 Mary Lou Curran took on the task of producing an assessment of Paleoamerican research in the state of New Hampshire as of that date. The title of the investigation "New Hampshire Paleoamerican research and the Whipple site" was published in the New Hampshire Archaeologist (Curran 1994). As part of site data reviews and identification of research issues, the interpretations Curran provided were from a vantage point uniquely shaped by her personal research of the Whipple site (Curran 1984, 1987). Whipple was identified in the mid-1970s and recognized as an important example of a major Paleoamerican site while unfortunately being the only one well documented and published. At that time, as important as the Whipple site was, only four other excavated sites with Paleoamerican components had been identified in New Hampshire. Those were the Thorne site in Effingham (Boisvert 2005), Hume site in Merrimack (Boisvert and Bennett 2004), Thornton Ferry site (Curran 1994), and the George's Mills site in Sunapee (Sargent 1982, 1990). Even though these sites had been identified and excavated, they remain unpublished for many years after the publication of the Whipple site. Complementing these few identified Paleoamerican sites were a handful of isolated fluted point finds from around the state dating to the Paleoamerican horizon. Examples of these isolated finds was a surface find at Ossipee Lake (Sargent and Ledoux 1973), other finds at Amoskeag Falls in Manchester, NH (Curran 1994), and an 1888 discovery of the "The Intervale point" in North Conway NH (Sargent and Ledoux 1973). These sites and isolated fluted point finds are shown in Figure 3.

Curran's assessment indicated that only very basic data was available, i.e., confirmation of the presence of caribou and beaver hunters, and that they occupied regions of the state in small camps with an estimated horizon date presence of 10,000-11,000 ^{14}C years ago.

Boisvert's (2012) interpretation of this assessment was that the status of Paleoamerican studies for New Hampshire by 1995 was only at a basic presence or absence level. The database for Paleoamerican sites was so meager that Whipple was the only site that had produced more than one fluted point or triangular spurred end scraper (Boisvert 2012).

For the state of New Hampshire, 1995 marked the beginning of a rapid accumulation of newly excavated Paleoamerican sites – growing by more than 100% by 2003 to an inauspicious total of 15. A key factor in the expansion of the total was the discovery of the first Israel River complex Paleoamerican site located in the Israel River Valley of the White Mountains of New Hampshire (Bouras and Bock 1997) (See Figure 1.3).

As of 2012 five additional sites in the Valley had been identified and excavated; all yielding flaked stone artifact assemblages that placed them within the Paleoamerican horizon. Meanwhile, 18 km to the east of the Israel River complex in the town of Randolph, the Potter site was discovered in 2003.

The site was initially identified by the surface find of a lithic artifact that had cultural significance during a walk-over before the potential sale of the land for use as a gravel pit. The flaked stone artifact found was made from Munsungun chert which is located over 400 km from the Potter site. Following the find and after extensive excavation what appeared was a large and important site discovery. While the number of sites with Paleoamerican components is slowly but steadily increasing around the state, considerable effort is now required to analyze and document these newly added finds to characterize their cultural adaptations, settlement patterns, and placement within the regional system of Paleoamerican behavior. The Potter site with its rich artifact assemblage represents just this type of opportunity.

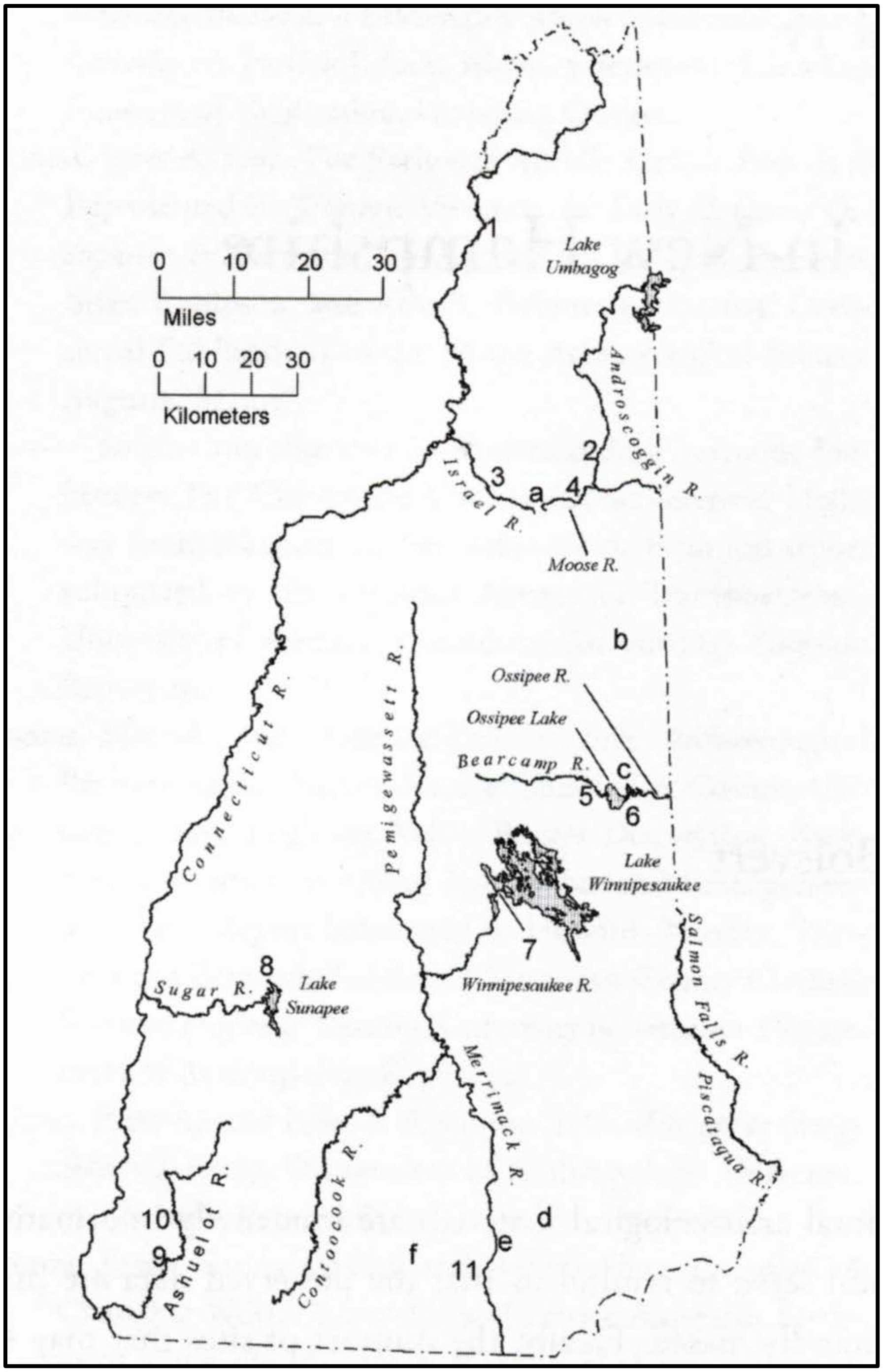


Figure 1.3 Map of Paleoamerican sites as of 2012 in New Hampshire and isolated finds. Sites: 1, Colebrook site, Colebrook 2; Mount Jasper lithic source, Berlin; 3, Israel River Complex, (Jefferson I, II, III, IV and V), Jefferson; 4, Potter site, Randolph; 5, Stone's Throw site, Tamworth; 6, Thorne site, Effingham; 7, Weirs Beach site, Laconia; 8, George's Mills, Sunapee; 9 Whipple site, Swanzey; 10, Tenant Swamp site, Keene; Thornton's Ferry and Hume sites, Merrimack. Isolated finds: a, Lowe biface, Randolph; b, Intervale point, Conway; c, Ossipee Lake point, Freedom; d, Massabesic Lake point, Auburn; e, Smyth, Neville, and Manchester points, Manchester; f, New Boston point, New Boston. (From Boisvert 2012:78).

In large part human cultures, including hunter-gatherers that occupied the Potter site, regularly contributed recognizable waste materials such as flaked stone tools and debitage to the natural environment. It is through these physical deposits, often deliberately discarded as trash, that archaeology of past societies is made possible. While refuse disposal is responsible for depositing most culturally produced artifacts in the archaeological record, other diverse processes including unintentional breakage, loss, abandonment, and caching, also contribute to the record (Schiffer 1987). When these artifact deposits are recovered and analyzed, cultural changes to meet environmental challenges in addition to behavior inferences can be drawn, thus providing evidence of a societal past and among other things, its cultural adaptations and settlement patterns.

Interpretation of Potter's occupant's adaptive behaviors, traits, mobility, and settlement patterns as delineated in the research problem and objectives are dependent, in large part, upon analysis of the site's flaked stone artifact assemblage. These adaptive behaviors are informed by environmental variables which measure resource accessibility, resource structure of the environment base, technology, and culturally adaptive processes. Two anthropological premises serve as an underpinning for the analysis and interpretation of the Potter site. Firstly, the environment, or more specifically composition of the environment's resource base, influence the frequency and arrangement of human movement across a landscape (e.g., Bettinger 1987; Binford 1978, 1980; Kelly 1983, 1995). Secondly, the nature and frequency of people's passage across a landscape influence their choice of technological strategies, including strategies for making and using lithic tools (e.g., Binford 1977, 1979; Bleed 1986; Bousman 1994; Kelly and Todd 1988; Nelson 1991).

1.7 New England Paleoenvironment summary

Approximately 28,000 years ago the Laurentide ice sheet spread south to southeast across the New England region from its source in Canada to the offshore islands of southern New England, and Long Island. The limits of the ice sheet were marked by a long series of moraines, geologically composed of a widespread dimensional grading of sediments that amassed along the glacier margins. The terminal moraine, delineating the furthest southward extent of the glacier, extended eastward across southern Long Island in addition to encompassing parts of Martha's Vineyard and Nantucket (Thompson & Eusden 2013). As the Pleistocene drew to a close, the New England landscape was visibly altered by a series of oscillatory glacial retreats and advances accompanied by sea level rise, isostatic rebounding, and the formation of inland water bodies (Cronin et al. 2008; Lothrop and Bradley 2012; Ridge 2012). Deglaciation and ice margin retreat, as calibrated by varve deposition, began approximately 24,000 cal yr BP and reached the Randolph - Jefferson region of the White Mountains of New Hampshire approximately 13, 400 cal yr BP (Thompson et al. 2002; Ridge 2012).

The interpretation of Paleoamerican occupation of the White Mountains of New England becomes one of assessing the arrival horizon of a pioneering population into the region. The significance of the dates for deglaciation and ice margin retreat is in setting an upper limit indicating when this area of the White Mountains was free of glacial ice and potentially suitable for the expansion of flora and fauna to support human habitation (Boisvert, 2002; 2013). Thompson et al. (1999, 2002) compiled previously published radiocarbon dates from several ponds in the White Mountains and adjacent areas. Most of these dates are from basal or lower portions of pond sediment cores and indicate limits on the time of deglaciation of each site. Support for the above possible habitation horizon premise was obtained from coring studies of the Pond of Safety, located in Randolph, NH nearby the Potter site. Selection of The Pond of Safety was based on its favorable location that allowed for a minimum age for deposition of the Androscoggin Moraine to the east and maximum age for the Bethlehem Moraine complex to the west (Thompson et al. 2002). The basal date from Pond of Safety coring is 12,450 ± 60 ^{14}C (Thompson et al. 2002, 2011). As a result, it is ventured that after the retreat of glacial ice and the expansion of suitable flora and fauna to support human habitation, Paleoamerican occupations were only probable after 12,000 ± 60 ^{14}C or many centuries after the glacial ice retreated from the region (Boisvert 1999).

Defining migration and colonization patterns into and throughout the New England and Maritimes region has been somewhat of an opaque process over the years, and especially so in New Hampshire for several reasons. Three of the most relevant limiting factors are: the small number of Paleoamerican sites identified and documented in the state, the number of years of active research investigation, and the geological characteristics of the region's soil and its effects on artifact preservation, often masking ephemeral pioneer site's archaeological visibility. After the initial pioneering arrivals into the region, in subsequent time horizons following familiarization with the landscape as well as its resources, it has been suggested that mobility patterns of hunter-gatherer bands occupying the area adopted band territories or geographic areas that they exploited on a regular seasonal, annual, and multiyear basis (Curran and Grimes 1989; Sampson 1988:17-28).

1.8 Research hypotheses

Formulation and statement of this study's hypotheses to be tested center on the research objectives employed in the interpretation of the Paleoamerican cultural lifeways and adaptations exhibited during the Potter site occupation. As noted above, the objectives to be tested fall into four broad categories: technology organization, temporal, settlement pattern, and site activities.

1.8.1 Hypotheses statement

The following is an enumeration of the hypotheses, null and alternative, which will be tested in comparison to results found from the analyses of the Paleoamerican cultural lifeways and adaptations of the Potter site occupation. The key interpretive issue is the relative size of the site and how such a site was accumulated.

1.8.2 Null Hypotheses

It is hypothesized that the Potter sites archaeological interpretation of the Paleoamerican cultural lifeways and settlement patterns in the White Mountains of New Hampshire, using Dincauze's (1996) significant large site interpretive taxonomy, is episodic reuse or accumulations of single sequential visits. These stays occurred at places favored for intercepting migrating caribou herds (Dincauze 1996; Funk 1973; MacDonald 1971; Witthoft 1952). For this hypothesis to be upheld it would be expected that specific elements of; 1) temporal aspects; 2) Mobility patterns and seasonal inferences; 3) Settlement pattern adaptions and site/loci land use activities; 4) and technological organization would exhibit expected outcomes when tested. Detailed below are the expected outcomes by enumerated topic.

1.8.2.1 Temporal aspects

It is hypothesized that The Potter site was an episodic reuse palimpsest of multiple occupations dating from differing sub-horizons of the Paleoamerican culture horizon (12,900 to 10,800 cal BP), inhabited for differing occupation lengths. If so, it would be expected that there should be differing sub-horizon dates for the sites individual loci occupations. Some loci would be expected to have been occupied between an early sub-horizon (12,900 to 12,200 cal yr BP), a mid-sub-horizon (12,200 to 11,600 cal BP), or late-sub-horizon component date (11,600 to 10,800 cal BP) (Bradley et al. 2008; Lothrop et al. 2016).

1.8.2.2 Mobility patterns and seasonal inferences

Regarding mobility patterns and seasonal rounds, to qualify as a Paleoamerican episodic reuse palimpsest of multiple occupations site type (Dincauze 1993 1996 taxonomy), it is expected that inhabitants would have a forager profile, (sensu Binford 1980) where inhabitants move to resources and exhibit high residential mobility. The frequency of hunter-gatherer residential mobility is defined and constrained by the rate of local resource depletion (Kelly 1992; Venkataraman et al. 2017). If so, the toolkit of a mobile forager population, as opposed to more sedentary collector inhabitants, would reflect this by differences in kit composition (Kuhn 1994). The forager toolkit would be expected to contain, flexible highly portable tools, relatively few tool types serving multiple functions, low core/biface ratios, and extensive reworking. Reduction stages present in loci tool and debitage assemblages are expected to be spatially differentiated that is, the primary blank reduction occurred at another location such as a tool stone source quarry (Symons 2003).

The expected seasonal round indicator for this mobility pattern is the percentage of tool stone material varieties from multiple locations found in the artifact assemblage. At the site, this would be expected to be Mount Jasper dike rhyolite and Jefferson cobble rhyolites in addition to Munsungun chert from Maine.

The Potter site lies on a potential caribou migration path from the Connecticut River Valley northward along the Androscoggin toward the Vail site in Northwestern Maine (Curran 1984, 1987). When caribou migration was in evidence from its southern wintering territory to northerly calving grounds, it was possible that the migration passed by the Potter site in both directions depending upon seasonal movements. Site occupation was expected to have occurred during the fall season because of the availability of primary prey (caribou) and caribou hide quality for use as clothing material and shelter coverings.

Caribou herd sizes vary from season to season due to ecological issues such as predator population (wolves), availability of nourishment, birth rates, climate variation in addition to other factors, leaving only a finite number of animals available for harvesting (Spiess 1979). This means that it would take a determinate amount of time for a migrating herd, depending upon its population size, to pass an intercept point such as a hunting site. In an ethnographic study of the Nunamiut by Binford (1979), he noted that the yearly caribou hunt season lasted for approximately 30 days: 15 days during the spring migration and 15 days during the fall migration. It would, therefore, be expected that the occupation span of the Potter site's inhabitants would be limited in time because of the narrow window of opportunity for harvesting a passing caribou herd migration. At this time a major secondary subsistence prey to caribou has not been identified in the region that would allow the inhabitants of the Potter site to be year-round occupants. Given the probability of a short occupation span and the need to find alternate subsistence options, it is expected that the inhabitants of the Potter site followed a seasonal round settlement-subsistence system.

1.8.2.3 Settlement pattern adaptions and site/loci land use activities

If as hypothesized, Potter was an episodic reuse multiple occupation site (Dincauze 1993 taxonomy), it is expected that loci occupation spans would be relatively short, perhaps days to weeks in length and used as short-term seasonal round sites. Evidence of reoccupation of the site and loci would also be anticipated. Occupation spans would differ in length, i.e., shorter for episodic reuse hunting camps than from those of a large single event or pioneering/marshaling aggregation site type (longer). Further, it would not be expected to see tool refits between individual Potter site habitation category (tent) loci as this would be indicative of contemporaneous occupation dates as found in single or longer-term aggregation sites (Gramly 1982:50-51; Robinson 2009).

Similarities and differences in land-use or activity functions at each site locus are expected to be revealed by the composition and variability of the artifact assemblages in addition to tool microwear indications. Signatures for varying site typologies are based on a study of 70 North American hunter-gatherer societies of 14 site types and 84 attributes performed by Newell and Constandse-Westermann (1996:373). This site type and attribute range were further refined regarding potential stone tool assemblage representation by Jones (2008). Habitation loci are expected to exhibit a high tool index or wide range and quantity of tool types. Further, habitation loci are also expected contain channel flakes from projectile point production, scrapers used in processing functions, somewhat larger locus area than processing or tool production loci (depending on occupation span length), significant debitage volume, a broader range of reduction flake sizes, and some number of cores (Andrefsky 2005 201:223, Chatters 1987:363-366; Gramly and Funk 1990:14; Kvamme 1988:387-393; Kooyman 2000:129-133; Nelson 1991:78-86; Odell 2003:188-202).

Processing loci are expected to exhibit a low tool index, no channel flakes, high concentrations of scrapers or single-function tools, a small to medium locus area, low debitage amounts from resharpening, small flake sizes, and no cortex coverage on early-stage reduction flakes.

Tool production loci are expected to show evidence of low tool index, multiple stages of reduction, cores, bifaces, and multiple sizes of reduction and sharpening flakes; in addition to a medium to small locus area (Newell and Constandse-Westermann 1996:373; Gramly and Funk 1990; Jones 2008). Also, byproducts of production are anticipated such as hammerstones, channel flakes, large quantities of debitage, and a small number of cores.

Generally, at both large and small eastern Paleoamerican sites, it is observed that the relative elevation of the sites is greater when compared to the surrounding terrain. Relative elevation in conjunction with a treeless tundra-like environment suggests a site function of an elevated lookout and/or camp for game hunting (Gramly 1982, 1984: Gramly and Funk 1990; Curran 1987).

1.8.2.4 Technological organization

The hypothesized technological organization of the Potter Site Paleoamerican inhabitants was based on selection and application of strategies for decisions concerning material sourcing, production sequence events, tool formality, tool use, resharpening, reuse, curation, material movement through the site, and discard. Assemblage analysis of early and middle Paleoamerican sites of the Northeast and the Northern Great lakes (Deller and Ellis 1992:87–92; Ellis 2008) observe that fluted point sites not connected with quarries typically produce assemblages containing broken and resharpened tools, small debris from late-stage biface reduction and edge repair of unifaces. These assemblage attributes suggest that early and middle Paleoamerican groups employed a highly segmented reduction sequence, producing standardized tool blanks and biface preforms for specific morphological tool types (Lothrop et al. 2016).

If so, the Potter inhabitant's tool production would be based on a staged tool blank, biface, preform, fluted point, core and flake reduction tradition. Production ratios of tools to debitage and flake size for tools produced from exotic cherts would be expected to be smaller than those produced from local rhyolite material. This circumstance owes to the fact that reduction sequence stages were limited to secondary reduction, thinning, edging and resharpening as primary reduction stages were performed some 300 kilometers distant at the Munsungun quarry site in addition to the desire to preserve limited quantities of a superior flaking material (Curran and Grimes 1989; Spiess et al. 1998). Ratios of tools to debitage and flake sizes for the local rhyolite materials are expected to be somewhat larger because of their readier availability than the exotic Munsungun chert. It would be expected that all stages from preform blank reduction to biface and finished tool production would be present and would include intermediate and later stage reduction sequences. Toolkits found and manufactured at the site should be comprised of bifacial and unifacial technology and composed of both formal and expedient tools. Large site flaked stone assemblages, i.e., Bull Brook, Tenant swamp, Whipple, and Vail have been found to contain both formal and informal or expedient flake tools. Expedient tools were utilized for "as needed" tasks such as cutting, wood shaving and occasional scrapping (Nelson 1991; Spiess and Wilson 1987; Robinson 2009; Goodby 2014; Curran 1984, 1987). Formally curated lithic tools would have been brought into, or produced locally, and then taken away from the site. It is expected that the Potter sites' flaked stone tools would be specifically designed and manufactured for transportability, versatility, flexibility, reliability, long use-life, efficiency, and maintainability (Bleed 1986;

Bousman 1994; Kuhn 1989; Kelly and Todd 1988; Bamforth and Becker 2000). In General, informal, or expedient tools would be manufactured, used, and discarded at the site over a relatively short time period.

1.8.3 Alternative Hypotheses

If the null hypothesis is not upheld or rejected, i.e., that the Potter sites archaeological interpretation using Dincauze's (1996) significant large site interpretive taxonomy, is identified as episodic reuse or accumulations of sequential visits, this outcome will necessitate another interpretation. From the taxonomy, the alternatives available would be the seasonal hunting aggregation interpretation, macro band camp interpretation, social aggregation interpretation, or pioneering model (Dincauze 1996; Funk 1973; MacDonald 1971; Witthoft 1952). As previously commented, while useful as a descriptive tool that encompasses most of the large site types, the taxonomy may not be exhaustive, and perhaps Potter could fall into an uncharacterized grouping.

For the alternative hypothesis to be selected or is true, it would be expected that when tested, the specific elements of the Null hypothesis discussed above would not exhibit a majority of the expected outcomes enumerated.

1.9 Analysis methodological synopsis

This investigations research problem and hypothesis will be tested by the application of lithic analysis methods to the Potter site's flaked stone tool and debitage assemblage within a technological organization framework. From this analysis, inferences can be drawn that yield a spectrum of relevant information relating to the cultural settlement pattern, mobility, and adaptive traits of the inhabitants of this prehistoric site. Technological organization, as used in this investigation of Potter's lithic assemblages, is regarded as the use of an organizational framework for structuring lithic analysis. This framework includes aspects of lithic technology such as the selection and integration of strategies for making, using, transporting, and discarding stone tools and the materials used in their manufacture and maintenance (Nelson 1991). Examples of selection and integration strategies are discernible and assessable as seen by variations in projectile point morphology and fluting, curation of formal tools, use of informal or expedient tools, the toolkit typology or system for arranging tools in groups, mobility, and selection of raw materials based on availability and tool function.

Inferences made from the modeled artifact records to resolve the research questions are a function of, or dependent only on the sites stone tool and waste flake artifact assemblages because of the unavailability of analyzable organic materials or features. If non-lithic eco-facts and features were available for analysis further insights into dietary and seasonality might be rendered. If other dating methods such as OSL and carbon dating were available more refined dating of site and locus occupations could be rendered.

In this study quantitative and qualitative, or more specifically formal and informal heuristic lithic analysis methods, are applied to the excavated site flaked stone tool and debitage artifact assemblage. Each locus is individually evaluated to infer behavior traits that comprise the site's overall activities and settlement pattern. Methods including models, which were developed and tested successfully on flaked stone artifact assemblages at other regional and national Paleoamerican sites (Andrefsky 2005; Hall 2004; Hayden 1979; Odell 2003; Surovell 2009), were applied to the archaeological record. These analytical methods identify, measure, quantify and classify traits to test the hypothesized settlement behavior patterns and organization of the site. Results of the analysis are contrasted with the cultural behaviors observed, inferred and documented at previously investigated, dated and verified sites of the same Paleo cultural time horizon in the New England-Maritimes region to compare, contrast, and gauge variability of the findings.

Chapter II

Late Pleistocene to early Holocene environment reconstruction of the New England-Maritimes and New Hampshire

One of the organizing elements of this chapter on Paleoenvironmental contexts of the New England-Maritimes and New Hampshire region revolves around the concepts presented in a paper by Kelly (1983). In it, he quantifies the resources of various environments or biomes and offers generalizations explaining how characteristics of differing environments correlate with hunter-gatherer foraging behavior and the land-use continuum. Kelly (1983) goes on to make use of the notion that there is a distinct hunter-gather foraging behavior as opposed to just random subsistence activities and demonstrates that their mobility is closely related to the structure of food resources in a given environment. In his model, various differing biomes are assessed from a human perspective through the assignment of the variables resource accessibility and resource monitoring. These variables are operationalized by assessing the interaction of effective temperature (ET) (Bailey 1960) and vegetation or primary biomass of an environment (e.g., Odum 1971). By way of example in general terms, increases or decreases in effective temperature raises or lowers the amount of solar energy available to plants, which in turn raises or lowers primary production and in turn increases or decreases the availability of primary biomass to animal species and therefore to foraging humans.

The sections that follow are organized to provide an insight into the broader New England-Maritimes region followed by more local aspects of a postglacial geographic, geological, and vegetational environment of the northern New Hampshire locality. Following this, how the paleoenvironmental reconstruction may be used to characterize the site occupant's lifeways and mobility patterns, is discussed.

The synthetic environmental reconstruction focuses on the late Pleistocene to early Holocene environment and ecology of the New England-Maritimes area. On a regional and site basis, the formation of the ecological environs, as well as human adaptations, were the product of the late Pleistocene early Holocene climatic environment. Geological and vegetation responses viewed from a broader regional basis to the post-glacial environmental variations in New England-Maritimes are presented. Focusing on the more site-specific New Hampshire postglacial geological and vegetation response, inferences derived from research on pond core stratigraphy, sedimentology, and chronology are outlined. With the local post glacial responses in mind, the faunal community composition is then discussed.

2.1 New England-Maritimes regional Paleo climatic environment

The Wisconsinan glaciation episode was the last glacial era of the Pleistocene and completely covered all of New England down to Long Island, New York. Long Island, NY represented the furthest extent of the glaciers' the southeastern margin. Only upon the recession of Laurentide ice sheet (LIS) could the landscape become available for human colonization, and then only habitable after the plant and animal communities became established, and a subsistence base was available. The northward movement of the glacial front began more than 20,000 years ago and moved at varying rates. Using the North American Varve Chronology developed principally from data in the Connecticut River Valley from Glacial Lake Hitchcock, Lake Coos and Lake Colebrook; Ridge et al. (2012) mapped the progression of the Laurentide ice sheet glacial retreat (see Figure 2.1).

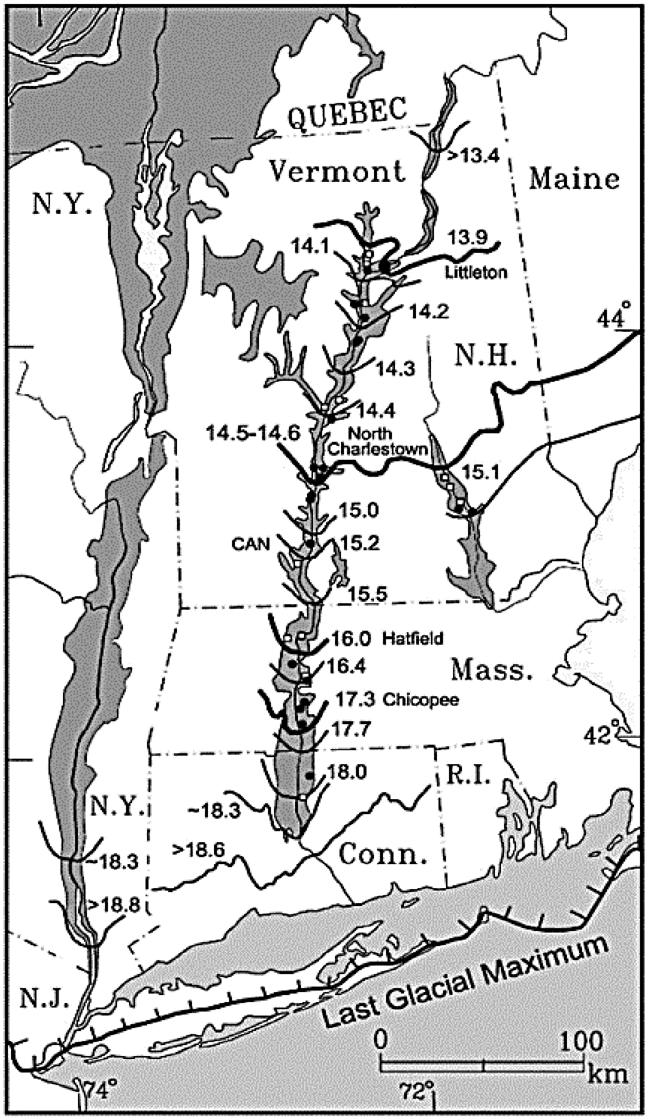


Figure 2.1 Glacial recession map. Adapted from (Ridge et al. 2012. Figure 12:705). Ages in years b2k of approximate reconstructed ice recession positions of the last deglaciation in western New England. The notation "b2k" was introduced together with the GICC05 timescale and mean *years before A.D. 2000 (*Ridge et al. 2012).

As observed from the graphic, it took over 5000 years to expose Connecticut and Massachusetts while the full length of the New Hampshire, nearly twice the distance, took 2000 years to become free of glacial ice. The movement of the ice front was by no means steady, given that re-advances and standstills occurred. The Littleton Re-advance at 13,900 years b2k (before

A.D. 2000. Ridge et al. 2012) marked the last period when the Moose and Israel River valleys were ice covered. After the re-advance terminated, the ice began to recede at a rate of greater than 150 meters per year leaving the rest of the state free of the glacial ice within a few centuries (Ridge et al. 2012: 709). The early post-glacial landscape was dominated by two phenomena, the glacial sediments – principally till and outwash sands - and glacial lakes. Over time the sediments became subsumed under the developing vegetation, and the glacial lakes drained.

During the time horizon when the Potter site was occupied, the climate was significantly colder and drier than in the preceding and subsequent eras. The early and middle Paleoamerican period in the far northeast overlaps closely with the Younger Dryas Chronozone (YDC) that dates to 12,900 to 11,600 cal years before present (cal BP) (Cwynar and Spear 2001).

Temperature variations (warming and cooling) in addition to dates of Paleoamerican activity in the Northeast between 16,000 and 10,000 (cal BP) are presented in Figure 2.2 (Adapted from Thompson et al. 2013). Records of these temperature variations episodes were resultant of Greenland ice sheet coring studies. The late Paleoamerican period followed the YDC cooling episode and extended to 10,800 cal BP (Bradley et al. 2008:120).

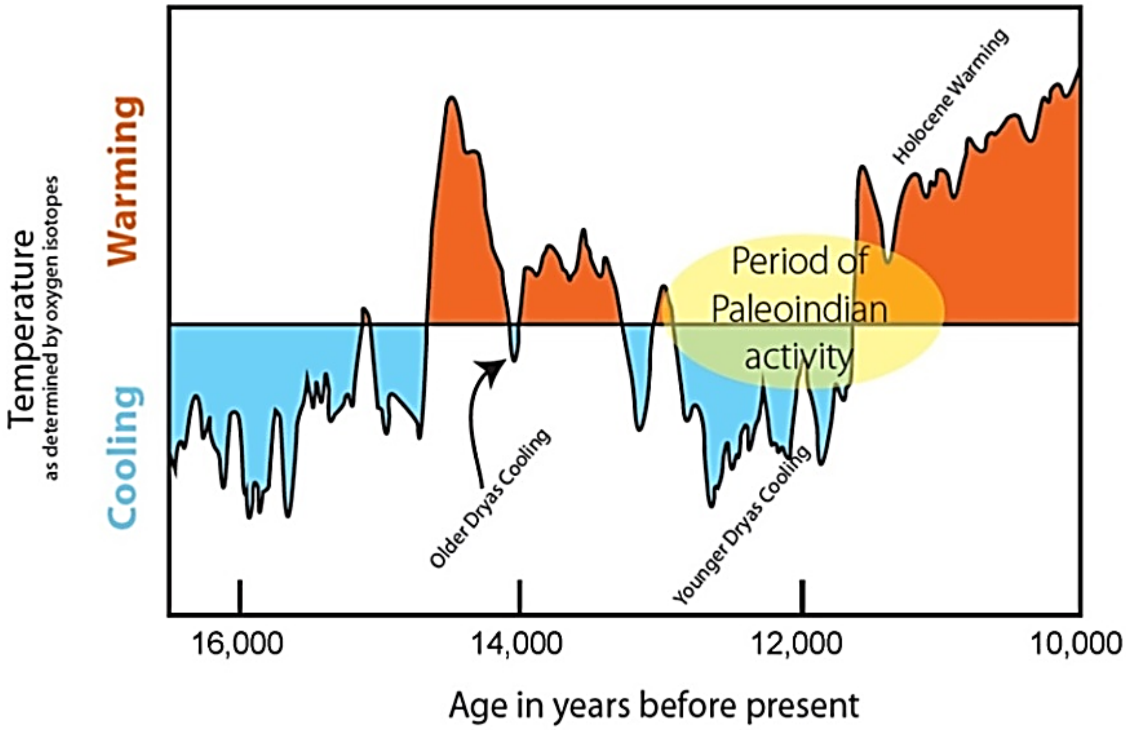


Figure 2.2 Temperature record (cal BP) (Adapted from Thompson et al. 2013:22).

The transition from the earlier climatic regime of the Late Pleistocene/Early Holocene to the YDC was abrupt and severe. The climate became significantly colder and drier with mean annual temperatures dropping 5.5 to 7.7 °C (10 to 14 °F) and occurred within the space of a few decades or less (Alley 2000).

One hypothesis concerning the basis of abrupt oscillations on millennial timescales and as an explanation for the approximately 1200-year YDC cold interval is based on changes in the rate of formation of North Atlantic Deep Water (NADW) and its attendant effect on oceanic heat transport (Clark et al. 2001). Several modeling studies show that the Atlantic thermalhaline circulation (THC) is sensitive to freshwater proportions at the site of deep-water formation. The models have established that a decrease in the formation of deep water due to fluxes of freshwater reduces meridional heat transport thus causing cooling in the higher latitudes. The YDC cold interval represented the best-documented case of such freshwater forcing when continental runoff was rerouted at approximately 13,000 cal BP. The Clark et al. (2001) reconstruction of North American runoff suggests that the freshwater rerouting that was responsible for the Younger Dryas Chronozone was only one of some similar events that occurred over the millennia. As the Laurentide ice sheet (LIS) retreated from the last glacial maximum, new pathways or drainage routes for massive amounts of meltwater were opened. When the southern boundary of the shifting LIS was located between approximately 43° and 49° North, fluctuations of the ice margin triggered episodic increases in the flux of freshwater through these new routes to the North Atlantic.

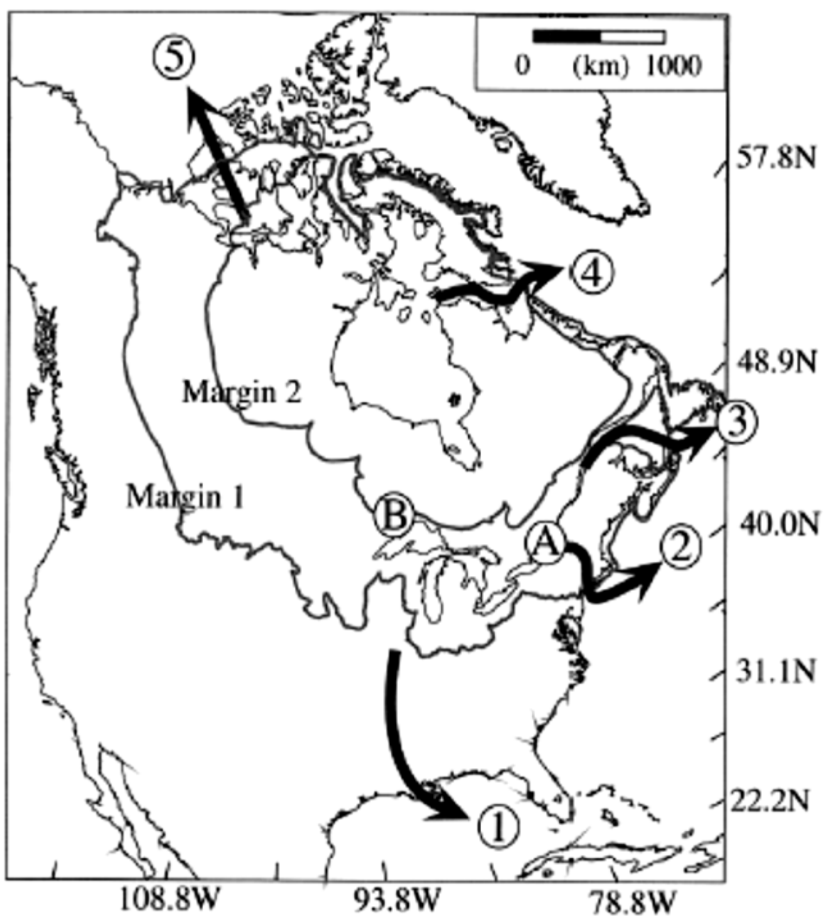


Figure 2.3 North American Continental meltwater runoff routes. Margin (1) of the LIS at 21 cal kyr BP and Margin (2) at 13 cal kyr BP indicating the opening of new routes of Continental runoff. (Adapted from Clark et al. 2001:284)

The newly opened and changing pathways allowed diversion of the meltwater away from the Mississippi River drainage, to the North Atlantic through the Great Lakes into the St. Lawrence River, Hudson River, Arctic Ocean, and Hudson Bay straight (see Figure 2.3 for suggested routes) (Clark et al. 2001; Rayburn et al. 2011). The Clark et al. (2001) modeling studies show that the most important factor in causing changes in the Atlantic THC is the location of freshwater outlet sources.

Increased freshwater flow through northern and eastern outlets such as through the St. Lawrence River, Hudson River, Arctic Ocean, and Hudson Bay straight suppresses THC. Similarly, the diversion of freshwater to the Mississippi drainage favors a more energetic thermalhaline circulation.

As an example of this mechanisms process; the onset of the YDC cold interval at approximately 13.0 cal kyr BP coincided with the diversion of freshwater drainage from the Mississippi River to the St. Lawrence River as the ice margin retreated out of the Lake Superior basin (Clark et al. 2001; Rayburn et al. 2011). Concurrently, Lake Agassiz's abrupt drainage through the St. Lawrence River is suspected of nearly doubling the amount of freshwater flowing through the St. Lawrence River to the North Atlantic. The increased volume of freshwater further added to the suppression of the NADW. In addition to Lake Agassiz's abrupt drainage, other sources of increased freshwater flowing to the North Atlantic during the YDC were icebergs released through the Hudson Strait and the rapid draining of the Baltic Ice Lake. The aggregate of all of the freshwater sources provided a continuing and a significant reduction in NADW formation during the YDC (Clark et al. 2001; Rayburn et al. 2011). Re-advancing of the LIS margin blocked the Eastern outlet of Lake Agassiz at 11.4 cal kyr BP causing an abrupt decrease in the amount of freshwater flux through the St. Lawrence River by rerouting drainage through other outlets thus marking the end of the Younger Dryas Chronozone (Clark et al. 2001).

2.2 New England-Maritimes post glacial regional geological and vegetation responses.

Variations in the New England-Maritimes vegetation and geography during the late quaternary period were influenced by changing climate patterns induced by freshwater discharges from the retreating ice sheets, orbitally driven insolation seasonal patterns, and increasing concentrations of carbon dioxide, all occurring with relative rapidity (Newby et al. 2005). The term insolation is the solar radiation that reaches the earth's surface. Orbitally driven insolation is one of the most prominent forcing mechanisms for long-term climate change (Lorenz et al. 2006). The effect of climate changes resulted in ecosystem variability at the regional level and impacted human access to resource procurement. More specifically, regional floral communities underwent significant change regarding composition and proportions (Newby et al. 2005).

To reflect the influence of the changing climate on regional floral communities (Newby et al. 2005) compiled a regional (Eastern New York, Connecticut, Rhode Island, Massachusetts, Vermont, New Hampshire, Maine, and Canadian Maritimes) pollen database from the North American Pollen Database, Brown University Palynology Laboratory, and the Base *Donnẽes Pollinqus et Macrofossiles du Quebec*. For the purposes of their analysis, pollen proportions of spruce, sedge, oak, alder, birch, and pine were selected and mapped by 1000-year intervals ranging from 14,000 to 10,000 cal BP (Figure 2.4). This approach provides a snapshot of environmental states as opposed to suggesting rates of change. The six specific pollen taxa selected are used to illustrate the contrasts between quantities of each and from this to visually demonstrate overall changes in vegetation for the region during the Paleo time horizon in the northeast and the hypothesized occupation time frame of the Potter site.

Spruce woodlands and open tundra-like vegetation characterized the mixed open/forest landscape of the region from deglaciation until the end of the Younger Dryas Chronozone and can be seen in the 14,000 and 13,000 cal BP graphics. Two dominant patterns may be observed from the vegetation graphic. The first shows that conditions before 11,600 cal BP indicate that large areas of tundra existed and are represented by high sedge pollen percentages north of the spruce woodlands. The second dominant pattern revealed in the graphic is that conditions after 11,600 cal BP, or the end of the YDC, show little sedge pollen and widespread increase in forest coverage manifested by high birch and pine pollen percentages (Newby et al. 2005).

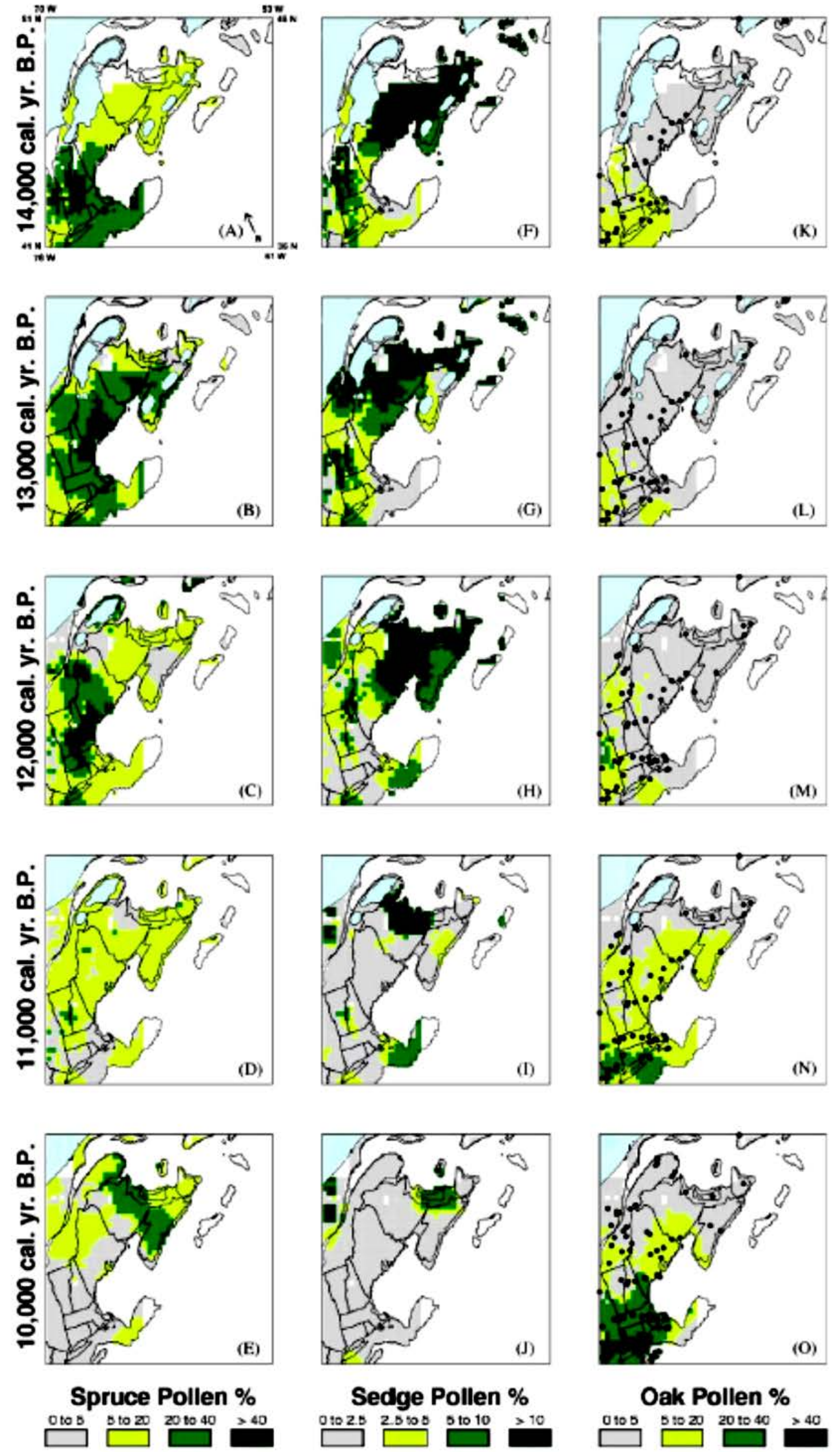


Figure 2.4 Changes in vegetation as indicated by pollen sample composition from 14,000 to 10,000 cal BP. (Adapted from Newby et al. 2005:144.)

Replacement of the widespread spruce woodlands and tundra by mixed pine forests at 11,600 cal BP occurred rapidly, as established by the time series for the sampled pollen sites (Newby et al. 2005). Effects of ecosystem variability at the regional level resulted in impacts to faunal species resources available, and thence those for human predation and resource procurement. Implications for the inhabitants of the Potter site, which is hypothesized to have occurred between 12,900 cal BP and 11,600 cal BP, is that the primary prey species may have shifted from the plentiful large herd barren ground migratory caribou to the smaller herd size less mobile woodland variety.

2.2.1 New Hampshire Postglacial geological and vegetation responses

Located just within the limits of glacial Lake Israel (Bailey's stage, the last of three stages of glacial decline; Thompson et al. 2013) or the spillway that drained the lake southward, Cherry Pond sediment history provides a local view of Paleoclimate variation and impacts on post-glacial geographical and vegetational responses. Cherry Pond, located in the Israel River Valley approximately 20 km to the west of the Potter site, was cored in 1999 to interpret the late glacial environment of immediate Israel and Moose River Valley region of the White Mountains. The present Cherry Pond has been identified as a sub-basin of the floor of ancestral Lake Israel (Dorion 1997, 2002). Lower parts of the cores exhibited varves which were presumably deposited at the ice sheet margin. Even though the number of organic macrofossils found in the varves was limited, analysis of three cores (A, B, and C) from Cherry Pond and other pond cores in the area, allowed for inferences to be made as to when the Valley became ice-free and hence suitable for Paleoamerican occupation (Dorion 2002). See Figure 2.5 for stratigraphic analysis of Core B. No sedimentary evidence was identified in the Cherry Pond record or other nearby ponds that indicate glaciers re-advanced into the Israel Valley as well as other parts of New Hampshire or Maine.

Sieving the three cores, i.e., A, B, and C, yielded 59 mg of plant and insect material which were then radiocarbon dated. The results closely agreed with the core stratigraphy and other late and post-glacial events in New Hampshire and Maine (Thompson et al. 2002; Ridge 2004). These ages suggest that the ice sheet had receded to the Northwest out of the Israel River Valley at or before 11,800 ^{14}C (13,653 ± 50 cal BP). During the next 1000 years, the high silt and clay content of Cherry Pond's bottom sediments were mixed by burrowing organisms. The composition of this section of the core reflects an open landscape with bare ground in places and probably wind-deposited silt and fine sand loess (Dorion et al. 2009).

Calibrated dates for the immediate onset of the Younger Dryas stadial (12,850 cal BP) and its termination (11,650 cal BP) (Meltzer and Holliday 2010) followed by the abrupt onset of the Holocene stratigraphic interval were recognized in the cores. The Younger Dryas Chronozone terminated as abruptly as it began. It is thought that it was during this interval of abrupt climate change that Paleoamericans moved into northern New England and that by 10,800 cal BP the Paleoamerican tradition had vanished in northern New England (Dorion et al. 2009). The early Archaic period in the NEM, with differing lifeways from those in the Paleoamerican horizon, has been defined to have begun at approximately 10,000 cal BP. There has been hypothesis put forward that speculates that there was a population decline in the NEM at the end of the late Paleoamerican horizon and then a reemergence in the early Archaic.

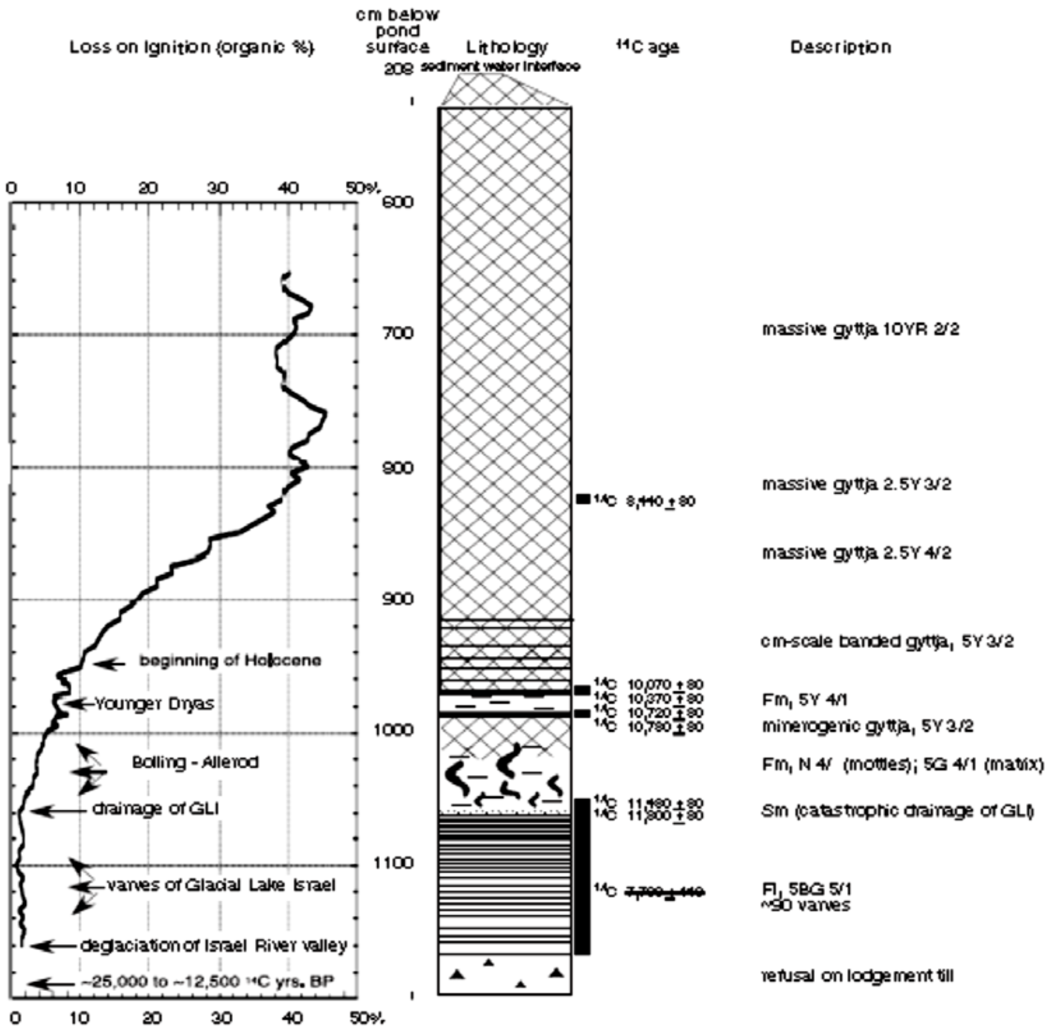


Figure 2.5 Analysis of core B from Cherry Pond in Jefferson New Hampshire. (Adapted from Dorion et al. 2009, Figure 15)

Another geographically nearby example of the results of climatic variation is revealed in the pollen record from Echo Lake near North Conway, NH located approximately 35 km south on the other side of the Presidential Range from the Potter site in Randolph New Hampshire (Shuman et al. 2005). This kettle pond is a body of water with no inlet or outlet and stands at an elevation of 150 meters in the Saco River valley.

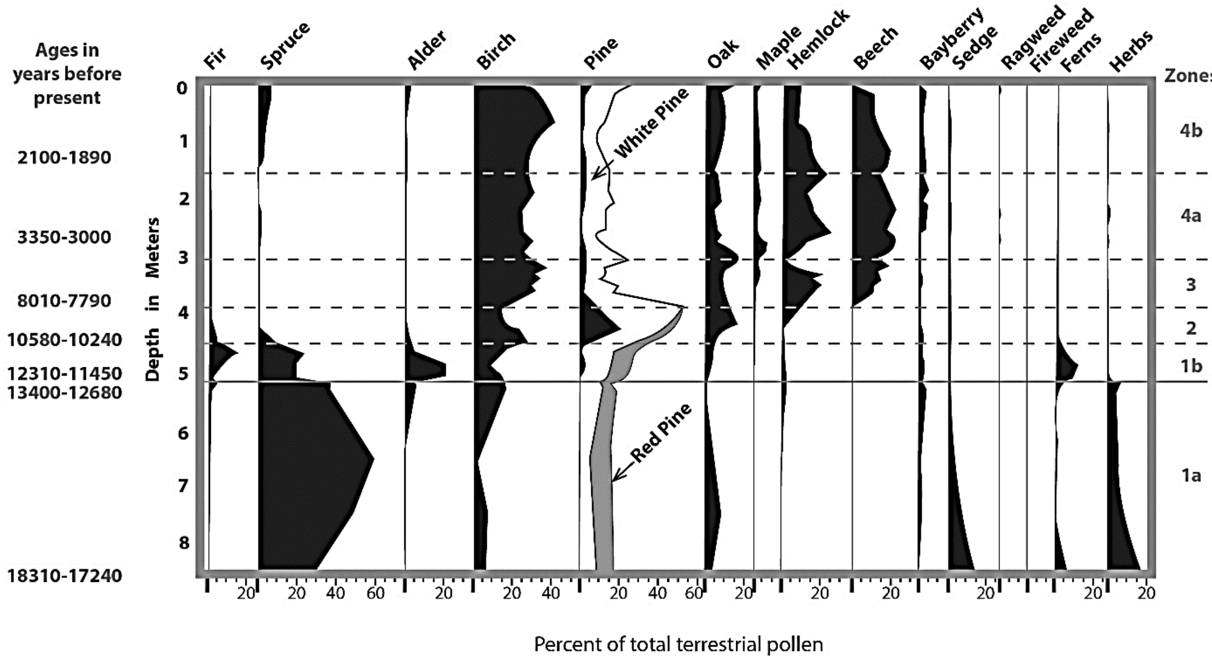


Figure 2.6 Echo Lake, NH core sample pollen percentages (Shuman et al. 2005, Figure 4).

As can be seen in the deepest pollen zone of the coring sample (Figure 2.6), which dates prior to 13,000 cal BP, spruce, birch, and red pine dominate and oak, sedge and herbs make an appearance. There is a pronounced break in the stratigraphy and pollen content between this lowest member (1a) and the gyttja or organic silts of the upper segment (1b) at Echo Lake. In the lower pollen zone spruce predominates with birch, red pine, and oak present, along with sedges and herbs. In the upper zone, dating to 11,900 - 10,700 cal BP, spruce and red pine pollen is still abundant. However, the herbs are much reduced, and alder, fir, and beech increase along with ferns (Shuman et al. 2005:242). Much the same result is noted as that from the Cherry Pond coring which effectively defines the Echo Lake geography as an open terrain and spruce parkland habitat during the cold and dry portion of the YDC, opening the way for the establishment of wide ranges for herd animals (Lothrop et al. 2011). The floral organization during the YDC was different not only from its proceeding and subsequent eras but contemporary conditions, even when compared with much higher latitude environments. Once again, the Echo Lake coring analysis demonstrates that the termination of the YDC was even more abrupt than the initiation with a reversal of temperatures occurring within a decade (Alley 2000). The reversal is recorded in the Echo Lake Pollen Zone 2 with high percentages of pine, the introduction of oak and hemlock and a decline in birch. The termination of the YDC corresponds to the Late Paleoamerican period and the shift to a full forested environment in the succeeding Archaic period.

2.2.2 New Hampshire Postglacial faunal community composition

Changes in the floral populations set the stage for the composition of the faunal communities. Evidence for late Pleistocene fauna of New England is elusive to the point of being ephemeral. Proboscideans in the region have been documented with a mammoth from Scarborough, Maine (Hoyle et al. 2004), a mastodon from Mt. Holly, Vermont (Leidy 1885, Hartnagel and Bishop 1922) but there have been no associations between these animals and humans. Caribou is the best-represented species with their bones having been identified at the Whipple site in Swanzey, NH (Spiess et al. 1984), the Bull Brook site in Ipswich, MA (Spiess et al. 1984), the Tenant Swamp site in Keene, NH (Goodby et al. 2014), the Vail site near Aziscohos Lake, ME (Gramly 1982), and at the Neal Garrison site in Eliot, ME (Spiess 2000). Cervidae protein, judged to be most likely caribou rather than elk, deer or moose, was found on a heavily worn flake from the Jefferson IV site in nearby Jefferson, NH (Boisvert and Puseman 2002).

Similarly, Cervidae protein is reported on five lithic artifacts (a point, a side scraper, an end scraper, and two bifaces) at the late Paleoamerican Rimouski site on the Gaspe Peninsula, Quebec, Canada (Newman 1994). Immunological analysis has also identified black bear at the Jefferson VI site (Boisvert and Mulligan 2014), located within 200 meters of the Jefferson IV site.

Wetlands associated animals have been reported including beaver at the Whipple site (Spiess et al. 1984) and otter at Tenant Swamp (Goodby et al. 2014).

Although the body of data is small and potentially biased towards larger animals due to preservation conditions, the weight of evidence points to a strong presence of caribou in the environment, allowing caribou to be the focus of subsistence for the Paleoamerican inhabitants of the region. Ellis (2011) argues in favor of this proposition based upon his interpretation of broad regional patterns of band movement. Others have also interpreted sites in the nearby Israel River Complex (Benney Basque 2010; Boisvert 2012) as having explicit caribou hunting focus based upon the composition of lithic assemblages and landscape positioning. Likewise, Robinson (2012) offers the proposition that communal caribou hunts were the reason why the Bull Brook site became an aggregation point where bands gathered. The data, faunal remains (osseous and protein) and human settlement patterns, strongly infer the presence and importance of caribou herds on the landscape during the YDC. We may also infer the presence of associated species, including predators such as wolves.

2.3 Chapter summary

As offered in the introduction, one of the organizing elements of this chapter on modern and Paleoenvironmental contexts of the region revolves around the concepts presented in a paper by Kelly (1983). Here he quantifies the resources of various environments or biomes and offers generalizations explaining how characteristics of differing environments correlate with hunter-gatherer foraging behavior and land-use continuum. Kelly makes use of the notion that foraging behavior is not just random subsistence activities and demonstrates that Hunter-gatherer mobility is closely related to the structure of food resources in a given environment. In his model, various differing biomes are assessed from a human perspective through the assignment of the variables resource accessibility and resource monitoring. The results of his analysis by biome are presented in Table 2.1.

Table 2.1 Structure of faunal resources (Adapted from Kelley1983:288)

Biome	Herbivore Size	Species Diversity	Primary Habitat	Secondary Biomass Distribution
Temperate grassland	Large	Low	Terrestrial-Burrowing	Gregarious
Tundra	Large	Very Low	Terrestrial	Gregarious/ Dispersed
Woodland/ scrubland	Medium	High	Terrestrial-Burrowing	Dispersed/ Gregarious
Temperate evergreen forest	Medium/ large	Low	Terrestrial	Dispersed
Desert/semi-desert	Small/ medium	Medium	Terrestrial-Burrowing	Dispersed
Swamp/marsh	Small to large	Extremely high	Aquatic and terrestrial	Gregarious/ Dispersed

Applying the Kelly (1983) model to predict the structure of faunal resources that would be supported in the region and site during its occupation horizon, reconstruction of the Paleoenvironment, based on the coring results from the Cherry Pond and Echo Lake geographic studies, indicates that the ecosystem was an open terrain and spruce parkland habitat (Dorion et al. 2009). This ecosystem reconstruction correlates most closely with Kelly's structure of faunal resources biome model predictions for the categories of temperate grasslands and tundra - although not in the sense of classically low temperatures specified in the generally accepted definition of tundra. The model predicts herbivore size to be large with low species diversity, whose primary habitat would be terrestrial and the secondary biomass distribution to be gregarious.

In the same way, the climate reconstructions based on the coring results from the Cherry Pond, the Echo Lake geographic studies, and those by Newby et al. (2005), all characterize the Potter site and its vicinity ecosystem as an open terrain and spruce parkland habitat that opened the way for the establishment of wide ranges for herd animals (Lothrop et al. 2011).

From the extensive literature on Younger Dryas age climate conditions in North America used to analyze the regional and site-specific climate reconstruction, some generalizations may be observed (Denniston et al. 2001; Peteet 2000; Yu and Eicher 1998). To begin with, there was cooling across northeastern North America during this period although less than indicated from the Greenland cores. Estimates of annual temperatures during the YDC based on data from a variety of proxies (e.g., chromoids, pollen, oxygen isotopes) indicate that mean annual temperatures were no more than approximately 5° cooler than at present, and often in the order of just 3 to 4° C cooler (Denniston et al. 2001; Meltzer and Holliday 2010; Peteet 2000). The effect of this climactic environment on the site's ecological structure corroborates that the ecosystem was an open terrain as well as a spruce parkland habitat conducive to the establishment of wide-ranging groups of herd animals such as caribou (Lothrop et al. 2011).

Similarly, in Newby's et al. (2005) research, evidence for Paleoenvironmental change was linked with the archaeological record to explore the possible impact that climate change may have had on forager resource use. These data indicate that human resource use in the New England and Canadian Maritimes (NEM) may have been profoundly altered by rapid environmental changes, associated with abrupt changes in climatic patterns. By 13,000 cal BP, spruce populations had extended into Maine, New Brunswick, and Nova Scotia, but by 12,000 cal BP, spruce abundance had declined throughout the same area. Concurrent with the onset of the Younger Dryas Chronozone, a change to cooler than previous conditions, caused spruce populations to shift southwards and expanded the extent of open tundra types such as sedge, willow, grass, and sage pollen in proportions. Along the southwestern edge of the Gulf of Maine and in New Hampshire and Massachusetts, abundant spruce populations increased even further. The spruce Woodlands and open tundra-like vegetation remained regionally important and are representative of an environment that is similar to long-range migratory and local caribou herd habitats found in northern regions today (Newby at al. 2005).

As was illustrated in this chapter on Paleoenvironmental reconstruction, several factors enter into the behavioral pattern choices available to hunter-gathers. Each of these choices can have a significant influence on their lifeways regarding the selection of prey species, hunting methodologies, and mobility. These same behavioral pattern alternative selections may have then had a follow-on effect to the choices made by Paleoamericans in their selection of a site location, its geographic positioning, function, and organization. Chapter III introduces the Potter site's archaeological context that portrays the sites regional, geographic, and geological setting in addition to discussing the sites excavated flaked stone artifact assemblage and its horizontal and vertical spatial distributions.

Chapter III

Potter site archaeological context

3.1 Potter site background and excavation history

The Potter Site (27-CO-60), named in honor of the landowner was identified in 2003 by the New Hampshire (NH) State Conservation and Rescue Archaeology Program (SCRAP) summer field school in Randolph, NH. During a walkover of the physical property to assess the presence of cultural resources, a retouched stone tool flake was found on the surface of a site foot trail through a second growth pine-fir-poplar forest (Boisvert et al. 2018). Prior experience with the cluster of Paleoamerican sites in Jefferson, NH, (Boisvert 2012) located less than 20 km west on the same east-west regional Route strongly suggested that a Paleoamerican site might be present. To confirm the initial suspicion of a Paleoamerican cultural presence, several transects of shovel test pits along the foot trails revealed a broad distribution of both local rhyolite and Munsungun chert debitage and eventually a readily identifiable channel flake fragment made from red Munsungun chert. Summer field schools were held in 2004, 2008 and 2009 in addition to annual four-day survey and excavation efforts by SCRAP volunteers in each October from 2003 through 2011 (Boisvert et al. 2018).

Through the excavation histories entirety, 799 half meter square shovel test pits (STPs) were dug in and near the site in addition to 93 square meters of one-meter-square test pits and small block excavations producing over 15,900 specimens of flaked stone tools and debitage. Throughout the eight years of investigations, all of the flaked stone diagnostic artifacts recovered was recognized as Paleoamerican, and no evidence of any later occupation horizon was found.

The Potter site thus represents a substantive multi-component Paleo-horizon site with the potential to reveal significant information on the period.

3.2 Potter site region, geographic, and geological context

Within the Moose River valley, the Potter site resides on the lower northeastern slope of the Presidential Range of New Hampshire's White Mountains. Figure 3.1 illustrates a graphic of northern New England with the region under study indicated by a call out rectangle located in the northerly portion of the state of New Hampshire. Also delineated in the graphic are the relevant major and minor watercourses that over the years may have provided access to the Moose and Israel River portions of the Valley.

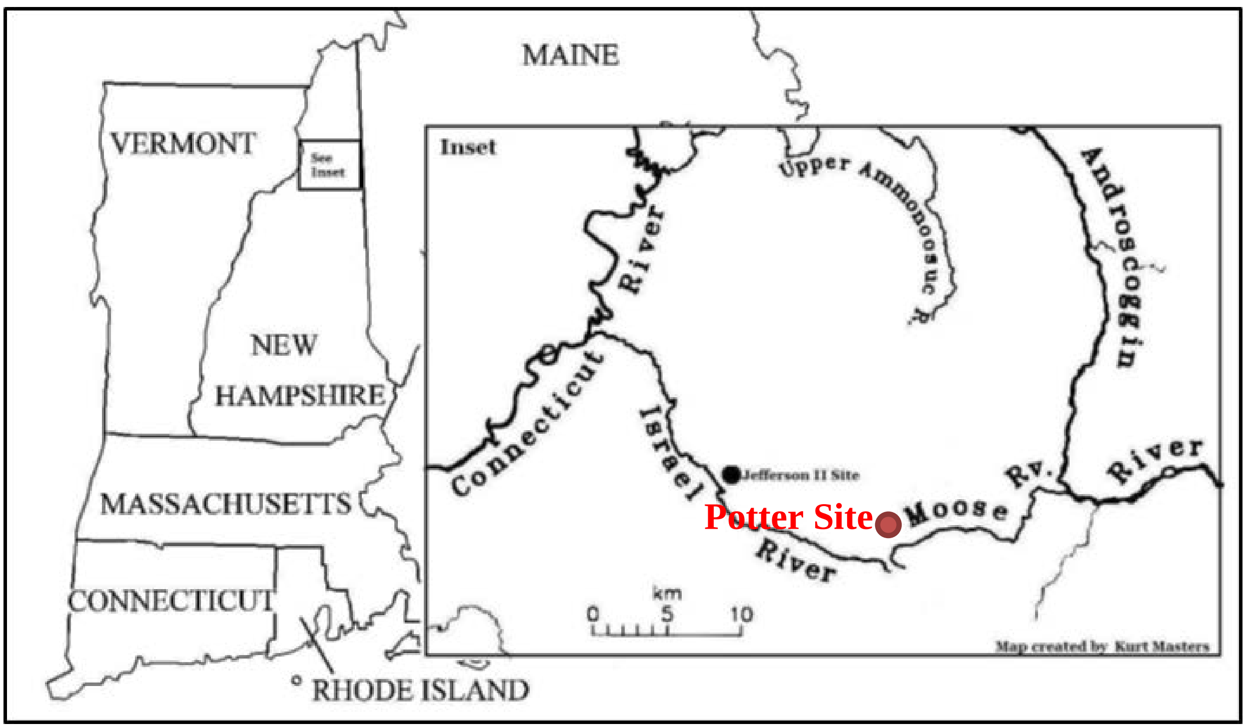


Figure 3.1 Northern New England and region under study (Masters 2012 unpublished)

Figure 3.2 provides an eastward-looking simulated aerial view of the call out rectangle area. Shown are the Israel and Moose River valleys from an elevated perspective that presents a sense of positioning of the Potter and Israel River Paleoamerican sites, waterways and significant geographic elevations. Representing the northernmost extension of the Presidential Range, sitting 2.8 km to the east, is Pine Mt. (Elevation 734 m / 2410 ft.). Mt. Madison (Elevation 1635 m / 5367 ft.) stands 5 km southwest of the site (Boisvert et al. 2018). The Crescent Range ascends to an elevation of just under 1000 meters or 3200 feet some 5 km north of the site. The north/south trending crest of the Presidential range with its Alpine Zone represents substantial barriers to easy travel while the lesser Crescent and nearby Pliny range present less daunting but still formidable mobility restrictions (Boisvert et al. 2018).

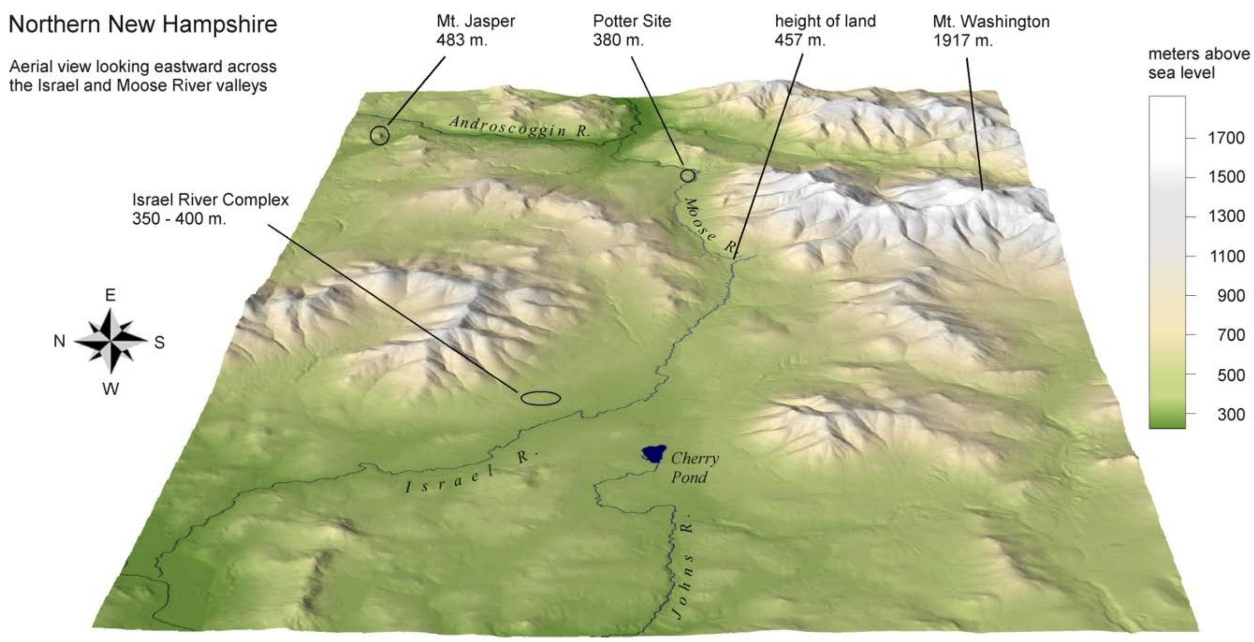


Figure 3.2 Eastward looking simulated aerial view of the Potter site relative location, Moose River valley, nearby mountains, and elevations. A few kilometers of watershed land is present between the Moose and Israel rivers. East-West distance is 24 km (15 miles). (From Boisvert et al. 2018:153, Greenly 2015)

While the White Mountains are not as towering, when judged by North American standards, they are nevertheless rugged, along with steep slopes and abundant fields of rock shattered by cryoturbation and colluviation (Boisvert et al. 2018). Colluvium or unconsolidated sediments are typically composed of a range of heterogeneous rock types and sediments extending from silt to rock fragments of various sizes deposited at the base of hillslopes by rain-wash, sheet-wash, slow continuous downslope creep, glacial sedimentation a or combination of these processes (Neuendorf 2005). Perhaps the best known nearby field is at the base of Cannon Mountain in Franconia Notch where angular boulders of all sizes create a kilometer-long talus slope which includes the remains of the Old Man of the Mountain profile that collapsed on May 3rd, 2003. These factors, plus the increasingly harsh weather conditions as the elevation increases served to encourage foot traffic to the lower and more level elevations (Boisvert 1999, 2012, 2013).

Winding through these ranges at the lower elevations are the Israel and Moose rivers which provide an east/west corridor connecting the Connecticut and Androscoggin Rivers that empty into Long Island Sound and the Gulf of Maine (Boisvert et al. 2018). The Potter sites elevation is 380 plus meters which are equivalent to sites within the Israel River Complex in the town of Jefferson New Hampshire. The Israel and Moose Rivers, with a watershed of only a few kilometers, provides an attractive passage corridor through the region reflecting significant historical and contemporary use (Boisvert et al. 2018). In 1967 Price (1958) documented the presence of a Contact Period Native American trail designated the Waumbek that followed the complete length of the Israel and Moose Rivers. Over time the New Hampshire highway system expanded to the North Country, and the Waumbek trail route from Lancaster to Gorham became US Route 2. Additionally, major utility corridors were constructed including a major electric power transmission line and oil pipeline (Boisvert et al. 2018). This natural travel corridor was established in the late Pleistocene and has been in use since that time (Boisvert 1999, 2012, 2013).

Figure 3.3 presents the above-described details in a present-day USGS topographic view of the Moose River valley, the town of Randolph, US route 2 (Waumbek trail), Nearby mountains, elevations, and the Potter site relative location.

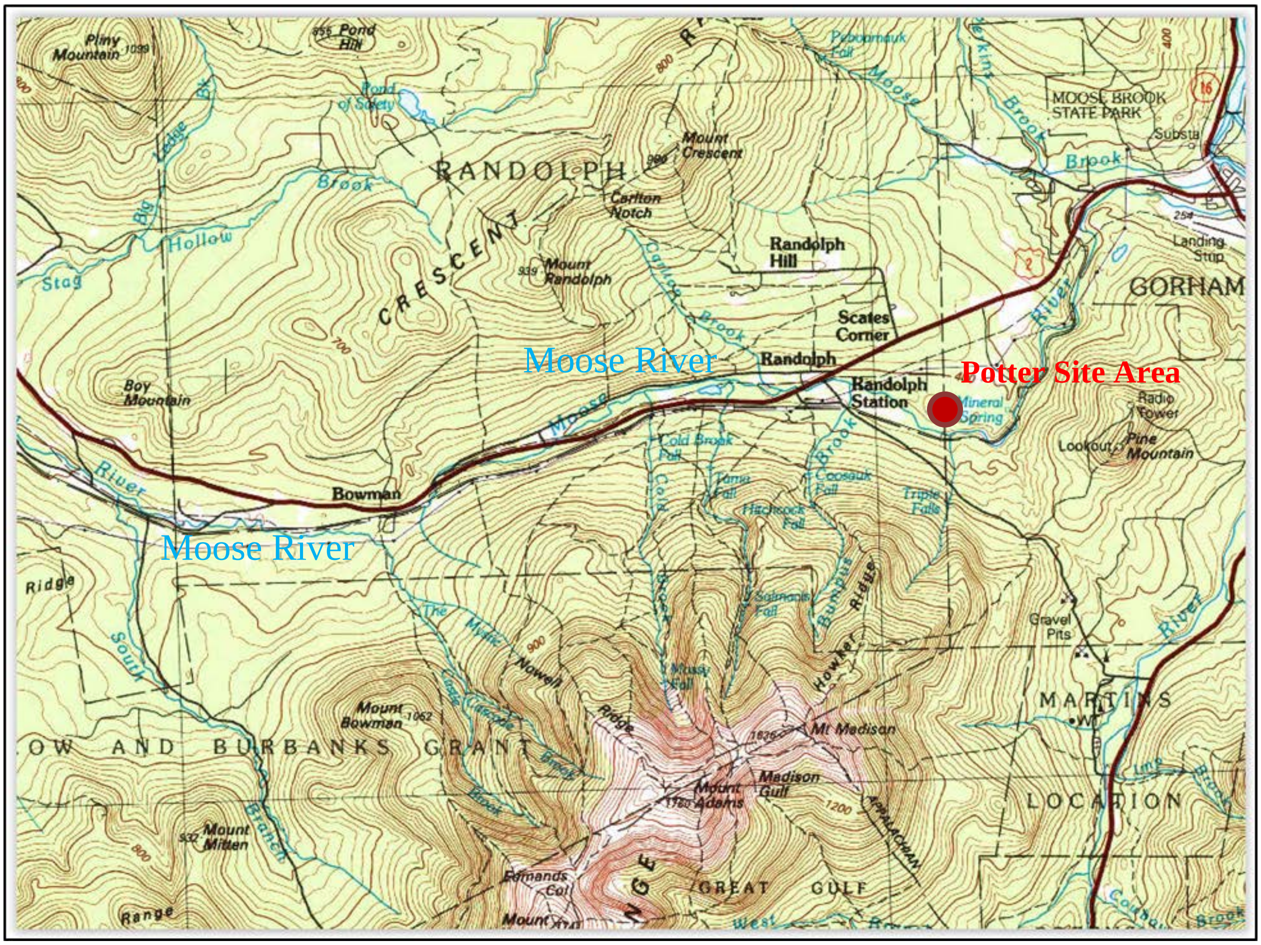


Figure 3.3 Topographic view of the Moose River valley, town of Randolph, nearby mountains, elevations, and Potter site relative location. (USGS NH Mount Washington 330409, 1986, 1:100000 scale, 30 X 60-minutes quadrangle.) East-West scale distance of map is 14.89km (9.25 miles).

3.2.1 Potter site geographic terrain

Geographically the Potter site occupies a low but steeply sloped rise overlooking a broad, shallow basin to the east (Figures 3.4, 3.5, 3.6, and 3.7). The Google Earth rendering as shown in Figure 3.4 provides a plan view of the Potter site setting and positioning relative to the nearby present-day access road, gravel pit, and beaver pond. The red polygon surrounding the gravel pit and bisecting a portion of the beaver pond delineates the extent of the site boundary.

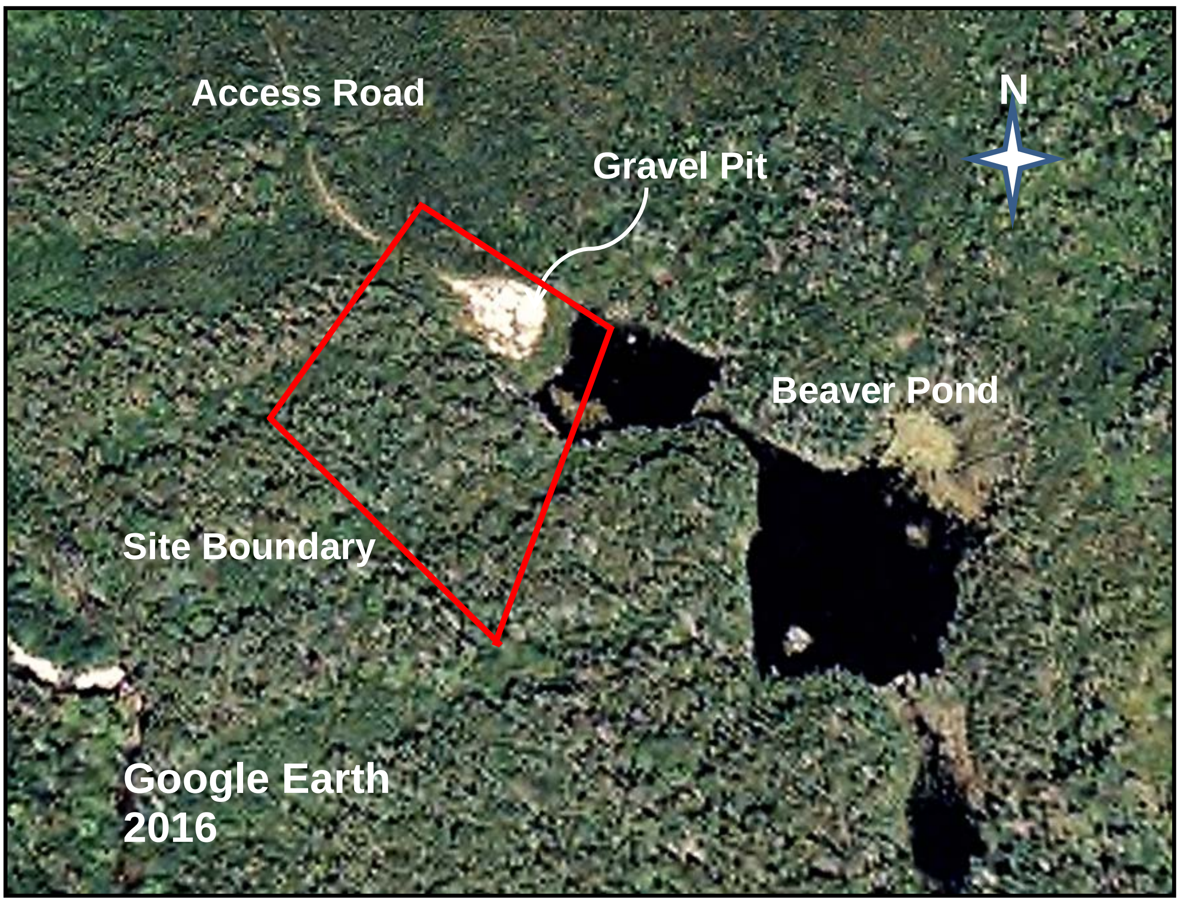


Figure 3.4 Potter site geographic setting and positioning relative to the nearby present-day access road, gravel pit, and beaver pond. The red polygon demarcates the excavated extent of the site boundary. (Greenly 2017).

Providing an elevation view pictorial representation, Figure 3.5 is a photograph taken from the rise of the site eastward towards the remnants of the gravel pit in the lower left and present-day beaver pond in the center-right. The excavation crew camping area is indicated in the foreground of the remnant gravel pit.

Figure 3.6 is a plan contour plot that displays floor and hillside contours of the Moose River Valley to the East of the Israel River Valley in addition to the location of the Potter site. The figure West to East view range is six km and its South to North, two km.

Figure 3.5 Potter setting viewed from the west of the site facing eastward and it's positioning relative to nearby gravel pit remnant in the foreground left and a beaver pond in the mid right. (Rusch 2010,)

A well-defined esker delineates the southern edge of the site. The northern side is marked by a small seasonal stream and hydric soils while the western side gently slopes down to similar soils. The bulk of the site area can be characterized as nearly level with gently rolling margins. At the time of the investigations, the site was covered by a second growth forest that varied from very dense thickets of firs to more open expanses of mixed deciduous trees including birch, poplar, and maple as well as mature pines (Boisvert 2012).

There has been no history of agriculture at the site, but logging is evident from the presence of sawn tree stumps and regular patterns of differential tree regrowth observable from historical aerial photographs. Soil disturbance is limited to woodland bioturbation (rodent burrows, tree falls, and root disturbance) and cryoturbation. The north edge of the site was impacted by a late 20th-century access road to a sand pit which had removed and disturbed an unknown portion of the site (Boisvert 2012, 2013).

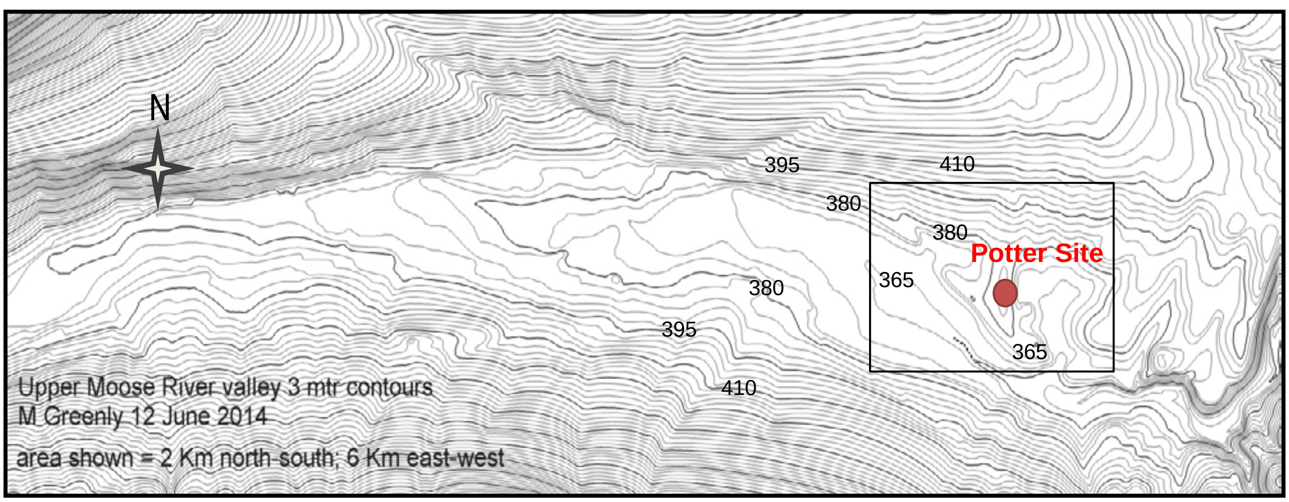


Figure 3.6. Plan contour plot displaying floor and hillside contours of the Moose River Valley to the East of the Israel River Valley in addition to the location of the Potter site. The figure West to East view range is six km and its South to North, two km. (Greenly 2014, unpublished).

Figure 3.7 is also a plan contour plot that focuses in on the eastern portion of the previous Figure 3.6 and shows the positioning of the Potter site within the Randolph portion of the Moose River Valley. The glacial moraine on which the site resides is seen by following the 380 m elevation contour and is indicated by the shaded oval. As can be observed from both Figures 3.6 and 3.7, the relatively even Valley surface, at an elevation of approximately 365 m, rises on its northern and southern borders through the central portion of the Moose River Valley.

The significance of this observation is that this location potentially served as a geographic narrowing or constriction for observing and controlling caribou herd movements past a somewhat elevated site location as an aid to the hunt. One of the mainstays of the Paleoamerican economy in the New England and Maritimes region was based on caribou (Curran & Grimes 1989; Spiess 1979). It is not unusual to find sites using similar natural geophysical characteristics thus demonstrating that the Paleoamericans of the Northeast were adept at selecting and using geographically strategic places to establish camps from which to intercept game animals. An example of the use of the natural terrain by the Paleoamerican inhabitants of the region is demonstrated by the Vail encampment, located in the state of Maine, and includes its nearby kill and butchery sites strategically positioned in the narrows of the Magalloway River Valley (Gramly 1982). The narrows are composed of projecting rocky hills that create an S-bend where migrating animals would have been constricted and concentrated creating limited mobility within this stretch of the valley and thus becoming game targets (Gramly 1982).

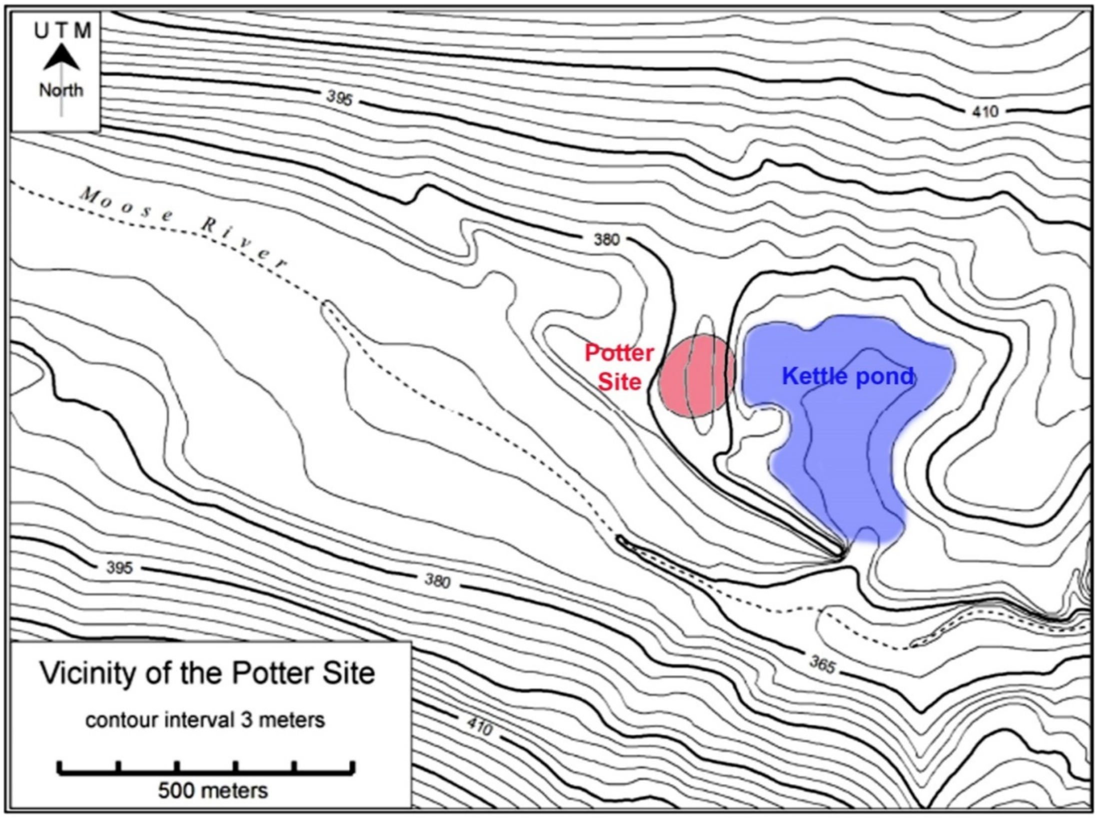


Figure 3.7. Plan contour plot that focuses in on the eastern portion of the previous Figure 3.6 and shows the positioning of the Potter site within the Randolph portion of the Moose River Valley. (Greenly 2014, unpublished).

The Whipple site, in southwestern New Hampshire, is similar to the Vail site in that it is also positioned at a Valley narrows thus providing another example of site establishment in a geographically strategic place (Curran 1987).

The Potter site is a further example of Paleoamericans selecting and using geographically strategic places to establish camps from which to monitor and intercept game animals. Figure 3.8 presents the Viewshed, or observable area, of the Moose River Valley as viewed from the Potter site elevation rising above the valley floor. Calculations for the Viewshed are based on the vegetational cover (sedge, spruce, herbs, and ferns), existing during the paleo horizon. From this geographically strategic observation position, it would be possible to ascertain caribou seasonal presence and distances in both a westerly and easterly direction. In Figure 3.8, the Viewshed observation extent is shown by the green shaded area. The site location is designated by the red triangle in the eastern portion of the figure.

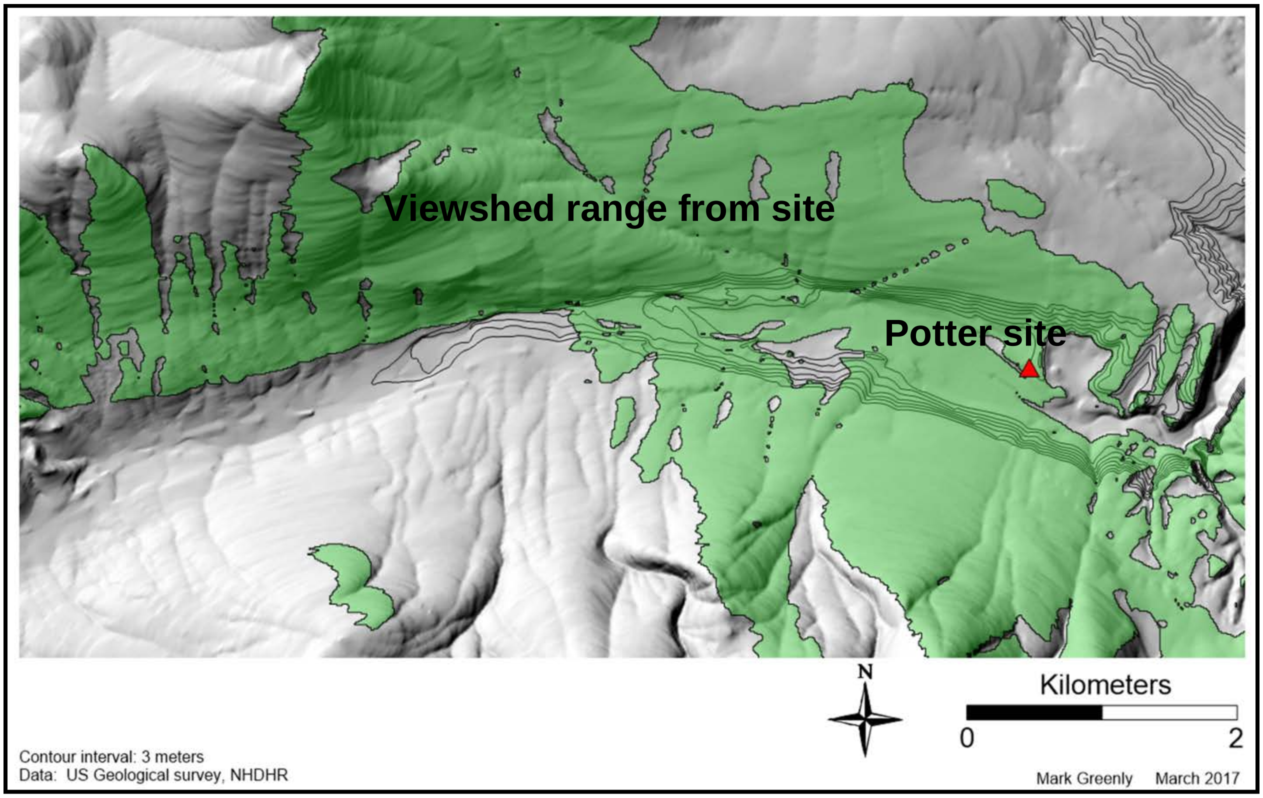


Figure 3.8 Viewshed of the Moose River Valley as viewed from the Potter site elevation above the valley floor revealing potential caribou observations and distances in both a westerly and easterly direction. The observation area is denoted by the green shaded area. The site location is indicated by the red triangle in the eastern portion of the figure. (Greenly 2017, unpublished)

Following the artifact find fashioned from Munsungun chert and the spread of rhyolite tool making material found across the region in addition to the low bluff and landscape setting, suggested that the next level of investigation should be a shovel test pit survey.

3.3 Site sampling strategy

During a walkover of the Potter site's physical property to assess the potential presence of cultural resources, a retouched stone tool flake was found on the surface of a foot trail. After the discovery and identification of the flaked stone tool, the possibility of further cultural finds was suggested. To substantiate the initial suspicion of a Paleoamerican cultural presence, several transects of shovel test pits (STPs) positioned along the foot trail revealed a broad distribution of both local rhyolite and exotic Munsungun chert debitage. Eventually, a readily identifiable channel flake fragment made from red Munsungun chert was found. Following the survey of the foot trail transects and artifact recoveries, a site grid was established as part of a research, survey, and reclamation plan. The grid was based on transects spaced 4 meters apart in a North reference direction.

After the initial grid layout, the field crew dug survey shovel test pits (STPs) every four meters along the transects, making changes or adjustments to the grid northing – easting referencing when necessary. (e.g., if trees were in the way of the test pit location, they were removed where possible depending on size). From experience in surveying and excavating New England and Maritimes Paleoamerican sites, it was held that using a four-meter grid spacing it would be possible to capture a reasonable size site and artifact concentrations (Boisvert personal communication 2010). After each excavation season, the four-meter center to center grid was extended in each direction to determine site boundaries. Site boundary limit was defined by the absence of flaked stone artifacts in two to three consecutive test pits extending from the periphery of the grid transects around the total site. Dimensions of the STP's were 50 by 50 centimeters (Figure 3.9), dug in 10 cm levels, and soil screened using one-quarter inch mesh. The depth of STP excavation ranged from 40 cm to 60 cm or more depending on the presence or absence of artifacts at each level increment. Shovel test pit artifact hotspots (defined loosely as one or more tools, or three to five or greater pieces of debitage) were then expanded to one meter or greater excavation units (Figure 3.10). One-meter excavation blocks and larger were troweled in five-centimeter levels and screened through one-eighth inch mesh. On occasion, a one-meter excavation block was opened in an area that the principal investigator felt would yield a particular bit of information without regard to the number of culturally diagnostic artifacts found during shovel testing.

After the initial grid was completed, permanent reference markers were installed to provide future orientation points for grid expansions. Additionally, supplementary geographic reference points such as a radio tower on a nearby mountain were mapped onto the grid. Grid development and expansion was done with a calibrated total station as opposed to rod and chain surveying methods. As the field seasons years progressed, additional transects for that season's excavations were appended to the original grid layout. With each addition to the initial survey grid, the same numbering convention and spacing were used.

Figure 3.9 50x50 cm survey shovel test pit (Boisvert 2008, unpublished).

Figure 3.10 one m^2 unit excavation (Boisvert 2008, unpublished).

The topographic site survey map, shown in Figure 3.11, represents the excavation history of the site from 2003 to 2011 and illustrates all STPs and concentrated artifact excavation blocks. The STPs are coded as positive finds (red) or negative, i.e., no artifacts identified (black). As indicated by the elevation contours, the site rises above the valley floor by approximately 15 m. True North and Grid North is indicated by TN and GN in the figure.

As also can be seen in Figure 3.11, despite the large number of positive STPs, only eleven major and minor excavation blocks were selected for further exploration. The selection of these excavation opportunities was based on the artifact sampling quantities found at any particular tested location (STP). If a significant number of diagnostic artifacts were identified in a particular test pit, it became a candidate for further examination. A singular tool, such as a simple retouched flake, or low quantity artifact outlier STPs containing few waste flakes were recorded but not further investigated or expanded.

As remarked on above, the Potter site resides on a glacial moraine which follows the 380/381 m elevation contour and is designated by the yellow and tan shaded areas in Figure 3.11. As can be discerned from the Figures 3.6 and 3.7, the relatively uniform Valley surface at an elevation of approximately 365 m, ascends on both its northern and southern borders through the central portion of the Moose River Valley to more than a thousand meters. The esker on which the site is situated rises to more than 15 m from the Valley floor. This lower portion of the Valley floor and Moose River course represents a potential path for caribou migration and where the 15-meter site elevation differential potentially served as an aid in observing and controlling caribou herd movements around the Potter site.

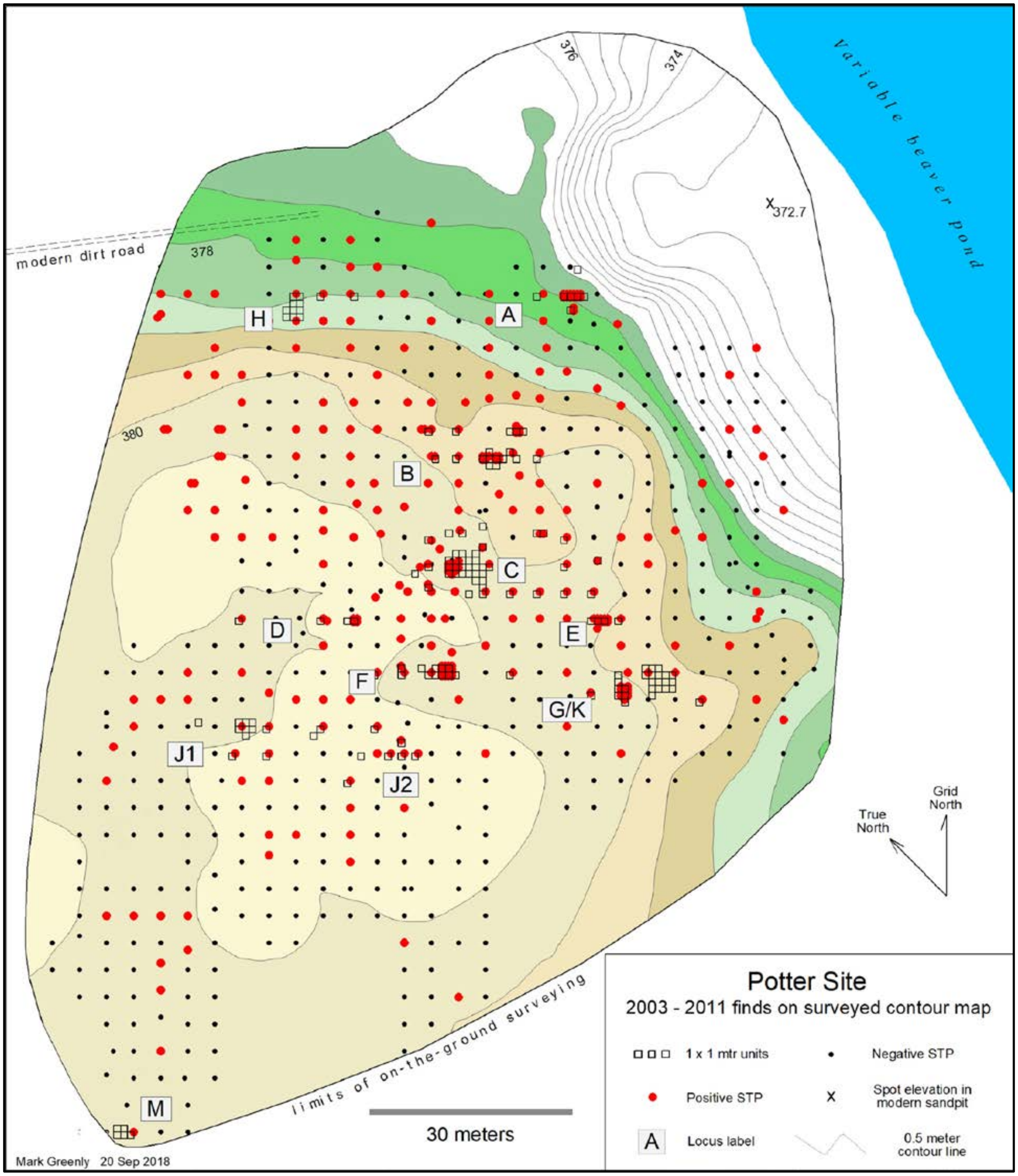


Figure 3.11 Potter site topographic view. The black dots indicate survey test pits and excavated blocks for the 2003 – 2011 field seasons. Remnant sand pit elevations are indicated in the upper center portion of the figure bounded by the dashed silhouette. The site rises above the valley floor by approximately 15 m. TN and GN indicate true North and grid North. (Greenly 2018, unpublished)

3.4 Potter site excavated flaked stone artifact assemblage

Following the 2003 to 2011 seasons of fieldwork, including shovel test pits and unit excavations, 15,912 flaked stone artifacts were identified and cataloged. Table 3.1 summarizes the entire Potter site flaked stone artifact assemblage in terms of specimen type, lithic material variety, and quantities. Spatial groupings were recognized using the coordinate data from the artifact assemblage distribution that indicated potential areas of focused activities. These spatial groupings or concentrations of co-located flaked stone tools and debitage were then defined as loci.

Table 3.2 displays and distributes the total site flaked stone artifact assemblage into the above-defined loci. Additionally, between each of the designated loci, miscellaneous random flakes scattered in low densities, were found throughout the site. These miscellaneous flakes were identified during the site survey and were not apparently part of any locus's sphere of artifact deposition. For recording completeness purposes, these random flakes between loci are identified in the following Tables (3.1, 3.2, and 3.3) as detached scatter and represent the sparse flake scatter across the entire site.

The data expressed in Tables (3.1, 3.2, and 3.3), i.e., flaked stone artifacts by specimen and material type was not the only data collected during the archaeological investigation of the site. Information concerning artifact positioning, weight, cultural horizon, artifact dimensions, and other details were also collected and entered into the assemblage database for analysis purposes. Further details concerning what the collected categories were and other considerations are found in Chapter V.

Table 3.1 is firstly organized by artifact category, i.e., tool types, waste flakes, and unmodified toolmaking raw material. Next, the material type groupings, from which the artifacts were manufactured, are arranged in descending magnitude and level of importance. The rhyolites are grouped first as they comprise approximately three-quarters of the assemblage's tool stone material. The rhyolites are then followed by Munsungun, an exotic chert, that represents 25% of the site's toolmaking lithic material. The remaining approximately 1 ½% of the assemblage is comprised of hornfels, unidentified cherts, quartz and a few pieces of granite. The quantities shown in Table 3.1 are arranged first by the number of artifacts followed in parentheses by their percentage of the total assemblage. The percentages are shown to 3 decimal places, which in itself is meaningless, but helps the totals appear more rational and not as affected by rounding errors.

Table 3.1 Total Potter site flaked stone artifact assemblage count by specimen and material type. The table is organized by material type and numerical magnitude, i.e., rhyolites, Munsungun chert, and secondary materials. Numbers in parentheses are percentages.

Artifact Type	Mt. Jasper Rhyolite	UNSP Rhyolite	Jefferson Rhyolite	Munsungun	Hornfels	Chert	Quartz	Granite	Artifact Total
Biface	34 (.214)	6 (.038)	0 (0)	10 (.063)	1 (.006)	3 (.019)	0 (0)	0 (0)	54 (.339)
Channel Flake	16 (.101)	2 (.013)	0 (0)	19 (.119)	0 (0)	2 (.013)	0 (0)	0 (0)	39 (.245)
Core	5 (.031)	1 (.006)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	6 (.038)
Core Fragment	7 (.044)	7 (.044)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	14(.088)
Hammerstone	0 ((0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	2 (.013)	1 (.006)	3 (.019)
Projectile Point / Knife	10 (.063)	1 (.006)	0 (0)	5 (.031)	0 (0)	0 (0)	0 (0)	0 (0)	16 (.101)
Raw Mtl Un-Mod	2 (.013)	0 (0)	0 (0)	1 (.006)	0 (0)	0 (0)	0 (0)	0 (0)	3 (.019)
Scraper	41 (.258)	8 (.050)	0 (0)	42 (.264)	2 (.013)	4 (.025)	0 (0)	0 (0)	97 (.610)
Uniface	1 (.006)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (.006)
Utilized Waste flake	10 (.063)	1 (.006)	0 (0)	2 (.0130)	0 (0)	0 (0)	0 (0)	0 (0)	13 (.082)
Waste Flake	7641 (48.02)	2567 (16.13)	194 (1.22)	3618 (22.738)	110 (.691)	87 (.547)	34 (.214)	0 (0)	14251 (89.56)
Waste Flake Modified / Retouched	42 (.264)	16 (.101)	2 (.013)	28 (.176)	0 (0)	4 (.025)	1 (.006)	0 (0)	93 (.584)
Wedge / Pièces esquillées	2 (.013)	0 (0)	0 (0)	3 (.019)	0 (0)	1 (.006)	0 (0)	0 (0)	6 (.038)
Detached Scatter	631 (3.966)	343 (2.156)	12 (.075)	318 (1.998)	3 (.019)	5 (.031)	3 (.019)	1 (.006)	1316 (8.270)
Artifact / Material Total	8442 (53.05)	2952 (18.55)	208 (1.31)	4046 (25.43)	116 (.729)	106 (.666)	40 (.251)	2 (.013)	15912 (100)

The main takeaway from Table 3.1 is that the bulk (over 97%) of the tool stone material is comprised of two tool stone varieties, i.e., rhyolites and Munsungun chert. The rhyolites are considered to be local material as they lie within a 20-mile radius of the Potter site. Of the rhyolites, the Mount Jasper variety appears to have been favored over the Jefferson type. The quantities and percentages that are shown in Table 3.1 only indicate the number and percentage of particular types of artifacts made from a particular material type in the total artifact assemblage and are not resident in any particular locus. Meanwhile, the quantities and percentages in Table 3.2 and 3.3 respectively indicate the number of pieces of material type regardless of the artifact type in each locus. Therefore there will be quantity and percentage differences in each of the columns and totals of Tables 3.1 and 3.2. These differences should not be viewed as errors because each table indicates different information even though the total number of artifacts (15,912) tally between both tables.

Table 3.2 Potter site flaked stone tool artifact assemblage by locus, material type, and quantity, i.e., rhyolites, Munsungun chert, and secondary materials.

Material type by Locus	Mt. Jasper Rhyolite	UNSP Rhyolite	Jefferson Rhyolite	Munsungun	Hornfels	UNSP Chert	Quartz	Granite	Locus Material Total
Locus A	134	15	0	27	0	0	5	0	181
Locus B	3727	329	82	75	2	7	7	0	4229
Locus C	1487	135	28	543	3	22	7	1	2226
Locus D	32	3	0	1	1	0	0	0	37
Locus E	411	40	9	1	0	0	0	0	461
Locus F	323	29	6	46	0	3	1	0	408
Locus G	12	1	0	1	0	0	0	0	14
Locus H	105	1914	47	1160	2	8	4	0	3240
Locus J	406	36	7	94	0	7	2	0	552
Locus K	1140	105	17	411	103	41	8	0	1825
Locus M	34	2	0	1369	2	13	3	0	1423
Detached Scatter	631	343	12	318	3	5	3	1	1316
Material type Total	8442	2952	208	4046	116	106	40	2	15912

Table 3.2 also reveals that, while there were eight material types identified in the artifact assemblage, the bulk, as noted earlier, is comprised of mount Jasper rhyolite, unspecified (UNSP) rhyolite, Jefferson rhyolite, and Munsungun chert. The sites flaked stone artifact by locus, material type, and the percentage is shown in Table 3.3. Of interest in tables, 3.2 and 3.3 is that there are differences in the material compositions and unit quantities between loci that may have been caused by locus activity function, occupation span, or intensity of use. Again, as noted for Table 3.1 the percentages in Table 3.3 are shown to 3 decimal places. This helps the totals appear more rational in light of the small tool artifact quantities and large debitage counts. Therefore, at three places the totals will not be as affected by rounding errors.

Table 3.3 Potter site assemblage by material type, by locus, and %.

Material by Locus	Mt. Jasper Rhyolite	UNSP Rhyolite	Jefferson Rhyolite	Munsungun	Hornfels	UNSP Chert	Quartz	Granite	Locus Material Total
Locus A	0.842%	0.094%	0.000%	0.170%	0.000%	0.000%	0.031%	0.000%	1.138%
Locus B	23.423%	2.068%	0.515%	0.471%	0.013%	0.044%	0.044%	0.000%	26.577%
Locus C	9.345%	0.848%	0.176%	3.413%	0.019%	0.138%	0.044%	0.006%	13.989%
Locus D	0.201%	0.019%	0.000%	0.006%	0.006%	0.000%	0.000%	0.000%	0.233%
Locus E	2.583%	0.251%	0.057%	0.006%	0.000%	0.000%	0.000%	0.000%	2.897%
Locus F	2.030%	0.182%	0.038%	0.289%	0.000%	0.019%	0.006%	0.000%	2.564%
Locus G	0.075%	0.006%	0.000%	0.006%	0.000%	0.000%	0.000%	0.000%	0.088%
Locus H	0.660%	12.029%	0.295%	7.290%	0.013%	0.050%	0.025%	0.000%	20.362%
Locus J	2.552%	0.226%	0.044%	0.591%	0.000%	0.044%	0.013%	0.000%	3.469%
Locus K	7.164%	0.660%	0.107%	2.583%	0.647%	0.258%	0.050%	0.000%	11.469%
Locus M	0.214%	0.013%	0.000%	8.604%	0.013%	0.082%	0.019%	0.000%	8.943%
Detached Scatter	3.966%	2.156%	0.075%	1.998%	0.019%	0.031%	0.019%	0.006%	8.270%
Material Type Total	53.054%	18.552%	1.307%	25.427%	0.729%	0.666%	0.251%	0.013%	100.000%

While the artifact total appears to be significant in total quantity for a New England-Maritimes Paleoamerican site, the assemblage is distributed between 11 artifact concentrations or loci over an area of two hectors. This organization by locus and material type of the artifact assemblage will prove useful in identifying cultural occupation horizons, material deposition patterns, domestic activities, and technology.

3.4.1 Site excavation block and locus relationship characterization

Potter (27 CO 60) as excavated, yielded eleven identifiable geographically separated artifact concentrations within the overall site. During field excavations, the flaked stone artifact concentrations were identified and labeled as blocks. This particular nomenclature developed as part of the site survey and exploration process. Over the various field seasons, as described, the site was surveyed by shovel test pits (50cm x 50cm) spaced on four-meter transects. In areas where test pits produced significant concentrations of artifacts (greater than five flakes or one or more tools in addition to four flakes), the area around the "hotspots" was expanded into a one-meter by one-meter quad blocks for further exploration. See Table 3.4 for block designations and flaked stone artifact concentration totals. Also indicated in the table are diagnostic artifacts if extant.

Geographically each of the blocks was separated by a distance of 7 to 60 m. Adjacent to the blocks within 3 to 4 meters was random lithic scatters composed mostly of debitage, and the very occasional tool find such as a retouched flake, scraper, or projectile point/knife fragment. As part of the overall assemblage, these scatters are designated as unattached scatters.

After completing the excavation, the author chose for analytical purposes, to include artifacts of the nearby scatters with the block assemblage and to classify the combination as a locus. The combination of artifacts from both distributions (blocks and nearby scatters) into "toss, drop zone" (Binford 1978:339) loci is an assumption on connectedness. However, to date, no artifact refits between the block and nearby scatter artifacts have been identified. In two cases smaller concentrations near enough to a larger density neighboring locus have been combined to form a single cluster or locus as in the case of blocks G/K and C/E. Similarly, in one case because of field defined center distances of artifact cluster concentrations, locus J has been combined into one individual locus for analysis purposes yielding an overall locus count of ten. Discussion of this locus and analysis is found in Chapter (IV). Positioning and distribution of loci and included blocks are shown below in the graphic (Figure 3.13), Potter site shovel test pits (STPs), excavation blocks, and defined loci.

Table 3.4 Assemblage artifact concentration quantities as distributed by block excavation unit.

Concentration field label	Artifact total in block	Excavated diagnostic artifact type
Block A	183	3 Channel flakes.
Block B	4234	6 Channel flakes.
Block C	2238	1 Michaud-Neponset and 2 fluted unidentified projectile points. 13 channel flakes.
Block D	40	1 Fluted point, unidentified.
Block E	461	No Diagnostic.
Block F	411	1 Fluted point unidentified, and 1 channel flake.
Block G	15	No Diagnostic
Block H	3254	2 Michaud points, and 3 channel flakes.
Block J	554	1 Fluted point untyped, and 3 channel flakes.
Block K	1874	2 Bull Brook, 2 Michaud, 1 fluted unidentified, and 3 untyped points. 6 channel flakes
Block M	1424	4 Channel flakes.

3.5 Spatial distribution of flaked stone artifact assemblage

As noted, when test pits yielded anthropogenic flaked stone artifacts, larger one-meter excavation blocks were opened up around the STPs and troweled in five cm levels. Soil from the excavation was then screened through one-eighth inch mesh to identify artifact finds (Figure 3.12).

Figure 3.12 Linda Fuerderer field screening of excavation soil through one-eighth inch mesh (Rusch 2008)

Figure 3.13, the site survey map, shown below represents the excavation history of the site from 2003 to 2011 and illustrates all STPs and concentrated artifact blocks coded by positive (black squares) finds or negative, i.e., no artifacts identified (gray squares).

As also can be seen in Figure 3.13, despite the large number of positive STPs, only eleven major and minor excavation blocks were selected for further exploration. The selection of these excavation opportunities is based on the artifact sampling quantities found (as characterized above) at any particular tested location (STP). If large numbers of flaked stone artifacts were discovered in a particular test pit, it became a candidate for further examination. Singular or low quantity artifact outliers containing few waste flakes were recorded but not further investigated. However, due to multiple other factors such as an interesting tool find, geographic terrain discontinuities, and a desire to sample a wide variety of areas some of the excavation choices made were based on non-numeric reasoning. The red oval shapes around the excavated blocks seen in Figure 3.13 represent the highest artifact concentration blocks, and near neighbor finds that were subsequently grouped and labeled as loci.

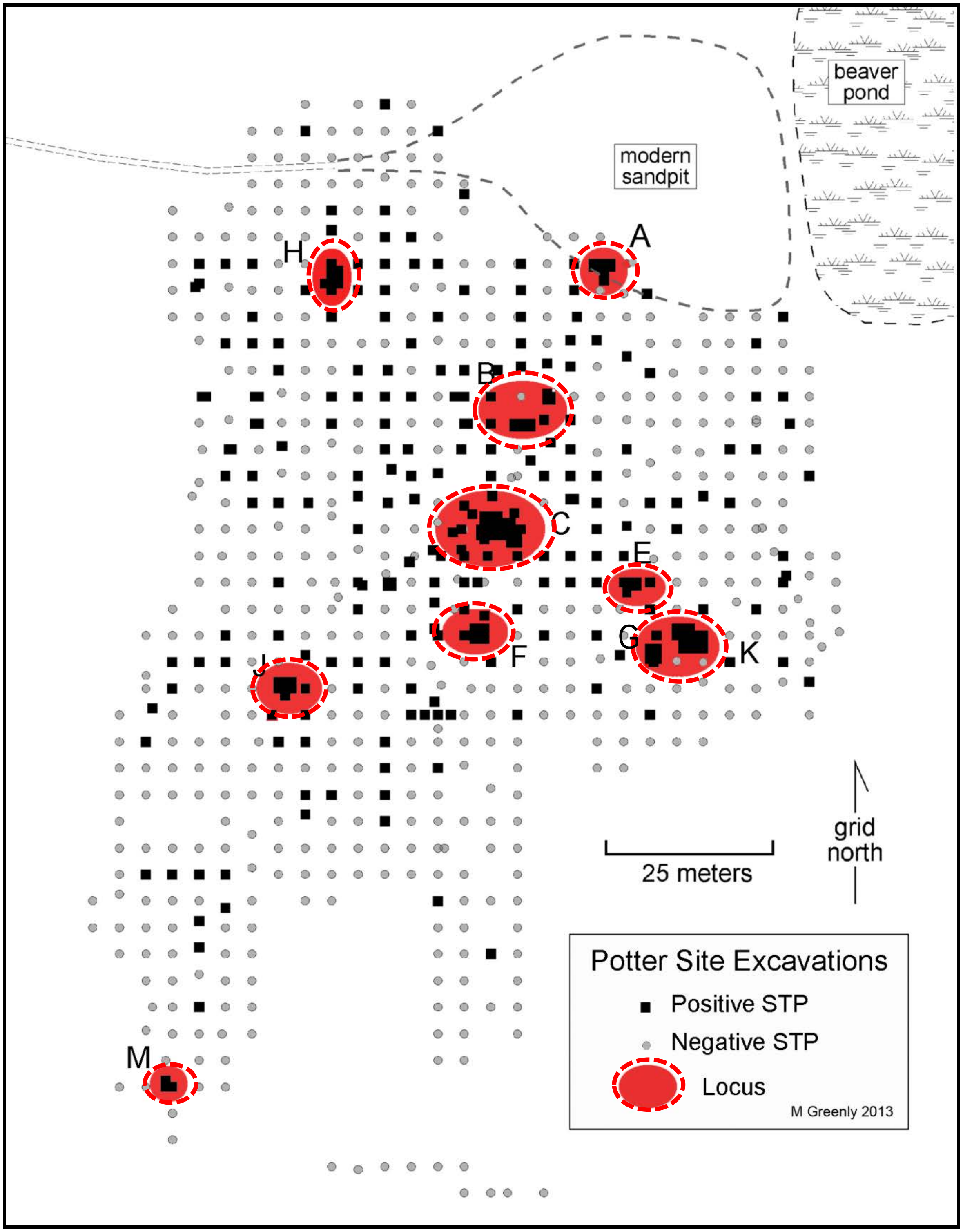


Figure 3.13 Potter site shovel test pits (STP), excavation blocks and defined loci. Ovals indicate demarcated loci, black rectangles indicate high-density concentrations of artifacts excavated within the locus, and gray indicates no artifacts (Greenly 2014).

3.5.1 Assemblage horizontal distribution representations

For horizontal artifact distribution analysis purposes, each defined locus is characterized by three graphical representations. Shown in Figures 3.14, 3.15, and 3.16 are examples of these plots generated from the actual data of the Potter site's locus H. The first is a horizontal isopleth artifact density plot showing the dispersal of the entire artifact distribution across the excavation grid. The increasing shading from light to dark in the isopleth Figure 3.14 indicates varying artifact density levels with the darkest indicating the highest concentration.

The second and third (Figures 3.15 and 3.16) plots show the horizontal distribution by 50 cm quad of the debitage and tool placement respectively.

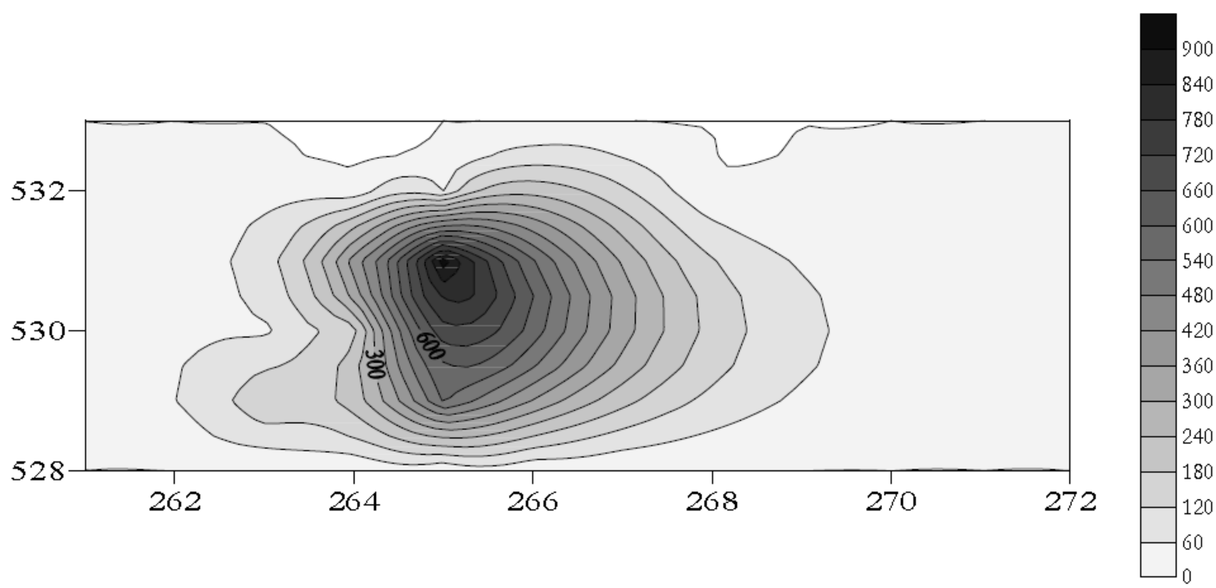


Figure 3.14 Example of horizontal isopleth artifact density plot for locus Northing and Easting. The darker the shading indicates higher artifact densities.

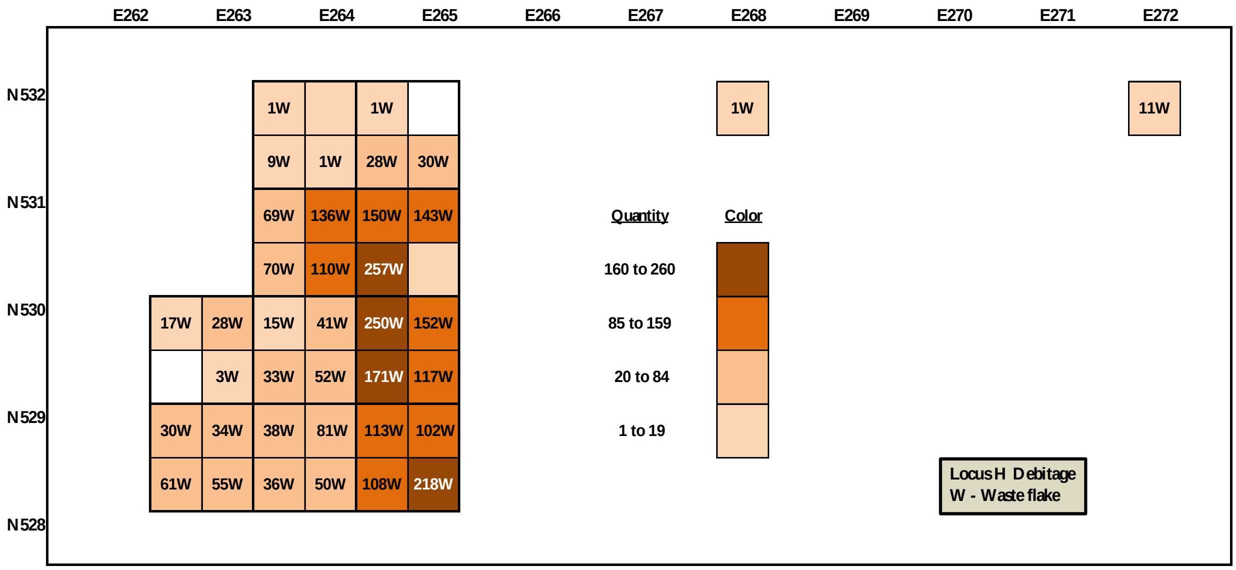


Figure 3.15 Example of horizontal debitage placements by 50 cm quad for generalized site locus. Positioning by grid North and East coordinates.

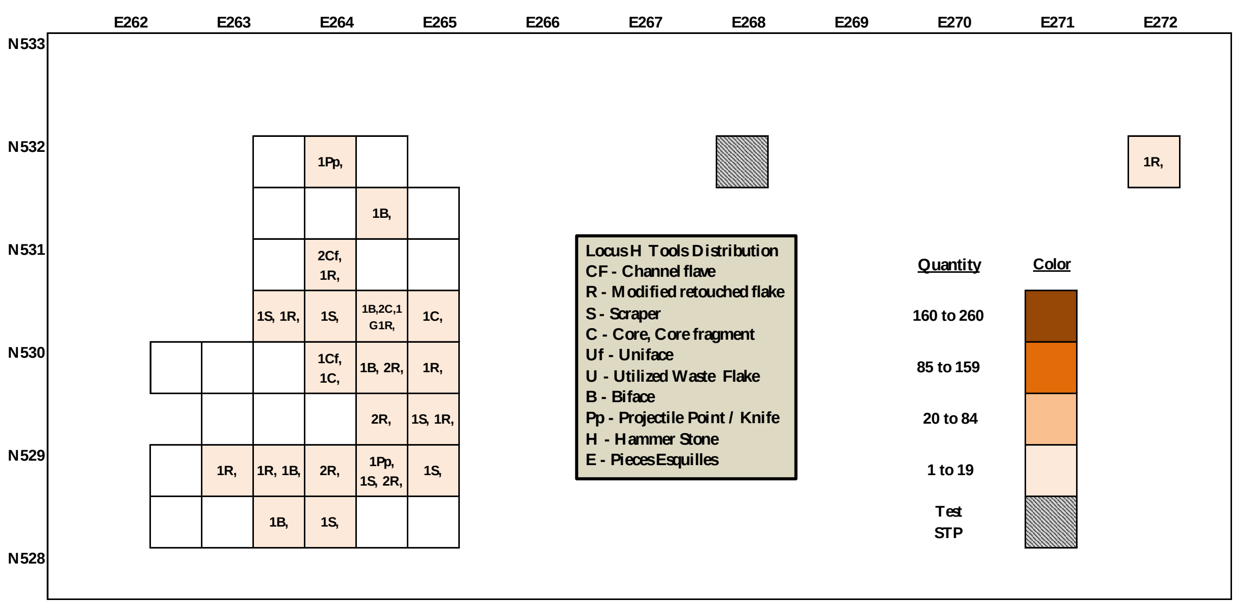


Figure 3.16 Example of horizontal tool placements by 50 cm quad for generalized site locus. Positioning by grid North and East coordinates.

Use of these loci spatial distribution graphical representations are located in each of the individual locus characterization analysis chapters as part of the horizontal and vertical artifact location and density depiction.

3.5.2 Assemblage vertical stratigraphy distribution representations

In the analysis of artifact assemblage distribution vertical stratigraphy of the site, loci are represented by two measures, soil horizons delineated as zones, and artifacts recovered by 5 cm excavation levels. The zone nomenclature was developed as a simplification for field school excavators' recording of soil level changes due to some of the participant's inexperience with soil profile classification and used in this analysis due to field convention of formatting data records. Zone 0 is the surface and forest duff layer O_g, Zone I corresponds to the A_g Horizon, Zone II corresponds to the B_g Horizon and frequently contains spodic layers, Zones III, IV, and V correspond to the C_g Horizon and are differentiated by a significantly more compacted bottom-most layer. It is Typical of the STP's and excavated blocks at this site, and others in the region, that the zone level depositions follow the simple O_g, A_g, B_g, C_g, D_g/R. Or in the case of Potter, Zone I, II, III, IV, and V to D_g/R bedrock sequence unless there has been some disturbance of the soil horizons through an exogenous disturbance event. Examples of potential disturbances are tree throws, intentional excavations, geologic disturbances such as faults, bioturbation, and cryoturbation.

The second measure of vertical stratigraphy is artifacts recovered by 5 cm excavation levels. The positioning of tools, tool type, and debitage of the chipped stone inventory represent a potentially significant variable that can assist in parsing the occupational history of each of the following characterized loci. As a part of the excavation and data recording processes, both the zone and level were recorded for each artifact in the assemblage.

3.6 Potter site individual locus flaked stone artifact composition by material type

Expanding upon the Potter site total composite flaked stone artifact assemblage by locus and material type, as displayed in Table 3.2, Table 3.5 below represents the artifact type (tools and waste flakes) by material type for each of the defined locus. As an example, the data in table 3.5 is from the Potter site locus H.

Flaked stone assemblage datasets such as that shown here for locus H are also presented further on for locus K, G, C, F, B, M, J, A, D, and E. Each of these individual loci datasets will be analyzed in later chapters using technological organization together with lithic analysis.

Table 3.5 Example Locus H flaked stone tool artifact composition by material type

Specimen Type	Rhyolite	Mt. Jasper Rhyolite	Jefferson Rhyolite	Granite	Quartz	Munsungun	Hornfels	Chert	Artifact Total
Biface	1					3		1	5
Channel Flake						3			3
Core	1								1
Core Fragment	5								5
Hammerstone									0
Projectile Point / Knife						2			2
Raw Material Unmodified									0
Graver						1			1
Scraper	1					4		1	6
Uniface									0
Utilized Waste flake									0
Waste Flake	1895	104	46		4	1144	2	4	3199
Waste Flake Modified / Retouched	11	1	1			3		2	18
Wedge / Pièces esquillées									0
Material Type Total	1914	105	47	0	4	1160	2	8	3240

3.7 Examples of what the flaked stone artifact assemblage can tell us

The Potter site flaked stone artifact assemblage has many insightful pieces of information that can be gathered from its analysis. The examples offered below intend to give insight into what the behavioral aspects of the Potter site occupants might have been by using technological organization and analysis of its flaked tool artifact assemblage. These examples are not meant to be exhaustive but to illustrate what can be determined from Potters flakes stone assemblage. Further details of the various analytical tools to be employed in the analysis will be selected and described regarding their function and efficacy in a later chapter.

To begin with, the large number of artifacts, i.e., debitage (14,251) and stone implements (345) or fragments thereof, places the site into one of the unusually rare Paleoamerican large site type categories. As discussed earlier, the vast majority of the Paleoamerican horizon site finds in the New England-Maritimes region are relatively small (Reith 2003; Jones 2008). Both the horizontal and vertical distribution patterns of the flaked stone artifact assemblage give insight into the spatial organization of the site's habitation or habitations. These concentrations may potentially shed light on whether they were an occupation or special activity area (Gramly and Funk 1990). Further, the spatial organization in conjunction with the number or density of artifacts found potentially may provide insight into the length of stay at a particular concentration area (Surovell 2009).

Questions concerning Paleoamerican behavior at the site may be addressed through the analysis of the technological organization of elements of stone procurement, techniques employed by flintknappers during tool manufacture, the organization of toolkits, patterns of use and discard, as well as maintenance or repair of formed implements. The type of stone implements in the assemblage in conjunction with microwear may potentially indicate what types of activities were engaged in during an occupation episode. Further aspects of the technological organization such as production trajectory, morphology, and debitage analysis can provide indications of cultural horizons and behavior patterns. For example, measures of the cortex quantity on the flaking debris and debitage flake size provides insight into what range of the production trajectory took place at the location in addition to providing understandings into mobility patterns (Andrefsky 2007; Odell 2003). The morphology of projectile points can be used as a relative dating predictor and in a like manner, the presence of channel flakes in the assemblage is a predictor of early and mid-Paleoamerican occupation in the new England-Maritimes region (Bradley et al. 2008). Toolkit composition, regarding the number of tool types, multipurposeness, size, and manufacturing attention to detail provides insight into mobility in addition to forager-collector behaviors.

A final example of the potential use of Potter’s lithic artifact assemblage is demonstrated by the acquisition and selection of material types used in the formation of the sites manufactured stone formed implements. The type of material, distance to its source, quality, and availability can provide perceptions into behavioral aspects such as choice of the material variety used for formal and expedient tools. The source location of material provides a potential understanding of seasonal rounds and acquisition methods, i.e., direct acquisition or downline trade.

3.8 Conclusions

The substance of this chapter was the introduction of the Potter archaeological site in its entirety. It’s excavation background and context were established in addition to the sites regional geographic and geological backdrop. Within this background framework, the Potter site’s excavated artifact assemblage, which consists solely of flaked stone tools and production debris, was described and detailed in its totality. As observed earlier, Potter is one of those few large and significant Paleoamerican regional sites thus making it an important investigation focus (Boisvert 2012; Dincauze 1993).

While a site's artifact assemblage characterization is vitally important and necessary for an investigation of the research hypotheses, Potter's assemblage inventory was not the only salient piece of information extracted and recorded during the excavation process. As part of the research design and methodology, detailed in a subsequent chapter, data regarding horizontal and vertical artifact spatial positioning, in addition to material types, dimensions, and artifact weights were collected as well.

Through the collection and examination of the spatial positioning data, it was revealed that the artifact distribution was not uniform across the site. On the other hand, it was found that there were eleven flake stone artifact concentrations scattered throughout the site's geographic boundaries. These high artifact density locations were designated as loci where some specialized behavioral activity potentially may have occurred. These identified loci will become a significant unit of analysis in support of the determination of the nature of the site. Furthermore, the characterization and relationships between each of the loci will become valuable in the determination of Potter's placement within the regional settlement pattern scheme. Either as some form of palimpsest or as a single large special purpose occupation.

Part II that follows, comprised of Chapters IV and V, presents, and characterizes the methodological framework and analytical tools to be employed in the investigation of the Potter site total artifact assemblage and those of its discrete loci.

Part 2

A methodological framework for processing and analysis of the Potter site and loci

The preceding chapter of this study developed the archaeological context for the Potter site. This portrayal included the site’s background, excavation history; regional, geographic, and geological setting; as well as the characterization of its excavated flaked stone artifact assemblage. The product of these depictions is roughly organized into quantitative lithic artifact assemblage statistics and spatial distributions in addition to their contextual environment. More specifically, for each of the depictions, i.e., Potter’s overall site assemblage, and individual loci, a significant amount of qualitative and quantitative information was gathered and presented.

In this part of the study, Chapter IV focuses on the investigation methodology used to analyze, from a bottoms-up perspective, the sites flaked stone assemblage. The primary methodology used in the examination of the assemblage is flaked stone tool analysis within a technological organization framework or context. The methodology discussion also includes artifact handling, cataloging, and database development. The chapter further explains hypothesis testing methodology through the application of technological organization framework modeling.

The description and functioning of settlement pattern inference models used in this investigation are explained in Chapter V. Each of the flaked stone tool analysis methods used in the analysis is described in the chapter including application assumptions used to resolve the proposed flaked stone technology organization, intra-site chronology, mobility pattern, and settlement pattern questions.

Chapter IV

Research design and methodology for the Potter site excavations

Given the quantitative and qualitative information gathered, the matter to be addressed in this chapter concerns itself with what methodologies will be utilized and how they will be organized to meet the goals of this investigation. The methodological selection issues present themselves as questions regarding what data and information collected can be usefully employed; how it was collected and organized; and in what ways can it be utilized to investigate and analyze the Potter site inhabitant's lifeways as discussed.

4.1 Methodological organizational framework

Archaeological site artifact assemblages identified in the New England-Maritimes region from the Paleoamerican and archaic horizons tend to be composed largely of lithic artifacts, features such as hearths, storage pits, as well as on rare occasions post molds (more often found in the archaic horizon sites), and fragments of calcined bone (Spiess et al. 1998). The reason for this generalized limited artifact assemblage configuration is due in part to the poor preservation of organic products such as bone and wooden technological implements caused by the acidic nature of the soil composition in the New England-Maritimes region. As will be observed in Chapters VI thru IX the characterized assemblages for the Potter loci and comparison reference sites, each follows this general bias toward mostly a stone tool artifact assemblage composition.

Analysts around the globe in their attempt to use stone tools as a record of the human past have recognized the sequential nature of stone-tool manufacture and have developed conceptual tools to understand how artifacts came to be as they are (Bleed 2009:103-131). These conceptual tools or models seek to reconstruct the organization of a technological system at a given archaeological site (Sellet 1993). While over the years there have been numerous efforts at developing a standardized or consistent methodology for lithic analysis, two national traditions of archaeological thought have emerged. These two traditions of lithic analysis frameworks are the French *chaîne opératoire* and American `reduction sequence′ or `technological organization′ (Shott 2003).

Lengthy discussions and critiques concerning the definition, development, similarities, and differences, in addition to the efficacy of each of these traditions, are well covered in the literature (Bar-Yosef and Van Peer 2009; Collins 1975:24; Johnson 1993:154; Leroi-Gourhan 1993; Sellet 1993; Shott 2003). The intent of proffering these two major alternatives is to provide recognition of their existence and further to present insight into the selection of an implementable framework for site evaluation. It is not the intent, however, to go over well-trodden and controversial ground concerning which method is more virtuous.

Chaîne opératoire methodology is often presented as a classification of technological systems (Leroi-Gourhan 1993). This method has its roots in French structuralism where sequences lend themselves to the further amplification by such issues as intent, choice, preference, gesture, event, cognition, structure, symbolism and agency (Bleed 2009:103-131). The Americanist reduction sequence concept arose in the eighteen-nineties and matured around 1970 and has been in use through to the present-day (Bradley 1975:8; Collins 1975:24; Johnson 1993:154). American archaeologists most often use reduction models or technological organization to address technological, cultural horizons, movement, site function, seasonality, territorial range, and adaptive strategies (Bleed 2009: 103-131).

In reviewing the analytical techniques used by the principal investigators of the New England-Maritimes large site comparison sites characterized earlier, their evaluation methodology employed most closely followed a technological organization framework. For comparison reasons and the Potter site artifact assemblage composition, to reach the stated research goals and objectives, the technological organizational framework appears to be best suited to the task.

4.2 Potter site analysis based on a technological organization framework

Since the 1970s, Archaeological research has begun to focus on questions concerning the organization of behavior in numerous aspects of a culture (Binford 1973, 1978, 1979; Kelly 1988, 1992; Shott 1986; Torrence 1983). One aspect of organizational behavior in these studies, as characterized by Nelson's (1991) application of the phrase, is the focus on technological organization.

In a broad sense, technology can be considered the sum of technical processes applied to an industry, in this case, stone tool production, including the knowledge and ability to use techniques and tools in its application. Bleed (1997:96-98) narrows this interpretation and defines technology "as society's customary means of manipulating the physical environment." In the sense of a "life-history framework," technological organization is a system of strategies for meeting environmental situations or conditions that enable human adaptation (Binford and Binford 1966; Bleed 1986; Bousman 1994; Carr and Bradbury 2011; Kelly and Todd 1988; Shott 1986). More specifically, this system of strategies as defined by Nelson (1991) is the "selection and integration of strategies for making, using, transporting, and discarding tools and the materials needed for their manufacture and maintenance" (Nelson 1991:57). Studies of the organization of technology also consider economic and social variables that influence those strategies (Carr and Bradbury 2011).

4.2.1 Potter site analysis framework elements

The purpose of this study, as expressed in Chapter I, is to investigate and analyze the Potter site's inhabitant's lifeways in contrast to the rare number of large site types identified regionally and determine its site type characterization and classification. To achieve this objective, the sites artifact assemblage data collected during its excavation must be examined, organized, and analyzed within the technological organization framework. Through this effort it is expected that insight into the temporal aspects of Potter's Paleoamerican occupation; their mobility patterns and seasonal inferences; settlement pattern adaptions and site/loci land use activities; in addition to lithic tool technological organization will be gained.

Following Nelson's (1991:57) portrayal of the technological organizational structure, the following major framework elements concerning archaeological context, data acquisition, and artifact handling, as well as analytical methodological procedures used in this study are enumerated below:

1. environmental reconstruction (discussed in Chapter II);
2. excavation sampling strategy (discussed in Chapter III);
3. artifact handling and cataloging (discussed in Chapter IV);
4. hypothesis testing through modeling (discussed in Chapter IV);
5. specific lithic analysis model development and functioning (presented in Chapter V); and
6. Potter site artifact assemblage raw material variability and sourcing (presented in Chapter IX).

4.3 Artifact handling and cataloging

Flaked stone tools and debitage from the Potter excavations of 2003 through 2011 dig seasons were collected, bagged, tagged, documented through a cross-referencing documentation system, and stored at the New Hampshire Archaeology Bureau warehouse for later analysis. In sum, 799 fifty-centimeter square shovel test pits were dug in and near the site plus 93 square meters of one-meter-square test pits and small block excavations which produced over 15,900 specimens.

Each stored tool and piece of debitage was entered into an excavation catalog record card to construct a database. The recovered artifacts included flaked stone tools, blanks, and preforms from which the tools were manufactured, cores and assorted large, medium, and small pieces of debitage resulting from the tool manufacturing processes. An example of the data entry form is shown in Figure 4.1. The major data entry fields that are important to the application of both quantitative and qualitative models are specimen type identifying descriptions; specimen metric descriptions such as weight, length, width, and thickness; frequency of or the number of specimens; material stone type; and position by metric grid coordinates. Information in the excavation data fields was used occasionally to specify horizontal and vertical stratigraphy as needed for clarification. The catalog number, provenience type, and bag number are simply mechanisms for individually sequencing each item in the paper and digital database. As indicated earlier, only flaked stone artifact assemblages are involved in this study leaving the fields for ceramics, flora, fauna, and historical descriptors unused. The codes noted on the cards are not important by themselves and serve as a shorthand classification of the verbal descriptions. For example, the material type field may be listed as Munsungun chert whose code is the number 13. Code number sheets for the specimen and material type are shown in Tables 4.1 and 4.2.

Following the data field and code entry into the data entry form, the information was then recorded in a digital database using the Microsoft Access software application. The database was then extracted into an Excel spreadsheet to facilitate data sorting, processing, and analysis.

There were approximately 15,900 artifact records available for data entry and analysis. As a quality control measure before entry, each of the significant tool types was visually re-inspected and verified for correctness of its cataloging description and material type by two independent assessors, the New Hampshire state archaeologist Richard Boisvert and me.

The compiled dataset was then sorted by specimen or artifact type; the frequency of or several specimens of each type including debitage; stone material type; specimen metric descriptions such as weight, length, width, and thickness; locus association; vertical and horizontal position by grid coordinates in meters. These categorizations provided the independent variables for data to be utilized in both the qualitative and quantitative analysis models.

4.4 Hypothesis testing through modeling analysis

The following paragraphs describing qualitative and quantitative analytical models and their relationship to settlement trait questions are provided to illustrate a summary of the methods employed to determine and test the hypothesized settlement pattern. Development and functioning of the specific models are presented in Chapter VIII.

To apply either qualitative or quantitative models as analytical tools, a functional relationship must exist between the question to be answered, the model to be used, and the corresponding data set. In this case, the hypothesized settlement trait questions are dependent upon the characteristics of the recovered artifact assemblage. In other words, locations are taken to be relevant proxies for human behavior (Binford 1983:109). Specific settlement pattern behavioral questions are classified as the dependent variable and are a function of the independent descriptive data proxy variables as represented by the artifact assemblage of the loci and or site under analysis.

As an example of applying qualitative models; culture horizon is a function of the Paleoamerican cultural descriptive traits consisting of the northeastern lithic reduction sequence, use of fluted points, evidence of channel flakes, indications of multipurpose tools, and use of high-quality stone for curated tools such as projectile points (Andrefsky 2005). Date of site occupation is a function of morphology and typology of the diagnostic projectile point characteristics. The individual locus occupation date is again a function of the morphology and typology of projectile point characteristics in addition to radiocarbon (^{14}C) and optically stimulated luminescence (OSL) dating methods when available. Locus activity area or land-use inferences are a function of attribute clusters, tool microwear , toolkit composition, and debitage specimen metrics. As a final illustration of a relationship between the dependent and independent variables, inferences regarding the number of cultural occupation horizons may be expressed as a function of the diagnostic morphology-based typology of point and knife characteristics and their stratigraphy. In a derivative way, the validated results of the application of these qualitative models to determine date horizons at Potter is dependent on other regional site analyses that have actual calibrated radiocarbon determined (^{14}C) dated results for specific diagnostic tools.

Using these functional dependencies, qualitative models produced settlement trait information to test elements of the hypotheses concerning temporal aspects of site occupation, settlement pattern adaptation, site, and locus landscape activities, and technological organization of the site occupants (Surovell 2009). Qualitative or informal models applied to the site included morphology-based typology, cultural horizon descriptive traits, and land-use or locus activity classification based on artifact toolkit composition as part of attribute cluster classification. A broader example of multiple applications of the morphology-based typological model is testing the assemblage to determine the date of site occupation, dates of individual locus occupation, and the number of different cultural horizon occupations that occurred (Bradley et al. 2008). A cultural horizon descriptive traits model was applied to investigate and verify the hypothesis that the occupations of the site occurred during the Paleoamerican period and that they shared the same cultural technological traits (Bradley et al. 2008). The land-use attribute classification model was used to identify and test for the activities engaged in at each site locus (Gramly and Funk, 1990).

In addition to qualitative modeling, quantitative models were also applied to the artifact assemblage database to determine if the remaining traits of the hypothesized settlement pattern were also a function of the independent descriptive data variables. What follows is a group of examples of quantitative models that show the functional relationship of dependent, independent and proxy variables. Detailed methodological characterizations and functional explanations of the models used in these examples, and the analysis of the site are described in Chapter V. The first example of a quantitative model for detecting instances of single or multiple occupations is expressed by a function that uses a proxy variable for mean per capita occupation span divided by the artifact density per square meter (Surovell 2009). A second derivative quantitative measure for instances of single or multiple occupations is a function of a different proxy variable expressing mean per capita occupation span that is defined by the ratio of local to non-local raw materials divided by artifact density per square meter (Surovell 2009). A temporal, quantitative measure of total site occupation span is given by the sum of the individual locus occupation time spans, if not concurrent occupations, and the time of non-occupation or years when the site was not used. Another temporal measure is individual locus occupation time span which is a function of the ratio of local to nonlocal tools by material type versus time. Finally, another measure for individual locus occupation time span is a function of the ratio of debitage to transported tools versus time (Surovell 2009).

Flaked stone tool technological organization is a function of the quantitative relationship between curated versus expedient tools, a high or low abundance of lithic material, and high or low lithic quality in addition to tool manufacturing methods such as flaking sequence and production methodology (Andrefsky, 1994:21–34). Flaked stone tool technological organization and mobility can also be defined as a function of the minimum analytical node analysis (MANA) process that relates material type, artifact class, and quantity of artifacts (Larson & Kornfeld, 1997).

Using these functional dependencies, quantitative models produced settlement trait information to investigate and test elements of the hypothesis concerning: instances of single or multiple occupations, individual locus occupation time, total site occupation time span, and technological organization of the site occupants.

The sequence of model applications to determine settlement pattern behavior traits was performed in the following manner. Excavation artifact data, as recorded in the database for each of the site's component loci, was processed independently as applicable through both the qualitative and quantitative models for the projected result. Processing the artifact assemblage for each locus separately and combining the results subsequently, as opposed to a onetime aggregation treatment of all loci artifacts, yielded a finer resolution and more accurate representation of the site's archaeological record. Using this application sequence yielded a broader spectrum of modeled information from which to draw overall site trait and individual loci inferences and conclusions.

Volunteer participants in the SCRAP program were given access to the documentation and artifacts to aid in academic research projects. The three-research projects by other SCRAP participants based on the Potter data set were an analysis of a fire pit in locus M (Abby Young), a materials analysis of locus M (Beth Potter), and the Microwear analysis (Heather Rockwell) of formal and expedient tools used at the Potter site. These three research projects were referred to and attributed in this thesis. None of the projects described used methods employed in this thesis. Specific maps included in this thesis were generated from the site survey mapping data performed by Mark Greenly, as requested by the author. The author created individual loci maps of artifact and debitage placement. Members of the SCRAP team who performed photography of the site and artifacts were Laura Jefferson, Richard Boisvert (state archaeologist), and the author.

The author's contribution to the SCRAP process was his fieldwork participation in surveying, STP assessment, unit excavation, screening, artifact identification, and recording. The fieldwork was followed by work in the laboratory to assess, characterize, analyze the fieldwork product, and adaption of a usable database. In addition to the field and lab work described above, the author's specific new contributions provided in this thesis are as follows. Firstly, the analysis of the Potter site was performed from a cultural behavior and ecological construct as opposed to the generally employed descriptive chronological culture-historical perspective of dig, date, catalog, and curate. Secondly, is the identification and application of quantitative and qualitative models to the site database to answer anthropological questions. Thirdly, is the performance of the locus by locus lithic analysis and technological organization of the Potter and comparison site's artifact assemblages. Finally, the author developed and tested a hypothesis that characterized the Potter site and its place in the regional system of site's and behaviors.

In summary, this methodology allowed the modeled results and inferences drawn from them, to answer the research questions for both the site and individual locus.

4.5 Research limitations

This study was naturally limited by the geographic area addressed and site cultural occupation horizon. Considered from an occupation horizon perspective, the Potter site and sites selected for comparison fall within the Paleoamerican time horizon and therefore do not address settlement pattern characterizations of the archaic and later cultural horizons. None of the sites has been identified as a multi-component site except for the Whipple site which contained a small quantity of flaked stone artifacts from a subsequent cultural horizon. As noted previously, from a geographic standpoint the area under study is restricted to the New England–Maritimes region. The Potter site and selected comparison sites fall within this substantial geographic area. Sites outside of this geographic region such as the Southeast and Southwest portions of the United States would, in all likelihood, not reflect the same settlement pattern characterizations. Potential reasons for this may be found in variations of geography, climate, mobility, tool stone availability, prey species and seasonality during the Paleoamerican horizon.

When viewed on a more limited scale, there is only one excavated archaeological site of record within a radius of 10 miles of the town of Randolph, and that is the Potter site. The immediate area surrounding the town of Randolph in which the Potter site resides has not been explored for Native American cultural resources. Given the topography of the area, it might be expected that there may be additional undiscovered Paleoamerican sites such as kill and butchering stands on the valley floor where caribou hunting intercepts could have occurred. If such hunter-gatherer occupations occurred and were discovered and analyzed, their existence could influence the interpretation of the Potter site.

As a further limitation, not all conceivable settlement traits were considered for the assessment using modeling techniques; only those discussed above were addressed.

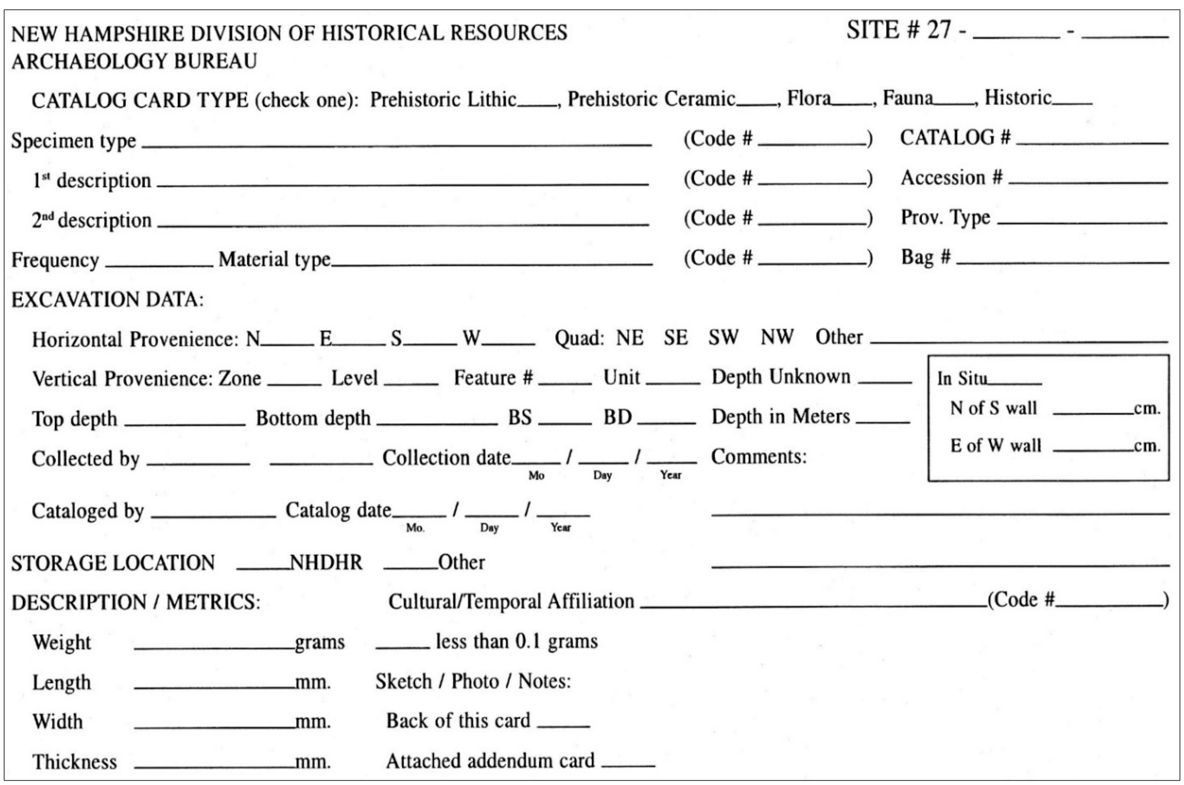
Finally, the probability of discovering a significant artifact density within site also represents a potential limitation because of the survey and excavation method's dependence on the sampling interval and artifact concentration size (Shott et al. 1989b: 396–404). As discussed above, transect spacing was based on a four-meter grid. If a three-meter or smaller artifact concentration was located in the center of a four-meter by four-meter grid spacing, it could potentially be missed. Typically, however, excavations of Paleoamerican sites in the New England-Maritimes region performed by cultural resource management firms and academic institutions use the sampling methods described above where testing is done through shovel test sampling and expanded into larger excavation areas upon identification of cultural materials (Boisvert personal communication 2010). Seldom is the entire area excavated unless every shovel test pit contained cultural materials throughout multiple acres of the grid.

4.6 Research design and methodology for the Potter site excavations chapter summation

Given the quantitative and qualitative information gathered from the excavation of the Potter site, the goal of Chapter IV was to present and discuss what methodologies will be utilized and directed toward the investigation of the stated research problem, objectives, and the testing of the hypotheses. As a part of the methodology discussion, it was necessary to select an analysis framework to work within. In reviewing the analytical techniques used by the principal investigators of the New England-Maritimes comparison sites, it was found that their evaluation methodology most closely followed a technological organization framework.

Using Nelson's (1991:57) definition of a technological organizational framework, the major structural elements concerning archaeological context, data acquisition, and artifact handling, as well as analytical methodological procedures used in this study were discussed.

To expand upon the methodological concepts introduced above, i.e., hypothesis testing through modeling, the following chapter will characterize, explain and evaluate a collection of qualitative and quantitative analytical tools. These tools will be utilized in the investigation and analysis of the Potter sites inhabitant's settlement patterns and lifeways.


NEW HAMPSHIRE DIVISION OF HISTORICAL RESOURCES
ARCHAEOLOGY BUREAU
SITE # 27 - ______ - ______

CATALOG CARD TYPE (check one): Prehistoric Lithic____, Prehistoric Ceramic____, Flora____, Fauna____, Historic____

Specimen type ______ (Code # ______) CATALOG # ______
1st description ______ (Code # ______) Accession # ______
2nd description ______ (Code # ______) Prov. Type ______
Frequency ______ Material type ______ (Code # ______) Bag # ______

EXCAVATION DATA:
Horizontal Provenience: N____ E____ S____ W____ Quad: NE SE SW NW Other ______
Vertical Provenience: Zone ____ Level ____ Feature # ____ Unit ____ Depth Unknown ____
Top depth ______ Bottom depth ______ BS ____ BD ____ Depth in Meters ____
Collected by ______ ______ Collection date____ / ____ / ____ (Mo Day Year) Comments:
In Situ____
N of S wall ______cm.
E of W wall ______cm.
Cataloged by ______ Catalog date____ / ____ / ____ (Mo. Day Year)

STORAGE LOCATION ____NHDHR ____Other

DESCRIPTION / METRICS: Cultural/Temporal Affiliation ______(Code #______)
Weight ______grams ____ less than 0.1 grams
Length ______mm. Sketch / Photo / Notes:
Width ______mm. Back of this card ____
Thickness ______mm. Attached addendum card ____

Figure 4.1 Excavation Catalog Data Entry Form (New Hampshire Division of Historical Resources Archaeology Bureau, 2007)

Table 4.1 Specimen type coding example (New Hampshire Division of Historical Resources Archaeology Bureau, 2009)

Specimen type	Description
1	Waste flake
2	Biface fragment
3	Biface
4	Uniface
5	Core
6	Projectile point/knife
8	Core fragment
10	Hafted scraper
11	Wedge / Pièces esquillées
13	Waste flake, modified/retouched
14	Channel flake
15	Edge damaged flake
16	Strike-a-light
17	Spokeshave
18	Graver
19	Drill
20	Scraper
22	Blade
23	Projectile point/knife fragment
24	Hoe
25	Channel flake utilized
58	Gorget fragment
59	Stone bowl fragment
60	Hammer-stone
61	Hammer-stone fragment
62	Celt
63	Celt fragment
64	Ax
65	Ax fragment
66	Ax chip
67	Gouge fragment
68	Gouge
69	Ground stone point
70	Plummet
71	Anvil stone
77	Adze

Table 4.2 Material type coding example (New Hampshire Division of Historical Resources Archaeology Bureau, 2009)

Specimen type	Description
1	Quartz
2	Hornfels
3	Rhyolite
4	Mount Jasper rhyolite
5	Chert
6	Quartzite
7	Banded chert
8	Felsite
10	Argillite
11	Kineo rhyolite
13	Ramah chert
13	Munsungun
14	Basalt
15	Schist
16	Ballast Flint
17	Feldspar
18	Jefferson rhyolite A
19	Jefferson rhyolite B
20	Jefferson rhyolite, unspecified
21	Volcanic, unspecified
22	Chalcedony
23	European Flint
81	Graphite
82	Red Ocher
83	Yellow Ocher
84	Ocher (color unspecified)
85	Steatite
86	Clay
87	Marble
88	Sandstone
89	Pumice
90	Mica
91	Concentration
92	Gneiss
93	Bog iron concretion
94	Coal (mineral)
95	Burned earth
96	Slate
97	Granite
98	Glacial pebble
99	Indeterminate stone
200	Plant, unidentified
201	Seed, unidentified
202	Nut, unidentified

Chapter V

Settlement pattern inference model's description and function

"*All models are wrong, but some of them are useful*" Box et al. (2005).

This chapter describes both the qualitative and quantitative models applied to the archaeological record of the Potter artifact assemblage. Each model's functional description is organized under the settlement pattern behavioral category to which it is applied, i.e., technological organization, temporal aspects of site habitation, settlement pattern adaptations, and land-use and domestic activities. At the core of each of these lithic analysis models is a qualitative or quantitative relationship from which inferences may be drawn between the technological organization of the site's stone tool assemblage and settlement pattern behavior.

5.1 Expectations for settlement pattern inferences using models

This section briefly outlines the use of qualitative and quantitative models to analyze lithic artifact assemblage records and explains expectations for their predictive inference results. In the absence of non-lithic artifacts and features, two data sets have been in general use and relied upon for the interpretation of Paleoamerican sites in New England (Burke 2004; Spiess et al. 1998). The first data set is composed of stone tool forms or morphologies in addition to the reduction flakes from the manufacturing process (Bradley 1998; Bradley et al. 2008; Spiess et al. 1998). Inferences from these lithic components indicate techno-functional features and fabrication methods. The second data set is made up of raw material types, from which the stone tool and flake artifacts were produced, and the source locations from where they were procured. From the tool stone procurement locations behavioral mobility patterns can then be inferred (Boisvert 2000; Burke 2004).

The process of using morphology and lithic material sourcing to generate settlement pattern models is relatively straightforward. The fundamentals of site function and calculation of the approximate age of formation may be estimated from tool morphology-based typologies by comparison with lithic toolkit assemblages from archaeological records of other regionally known and dated sites. With the identification of the raw material source locations, linkages can be developed that potentially indicate various geographical points traveled through in the New England-Maritimes (NEM) Paleoamerican settlement mobility system (Boisvert 2000; Burke 2004). Through the application of this process, movements of the people who acquired, used, and eventually deposited the stone tools into the archaeological record may be traced. Burke (2006) graphically developed this relationship between material sources, site locations, inter-group exchange and band mobility in the northeast. Details of the functioning and application of Burke's (2006) seasonal and annual round model are described in the mobility patterns and seasonal inferences section of this chapter.

Interpretations and inferences developed from morphology-based typologies and lithic source models are by no means unique or novel. They have been effectively applied to determine cultural time horizons and mobility patterns throughout the Americas (Burke 2004, Dibble 1987; Dick and Mountain 1960; Sackett 1986; Spiess et al. 1998). These types of qualitative models can be effectively applied to the hypothesis testing of the Potter site (Spiess et al. 1998; Burke 2004).

More explicitly, in addition to or in lieu of reliable ^{14}C dates, researchers have applied morphology-based typology models to different projectile points for the assessment of various

Great Plains cultural complex sites. The sites in the Folsom-Midland, Agate Basin, Hell Gap, and Alberta-Cody complex located in Northwestern Plains (Frison 1991:39-87), were analyzed with a morphology-based model to determine which and how many cultural horizons characterized these sites.

Boisvert (2000) cites several instances where heuristic raw material source models were applied to lithic assemblages in the New England-Maritimes region in order to develop inferences about Paleoamerican mobility traits. These were able to detect regional movement patterns. For example, Curran and Grimes (1989:41-74.) modeled the use of non-local lithic sources as an indicator of settlement patterns regarding the prehistoric exchange and interaction patterns at the Whipple site. The evidence analyzed consisted of preform blanks and finished tools of exotic materials that were brought to the site as part of its formation and occupation process (Curran and Grimes 1989:41-74.). Modeling nonlocal lithic sources (located greater than 20 km from site) and inferring mobility patterns indicated that in addition to direct procurement, the presence of exotic material potentially occurred from both exchange and social interaction patterns. The material acquisition mode alternatives for the Potter site are discussed in Chapter IX. Bradley (1998) examined and modeled long distance travel between interior and coastal sites through material associations to provide insight into the Paleoamerican seasonal round movements and identified various elements of their economic behavior. Spiess & Wilson (1987) used material source and type in analyzing the reassembly and replacement of broken projectile points in a specific locus at the Michaud site. They identified associated habitation and kill sites via material determined sources, in addition to morphological typology analysis and refit.

In practice, as just described, lithic analysts frequently make inferences about behavior based on the empirical characteristics of objects recovered from archaeological contexts, and it is this process of making these inferences that can be of concern when using morphology-based typologies as a unit of analysis. Odell (1981) observed that because of the differing nature of regionally and environmentally characterized lithic artifact collections there are few if any morphological-functional equivalences that provide widespread validity. When regionally based morphological-functional interpretations are used alone, they are not sufficient as a guaranteed tool function predictor applicable in a general context. Odell (1981) suggests however that using morphology-based typologies in conjunction with relevant functional data from the analysis of microwear damage will be increasingly valuable in constructing sound functional frameworks for tool function interpretations. This study of the Potter sites' assemblage makes use of microwear analysis on formal and expedient tools where obtainable for each locus (Rockwell 2010; 2014).

Qualitative models such as those described above find application to the Potter artifact record and are expected to produce settlement pattern information to test elements of the hypothesis. It is anticipated that the results will be able to assess the hypothesized temporal aspects of site occupation, landscaped use activities, and technological organization of the site occupants.

Surovell (2009) defines a quantitative or "formal model" as a model that is constructed mathematically and built using mathematical expressions, algorithms, or graphic solutions of relatable variables. One of the advantages of applying formal models is that they lead to explicit predictions. In the analysis of stone tool archaeological assemblages using quantitative models, an approach known as accumulations research is utilized (Surovell 2009). In this approach, the excavated stone tool assemblage is used to estimate site occupation span or the time duration that a site was occupied in addition to whether or not the site was reoccupied.

To describe the relationship between artifact accumulations and site occupation span, Schiffer (1975) developed a formulation which Surovell (2009) adopted with the use of proxy variables to gauge length of stay at a stone tool using site. With the expansion of this basic formulation into other related equations, the piece count of stone tools, number of debitage flakes, and quantity of different material types in the assemblage, additional quantitative relationships can be constructed.

Quantitative models can be applied to the testing of elements of hypothesized settlement patterns such as the following.

1. occupation span determined by lithic material type ratios (local to non-local)
2. occupation span by transported tools to debitage ratio
3. the probability of site reoccupation by the ratio of occupation span to artifact density
4. technological organization elements from formal vs. expedient tool relationships
5. technological organization by minimum analytical node analysis (MANA)
6. mobility-sedentism inferences from the core to biface ratio
7. material quality vs. availability
8. others to be introduced further on

Using both quantitative and qualitative models in conjunction with microwear studies as opposed to utilizing qualitative models only, a more in-depth interpretation of settlement traits and pattern can be advanced.

5.2 Lithic analysis models based on technological organization

Reiterating, technology can be considered the sum of technical processes applied to an industry, in this case, stone tool production, including the knowledge and ability to use techniques and tools in its application (Nelson 1991). In the following sections, lithic analysis models based on technological organization of flaked stone tools are depicted that describe methods useful in determining settlement pattern behavioral research questions. Several of the behavioral issues of the Potter site occupants to be examined are temporal horizon aspects of site habitation, settlement pattern adaptations, and land-use as well as domestic activities.

The first group of technological organization models deals with design strategies and goals for the manufacture and maintenance, use, transporting, and discard conditions within a Binford and Binford (1966) extractive and maintenance task framework. Within this framework, extractive tools are used to obtain food while maintenance tools are those used in the manufacture or repair of other technological tools (Binford and Binford 1966). Bleed (1986) introduced two important tool design parameters, reliability, and maintainability. Each of these design concepts would have a direct bearing on the production and maintenance strategies of curated stone tools in the foraging and collecting continuum land-use system. Additional technological organization design considerations in forager-collector system models are; time minimization - resource maximization (Bousman 1994; Torrence 1983), make and mend - gearing up (Binford 1980; Bousman 1994), tools used to exhaustion – replaced before exhaustion (Kuhn 1989), and less-more attention to hafting (Nelson 1991).

The technology organizational aspects of the production of formal versus informal, or expedient, tool styles conditioned by material type quality and availability are addressed by an informal heuristic model developed by Andrefsky (1994). Site technological activities are inferred from the application of Minimum Analytical Node Analysis (MANA) modeling that deals with analytical nodule composition and implied associated technology organizational behavior (Larson & Kornfeld 1997).

5.3 Technological organization of flaked stone tool modeling

5.3.1 Distinguishing cultural horizon: technological organization of early, middle and late Paleoamerican flaked stone tools production trajectories

Lothrop et al. (2016) produced a synthesis of the technological organization of flaked stone tools for early, mid, and late Paleoamerican technological organization based on a Deller and Ellis (1992:87-92a) study. Early and middle Paleoamerican Eastern Great Lakes (EGL) site assemblage analysis led to a technological organization model for the northern portions of the Northeast including the New England-Maritimes (NEM) region (Deller and Ellis 1992a:87-92; Ellis 2008; Adovasio and Carr 2009:518).

This model proposes that tool blanks were principally generated from polyhedral block cores using high-quality primary source stone. Nevertheless, the use of polyhedral block cores does not imply morphological blade production (Deller and Ellis 1992; Ellis 2008). In the NEM region early and middle Paleoamerican technologies were based on a “staged biface reduction sequence”, where most assemblage characteristics suggest these groups employed a highly segmented reduction sequence, producing standardized tool blanks and preforms for specific morphological tool types (Adovasio and Carr 2009:518; Deller and Ellis 1992a:87-92; Ellis 2008; Lothrop et al. 2016). As a corollary, a minority of the transported toolkit was produced on flakes or blanks from bifaces (Adovasio and Carr 2009). Expedient tools such as modified and utilized flakes as well as flake gravers were restricted to flakes or blanks from bifaces or biface cores (Lothrop et al. 2016). A common characteristic found in early and middle NEM Paleo horizon technology for projectile points and later stage biface reductions is fluting and the associated byproduct, channel flakes (Bradley et al. 2008; Lothrop et al. 2016).

At quarry-related sites such as Mt. Jasper and Munsungun Lake, Paleoamericans performed early through late stage reduction, carrying away standardized tool blanks, biface preforms, and finished tools (Gramly 1984; Lothrop et al. 2016). This production strategy served to reduce the weight of the transported toolkit, enhancing portability and mobility. Further, this strategy suggests flexibility in the toolkit, where blanks and bifaces could be converted to different morphological tool types for use at other locations as required. Sites that are not directly associated with quarries typically generate stone tool assemblages consisting of broken and resharpened tools in addition to small debris from late-stage biface reduction and debitage from the maintenance of unifaces such as end and side scrapers (Deller and Ellis 1992a; Ellis 2008).

Early and mid-Paleoamerican tool assemblages across the NEM and EGL share similarities from a projectile point morphological (Bradley et al. 2008) standpoint. Common uniface tool classes in the NEM such as hafted end and hand-held side scrapers also share similarities in their morphological characteristics. Fluted twist drills appear to be limited to early Paleoamerican sites (Gramly 1982; Robinson et al. 2009) in the NEM but not in the EGL. Uniface forms labeled limaces (Gramly 1982) or flake shavers (Grimes and Grimes 1985) are recorded at early Paleoamerican NEM sites but seem not to be present at sites in previously unglaciated terrain locations. Bipolar artifacts referred to as *pièces esquillées* or wedges are common on many sites in NEM. However, these bipolar forms are rarely observed at Gainey, Barnes, and Holcomb phase sites in the EGL (Lothrop and Bradley 2012:33).

During the late Paleoamerican horizon various tool forms disappeared from the toolkit-inventory such as *pièces esquillées* and burins (Ellis and Deller 1997). The appearance of new tool forms such as backed bifaces, large alternately beveled bifaces, and narrow/nosed end scrapers followed. Also, changes in projectile point tip form from thick, parallel-sided objects with long fore-sections and wide bases, to thin items short fore-sections whose sides expand from a narrower base towards the tip are observed in the EGL (Ellis and Deller 1997). Another change in projectile point technology was the disappearance of fluting and associated channel flakes in favor of basal thinning and grinding.

5.3.1.1 *Model applicability considerations and prior testability of usage*

As noted, Lothrop et al. (2016) produced a technological organization of flaked stone tools model for the early, mid, and late Paleoamerican horizons. This technological organization model was developed and based on the Deller and Ellis (1992a:87-92) study. The precontact regional sites in the EGL and NEM where the study was organized and applied were Barnes, Leavitt, Gainey, Holcombe, Parkhill, Crowfield, Nobles Pond, Fisher, Banting, Zander, Udora, Potts, and Reagen. This is a geographical limiting factor. However, other technological organization of flaked stone tool schemes for other geographic regions of the country have also been described and documented in the literature (Bradley et al. 2008; Lothrop et al. 2016; Nelson 1991; Odell 1981). The applicability of the Lothrop et al. (2016) technological organization of flaked stone tools model to these other regions is unknown and questionable. Therefore, the model's use is limited to the EGL and NEM.

5.3.2 Technological organization: production of formal vs. informal tool types conditioned by material type quality and availability

Andrefsky (1994) has identified a relationship between material availability and quality that is a primary factor in how a lithic assemblage is ultimately organized in terms of tool form, production effort, and time budgeting. This model argues that the dominant issue in understanding the organization of technology regarding production decisions for the manufacture of formal and informal lithic tools is dependent upon raw material availability and quality.

In this model, the term formal is used to describe a wide variety of tools that have undergone additional design and effort in their production. Formally curated lithic tools are stone tools that were specifically designed and manufactured for transportability, versatility, flexibility, reliability, long use-life, efficiency, and maintainability. Curated tools such as bifaces, preforms, projectile points, knives, scrapers, and formally prepared cores were likely to have been transported and used at multiple site locations (Andrefsky 1994).

At the opposite end of the production continuum, are informal or expedient tools that are defined by the amount of effort expended in the manufacture of the tool. Informal tools are unstandardized or casual regarding form, and this tool type is believed to have been manufactured, used, and discarded in the same place over a relatively short period (Andrefsky 1994; Bamforth 1986; Nelson 1991:64; Parry & Kelly1987).

In the model (Table 5.1), cell one is characterized as having high-quality lithic materials in great abundance. Both formal and informal tools were found to have been produced in approximately the same proportions. Cell two represents the case where low-quality lithic materials occur in great abundance. It has been found that informal tools were primarily manufactured and the few formal tools were made from non-local high-quality sources. Cell three represents the instance where high-quality materials occur in low quantity. It is predicted that because of low quantity there would occur a predominance of formal tool production. Finally, cell four represents the co-occurrence of low-quality materials in low volumes. In this case, informal tools would be made from local sources and better-quality nonlocal materials would be used to fabricate all of the formal tools (Andrefsky, 1994). These relationships are exhibited in Table 5.1 that relates high and low lithic abundance, high and low lithic quality to the type of tool manufacture to be expected in a site artifact assemblage.

If other variables are held constant, quality and quantity of raw materials do in fact structure stone tool production in a relatively predictive manner. As demonstrated from site analysis, ethnographic accounts, and experimental archaeology, low-quality raw materials tend to be manufactured into informal or expedient tool designs (Bamforth 1986). This trend is apparent whether the low-quality raw materials are in high or low abundance (Odell 2000, 2003; Andrefsky 1994). Correspondingly, high-quality materials tend to be manufactured into formal varieties of tools. This is particularly true when the high-quality raw materials occur in low quantities or are found at distant locations (Andrefsky 1994).

The results of this model are applied to the Potter artifact assemblage to verify technological organization regarding the manufacture of formal and informal tools for each of the site's loci. This will evaluate the hypothesis that each of the locus occupations has a similar or differing technological organization of production decision characteristics.

Table 5.1 Relation between quality and abundance of lithic raw material and kinds of tools produced.

	High Lithic Quality	Low Lithic Quality
High Lithic Abundance	**Cell 1** Formal and informal tool production	**Cell 2** Primarily informal tool production Few formal tools made from non-local materials
Low Lithic Abundance	**Cell 3** Primarily formal tool production	**Cell 4** Primarily informal tool production from locally sourced material Formal tools made from non-local materials

Note. Adapted from Andrefsky (1994:30). Figure 2.

5.3.2.1 *Model applicability considerations and prior testability of usage*

This model that demonstrates the relationship between technology production decisions, in relation to formal and informal tool designs, was developed through the analysis of lithic assemblages from several pre-contact sites in the Western United States (123 sites) and Australia (5 sites) (Andrefsky 1994:24-29). The statistical analysis of the sites in the Rochelle Archaeological District in Campbell County, Wyoming; Calispell Valley site in Washington State; Pinon Canyon Archaeological Survey located in Las Animas County, Colorado in addition to the Australian sites demonstrated, that the availability and quality of lithic raw materials directly affected production decisions of tool types manufactured (Andrefsky 1994:30-31).

Andrefsky (1994:23) further generalizes the proposition advanced in this model, that relates high and low lithic abundance, high and low lithic quality to the type of tool manufacture, to the New England-Maritimes region with the following observations by Gramly (1983).

> *Archaeological evidence suggests that prehistoric populations had discarded formal tools made of high-quality lithic raw materials when fresh raw materials were close at hand. Gramly (1983) reported "dumping" behavior at a small habitation site outside of the Mount Jasper prehistoric quarry in New Hampshire. In this situation, it appears that a prehistoric group traveling from a distant location "retooled" at the quarry and moved on. In the process, they discarded formal tools, which may have been transported from as far away as northern Maine and New Brunswick (Gramly 1983:826). It is not known what the circumstances of travel were for the prehistoric population that retooled at Mount Jasper. Gramly (1983:825) notes that no evidence of major habitation-such as post molds, ceramics, or features-was present, and that the visit was probably transitory. The visit to the area appears to have been primarily for the acquisition of lithic raw material from the nearby quarry, although this has not been demonstrated* (Andrefsky 1994:23).

The results of this model presented here suggest that lithic raw-material availability is a significant factor in the organization of lithic technology. The proposition that lithic-production technology may be directly attributed to the quantity and quality of lithic raw material appears to have been tested and generalized sufficiently for use in the analysis of the Potter site's technological organization.

5.3.3 Technological organization: inferred activity and technological behavior (MANA)

An analytical process for the classification of chipped stone assemblages includes a methodology that groups artifacts into raw material type categories called nodules. These nodule groupings are then further subdivided based on some distinctive organizational unit such as variation in material coloration, geological properties, or grouping of artifacts into a core, tool, and debitage collection. Using this procedure, technological organization, material movement into, through, and out of a site, seasonal round locations and settlement patterns have been inferred (Larson and Kornfeld 1997). This analytical procedure, grouping artifacts by material type and other subgroupings, is referred to as creating minimum analytical nodules (MANs). Larson and Kornfeld (1997) employed (MANs), and their analysis (MANA) as a means of further understanding chipped stone technological organization. When noncultural site formation processes are excluded, variations in the configuration of MAN artifacts may be attributed to choices the site occupants made relative to their technological needs. The artifact pieces of one nodule share a specific group of features that differentiate it from those members found in another nodule of the same raw material type. In this case, different stone tool types can represent such a differentiating group of nodule features.

This model's methods and techniques of analysis involve a three-step approach. These steps are grouping tools, debitage, and cores into minimum analytical nodules; followed by morphological and metric analysis of stone tools, debitage, and cores; and finally, the characterization, regarding technological activities and organization, of the nodule component elements (Larson and Kornfeld 1997). The characterization of activities and lithic technological organization focuses on raw material use, production events, morphological typological classification, tool use, reuse, resharpening, discard, and other aspects. In cases where there is an absence or insufficiency of refittable pieces, MANA comparisons of variation in formal tools, expedient tools, and debitage within different MANs can yield information on Hunter-gatherer technological organization in addition to spatial inferences concerning the potential identification of intrasite activity areas.

Application of minimum analytical node analysis (MANA) process begins with the grouping of the artifact assemblage into MANs based on material type. As noted, in the case of Potter, the material types are rhyolite varieties, Munsungun and small numbers of unidentified cherts. The next level of subdivision further segments each of the raw material types based on identifying characteristics such as color, inclusions, and other traits including texture, background mineral matrix, flow bands, and entrained ringed or non-ringed spherules. Rhyolite from the site has been recognized as deriving from two distinct sources, both local, based on specific inclusions and banding characteristics. Following subdivision by identifiable node lithic characteristics, each nodule is then subdivided by production strategy. Production strategy segments include tools, debitage, and cores. Finally, the tools subsection is further segmented into bifaces such as preforms, points, and knives; unifaces taking the form of blades, end and side scrapers; and expedient tools produced from retouched flakes. The process described above for the development of MANs is diagrammed in Figure 5.1.

Upon completion of MAN configuration and characterization, inferences are then drawn that describe the activities that these nodule types represent followed by expectations of implied technological behavior organization. For purposes of inferring behavioral activity and technological organization, MANs are represented by one of two basic classifications: single and multiple item nodules. Within these two variations, each node is characterized based on artifact presence or absence. Single item nodules SINs; consist of a single tool or piece of debitage. Multiple item nodules MINs; consist of either multiple pieces of debitage or a combination of multiple tools and debitage.

With the artifact assemblage tool types subdivided by material type and arrayed in SINs and MINs, Larson and Kornfeld (1997) predict that on-site activity behavior can be predicted in conjunction with broader implications of technological organization. Larson and Kornfeld (1997) grouped on-site activity behavior into four categories or scenarios which follow.

Scenario 1

If a MAN consisted of a single tool artifact and was not subjected to further on-site reduction processes including sharpening, the piece was potentially transported from another location. This artifact may or may not have been used in habitation activities; however, it was subsequently discarded at the site. The tool's presence in the site's archaeological record may have resulted from the unintended loss or intentional discard of a curated item (Larson and Kornfeld 1997). Without other reduction flakes in evidence, it is unlikely that this tool was manufactured or maintained at the site. This being the case, the technological behavior inferred from this type of nodule implies "no on-site maintenance and long-term tool curation with discard at the find location."

Scenario 2

A single flake MAN is defined as indicative of a case where a single resharpening flake was deposited. The behavior inferred from this MAN configuration includes one episode of resharpening, resulting from on-site maintenance of the tool that is not part of the assemblage. One potential inferred implication for the technological organization includes, "continued tool maintenance and curation" (Larson and Kornfeld 1997).

Scenario 3

MANs containing multiple instances of debitage only, suggests that a tool or some other lithic artifact was produced or maintained on location, and at some later date was removed from or brought to another part of the site. Such activities imply local tool production and/or on-site maintenance with tool or raw material curation.

Scenario 4

Multiple item MANs that contain tools or tool fragments in addition to debitage infers on-site production, use, and discard of the tools as well as their production debris. Technological implications inferred from this nodule configuration include both tool production and expedient on-site use (Larson and Kornfeld 1997).

Single item nodules (SIN) are more likely to have been manufactured elsewhere, brought to, and discarded at the site because there is no accompanying byproduct of their manufacture in evidence. Multiple item nodules (MIN), in contrast, presumably represent on-site manufacture. The entire range of nodules at a given site provides an insight into the segmentation of lithic activities in space and time (Sellet 2006).

Each of the above-described MAN configurations, instances of SINs and MINs, including their constituent artifact compositions with implied behavioral activities and technological organization is diagrammed in Table 5.2. Curated tools are produced and maintained within a technology for future use. Curation also refers to items manufactured at another location, maintained within the technology, and introduced into the site as finished tools. Expedient tools are manufactured, used, and discarded at the same location. The terms curation and expedient use of tools noted in Table 5.2 follow Binford's (1979) "curation-expediency" model.

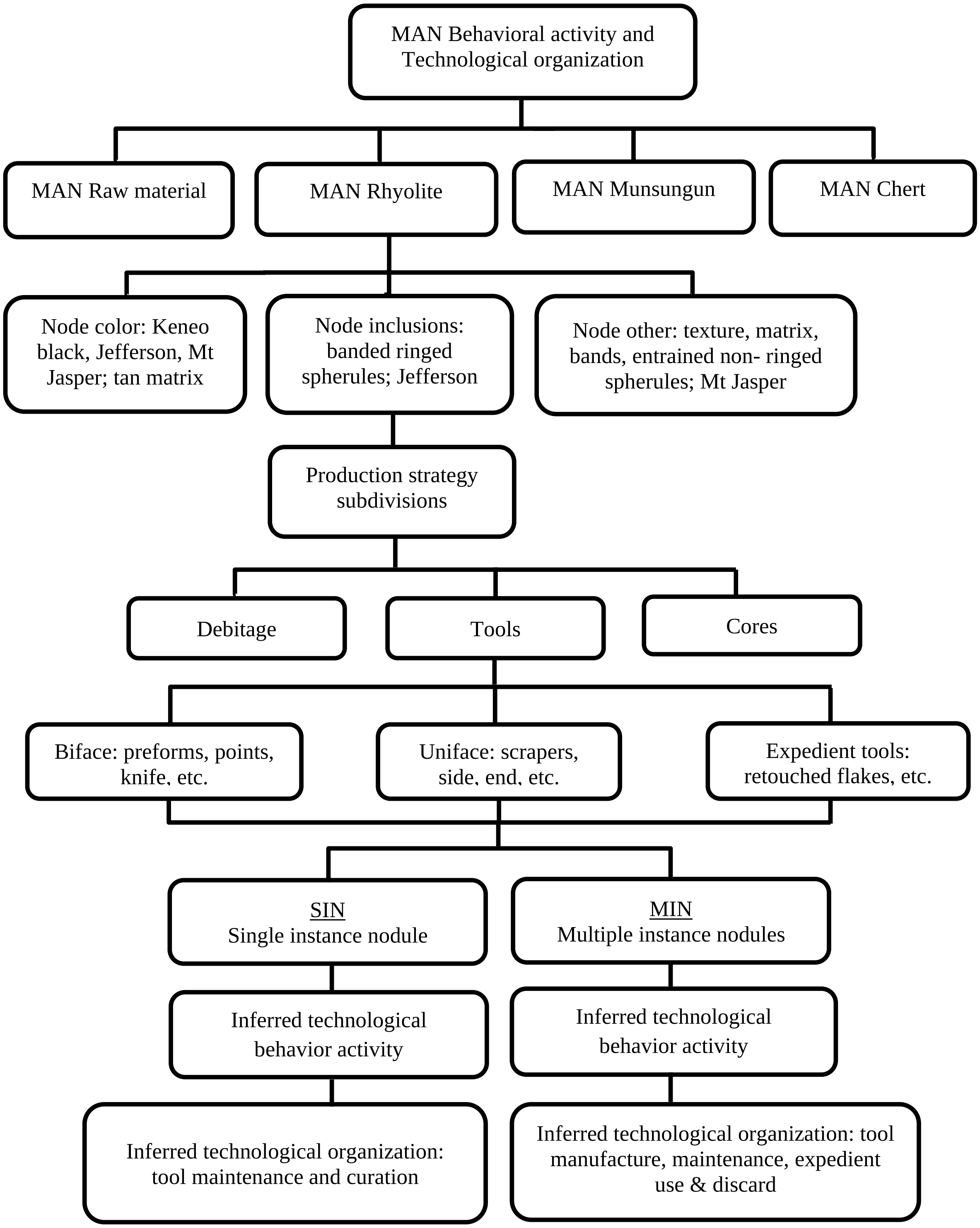


Figure 5.1 Example of the characterization sequence of MANs and their inferred behavioral activities that include implied technological organization. (Constructed by Rusch from Larson and Kornfeld, 1997 data description pp. 10-12)

Table 5.2 Node types based on artifacts contained within the nodule.

Type of nodule	Single item nodules	Single item nodules	Multiple item nodules	Multiple item nodules
Artifact found	Tool	Flake	Debitage only	Debitage and tools
Inferred behavioral activity	No on-site maintenance	On-site maintenance or resharpening of removed, curated item	On-site production and maintenance of removed, curated items	On-site production, maintenance, use, and discard
Technological organization	Tool curation with on-site discard	Tool maintenance plus curation	Tool production /maintenance with core and/or tool curation	Tool production, maintenance, and expedient use of tools

Note. Adapted from Larson and Kornfeld (1997:11).

The results of this model are applied to each locus of the Potter lithic artifact assemblage to infer behavioral activities and technological organization by the application of MANs and minimum node analysis (MANA) to each of the site's loci.

5.3.3.1 *Model applicability considerations and prior testability of usage*

Larson and Kornfeld (1997) developed and refined the MANA process as an aid to the refitting technique. They remarked that "anyone who has spent time refitting realizes that, after the first few easy fits, the success of refitting diminishes markedly" (Larson and Kornfeld (1997:4). The model was developed and tested from interpretations based on MANA investigations in the Northwest Plains, the adjacent Rocky Mountains, and intermountain basins. They applied the MANA analytical techniques to three different archaeological sites which are given as examples. Two of the sites, Laddie Creek and Lookingbill, are deeply stratified, foothill and mountain localities. The third site is known as Henn site and is located at the foot of the Teton Range in Jackson Hole Wyoming.

Knell (2012) applied and tested minimum analytical nodule analysis (MANA) as a tool to evaluate local-scale patterns of lithic technological organization in the Late Paleoamerican Cody complex Locality I and V components at the Hell Gap site, Wyoming. Sellet (2006) also evaluated the technique at Hell gap Locality 1. The Hell gap site is a series of localities situated in a small valley that opens onto the plains of southeastern Wyoming. Further testing and application of MANA were performed by Hall (2004) at the beehive site in Wyoming.

One of the problems in using the model revolves around the nature of the raw materials and the ability to separate them into nodules. Raw materials provide the "initial round" for nodule sorting, and if the material is difficult to differentiate, it will be difficult to identify the nodules. In general, the Potter site's material types, i.e., Mount Jasper and Jefferson rhyolites, as well as Munsungun chert can be differentiated.

While most of the testing was done on sites in the Western United States, there is nothing in the model that is unique to location or geography. The model's interpretation is based upon quantities and types of flaked stone artifacts. Therefore, this model's applicability to evaluating patterns of the lithic technological organization at the Potter site appears to be relevant.

5.4 Temporal aspects of site habitation modeling

Models to aid in developing inferences concerning temporal aspects of site habitation described in this section include those for determining: cultural horizon and date of site occupation; individual locus occupation dates; length of stay at each locus (occupation span); single or reoccupation of locus and site; and number of cultural occupation horizons identified at the site. In order to investigate the aforementioned temporal aspects of Potter's site habitation, qualitative typological, morphological and diagnostic trait models in addition to quantitative proxy variable mean per capita occupation span (Surovell 2009), circular ring area regression Yellen's (1977), and tool loss models (Mc Ghee 1979; Spiess 1984), development, as well as function, are discussed.

5.4.1 Typological morphological model

Typology, or ordering objects into discrete categories, indicates a system of types that are defined by two or more attributes (Odell 1981). Lithic artifacts can be typologically classified according to the technique of manufacture, specific modal measurement attributes, morphology, or use/function. The most popular and basic classification methodology is the form or shape of the finished artifact. The main aim of typology is to enable comparisons to be made between the material from one site and that from others. Artifact classifications have customarily served to order archaeological assemblages in time and space (Odell 2003). However, shape alone is insufficient as the criteria for classification. When developing criteria for a typology, shape does, in fact, contribute to classification, but other factors are also necessary to be maximally useful. Such a typological system must have at least one other quality besides shape such as technology as in reduction trajectory, type and location of retouch edges, modal measurement attributes, or microwear to indicate function (Odell 2003).

The typological morphological model applied to the Potter lithic projectile point assemblage is a regionally specific type (Bradley et al. 2008). It was developed based on recognizable New England-Maritimes diagnostic projectile point morphologies and specific modal measurement attributes. Its development was intended to indicate significant variability between each time and spatial category as well as its modal traits (Bradley et al. 2008). In addition to the characteristic diagnostic shapes, four sets of attributes have proven most useful in defining these modal trait categories. These are, overall dimensions (Figure 5.2) as given by (a) length, (b) medial width, (c) basal width and thickness. The specific projectile point type face angle (e) is defined by the degree of divergence or convergence of its sides. The basal treatment is characterized by the presence or absence of ears, basal depth (d), and shape. And lastly, the observed presence or absence of the point's fluting and flute length. Figure 5.2 illustrates how several of these measurements were made.

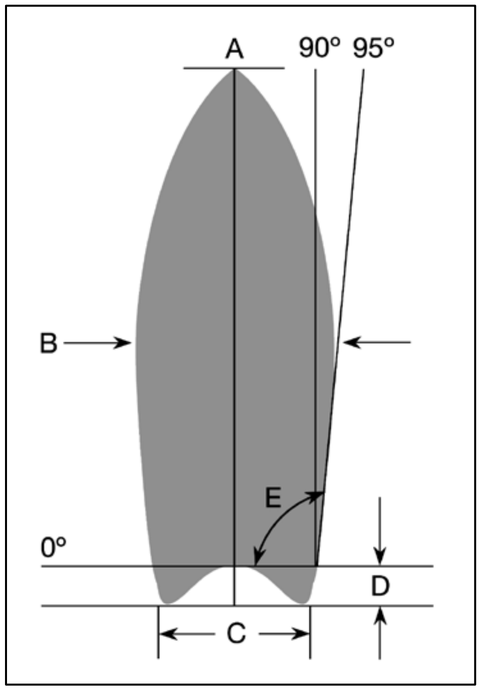


Figure 5.2 Projectile point measurement attributes.
(From Bradley et al. 2008:124. Figure 3)

5.4.1.1 *Model applicability considerations and prior testability of usage*

Research in the New England-Maritimes region has identified ten Paleoamerican sites with accompanying radiocarbon dates. Six are in Maine (Vail, Hedden, Michaud, Cormier, Esker, and Varney), three are located in New Hampshire (Whipple, Colebrook, Weirs), and finally, the Neponset site, is located in Massachusetts (Bradley et al. 2008). These, plus a few additional dated sites from elsewhere in the region (Bradley et al. 2008), provide a chronological framework of evidence for temporal and spatial dating in addition to examining how the projectile point morphology changed between 13,000 and 10,000 years ago (Bradley et al. 2008). ^{14}C dates related to specific sites are listed in radiocarbon years (BP), however, for easier reference, discussion of these dates includes calibrated, or calendar, years before present (cal yr. BP).

This model proposes definitions for eight Paleoamerican projectile point forms for the New England-Maritimes region. These are Kings Road-Whipple, Vail-Debert, Bull Brook-West Athens Hill, Michaud-Neponset, Crowfield-related, Cormier-Nicholas, Agate Basin-related, and Ste. Anne-Varney. These defined point forms are illustrated in Figure 5.3. The developers of this typology and derivatives (Bradley et al. 2008; Lothrop et al. 2011), did not put these point forms forward as formally defined "types" but rather as modal, or common, forms recognizable across the region. The descriptions are based on specific attributes and measurements recorded from one or more sites that best represent the characteristics of that regional style. Defining the typology in this manner provides a way to acknowledge the geographical extent over which a particular style has been documented (Bradley et al. 2008). In constructing these categories, it has been found that distinct variability can occur within them. For example, the Vail-Debert category is based on the assemblages from both sites. This is not to imply that the points from these two sites are identical. They are not, but they are more similar than dissimilar. The same holds true with the Nicholas-Cormier category (Bradley et al. 2008).

Using definitions for the New England-Maritimes Paleoamerican projectile point typology and accompanying radiocarbon dates, spatial and time associations can be made. Spatial associations are defined by the geographic location of the point type, and time by the chronological positioning within the Paleoamerican culture horizon. The early Paleoamerican period, whose chronology ranges between 12,900 and 12,200 years before present, is defined by the Kings Road-Whipple, Vail-Debert, and Bull Brook-West Athens Hill point types.

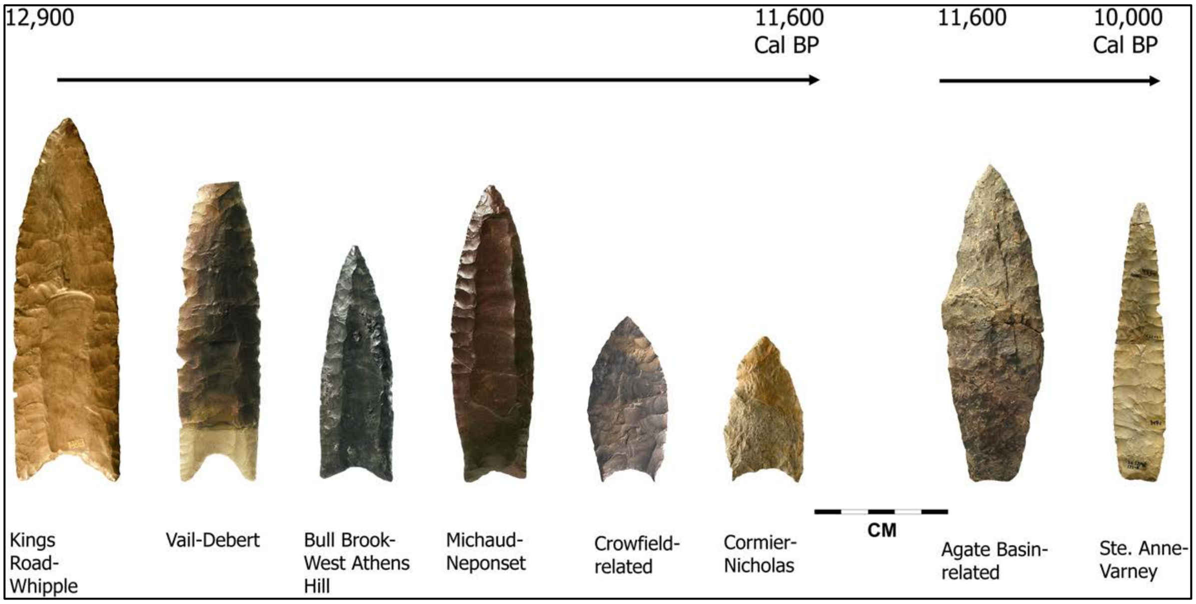


Figure 5.3 Sequence of New England-Maritimes region Paleoamerican biface forms, including fluted points during the YD 12,900-11,600 cal BP and unfluted points, post-YD 11,600-10,000 cal BP. (From Lothrop, Newby, Spiess, & Bradley 2011 Figure 6.)

The middle Paleoamerican period, with a date range of 12,200 to 11,600 years before present, is defined by the Michaud-Neponset, Crowfield-related, and Cormier-Nicholas types. Lastly, the late Paleoamerican period, with a date range of 11,600 to 10,800 years before present, is defined by the Agate Basin-related, and Ste. Anne-Varney types. The relationship expressed above is tabularized below in Table 5.3. For a regional reference comparison, Great Lakes point types are also noted in the Table.

Diagnostic artifacts from the Potter assemblage were analyzed against this typological morphological model to determine the temporal aspects of the site habitation. These temporal traits include the date of site occupation, individual locus occupation dates, and the number of cultural occupation horizons identified at the site.

Table 5.3 Summary of New England modal point form types and chronology.

Chronology	New England – Maritimes region point type	Great Lakes region classification
Early Paleoamerican		
12,900-12,200 cal yr. BP (11,000-10,300 BP)	Kings Road – Whipple (12,900-12,700 cal BP)	Gainey
	Vail – Debert (12,700-12,200 cal BP)	None
	Bull Brook –West Athens Hill (12,700-12,200 cal BP)	Butler
Middle Paleoamerican		
12,200-11,600 cal yr. BP (10,300-10,100 BP)	Michaud – Neponset (12,200-11,800 cal BP)	Barnes
	Crowfield – related (Age indeterminate)	Crowfield
	Cormier – Nichols (11,800-11,600 cal BP)	Holcombe
Late Paleoamerican		
11,600-10,800 cal yr. BP (10,100-9000 BP)	Agate Basin – related (11,600-10,800 cal BP)	Agate Basin/Plano
	Sainte Anne – Varney (10,800-10,000 cal BP)	Eden/Plano

Note. Adapted from Bradley et al. (2008) and modified Lothrop et al. (2011).

5.4.2 Occupation cultural horizon dating

The Paleoamerican era in the New England Maritimes region of the United States is generally accepted to have existed between 13,000 cal yr BP and 10,000 cal yr BP (Lothrop et al. 2016). As a further refinement Lothrop et al. (2016) in addition to other researchers, segmented this almost 3000-year cultural Horizon span into three time-delineated sectors. During each of these Paleoamerican subdivision refinements i.e. early (13,000–12,200 cal yr BP), middle (12,200–11,600 cal yr BP), and late (11,600–10,000 cal yr BP), studies have produced differences in lithic technology organization, subsistence, and settlement patterns (Bradley et al. 2008; Gramly and Funk 1990; Lothrop et al. 2016). However, throughout the entire cultural horizon, there were a group of diagnostic traits that defined this era.

During the entire Paleoamerican era in the New England Maritimes there existed a core tool and flake industry as characterized earlier. Projectile points that exhibited fluting or basal thinning distinguish the Paleoamerican era in the Northeast from its earliest beginnings until its latest horizon (Gramly and Funk 1990). Sometime after middle Paleoamerican into the late period fluted points found in the early and middle horizons in the northern regions of the Northeast and adjacent Quebec and Ontario were succeeded by unfluted, collaterally-flaked, basally-thinned projectile points resembling the Plano form (Bradley et al. 2008; Gramly and Funk 1990; Lothrop et al. 2016).

Table 5.4 portrays a summary of the New England-Maritimes (NEM) Paleoamerican lithic tool diagnostic traits that form the basis for a qualitative heuristic model to evaluate the Potter site's occupation horizon.

Table 5.4 Paleoamerican NEM lithic tool diagnostic traits.

Diagnostic Trait	Presence/Absence
Projectile point/knife fluting on both faces from carefully prepared platforms. (Early and mid-Paleo horizon)	P
Channel flakes found in tool manufacturing artifacts and debris. (Early and mid-Paleo horizon)	P
Preform thinning by medial percussion flaking.	P
Points received no additional thinning after fluting. (Early and mid-Paleo horizon)	P
Lateral grinding evident from midsection to basal ears.	P
Basal grinding common.	P
Late Paleo horizon points are basally thinned but not fluted.	P
Local and nonlocal tool stone sources.	P
High-quality lithic material	P
Spurred end scrapers	P

Note: Fabrication or production sequences of various modal types of the New England Maritimes projectile points. (Adapted from Bradley et al. 2008:122-124, 161-162.)

A typological/morphological model, in addition to the Paleoamerican lithic tool diagnostic trait model, is employed to further refine the specific loci's date of occupation. The Paleoamerican lithic tool diagnostic trait model provides additional detail that includes fabrication and production statistics for the various modal types of projectile points from the NEM region.

Within certain geographic regions of the NEM variations among point types are thought to be a temporal progression involving the following attributes: base edge angles; the number of channel flakes on each face and length; thickness; basal concavity shape and finish; and basil ear shape (Gramly and Funk 1990).

5.4.3 Temporal aspects of site habitation: length of stay

5.4.3.1 Surovell mean per capita occupation span model

The Temporal settlement trait of the occupation pattern modeled in this section addresses the length of occupant stay at each locus. Surovell's (2009) quantitative mean per capita occupation span model is used in the determination of the interpreted length of stay at each locus.

This model intends to address the issue of site and locus occupation span using a quantitative methodology of artifact accumulation that allows the estimation of average per capita occupation span from lithic assemblages (Surovell, 2009). Occupation duration is calculated from the ratio of transported versus locally acquired flaked stone artifacts which is directly quantifiable from the lithic artifact record of the excavated site. The logic of the model follows below.

The model's development starting point is Schiffer's (1987:33) discard equation solved for occupation span:

$$t = \frac{L}{S} d_t$$

where t is the occupation span, S is the number of artifacts maintained in a systemic context, L is the average use life, and d_t is the number of a given type of artifact discarded as a function of time.

In this model, the occupation span is defined as the time elapsed from the arrival of the first occupant at the site to the departure of the last for any continuous habitation. Occupation intensity is defined as the sum of all time spent at a site for all inhabitants and is measured in a unit of person time, that is, person days (Surovell 2009). Because people join and leave the occupying band at different time intervals, thus changing its composition, occupation span is calculated on an average or mean basis. Therefore, from the above definitions the dependent variable, per capita occupation span, can be defined as the average length of stay per site occupant and used to determine the temporal settlement trait, length of stay at each locus. The model's unit of calculation is based on a per capita or person occupation span. Therefore, its computation is independent of the overall quantity of occupants (Surovell 2009).

Application of this model requires that there be at least two classes or types of lithic artifact material to be analyzed in conjunction. In the case of Potter, the lithic assemblage is composed of artifacts manufactured from a local material, identified as Mt. Jasper and Jefferson rhyolites, in addition to those fabricated of material from remote geographic source locations. Remote or exotic materials, as they are sometimes labeled, are somewhat arbitrarily defined as being from material sources located greater than 20 km from the site under consideration (Surovell 2009:78). This measure represents the distance that can be covered on foot; perform lithic material collection and reduction, and finally returning to the site all in one day. The artifacts made of remote source material were most likely imported into the site during the provisioning stage of habitation, trade, or from occupants who joined the band or group subsequent to site formation. The composition of the remote location lithic source material found at the site is Munsungun chert and other unidentified cherts.

Class (a) artifacts types are characterized as nonlocal raw material in the form of debitage, cores, bifaces, channel flakes, expedient flake tools greater than eight grams in weight, and points introduced into the site from remote locations. This class represents the number of artifacts in the toolkit at the start of site occupation and those manufactured on location from imported remotely sourced materials during the habitation period. Class (b) types are defined as lithic artifacts in the archaeological assemblage, that is also found in the form of debitage, cores, bifaces, channel flakes, expedient flake tools greater than eight grams in weight, and points, produced from local Jefferson rhyolite material. Over time the tools that were imported into the site and those produced locally from preforms of class (a) materials, will be consumed through use. As consumption progresses, these original tools will be replaced with implements manufactured from the local class (b) material.

Therefore, mean occupation span can be expressed using countable lithic tool artifacts of differing material that were recorded in the excavation database, as proxy variables in addition to a simple ratio calculation as denoted in Equation 5.1.

Equation 5.1 $$\text{Mean occupation span } (t) = f\left(\frac{\text{Class (b) artifacts}}{\text{Class (a) artifacts}}\right)$$

Mean occupation span is then a function of the ratio of the proxy variables, defined by local class (b) and remote class (a) artifact materials (Surovell, 2009).

Surovell (2009:76) formalizes this functional relationship with the following equation 5.2 based on cumulative artifact discard rates.

Equation 5.2 $$\frac{d_{bt}}{d_{at}} = \frac{kt}{u\left(a_0 - a_0 e^{-\frac{t}{u}}\right)} - 1$$

In this formulation d_{at} is the cumulative number of class (a) artifacts discarded as a function of time and d_{bt} is the cumulative number of class (b) artifacts discarded as a function of time. Also, a_0 is the number of artifacts of class (a) in a tool kit at time zero or start of occupation, u is the mean use-life of an artifact, and k is the optimal tool kit size. Additionally, the following assumptions are made: discard is probabilistic and is a function of use-life, the mean use-lives of transported and locally acquired artifacts are equal, and once class (a) artifacts are discarded, they are always replaced with class (b) artifacts (Surovell 2009).

Therefore, the ratio of class (b) local to class (a) transported artifacts provides a measure of mean occupation span as both discard rates change as a function of time (Surovell 2009).

The model predicts that as occupation span is lengthened, archaeological assemblages will become increasingly dominated by artifacts manufactured locally. The equation for mean occupation span of the ratio of class (b) to class (a) artifacts versus time is depicted in Figure 5.4.

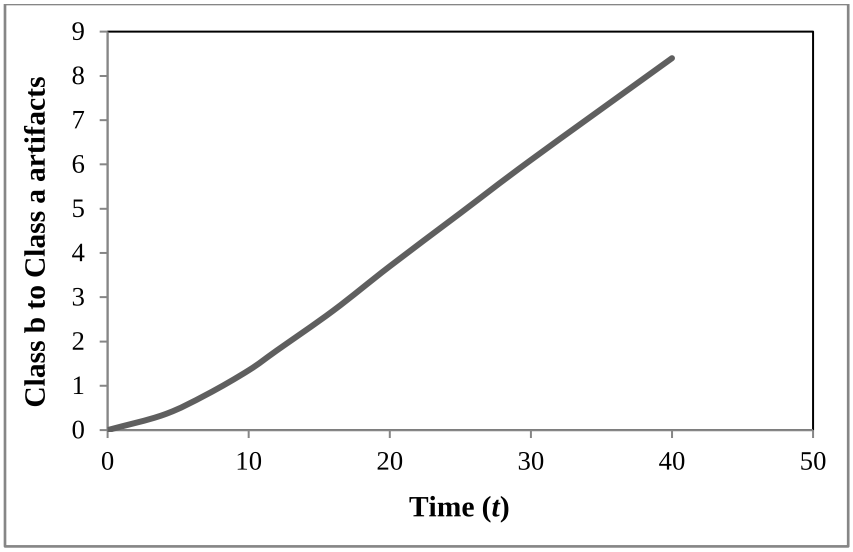


Figure 5.4 Mean occupation span derived from the ratio of class (b) to class (a) artifacts versus time. (Adapted from Surovell, 2009:76. Figure 3.3)

As can be observed from the graph class (b) artifacts become almost linearly increasingly numerous as occupation span increases. The reciprocal of the equation (not shown), demonstrates that very short-term occupations will be dominated by class (a) artifacts and also shows that the ratio of class (a) to class (b) drops rapidly as the occupation duration lengthens (Surovell, 2009).

To meaningfully apply this model or any variation developed from Schiffer's (1987) discard equation, the effects of the initializing variables, a_0 or number of artifacts of class (a) in a tool kit at time zero or start of the ccupation, u the mean use-life of an artifact, and k the optimal tool kit size, must be taken into consideration. In general, a tool kit is composed of numerous tool types, each having different and varying probabilistic use-lives (Shott, 1989a). Because the differing use-lives and systemic numbers of artifacts at a site estimated to be 12,000 years old are at best rough estimates, and more likely not known, direct absolute time span determinations are problematic to predict. However, by calculating the ratios of the differing material artifact proxy variables and comparing such measures across a range of sites allows for their ordinal ranking

(Surovell, 2009). As an example, kill and butchering sites, from ethnographic and artifact records, are short term occupations that range from a day to at most a week in length. Through ratio comparisons, occupation spans developed using the mean occupation span model can be ordinally ranked to provide a calculation of the time span.

5.4.3.1.1 *Model applicability considerations and prior testability of usage*

Some issues are inherent in the applications of the mean occupation span model. First, it can be applied only to an assemblage that is composed of both local and nonlocal materials (Surovell, 2009). If one material type is lacking, the assumptions of the model are broken. In effect, this indicates that there would be either no transported or no local toolkit represented. Secondly, the possibility exists that some proportion of the raw materials treated as local were acquired before a site's occupation. Therefore, it is possible that some of the lithic material present may have been imported from a previous campsite or quarry visit. Acknowledging this, all raw materials that are locally available, for purposes of use of this model, are treated as locally acquired, and all raw materials not locally available are treated as transported into the site from a previous residential occupation (Surovell, 2009). Thirdly, the indicated output result of the model is a relative and not an exact number because of the variations possible in the starting initial condition parameters. The model and variations of it do a credible job of differentiating between occupation spans of a group of loci regarding short, medium, or long-term occupations (Surovell, 2009).

Furthermore, the relative values of the model can be calibrated by known ethnographically developed occupation spans such as kill sites or other comparative site types. However, in the calibration process intensity of site usage must be considered. For example, activities at the kill site tend to be more intensive than those at a habitation site (Bradley B. personal communication 2015).

Surovell (2009) developed and tested this model with data that originated from Paleoamerican and Archaic horizon sites. The sites examined were: Carter/Kerr-McGee, Agate Basin, Krampotich, Barger Gulch, Upper Twin Mountain, Bobtail Wolf, Cooper Lower Kill, Cooper Middle Kill, Hansen, Lake Theo, and Mill Iron, that are located in the Western United States. Surovell (2009) further tested the model successfully at the Puntutjarpa rock shelter in the Western Desert of Australia. The data used in this model is composed of material types and flaked stone artifact quantities that are not geographically specific. The model, therefore, should apply to Paleoamerican sites throughout the country. Since its introduction by (Surovell, 2009) the model and its derivatives have also been applied to sites on the East Coast of the United States by Gingerich (2013: 15-16), Kitchel (2016), and Rockwell (2014).

5.4.3.2 Yellen's ring model length of occupation

Yellen (1977) proposed a model consisting of two concentric rings or areas. The inner ring area corresponds to the location of the hut circle and is dependent on group size. The outer ring area, where special activity areas reside, primarily reflects the length of time a camp is occupied. Special activity areas consisted of places were activities such as meat drying, skin preparation, roasting, quiver making, and guest quartering occurred (Yellen 1977:125-130).

The model was developed from artifact and feature remains of 16 !Kung camps. Variables considered in its development were areas and groupings for total camp, resident huts, special activities, limits of scatter, and artifact richness as calculated from Shannon-Weiner function (Yellen 1977:125-130).

Using these variables and the 16 site data-set, Yellen (1977) performed several correlation regression analyses finding that the inner ring area was a correlated function of social units such as population and the outer ring special activities area correlated with length of occupation (r = .67). Interestingly, correlation of length of occupation to richness was quite low (r = .184).

Yellen's (1977:130) linear correlation ring model takes the following construct if presented in an archaeologically useful form. With time as the dependent variable, the length of occupation is given by Equation 5.3.

Equation 5.3 $\text{Number of occupation days} = 0.1(area) + 1.87$

When applying the model to lithic scatters Yellen (1977:131) observes the following:

> "*With only a seemingly meaningless scatter of stone tools and faunal remains when is it useful to think in terms of "rings?" I would suggest several guidelines. First, I would see if fairly distinct clusters of debris are present or if all material is randomly distributed across the site. If such clusters are definable, I would measure the size and richness of each and then determine similarities between clusters on the basis of specific kinds of remains. If activities were patterned along the !Kung model even though the activities themselves were quite different, one might predict the kind of cluster arrangement that would result. The larger, richer clusters would lie nearer the center of the site and would share basically the same components. Outlying clusters would likely be smaller and less rich… The more nearly the patterning of debris conforms to this ideal, the greater the likelihood that a ring analysis would produce meaningful results.*" Yellen (1977:131).

5.4.3.2.1 *Model applicability considerations and prior testability of usage*

Yellen's !Kung data served as the basis for studies of the relationship between population and settlement area in hunter-gatherer camps (Yellen 1977). Both ethnoarchaeological and archaeological research suggests that the common-sense assumption which this theory is based on is basically correct, i.e., more time and more people at a site results in the accumulation of more debris material (Nelson et al. 1994). From this Yellen created an abstraction for analyzing !Kung camp behavior, known as the ring model (Yellen 1977:125 – 131). As described above, Yellen's model used linear regression to relate population to the camp area.

However, as Binford (1983:319-324) commented, Yellen (1977) did not attempt to explain why the specific relationship functioned and why it failed to specify under what conditions it would be expected to be relevant. Binford tested the model with data from the Nunamiut Mask site and found discrepancies in its predicted results. Binford noted the result differences, but not their causes (Yellon provided the best fit solution to his data and not an explanatory model). Upon review of the model Whitelaw (1983) found that some of Yellen's (1977) application assumptions were suspect or incomplete. For example, one of the issues identified was that the spacing between the households was equally as important as the population and settlement area in the results generated. Yellen (1977) assumed constant spacing, but it was found that it could be variable based on family social relations between different camp organizations. Another difference was based on the assumptions that all hunter-gatherer groups organized in the ring configuration. It is later found that for some groups the configuration took on a linear formation (Whitelaw 1983). The configurations were judged as non-random (Spiess 1984; Whitelaw 1983).

Yellen (1977) did acknowledge that the fit of the model does vary (Yellen 1977:89 – 127). However, in his regression model, he assumed that the same organizational principles applied to all hunter-gatherer groups. He makes this assumption, even though the !Kung's small, rainy season, family camps and the large, dry season full band camps, represent different social situations (Whitelaw 1983:56).

In Whitelaw's (1983) review of Yellen's (1977) model, he remarked that two major points had been established that were relevant to the !Kung camp growth. 1) The ring model results are not especially valid for the !Kung's small camps. 2) The assumption of constant nuclear area spacing is unjustified, and that variation in spacing is highly dependent upon differences in social distances between occupants. Incorporating these two observations, Whitelaw (1983) proposed two models, each with inter-hut distances increasing with the number of social units in a camp. The first model, known as an accretion model, postulates that spacing alone is important. This model produces a linear growth in the camp area. The second model, an exponential variation on the ring model, postulates that family units are arranged around the perimeter of a circle. This model produces exponential growth in the camp area. Whitelaw (1983) opined that he would expect the first model to be particularly relevant to the small, rainy season camps, and the second to the large, dry season camps. In the evaluations of his models, Whitelaw (1983) included additional statistics from several other large !Kung and G/wi camps to the original Yellen (1977) !Kung data set.

The enhanced Whitelaw (1983) data set takes the shape of an open top parabola given by the equation 5.4.

Equation 5.4 $$Y = a_0 b^{cx}.$$

b represents the base that is raised to the cx power. The equations parameters a, and c, are constants, and in this case, the variable x represents the area of the locus or site depending upon the analysis to be performed. The above equation is a nonlinear function that symbolizes the shape of the data set and is known as an exponential best-fit form equation.

Figure 5.5 shows an example of a plotted data set with a best fit exponential equation expression indicated by the continuous blue line representing the data trajectory. It should be taken into account that linear and nonlinear function transformed logarithmic regressions are all descriptive models designed to produce an equation giving the best fit to the specific data set. The actual parameters of the equations should, therefore, be a good fit to the site under investigation, but they are not explanatory models per se. It would be expected that the actual relationship at sites could move between the accretion and the exponential best fit ring model upon shifting from small to large camps based on the area (Whitelaw 1983:57).

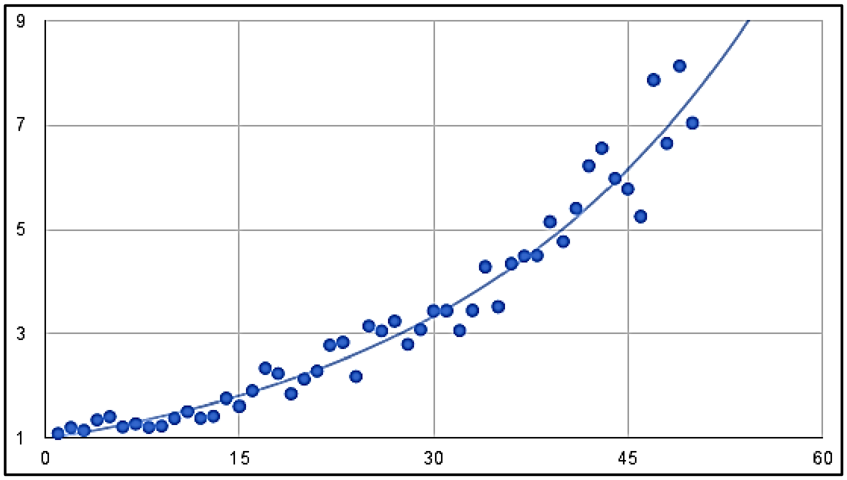


Figure 5.5. Example of a nonlinear function representation of a data set. The solid blue line represents a best fit exponential expression of the plotted data set.

Equation 5.5 expresses Whitelaw's (1983) exponential best-fit form equation with its a and c coefficients included. Not having access to the original or Whitelaw's (1983) expanded data set, the coefficients for a and c are derived from Yellen's intercept and slope coefficients and then were substituted into the nonlinear function (equation 5.5). Equation 5.6, the accretion model, postulates that spacing alone is important. This model produces a linear growth in the camp area and was deemed useful for smaller sites or loci by Whitelaw (1983).

Equation 5.5 $\text{Number of occupation days} = 1.87b^{.1*(area)}$ Exponential form

Equation 5.6 Number of occupation days = .1*(area) + 1.87 Linear form.

Application of the Whitelaw's (1983) exponential best fit (and log-log transformation) variation of the ring and linear model expressed in the equations 5.5 and 5.6 will only be used on the Potter and comparison site data as an indicator of relative occupation span for each of the site's loci. That is, occupation span will be indicated on a relative scale as short, medium, or long and not an absolute value. This broadened interpretation is employed to compensate for data set variation between sites.

5.4.3.3 Length of occupation from a tool loss calculation model (Mc Ghee 1979, Spiess 1984)

Comparing reoccurring regularities in activity area distribution pattern, size and lithic artifact assemblages at the Vail, Bull Brook, Debert and Koliktalik Paleoamerican sites, Spiess (1984) employed a heuristic model with a tool loss per day metric to estimate person day occupation spans. Earlier, Mc Ghee (1979) made a rough tool loss calculation for his work at the Arctic Small Tool Tradition Cold Sites. The technology of the sites that Spiess (1984) compared were characterized by care in workmanship, use of high-quality cherts and flints, variety of tool forms, multiple functionality, and small sizes. This particular technological organization was thought to be similar to that of the McGhee's (1979) and Abri Pataud (Spiess 1979) sites and similarly comparable regarding tool loss calculation estimates. Tool loss deposition derives from at least three sources; direct loss, discard of tools made poorly in manufacture, and discard of consumed unusable artifacts (Spiess 1984). The Potter site also shares this technological organization and can make use of the tool loss estimate model as an alternate methodology for calculating occupation span.

Ratios for the length of occupation from the tool loss model defined by Mc Ghee (1979) and Spiess (1984) were 1/2.5 to 1/3 per person day or one tool loss in every 2.5 to 3 days. Occupation spans estimates based on the application of tool loss ratios per person day must also take into account band size. Ethnographic analogs compare New England Maritimes Paleoamerican bands to Arctic caribou hunters that lived in small band groups of 30 to 60 people (Spiess 1984). This small band group estimate is further apportioned by the number of habitation loci identified at the site. A conservative estimate of inhabitants per locus is five ranging to 10 persons (Spiess 1984). Spiess (1984) calibrates this methodology as having the potential to vary by some factor among Paleoamerican sites or activity areas.

5.4.3.3.1 *Model tested applicability considerations and prior testability of usage*

Spiess (1984) tested this heuristic model on the assemblages from Vail, Bull Brook, Debert and Koliktalik Paleoamerican sites. Spiess (1979) also tested the model at Abri Pataud a French Upper Paleolithic site (Spiess 1979: 222-226). Similarly, Mc Ghee (1979) tested this model on his Arctic Small Tool tradition Cold Sites. Each of these tests yielded a usable relative result in a broad range of sites with some level of variability. Therefore, it applies to the Potter and comparison site assemblages as an order of magnitude check of other occupation span methods.

As noted above there is the potential for the results of this heuristic model to vary by some factor. Sources of this variability could conceivably occur from place to place, from season to season, and in proximity to a lithic source (Gramly 1980), let alone from culture to culture. Until further data become available, Spiess (1984) accepts the ratio of one lithic per three person-days as an order-of-magnitude estimate and assumes that it may vary by as much as a factor of two or greater among Paleoamerican sites or activity areas.

5.4.4 Temporal aspects of site habitation: detecting instances of locus reoccupation.

5.4.4.1 Detecting reoccupation: Surovell's (2009) regression correlation model

Single or multiple instances of locus occupation at the Potter site can be determined by the application of Surovell's (2009) model for detecting reoccupation in archaeological sites. The model for detecting the presence of multiple sites and locus reoccupations was develop using a component from Surovell's (2009) mean per capita occupation span model discussed above. This reoccupation model finds relevance in determining buried single component, deeply stratified sites with multiple components, and for the evaluation of surface collections (Surovell 2005).

By definition, for any set of positive numbers, its mean or average value is less than its sum. This simple mathematical relationship can be used as the basis for detecting the reoccupation of archaeological sites. This is because, for reoccupied sites, where the number of occupations is greater than one, the mean occupation span will be less than the cumulative occupations span (Surovell 2009). The development of this model uses two measures of occupation duration, i.e., cumulative occupation span and mean occupation span. In single occupations, where group membership is not extremely variable, the mean occupation span and the cumulative occupation span will be the same or equal (Surovell 2009). Given this, the plot of a collection of sites comprised of single occupations would be expected to be represented by a graph of a straight line where its x values equal its y values or $x = y$, having a slope of one, and a y-intercept of zero. The x-axis is identified as the cumulative occupation span and the y-axis as the mean occupation span. In the case of sites with multiple occupations, the mean occupation span would not be equal to the cumulative occupation span but would be less (Surovell 2009). A site composed of multiple occupations would not fall on or near the graph of the line ($y = x$), because of the inequality between mean and cumulative span values. Re-occupied sites would fall to the right of that line, i.e., $y < x$ (Surovell 2009). Graphically, Figure 5.6 represents the relationship described relating cumulative occupation span and mean occupation span. Reiterating, this model is based on distinguishing between single occupations and multiple occupations by using the relationship between cumulative occupation span (x-axis), mean occupation span (y-axis) and the relationship $y = x$.

Applying the model archaeologically is not as simple a matter as the relationship $y = x$, because mean and cumulative occupation spans are not directly known and can be estimated only using proxy variables (Surovell 2009). For practical implementation of the model, proxy variables must be substituted for both the cumulative occupation span (x-axis), and mean occupation span (y-axis) (Figure 5.6).

Using values from the excavation artifact record database, ratios of local to nonlocal raw materials and debitage to nonlocal tools provide proxy measures of the mean per capita occupation span (y-axis). Horizontal artifact densities can be used as a proxy for cumulative occupation span because the occurrence of multiple occupations leads to greater numbers of artifacts per unit area

(Surovell 2009). Artifact density provides the proxy measure for the cumulative occupation span (x-axis).

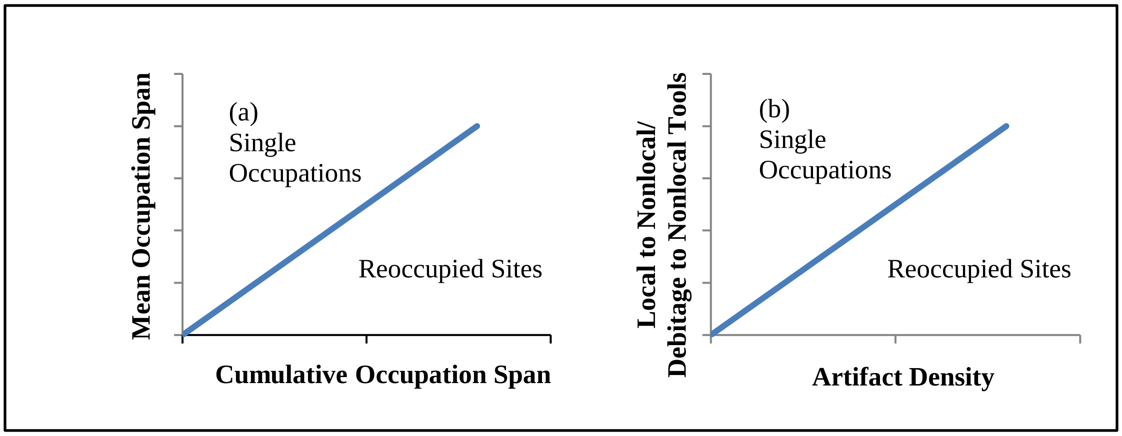


Figure 5.6 (a) Model for distinguishing between single and multiple occupations using the relationship between cumulative occupation span and mean occupation span. (b) The same relationship is shown with proxy variables substituted for generalized variables. (From Surovell, 2009:100. Figure 4.1)

The index occupation span index (OSI) is a smoothed measure of mean per capita occupation span and is created by normalizing and averaging the ratios of local to nonlocal material and debitage to nonlocal tools for each of the sites in the data set into which the Potter statistics were included (Surovell 2009). Surovell (2009) explains, "*to calculate OSI, values for each ratio are transformed to values ranging from 0 to 100 by standardizing each observation (dividing by the largest observation) to the largest for that variable and multiplying by 100. The two values are then averaged*" (Surovell 2009:102).

In summary, the proxy variables developed from the known artifact record that must be substituted to make the model usable are artifact density for the cumulative occupation span (x-axis), and OSI for the mean occupation span (y-axis). As a final transformation to aid in graphically displaying the calculated values of OSI and artifact density, both are logged (ln) to the base e. With the substitution of these proxy variables and log transformation, the model based on distinguishing between single occupations and multiple occupations by using the relationship between cumulative occupation span and mean occupation span is usable for application.

In dealing with the issue of Paleoamerican reoccupation, the more narrowly defined concept of a single occupation campsite, as opposed to the broader definition of a multi-locus site requires examination. One explanation offered by Surovell (2009) for the conclusion of single occupation sites is that the use of a specific campsite reduces its potential for future habitation. This occurs because of resource depletion in the immediate area and or an accumulation of debris and waste (Binford 1983). The depletion of firewood could make a location unsuitable for future habitation for many years because it would have a relatively long regeneration time (Moore 1987). The impact of resource depletion and trash accumulation on campsite suitability is proportional to occupation intensity (people multiplied by time). Surovell (2009) proposes a second and perhaps more likely explanation, and that is spatial congruity reoccupation is a very low probability event because there could be many suitable camping locations. These site opportunities occur even in very attractive areas of the landscape where the availability of resources is abundant. In running simulations, Surovell (2009) developed estimates based on a concentrated open regional occupation space and found that in 17 occupations of 50 hectares of available space and circular campsites of .25 hectares in area, the probability of having one overlap was only 50% in the 17 trials. Using the Folsom cultural horizon for this estimate, he found that, if the period lasted 800 years and such a location is reoccupied once every 50 years, approximately 16 campsites would be represented, and on average, zero or two would likely overlap. When the available area increases, the probability of reoccupation overlap drops (Surovell 2009).

5.4.4.1.1 Model applicability considerations and prior testability of usage

As was in the case of the mean occupation span model, there are some issues inherent in the applications of the detecting reoccupation regression correlation model. First, because the model uses occupation span as a proxy variable, it can be applied only to an assemblage that is composed of both local and nonlocal materials (Surovell, 2009). If one material type is lacking, the assumptions of the model are broken. In effect, this indicates that there would be either no transported or no local toolkit represented. Secondly, the possibility exists that some proportion of the raw materials treated as local were acquired before a site's occupation. Therefore, it is possible that some of the lithic material present may have been imported from a previous campsite or quarry visit. Acknowledging this, all raw materials that are locally available, for purposes of use of this model, are treated as locally acquired, and all raw materials not locally available are treated as transported into the site from a previous residential occupation (Surovell, 2009).

5.4.4.2 Detecting reoccupation: artifact distribution stratigraphy model

An alternative heuristic model using lithics for determining reoccupation in addition to the number of cultural horizons for a locus or site is constructed upon the stratigraphic artifact distribution or positioning, as well as assemblage diagnostic attributes. If there is clear evidence of a separation between assemblages' vertical distribution, this potentially suggests different depositional events occurred at the locus thus indicating reoccupation. However, if there is significant overlap in the stratigraphy of the assemblages or material type artifact distributions, potentially due to the effects from a possible exogenous event causing mixing of soil horizons, a multi-occupation hypothesis is not supported.

Diagnostic factors that may aid in determining deposition or cultural horizon variation of the stratigraphic deposits are variations in technological organization such as projectile point type morphology, craftsmanship, materials, debitage configuration as well as distribution, and assemblage composition. If, however, multiple technology organizations are evident in the assemblage, contemporaneous occupation may have occurred or mixing of soil horizons cannot be ruled out.

5.4.4.3 Detecting reoccupation: density of artifact and material type sourcing location model

Reoccupied sites may often be characterized, from a heuristic or trial-and-error field experience method, by high artifact densities coupled with relatively lower frequencies of local raw materials and debitage (Spiess et al. 1998; Gramly and Funk 1990). By way of example, consider that a site locus lithic artifact composition is two-thirds or more local felsic material and one-third or less of nonlocal chert. Also, consider, that the locus' nonlocal artifact density per meter square is moderate while the density of the local felsic artifact material is higher. By these two measures, indications are that the locus was not reoccupied.

5.5 Mobility patterns in hunter-gatherer settlement system and seasonal round modeling

5.5.1 Mobility of foragers and collectors in hunter-gatherer settlement system pattern modeling.

5.5.1.1 Maintainable-reliable technology mobility model

In Bleed's (1986) maintainability-reliability technology model he suggests a correlation between Binford's (1980) hunter-gatherer settlement system continuum of foragers and collectors and weapon system design goals. Bleed (1986) defines reliable weapon systems as those that ensure proper function when required. They are generally characterized as overdesigned; heavier and larger in size; have redundant components; exhibit a high level of craftsmanship; regular flaking patterns; high energy investment in knapping; are discarded and not repaired; made and maintained by specialists; and are produced and maintained during specified intervals different from use time (Bleed 1986). More reliable designs would be adopted by logistic collectors, who focus on specific large game or seasonally abundant game, in addition to following a schedule that has predictable time periods for tool production and maintenance tasks (Bleed 1986:739).

Maintainable systems are designed to be easily brought to a usable or functional condition and are characterized as portable and lightweight, and can function under non-optimal conditions. They also have evidence of extensive rework in the haft, show an absence of craftsmanship as indicated by irregular flaking patterns, are repairable and maintainable by the user, and maintained, repaired or repurposed during use without preplanned scheduling.

5.5.1.1.1 Model applicability considerations and prior testability of usage

Bleeds (1986) method to test the utility of these ideas for the interpretation of archaeological remains was to determine if ethnographic hunters make use of both maintainable and reliable weapons systems in situations for which they would be appropriate. The data sets examined and modeled were from the !Kung San, Yanomamo Amazonian, Nunamiut, and Central Eskimo summer caribou hunters.

The goal of this model is to establish how the Paleoamerican occupants of the Potter site utilized the landscape regarding residentially mobile foragers or logistical collectors by evaluating the technological design organization of their weapon system and toolkit.

5.5.1.2 Time minimization - resource maximization, weapon systems production technology model

The Bousman (1994) model links the distinctions between the stone tool technology of foragers and collectors by classifying residentially mobile groups as "time minimizer's" (Torrence 1983) who adopt more casual and less demanding tool production and maintenance standards. The technology used in the production of tools is more informal and based on flake blanks and irregular flaking patterns (Bousman 1994; Torrence 1983). Energy invested by forager time minimizes into the production of their tools is less than their collector counterparts. The flaking index indicates that the intensity of production effort is less than 0.25 for forager weapons system tools. Following the casual and less demanding tool design requirements theme, foragers practice expedient repair in their tool maintenance activities.

Groups that move residence infrequently but then again make logistical forays to procure specific resources are termed resource maximizers and focus on weapons efficiency (Bousman 1994). Resource maximization collectors' technological organization produces tools that are more formal and based on biface blanks and exhibit more patterned flaking (Bousman 1994). Energy invested by collectors into the production of their tools is greater than their forager opposites. Flaking index value of production effort is greater than 0.25 for resource maximizer collectors' weapons system tools (Bousman 1994).

The goal of this model is to establish how the occupants of the Potter site utilized the landscape regarding residentially mobile foragers or logistical collectors. This was accomplished by evaluating and classifying residentially mobile groups as "time minimizer's" (Torrence 1983) who adopt more casual and less demanding tool production and maintenance standards. The measure to accomplish this was flaking index value of production effort.

5.5.1.3 Tool use to-or replacement before exhaustion and make and mend technological models

In the same context as the Bleed (1986) maintainable and reliable systems model, Kuhn (1989) suggested a replace-before-failure strategy for extractive tools as a response to high risk during food acquisition by collectors. Kuhn's (1989) argument is that between residentially and logistically organized systems the use-life of tools varies, where foragers use tools to exhaustion, and collectors, concerned with failure, replace them before exhaustion with those in better condition.

This model is operationalized by comparing extractive tools used to exhaustion by foragers where extensive reworking and smaller size is observed with those of collectors who would replace before exhaustion and are characterized by signs of less rework and larger size.

As an adjunct or corollary model known as the "make and mend" by Bousman (1994), he proposes that forager weapons systems would show evidence of expedient repair and fewer broken points due to reworking. Evidence of less reworking and more broken points would be indicative of logistically oriented collectors gearing up tool production activity.

5.5.1.4 Core/biface ratio technological organization model

Bamforth and Becker (2000) refined, within a more narrowly defined hunter-gatherer life way, Parry and Kelly's (1987) model regarding a relationship between Plains Paleoamerican technological organization and regional patterns of land use. This model postulates that core/biface ratios may vary with increasing sedentism with no change in technology because sedentary communities produce and exhaust cores predominantly at a single location (Bamforth and Becker 2000). Within this model low core/biface ratios are often linked to high mobility while conversely; high ratios are correlated to more sedentary lifestyles.

In cases where the core/biface ratio is low, this relationship suggests that cores passed through the site more often than bifaces and were rarely discarded there (Bamforth and Becker 2000). They explain that this pattern probably points toward low failure and discards rates in core reduction relative to biface reduction in conjunction with brief site use. Application of this model provides an additional inference of the Potter site occupants' mobility pattern.

5.5.1.5 Mobility model based on toolkit design

Kelly and Todd (1988) suggested that residentially and logistically mobile Paleoamericans who shifted their range frequently would require a portable technology which could fulfill all their tool needs, including game hunting. Given that requirement, it could be expected that Paleoamerican stone tool assemblages would likely contain many bifaces (Kelly and Todd 1988).

Bifaces, if made from high-quality lithic material, can be crafted to have a sharp, durable edge that can be resharpened often (Goodyear 1979; Kelly and Todd 1988). Bifaces, as opposed to simple cores of similar weight, can produce more usable flake edges because a biface reduction flake has a high edge-to-weight ratio (Kelly and Todd 1988). As a result, for highly mobile people, bifaces maximize the number of tools that can be carried and at the same time minimize the amount of stone carried. This generally applicable "weight savings for mobility" argument also applies to microblade technology traditions in East Asia, Africa and Europe (Sano et al. 2007; Burdukiewicz 2005).

The Mobility Model proposed by Kelly and Todd (1988) is a function of a toolkit that is flexible, maintainable, repurposable, and portable allowing for high residential mobility. High residential mobility toolkits would have relatively few tool types that serve multiple functions. The number of moves per year would negatively correlate with tool diversity. As a corollary, decreasing residential mobility biface tradition toolkits should have more specialized tools with less need for portability. However, in many formative assemblages such as the Pueblo tradition specialized tools are generally replaced by expedient flake production (Bradley, B. personal communication 2017).

5.5.1.6 Mobility/sedentism indications based on artifact debitage assemblage.

Symons (2003) adapted Torrence's (1992) model for mobility-sedentism employing an analysis of lithic reduction sequences in relation to spatial patterns, which established that variation within metric attributes of reduction byproducts could be linked to different reduction stages. As a predictor for mobility, stone production for a mobile population would result in reduction stages being spatially differentiated or distributed around the landscape. In contrast, most stages of stone production at sedentary residences would have been concentrated at one location.

Table 5.5 enumerates the metric attributes of the flake byproduct (dimensions and weight, cortex, platform type, and dorsal scar count) as correlated to the varying reduction stages (initial reduction, further reduction, and late reduction stages) used in the determination of mobility-sedentism.

Table 5.5 Mobility/Sedentism based on reduction stage distribution of debitage assemblage.

	Cortex	Dimensions and weight	Platform type	Dorsal scar count	Cores
Initial reduction	Much cortex, primary flakes	High	Plain flaked	Low	Present
Further reduction	Les cortex, more secondary than primary flakes	Low to high	Plain flaked	Low to high	Present
Late reduction	Rare/absent	Low	Flaked	High	Rare

Note: Adapted from Symons (2003:130. Table 2.).

As a measure of mobility- sedentism of the Potter inhabitants, Symons' (2003) model is applied to the debitage assemblage using the metric attributes of dimensions by weight, cortex, and dorsal scar count. By way of application, Figure 5.7 presents a distribution of the metric attribute of weight as a proxy for size or dimension as an example.

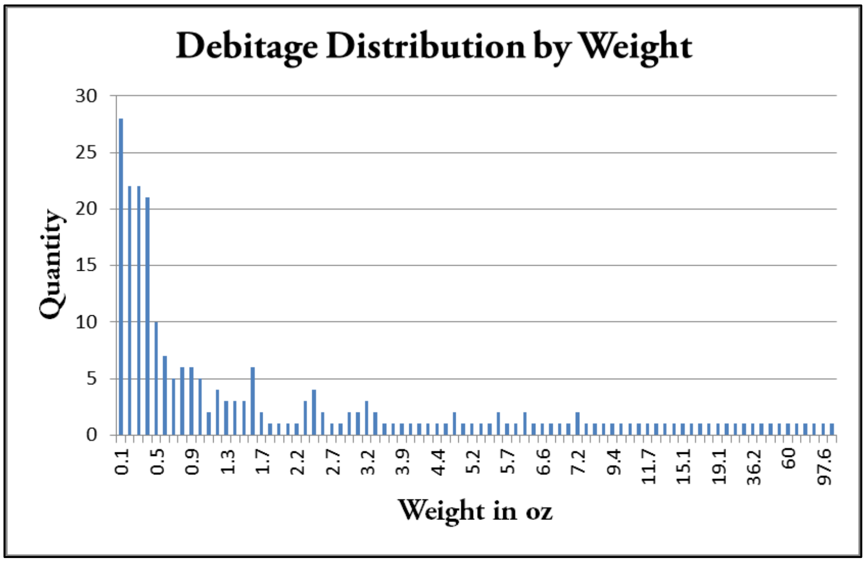


Figure 5.7. Example of a debitage distribution by weight as a proxy for size.

5.5.2 Hunter-gatherer band range mobility and seasonality modeling

In this section three models for determining band range mobility and seasonality are described including their assumptions and functioning, i.e. Curran and Grimes' ecological adaptation (1989), Burke et al.'s (2006) lithic material sourcing location – cultural occupation horizons separation, and Rockwell's (Rockwell's 2012) seasonal hunter-gatherer toolkit composition. These models are employed in an endeavor to define the band range round of geographic mobility and seasonality of the hunter-gatherers that occupied the region and site. Each model is based on geographic raw material sourcing and diachronic separation of cultural horizons. These models stipulate that during the Paleoamerican horizons of the NEM formal tools tend to be made of high-quality cherts; in this case, Munsungun and northern Vermont cherts, while expedient or less essential tools are made from lower quality felsitic materials or rhyolites. Curran and Grimes' (1989) model further asserts that better quality cherts are found geographically in the northern NEM while lesser quality material, i.e., felsites and rhyolite are found in the South.

5.5.2.1 Material sourcing location- cultural occupation horizons separation model

Burke et al.'s (2004) model to determine the range of Paleoamerican bands in the NEM is operationalized by the distribution of raw materials from their bedrock quarry or source origins as found in the artifact assemblages of identified regional archaeological sites. The term range refers to the territory or geographic area utilized on a regular (seasonal, annual and multi-year) basis by a hunter-gatherer band (Burke et al. 2004).

A second element of the model is based on time and the separation of occupation horizons by Paleoamerican sub-periods. It is proposed that as climate varied diachronically providing more hospitable conditions, primary subsistence prey and their related hunter-gather band pursuers moved inland altering subsistence round geographic location over time (Burke et al.'s 2004). Figure 5.8 graphically displays the early Paleoamerican range by cultural occupation phase horizon and range size. Table 5.6 presents cultural occupation horizon phases by chronology and range size as observed in Figure 5.8.

Table 5.6. Cultural occupation horizon phases, chronology, and range size.

Horizon Phase	Chronology	Early Paleoamerican range sizes
Vail – Debert Phase	(12,700-12,200 cal BP)	18,600 sq. km
Bull Brook –West Athens Hill Phase	(12,700-12,200 cal BP)	28,700 or 73,400 sq. km
Michaud – Neponset Phase	(12,200-11,800 cal BP)	20,500 or 31,500 sq. km

Note: (Adapted from Burke et al. 2004; Bradley et al. 2008)

From the morphology/typology of the fluted points and bases found in the various NEM sites loci assemblages, period horizon dating may be determined (Spiess et al. 1998). With these time horizons dates Burke et al. (2004) hypothesize that based on materials and their percentage composition found at sites occupied during the period, several possible band ranges can be identified. For example, one band range (seasonal, annual, and multi-year) during the Michaud-Neponset horizon extends from sites at Lake Munsungun on to Megantic then down to Jefferson/Potter ending at Neponset and returning to Michaud/Lamoreaux followed by completing the circuit to Munsungun. The area encompassing the seasonal round of this alternative is 31,500 km^2. The second band range, and somewhat shorter, begins again from sites at Lake Munsungun on to Megantic then to Jefferson/Potter returning to Michaud/Lamoreaux followed by completing the circuit to Munsungun. The area of this shortened seasonal round circuit was 20,500 km^2. These two circuits based on lithic material sourcing are shown in Figure 5.8. When the distribution of sites during the Michaud-Neponset horizon is taken into consideration as well, it should be noted that the number and range of sites from the earlier Vail Debert time horizon have contracted where the northern Debert sites appear to have been abandoned (Lothrop et al. 2011).

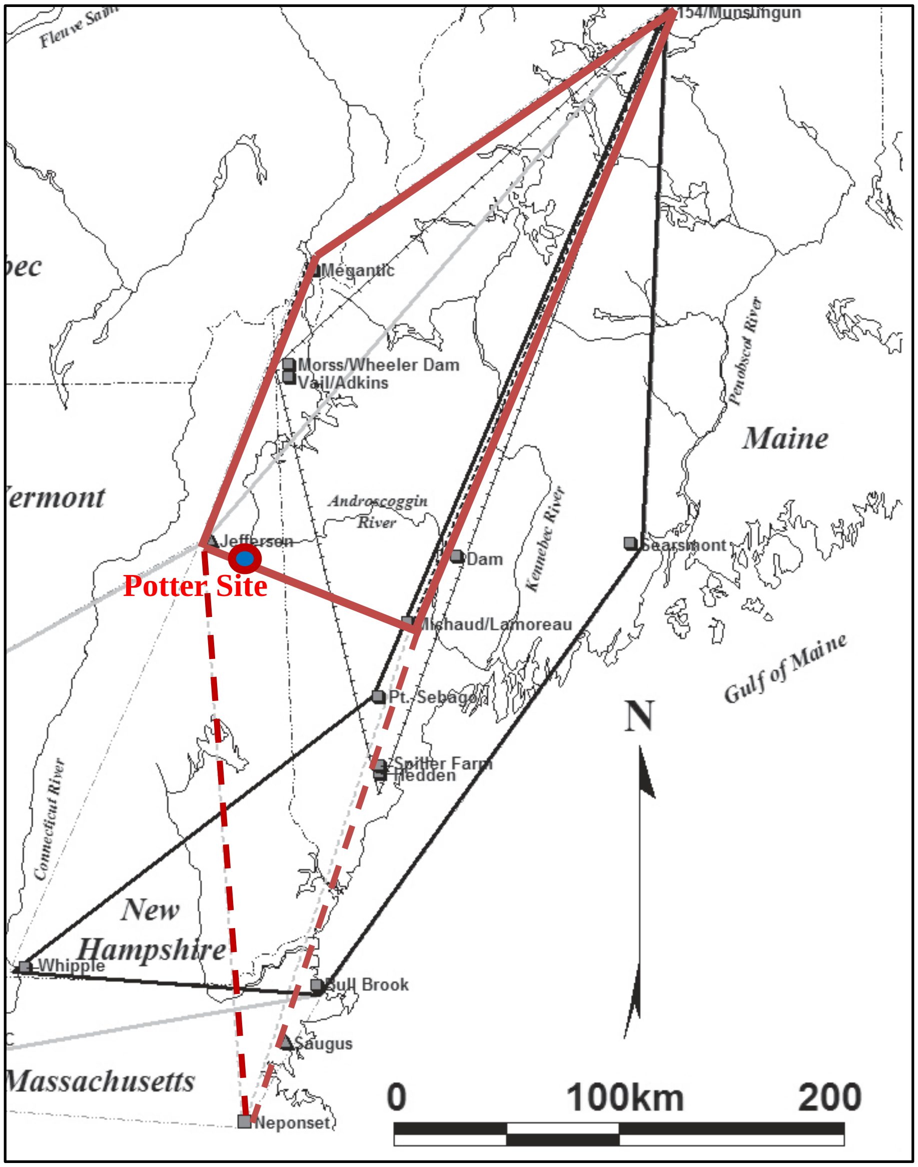


Figure 5.8. Michaud-Neponset sub-horizon band range alternatives. Alternative I: solid plus dashed ranges from Munsungun to Neponset. Alternative II: Solid red line ranging from Munsungun to Jefferson to Michaud. For reference, the Potter site is located on band range alternatives as a blue dot. (Adapted from Burke et al. 2004)

5.5.2.2 Ecological adaptation of Paleoamerican hunter-gatherers

The Curran and Grimes (1989) model for adaption of Paleoamerican hunter-gatherers to the ecology of the NEM conjectures that small bands of hunter-gatherers with high residential mobility covering large annual territories moved along a north-south, interior and coastal axis depending on the seasonal abundance of resources including migratory caribou herds and stone for tools. Curran and Grimes (1989) posit that seasonally acquired materials of primary higher-quality northern derived cherts occur in summer and a secondary source representing lesser quality southern derived felsites takes place in winter. Additionally, during seasonal migration transitional movements, a background presence of stone consisting of a variety of opportunistically acquired miscellaneous raw material is present in small quantities. Table 5.7 represents the expected distribution of material types found in a regional site's artifact assemblage by season.

To infer hunter-gatherer regular band range mobility and seasonality, the percentage of material type composition by season model will be applied to the Potter site loci assemblage in Chapters XI, XII, and XIII.

Table 5.7 Expected distribution of material types found in a site's artifact assemblage by season.

Season	Northern Cherts Munsungun, Champlain Primary Lithic	Southern Volcanics/Felsite Secondary Lithic	Cherts, Jasper, Quartzite (Opportunistic exchange/acquisition) Miscellaneous
Summer (North)	Majority %	None	0 to Negligible %
Fall Transit (North to South)	Majority %	None	Small %
Winter (South)	Majority-declining %	Increasing %	Small-increasing %
Spring Transit (South to North)	Majority-further declining%	Significant %	Small-further increasing %

Note: Adapted from Curran and Grimes (1989:47-52).

5.5.2.3 Hunter-gatherer length of site occupation vs. toolkit organization model

The Rockwell (2010, 2014) model proposes that, based on the NEM hunter-gatherer toolkit composition and length of site occupation or occupation span, a prediction of the behaviors should be observable by season. Occupations containing large numbers of tools related to butchery and hide working likely represent late summer and early fall occupations and would be short to medium in length as fall caribou hides and meat are at their prime. Winter to early spring occupations is represented by a wide diversity of activities, occurring at sites occupied for an extended period and often located near lithic sources. Late spring and early summer occupations show evidence for regular moves and short occupations with few activities occurring at each site. There will likely be a great mixture of residential and logistical sites found in the late spring and early summer occupations. Application of Rockwell's (2012) seasonality parameters model to Potters loci artifact assemblage (Chapters XI, XII, and XIII) should provide a further indication of the seasonality as measured by toolkit composition. These results are summarized in table 5.8.

Table 5.8 Site occupation duration vs. toolkit organization by season.

Season	Site Occupation vs. Tool Kit Organization
Winter to early spring	1. Sites occupied for an extended period of time and located near lithic quarries 2. A wide diversity of activities, and a wide range of tool types.
Late spring and early summer	1. Evidence of regular moves and short occupations. 2. Likely a mixture of residential and logistical sites represented. 3. Few activities occurring at each site, tool type range limited.
Late summer and early fall	1. Occupations likely to be short to medium in length as fall caribou hides and meat are at their prime. 2. Occupations contain large numbers of tools related to butchery and hide working.

Note: Developed from Rockwell (2012).

5.5.2.4 Seasonal round from prey source mobility and reconstruction of primary and vegetational cover

As another inferential indicator of seasonal round mobility, reconstruction of the primary prey source and vegetational cover of northern New England at 11,000 C^{14} years BP (Spiess et al.1984; Newby et al. 2005) indicate that tundra covered Maine and southern Québec roughly north of 45 1/2° and included southerly extensions at higher altitudes. Southcentral Maine, southern New Hampshire, and Massachusetts were covered by a poplar and spruce-fir forest in addition to hardwood such as oak and maple in southern New Hampshire and Massachusetts. At 11,000 ^{14}C BP, it would be expected that caribou would have wintered 10 to 50 km south of the forest boundary in south-central Maine and southern New Hampshire (Spiess 1984). Spiess indicates (personal communication 2016) that the furthest south that the long-distance migratory caribou traveled between wintering and calving grounds was the same latitude as the Bull Brook site in northeastern Massachusetts or 10 to 50 km inside (south) of the forest boundary. This range of migratory caribou movements corresponds to the second, and somewhat shorter, circuit from Lake Munsungun, Megantic, Jefferson/Potter, Michaud/Lamoreaux and completing the circuit to Munsungun as described in the Burke model.

5.6 Settlement pattern adaptations, site, and loci landscape usage activities modeling

5.6.1 Attribute cluster method

The concept of delineating activity areas or activity patterning has long been used in investigations of settlement and subsistence patterns of prehistoric hunter-gatherers. For example, Sivertesen (1980) constructed a regional narrative model based on the artifact record of 22 hunter-gatherer sites in the Great Plains that included both taphonomic bone refuse and the density of various stone tools. By clustering 37 observable attributes that included both the refuse and tools, Sivertesen (1980) was able to form a site activity model for kill and butchering activities at hunter-gatherer sites. This informal or narrative activity model, regional in nature, employed numerous observable attributes to infer landscape activity and loci usage. Many regional studies use classes of sites as analytical units in the analysis of landscape usage. Instances of these analytical site use class units are: spring and autumn small residential, field, and transit camps; base camps; habitation sites; hunting station lookouts; quarrying locations, kill and butchering site, in addition to logistical and processing camps (Binford 1978, 1979, 1980; Jones 2008; Nelson 1991; Nelson & Camilli 1984).

Characteristics of a particular site type, even though an ideal to which reality may only approximate, in one region will not necessarily apply to any other region and should not be considered as a guaranteed site usage predictor in different contexts (Nelson 1991).

In the New England-Maritimes (NEM), similar heuristic approaches based on observed Paleoamerican site attributes have been used to develop various regional qualitative models for the identification of Paleoamerican landscape activities and site loci usage. In Gramly and Funk's (1990) model, seven loosely defined types of fluted point sites are recognized. These types are identified as: sources, workshops, habitations, kill butchery sites, burials or caches, and isolated occurrences of artifacts which were mainly projectile points.

As another example of activity patterning based on attribute clusters, Jones (2009) in an investigation of two Middle Archaic small upland lithic sites in North Stonington, Connecticut, adapted Newell and Constandse-Westermann’s (1996) classification model of site types to analyze landscape usage. Table 5.9 summarizes data pertinent to this model regarding an enumeration of small site types and the activities or functions typically expected from a specific site type. Jones' (2009) taxonomy included small residential camps, field camps, hunting stations or kill sites in forested environments.

Table 5.9 Small site types and the activities or functions typically expected from a specific site type.

	Net drying rack	Fish dry/smoke	Hide scraping stump	Hide drying frame	Skin Burke tent	Meat/fish dry rack	Hide staking area	Fish we' re/trap	Expedient shelter	Outside cook hearth	Drop and toss zone	Above/underground cash	Inside hearth	Bone dump	Surface hearth	One-man tent	Shooting blind	Tool cash	Wind break	Game drive fence	Butchering area
Small residential camp	x	x	x	x	x	x	x	x		x											
Field camp					x	x	x		x		x		x	x	x	x					
Transit camp					x				x												
Hunting station						x	x			x				x	x		x	x	x		
Kill butchering site						x		x		x	x									x	x

Note: Adapted from Jones (2008) Condensed from Newell and Constandse-Westermann (1996): Figure 2)

By constructing a model using these observable site types as units of analysis in conjunction with functions normally expected to be organized into attribute clusters, it becomes possible to infer landscape or site usage activities from its artifact assemblage.

With cautions in mind, formulation of a landscape usage model based on attribute clusters involves incorporating several technological, behavioral, and temporal elements such as: assessing the variety, availability and quality of raw material; modularity and flexibility of tool design strategies; stage of the reduction sequence for transportability; and tool type variation, quantities and kit configuration in relation to site category. Other considerations for inclusion include assessment of assemblage debitage dimensional gradation correlated with reduction sequence stage in relation to site type, trade-off decisions between core forms and mobility, in addition to hafting considerations. Behavioral decisions and environmental considerations reflected in the model are questions involving the choice of curated versus expedient tool technology, concern over transportation of finished tools or core material, conservation, storage or caching, and topographical choices in the location of the site.

While all these attributes may not be recognizable in a site's artifact assemblage; many are. Assembling these factors into a working model of site types and classifying features, Table 5.10 below presents a matrix of the generally expected geographical and geological site properties, toolkit makeup, debitage reduction stage, material type, temporal culture horizon, and tool production by landscape site/loci activity category. An example of an attribute cluster for two loci of a Paleoamerican site is shown in Table 5.11.

Table 5.10 Landscape loci activities classifying feature matrix.

Classifying feature	Quarry	Workshop	Habitation	Kill butchery	Burials and caches	Pioneers
Geological and geographic depiction	Evidence of raw material mining and processing. Often occurring at outcrops.	Tend to be located on level ground.	Correlation of Paleo habitation sites with dry, level, and well-drained areas of Sandy soil on elevated features. Avoided location on floodplains.	Selected geologically strategic places to establish camps to intercept animals. Large sites may have mineral licks in the same region.	Recognition of burial sites problematic due to bone and organic material breakdown and acidic soils.	Glacial recession occurs 12 to 14,000 years BP. Ice free 12,000 BP. Potential entries into area from cells and or West. Very few sites of this type
Artifact toolkit makeup	Assemblage: quarry debris, discarded broken formal tools, bi and unifaces of exotic material. Formal and expedient tools of local material.	Assemblage: bifaces and biface fragments, unifaces and Uniface fragments, cores, debitage, tools, and discarded tool fragments.	Assemblage: a wide range of tool types; points, knives, scrapers for food and material processing, drills, wedges and retouched flakes & expedient tools.	Assemblage: projectile points, butchering, and processing tools such as scrapers, flake knives, and choppers.	Assemblage: clusters of artifacts, or burial furnishings. Clusters can also be interpreted as toolkits cached for future use.	Assemblage: toolkit consisting of bifaces, projectile points, knives and finished tools produced from a nonlocal material
Reduction stage - debitage structure	Evidence of first stage reduction. Nodules, cores and large flakes. Small retouch flakes are seldom found.	All phases of reduction sequence in evidence. Large, medium and small debitage flakes.	Debitage resulting from tool production, maintenance, and resharpening. Only minor amounts of debitage from the primary reduction of quarried raw materials.	Possible sites yield very few artifacts. Tools in all probability produced at another site. Maintenance and sharpening debitage may be in evidence.	Generally contains finished tools. Tools may have multiple interpretations such as a cache or ceremonial or votive site.	Debitage resulting from tool production of transported core blanks, maintenance, and resharpening.

Note. Adapted from Gramly and Funk, 1990 narrative pp. 12-19.

Table 5.10 continued.

Landscape loci activities classifying feature matrix.

Classifying feature	Quarry	Workshop	Habitation	Kill butchery	Burials and caches	Pioneers
Artifact discard material type	Discards of exotic material tool fragments infer retooling at the site.	In Paleo sites, local and exotic lithics are found. Highest material concentration is locally available stone.				Arrived with tools and materials from distant quarries. Example, Pennsylvania Jasper, and Onondaga limestone chert from New York.
Temporal cultural horizon identifying characteristics		Paleoamerican sites – fluted point and knives are in evidence in addition to channel flakes.	Paleoamerican sites – fluted point and knives are in evidence in addition to channel flakes.			Paleoamerican sites – fluted point and knives are in evidence in addition to channel flakes.
Activity area dimensions	Dependent upon outcrop geological dimensions.	Workshop areas are found in clusters 3 to 4 m in diameter on level ground.	Dimensions of activity areas or habitation loci have been found to range between six and 20 meters.			
Distance from habitation site		Workshop/tool manufacturing sites are often found 20 to 50 m from habitation site.		Presence close to the area of Paleo encampments may be anticipated.	New England burial sites situated away from dwellings or habitation location.	

Note. Adapted from Gramly and Funk, 1990 narrative pp. 12-19.

Table 5.10 continued.

Landscape loci activities classifying feature matrix.

Classifying feature	Quarry	Workshop	Habitation	Kill butchery	Burials and caches	Pioneers
Knapping episodes-tools and debitage		Knapping episodes are found in defined clusters including tool fragments, rather than individual tools.	Failed attempts to produce tools with inferior local chert cobbles			Failed attempts to produce tools with inferior local chert cobbles.
Presence of site features and organic materials			Features such as post molds, calcined bones, carbonized foodstuff material, and hearths.			
Differences due to site dimensions/size			No qualitative difference from small and large assemblage sites.			
Repurposing of tool					.	The smashing of existing larger tools to make new tools from exotic material
Regional site examples	Mt. Jasper rhyolite – Berlin, NH. Munsungun chert, Lake Munsungun, Maine.	Israel River complex – Jefferson, NH. Potter site – Randolph, NH.	Israel River complex – Jefferson, NH. Potter site – Randolph, NH.	Vail encampment-Maine. Whipple site-NH.		Bull Brook, Massachusetts. Whipple, NH. Kings Rd., New York.

Note. Adapted from Gramly and Funk, 1990 narrative pp. 12-19.

Table 5.11 An example of attribute clusters for two loci of a Paleoamerican site. (Rusch 2017)

Attribute Clusters	Locus A	Locus B
Artifact types		
Projectile points and point fragments	3	1
Channel flakes	13	1
Bifaces	3	0
Biface fragments	12	9
Cores and core fragments	7	0
Retouched flake	34	10
Utilized waste flake (Channel)	5	1
End scraper	8	14
Side scraper	2	2
Untyped scraper	3	11
Uniface and Uniface fragments	1	0
Drill	0	0
Pieces esquillées	2	2
Number of tools in assemblage	96	50
Classifying features		
Aggregate debitage classification		
First stage reduction, nodules, cores, and large flakes	8	7 Very large 1st
Reduction flakes greater than 8 g	8	10
Reduction flakes – small	2134	349
Range, variety, and quantity of tool types	12	6
Material type sources	9	6
Primary source of lithic tool making material – local or exotic	Mt Jasper rhyolite Local	Mt Jasper rhyolite Local
Dimensions of Locus area m² (excavated not encompassed)	28	11
Number of artifact/activity concentrations per locus	1	1
Artifact and density –artifacts/ m²	79.9	37.2
Tool artifact and density – tools/ m²	3.43	4.5
Distance relationship between locus area clusters in meters	14	14
Site features and organics	0	0
Knapping episodes – both tools and debitage co-located	Yes	Yes
Geological and geographic characterization	Sandy glacial till	Sandy glacial till

5.6.2 Graphical attribute cluster presentation

As an adjunct and graphic representation of the activity attribute modeling method, a clustering technique using lithic artifact composition types is employed to infer potential locus landscape activity use patterning for individual site loci. The methodology employed in the graphical cluster presentation approach is like the activity attribute method and uses a group of the selected quantifiable site and lithic assemblage characteristics. Again, as with any analytical unit tool, when applying this graphical cluster technique there are several cautions to take into consideration; such as parameter selection, weighting, and regional applicability. If interpretable artifactual features are not available to be associated with the collections, as is many times the case in NEM Paleoamerican sites, it becomes difficult to credibly assign functional meaning to classes of sites. Functional analysis of individual tools or assemblages is an alternative; however, the results can be controversial (Kvamme 1988).

The method as applied to Potter's loci focuses on a simple graphic technique that facilitates clustering or grouping of lithic scatter locations into general types based on similarities in attribute clusters or assemblage content. This technique uses multiaxial percentage bars with a common point for zero percent. The same data could be displayed as line graphs, cumulative line graphs (commonly used for analyses of European Paleolithic assemblages), or bar charts. The technique used here has been chosen as it provides an effective visual representation of distinctions among datasets with different proportions of artifacts from a chosen set of categories. Using multiple dimensions of lithic assemblage variability allows for the grouping of multiple sites or loci within a given site with similar assemblage characteristics to be classified regarding potential activity use. The dimensions selected for analysis of the Potter site include: tool type range and quantity, flake size in addition to quantity, number of cores, cortex coverage, locus area, channel flakes indicative of fluted point production, scrapers potentially used in material processing such as hide and wood product scraping, and other features of the lithic artifact assemblage. The resultant groupings represent lithic scatter types regarding the dimensions examined. Although the exact locus function cannot be specifically addressed, e.g., was a processing site with several scrapers employed for hide scraping or woodworking? However, additional analytical techniques such as microwear analysis (discussed later) may aid in narrowing the interpretation. However, this technique does appear to have an underlying functional basis for representing site or loci classes obtained through selected classifying parameters. Even though the graphical method seems to allow ready distinction between areas with markedly different assemblage characteristics, the process of assigning sites or loci to types is a subjective one (Kvamme, 1988).

The loci types represented in this analysis characterized by attribute groupings are:

1. extended/multiple occupation span or habitation areas;
2. limited-term occupations;
3. tool production, maintenance, or resharpening chipping locations;
4. resource processing areas;
5. and sources.

Paleoamerican occupation sites are generally characterized by their larger areas, indications of tool production including channel flakes and tool usage, significant amounts of debitage, cores, in addition to high tool index values. Limited occupation sites attributes are similar to the extended occupation sites; however, their scale of evidence is more limited. Examples of longer-term and more limited occupation; loci A, B, and C (blue, green and red) are shown in Figure 5.9. Tool production or chipping sites tend to be defined by significant amounts of debitage or chipping debris, cores, limited tool range, and occupy smaller areas. An example of this classification is presented in Figure 5.10 for the Potter site Loci D and E (blue and red). Analogously, processing locations are defined by a low to moderate tool index, a significant volume of specific tool types such as scrapers, few pieces of debitage and cover a relatively small area. Processing loci represent locations of specialized task execution. Finally, quarry sites are generally described by large numbers of cores, larger mean flake sizes, a relatively small number of latter stage reduction tool fragments or complete tools, and higher cortex rates.

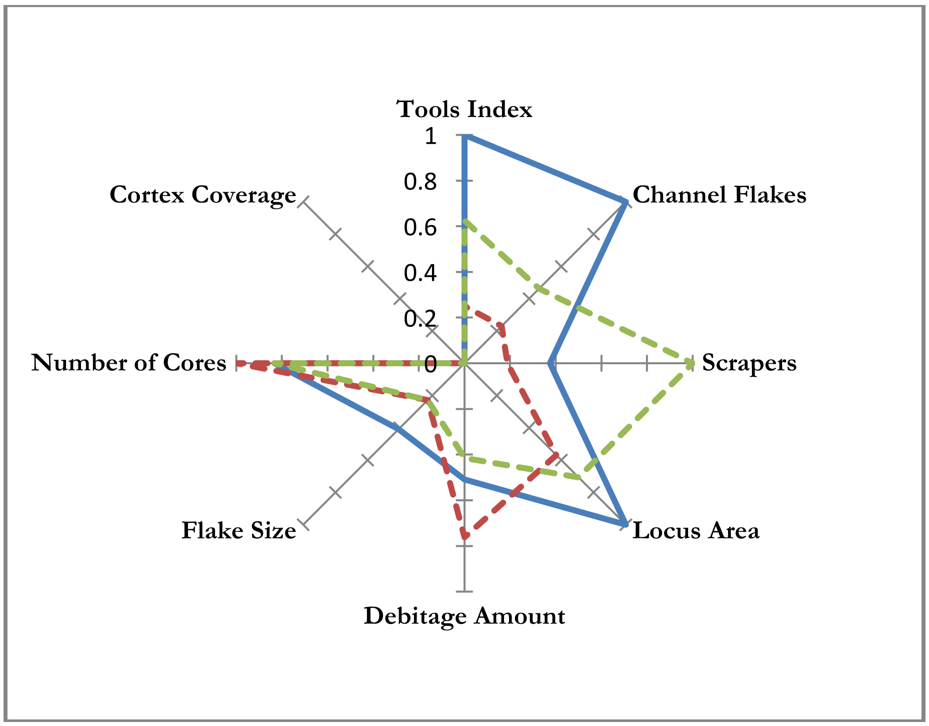


Figure 5.9 Examples of habitation loci types graphically characterized by attribute groupings: Loci A blue solid, B green dashed, and Locus C red dashed (Rusch 2017 after Kvamme 1988:389).

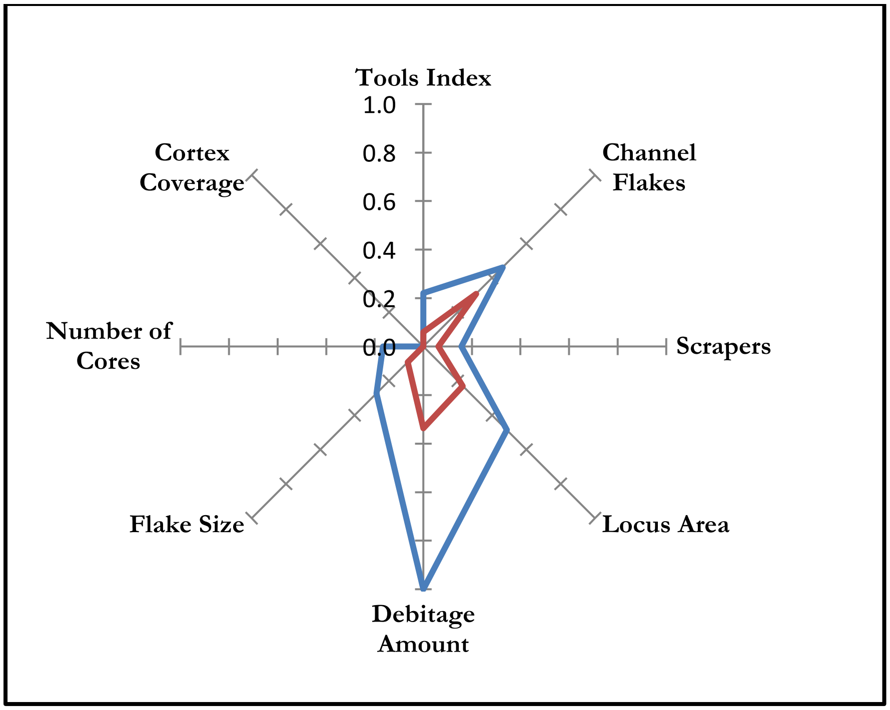


Figure 5.10 Examples of tool production loci types graphically characterized by attribute groupings: Loci D blue solid, and Locus E red solid (Rusch 2017, after Kvamme 1988:389)

5.6.3 Microwear analysis method of determining tool use, loci, and landscape activities

Interpretations of Paleoamerican site behaviors by researchers in the past have often been based upon strict tool morphology. In at an attempt to further refine site and loci land-use and domestic activities at the Potter site, a “low-power” microwear study was performed on a sample of the site assemblage by Rockwell (2010, 2014).

Included in this examination were 975 artifacts in total composed of 151 tools and 823 pieces of debitage. From the entire assemblage, all formal tools (n=151) which include, scrapers, projectile points, bifaces, *pièces esquillées*, and others, were selected for examination. In addition to the selection of formal tools, a random sample of debitage (823 pieces selected using a random number generator) larger than ¼ inch was chosen for analysis. Smaller pieces of debitage are unlikely to carry enough information to accurately determine the use or overall utility (Rockwell 2010). Included in Rockwell's (2010, 2014) application of the term "debitage" were expedient tools such as utilized flakes in addition to retouched flakes.

Microwear analysis of the Potter site assemblage suggests that there was far more activity in terms of material processing occurring at the site loci than an analysis of only the formal tool assemblage would suggest. Only 50% of the utilized assemblage was formal tools. The inclusion of expedient and modified flake tools provides a more accurate picture of the range of behaviors at this site. For example, Rockwell (2010:60-90, 81-84) identified the use of expedient flakes for the processing of food stuffs and wood products.

A "low-power" microwear approach was utilized for the artifacts in this study. This methodology emphasizes the significance of edge scarring patterns, with less emphasis on polish and striations (Rockwell 2010, 2014). In the early stages of site excavation (2005), analyses of 18 artifacts from a single locus were examined utilizing high-power analysis by Dr. Marilyn Shoberg of Texas Archaeological Research Laboratory. Rockwell's (2010, 2014) results differed from Shoberg's only in level specificity of the contact.

5.6.4 Landscape use patterning and domestic activities validation model: Shannon-Weaver analysis

Shannon and Weaver (1949:100) suggested a mathematical formulation for determining the information content of a message (Dickens and Fraser 1984:144-152).

> "*Information is characterized by the dichotomous qualities of "entropy" and "redundancy." Messages with large amounts of information-with more randomness, variability, and unpredictability-will have a high entropy level,*

whereas those with less information will have lower entropy but higher redundancy" (Shannon and Weaver 1949:22-26, 102-106).

Although it was developed in the context of electronic communications systems, the authors recommended that it should be applied to a broader range of systems (Shannon and Weaver 1949:100). Dickens and Fraser (1984:144-152) used the Shannon and Weaver's information theory approach to measure variability in ceramic design features of late Archaic and Early Woodland period cultures. Curran (1984) applied this technique to the Whipple site's stone tool artifact assemblage to differentiate between loci activities (Andrefsky 2005:201-223, Chatters 1987:363).

To validate site locus activity area characteristics, the diversity or entropy index measurement that is based on the Shannon-Weaver information theory equation (5.1) evaluates each locus' tool assemblage breadth. A large diversity or entropy number indicates a more extensive and broader variety of tools as might be found in habitation sites or loci. A small diversity or entropy number signifies a narrower range of tools as might be found in a processing or tool making or maintenance site.

Equation 5.7 Diversity or entropy index $= \sum_i^n p_i \log(p_i)$

For this expression, p_i is the proportion of a particular tool type in the entire tool assemblage. The number of tool categories is represented by n, and i is the index (i to n) of the summation.

This model will be used to test the variability of the Potter site's loci toolkits.

In Part III, that follows this chapter, Chapters VI, VII, and VIII narrows the focus to the characterization of each of the Potter site's individual loci.

Part 3

Potter site loci archaeological characterization data

This part of the study focuses on the archaeological context and characterization of the distinct loci of the Potter site that is required for the investigation and analysis, of a Paleoamerican occupation in the White Mountains of New Hampshire. The overall Potter site archaeological context was presented in Chapter III. This macro view included the site background and excavation history; regional geographic and geologic context; sampling strategy; and total site excavated flaked stone artifact assemblage. In addition to the complete assemblage delineation, the spatial distribution including horizontal and vertical representations to be utilized in its characterization was described.

Each of the three chapters that follow in this section, (Chapters VI, VII, and VIII), characterize an individual Potter site locus. The selection of loci to be characterized and discussed in each of these three chapters is based on observed similarities or differences of particular aspects of the loci characterization the data described in these loci characterizations include the artifact assemblage composition and quantities, horizontal and vertical assemblage dispersal, in addition to the distribution of artifacts by material type. Organization of these loci groupings is based on variations such as the similarity in the wide range of tool types and quantities in each locus (high tool index). Similarly, the loci groupings are organized on a narrower range and quantity of tool types (low tool index) in addition to the high ratio of debitage to tools, or for reasons of their lack of material diversity, small size, or unusual artifact distributions.

Chapter VI

Potter site loci archaeological context and data

The focus of Chapters VI, VII, and VIII narrows from the overall site depiction presented in Chapter III to the characterization of the individual locus. The archaeological data context for each of the formerly enumerated Potter site loci is characterized regarding its assemblage composition, artifact type and material from which it was produced in addition to the horizontal and vertical artifact distributions.

In the text which follows, reference is made to locus size by artifact count in addition to the size of the area enclosed. As a re-orientation, Chapter III Table 3.2 presented the Potter site flaked stone assemblage arranged by locus, material type, quantities, and totals that indicated artifact quantity size ranking. The characterization of Potters individual loci is distributed over the next three chapters. Chapter VI details loci H, K/G, and C. These three loci are grouped together because of their similarity in the wide range of tool types and quantities in each locus in addition to their area size. Chapter VII includes loci F and B and is grouped jointly because of their narrower range and quantity of tool types in addition to the high ratio of debitage to tools. Finally, Chapter VIII characterizes loci M, J, A, D, and E that are grouped collectively for reasons of their diversity in terms of small size, unusual horizontal artifact distribution, or single material type assemblage.

Locus H, K/G, and C characterizations

6.1 Locus H artifact composition

Locus H (see Figure 3.13), the second largest locus being analyzed by artifact count, contains 41 tools (Table 6.1), including bifaces, and 3199 pieces of debitage for a total of 3240 artifacts from 10.5 m² of excavated but not encompassed area. Total artifact density is 303.8/ m² with a tool density of 3.9/ m². Material sources for Locus H's artifact assemblage are comprised of eight lithic types with the dominant varieties being undifferentiated rhyolite, Mt. Jasper rhyolite, Munsungun chert, and Jefferson rhyolite in that order. Artifact category, material type, and quantities are displayed in Table 6.1 and by percentage in Table 6.2.

Table 6.1 Locus H flaked stone tool artifact composition by material type

Specimen Type	Untyped Rhyolite	Mt. Jasper Rhyolite	Jefferson Rhyolite	Granite	Quartz	Munsungun	Hornfels	Untyped Chert	Grand Total
Biface	1					3		1	5
Channel Flake						3			3
Core	1								1
Core Fragment	5								5
Hammerstone									0
Projectile Point / Knife						2			2
Raw Material Unmodified									0
Graver						1			1
Scraper	1					4		1	6
Uniface									0
Utilized Waste flake									0
Waste Flake	1895	104	46		4	1144	2	4	3199
Waste Flake Modified / Retouched	11	1	1			3		2	18
Wedge / Pièces esquillées									0
Grand Total	1914	105	47	0	4	1160	2	8	3240

Examples of Locus H's flaked stone tool assemblage are presented in figure 6.8 including a reference number for identification which provides instances of the various tool types and raw source material from which they were produced. Sources for undifferentiated and Mt. Jasper rhyolite are located within a 20-30km radius and are considered local whereas Munsungun chert is classified as remote being from a source located some 300 km distant in the state of Maine.

Table 6.2 Locus H artifact composition by the percentage of material type

Specimen Type	Untyped Rhyolite	Mt. Jasper Rhyolite	Jefferson Rhyolite	Granite	Quartz	Munsungun	Hornfels	Untyped Chert	Grand Total
Artifact frequency	1914	105	47	0	4	1160	2	8	3240
%	59.1	3.2	1.5	0.0	0.1	35.8	0.1	0.2	100

6.1.1 Locus H horizontal flaked stone assemblage distribution

The horizontal density distribution of the flaked stone artifact assemblage for Locus H is displayed in Figures 6.1, 6.2 and 6.3. Locus H's site isopleth artifact density plot (Figure 6.1) is arranged by Northing and Easting excavation grid range and displays the enclosed artifact distribution density gradation.

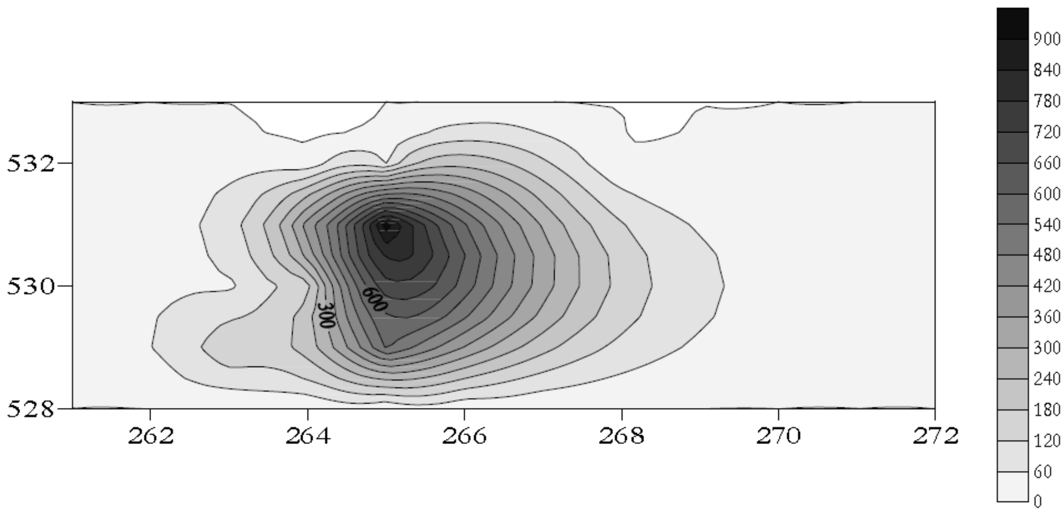


Figure 6.1 Block H Northing, Easting horizontal isopleth artifact density plot.

As indicated in Figure 6.2, Locus H horizontal debitage placement by 50 cm quad, over 90% of the flaked stone artifacts lie within a rectangle approximately 3.25 meters high by 2 meters in width that is oriented north to south on the site grid.

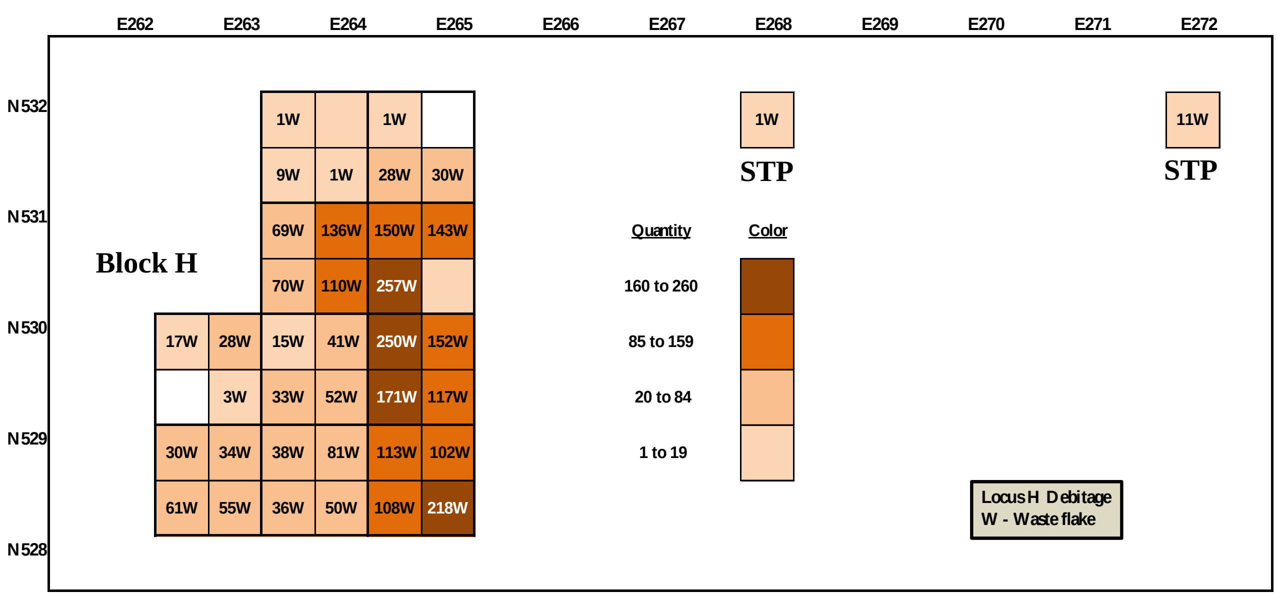


Figure 6.2 Locus H horizontal debitage placement by 50 cm quad.

Both waste flakes and tools in high concentration are found co-located in the interior quads of the locus boundaries. Little correlation is observed between tool type and density of waste flakes co-located by quad or near neighbor. Very low concentrations of scattered outlier waste flakes and miscellaneous individual tools occur from two to five meters from the central high-density portions of the locus. Generally, Locus H's distribution of horizontal waste flake concentrations drops off rapidly except for the north and northwest boundaries.

Two roughly oval tool cluster concentrations (Figure 6.3) are observed in a 1 x 2 ½ m NE to SW cluster centered at N530–E264 and a 1 x 2 ½ m centered at approximately N529–E264 with a slight overlap at N529–E265. High waste flake density concentration ranges from N528-N531 and E263-E265. These potential event cluster concentrations are also observable in the tool density plot shown in Figure 6.3; Locus H horizontal tool placement by 50 cm quad. The increased artifact concentrations are more apparent in the marked areas of the flaked stone tool density plot Fig. 6.3.

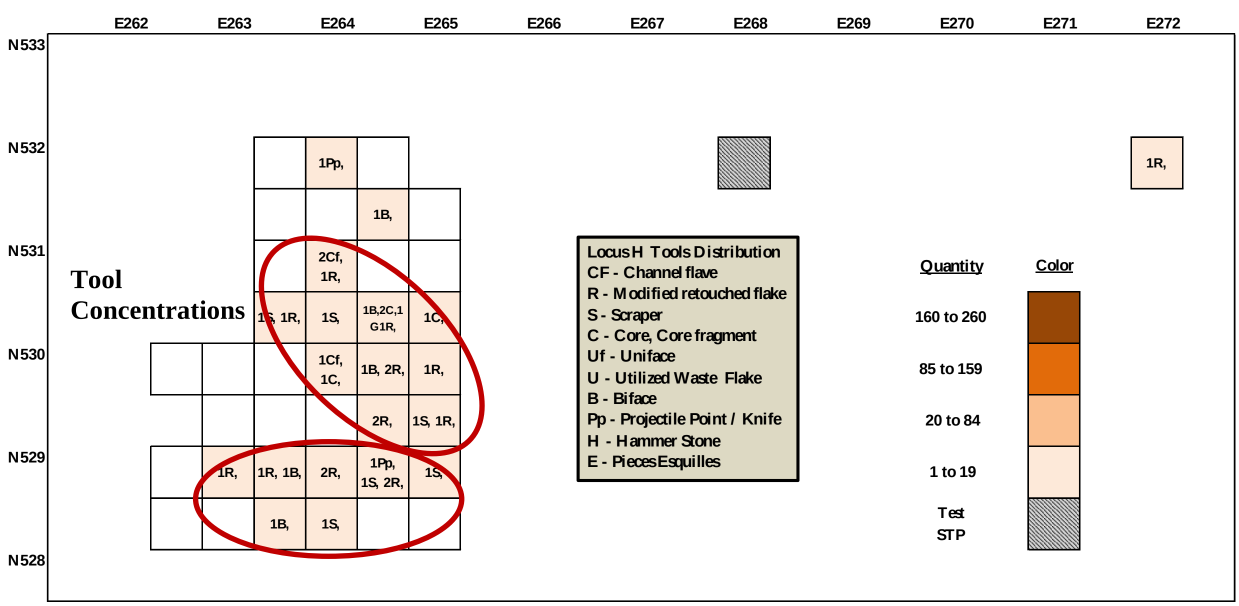


Figure 6.3 Locus H Horizontal tool placement density plot by 50 cm quad.

However, sometime in the past a disturbance occurred in the locus and may have distorted the horizontal and vertical artifact distribution interpretation. Discussed below is a potential cause of the disturbance.

6.1.2 Locus H vertical assemblage distribution

Locus H's vertical assemblage distribution defined by soil levels resided primarily in Zone I or A_1 horizon (800 artifacts), Zone II (1875), and Zone III (575) or the $B_{1,}$ and B_2 horizons. This depiction comprises the combined flaked stone tool and debitage concentrations. Inspection of field profiling records indicated a soil disturbance in the locus. Evidence of this disturbance was observed in the record from an intervening element of a C horizon (zone IC) soil composition interspersed between Zone I (A_1) and Zone II (B_1). A possible cause for the disturbance, which is common in the New England-Maritimes region, was from a tree throw that occurred during some later time horizon forest growth. This disturbance of the vertical distribution may, as in the case of the horizontal artifact dispersal, distort the interpretation of this locus.

Generation of Locus H's vertical assemblage distribution histograms by tool type, waste flake artifact quantities, and raw material type by excavation level, was constructed from the data collected and organized in the site excavation database. The graphical representation of stratigraphic flaked stone artifact and tool positions excavated by 5cm level is illustrated in Figures 6.4 and 6.5.

The combination of Locus H's assemblage lithic types, comprised of both tools and waste flakes, in their distribution quantities by level, the bulk of the distribution is seen to occur in Levels 2 through 10. The highest density of artifacts, quantities of 200 to 500, occur in Levels 3 through 10 with lower quantities in the low double or single digits ranging through Levels 11-14.

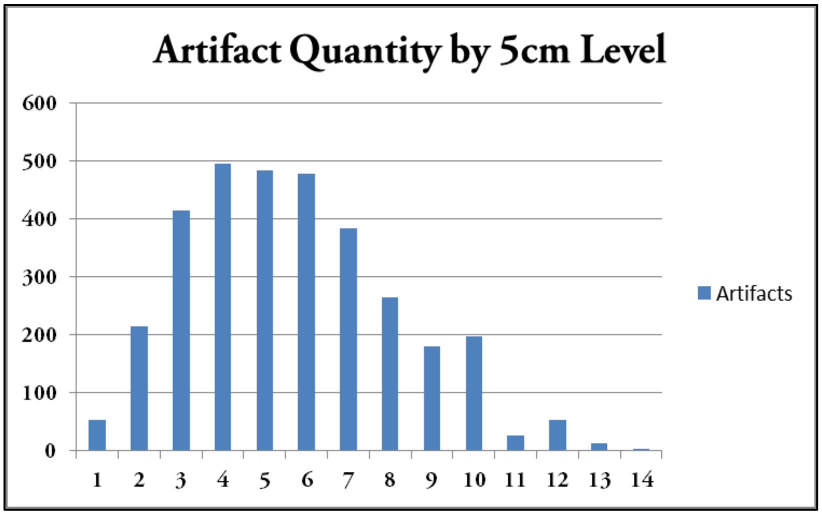


Figure 6.4 Locus H artifact count by 5 cm Level

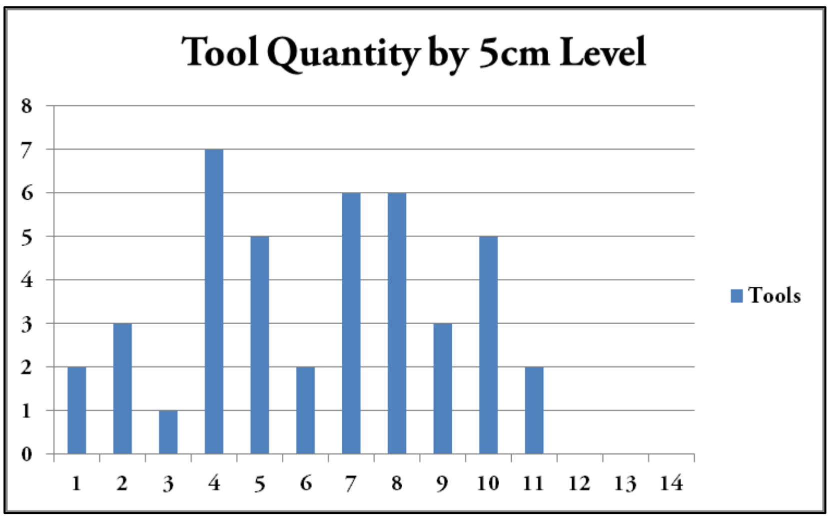


Figure 6.5 Locus H tool count by 5 cm Level

The slight increase in artifact frequency at Level 10 likely represents mixing in addition to the limit of artifact migration, essentially very small flakes, down through the soil column and coming to rest on the very compact lowest zone. However, when tool type count by level was plotted (Figure 6.5), the distribution appears multi-modal and more uniform in its dispersal, which was possibly the result of the soil disturbance.

When the artifact distribution by level and material type shown in Figure 6.6 is considered, the most prevalent material types, i.e., untyped rhyolite, Munsungun chert, Mount Jasper rhyolite, and Jefferson rhyolite are seen nominally to occur in all levels of the excavation.

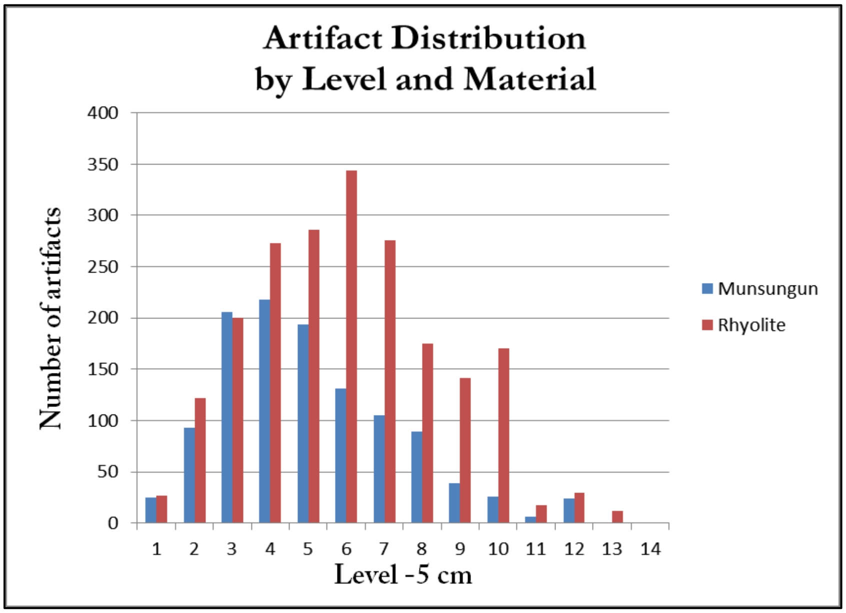


Figure 6.6 Locus H artifact distribution by 5 cm Level and material type

However, in the case of Munsungun chert, a significant percentage resides in Levels 2 through 7 with a peak occurring between Levels 3 and 5. Similarly, a uniform quantity of Munsungun chert tools was distributed across Levels 1 to 10 with a concentration bias indicated at Levels 1 to 7 (Figure 6.7).

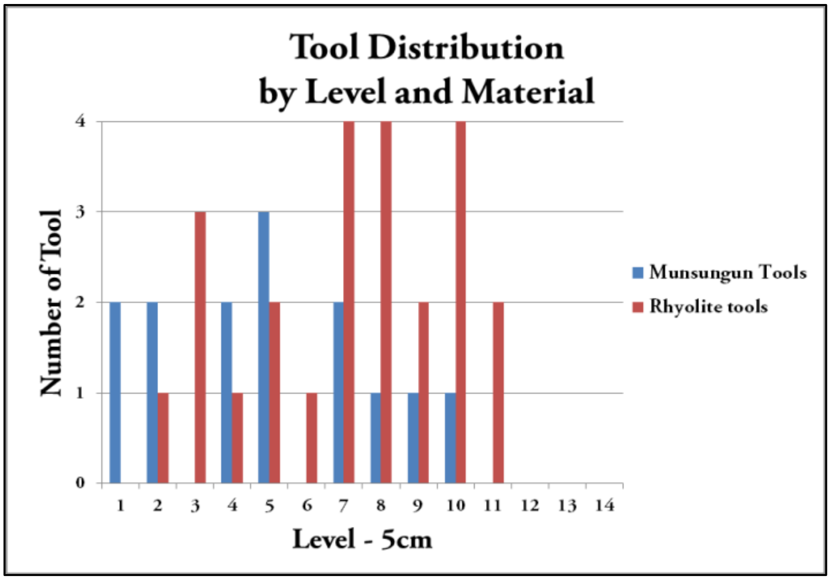


Figure 6.7 Locus H tool distribution by 5 cm Level and material type.

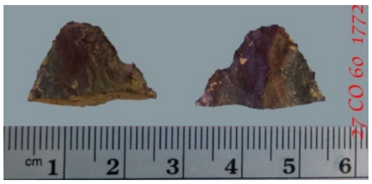
In the case of rhyolite waste flakes (Figure 6.6), a substantial number were found in Levels 2 through 10 with a peak indicated at Levels 4 to 8. Like the entire tool vertical distribution, rhyolite tools are distributed over Levels 2 through 11 with a somewhat higher multimodal peak occurring at Levels 5 through 10. With the combined tool and waste flake distribution, a greater concentration of Munsungun chert appears at Levels 3-5 while the mount Jasper rhyolite and other rhyolite's peaks occur at Levels 4-8. The material peak differential might suggest different deposition events at the locus. However, because there is significant overlap of both material type distributions and the effects of the mixed soil horizon from a potential tree throw, this hypothesis is not supported.

Moreover, cryoturbation and bioturbation must be considered in examining these distributions and evaluation of this hypothesis. It might be suggested that due to these exogenous effects one material distribution or the other could be more affected. Based on specific gravity values as a density measure, there is little difference between the Mt. Jasper rhyolite and

Munsungun chert. The specific gravity values for the cryptocrystalline materials are rhyolite 2.4–2.6, chert 2.60 – 2.64, and chalcedony 2.3 – 2.6. So, it is doubtful if the two major material types would have been affected differently. Also, the consistently smaller size of the Munsungun chert flakes would imply that this material would be more likely to drift lower in the soil column, contrary to the observed distribution. Even though there are knappability differences between Munsungun chert and the rhyolites, their specific gravities remain nearly the same. Therefore, knappability differences would most likely not cause different materials to drift lower in the soil column. Tool artifact examples are shown in Figure 6.8.

Figure 6.8 Samples of Locus H artifact types.

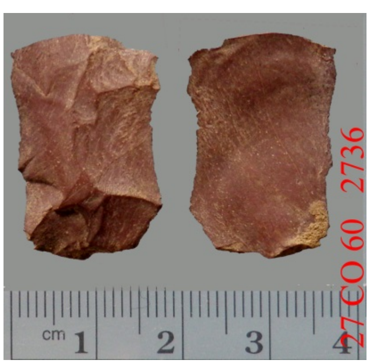
No. 1711 Biface fragment



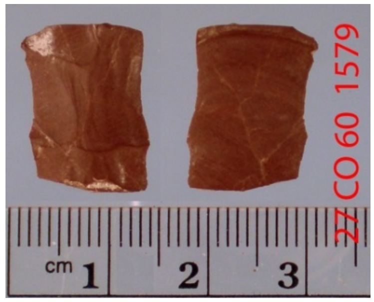
No. 1772 Biface fragment

No. 1705 Biface fragment

No. 1760 Biface



No. 2736 Channel flake w/medial ridge



No. 1579 Channel flake fragment w/medial ridge

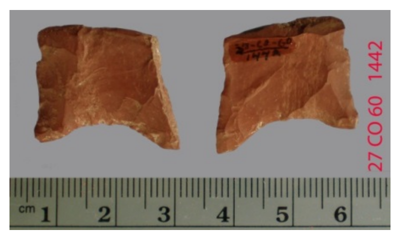
No. 1795 Channel flake prox. fragment w/medial ridge.

No. 1761 Core

No. 2738 Core fragment

No. 2738 Core fragment

No. 1782 Projectile point base.

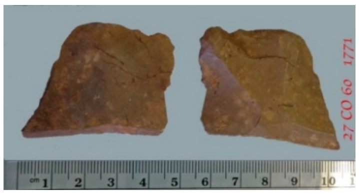


No. 1442 Projectile point base.

No. 2276 Graver

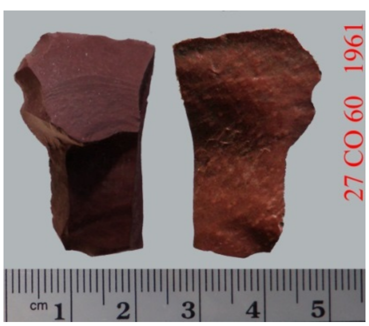
Figure 6.8 Samples of Locus H artifact types continued.

No. 1592 Scraper, side



No. 1771 Retouched/modified waste flake

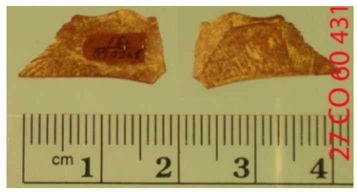
No. 2351 Retouched/modified waste flake



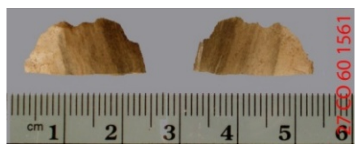
No. 1961 Retouched/modified waste flake

No. 1775 Retouched/modified waste flake

No. 1702 Retouched/modified waste flake



No. 431 Retouched/modified waste flake



No. 1561 Retouched/modified waste flake

No. 2702 Retouched/modified waste flake

No. 2284 Retouched/modified waste flake

No. 2781 Retouched/modified waste flake

No. 2805 Retouched/modified waste flake

No. 2793 Retouched/modified waste flake

No. 1790 Retouched/modified waste flake

No. 2728 Scraper, end

6.2 Locus K/G artifact composition

Locus K/G (see Figure 3.13), is two artifact concentrations separated by only two meters and are suspected to be related perhaps during a reoccupation event. Therefore they have been combined into a single locus for purposes of these analyses. The fourth largest, Locus K/G, measured by flaked stone artifact count (Table 6.3), contains 82 non-waste flakes composed of 71 tools including eight bifaces, in addition to 11 non-tools, i.e., two cores, three core fragments, and six-channel flakes. Non-waste flake artifacts plus 1757 pieces of debitage yields a total of 1839 pieces from 20 m² (16 m² K, four m² G) of the excavated but not encompassed area. Examples of tool artifacts are shown in Figure 6.16 including a reference number for identification of specific pieces. Included in the total are two scrapers, and 12 waste flakes from the four m² excavated area of Locus G. Total artifact density is 93.4/ m² with a tool density of 3.55/ m².

Table 6.3 Locus K/G flaked stone tool artifact composition by material type

Specimen Type	Untyped Rhyolite	Mt. Jasper Rhyolite	Jefferson Rhyolite	Granite	Quartz	Munsungun	Hornfels	Untyped Chert	Grand Total
Biface	1	6						1	8
Channel Flake		3				3			6
Core		2							2
Core Fragment	1	2							3
Hammerstone					1				1
Projectile Point / Knife	1	6				1			8
Raw Material Unmodified									0
Scraper	3	20				11			34
Uniface									0
Utilized Waste flake									0
Waste Flake	98	1097	17		7	395	103	40	1757
Waste Flake Modified / Retouched	2	14				2			18
Wedge / Pièces esquillées		2							2
Grand Total	106	1152	17	0	8	412	103	41	1839

Material sources for Locus K/G's artifact assemblage are comprised of seven lithic types with the dominant varieties being undifferentiated or untyped rhyolite, Mt. Jasper rhyolite, and Munsungun chert. Artifact category, material type, and quantities are exhibited in Table 6.3 and by percentage in Table 6.4.

Table 6.4 Locus K/G artifact composition by percentage of material type

Specimen Type	Untyped Rhyolite	Mt. Jasper Rhyolite	Jefferson Rhyolite	Granite	Quartz	Munsungun	Hornfels	Untyped Chert	Grand Total
Grand Total	106	1152	17	0	8	412	103	41	1839
%	5.8	62.6	0.9	0.0	0.4	22.4	5.6	2.3	100

6.2.1 Locus K/G Horizontal assemblage distribution

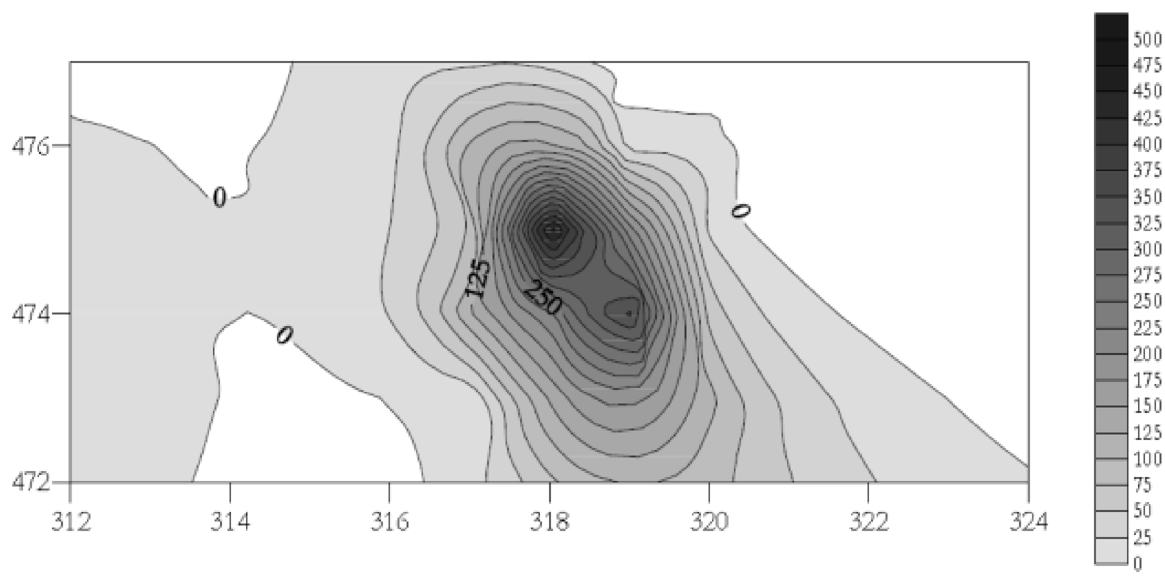


Figure 6.9 Block K/G Northing, Easting horizontal isopleth artifact density plot.

The Horizontal artifact assemblage density distribution for Locus K/G is represented by Figures 6.9 total chipped stone artifact density, 6.10 horizontal debitage placements by 50 cm quad, and 6.11 horizontal tool placement by 50 cm quad. This locus contains the K/G Block excavation units, and any associated nearby flake scatter. The isopleth site grid shown in Figure 6.9, dimensioned in meters, exhibits the highest density total combined tool and debitage concentrations by area for Locus K/G.

Over 93% of the artifacts are found in an oval measuring approximately four by five meters and oriented northwest-southeast on the site grid as shown in Figure 6.10. Block G, located two meters to the west, contains a scatter of 12 mostly rhyolite waste flakes with two rhyolite scrapers located at the southeast end. However, no diagnostic artifacts were found in Block G.

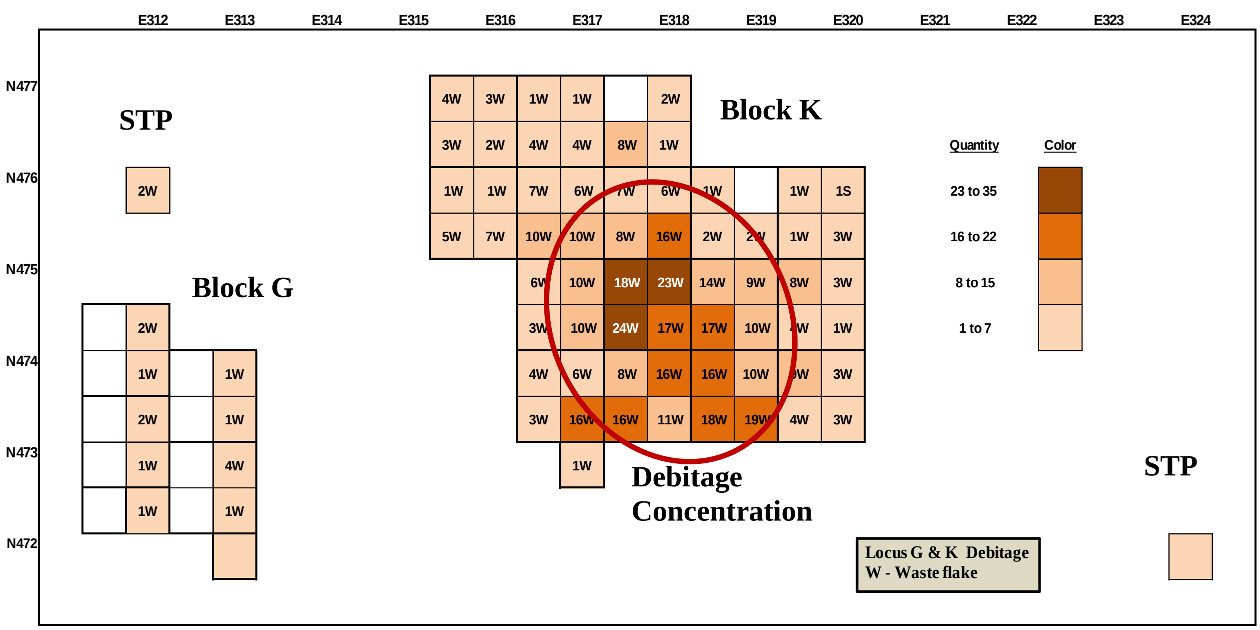


Figure 6.10 Locus K/G Horizontal debitage placement by 50 cm quad.

Figure 6.11, horizontal tool placement also exhibits, but to a lesser extent, the same pattern as the debitage distribution orientation. Both waste flakes and tools are co-located in the interior quads of the higher-density region which is oriented on the northwest-southeast axis of the locus. Little correlation is observed between tool type and density of waste flakes co-located by quad or near neighbor.

Low concentrations of scattered outlier waste flakes and miscellaneous individual tools from the STP site survey occur from 2 to 5 m from the central high-density portion of the locus.

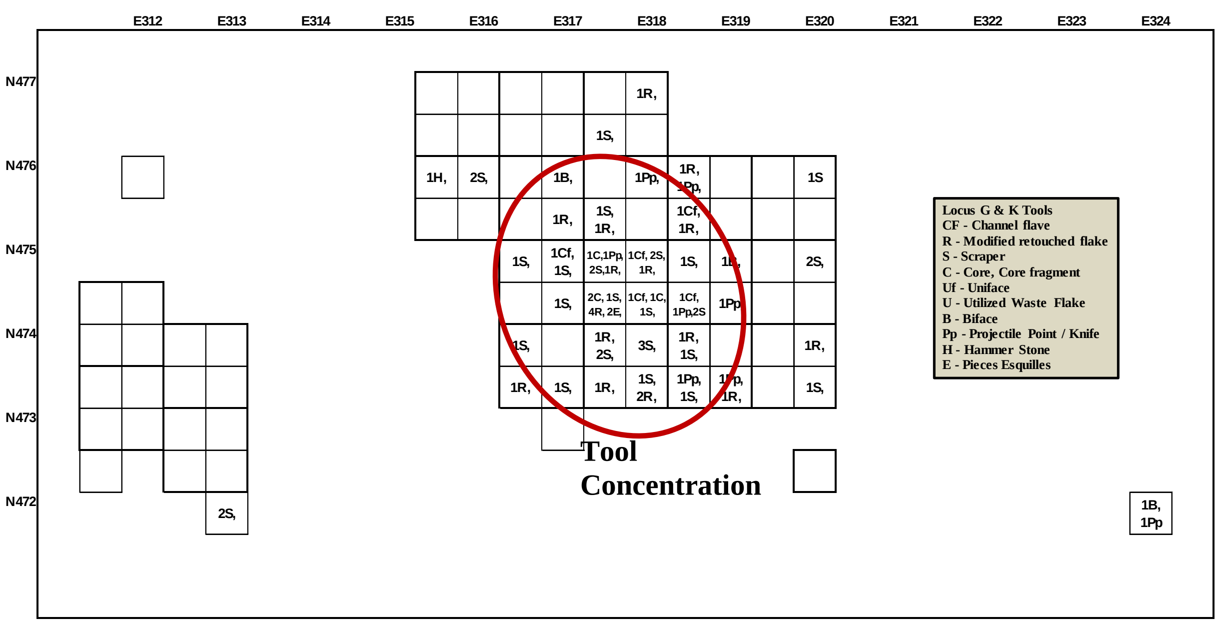


Figure 6.11 Locus K/G Horizontal tool placement by 50 cm quad.

6.2.2 Locus K/G vertical assemblage distribution

Locus K/G's vertical assemblage distribution defined by soil levels resided primarily in Zone I or A_1 horizon (1300 artifacts), and Zone II (550), with a few residing in Zone III (35) or the B_1, and B_2 horizons. No artifacts were identified in Zone 0 or O_g horizon, the surface, and forest duff layer. This artifact distribution is comprised of the combined flaked stone tool and debitage concentrations. These two zones comprise approximately 25 cm of excavated depth.

Generation of Locus K/G's vertical assemblage distribution histograms by tool type, waste flake artifact quantities, raw material type by excavation level was constructed from the data collected and organized in the site excavation database. The graphical depiction of stratigraphic flaked stone debitage and tool positions excavated by 5cm level is illustrated in Figures 6.12 and 6.13.

Locus K/G's assemblage, comprised of both tools and waste flakes of all material types, occurs in Levels 2 through 8 or 10 cm to 30 cm in depth. The highest density of artifacts, i.e., quantities of 200 to 400, occur in Levels 2 through 6. Lower quantities appear with lower double or single digits in Levels 8-12.

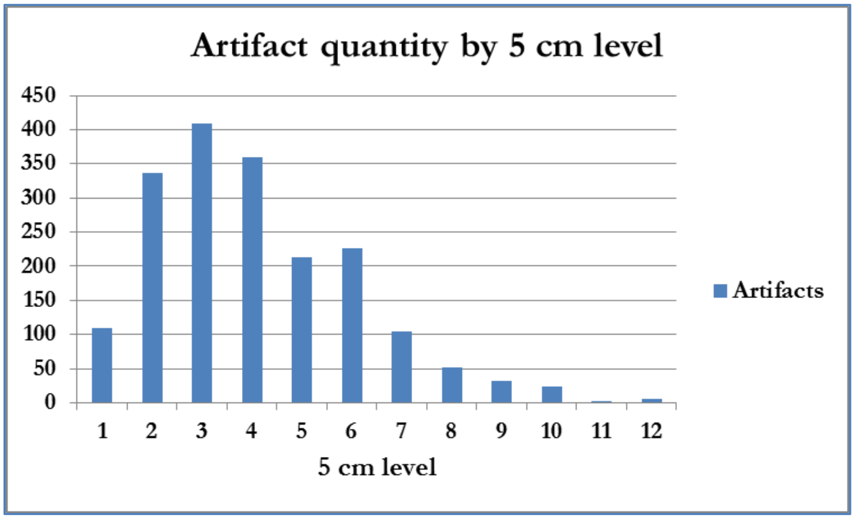


Figure 6.12 Locus K/G artifact count by 5 cm level

Locus K/G's combined material type tool distribution by quantity and 5 cm level (Figure 6.13), closely follows the distribution pattern, and artifact count by level, as shown in Figure 6.12. Again, the bulk of the distribution is seen occurring in 5 cm Levels 2 through 7, or 10 cm to 25 cm in depth. The highest density of tools, i.e., quantities of 6 to 18, occur in Levels 2 through 7 with lower quantities in the single digits ranging through Levels 8-9.

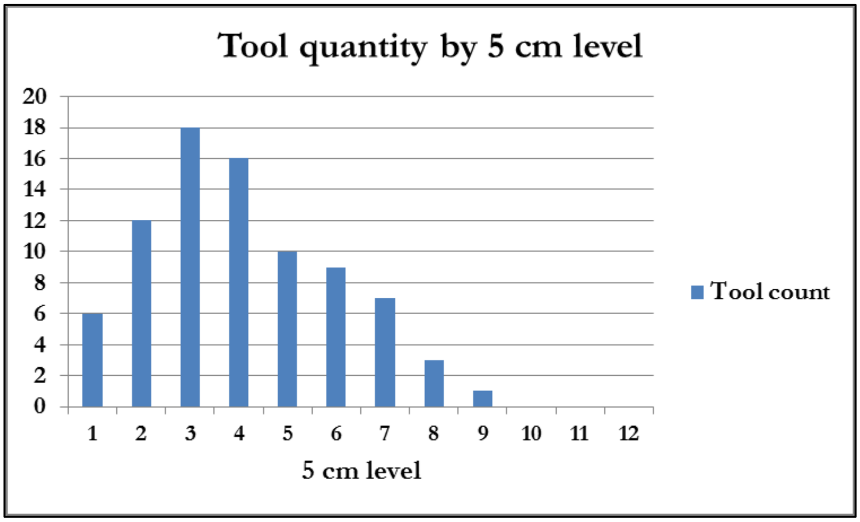


Figure 6.13 Locus K/G tool count by level.

When the artifact distribution by level and material type shown in Figure 6.14 is considered, the most prevalent artifact material types, i.e., untyped rhyolite, Munsungun chert, Mt. Jasper rhyolite, and Jefferson rhyolite are seen to nominally occur in all levels of the excavation. However, in the case of Munsungun chert artifacts, a significant percentage resides in Levels 2 through 6 with a peak occurring between Levels 2 and 3. Conversely, the distribution of rhyolite artifacts peaks some 10 cm lower in depth at Level 4.

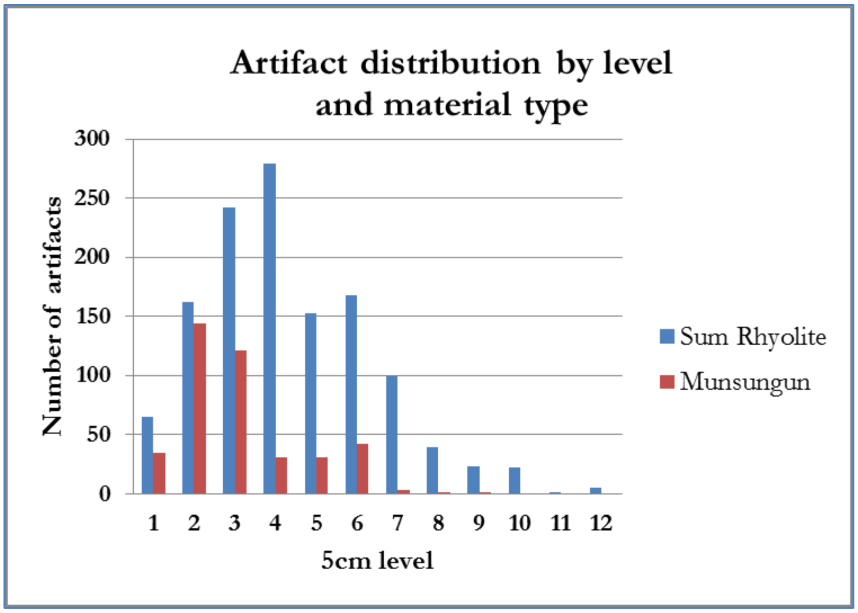


Figure 6.14 Locus K/G artifact distributions by 5cm level and material type.

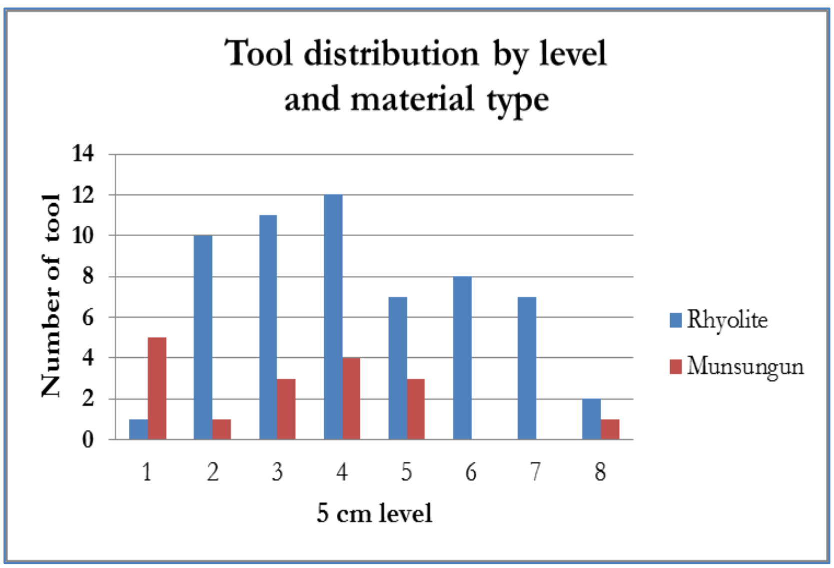


Figure 6.15 Locus K/G tool distributions by 5cm level and material type.

Considering only tools by material and level, a uniform quantity of Munsungun chert tools is distributed across Levels 1 to 5 with an outlier at Level 8 (Figure 6.15). In the case of rhyolite tools (Figure 6.15), a substantial number are found in Levels 2 through 8 with somewhat of a peak indicated at Level 4. Comparable to the entire tool vertical distribution, rhyolite tools are distributed over Levels 1 through 9 as opposed to the Munsungun tools found in levels one through five. The material type differential might suggest different deposition events at the locus. However, because there is significant overlap of both material type artifact distributions in addition to the effects of the mixed soil horizon from cryoturbation and bioturbation, these factors must be considered in examining the artifact distributions and evaluation of this suggestion.

The suggestion that multiple depositions events occurred because of the stratigraphic positioning of the Munsungun and rhyolite tool artifacts is attractive because of the morphologically diagnostic projectile points found at the locus from two different Paleoamerican horizons (Bull Brook and Michaud). However, because tool distribution by material type (Figure 6.15) displays overlap as well as insufficient stratigraphic separation and point depositions separated from 1-3m horizontally and at different levels, further consideration is warranted.

Figure 6.16 Samples of Locus K/G artifact types.

Ref. No. 1783 Projectile point base.

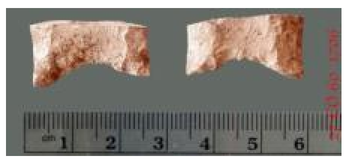
Ref. No. 1723 Projectile point Untyped.

Ref. No. 1746 Biface Fragment

Ref. No. 1730 Channel flake

Ref. No. 1778 Biface Fragment

Ref. No. 1730 Channel flake

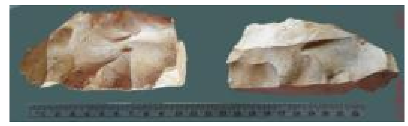


Ref. No. 1706 Projectile point base.

Ref. No. 1457 Biface

Ref. No. 1723 Projectile point Untyped.

Ref. No. 1751 Core



Ref. No. 1717 Core

Ref. No. 2180 Hammer stone fragment

Ref. No. 1769 Side scraper

Ref. No. 1770 Scraper

Figure 6.16 Samples of Locus K/G artifact types continued.

Ref. No. 1709 End Scraper

Ref. No. 1734 End Scraper

Ref. No. 1541 Retouched / modified waste flake

Ref. No. 2748 Side Scraper

Ref. No. 1734 End Scraper

Ref. No. 2805 Retouched / modified waste flake

Ref. No. 1793 Retouched / modified waste flake

Ref. No. 2714 Retouched / modified waste flak

Ref. No. 2721 Retouched/waste

6.3 Locus C artifact composition

Locus C (see Figure 3.13) is the third largest locus by artifact count of the loci being analyzed. The locus contains 91 non-waste flakes composed of 71 tools including 15 bifaces (see Figure 6.24 for examples). In addition, there are 20 non-tools, i.e., one core, four core fragments, 13 channel flakes and two pieces of unmodified raw material. Non-waste flakes artifacts and the 2135 pieces of debitage gives a total of 2226 chipped stone artifacts from 23 m² of excavated but not included area. Total artifact density is 93.3/ m² with a tool density of 3.78/ m². Material sources for locus C's artifact assemblage are comprised of eight types with the dominant varieties again being Mt. Jasper rhyolite, Munsungun chert, and Jefferson rhyolite in that order. Artifact category, material type, and quantities are presented in Table 6.5 and by percentage in Table 6.6 below.

Table 6.5 Locus C flaked stone tool artifact composition by material type

Specimen Type	Untyped Rhyolite	Mt. Jasper Rhyolite	Jefferson Rhyolite	Granite	Quartz	Munsungun	Hornfels	Untyped Chert	Grand Total
Biface	1	11				3			15
Channel Flake	1	4				8			13
Core		1							1
Core Fragment	1	3							4
Hammerstone				1					1
Projectile Point / Knife		1				2			3
Raw Material Unmodified		2							2
Scraper	1	4				6		1	12
Uniface		1							1
Utilized Waste flake	1	4							5
Waste Flake	128	1440	27		6	512	3	19	2135
Waste Flake Modified / Retouched	2	16	1		1	11		1	32
Wedge / Pièces esquillées						1		1	2
Grand Total	135	1487	28	1	7	543	3	22	2226

Table 6.6 Locus C Summary Material Composition by percentage

Specimen Type	Untyped Rhyolite	Mt. Jasper Rhyolite	Jefferson Rhyolite	Granite	Quartz	Munsungun	Hornfels	Untyped Chert	Grand Total
Grand Total	135	1487	28	1	7	543	3	22	2226
%	6.1	66.8	1.3	0.0	0.3	24.4	0.1	1.0	100

6.3.1 Locus C horizontal assemblage distribution

Locus C's horizontal artifact assemblage density distribution is shown in Figure 6.17; total chipped stone artifact density, Figure 6.18 horizontal debitage placements by 50 cm quad, and Figure 6.19 horizontal tool placement by 50 cm quad. This locus is made up of the C Block excavation units, and any associated nearby flake scatter. Measured in meters, the isopleth site grid shown in Figure 6.17, exhibits the greatest density of total combined tool and debitage concentrations by area for Locus C.

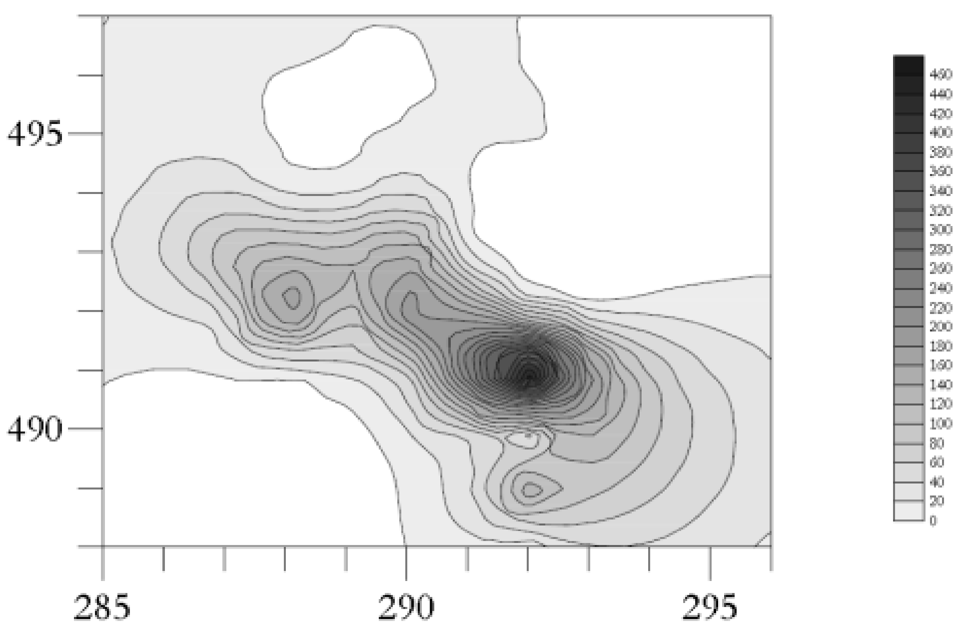


Figure 6.17: Locus C Horizontal artifact density by quantity

The bulk of the flaked stone assemblage (over 90%) lies within an oval approximately 6 meters by 3.5 meters and is oriented Northwest to Southeast on the site grid (see oval marked on Figure 6.18). Both waste flakes and tool artifacts are found co-located in higher concentrations in the interior quads of the locus boundaries. There is no strong correlation observed between tool type and density of waste flakes co-located by quad. Low concentrations of outlier waste flake and individual tools occur from two to five meters distant to the central high-density portion of the locus.

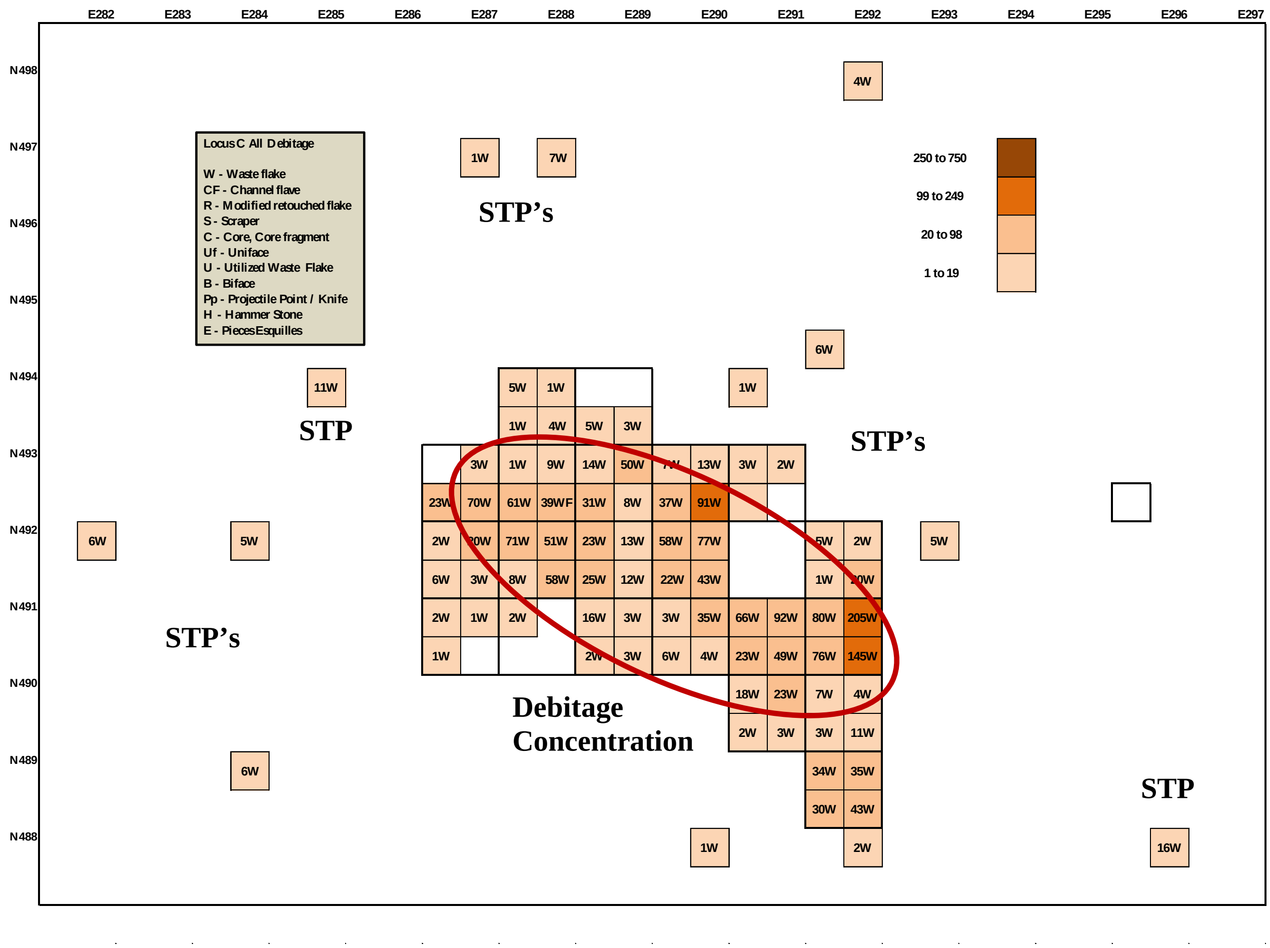


Figure 6.18 Locus C horizontal debitage quantity and placement by 50 cm quad with the concentration outlined in red.

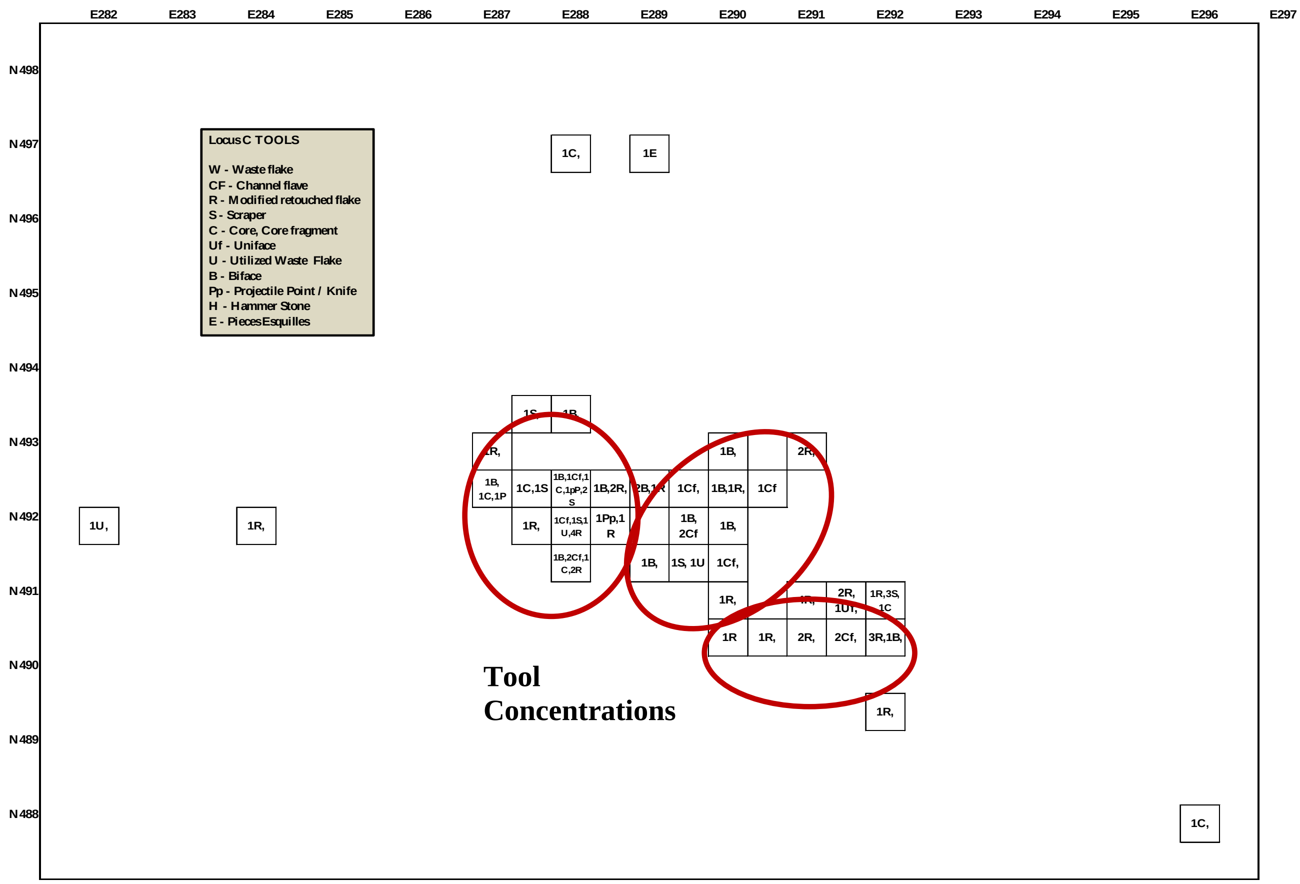


Figure 6.19 Locus C horizontal tool placement by 50 cm quad.

When viewed from a tool only perspective, three artifact clusters of higher concentrations of co-located tools becomes evident in a roughly circular cluster located at N492–E288; a 2 x 1 m oval at N492–E290; and a 2 x 3 m oval at N490–E291. These higher artifact potential event clusters are more discernable in the horizontal tool artifact placement plot shown in Figures 6.19.

6.3.2 Locus C vertical assemblage distribution

When Locus C's lithic artifact types, composed of both tools and waste flakes are considered by zone, the vertical assemblage distribution defined by soil levels resided primarily in three zones. These are Zone I or A_1 horizon (750 artifacts), and Zone II (1420), with a few residing in Zone III (42) or the B_1, and B_2 horizons. And lastly, there were a very small number of flakes found in Zone IV (14) corresponding to the C Horizon that was differentiated by a significantly more compact bottom-most layer. No artifacts were identified in Zone 0 or O_g horizon, the surface, and forest duff layer. These two zones encompass approximately 30 to 35 cm of excavated depth.

Viewed by distribution quantity by level, the bulk of the dispersal occurs in Levels 2 through 10. The highest density of artifacts, i.e., quantities of 150 to 430, appear in Levels 3 through 8 with smaller quantities in the low double or single digits ranging from Levels 10 to 19. The frequency diagram, giving excavated stratigraphic artifact position by 5 cm Level, is shown in Figure 6.20.

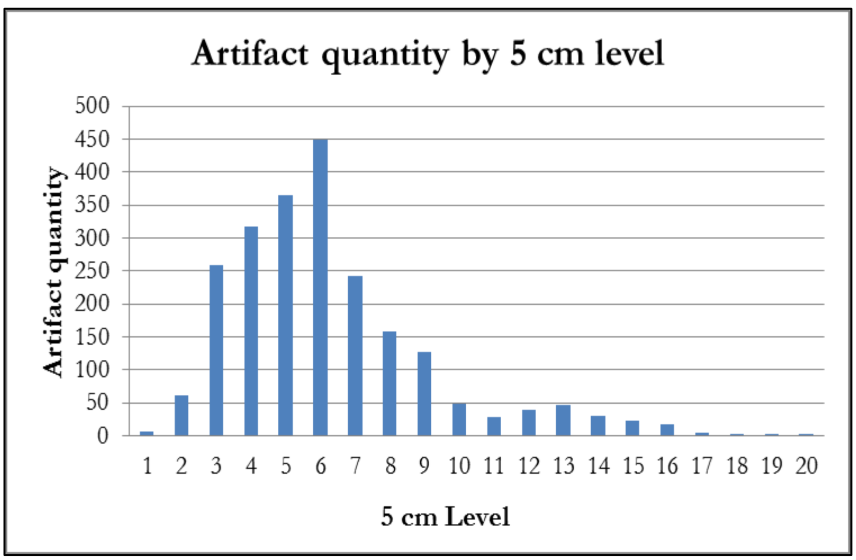


Figure 6.20 Locus C vertical artifact distribution by 5 cm Level.

The slight increase in artifact frequency in the lowest levels likely represents the limit of downward artifact migration. This occurs when very small flakes migrate down through the soil column and coming to rest on the more compact lower zones or bedrock. Migration occurs from natural phenomena such as the freeze-thaw cycle in addition to worm and rodent burrowing.

Locus C's tool distribution quantities of combined material type by level (Figure 6.21), closely follows the distribution pattern as shown in Figure 6.20, artifact distribution by 5 cm level. The highest density of tools, quantities of 6 to 23, occur in Levels 2 through 6, corresponding to 10 cm to 30 cm of excavated depth, with lower quantities in the single digits ranging through Levels 7- 20.

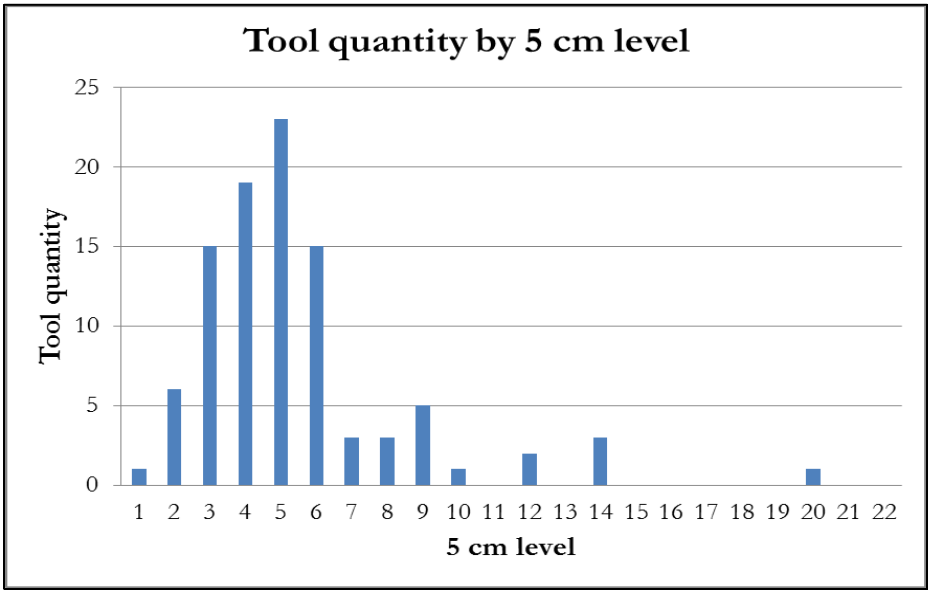


Figure 6.21 Locus C vertical tool distribution in by 5 cm level.

The material type of the chipped stone assemblage is a potentially significant variable that may assist in parsing the occupational history of this locus. Figure 6.22, constructed from the data in the site's flaked stone artifact database, shows the most prevalent artifact material types for locus C, i.e., untyped rhyolite, Munsungun chert, Mt. Jasper rhyolite, and Jefferson rhyolite, and is seen nominally to occur in all levels of the excavation. However, in the case of Munsungun chert artifacts, a significant percentage resides in Levels 2 through 8 with a broad peak occurring between Levels 3 to 6. Conversely, the distribution of rhyolite artifacts peaks 10 cm lower in depth at Levels 5 to 8.

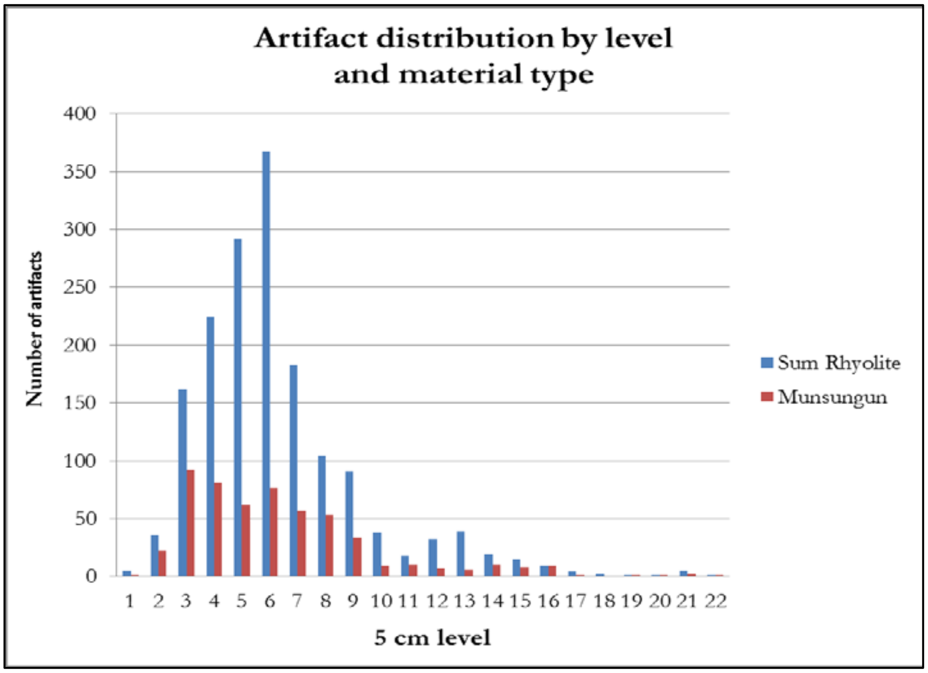


Figure 6.22 Locus C vertical artifact distribution in unit quantity by 5 cm level and material type.

Considering only tools, by material and level, some quantity of Munsungun chert tools are recognized across Levels 1 to 13 (Figure 6.23) with the bulk residing in Levels 1 - 5. In the case of rhyolite tools (Figure 6.23), quantities are also identified across Levels 1 to 13 but with the most substantial number occurring in Levels 3 through 8.

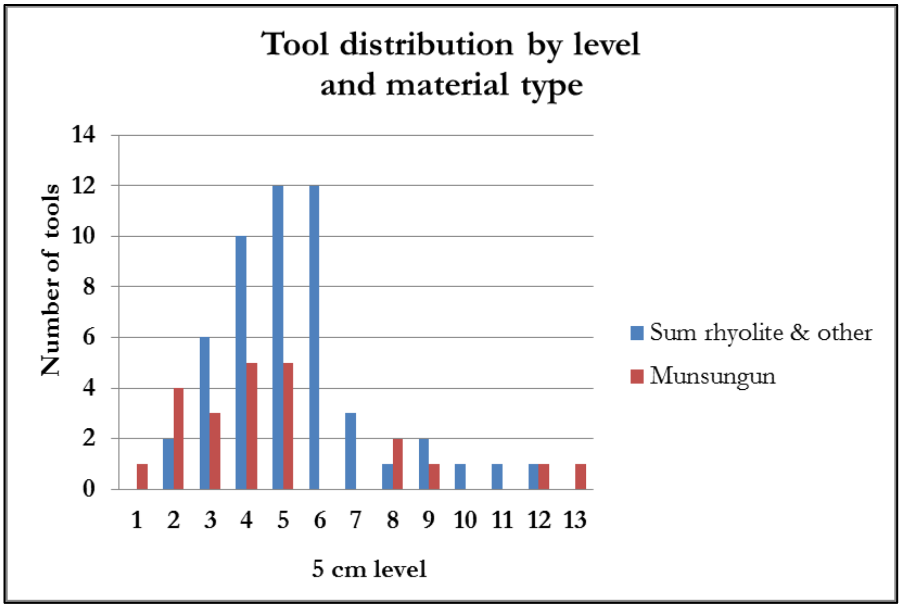


Figure 6.23 Locus C vertical tool distribution in unit quantity by 5 cm level and material type.

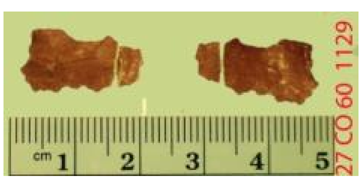
The overall difference in peak levels of both the vertical artifact distribution and tool distribution by level and material type might suggest different deposition events at the locus. However, because there is significant overlap of both material types artifact distributions and the effects of the mixed soil horizons from cryoturbation and bioturbation, these exogenous factors must be considered when examining these distributions for support of this hypothesis. There is, however, no diagnostic artifact or ^{14}C support.

Figure 6.24 samples of Locus C artifact types.

Ref. No. 1789 Biface

Ref. No. 496 Biface

Ref. No. 950 Biface



Ref. No. 1129 Channel flake

Ref. No. 1764 Channel flake

Ref. No. 1817 Channel flake

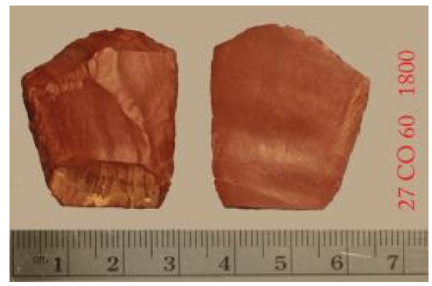
Ref. No. 1812 Core

Ref. No. 1016 Core

Ref. No. 769 Projectile Pt. / Knife Frag

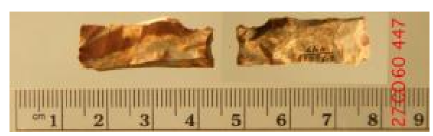
Ref. No. 332 Projectile Pt. / Knife Frag

Ref. No. 1339 End Scraper



Ref. No. 1800 End Scraper

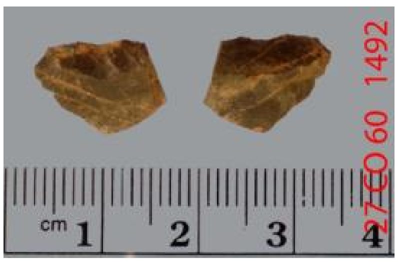
Ref. No. 498 End Scraper



Ref. No. 447 Side Scraper

Figure 6.24 samples of Locus C artifact types continued.

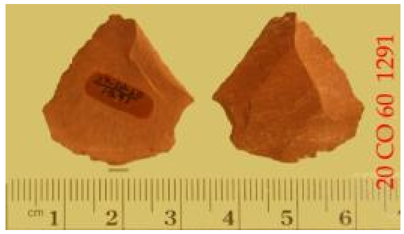
Ref. No. 768 Side Scraper



Ref. No. 1492 Untyped Scraper

Ref. No. 412 Retouched / modified waste flake

Ref. No. 1791 Retouched / modified waste flake



Ref. No. 1291 Retouched / modified waste flake

Ref. No. 1813 Retouched / modified waste flake

Ref. No. 1828 Retouched / modified waste flake

Ref. No. 1768 Wedge

Ref. No. 1828 Retouched / modified waste flake

Ref. No. 1778 Biface

Ref. No. 511 Channel flake

6.4 Conclusions

This chapter portrayed the Potter site archaeological context and characterization of Loci H, K/G, and C. For each of the loci, its' assemblage composition by artifact type, quantity and production material was presented. Also, both the horizontal and vertical assemblage distribution was depicted showing piece positioning by type in addition to areas of high artifact concentration. While several flaked stone material types were identified in each of the loci, the bulk (greater than 90%) of each of the assemblages was composed of local rhyolites and exotic Munsungun chert.

Loci H, K/G, and C each exhibited the interesting property of a high tool index value, where tool index value is defined as the product of the number of different tool types multiplied by the quantity of each of these tool types. This characteristic may be indicative of the range of activities that took place at each of these loci.

Chapter VII

Potter site locus F and B archaeological context

Chapter VII continues with the archaeological contextual characterization for loci F and B following the same format as used in Chapter VI. Loci F and B are grouped jointly because of their similarity in a narrower range and quantity of tool types in addition to the high ratio of debitage to tools.

Locus F characterization

7.1 Locus F artifact composition

Locus F (see Figure 3.13), is one of the smaller loci being analyzed both regarding the surface area and the total artifact numbers. Made up of a total of 408 artifacts, Locus F's assemblage is comprised of 48 tools including bifaces, one channel flake (Table 7.1) and 359 pieces of debitage within 11 m^2 of excavated but not included area (block versus included area discussed in Chapter III). Examples of tool artifacts are shown in Figure 7.7 including a reference number for identification of specific pieces. Artifact category, material type, and quantities are displayed in Table 7.1 and by percentage in Table 7.2.

The total artifact density is 34.2/ m^2 with a tool density of 4.5/ m^2. Locus F's artifact assemblage material sources consist of six varieties with mount Jasper rhyolite, Munsungun chert, and untyped rhyolite being the dominant varieties (Table 7.2).

Table 7.1 Locus F flaked stone tool artifact composition by material type

Specimen Type	Untyped Rhyolite	Mt. Jasper Rhyolite	Jefferson Rhyolite	Granite	Quartz	Munsungun	Hornfels	Untyped Chert	Grand Total
Biface	1	7				1			9
Channel Flake								1	1
Core									0
Core Fragment									0
Hammerstone									0
Projectile Point / Knife		1							1
Raw Material Unmodified									0
Scraper	1	7				17		1	26
Uniface									0
Utilized Waste flake									0
Waste Flake	27	305	6		1	19		1	359
Waste Flake Modified / Retouched		3				7			10
Wedge / Pièces esquillées						2			2
Grand Total	29	323	6	0	1	46	0	3	408

Table 7.2 Locus F summary material composition by percentage

Specimen Type	Untyped Rhyolite	Mt. Jasper Rhyolite	Jefferson Rhyolite	Granite	Quartz	Munsungun	Hornfels	Untyped Chert	Grand Total
Grand Total	29	323	6	0	1	46	0	3	408
%	7.1	79.2	1.5	0.0	.02	11.3	0.0	0.7	100

7.1.1 Locus F horizontal assemblage distribution

Horizontal artifact assemblage density distribution for Locus F is shown in Figures 7.1 as the total chipped stone artifact density isopleth, in 7.2 as horizontal tool placements by 50 cm quad, and in 7.3 as the horizontal waste flake placement by 50 cm quad. Excavation units of Block F and associated peripheral shovel test pits are included in this locus. The isopleth site grid shown in Figure 7.1, displays the greatest density of combined tool and debitage concentrations by area.

With an East to West orientation on the site grid (Figure 7.3), the bulk of the artifacts lie within a rectangular distribution measuring approximately four meters by two meters (E284-E288, N475-N477).

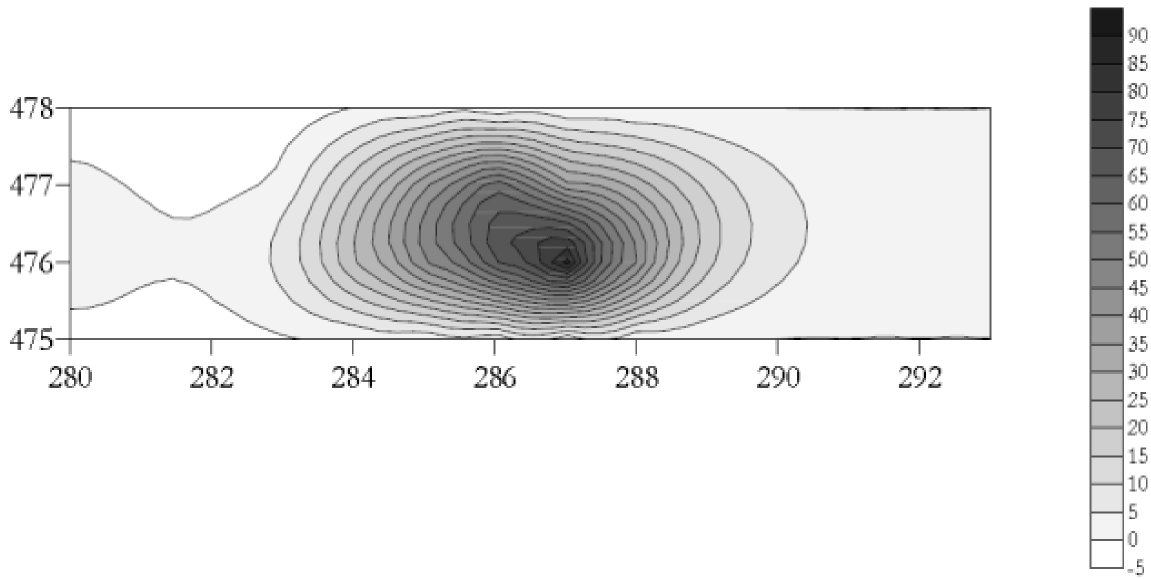


Figure 7.1 Locus F horizontal total artifact density by quantity isopleth

Horizontal tool and waste flake distribution placement by 50 cm quad (Figures 7.2 and 7.3) show a somewhat different view from that of a homogenous distribution of tools and waste flakes. In the case of tool artifacts, two distinct concentrations are observed (Figure 7.2). The first extends from E284-N475 to E286-N477 in a southwest to northeast cluster and the second, E285-N475 to E287-N476 orients in an east-west direction. Tool types in the first cluster consisted of six retouched flakes, four bifaces, 15 scrapers, and two wedges. A similar distribution is found in the second cluster, i.e., three retouched flakes, four bifaces, 11 scrapers and one projectile point fragment showing little differentiation in tool types by the cluster.

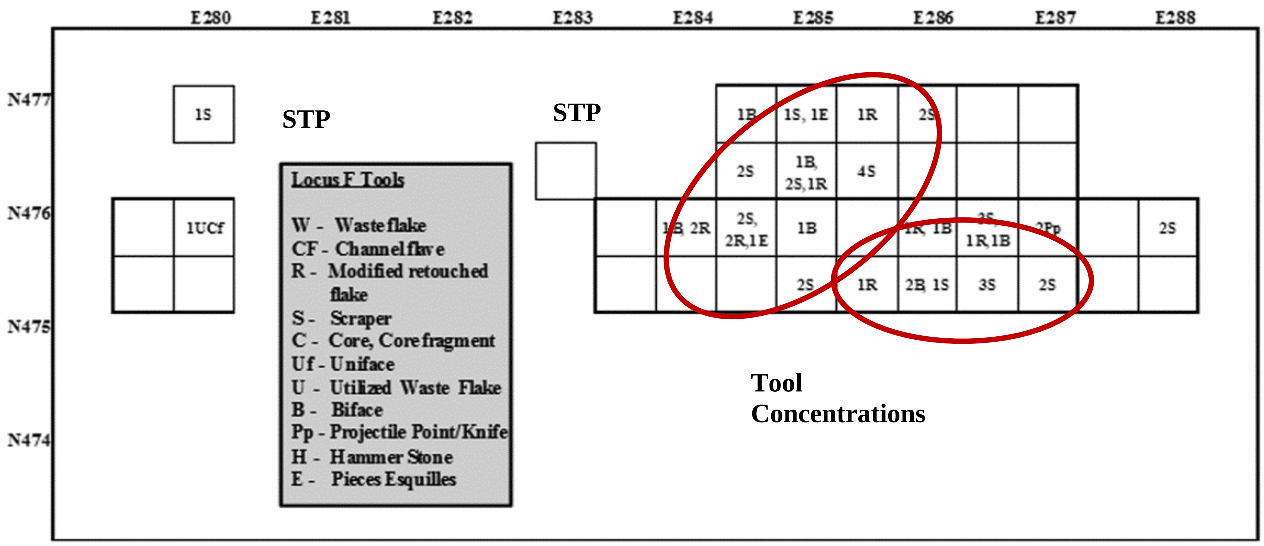


Figure 7.2 Locus F horizontal tool quantity and placement by 50 cm quad.

However, the correlation between tool concentrations and debitage distribution is weak to moderate at best. Waste flakes are distributed over the excavation area with larger concentrations at the south center, east and west ends. Further, little correlation is found between tool type and density of waste flakes co-located by quad or near neighbor.

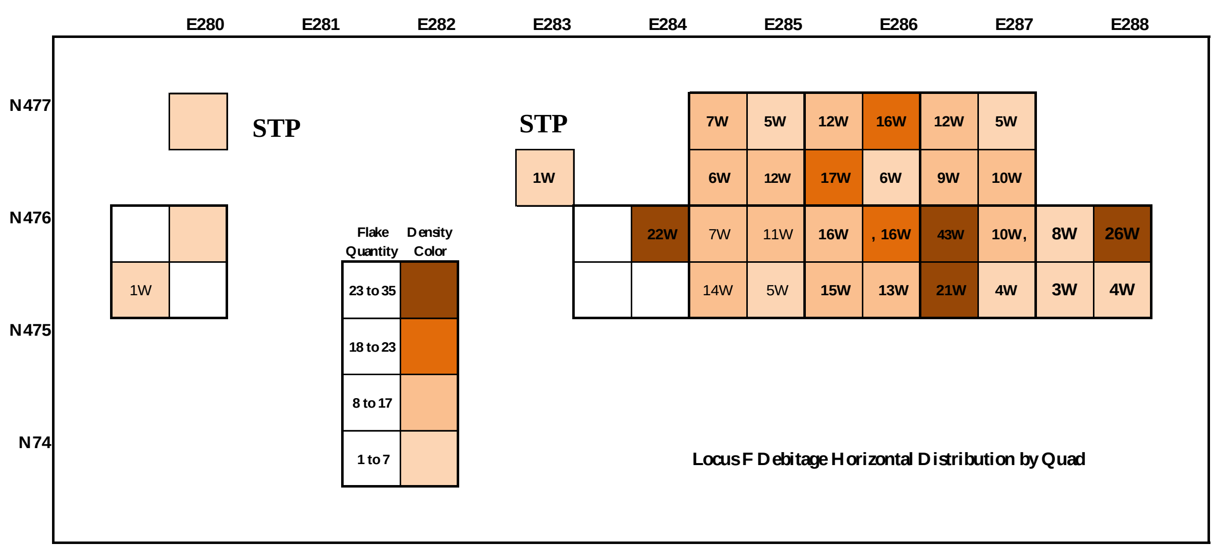


Figure 7.3 Locus F horizontal debitage quantity and placement by 50 cm quad.

7.1.2 Locus F vertical assemblage distribution

Locus F's vertical assemblage distribution defined by soil levels resided primarily in Zone I or A_1 horizon (170 artifacts), Zone II (225), and Zone III (13) or the B_1, and B_2 horizons. This depiction comprises the combined flaked stone tool and debitage concentrations. These three zones correspond to approximately 25 to 30 cm of excavated depth.

When Locus F's lithic assemblage, composed of both tools and waste flakes, are displayed by level (Figure 7.4) the highest density of artifacts, i.e., quantities of 40 to 90, appear in Levels 2 through 5 with smaller quantities in the low double or single digits ranging from Levels 6 to 8.

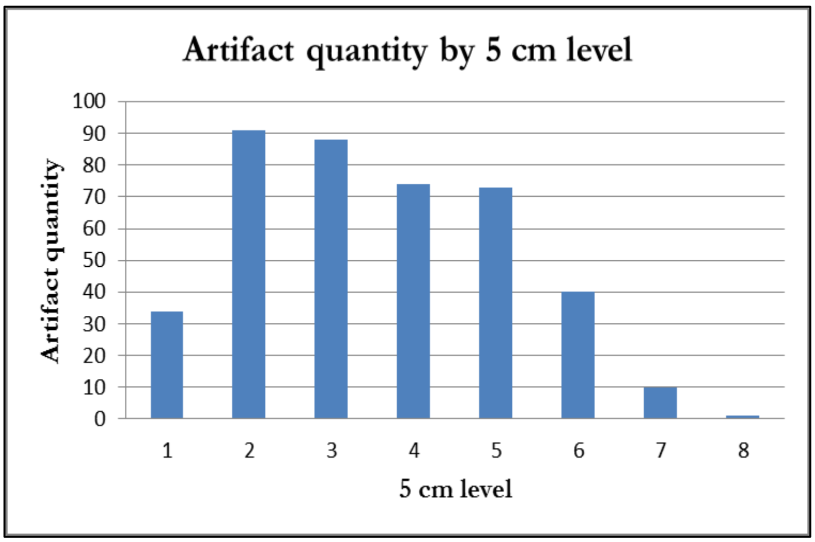


Figure 7.4 Locus F vertical artifact distribution by 5 cm Level.

Locus F's tool quantities by combined material type and level (Figure 7.5), follows a similar distribution pattern as shown in Figure 7.4, artifact count by level. The highest density of tools, quantities of 6 to 17 occur in Levels 1 through 5 or 5 cm to 25 cm in depth, with quantities in the single digits ranging through Levels 6-8.

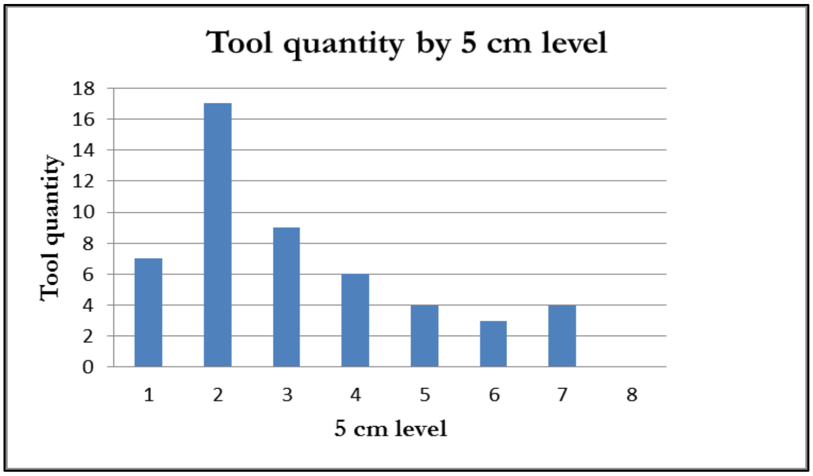


Figure 7.5 Locus F vertical tool distribution by 5 cm Level.

Figure 7.6, artifact distribution by level and material type, showing the most prevalent artifact material types, i.e., untyped rhyolite, Mt. Jasper rhyolite, Jefferson rhyolite (rhyolites), and Munsungun chert are seen to nominally occur in all Levels of the excavation. However, in the case of Munsungun chert artifacts, a significant percentage (66 plus %) resides in Levels 1 through 4 with a peak occurring at Level 2. Conversely, the distribution of rhyolite artifacts peaks 5 cm to 10 cm lower in depth at Levels 3 to 5.

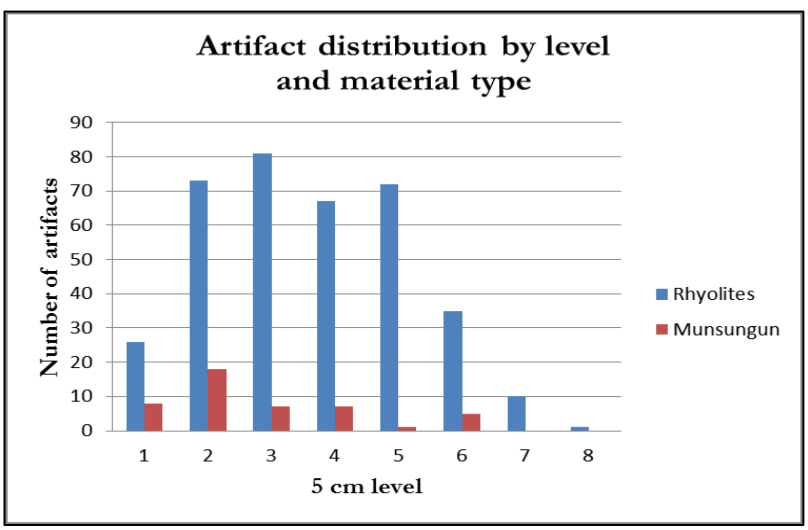


Figure 7.6 Locus F vertical artifact distribution by 5 cm Level and material type.

The overall difference, though small, in levels of both the vertical artifact distribution and tool distribution by level and material type might suggest different deposition events at the Locus. As will be discussed in a latter analysis section there were potentially two different use category events occurring at this locus. However, because there is significant overlap of both material type artifact distributions and the effects of the mixed soil horizons from cryoturbation and bioturbation, these exogenous factors must be considered in examining these distributions for support of this hypothesis. There is, however, no diagnostic artifact or ^{14}C evidence to support the hypothesis.

Figure 7.7 samples of Locus F artifact types.

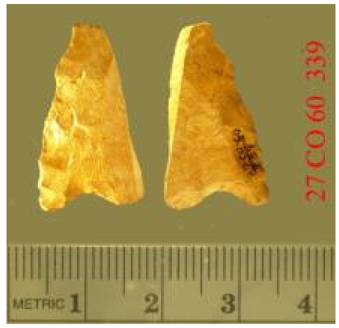
Ref. No. 411 Biface fragment

Ref. No. 540 Biface fragment

Ref. No. 681 Biface fragment

Ref. No. 978 Biface fragment

Ref. No. 378 End Scraper

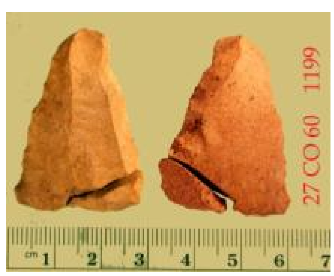


Ref. No. 339 Point / Knife Frag

Ref. No. 603 End Scraper

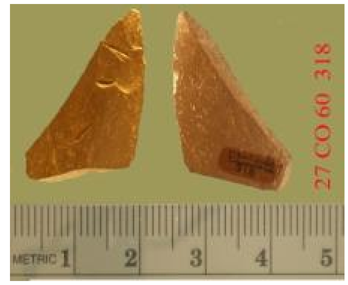
Ref. No. 323 Scraper

Ref. No. 765 End Scraper



Ref. No. 1199 End Scraper

Ref. No. 501 End Scraper

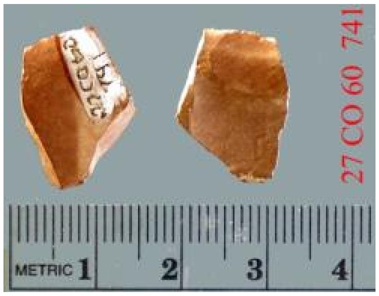


Ref. No. 318 Retouched / modified waste flake

Ref. No.529 Retouched / modified waste flake

Ref. No. 502 Retouched / modified waste flake

Figure 7.7 samples of Locus F artifact types continued.



Ref. No. 741 Retouched / modified waste flake

Ref. No. 959 Retouch/mod waste flake

Ref. No. 546 distal frag channel flake

Ref. No. 920 Wedge

Locus B characterization

7.2 Locus B artifact composition

Locus B is the largest Locus being analyzed regarding total artifacts. Made up of a total of 4229 artifacts Locus B's assemblage is comprised of 32 non-waste flakes artifacts of which there were 25 tools, six-channel flakes and one core fragment (see Figure 7.14 for tool examples), and 4197 pieces of debitage. The 4229 artifacts were found within 13.25 m² of excavated but not encompassed area. The total artifact density is 260.6/ m² with a tool density of 4.0/ m². Locus B's artifact assemblage material sources consist of six types with mount Jasper rhyolite (98%), and to a negligible extent Munsungun chert (1.77%), being the major varieties, in that order. Artifact category, material type, and quantities are displayed in Table 7.3 and by percentage in Table 7.4.

Table 7.3 Locus B flaked stone tool artifact composition by material type

Specimen Type	Untyped Rhyolite	Mt. Jasper Rhyolite	Jefferson Rhyolite	Granite	Quartz	Munsungun	Hornfels	Untyped Chert	Grand Total
Biface	1	5				1		1	8
Channel Flake		6	0						6
Core									0
Core Fragment		1							1
Hammerstone					1				1
Projectile Point / Knife									0
Raw Material Unmodified									0
Scraper		3				2			5
Uniface									0
Utilized Waste flake		5				1			6
Waste Flake	328	3703	82		6	71	2	5	4197
Waste Flake Modified / Retouched	0	4						1	5
Wedge / Pièces esquillées									0
Grand Total	329	3727	82	0	7	75	2	7	4229

Table 7.4 Locus B summary material composition by percentage

Specimen Type	Untyped Rhyolite	Mt. Jasper Rhyolite	Jefferson Rhyolite	Granite	Quartz	Munsungun	Hornfels	Untyped Chert	Grand Total
Grand Total	329	3727	82	0	7	75	2	7	4229
%	7.8	88.1	1.9	0.0	0.2	1.8	0	0.2	100

7.2.1 Locus B horizontal assemblage distribution

Horizontal artifact assemblage density distribution for Locus B is shown in Figure 7.8 total chipped stone artifact density, Figure 7.9 horizontal tool placements by 50 cm quad, and Figure 7.10 horizontal waste flake placement by 50 cm quad. Artifacts from excavation units of B Block and associated peripheral STP’s and near neighbor pits are included in this Locus. The isopleth site grid shown in Figure 7.8, displays the greatest density of combined tool and debitage concentrations by area. With a roughly oval orientation on the site grid (Figure 7.10), the bulk of the artifacts lie within an area measuring approximately three meters by four meters. There is a secondary concentration of 430 artifacts containing seven tools and 423 waste flakes located approximately four meters to five meters to the northeast from the main concentration.

Horizontal tool and waste flake distribution placement by 50 cm quad (Figures 7.9 and 7.10) show both waste flakes and tool artifacts co-located in higher concentrations in the interior quads of the locus boundaries. Little correlation is observed between tool type and density of waste flakes co-located by quad or near neighbor.

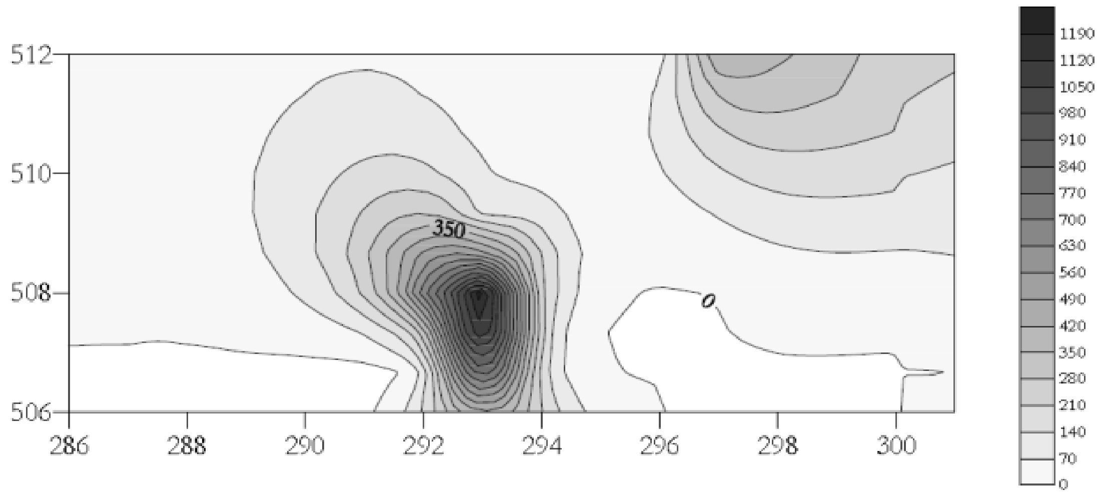


Figure 7.8 Locus B horizontal total artifact density by quantity isopleth

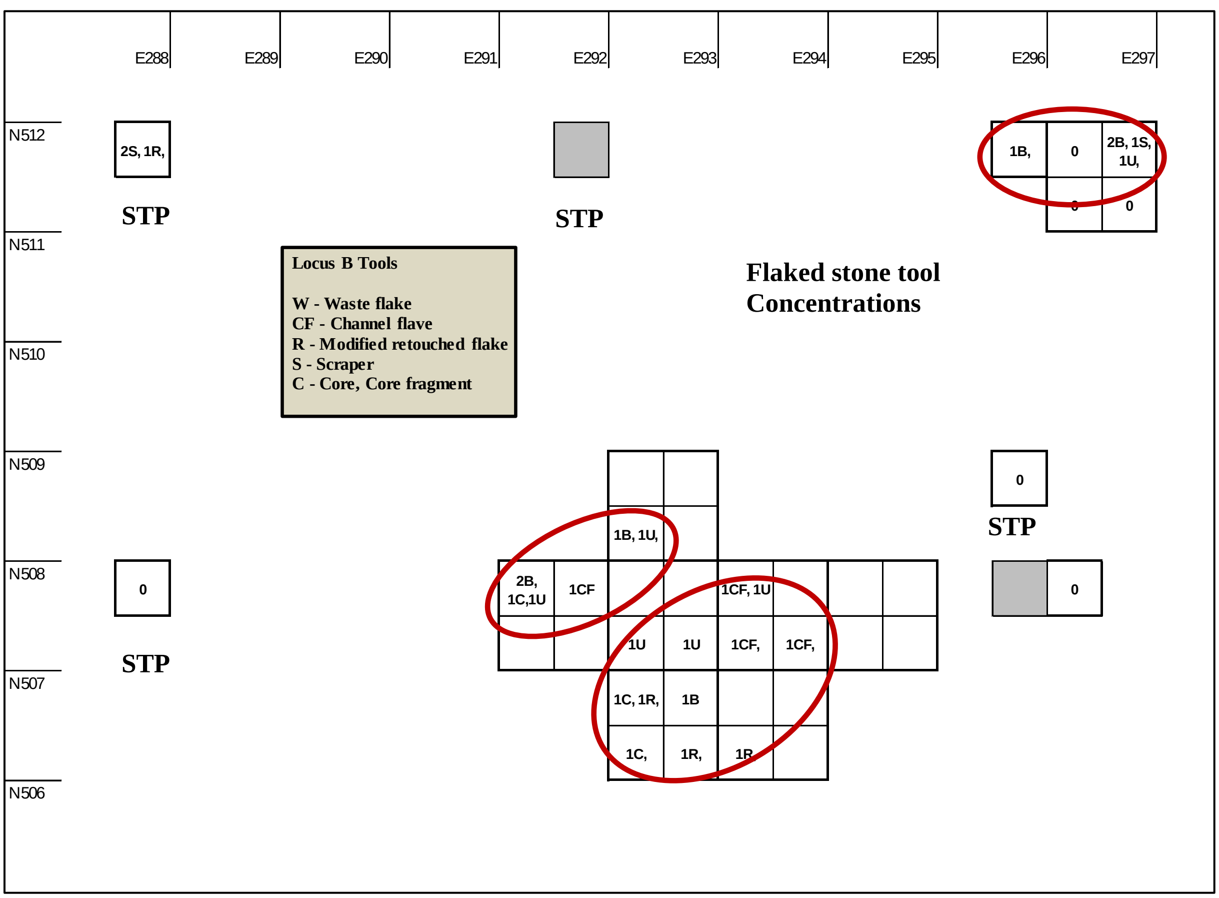


Figure 7.9 Locus B horizontal tool quantity and placement by 50 cm quad.

In the case of tool artifacts, as noted two distinct clusters are observed (Figure 7.9). The first extends from E291–N506 to E294–N508 in an approximately oblong cluster and the second oval, E295–N512 to E297-N512 orients in an east-west direction.

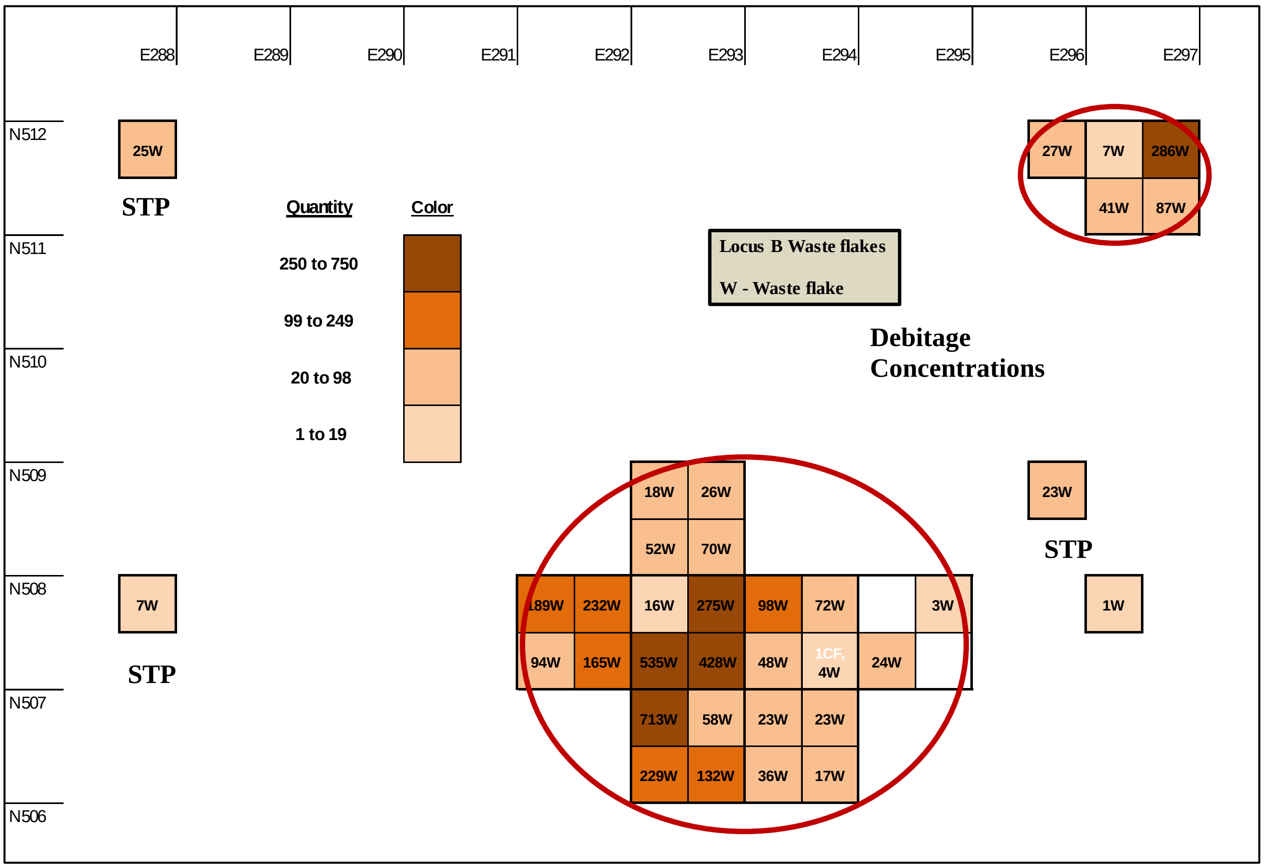


Figure 7.10 Locus B horizontal debitage quantity and placement by 50 cm quad.

7.2.2 Locus B vertical assemblage distribution

Locus B's vertical assemblage distribution defined by soil levels resided primarily in Zone I or A_1 horizon (270 artifacts), Zone II (2350), Zone II (1500), and Zone LL (109 lower level and wall scrapings), or the B_1, B_2 and D_g/R horizons. This depiction comprises the combined flaked stone tool and debitage concentrations. These three zones correspond to approximately 5 to 50 cm of excavated depth.

Locus B's artifact stratigraphic position by 5 cm level is shown in Figure 7.11. Viewed by quantity and level, the bulk of the distribution occurs in Levels 1 through 10. The highest density of artifacts, quantities of 300 to 600, appear in Levels 2 through 9 with smaller quantities in the low double or single digits in Levels 1 and 11.

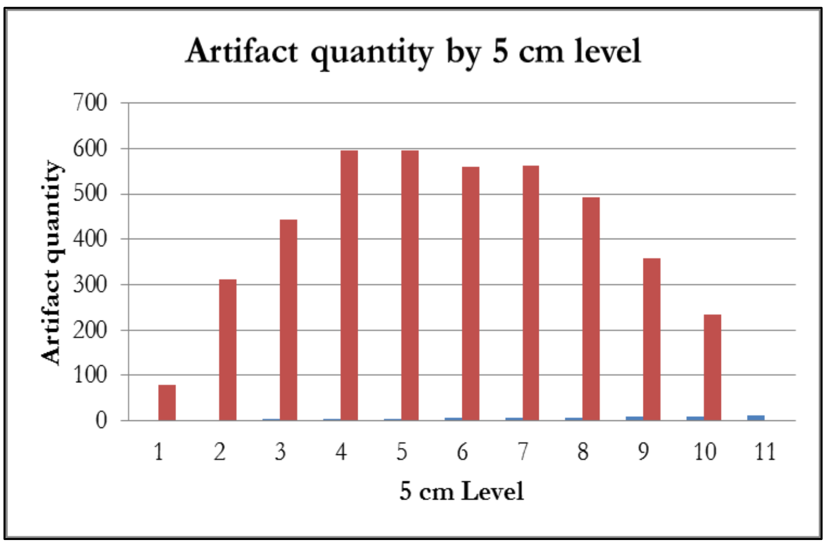


Figure 7.11 Locus B vertical artifact distribution by 5 cm Level.

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Locus B's tool quantities by combined material type and level (Figure 7.12), follows a relatively uniform distribution pattern in that artifacts were found in all levels from 1 through 10. The highest density of tools, in quantities of 7 to 8 occurs in Levels 3 and 4 or at 10 cm to 20 cm in depth. Lower quantities appear in single digits in Levels 1 and 2 in addition to Levels 5 through 10. It can be observed, however, that the number of tool artifacts is quite limited in scope and quantity with the bulk being bifaces, channel flakes, utilized and modified/retouched waste flakes.

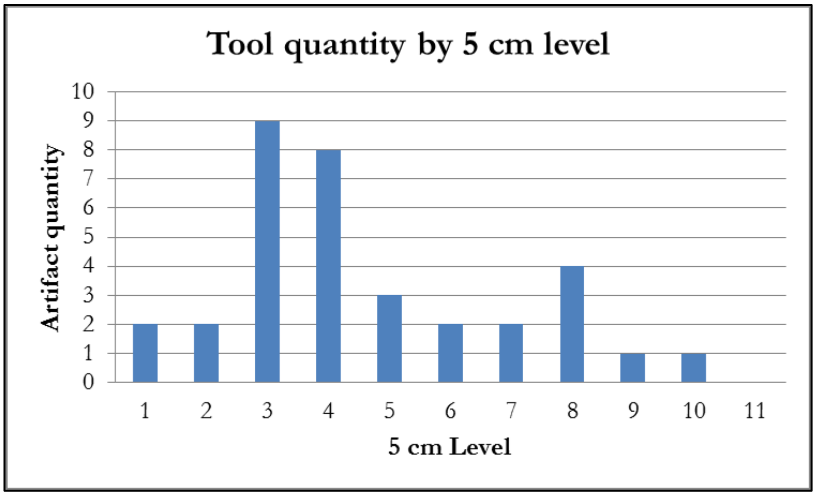


Figure 7.12 Locus B vertical tool distribution by 5 cm Level.

Figure 7.13, artifact distribution by level and material type, showing the most prevalent artifact material types, Mt. Jasper rhyolite, and Munsungun chert are seen to nominally occur in all levels of the excavation. As indicated earlier, Mt. Jasper rhyolite represents 98% of the assemblage of which 99+ percent are waste flakes. Munsungun chert with only a 2% proportion of the assemblage represents only four of the 24 tools.

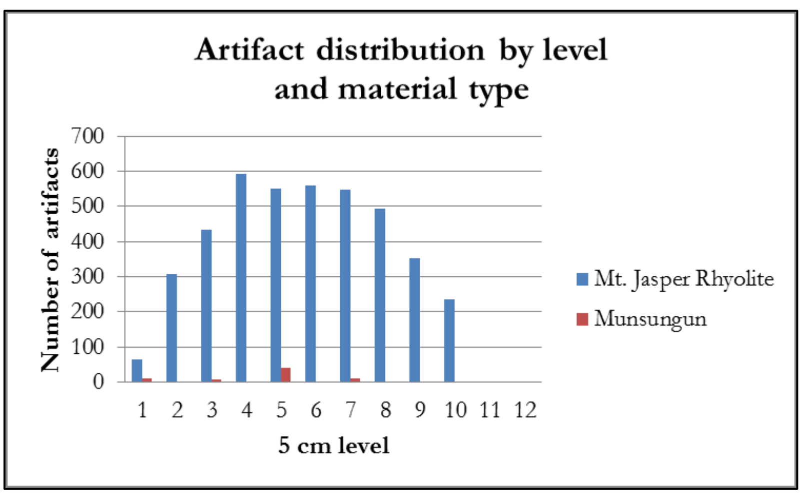
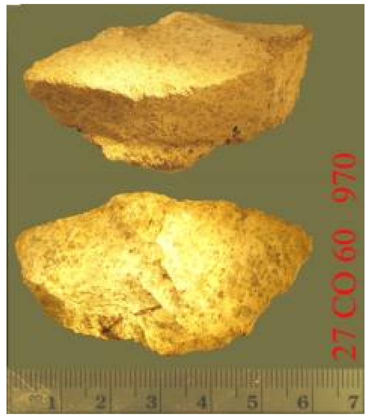


Figure 7.13 Locus B vertical artifact distribution by 5 cm Level and material type.

Figure 7.14 samples of Locus B artifact types.

Ref. No. 68 Biface fragment



Ref. No. 970 Biface fragment

Ref. No. 151 medial frag channel flake

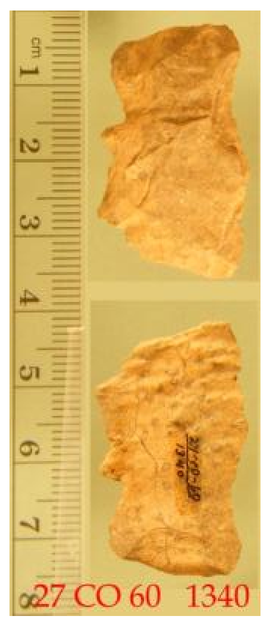
Ref. No. 180 Biface fragment

Ref. No. 1305 Biface fragment

Ref. No. 1333proximal frag channel flake

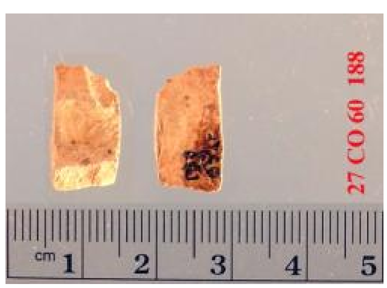
Ref. No. 181 Biface fragment

Ref. No. 151 medial frag channel flake



Ref. No. 1340 proximal frag channel flake

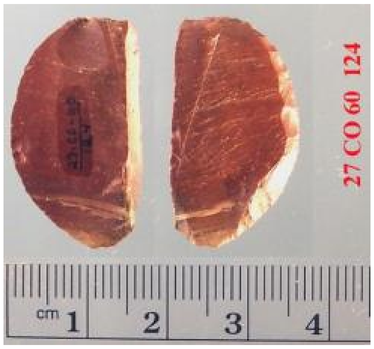
Ref. No. 185 Biface fragment



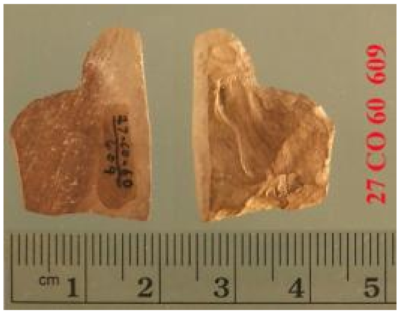
Ref. No. 188 medial frag channel flake

Figure 7.14 samples of Locus B artifact types continued.

Ref. No. 89 End Scraper



Ref. No. 124 Side Scraper



Ref. No. 609 Untyped Scraper

7.3 Conclusions

Chapter VII depicted the Potter site archaeological context and characterization of Loci F and B. For each of the loci, its' assemblage composition by artifact type, quantity and production material was described. Additionally, both the horizontal and vertical assemblage distribution was depicted showing piece positioning by type in addition to areas of high artifact concentration. While several tool stone material types were identified in each of the loci, the bulk of locus Fs' assemblage was composed of 87.8% local rhyolites and 11.3% exotic Munsungun chert. Locus Bs' assemblage was comprised of 97.8% local rhyolites and 1.8% exotic Munsungun chert.

It is noteworthy that Locus B has the property of a low tool index value and high debitage count, where tool index value is defined as the product of the number of different tool types multiplied by the quantity of each of these tool types. Similarly, Loci F has the property of a low tool index value, low debitage count but a high specialized tool count i.e., scrapers or cutting tools. These properties may be reflective of the range of activities that took place at each of these loci.

Chapter VIII

Potter site Locus M, J, A, D, and E archaeological context

Chapter VIII completes the archaeological contextual characterization of the Potter site's Loci M, J, A, D, and E following the same format as used in Chapters VI and VII. Loci M, J, A, D, and E are grouped collectively for reasons of their variety in terms of their small size either in number of artifacts or area covered, unusual horizontal artifact distribution, or single material type artifact assemblage.

Locus M characterization

8.1 Locus M artifact composition

Locus M (see Figure 3.13) is a relatively small locus consisting of only five 1 x 1 m excavation units located over 50 meters to the Southwest from the other site loci. Locus M's assemblage is made up of a total of 1423 artifacts and is comprised of 10 non-waste flake artifacts that include six tools and four-channel flakes (Figure 8.1) in addition to 1413 pieces of debitage. The assemblage was discovered within 3.25 m^2 of excavated but not included area. The total artifact density is 225.7/ m^2 with a tool density of 1.6/ m^2. Locus M's flaked stone assemblage material sources consist of six varieties with Munsungun chert being the bulk (96.3%), and to a negligible extent, rhyolites (2.5%). Artifact category, material type, and quantities are displayed in Table 8.1 and by percentage in Table 8.2. Figure 8.9 provides examples of tool artifacts.

Table 8.1 Locus M flaked stone tool artifact composition by material type

Specimen Type	Untyped Rhyolite	Mt. Jasper Rhyolite	Jefferson Rhyolite	Granite	Quartz	Munsungun	Hornfels	Untyped Chert	Grand Total
Biface						1			1
Channel Flake						3		1	4
Core									0
Core Fragment									0
Hammerstone									0
Projectile Point / Knife									0
Raw Material Unmodified									0
Scraper							2		2
Uniface									0
Utilized Waste flake						1			1
Waste Flake	2	34			3	1362		12	1413
Waste Flake Modified / Retouched						2			2
Wedge / Pièces esquillées									0
Grand Total	2	34	0	0	3	1369	2	13	1423

Table 8.2 Locus M summary material composition by percentage

Specimen Type	Untyped Rhyolite	Mt. Jasper Rhyolite	Jefferson Rhyolite	Granite	Quartz	Munsungun	Hornfels	Untyped Chert	Grand Total
Grand Total	2	34	0	0	3	1369	2	13	1423
%	0.1	2.4	0.0	0.0	0.2	96.3	0.1	0.9	100

8.1.1 Locus M horizontal assemblage distribution

Assemblage horizontal artifact density distribution for Locus M is shown in Figures 8.1 total chipped stone artifact density, 8.2 horizontal tool placements by 50 cm quad, and 8.3 horizontal waste flake placement by 50 cm quad. Artifacts from excavation units of M Block and associated nearby peripheral shovel test pits are included in this locus. The isopleth site grid shown in Figure 8.1, displays the greatest density of combined tool and debitage concentrations by area.

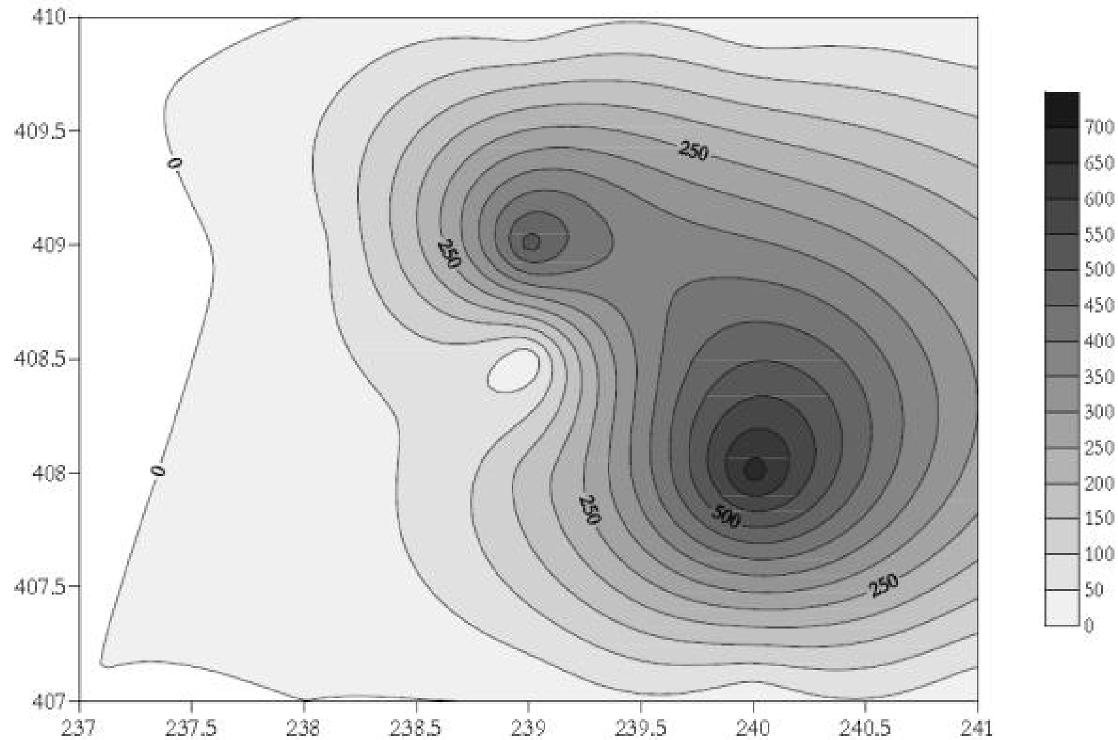


Figure 8.1 Locus M horizontal total artifact density by quantity isopleth

As may be observed (Figures 8.1 and 8.3), the highest artifact densities lie within roughly an oval profile-oriented Northwest to Southeast (N409.5-E233.5, N405.5-E241) with slightly higher densities distributed toward each end (Figure 8.3). Horizontal tool and waste flake distribution placement by 50 cm quad (Figures 8.2 and 8.3) show both waste flakes and tool artifacts co-located in higher concentrations at the Northeast and Southwest portions of the distribution.

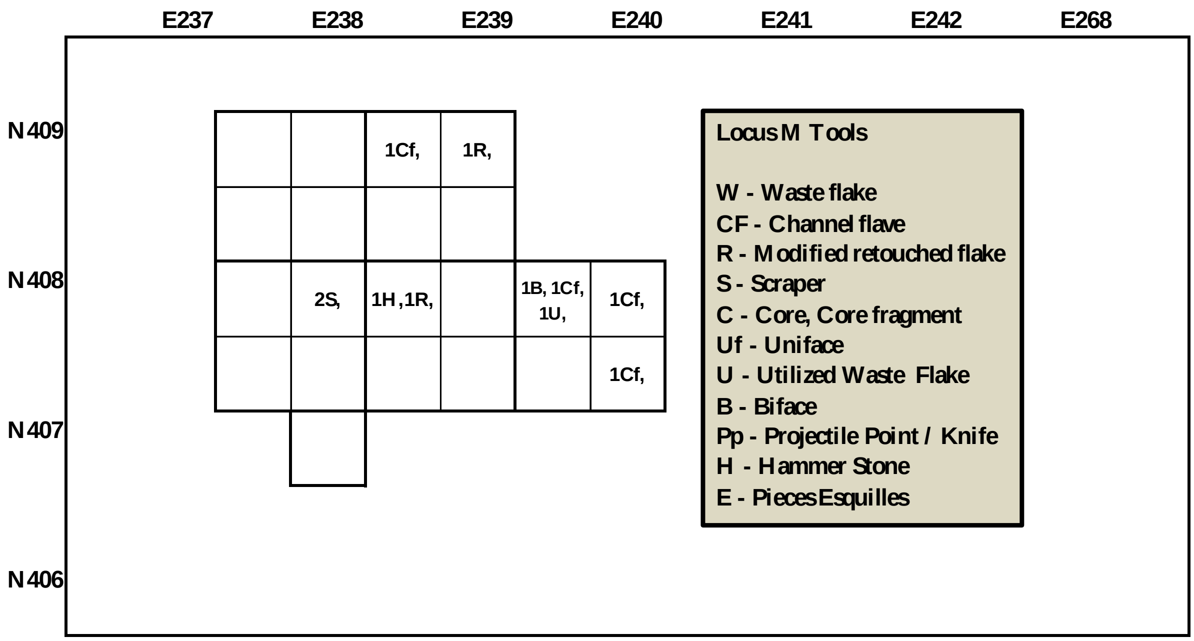


Figure 8.2 Locus M horizontal tool quantity and placement by 50 cm quad.

However, in the case of the non-waste flake or tool artifacts only, it is observed that there are three groupings of adjacent quad clusters located at N408-E238, N409-E239, and N408-E2 40 (Figure 8.2). Because of both the small number of artifacts and types in each of these clusters and the small horizontal spatial distribution distances, no reasonable significance can be attached to their positioning within the locus.

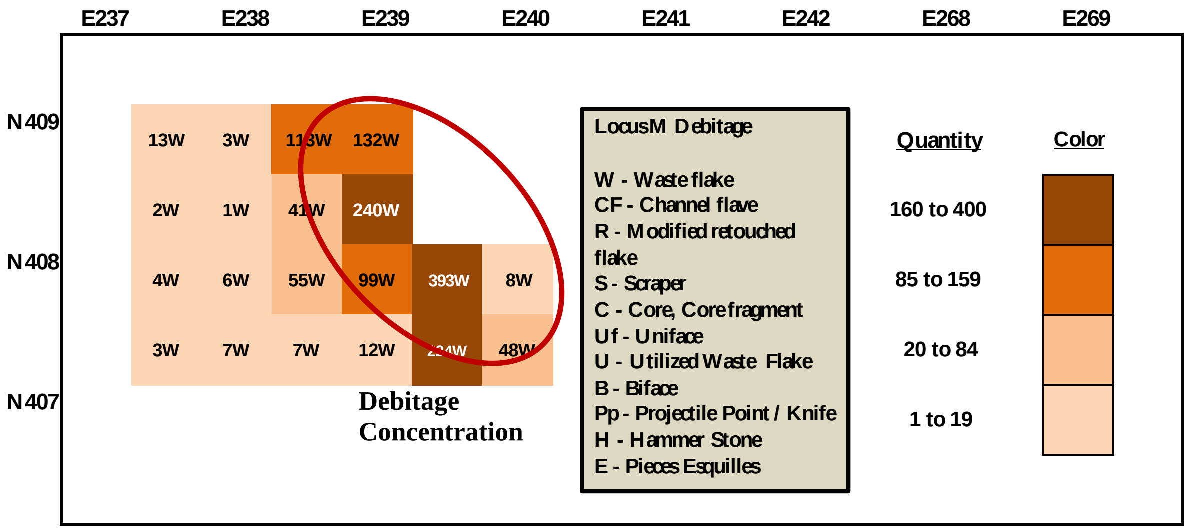


Figure 8.3 Locus M horizontal debitage quantity and placement by 50 cm quad.

8.1.1.1 Locus M horizontal placement of Feature 2

At Zone II or B_1 soil horizon, Level eight of the Locus M Block excavation, a distinct soil color change and a cluster of stones whose diameter ranged between 3 cm and 5 cm was identified. The distribution of stones and soil color variation occurred in a circular pattern approximately 75 cm in diameter that resided in both the south-east and south-west quadrants of unit N408-E240 (Figure 8.4). Identified as “Feature 2,” Block M contained what appeared to be a hearth feature, based on the change in soil color and the concentration of rocks (Young 2010:8). Analysis of the feature, including paleobotanical, yielded charred and uncharred botanicals identified as spruce seeds with clay capping in addition to a quantity (10) of micro debitage (Young 2010). The soil of the feature and close surrounds included distinctly reddened areas indicating that it had been heated. However, the primary function (cooking, warmth, or material treatment) of the feature was not able to be concisely identified. The lack of charred plant material other than spruce seeds implies that the feature held a very high heat which may have consumed the charcoal and plant materials thus not clearly indicating what type of food was potentially cooked (Young 2010).

With the greatest artifact densities occurring in the Eastern most excavation units it would appear the region around the hearth feature was the most intensively utilized area.

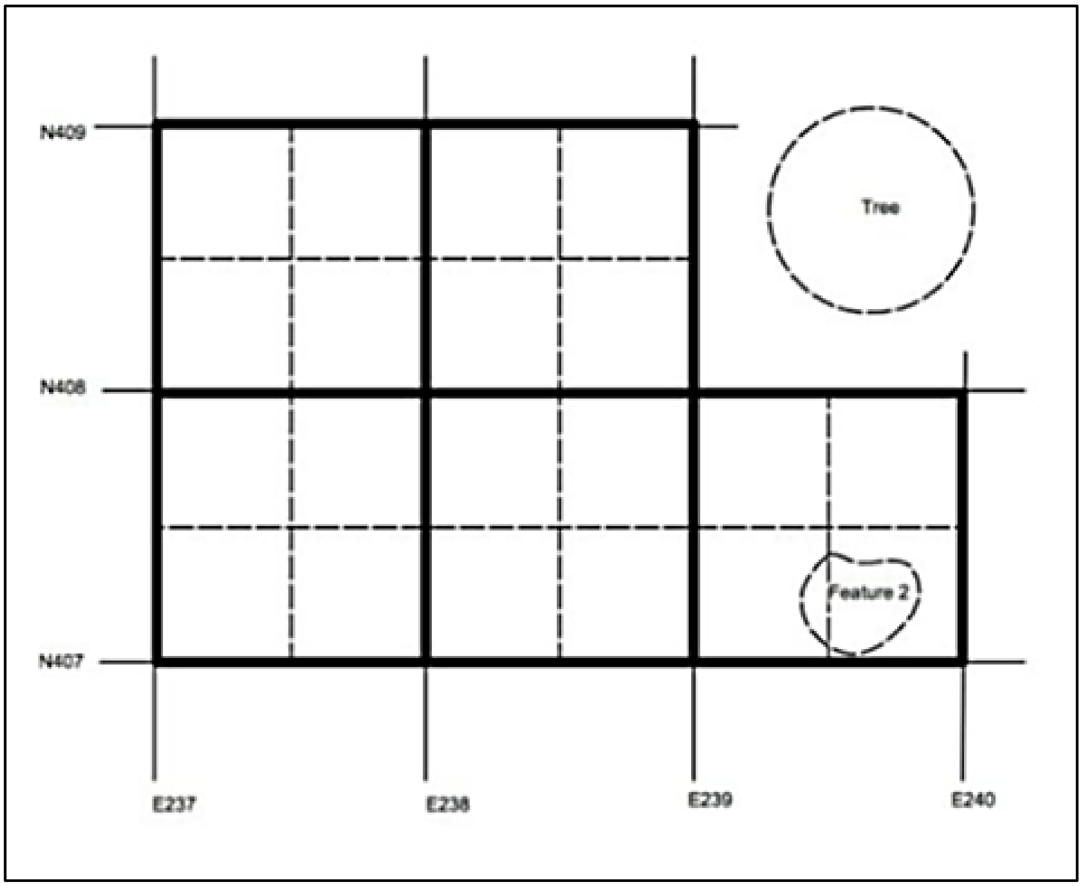


Figure 8.4 Locus M horizontal placement of Feature 2 by 50 cm quad (From Young 2010; Potter 2013)

8.1.2 Locus M vertical assemblage distribution

Locus M's vertical assemblage distribution as defined by soil levels resided primarily in Zone I or A_1 horizon (990 artifacts), and Zone II (355), with a lesser number residing in Zone III (78) or the $B_{1,}$ and B_2 horizons. No artifacts were identified in Zone 0 or O_g horizon, the surface, and forest duff layer. This artifact distribution is comprised of the combined flaked stone tool and debitage concentrations. These three zones or horizons comprise approximately 30 cm of excavated depth. Artifact stratigraphic position by level for Locus M's assemblage is shown in Figure 8.5.

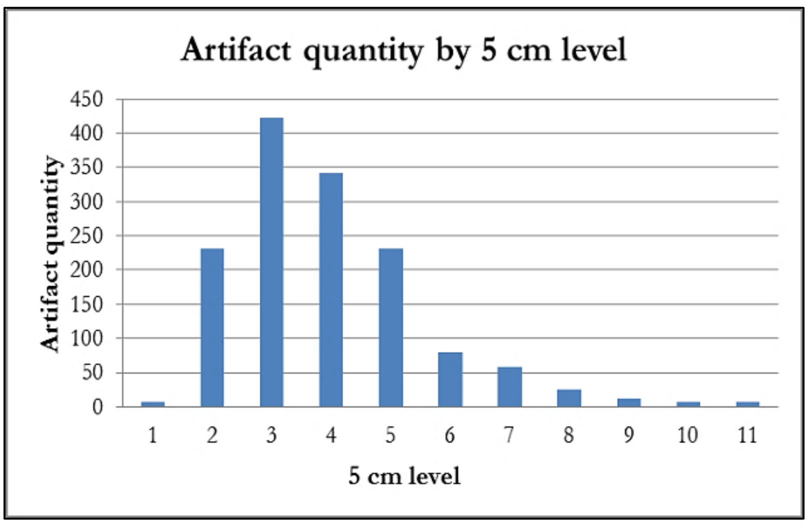


Figure 8.5 Locus M vertical artifact distribution by 5 cm level.

Viewed by quantity and 5 cm level, the bulk of the distribution occurs in Levels 2 through 8. The highest density of artifacts, quantities of 200 to 400, appear in Levels 2 through 5 with smaller quantities in the low double or single digits in Levels 6 through 11. Locus M's tool quantities by combined material type and level (Figure 8.6), even though mostly Munsungun chert with very few rhyolite flakes, follows a relatively uniform distribution pattern with artifacts found in all Levels from 2 through 8 except Level 4.

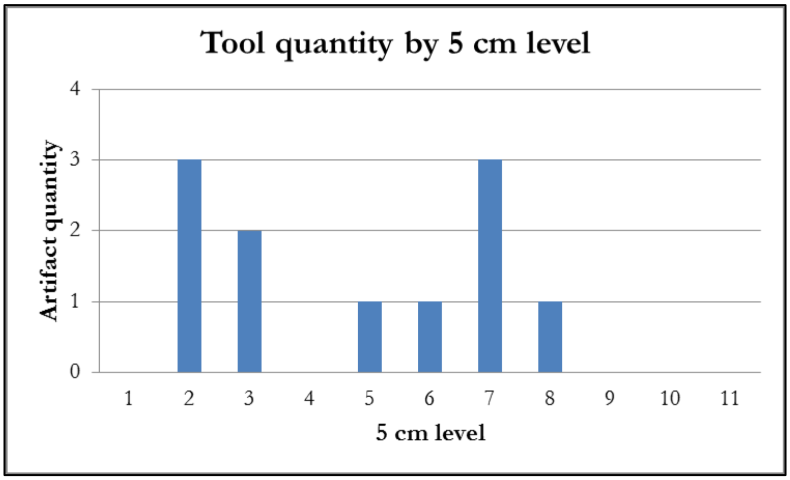


Figure 8.6 Locus M vertical tool distribution by 5 cm level.

It should be remarked, however, that the number of tool artifacts is quite limited in scope and quantity with an assemblage of 10 non-waste flake artifacts composed of 1 biface, four channel flakes, two scrapers, and three utilized and modified/retouched waste flakes.

Figure 8.7 shows the artifact distribution by level and material type to indicate the most prevalent artifact material type, i.e., Munsungun chert. The quantities of the rhyolites and unidentified cherts are displayed in Figure 8.8. Even though miniscule in number when compared to the Munsungun chert quantities, the rhyolites are seen to nominally occur in all levels of the excavation with the bulk being found in level 12. As indicated earlier Munsungun chert represents 96.3% of the assemblage of which 99+ percent are waste flakes. Rhyolites with only a 2.5% proportion of the assemblage represent only three of the 11 non-waste flake artifacts.

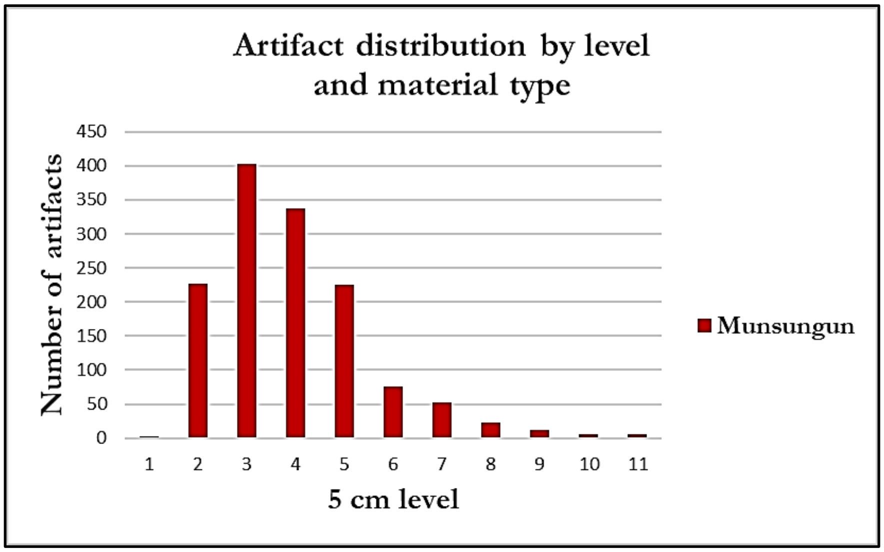


Figure 8.7 Locus M vertical artifact distribution by 5 cm level for the Munsungun material type.

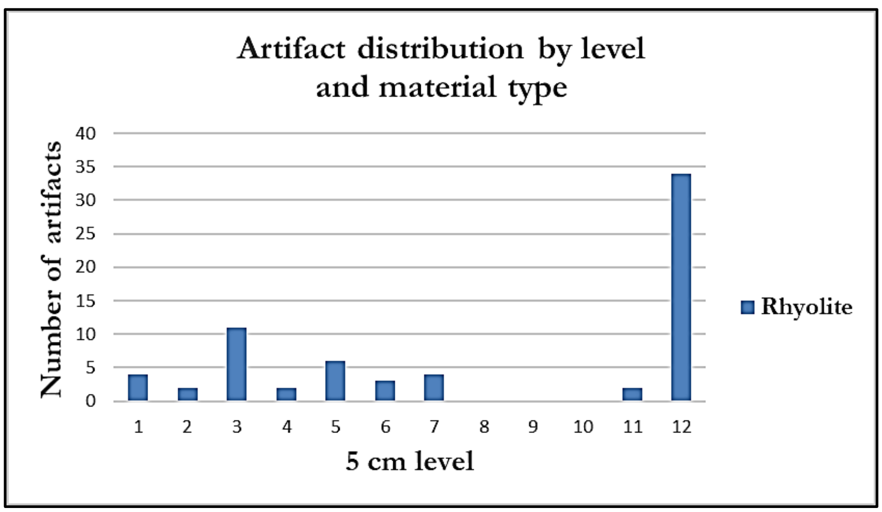
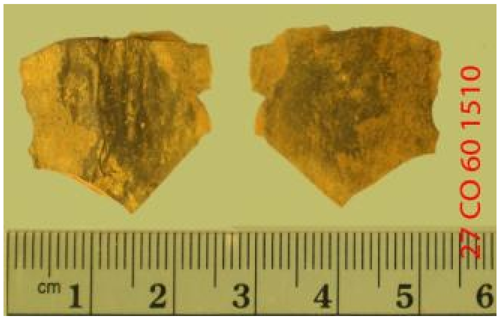
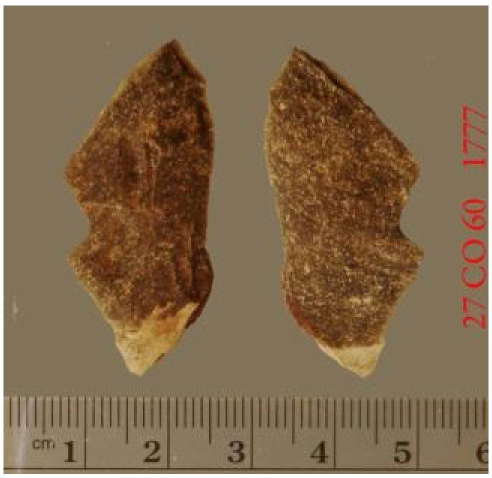


Figure 8.8 Locus M vertical artifact distribution by 5 cm level for the rhyolites and unidentified chert material types.

Figure 8.9 samples of Locus M artifact types.



Ref. No. 1510 proximal frag channel flake



Ref. No. 1777 medial frag channel flake

Ref. No. 1786 proximal frag channel flake

Ref. No. 1785 medial frag channel flake

Ref. No. 1787 Waste flake retouched

Ref. No. 3530 medial frag channel flake

Locus J characterizations

8.2 Locus J artifact composition

Locus J is a small locus (see Figure 3.13), when measured by artifact count, but spread over a relatively large area. Locus J contains 25 tool and other non-waste flake artifacts (Figure 8.15) including bifaces and 527 pieces of debitage for a total of 552 artifacts (Table 8.3) from six m² of the block and three m² of shovel test pit (STP) excavated area. Included area, however, incorporates over 180 m². The term, included area, is a somewhat arbitrary designation in the case of this locus arising from artifacts found in nearby STP's. During the search for locus boundaries, tool type artifacts were identified at a distance and included in locus J by the principal investigator. Total artifact density based on excavated area is 92.3/ m² with a tool density of 4.16/ m².

Table 8.3 Locus J flaked stone tool artifact composition by material type

Specimen Type	Untyped Rhyolite	Mt. Jasper Rhyolite	Jefferson Rhyolite	Granite	Quartz	Munsungun	Hornfels	Untyped Chert	Grand Total
Biface		4				1			5
Channel Flake	1	2							3
Core		1							1
Core Fragment									0
Hammerstone									0
Projectile Point / Knife		1							1
Raw Material Unmodified									0
Scraper	1	7				2		1	11
Uniface									0
Utilized Waste flake									0
Waste Flake	34	389	7		2	89		6	527
Waste Flake Modified / Retouched		2				2			4
Wedge / Pièces esquillées									0
Grand Total	36	406	7	0	2	94	0	7	552

Material sources for Locus J's artifact assemblage consist of seven lithic types with the dominant varieties being rhyolites (81% of untyped, Mt. Jasper and Jefferson rhyolites) and Munsungun chert (17%) in that order. Artifact category, material type, and quantities are exhibited in Table 8.3 and by percentage in Table 8.4.

Table 8.4 Locus J artifact composition by percentage of material type

Specimen Type	Untyped Rhyolite	Mt. Jasper Rhyolite	Jefferson Rhyolite	Granite	Quartz	Munsungun	Hornfels	Untyped Chert	Grand Total
Grand Total	36	406	7	0	2	94	0	7	552
%	6.5	73.6	1.3	0.0	0.4	7.0	0.0	1.3	100

8.2.1 Horizontal assemblage distribution

The horizontal artifact assemblage density distribution for Locus J is displayed in Figures 8.10, 8.11 and 8.12. Figure 8.10, horizontal isopleth artifact density plot contains the J Block excavation units and associated peripheral shovel test pits. The most prominent artifact density concentrations lie in an area bounded by N462 to N470 and E253 to E262 on the site grid (Figure 8.10). It should be noted, however, that at N466 and E281 there is a minor concentration of five scrapers in addition to seven waste flakes and one projectile point/knife untyped tip fragment all of which are spread over approximately 10 m. This concentration may have been an associated processing area.

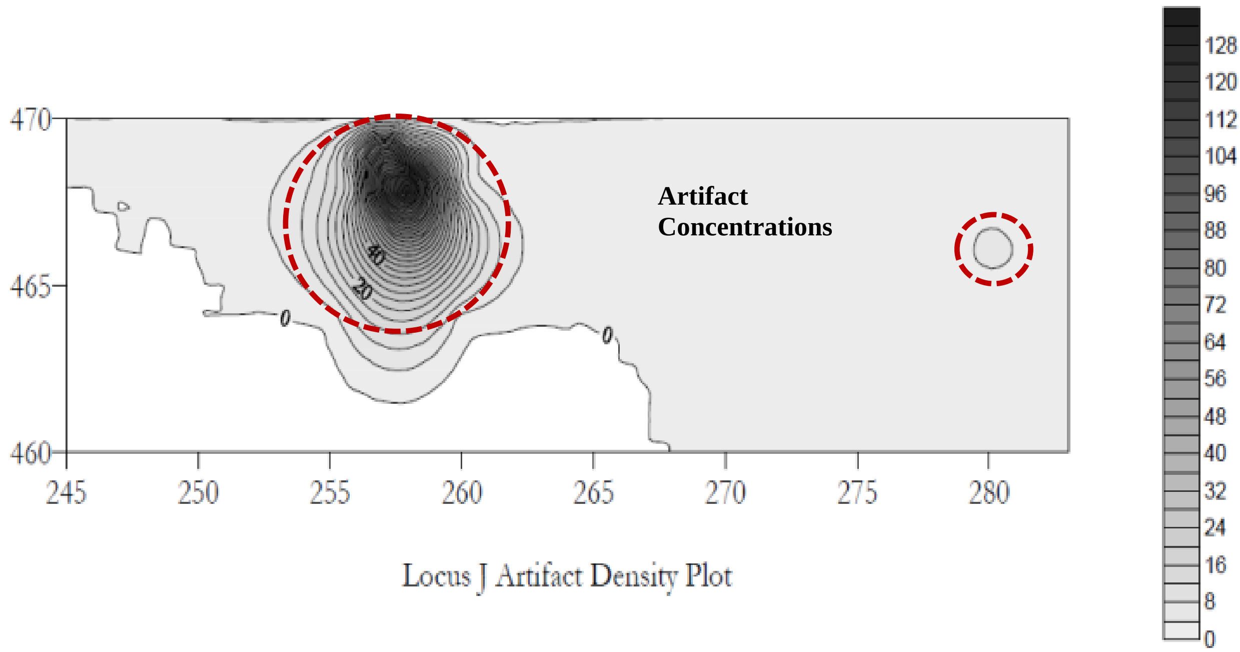


Figure 8.10 Locus J Northing, Easting horizontal isopleth artifact density plot.

Over 98% of the artifacts lie within a roughly circular area approximately 3 meters in diameter located at N468 E253.5 on the site grid and as shown in Figure 8.11, Locus J Horizontal debitage placement by 50 cm quad.

Figure 8.12, Locus J's Horizontal tool placement by 50 cm quad, also exhibits, but to a lesser extent, the debitage distribution pattern orientation. Both waste flakes and tool artifacts in higher concentration are found interspersed in the inner quads of the Southwest oriented higher density region of the locus. Negligible correlation is observed between tool type and waste flake densities co-located by quad or nearby quad.

Generally, Locus J's distribution of horizon waste flake concentrations drops off rapidly surrounding the edges of the excavation except in the case of the southeastern boundary.

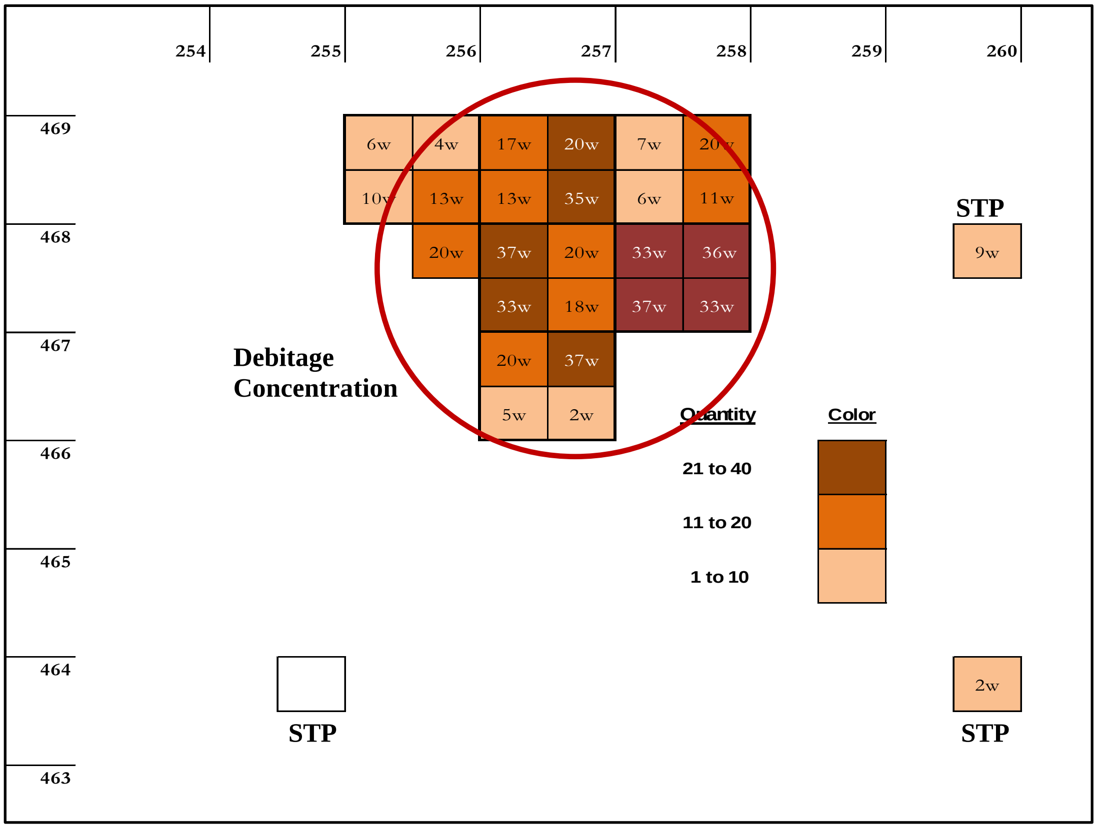


Figure 8.11 Locus J Horizontal debitage placement by 50 cm quad.

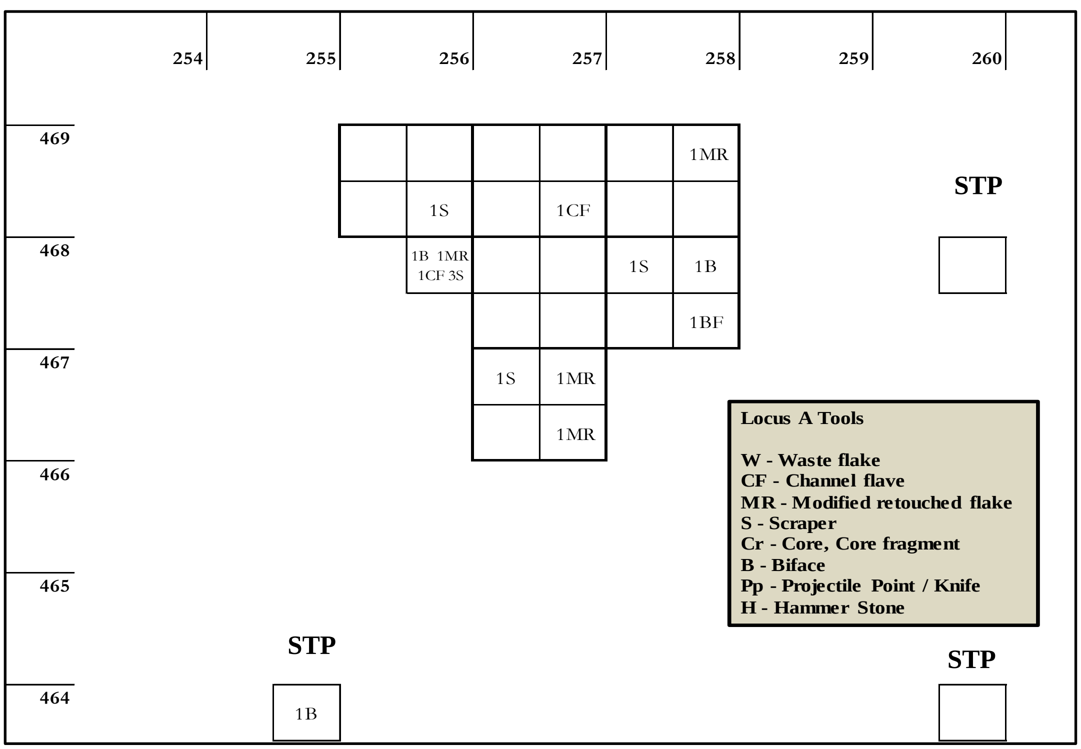


Figure 8.12 Locus J Horizontal tool placement by 50 cm quad.

8.2.2 Vertical assemblage distribution

Locus J's vertical assemblage distribution defined by soil levels resided primarily in Zone I or A_1 horizon (185 artifacts), and Zone II (287), with a lesser number residing in Zone III (66) and Zone IV (14) or the B_1, B_2 and B_3 horizons. No artifacts were identified in Zone 0 or O_g horizon, the surface, and forest duff layer. This artifact distribution is comprised of the combined flaked stone tool and debitage concentrations. These four zones or soil horizons comprise approximately 30 cm of excavated depth.

Stratigraphic artifact and tool position by excavated 5cm levels graphic representation is displayed in Figures 8.13, and 8.14. The combined tool and waste flake assemblage of Locus J (Figure 8.13), shown by distribution quantities and 5 cm level reveals that the bulk of the distribution is seen to occur in Levels 1 through 7, or 5 cm to 35 cm in depth. The highest density of artifacts, quantities of 60 to 100, occur in Levels 2 through 6 with decreased quantities in the lower double or single digits ranging through Levels 8-10.

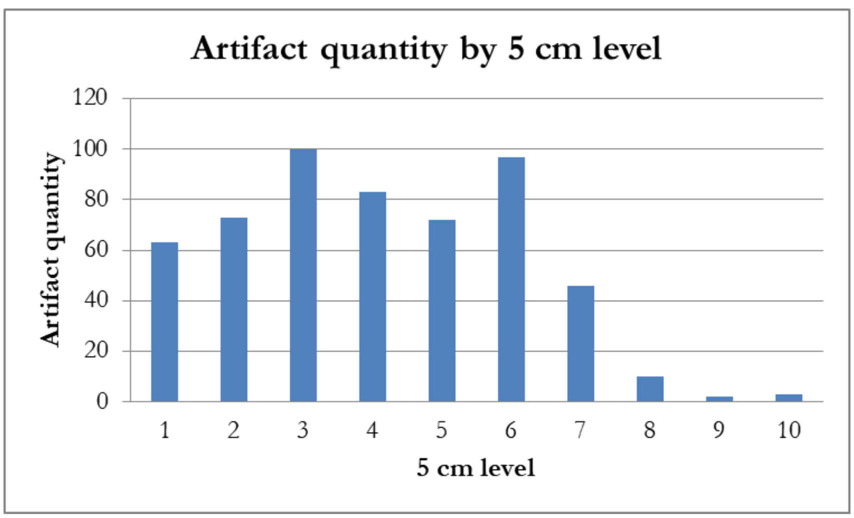


Figure 8.13 Locus J Artifact count by 5 cm level

Locus J's combined material tool distribution quantities by level (Figure 8.14) closely follow the artifact count by level distribution pattern as shown in Figure 8.13. Again, the bulk of the distribution is seen occurring in Levels 1 through 6, or 5 cm to 30 cm in excavated depth. The higher density of tools, quantities of 3 to 6, distributes somewhat uniformly across Levels 1 through 6 except for Level 4.

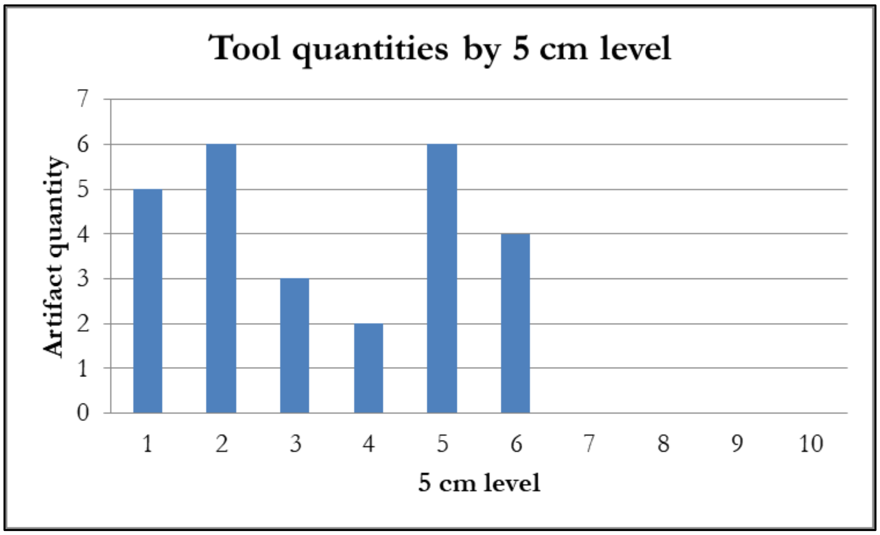


Figure 8.14 Locus J tool count by 5 cm level

When the artifact distribution by level and material type shown in Figure 8.15 is considered, the most prevalent artifact material types, i.e., untyped rhyolite, Jefferson rhyolite, Mt. Jasper rhyolite (rhyolites), and Munsungun chert are seen to nominally occur in all levels of the excavation. While there are both Munsungun and rhyolites distributed over Levels 1 through 8 the slightly higher quantities of Munsungun are found in Levels 1 through 5 whereas the higher quantities of rhyolite are found in Levels 2 through 6. The difference in the slight variance between material type depositions is not clear enough to interpret as a different depositional event.

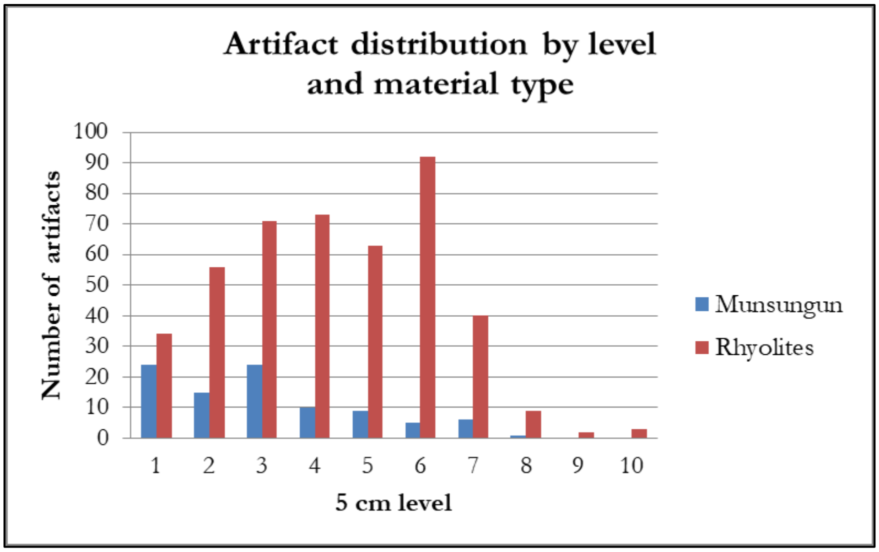


Figure 8.15 Locus J artifact distribution by 5cm level and material type

In the case of only tools by material and level, a dispersed quantity of Munsungun chert tools is distributed across Levels 1 to 6 (Figure 8.16). For rhyolite tools, Figure 8.16 shows a substantial number are also found in Levels 1 through 6 with somewhat of an apex indicated at Levels 2 and 5.

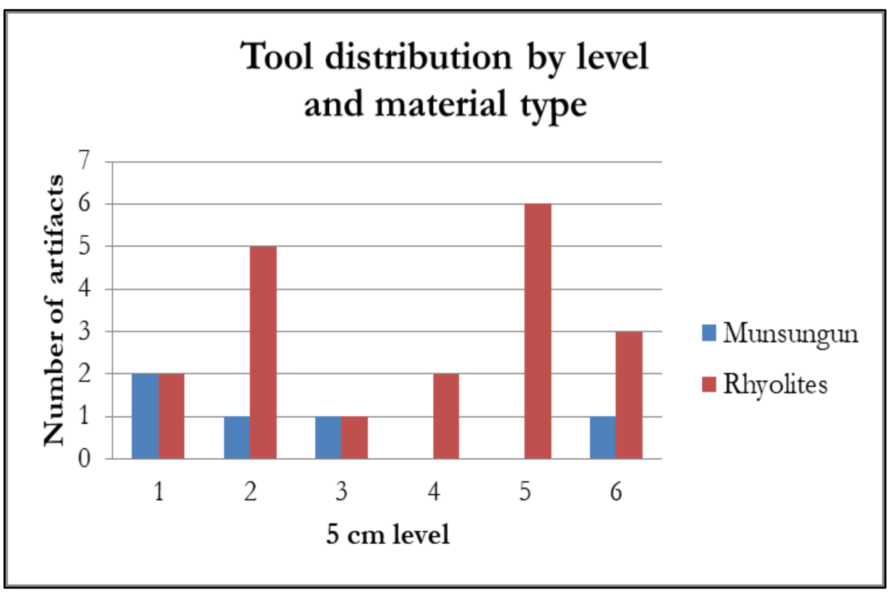
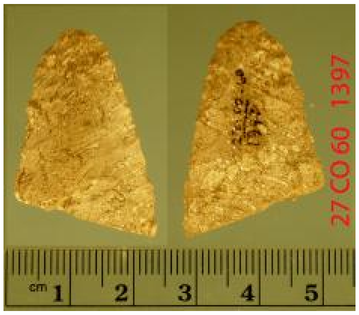


Figure 8.16 Locus J tool distribution by 5cm level and material type

Munsungun tool distribution skews somewhat to Levels 1 to 3 with one tool located in Level 6. The tools by material distribution might also suggest different deposition events at the locus. However, because there is significant overlap of both material type artifact distributions and considering the effects of the mixed soil horizons from cryoturbation and bioturbation, this is most likely responsible for the observed variation. Examples of Locus J tool artifacts are shown in Figure 8.17.

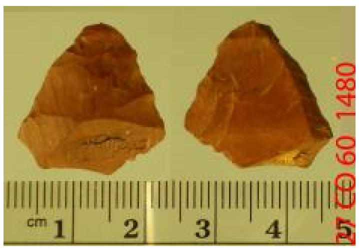
Figure 8.17 samples of Locus J artifact types.



Ref. No. 1397 Projectile point tip.

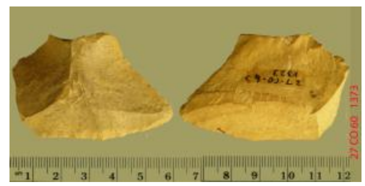
Ref. No. 2206 Channel flake

Ref. No. 477 Side scraper



Ref. No. 1480 Biface Fragment

Ref. No. 1361 Biface Fragment



Ref. No. 1373 Scraper

Ref. No. 1379 Channel flake

Ref. No. 2329 Biface

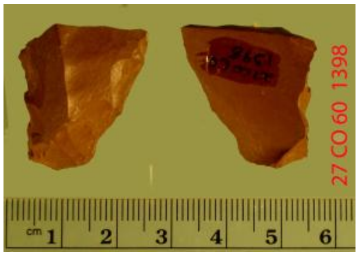
Ref. No. 1703 End Scraper

Ref. No. 1407 Biface Fragment

Ref. No. 1386 Core

Ref. No. 11381 End Scraper

Figure 8.17 samples of Locus J artifact types continued.

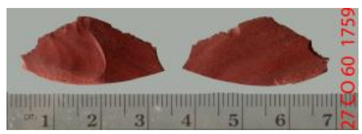


Ref. No. 1398 End Scraper

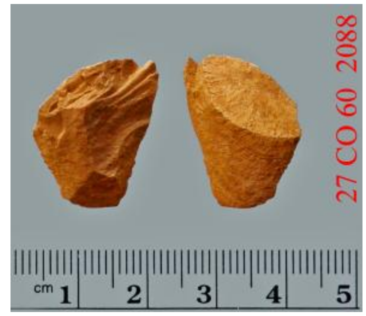
Ref. No. 2475 Side Scraper

Ref. No. 1734 End Scraper

Ref. No. 2274 Retouched / modified waste flake



Ref. No. 1759 Retouched modified waste flake



Ref No. 2088 Retouched/waste

Ref. No. 1370 Retouched / modified waste flake

Locus A characterizations

8.3 Locus A artifact composition

Locus A contains the remnants of an area disturbed during a commercial gravel excavation. It is included in the analysis to determine if the residual disturbed artifact assemblage is the result of an occupation that occurred during a cultural horizon other than Paleoamerican. This examination may be inconclusive since any of the missing artifacts from the disturbed portion of the locus, may have come from another cultural horizon. However, if the artifacts from the recovered portion of A's assemblage are from the Paleoamerican horizon, it may also be indicative of the whole cultural horizon of Locus A.

Locus A's contaminated remnant assemblage is made up of a total of 181 artifacts that is comprised of 6 non-debitage artifacts (Figure 8.19) and 175 pieces of debitage within 4.5 m^2 of excavated but not included area. The total artifact density is 40/ m^2 with a tool density of 1.3/ m^2. Locus A's artifact assemblage material sources consist of four identifiable varieties with rhyolites (82.3%), and Munsungun chert (14.9%) representing the major types. Artifact category, material type, and quantities are displayed in Table 8.5 and by percentage in Table 8.6.

Table 8.5 Locus A flaked stone tool artifact composition by material type

Specimen Type	Untyped Rhyolite	Mt. Jasper Rhyolite	Jefferson Rhyolite	Granite	Quartz	Munsungun	Hornfels	Untyped Chert	Grand Total
Biface									0
Channel Flake		1				2			3
Core		1							1
Core Fragment									0
Hammerstone									0
Projectile Point / Knife									0
Raw Material Unmodified									0
Scraper									0
Uniface									0
Utilized Waste flake									0
Waste Flake	15	131			5	24			175
Waste Flake Modified / Retouched		1				1			2
Wedge / Pièces esquillées									0
Grand Total	15	134	0	0	5	27	0	0	181

Table 8.6 Locus A summary material composition by percentage

Specimen Type	Untyped Rhyolite	Mt. Jasper Rhyolite	Jefferson Rhyolite	Granite	Quartz	Munsungun	Hornfels	Untyped Chert	Grand Total
Grand Total	15	134	0	0	5	27	0	0	181
%	8.3	74.0	0.0	0.0	2.8	14.9	0.0	0.0	100

8.3.1 Locus A horizontal assemblage distribution

Assemblage horizontal artifact density distribution for Locus A is shown in Figure 8.18, horizontal waste flake placement by 50 cm quad. Artifacts from excavation units of A Block and associated peripheral shovel test pits are included in this locus. The amount of horizontal and vertical soil disturbance from initial mining excavations is unknowable.

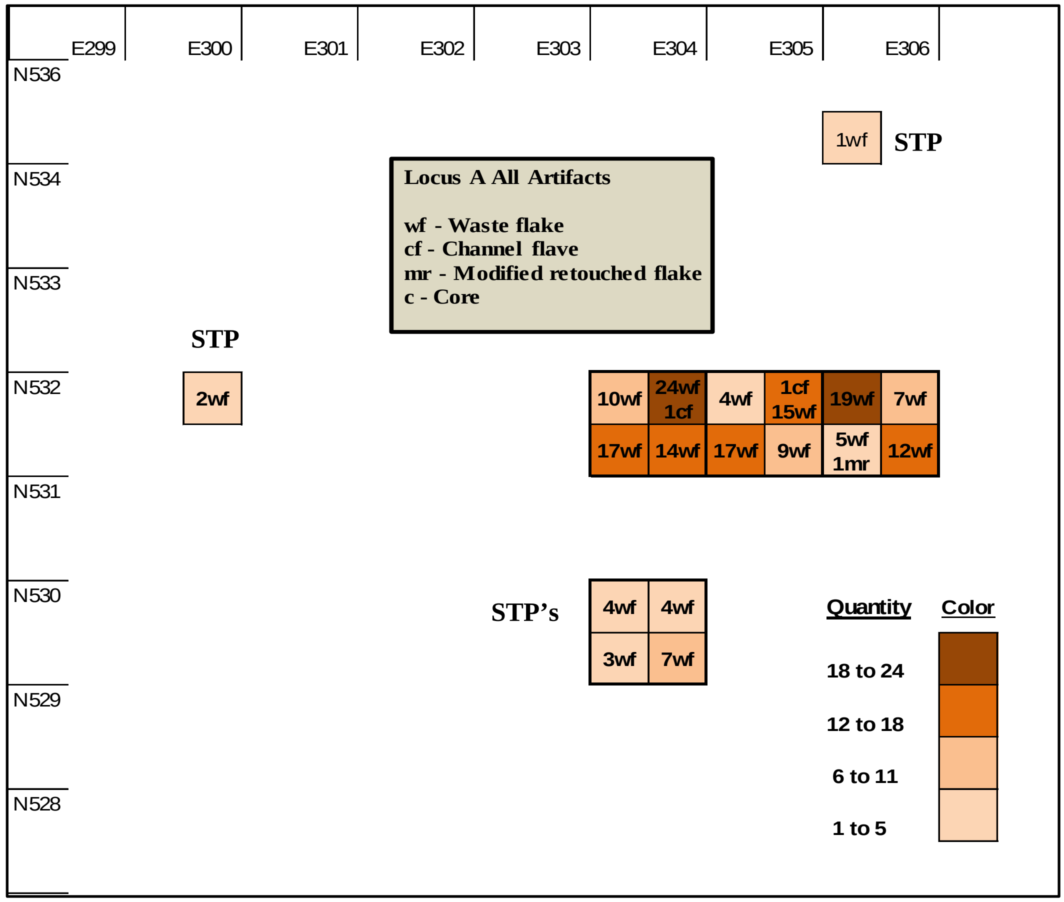
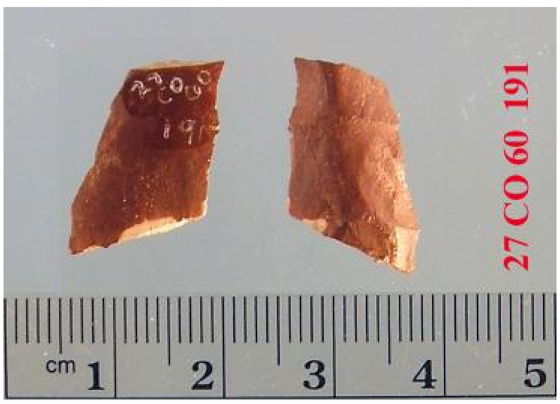


Figure 8.18 Locus A horizontal artifact quantity and placement by 50 cm quad.

Figure 8.19 samples of Locus A artifact types.

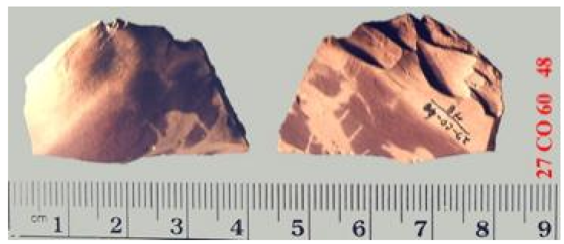
Ref. No. 55 medial frag channel flake



Ref. No. 191 medial frag channel flake

Ref. No. 1785 proximal frag channel flake

Ref. No. 1033 Waste flake retouched



Ref. No. 1787 Waste flake retouched

Locus D and E characterizations

8.4 Locus D and E artifact composition

Locus D and E are included for completeness of the analysis, but because of their small artifact counts and widely scattered artifact distribution, no critical analysis will be attempted. Locus E's artifact composition is made up of one biface, one scraper, one modified/retouched waste flake and 458 waste flakes distributed over an area of 4 m in length by 1 m in width.

In the case of locus D, its artifact composition is represented by only 37 pieces. Comprised of two bifaces, one projectile point fragment, one utilized waste flake, 31 waste flakes, and one modified/retouched waste flake, Locus D's assemblage resided in 6 m^2 of the excavated area but was scattered over a rectangle 18 m length by 1 m in width.

Table 8.7 Locus D flaked stone tool artifact composition by material type

Specimen Type	Untyped Rhyolite	Mt. Jasper Rhyolite	Jefferson Rhyolite	Granite	Quartz	Munsungun	Hornfels	Untyped Chert	Grand Total
Biface		1					1		2
Channel Flake									0
Core									0
Core Fragment		1							1
Hammerstone									0
Projectile Point / Knife		1							1
Raw Material Unmodified									0
Scraper									0
Uniface									0
Utilized Waste flake		1							1
Waste Flake	3	27				1			31
Waste Flake Modified / Retouched		1							1
Wedge / Pièces esquillées									0
Grand Total	3	32	0	0	0	1	1	0	37

Artifact category, material type, quantities, and percentage are displayed in Tables 8.7, 8.8 (Locus D) and Tables 8.9, 8.10 (Locus E) respectively.

Table 8.8 Locus D artifact composition by the percentage of material type

Specimen Type	Untyped Rhyolite	Mt. Jasper Rhyolite	Jefferson Rhyolite	Granite	Quartz	Munsungun	Hornfels	Untyped Chert	Grand Total
Grand Total	3	32	0	0	0	1	1	0	37
%	8.1	86.5	0.0	0.0	0.0	2.7	2.7	0.0	100

Locus D and E's artifact assemblage material sources consist of four identifiable types with rhyolites (D 94.6 %, E 99.8%), and Munsungun chert (D 2.7%, E .20%) representing the major types.

Table 8.9 Locus E flaked stone tool artifact composition by material type

Specimen Type	Untyped Rhyolite	Mt. Jasper Rhyolite	Jefferson Rhyolite	Granite	Quartz	Munsungun	Hornfels	Untyped Chert	Grand Total
Biface	1								1
Channel Flake									0
Core									0
Core Fragment									0
Hammerstone									0
Projectile Point / Knife									0
Raw Material Unmodified									0
Scraper	1								1
Uniface									0
Utilized Waste flake									0
Waste Flake	37	411	9			1			458
Waste Flake Modified / Retouched	1								1
Wedge / Pièces esquillées									0
Grand Total	40	411	9	0	0	1	0	0	461

Table 8.10 Locus E artifact composition by the percentage of material type

Specimen Type	Untyped Rhyolite	Mt. Jasper Rhyolite	Jefferson Rhyolite	Granite	Quartz	Munsungun	Hornfels	Untyped Chert	Grand Total
Grand Total	40	411	9	0	0	1	0	0	461
%	8.7	89.2	2.0	0.0	0.0	0.2	0.0	0.0	100

8.5 Conclusions

Chapter VIII depicted the Potter site archaeological context and characterization of Loci M, J, A, D, and E. For each of the loci, its assemblage composition by artifact type, quantity and production material was described. Additionally, both the horizontal and vertical assemblage distribution, when applicable, was depicted showing piece positioning by type in addition to areas of high artifact concentration.

When considering the distribution of tool production material, it was found that in the case of Locus M, the bulk of the assemblage was composed of only 2.5% local rhyolites and 96.2% exotic Munsungun chert. Locus J's assemblage was comprised of 81.0% local rhyolites and 7.0% Munsungun chert. Locus A's assemblage was comprised of 82.3% local rhyolites and 14.9% Munsungun chert. Finally, Locus D and E's assemblage was comprised of rhyolites (D 94.6 %, E 99.8%), and Munsungun chert (D 2.7%, E .20%). Reasons for these particular asymmetrical distributions of major material types may be attributable to many sets of circumstances. For example, the material type distributions noted for each locus may potentially have been caused by small locus sizes in terms of artifacts or area, occupation duration, activity function, or usage intensity.

Chapter IX

Potter site lithic artifact assemblage raw material variability and sourcing

The essential effects of the ecosystem on hunter-gatherer subsistence choices and activities were demonstrated in Chapter IX. Equally as important to these foragers was their ability to fashion tools to meet the environmental challenges of their subsistence choices. In the case of the New England-Maritimes Paleoamericans, their toolsets were primarily based on flaked stone, bone, and wood products (Lothrop et al. 2011). The lithic material from which the Potter site Paleoamericans fashioned their tools regarding varieties, quantities, characteristics, sourcing methods, motives, and locations are the subject of this chapter.

One of the fundamental elements in the analysis of Paleoamerican lithic assemblages has been the recognition of raw material types used in the manufacture of tools and debitage. Inferences concerning group range, settlement patterns, migration routes, exchange patterns, and nuances of tool manufacturing preferences have been strongly dependent on identifying the geographic source locations of the lithics that were selected, used, transported, abandoned, cached, lost, or otherwise deposited in an archaeological context (Andrefsky 2005, 2008; Kooyman 2000; Williams 2013).

Since the identification of Potter as a Paleoamerican horizon occupation, one of the underlying research objectives has been to identify and analyze the specific areas of focused activity at the site. However, due to the acidity of the New England soil composition, organic artifacts such as faunal materials, charred plant remains, wooden implements, and cordage is essentially missing from the site inventory. In light of this reality, stone artifacts provide the only viable perspective to analyze adaptations at the site. While undeniably rendering a biased view, this element of an idealized assemblage is none-the-less abundant and diverse. Site raw materials composition can provide insight into the Potter site occupants efforts directed toward sourcing of raw materials, industries, and to the determination of movement patterns of its people and stone, which in some cases was over great distances.

9.1 Potter site lithic material varieties, source, and quantities

Following several seasons of fieldwork, including shovel test pit sampling and unit excavations, 15,913 lithic artifacts were excavated, identified and cataloged. Spatial groupings were distinguished, using the position coordinate data of the lithic artifact concentrations, to indicate potential areas of focused activities. These spatial groupings or concentrations of colocated flaked tools and debitage were characterized as loci by the author and were characterized previously. Furthermore, between each of the designated loci miscellaneous random flakes, scattered in low densities, were found that were not apparent in the locus sphere of deposition. For completeness purposes, these random flakes have been identified in Table 10.1 as detached scatter and represent the sparse scatter across the entire site.

Summarized in Table 9.1, which is a repeat of table 3.1, is the Potter site flaked stone artifact assemblage as regards to the distribution of lithic material by source type. While the total appears to be significant in total quantity, it must be born in mind that they are scattered between 11 artifact concentrations or loci over an area of two hectares. This organization by locus and material type of the artifact assemblage will prove useful in identifying cultural occupation horizons, material deposition patterns, potential domestic activities, and technology. Source locations of the site's lithic material and their distribution over the New England Maritimes region are presented in Figure 9.1.

Table 9.1 Potter site artifact assemblage by locus and material type.

Material Type by locus	Unspecified Rhyolite	Mt. Jasper Rhyolite	Jefferson Rhyolite	Munsungun Chert	Unspecified Chert	Hornfels	Quartzite Quartz	Unspecified Stone	Grand Total
Locus A	148	1		27			5	2	183
Locus B	3	4138		75	7	2	7	2	4234
Locus C	5	1544	99	543	22	3	7	15	2238
Locus D	35			1		1		3	40
Locus E	459	1		1					461
Locus F	226	131		46	3		2	3	411
Locus G	12	1		1				1	15
Locus H	1915	105	47	1160	8	2	4	13	3524
Locus J	435	9	5	94	7		2	2	554
Locus K	734	513	12	411	41	103	8	52	1874
Locus M	34	2		1369	13	2	3	1	1424
Detached Scatter	343	539	12	318	5	3	3	2	1225
Total	4349	6984	175	4046	106	116	41	96	15912

Note: repeat of table 3.1 for ease of reference.

The bulk of the identified lithic source materials in the Potter site flaked stone assemblage, as indicated in Figure 9.1, includes rhyolites from Mt. Jasper and Jefferson, and Munsungun chert. Additionally, insignificant quantities of chert sources suspected to be from Vermont, New York, and Pennsylvania were found but not geo-chemically verified. The white lines of the image represent the locations of the Potter assemblage material sources and indicate the direction and potential distances of material movement into the site (the method of acquisition is not specified here but is discussed further on). Correspondingly, material movement of Mt. Jasper and Jefferson rhyolites outwards to other Paleoamerican site locations are represented by the orange lines and location labels. The discussions of potential seasonal rounds based on the site material composition are addressed in a subsequent chapter on mobility.

Rhyolites dominate the Potter site lithic assemblage and account for nearly three-quarters of all flaked stone artifacts (72.32%). The rhyolites are then followed by cherts that make up the next tier of lithic types accounting for the next quarter-plus of the artifacts. These cherts are Munsungun (25.43%), and a few unidentified chert stone types (0.67%) referred to previously. Hornfels; a dark, fine-grained metamorphic rock consisting largely of quartz, mica, and particular feldspars; unspecified stone; quartz; and quartzite make up the remaining 1.66% of the flake stone assemblage.

Figure 9.1 New England-Maritimes region. Source material found at Potter site represented by white line and labels. Finds of Mt. Jasper and Jefferson rhyolite in remote sites artifact assemblages is represented by orange lines and labels. The Potter site location on the graphic is equal distant between the Mt Jasper and Jefferson material sources. (Boisvert 2015 personal communication).

9.2 Rhyolite sourcing

Rhyolite is an igneous, volcanic rock, of silica-rich composition that typically contains greater than 74% silicon dioxide (SiO_2) (Dietrich & Skinner 1979:101). The chemical mineral composition is typically quartz (SiO_2), with common but in minor or lower represented percentages, adjunct minerals including; Al_2O_3, Fe_2O_3, FeO, MgO, Na_2O, K_2O, and H_2O (Jackson 1970; Dietrich & Skinner 1979:101). Textures range from glassy to aphanitic to porphyritic.

Rhyolite can be considered as the extrusive equivalent to plutonic granite rock, and as a result, outcrops of rhyolite may appear similar to granite. Due to their high content of silica and low iron and magnesium contents, rhyolite melts are highly polymerized and form highly viscous lavas (Dietrich & Skinner 1979:148-149). They also occur as breccia or in volcanic plugs and dikes as is found at the Mt. Jasper rhyolite source. Slower cooling forms microscopic crystals in the lava and results in textures such as flow foliations, spherulitic, nodular, and lithophysal structures (Jackson 1970; Dietrich & Skinner 1979). Mt. Jasper and Jefferson sources of rhyolite both exhibit spherulitic textured structures.

Mt. Jasper rhyolite originates at a lithic source located in Berlin, NH (Boisvert 1992, Gramly 1984). The source is a rhyolite dike located on Mt. Jasper (Figure 9.2a and 9.2b) overlooking the confluence of the Dead and the Androscoggin Rivers. The source is well known by local inhabitants and has been utilized consistently from Paleoamerican thru modern times (Pollock et al. 2008).


Figure 9.2a. Mt. Jasper adit views (Boisvert 2013).


Figure 9.2b. Mt. Jasper adit views (Boisvert 2013).

Mt. Jasper material comes in a variety of colors from brown to red and green, often with close flow banding and tightly entrained spherules. Remarkably, as a material source, spherulitic dikes are quite rare in northern New England (Pollock et al. 2008). The distinctive features of the material are enhanced when weathered (Figure 9.3 A & B) allowing for easy recognition of the spherules and banding.

Figure 9.3. Mt. Jasper and Jefferson rhyolite examples. Exhibits A and B are samples of Mount Jasper rhyolite that show color variations, spherules, and flow banding properties of the material. Scale factors for A and B are 8 cm in width. Exhibit D is a sample of weathered Jefferson rhyolite also showing its spherulitic nature and flow banding. Scale factor for exhibit D is 6 cm in width. Exhibit C is an example of a Jefferson rhyolite block possibly deposited by glacier recession in its natural state. No human preparation or modification was made to this sample. It is suspected that its shape is the product of faulting in addition to the freeze-thaw cycle at its original source before movement. The bucket and geologist hammer provide scale. (Boisvert 2013).

In the case of Jefferson Rhyolite, the source outcropping from a geological perspective has not yet been definitively located, though, the location of source material concentration appears to center on or near the town of Jefferson, New Hampshire. Unmodified pieces of rhyolite weighing upwards of 60 kg, occur on the sites of the Israel River Complex located in Jefferson. Figure 9.3 C is the largest specimen documented in the region and occurs at the northern end of the Jefferson site cluster. Cobbles and blocks such as those found in stream beds and the surficial glacial till are relatively common (Figure 9.4). They frequently are very angular and do not exhibit any significant rounding or high polish.

Figure 9.4 Jefferson stream bed containing rhyolite blocks and cobbles (Rusch 2010).

Jefferson rhyolite material ranges in color from light tan to nearly black and often have small spherules that in a weathered state exhibit white concentric rings encircling the spherules Exhibit D (Figure 9.3) shows a sample of weathered Jefferson rhyolite exhibiting its spherulitic nature and flow banding.

9.2.1 Rhyolite source differentiation

Both the Mt. Jasper and Jefferson materials vary from high-grade to somewhat coarse-grained texture, and it can be difficult to distinguish between them (Pollock, 2008:39-40). The most accurate means by hand of identifying the material visually is by examination of the spherules, weathering rings, flow bands, matrix and spherical entraining (entraining is defined as one spherule following after another in a series). For example, Jefferson rhyolite spherules have a bulls-eye pattern with a white rim and black center, whereas the Mt. Jasper rhyolite spherules are not rimmed and reddish brown in color (Pollock, 2008:40).

Even with the number of visual cues available for hand analysis, the identification of rhyolites as to their geological source remains problematic. Considerable effort has been made to reliably distinguish among them (Boisvert 1992; Pollock *et al.* 2008; Rusch 2012). In an attempt to make the process more predictable a pilot assessment of 159 rhyolite specimens from the Potter site and Israel River Complex sites (Williams 2013) revealed that even conservative efforts conducted by field personnel and analysts were sometimes in error. The inability to reliably distinguish between rhyolite types is due in large part to the fact that Mt. Jasper rhyolite and Jefferson rhyolite are comagmatic and will often present visually as identical. Additionally, many specimens were too small or weathered such that discriminating characteristics could not be recognized. For the Potter site assemblage, unless there was high confidence that a specimen could be attributed to either the Mt. Jasper or Jefferson types, the designation was left as unspecified rhyolite as noted in Table 9.1.

For the purposes of this research effort, differentiation between rhyolite types, i.e., Mt. Jasper and Jefferson rhyolite, was arrived at through the application of x-ray fluoroscopy technology (pXRF). The analysis of the artifacts was conducted using a Bruker Tracer III-SD handheld (pXRF) x-ray fluorescence spectrometer (Figure 9.7). Results from the pilot study included tools from Potter loci B, C, F, and K. The remaining loci tools, excluding locus A, were analyzed in a follow-up study by Williams and Rusch (2014) to provide an accurate view of the material sources of the assemblage. In the process, raw material sources were identified, characterized and then compared to various site artifacts. Employing this methodology, the majority of the tool type artifacts from the combined study of the Potter site loci were analyzed and categorized as to source location. Further, in the case of the loci debitage, a representative random sample was selected from each locus, analyzed with pXRF, and population statistical inferences made from the results of the testing.

Results from the application of pXRF testing to the site loci flaked stone tool artifacts and debitage, fabricated from Mt. Jasper and Jefferson rhyolite sources, showed two distinct geochemical signatures that were used to discriminate between the sources. The mean average concentrations suggest that Rb, Sr, and, Zr are the major discriminating elements between the sources (Table 9.2) (Williams 2013).

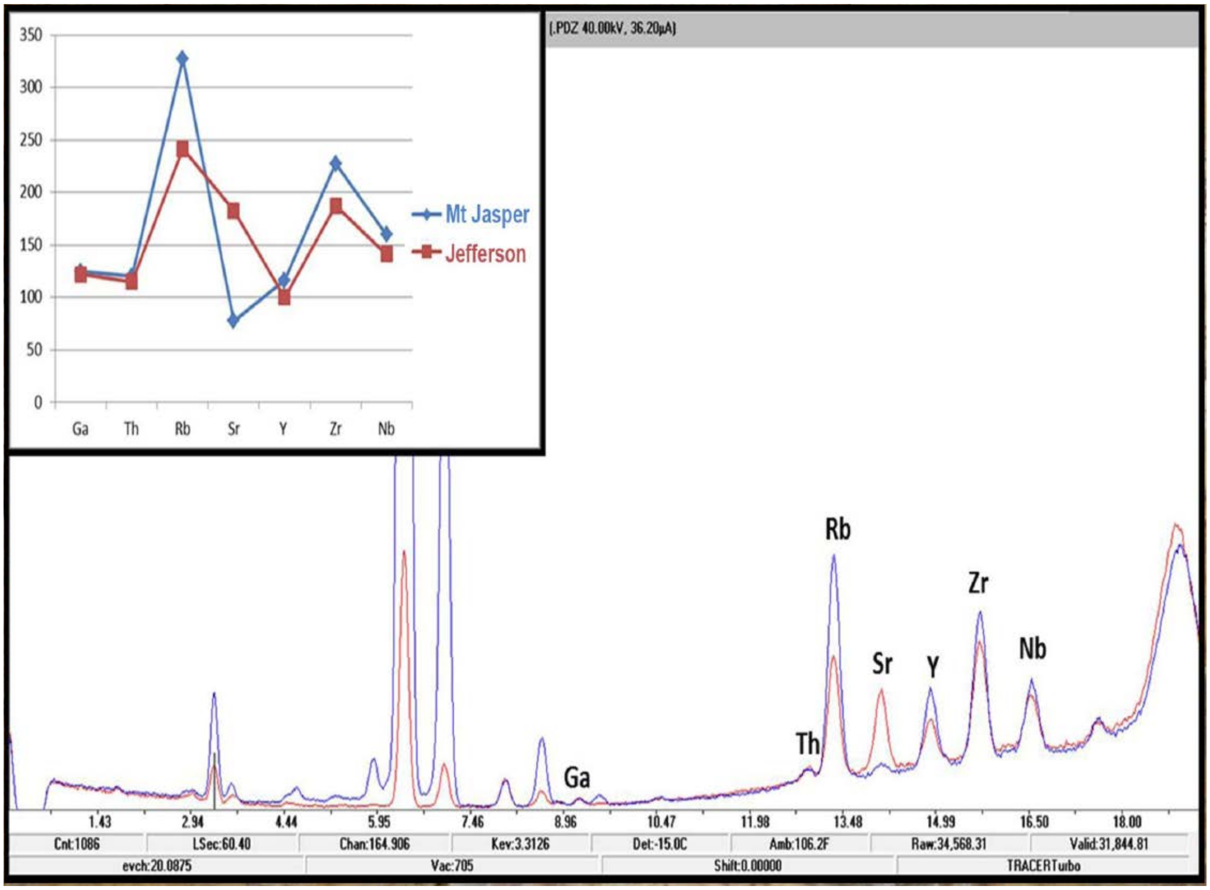


Figure 9.5 Mt. Jasper (blue line) & Jefferson (red line) spectral line distributions. (From Williams 2013).

Figure 9.5 shows the spectral data from two samples, i.e., Mt. Jasper shown by the blue line and the Jefferson source as indicated by the red line (Williams 2013). Comparison of both spectral lines demonstrates the Rb, Sr, and, Zr elemental differential. Utilizing the observable differences in the spectral lines of figure 9.5 in addition to the quantitative values shown in Table 9.2 for the elements Rb, Sr, and, Zr, each of the source locations of the rhyolite can be differentiated.

Table 9.2 Elemental concentrations of geologic sources.

Source	Ga	Th	Rb	Sr	Y	Zr	Nb
Mt. Jasper	125+/-0.3	120+/-0.5	328+/-5	77+/-0.2	116+/-0.4	227+/-0.4	160+/-0.9
Jefferson	122+/-0.3	115+/-0.5	242+/-3.8	183+/-4.6	100+/-1.2	188+/-0.5	141+/-1.0

Note: (From Williams 2013)

As a part of the pXRF system, software was included that enabled statistical analysis using multivariate analysis techniques such as linear discriminant analysis. The result from the linear discriminant analysis shows that there are no misclassifications of the data, thus indicating that these two sources are distinct from each other and that results of this analysis can be used on artifacts for further archaeological provenance analysis. This is further supported by a canonical discriminant analysis which was used to graphically plot the results of the linear discriminant function (Williams 2013).

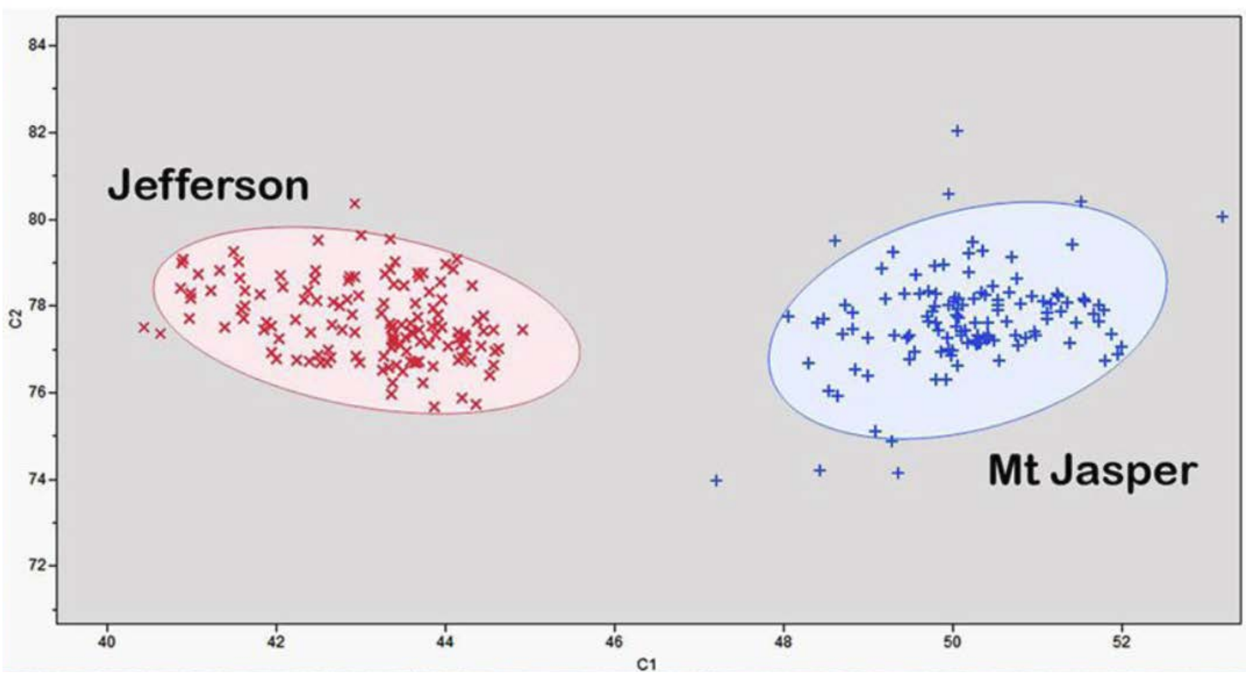


Figure 9.6. 95% confidence ellipses for each geologic source. (From Williams 2013)

Results of this analysis confirm that two distinct clusters (Figure 9.6) are evident; one for the Mt. Jasper source and another for the Jefferson source. A loading plot, not shown, indicates which elements are most heavily affecting the distribution of the points in the graph by vectors indicating direction and magnitude, confirming that Rb, Sr, and Zr are the main elements affecting the positioning of each cluster, with Sr and Zr being the key elements that separate each cluster.

The two rhyolite sources are also nearly equidistant from the Potter site with Mt. Jasper being 17 km north and Jefferson 20 km west if proceeding along the Moose and Israel rivers. The Munsungun chert source is significantly more distant being approximately 285 km on a straight line, whereas the open pathway traveling distance would likely be closer to 350 km.

Figure 9.7 Bruker Tracer III-SD handheld (pXRF) x-ray fluorescence spectrometer system (Rusch 2013).

Other assemblage trace cherts such as those from Vermont, Pennsylvania, and New York would be at minimum 200 km distant and potentially much further. The rhyolites sources are considered to be local (within 40 km) or regionally available while the cherts would be considered exotic.

9.3 Munsungun chert source

Munsungun chert is well documented in the inventory of Paleoamerican sites of the Northeast (Pollock et al. 1999). Its origin is in the Munsungun Lake formation located at Piscataquis, northern Maine. During Paleo times the formation's chert outcrops and quarries near the site were potentially accessible from distant locations through the Penobscot and Arootstock River drainage systems. Significant numbers of the outcrops occur at various stratigraphic horizons and various geographic localities within the Munsungun Lake formation. Additionally, there is evidence of numerous quarry sites that were exploited approximately simultaneously (Pollock et al. 1999).

Chert is a fine-grained silica-rich microcrystalline, cryptocrystalline or micro-fibrous sedimentary rock that in many cases may contain small fossils such as radiolarians, diatoms or siliceous sponges (Luedtke 1979; Jackson 1970). Chert material deposits in the formation occur at several bedrock outcrops ranging over several square kilometers around Munsungun Lake. The Munsungun Lake formation consists predominantly of rocks of volcanic origin but contains small volumes of chert and other sedimentary rock in an Ordovician volcanic arc (Pollock 1987). The Munsungun Lake formation is made up predominantly of thick-bedded, fine to coarse-grained felsic, crystal, lithic and mixed tuffs, agglomerates and flows. Chert, which is embedded with the volcanics and volcanoclastics, is estimated to comprise less than 10% of the formation within this area (Pollock et al. 1999).

In general, chert is recognized to originate through several separate and distinct geologic processes, in addition to occurring in several distinct geological environments. Occurrences of chert deposits may be characterized as bedded or nodular. Bedded chert is commonly found in oceanic and volcanically influenced environments, while nodular chert is usually replacement material associated with carbonates and evaporates (Jackson 1970; Pollock et al. 1999). Munsungun Lake formation chert is bedded as opposed to nodular in its formation. Bedded cherts may be formed in several ways: a volcanically influenced environment where leaching of pyroclastic material leaves only the silica of the original ash, inorganic precipitation of colloidal silica or recrystallized organic silica sediments (Jackson 1970). Micro-textures, mineralogy, and chemistry suggest that the original Munsungun Lake formation sediments probably contained variable proportions of biogenically derived silica and clay (Pollock et al. 1999).

Color variation between outcrops is significant. Outcrops may exhibit a single, uniform color, or exhibit a range of inter-laminated and mottled colors. Munsungun cherts have been characterized by observed color variations:

a. grayish red, dusky red, blackish red, or dark reddish brown;
b. grayish red, dusky red, blackish red, or dark reddish brown with varve like lamination;
c. dusky red, or blackish red and dark gray to grayish black, or greenish black;
d. medium light gray to dark gray or greenish black to black – color laminated;
e. grayish to blackish – well laminated;
f. olive gray to olive black – thinly laminated (Pollock et al. 1999).

The colors given here are from the rock color chart (Pollock et al. 1999). Radiolarians are uncommon and less than 10%. The red cherts are visually striking and may be used as an elementary diagnostic indicator of a Munsungun provenance.

While the material occurs in a wide variety of colors and lusters, the overwhelming proportion of specimens in the Potter site are a dusky matte red with occasional examples exhibiting fine black lines or white bands (Figure 9.8). Dark gray to black specimens are also found in the collection.

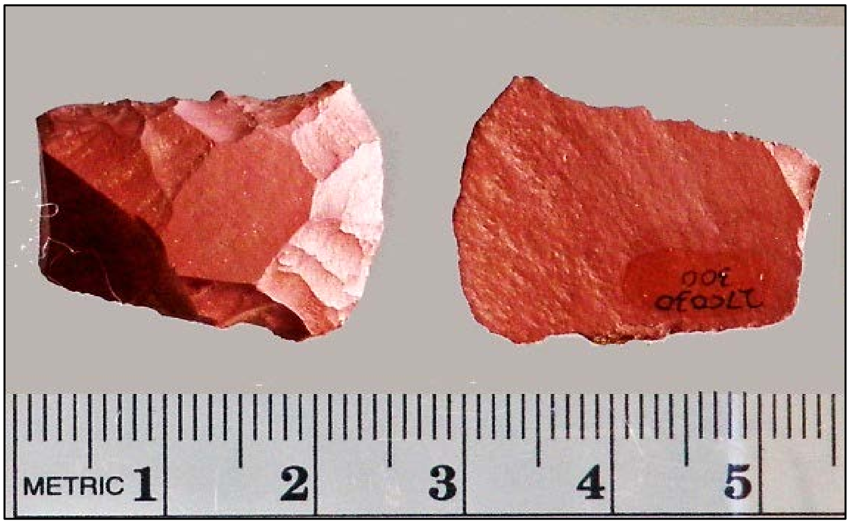


Figure 9.8 Example of Red Munsungun chert spurred scraper (Jefferson 2010)

The choice of material color and texture and the specific manner in which the materials were used in fashioning lithic tools suggests that aesthetics played a role in artifact construction. Moreover, the red varieties may have been utilized for specific forms of artifacts where red colors were preferred for meat processing (Pollock et al. 1999). However, the gray chert variations have been more heavily exploited where the gray and not the red varieties dominate the Paleoamerican fluted point sites at Munsungun Lake. Additionally, gray varieties are also found to be the major source material at the larger Spiller Farm, and Bull Brook sites as well as the smaller Point Sebago, Searsmont and Hedden sites. Interestingly, the red cherts dominate the Michaud and Lamoreaux sites, which are fairly large sites. Among the other smaller sites (Adkins, Dam, Morss and Vail Kill), the red varieties are the dominant types (Pollock et al. 1999).

9.4 Assemblage by weight

The comparison of the proportions of rhyolites, cherts and other materials by percentage can be viewed from another perspective, i.e., the weight of the specimens (Table 9.4). Differences in the deposition proportions of assemblage source material debitage size potentially lead to an indication of the reduction stage in knapping episodes at the site loci. The debitage shows an expected pattern. The more local materials (unspecific rhyolite, Mt. Jasper rhyolite, and Jefferson rhyolite) are more abundant than the exotic cherts (Munsungun chert and unspecified chert) by approximately a 3:1 ratio (Table 9.3).

Table 9.3 Potter site artifact assemblage by locus and % material.

Material Type	Unspecified Rhyolite	Mt. Jasper Rhyolite	Jefferson Rhyolite	Munsungun Chert	Unspecified Chert	Hornfels	Quartz Quartzite	Unspecified Stone	Grand Total
Locus A	0.93%	0.01%	0.00%	0.17%	0.00%	0.00%	0.03%	0.01%	1.15%
Locus B	0.02%	26.01%	0.00%	0.47%	0.04%	0.01%	0.04%	0.01%	26.61%
Locus C	0.03%	9.70%	0.62%	3.41%	0.14%	0.02%	0.04%	0.09%	14.06%
Locus D	0.22%	0.00%	0.00%	0.01%	0.00%	0.01%	0.00%	0.02%	0.25%
Locus E	2.88%	0.01%	0.00%	0.01%	0.00%	0.00%	0.00%	0.00%	2.90%
Locus F	1.42%	0.82%	0.00%	0.29%	0.02%	0.00%	0.01%	0.02%	2.58%
Locus G	0.08%	0.01%	0.00%	0.01%	0.00%	0.00%	0.00%	0.01%	0.09%
Locus H	12.03%	0.66%	0.30%	7.29%	0.05%	0.01%	0.03%	0.08%	20.45%
Locus J	2.73%	0.06%	0.03%	0.59%	0.04%	0.00%	0.01%	0.01%	3.48%
Locus K	4.61%	3.22%	0.08%	2.58%	0.26%	0.65%	0.05%	0.33%	11.78%
Locus M	0.21%	0.01%	0.00%	8.60%	0.08%	0.01%	0.02%	0.01%	8.95%
Unattached scatter	2.15%	3.38%	0.08%	2.00%	0.03%	0.02%	0.02%	0.01%	7.70%
Locus total	27.33%	43.89%	1.10%	25.43%	0.67%	0.73%	0.26%	0.60%	100.00%

When viewed by weight, which is a reasonable proxy for flake size, the distinction is even greater with approximately a 13:1 ratio (Table 9.4). This supports the normative view that tools made from exotic (i.e., chert in this assemblage) materials are entering the site in a prepared blank, preform or finished state and are subject to final shaping, resharpening or recycling actions. At the same time, the local rhyolites reflect a wider on-site manufacturing history with more and larger flakes.

Table 9.4 Potter site artifact assemblage summaries by % material type, % weight and mean flake weight in grams.

Material	% by Frequency	% by Weight	Mean flake weight (g)
Rhyolites combined	72.32	90.8	0.83
Cherts combined	26.10	7.1	0.19
Other lithic types	1.66	2.1	0.55

This interpretation is further supported by the distribution of channel flakes by material type. Accepting that the fluting process is a final or near-final step in the fluted point New England and Maritimes manufacturing process (Bradley et al. 2008), it is notable that of the 45 identified channel flake fragments found at the site, 25 are made from Munsungun chert. Conversely, among the biface fragments, only 12 are made from Munsungun chert while 37 are rhyolites.

9.5 Material acquisition methodology

In many North American regional analyses, Paleoamerican lithic material distribution and sourcing has been interpreted in the context of two separate descriptive premises (Spiess and Wilson 1987). First, the settlement pattern premise suggests that lithic procurement occurrences are an integral feature of a seasonal transhumance cycle that includes the participation of most or all of any given band population. The second premise used to explain Paleoamerican lithic transport and distribution is exchange. The broadly defined alternatives for the second proposed premise include casual exchange among families seasonally dispersed over a band territory and reciprocal exchange over long distances (Spiess and Wilson 1987).

During his endeavor to answer the question “Was stone exchanged among Eastern North American Paleoamericans” Meltzer (1989) expanded upon the two alternative premises defined above and proposed four different methods for moving tool stone from source to site, each with diverse implications.

1) *Direct acquisition:* is where the stone is acquired at the primary geological source or outcrop, and then carried by the band from source to site.
2) *Indirect acquisition:* is where the stone is acquired at the primary geological source or outcrop by one group, and then transferred to another group. There are a variety of transfer methods including exchange, gifting, movement of individuals between groups, and conquest.
3) *Direct acquisition from secondary sources:* stone is acquired from a secondary geologic source, such as a transported cobble bed. The stone may be located some distance from the primary outcrop, and then carried by the group from source to site.
4) *Indirect acquisition from secondary sources:* stone is acquired from a secondary geologic source, such as a transported cobble bed. The stone may be located some distance from the primary outcrop and then transferred via exchange, movement of individuals between groups, or gifting to another group (Meltzer 1989).

Even though the above hypotheses, regarding the movement of tool stone from its source location to its users, appear to be rationally constructed, direct evidence for any of these mechanisms is difficult to distinguish archaeologically. Meltzer (1989) observes that only a very few archaeologists have attempted to address the matter of separating traces of direct from indirect raw material acquisition, but those who have mostly conclude that:

> *"one cannot distinguish archaeologically between either special purpose lithic resource procurement or long-distance transport and/or exchange of lithic materials, on the one hand, and the distribution of materials in the context of the normal range of foraging by highly mobile aborigine hunter-gatherers, on the other hand"* (Gould and Saggers 1985:123).

9.5.1 Arguments for indirect acquisition

Hayden (1982) offered a comprehensive discussion concerning the indirect acquisition of stone material as part of an effort to explain aspects of North American Paleoamerican occupation. He characterized Paleoamerican horizon behavioral traits regarding the use of exotic stone, exceptionally fine quality craftsmanship, stylistic homogeneity over a vast area, and lower stylistic diversity than in latter archaic times (Hayden 1982:114). Such characteristics reflect an adaptation that was:

> *"very extensive, with comparatively little stylistic diversity, with diffuse boundaries, involving highly crafted artifacts and/or large amounts of rare raw materials from relativity distant sources, symmetrically exchanged"* (Hayden 1982:114-115).

Further, Hayden alleged it was "clear that lithic materials were being exchanged by Paleoindians" in "widespread interaction networks," which were later replaced by smaller exchange networks in the archaic times (Hayden 1982:115). It would also have been necessary for Paleoamerican horizon inhabitants to regularly replenish tool-making stone supplies, thereby requiring continuous or at least regular contacts among other supplier bands, and thus maintaining the interaction network (Hayden 1982:118). This position relies on the belief that inhabitants of the Paleoamerican horizon were territorial in addition to implying that band population quantity and sizes were larger than archaeologically justifiable in the Northeast.

While exchange can be hypothesized to occur in several contexts and can involve a wide variety of goods, another justification for this medium is that it can function as a risk reduction strategy. Maintaining interaction among disparate bands can function as a form of economic insurance or buffer. In times of resource stress, this permits groups to gain access to resources from other, less depleted territories (Meltzer 1989).

9.5.2 Arguments for direct acquisition

Paleoamerican archaeologists practicing in the Northeast present arguments for the direct acquisition of Tool stone that are just as convincing as those discussed above for acquisition by exchange. Their arguments are also based on a set of assumptions or initial conditions and are in some instances at variance with those assumed for the acquisition by exchange case.

Meltzer (1989) posits that North American Paleoamericans were noncomplex social groups that inhabited a relatively empty landscape and probably at low population densities. Widespread stylistic similarities in projectile points indicate these groups were not highly territorial. Paleoamerican lithic assemblages routinely include exotic raw materials from sources over 300 km and sometimes as much as 800 km from the site (Meltzer 1989).

Paleo horizon hunter-gather groups in the Northeast exhibited strong preferences for using certain sources of lithic raw material to the exclusion of others. These groups also exhibited a focus on the use of the highest flakable grades of fine-grained raw material (cryptocrystalline), an emphasis on the use of bedrock rather than secondary deposits of stone raw materials, and a tendency to employ only certain sources of the above kinds of raw material to the exclusion of others (Ellis 1989; Goodyear 1979).

Paleoamerican sites were dominated by one or two lithic material sources in virtually all areas of the Northeast, strongly suggesting that only one or a limited number of sources may have regularly been visited in the course of an annual round (Ellis 1989). Goodyear (1979) observed that Early Paleoamericans focused on high-quality cryptocrystalline rocks for the manufacture of their chipped stone tools: bifaces, scrapers, gravers and pièces esquillées. They also favored massive bedrock sources, i.e., beds, lenses, large nodules over secondary deposits. This preference seems to be particularly true in the case of the glaciated regions of eastern North America (Meltzer 1989).

Sites in the Northeast such as Debert, Vail, and others document the use of coarse-grained rocks for large tools including choppers as well as for simple expedient, and briefly used flake tools (Ellis 1989). In contrast to most archaic groups, reliance on coarse-grained materials was less prevalent among Paleoamerican groups. Furthermore, more formalized, and curated tools were consistently made on the finest grades of materials on Paleoamerican sites whereas this is certainly not a general rule in the archaic and particularly in the middle to late Archaic. (Ellis 1989).

Viewing the concept of risk from a perspective other than what was suggested in the material acquisition by trade case, Jones and colleagues (2003:9) hypothesized that:

> "*exclusive reliance on exchange to provision a critical resource like lithic material…entails great risk. This risk would take the form of difficulty in coordinating exchanges between groups, especially under conditions of low population density as hypothesized in the Northeast and would increase the*

likelihood that the exchange would fail to convey the resources to the groups needing them” (Jones et al. 2003:9)

The predictable nature of tool stone source locations in time and space may also suggest the primacy of direct procurement of tool stone (Jones et al. 2003:9).

As a result of the above assumptions and archaeological evidence, Paleoamerican archaeologists practicing in the Northeast generally assume that the acquisition and circulation of tool stone reflect direct procurement embedded in subsistence pursuits (Ellis 1989; Goodyear 1979; Spiess and Wilson 1987; Meltzer 1989). Additionally, some have suggested that a high proportion of exotic stone in an assemblage precludes indirect acquisition because of the physical limitations on a donor group carrying two complements of stone, i.e., one for use and one for exchange. Furthermore, the assumption of reliance on exchange for critical raw materials is a highly disadvantage adaptive strategy (Meltzer 1989).

9.5.3 Direct or indirect acquisition at the Potter site?

Taking into consideration the arguments discussed above for the acquisition of tool stone and archaeological evidence at the Potter site, I conjecture that it suggests a composite direct and indirect acquisition structure.

This suggested a composite acquisition method could potentially be organized as follows. The majority tool stone component of the assemblage, i.e., local rhyolites and Munsungun chert which represent 97% of the assemblage lithic materials, were acquired as part of the seasonal round activities. A variation on this theme may well be that somewhere in the seasonal round a special task group may have separated from the main population body for the specific purpose of acquiring

Munsungun chert or rhyolite. This variation would still be considered direct acquisition. Because of the insignificant proportion of the unspecified cherts, unidentified stone, and hornfels located at potentially greater distances it is unlikely that these were acquired as part of the seasonal round. A more likely scenario is that they made their way into the assemblage through the fluid movement of individuals from other bands into the inhabitant population of the Potter site.

The reasoning for this view follows from the following assemblage characteristics and acquisition arguments offered below by (Ellis 1989; Goodyear 1979; Jones et al. 2003:9; Meltzer 1989; and Spiess and Wilson 1987).

As detailed in other sections of the chapter, the majority of the Potter site artifact assemblage by percentage material variety is composed of 72.32% local volcanic rhyolites (within 20 km radius of Potter) and 25.43% Munsungun chert whose source is located approximately 260 miles or 420 km from the site. Of the remaining 2.26 %, 0.67 % of the assemblage is made up of unspecified cherts (potentially identified without formal testing as Onondaga chert from New York, Vera Cruz chert from Pennsylvania, and Cheshire chert from Vermont). These are considered exotics because they are from distances over 150 miles. The remaining 1.66 % is hornfels and unspecified stone whose source location is indeterminate.

Given the site tool stone composition, enumerated below are a group of hypotheses posited by the authors (Ellis 1989; Goodyear 1979; Jones et al. 2003:9; Meltzer 1989; and Spiess and Wilson 1987) whose views were discussed above. These views establish the ecological conditions for tool stone acquisition during the Paleoamerican horizon. Following each of these hypothetical interpretations are comments relative to the Potter site inhabitants' potential behaviors showing support for the proposed stone tool material acquisition model.

1. North American Paleoamericans inhabited a relatively empty landscape at low population densities and were nonterritorial noncomplex social groups (Meltzer 1989). Because of this the inhabitants of the Potter site, who ostensibly relied on caribou hunting for subsistence, would have been able to travel unimpeded between the rhyolite and Munsungun sources.
2. A high proportion of exotic stone in an assemblage precludes indirect acquisition because of the physical limitations on a donor group carrying two compliments of stone, i.e., one for use and one for exchange (Ellis 1989; Jones et al. 2003:9). As noted above a significant portion of the assemblage is composed of Munsungun chert, i.e., 25.43%. Traveling in their seasonal round the inhabitants of Potter could not have been certain when they would meet another band who would have a large enough stock of high-quality Munsungun chert for indirect acquisition. Again, however, the method of direct acquisition does not preclude the use of a special task group to acquire the chert as opposed to the entire band traveling to the Munsungun source as part of the seasonal round.
3. The reliance exclusively on exchange to provision a critical resource like lithic materials entails great risk. "The risk would take the form of difficulty in coordinating exchanges between groups, especially under conditions of low population density as hypothesized in the Northeast and would increase the likelihood that the exchange would fail to convey the resources to the groups needing them" (Jones et al. 2003:9). Given that the occupation horizons of the Potter site fall in the early to the middle Paleoamerican horizon, indirect acquisition would have been a risky acquisition method.
4. Paleoamerican foragers favored massive bedrock sources for their tool stone, i.e., beds, lenses, large nodules over secondary deposits. This preference seems to be particularly true in the case of the glaciated regions of eastern North America (Meltzer 1989). The Mount

Jasper rhyolite is from a mined quarry as well as the Munsungun chert. However, even though Jefferson rhyolite is a smaller percentage of the rhyolite composition, it is found in a nodular form. From chemical tests of both the Mount Jasper and Jefferson rhyolites, it appears they were comagmatic even though the source of the Jefferson rhyolite has yet to be identified. As part of the Potter site inhabitants highly mobile lifeway and Paleoamerican bedrock material souring preferences it would seem that this indicates an embedded acquisition strategy.

9.5.4 Equifinality and the unavailability of direct evidence

Even as all of the above reasoning appears to be plausible, there is a substantial problem of equifinality and the unavailability of direct evidence. The two processes discussed, direct and indirect acquisition can yield essentially the same outcome. By way of example, the presence in an assemblage of fluted points made of exotic stone from sources hundreds of miles distant may well represent a form of gift or some other mode of exchange. Then again, it may not (Meltzer 1989). Meltzer (1989) remarked that:

> *"the unfortunate bottom line is that there do not seem to be clear-cut rules for sorting direct from indirect acquisition and any deterministic fashion. It is, for now, impossible to devise by conditional statements of the form certain attributes of an assemblage will appear if and only if indirect or direct acquisition occurred. From this, it follows that any assertion that one or the other of those mechanisms were responsible for bringing stone to a site, particularly assertions unsupported by consideration of alternate possibilities and evidence for the same, are empirically unacceptable"* (Meltzer 1989).

That said, even in light of the significant issues of equifinality and the unavailability of direct evidence, from the logic developed relative to indirect and direct sourcing methods in addition to the site's archaeological indications, the model presented for Potters material sourcing is plausible.

9.6 Conclusions.

This chapter discussed the varieties, quantities, characteristics, locations, and sourcing methods of the lithic material from which the Potter site Paleoamerican inhabitants fashioned their flaked stone tools.

Chapter X that follows introduces the comparative sites and their archaeological data. The sites will be used in the evaluation of the behavioral characteristics of the Potter site. The Whipple, Bull Brook, Vail, and Tenant swamp Paleoamerican sites were selected as the comparative evaluation sites. Their selection was based on their regional proximity, similar cultural horizon dating, in addition to the quality of the documentation available.

Part 4

Comparative site archaeological characterization data

Part 4 and Chapter X, in a similar fashion to the preceding chapters, provides characterizations of the Whipple, Bull Brook, Vail, and Tenant swamp Paleoamerican comparison sites. These comparative sites are provided for two important purposes. First, the sites have been identified, excavated, characterized, analyzed, published, and peer-reviewed by experienced principal investigators making them an accepted standard for archaeology in the period and region. Secondly, each of the investigators provided sufficient analysis and characterization of their site type to allow placement into its respective large site interpretive taxonomy category. However, not all the comparison site point for point data, in the same format as for the Potter site, was available. Nevertheless, there was enough detail accessible in the published literature to perform a comparative analysis.

The same analytical modeling techniques and methods as described earlier in Chapter V will be applied to the comparison sites as well as to the Potter site lithic assemblages in Chapter XII. This procedure will provide a corroboration or refutation of the methods employed in the analysis of the comparison sites and Potter as well as adding validity to the acceptance of the null hypothesis or its rejection.

Chapter X

New England-Maritimes comparative site archaeological characterization data

The Potter site is a significant addition to Paleoamerican archaeology in the region. Its importance becomes apparent if the following four comparison sites, i.e., Whipple, Bull Brook, Vail, and Tenant Swamp are presented in a similar way. Further, these four sites contextualize Potter's position within the period and regional archaeological frameworks. These four sites are those that are closest in age and location and have good excavation records. Regionally, Bull Brook, Whipple, and Tenant Swamp are located south to southwest within 210 to 250 km of the Potter site whereas Vail is positioned 75 km to the north northeast. The Potter, Whipple, and Tenant Swamp sites reside in the state of New Hampshire, Vail on the border between New Hampshire and Maine, and Bull Brook in the neighboring state of Massachusetts. The sparse data for the period is itself a statement of the potential significance of the Potter site to the Paleoamerican period exploration of the region.

The geographic locations in the New England-Maritimes region of the comparison sites to which Potter is to be evaluated regarding site functional interpretation are shown below in Figure 10.1. Comparison reference site and loci or activity concentrations characterization consists of a description of the excavated artifact assemblage and its environment. More specifically, the characterization foci include research objectives; site setting and stratigraphy; site and loci flaked stone assemblage composition; horizontal distribution; vertical distribution where information was available; features; and artifact type by the source material.

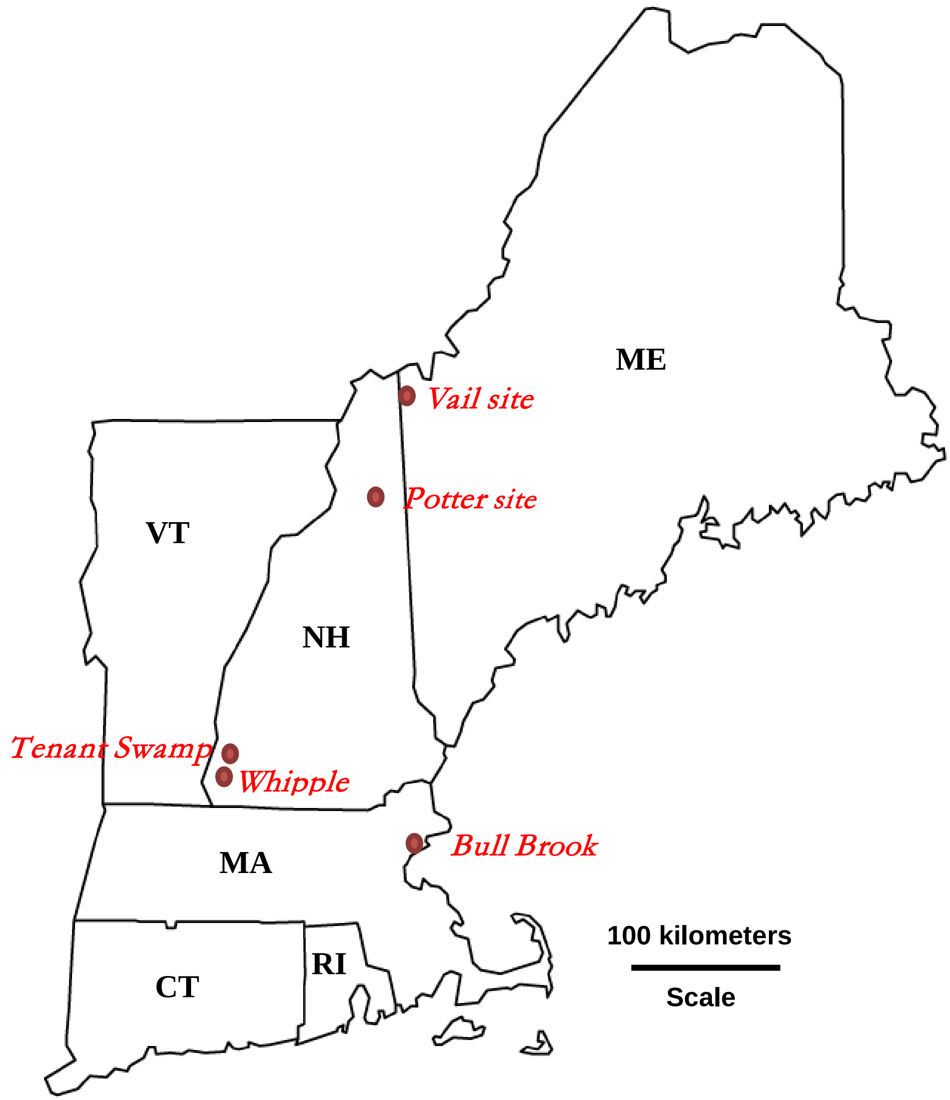


Figure 10.1 Location of comparison sites: Whipple, Bull Brook, Tenant swamp, Vail, and Potter (New England States Map, DIY Pinterest: New England map 31).

Each of these descriptive measures, where obtainable from original site researcher publications, is presented in a similar format organization as was employed in the case of the Potter site assemblage totals and loci. These flaked stone artifact assemblage characterizations, individually and in sum, provided the basis for the analysis performed relative to issues described in the research problem, goals and hypothesis discussion. Comparison site behavioral and functional interpretation evaluations are presented in the analysis section of the study (Chapters XIII and XIV).

10.1 Whipple site archaeological context and characterization

The Whipple site is located in the Ashuelot River Valley, on a tributary of the Connecticut River, intermediate to the uplands of southwestern New Hampshire. Mapping coordinates for the site are in the United States Geological Survey (USGS) Keene quadrant, 42° 53'N; 72°18'W, elevation 148.5 m (483'). Site survey work began in 1976 and continued in 1977 (Curran 1984).

10.1.1 Site research objectives

The stated research aims for the Whipple investigative project were to establish an ecological context in support of determining the site occupation horizon with a view toward developing a broad-spectrum subsistence model using various social organization concepts and Paleoamerican behaviors (Curran 1984:5-8).

To develop a general subsistence model, Curran (1984:5-8) focused on expanding knowledge of Paleoamerican internal site functioning using comparisons with artifact, ecofact, and feature distributions of five other Northeastern Paleoamerican sites: Templeton (6LF21), Connecticut; Wapanucket 8, Massachusetts; Bull Brook, Massachusetts; Vail, Maine; and Debert, Nova Scotia, Canada.

10.1.2 Site setting and stratigraphy

Within the Ashuelot River Valley, the Whipple site is positioned on a gradually sloping surface of a delta deposit approximately 180 meters from the modern Ashuelot River. Bordering the site, and some four meters below the surface runs a small spring-fed brook that empties into a low-lying marsh and bog (Curran 1984:8). Curran's (1984 Figure 2) shown in Figure 10.1.1 below, illustrates the Whipple site elevation contours (dashed lines with elevation figures) and site configuration including locus positioning. A spruce woodland-forest environment during Paleoamerican times is indicated from geologic and pollen studies of the bog and surrounding areas (Curran 1984). Three loci, labeled A, B, and C were identified during field excavations.

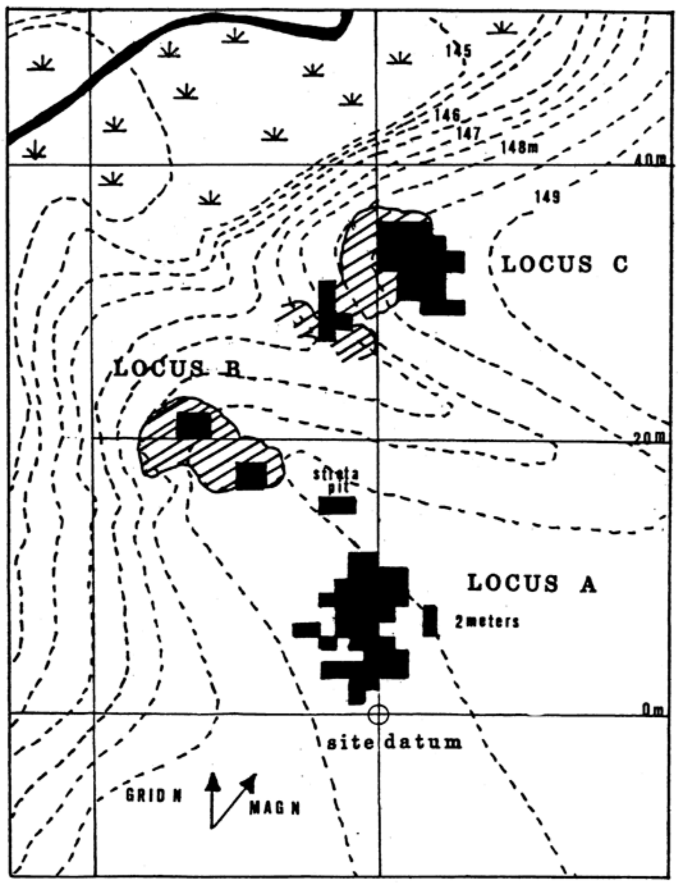


Figure 10.1.1. Whipple site loci positioning, and elevation contours as indicated by dashed lines with elevation figures. From Curran (1984) Figure 2.

The soils composition of Loci A is Bare Carver loamy sands, (mixed, with a moderate supply of moistness), interspersed in dense deposits of sand and gravel (Curran 1984:8). In the main site area of Locus C patches of less gravelly Windsor loamy sands have been identified

(Curran 1984). An organic layer (Ao) is underlain by a 10 to 15 cm dark humic (organic soil material intermediate in the degree of decomposition between the less decomposed fabric material and the plowzone's more decomposed sapric material (USDA Glossary of Soil Survey Terms). Below that stratum is a bluish-gray subsurface layer of leached clay, beneath which fine unstructured sands are characterized by a B and then C soil horizon (Curran 1984:8).

10.1.3 Whipple site flaked stone artifact assemblage

Table 10.1.1 represents a summary of the flaked stone artifact assemblages for the total site and individual loci at the Whipple site. This table was constructed from the Curran (1984) descriptive text. Nearly all Paleoamerican artifacts, as well as charcoal and bone clusters, occur within the B horizon in both Loci A and C (Curran 1984). Occasional items were found in rodent burrows or root paths extending into the C horizon.

Table 10.1.1. Total Whipple site and Locus lithic artifact assemblage (tools and tool fragments).

Tool type	Total site	Locus A	Locus B	Locus C
Bifaces (fluted including fragments)	18	12	3	3
Preforms	14	11	1	2
Fluted drill	1	1	0	0
Wedges plus wedge spalls	2	0	0	2
End scrapers	40	4	17	19
Side scrapers	12	5	1	6
Flake tools, (used as gravers, scrapers, and knives. Curran 1984:9)	16 plus	Numerous	12	4
Utilized flakes	Numerous	Numerous	Numerous	Unknown #
Chopper	1	1	0	0
Hammerstones,	Several	Several	0	Several
Debitage	38,000	30,000	2000	6000

Note: Table Constructed from Curran (1984) descriptive text.

Some 350 calcined bone fragments constitute the Whipple site faunal assemblage (Curran 1984). As reported by Curran (1984) an analysis performed by Dr. Arthur Spiess of the Maine

Historic Preservation Commission, has "resulted in the identification of 83 mammal bones, of which 15 bones are attributable to family *Cervidae,* 36 are from a large or medium mammal, and three have been identified as caribou" Curran (1984:5).

10.1.4 Locus A

As well as data for the total site assemblage, Table 10.1.1 presents a tabulation of the flaked stone artifact assemblage excavated from the Whipple site's Locus A, B, and C.

10.1.4.1 Locus A lithic raw material sources

In Locus A the primary raw material was a fine-grained chert, ranging from grey to brown in color. A red-brown, coarser silicified siltstone and a fine-grained bluish quartzite formed a less significant portion of the discarded artifacts. Visually the chert and siltstone samples are identical to materials from the Bull Brook site, Ipswich, Massachusetts (Grimes 1979). However, a more recent analysis of the Whipple assemblage by Burke (2004) found that a significant percentage (77%) was made up of Munsungun chert from the Munsungun, Maine quarry. Percentages used by Burke (2004) for his analysis are based on data published in Pollock et al. (1999). The northern New Hampshire rhyolites (from Mount Jasper and Jefferson) that are so abundant at middle and later Paleo-horizon sites in the New England-Maritimes (NEM) are absent from the Whipple assemblage (Goodby 2014). Of the two of the most common materials at the Whipple site, the grey-brown chert is thought to originate from the Hardaway formation in Vermont, and the blue-gray quartzite is thought to originate in the Cheshire formation of Vermont (Goodby 2014).

10.1.4.2 Locus A Features:

The only cultural feature defined in the Locus A field area consisted of a 1 by 1½ m concentration of burned bone, debitage, and charcoal that was considered to be a hearth area (Curran 1984:9-10). There was a significant decrease noted in both tool fragments and debitage north of the hearth area. Curran (1984) observes that the drop-off coincides with a relatively high phosphate increase, suggesting perhaps the presence of a lean-to or partially enclosed shelter. Applications for phosphate analysis are found in locating settlements, determining the limits of a settlement, diet of a settlement and differentiating between such things as grave mounds and mounds produced by land clearance (Provan 1971). Soil phosphate analysis as a tool in archaeology has demonstrated that there is a relationship between the phosphate content of soils and human occupation (Provan 1971). Outside the immediate hearth-centered activity area, phosphate peaks were measured indicating that potential peripheral activities occurred, as well as additional low-density tool and debitage discards (Curran 1984:10).

10.1.5 Locus B

Between the time (unspecified) that the site was reported by Arthur Whipple and when funds were obtained for field work (unspecified time period), the area (Locus B) was almost destroyed by looting. The collection of Paleoamerican materials from this Locus was available temporarily, permitting a rapid descriptive summary. Curran (1984) does not mention how the viewing of artifacts was accomplished between the finding by Arthur Whipple and the destruction by looting of the locus or why time was limited. As noted, Table 10.1.1 presents the excavated flaked stone artifact assemblage for Locus B at the Whipple site presumably compiled by Arthur Whipple. There are no indications that Loci A and C suffered from earlier or later looting.

10.1.5.1 Locus B lithic raw material sources

There were no reliable debitage counts obtained for Locus B [2000 pieces estimated by Curran (1984)], given the uncontrolled method of collecting. Therefore, there is no definitive debitage material type distribution available for locus B. However, Curran notes that of the tools recorded, the dominant material in the assemblage was also a chert that grades from brown through gray to black, as described in Locus A (Curran 1984). As suggested earlier, aside from the Munsungun chert, the remaining two most common materials at the Whipple site, were Hardaway and Cheshire chert from Vermont (Goodby 2014).

10.1.6 Locus C

Table 10.1.1 presents the excavated flaked stone artifact assemblage for Locus C. The bulk of the artifacts recovered were found in the lower strata of the A horizon. Additionally, a few artifacts were found residing in the B horizon soils, as well as a stone-filled hearth (Curran 1984). Artifacts were also recovered downslope from the locus in undisturbed B horizon soils, suggesting that horizontal artifact downhill movement, possibly from erosion, occurred sometime in the past.

10.1.6.1 Locus C lithic raw material sources

Materials in Locus C are made up of predominantly brown-grey chert (Vermont Hardaway formation) and appeared to be of variable quality. In many cases, severe weathering of the lithics, related to geochemical reactions and potentially to heat spalling, has obscured the quality of the artifacts. Additionally, small quantities of quartzite, red-brown silicified siltstone, and a small amount of red jasper were recovered (Curran 1984). As remarked earlier, a recent analysis of the Whipple assemblage by Burke (2004) found that a significant percentage (77%) of the material was Munsungun chert from the Munsungun, Maine quarry.

10.1.7 Site Radiocarbon dating

Radiocarbon dating of the site's initial sample was based on charcoal from a coniferous tree or shrub source. A second dating attempt was based on hardwood charcoal samples. Curran's (1984) ^{14}C analysis and documentation provided the following methodology and dates.

> *"The first sample dated included two charcoal lumps, identified as coniferous specimens (targets C-344 and C-453). They yielded dates of 9,820 ± 450 and 11,430 ± 395 years B.P., suggesting that the fragments were not from the same population of charcoal. The second sample (two measurements on one target (C-345) of 10,150 ± 815 [11660 ± 1045 cal] and 10,670 ± 570 [12312 ± 749 cal] years B.P. agree very well with a second target (C-454) which dated at 10,885 ± 665 years B.P. [12573 ± 872 cal] produced a weighted mean of 10,680 ± 400 years B.P. [12392 ± 546 cal]. In this case, they represented four pieces of hardwood charcoal."* (Curran 1984:10-13).

As noted in Curran's above quote, the dating of the targets C-345 and C-454 provided a weighted mean of 10,680 ± 400 years B.P. [12392 ± 546 cal] which has been accepted as the site date.

10.2 Bull Brook site archaeological context and characterization

The Bull Brook sites' Paleoamerican component was discovered by Joseph Vaccaro when he found a fluted point on a bulldozed surface on November 17, 1950. A group of avocational archaeologists salvaged the site from imminent destruction in the 1950s. The excavation team hypothesized that the ring-shaped pattern (comprised of 36 distinct loci as of the 2009 reanalysis) of the Bull Brook site horizontal artifact deposition was the result of a single occupation. As excavation proceeded over time, the observable settlement pattern plan developed, and correlated with the excavators' initial hypothesis; the site represented a single occupation (Robinson et al. 2009).

10.2.1 Site research objectives

The focus of the Robinson et al. (2009) project was to re-evaluate the internal structure of the ring-shaped occupation pattern observed and published from the original excavation efforts by Eldridge and Vacaro (1952). To execute the re-analysis, it was necessary that a full reconstruction of the site plan using field notes, aerial photography, color slides, and home movies be undertaken. Robinson et al. (2009) developed a group of hypotheses that would be tested by the re-evaluation of the Bull Brook I site setting, habitation location distribution, artifact assemblage, and toolkit composition. Using an ethnographic analogy, Robinson et al. (2009) hypothesized that large group camps on the scale of Bull Brook should be macro-band gatherings. Based on the identification of caribou bone at the site and a working model involving a nearby maritime island exposed at the low stand of sea level, Robinson et al. (2009) hypothesized that Bull Brook was associated with communal caribou hunting. Robinson et al. (2009) further hypothesized that the ring-shaped settlement arrangement of activities, in some measure, may have been attributable to gender correlation with hunting preparations, processing, and other social/ritual activities.

10.2.2 Bull Brook site Paleoenvironmental reconstruction

The site dating efforts by Robinson et al. (2009) places the occupation of Bull Brook near the more recent end of the Gainey/Bull Brook phase which falls into the latter half of the Younger Dryas period. In northern Maine, during this time period, there was a glacial re-advance in areas of open tundra. Concurrently, northeastern Massachusetts located approximately 650 km south of northern Maine, was open coniferous/deciduous forest (Newby et al. 2005:150). Correspondingly three miles east from the site the Atlantic Ocean maximum low stand of sea level was estimated to be 55 to 60 meters below present, occurring approximately 10,500 – 11,000 radiocarbon years ago (Pelletier and Robinson 2005). Robinson et al. (2009) estimate that Jeffreys Ledge (now a submerged fishing bank four kilometers east of Bull Brook) would have been a large island extending into the Gulf of Maine. Given sea levels this transitory island may have been a caribou refuge with a predictable fall migration to the wooded mainland, occurring in the direction of Bull Brook (Pelletier and Robinson 2005).

10.2.3 Site setting stratigraphy and spatial patterning

The original Bull Brook I site, before its destruction through sand pit excavation, was located approximately three miles inland from the Atlantic Ocean on the northern edge of the township of Ipswich; on a high sand plateau about 40 feet above sea level (see Figure 6.2.1). Northeast of the site proper lies a tidewater salt marsh where a cut channel flows through the site into the marsh and then on to the sea. Directly below, at the base of the site elevation, and above the Tidewater is an active spring (Robinson et al. 2009; Fowler 1973).

Site topographic reconstruction efforts by Robinson et al. (2009) describe Bull Brook's landscape, terrain, and occupation surface is given below and presented in detail in Figure 10.2.1. Also visible in the plan view, is the ring-shaped settlement arrangement of activities, as identified during the original excavation and the further analysis by Robinson et al.

> *"The landform was an almost isolated flat-topped plain described as a kame plain or a kame delta. It crested near the top of the steep NW slope, with most of the ring pattern situated on a one percent SE slope that became steeper toward the SE edge. Jordan's notes include a valuable surveyed profile running from the central area to the salt marsh edge. No other topographic or hydrologic variability could be identified within the central area of the Paleoamerican ring. There is no evidence that the ring-shaped pattern itself is the result of topographic constraints. The selection of a large, flat landform is an important criterion for comparison with other Paleoamerican sites of different sizes. Smaller sites, such as the nearby Bull Brook II site, are often placed on more topographically pronounced landforms, rather than large plains without topographic constraint."* (Robinson et al. 2009: 434).

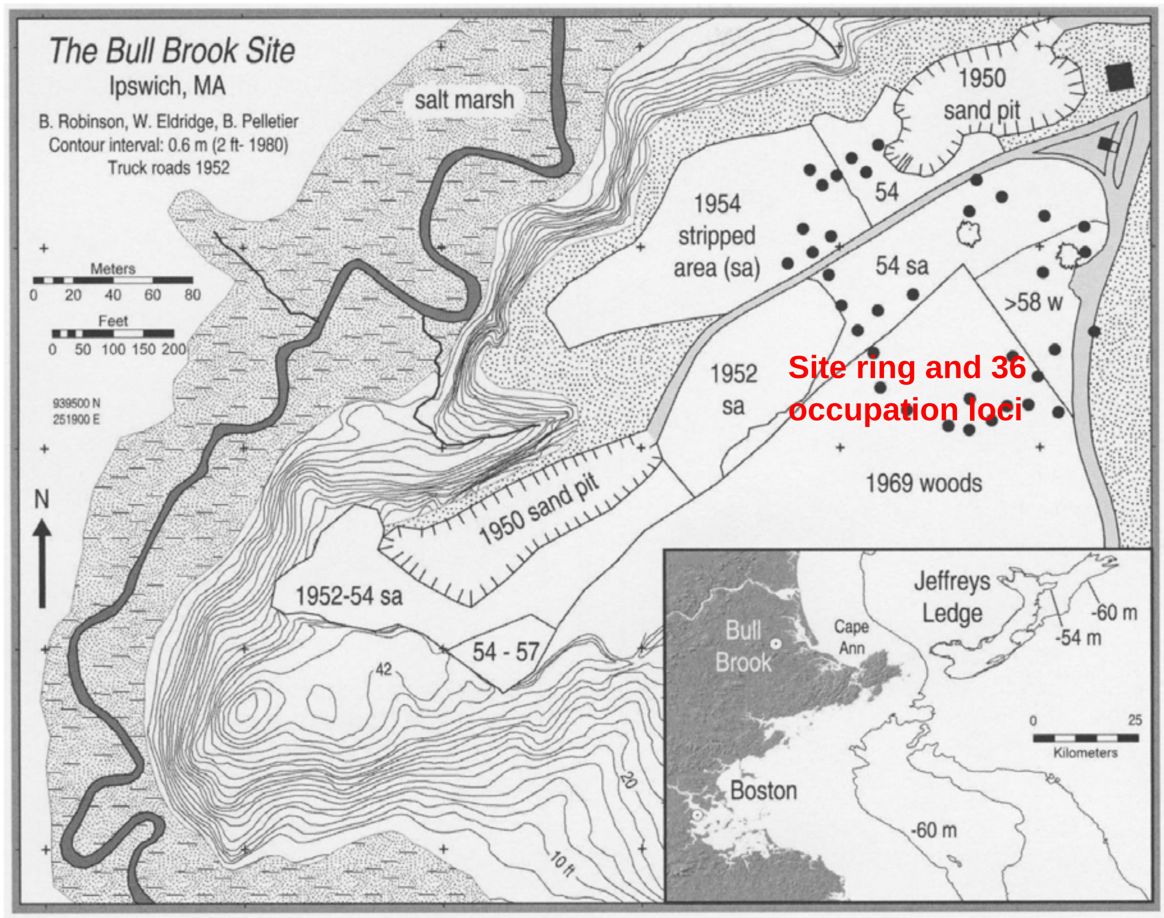


Figure 10.2.1. Plan view of Bull Brook site with tracts of land in the sand pit area dated to the time of destruction. The circle of dots in the northeast of the Figure signifies the 36 occupation loci of the total defined site. The loci configuration represents an outline of the ring-like configuration of the site. Inset shows Bull Brook site opposite Jeffreys Ledge at the low stand of sea level. (From Robinson et al. 2009, Figure 5).

It has been proposed by Slobodin (1962: 44) and Yellen (1977: 69-72) that social groups such as extended families are likely to cluster together in different segments around a larger circle. This view is still prevalent (Binford 1983; Robinson 2012). Robinson (2009) identified four groupings of loci that followed the patterning of smaller Paleoamerican sites which he identified as segments. These segments resemble the plans of smaller Paleoamerican sites found in the Americas that occur as straight or arc-like configurations (Figure 10.2.2) which provided models for investigating social organization (Robinson 2009).

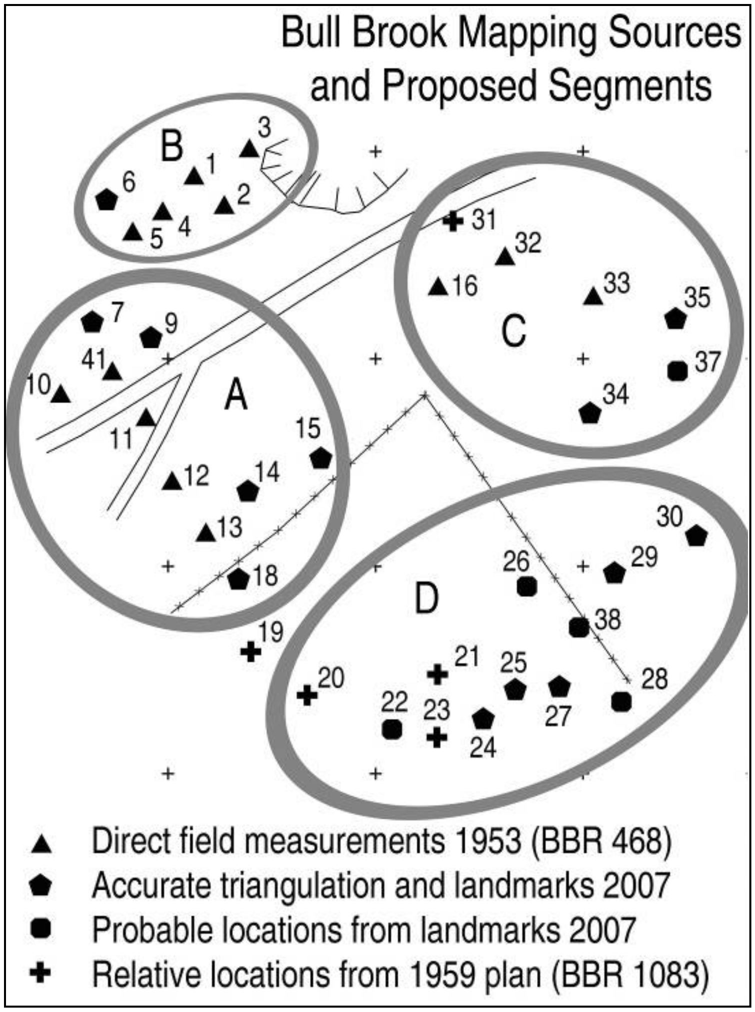


Figure 10.2.2. Ring configuration and proposed extended family or social group segmentation. Segments are delineated by ovals and identified as A, B, C, and D. The Loci and their defined segments were concurrently occupied (From Robinson et al. 2009).

10.2.4 Site lithic raw material sources and regional mobility

With the aid of petrographic analyses, lithic materials at Bull Brook have been attributed to the following source geographic areas: Normanskill/Mount Merino formation chert from New York, Munsungun formation chert from Maine, Hardyston formation jasper from Pennsylvania, and spherulitic rhyolite from New Hampshire (Robinson et al. 2009). Figure 10.2.3 shows the relative distribution of material types by source region and different segments around the circumference of the ring.

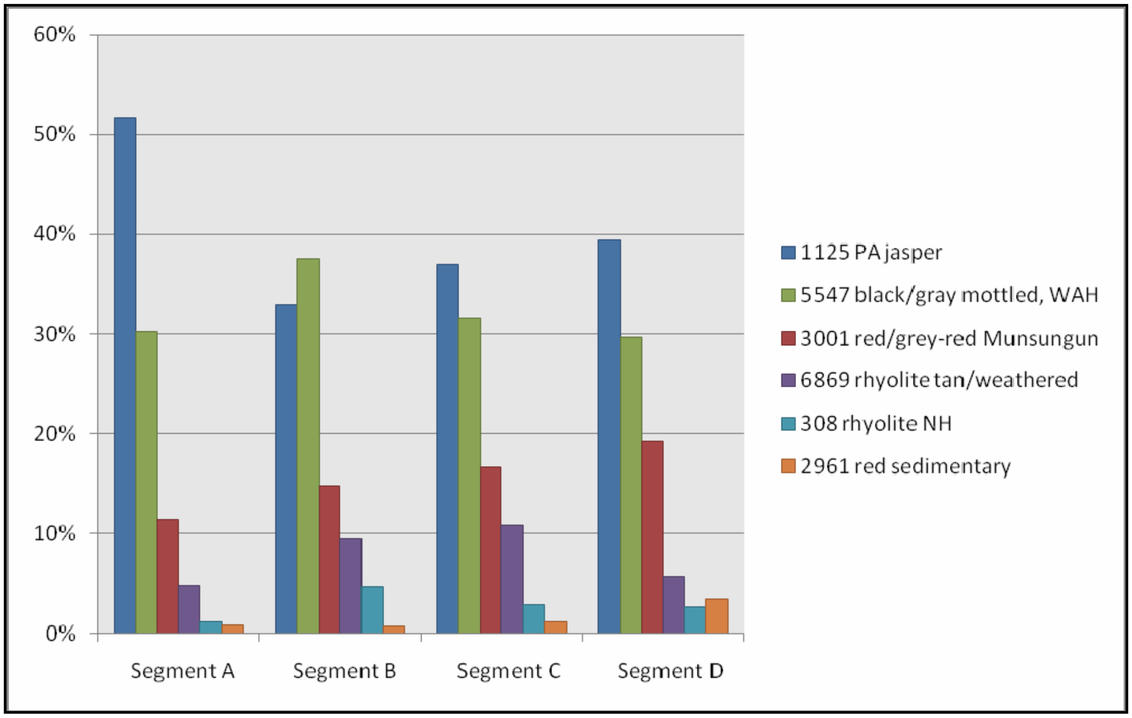


Figure 10.2.3. Distribution of material types compared by the source region and ring segments. All segments have the same most popular few sources, with 3 of the 4 in the same order of abundance. However, segment D has slightly more of the red sedimentary material. (From Robinson et al. 2008 Figure 9).

Each of the noted lithic source geographic locations, representing approximately 95% of the artifacts found at Bull Brook, comes from a minimum 250 km distant. Robinson et al. (2009) observe that none of the unusual rarer exotic materials such as Knife River Flint and other rare sources used during the Paleoamerican period seem to be present suggesting a large but well-bounded territory for material sourcing and a regional mobility range.

10.2.5 Internal site structure and flaked stone artifact distributions

Robinson et al. (2008) reconstructed a revised Bull Brook site plan that reproduces the ring-shaped pattern of the original 1950s analysis but represents it with a more symmetrical, somewhat pear-shaped contour in addition to new evidence of internal segmentation based on tool type (scraper and biface) distribution location Fig.10.2.4.

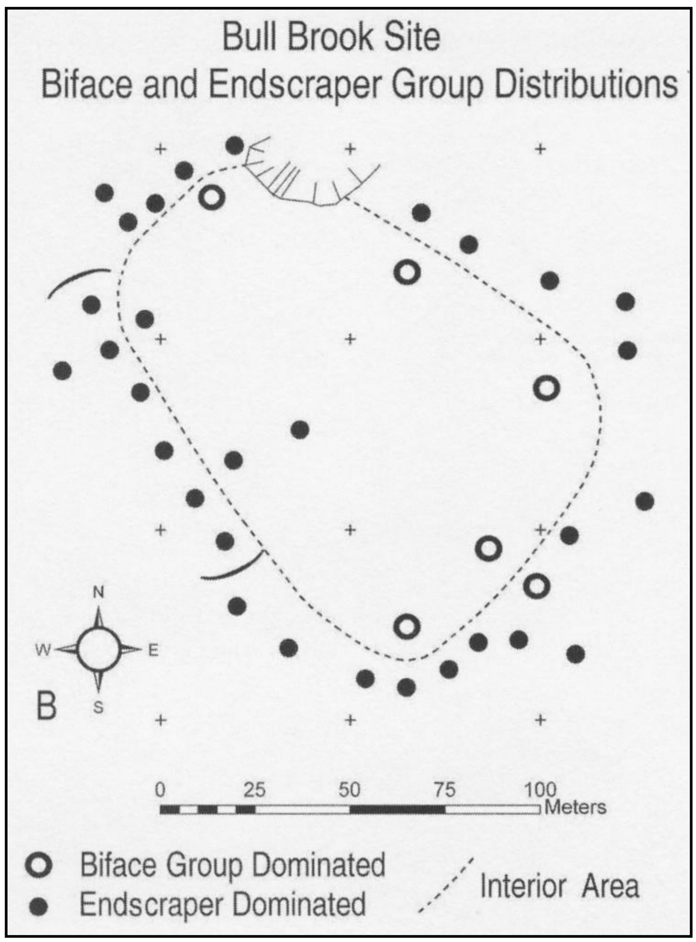


Figure 10.2.4 Bull Brook I site plan of ring-shaped horizontal distribution of artifact concentrations (loci) including biface and end scraper distribution. (From Robinson et al. 2009, Figure 5).

Artifact totals from the Robinson et al. (2009) re-analysis of the site's flaked stone assemblage include 5,215 Paleoamerican tools and 36,597 flakes from 36 loci. Table 10.2.1 is a representation of the artifact assemblage structured by interior and exterior loci location. Interior and exterior loci are defined by the position of the locus relative to the segmented circle. Analysis conducted on 2,543 of the more regular tool forms, averaged 70 flaked stone artifacts per locus. Robinson et al. (2008) cataloged the assemblage description as follows.

"Bifaces include 54 nearly complete fluted points, 42 fluted bases and 186 fragments or preforms. Paleoamerican drills are rare except on large sites such as Bull Brook and Vail. Bull Brook drills have carefully prepared S-shaped bits for rotation in one direction. Other artifacts include unifacial flake shavers (limaces), end scrapers, gravers and wedges (pieces esquillées)" (Robinson et al. 2008:437)

Table 10.2.1 Bull Brook flaked stone artifact quantities enumerated by interior and exterior of loci ring. Z scores indicate both positive and negative correlations for each set, with absolute values as the greater than 2.58 significant at 95%. (From Robinson et al. (2009), Table 1.)

Bull Brook Category	Interior Loci			Exterior Loci		Site Total Count	Six Biface Dominated Loci	
	Count	Z-score	% of Site Total	Count	Z-score		Count	% of Site
Loci Included	8		22%	28		36	6	17%
Artifacts Included in Statistical Analysis								
Flakeshaver	81	8.46	64%	45	-5.00	126	79	63%
Drill	48	7.12	70%	21	-4.21	69	44	64%
Biface	127	6.31	45%	155	-3.73	282	97	34%
Endscraper	203	-5.03	18%	910	2.97	1,113	61	5%
Wedge	75	-3.12	18%	339	1.84	414	40	10%
Graver	32	-2.42	17%	157	1.43	189	15	8%
Side scraper	93	0.24	27%	257	-0.14	350	59	17%
Total	659		26%	1884		2,543	395	16%
Flakes and Flute Flakes								
Flakes	17,169		47%	19,306		36,475	16,807	46%
Flute flakes	103		84%	19		122	108	89%

The two sets of loci artifacts collected from the outer and interior ring provide two sufficiently large samples to test whether inner and outer loci represent different activity behaviors or gender roles. The Robinson et al. (2009) statistical analysis demonstrates that Z-scores and percentages show four artifact classes that are most strongly contrasted. Eight interior loci have 26 percent of all artifacts, constituting 70 percent of flake shavers, 64 percent of drills, and 45 percent of bifaces. However, the same loci produced only 18 percent of the end scrapers (Robinson et al. 2009). From the statistical analysis of the seven standardized artifact classes listed in Table 10.2.1 it is indicated that differences between the interior and exterior are not coincidental (chi-square = 274, df = 6, p = .0000) (Robinson et al. 2009). Examples of the Bull Brook lithic artifact tool assemblage are shown in Figure 10.2.5.

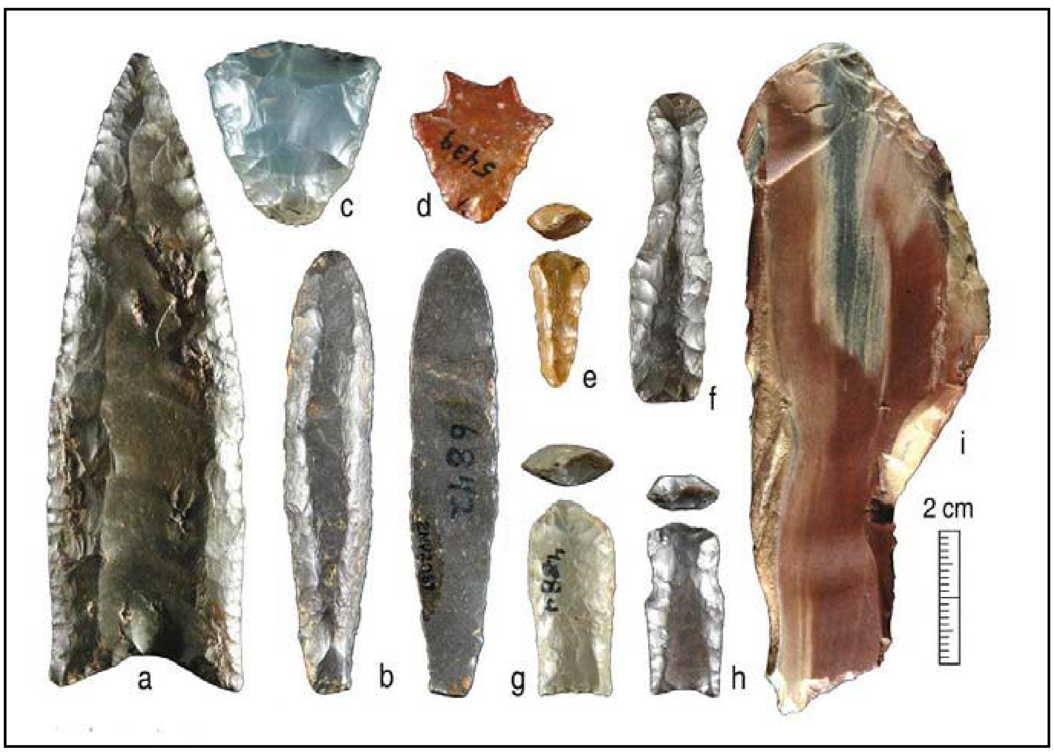


Figure 10.2.5 Bull Brook artifacts: a, fluted point; b, unifacial flake shaver; c, end scraper; d, graver; e-h, drills; i, side scraper. Photographs by Erica Cooper: courtesy of RSPM (a, i) and PEM (b - h). (From Robinson et al. 2009).

10.2.6 Features

The only cultural features identified at the site consisted of concentrations of calcined bone likely representative of surface hearths, with artifacts and bones bioturbated into lower strata (Robinson et al. 2009). In support of this conclusion, individual charcoal fragments suggest that the recent AMS dates likely represent natural or later cultural burning events (Robinson et al. 2009). As characterized by the original excavators, the concentrations were described as “elliptical in shape, about 15 by 20 feet in dimensions” (4.5 by 6 m; Jordan 1960:131) often with hearths including concentrations of burned bone (Byers 1955:274).

10.2.7 Site radiocarbon dating

Greater than 1,000 fragments of burned bone were recovered from the Bull Brook site excavations with one burned bone feature from Locus 18. Identified species from the bone fragments were caribou (*Rangifer tarandus*) and beaver (*Castor canadensis*) (Robinson et al. 2009; Spiess et al. 1998:208). Robinson et al. (2009) report that two samples of calcined long bone were dated at Beta Analytic and gave a date of 10,410 +/- 60 BP. A second date of 10,380+/- 60 BP was obtained on three shaft fragments associated with caribou bone from Locus 22 (Robinson et al. 2009). Presuming the new dates are in fact correct they would correspond to the more recent end of the Gainey/Bull Brook phase, falling in the latter half of the Younger Dryas period (Robinson et al. 2009).

10.3 Vail site archaeological context and characterization

The Vail site is located on the eastern side of Lake Aziscohos in Oxford County West Central Maine (Figure 10.3.1). Lake Aziscohos is an artificial lake formed by the damming in 1911 of a meandering channel of the Magalloway River. Prior to that event, the Magalloway River flowed uninterrupted from the Canadian border of the province of Québec South to Umbagog Lake that straddles the New Hampshire and Maine border (Gramly 2009). Present-day Lake Aziscohos is approximately 37 km long as well as filling the Magalloway River Valley in addition to submerging the Paleoamerican horizon Vail site.

Lake Aziscohos level is controlled according to regional power generation needs by the Union Waterpower Company of Lewiston Maine who on a yearly basis draws down up to 10 cm of water per day following the fall Labor Day holiday celebrated on the first Monday of September. The drawdown causes the lake level to drop 2 to 3 meters before potential late fall rains, that may or may not occur. If there are fall rains, they will begin to refill the lake to some lower level (Gramly 1982). The drawdown makes room for any potential rain and winter snowmelt from the surrounding mountains in the spring. The rate of drawdown is not a fixed rate but dependent upon multiple factors such as the starting, downstream, and absorption levels, as well as temperature and humidity. It is an up to rate of 10 cm per day dependent upon circumstances.

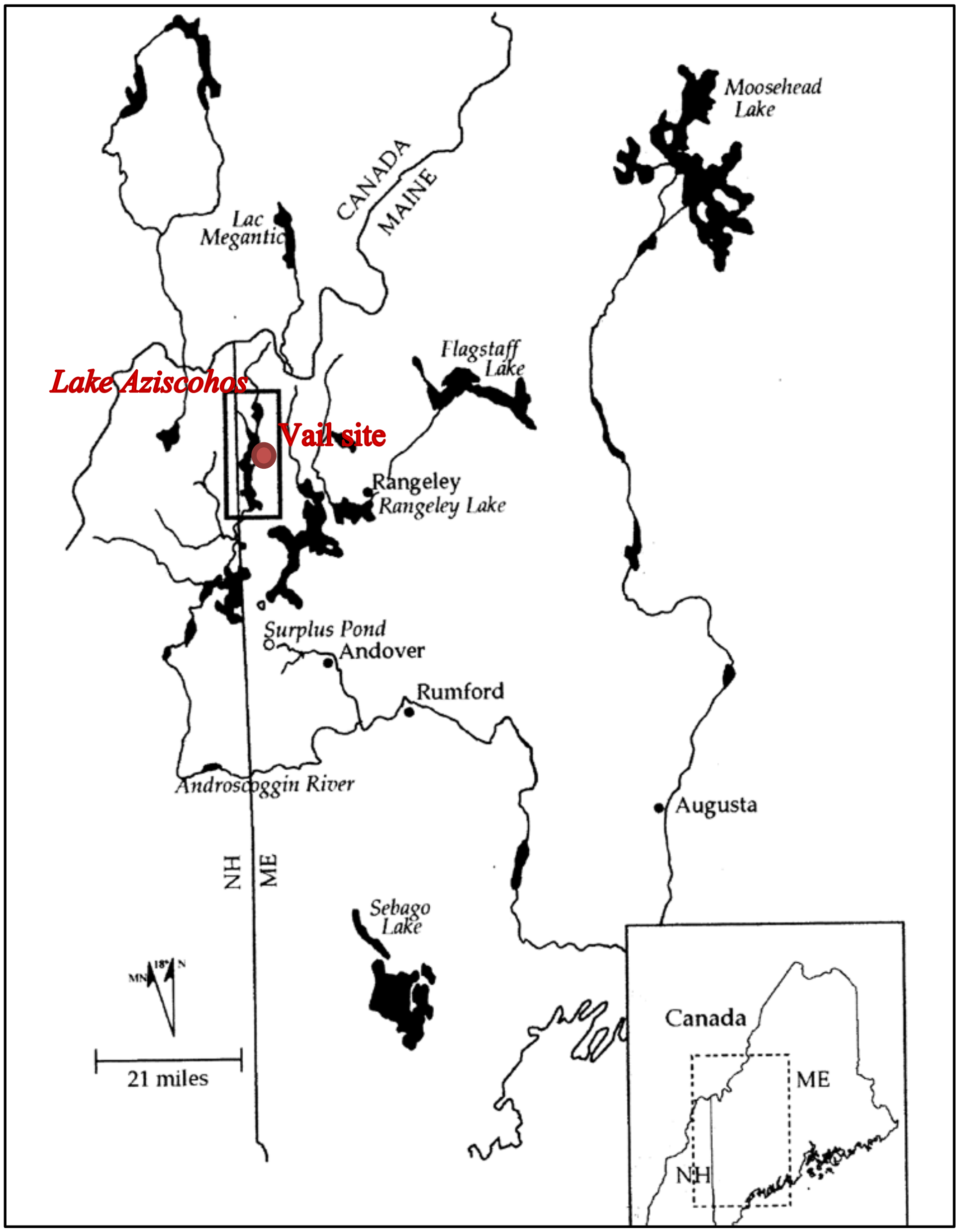


Figure 10.3.1 Vail site positioning on the eastern side of Lake Aziscohos (shown above in rectangle) in Oxford County West Central Maine. Adapted from figure 1.1 "Map of the study area. Lake Aziscohos" Gramly (2009:31).

The Vail site itself is generally submerged by up to three meters of lake water until the late fall when the eastern fringe of the site may become exposed (Gramly 2009). When Lake Aziscohos levels drop greater than five meters, due to lack of wetness, the modern channel of the Magalloway River and the Vail site may be seen (Figure 10.3.2).

10.3.1 Site research objectives

During a low-water year of Lake Aziscohos in 1970, Francis Vail, Jr., of East Stoneham, Maine, disembarked from his boat onto the sandy beach of the now exposed Vail site. There he found his first Paleoamerican artifact, a fragment of a large chert biface knife while looking for a lost fishing lure (Gramly 1982). On six or seven instances between 1970 and June 1979, Francis Vail and family returned to the original find spot; lake level permitting, to explore for additional rare Paleoamerican stone tool artifacts (Gramly 1982). On one of the trips to the site, Francis Vail invited Reginald Bachelder, a longtime friend, and fellow amateur mineralogist, to search for artifacts. Twelve additional artifacts were found at the site. During a visit to a rock and mineral shop owned and operated by Reginald Bachelder, Richard Michael Gramly, a trained and experienced Paleoamerican archaeologist learned of the Vail site, and its artifact finds. Gramly (1982) then made arrangements with granting agencies to prepare an organized field exploration and analysis of the Vail site in conjunction with the Maine State Museum field party (Gramly 1982). Field operations spanned the 1979 and 1980 excavation seasons with the 1980 season producing the bulk of the artifact production. Thus identifying and characterizing the first Paleoamerican site found in the state of Maine

10.3.2 Site setting and stratigraphy

The Vail habitation site is situated on glacial outwash sediments of the floodplain of the ancient Magalloway River. The Aziscohos Lake and Vail site elevation is 568 m above sea level which is no greater than the general elevation of the surrounding Plateau uplands (300-500 m) fringing the St. Lawrence basin (Gramly 1982).

Directly south of the encampment, situated on the valley floor, Gramly (1982) hypothesized that there was a meadow during Paleo-environmental times. Surrounding both sides of the meadow were sharply defined sheer rock faces. Even today, this constriction of the valley by the rocky hills is evident in aerial photographs (Figure 10.3.2). Subsistence game such as caribou would have been unable to ascend the valley walls at the narrows or even move along them following contours. This natural chokepoint at the rock faces would have allowed the parties of Paleoamerican hunters to direct their quarry through the maze of meandering river channels, sink-holes worn by springs, and ponds toward killing grounds where they were speared (Gramly 1982).

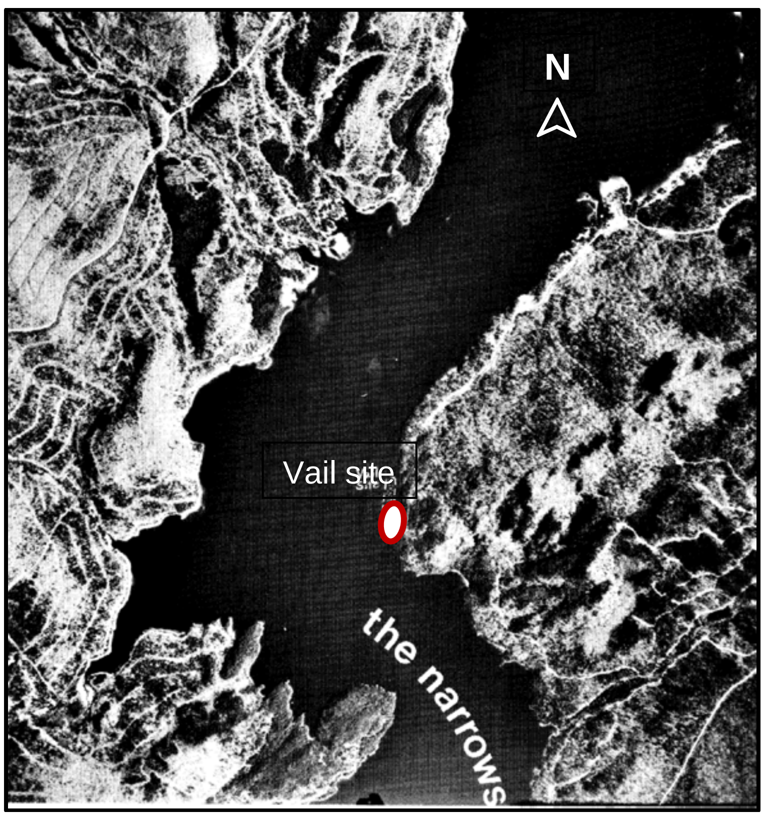


Figure 10.3.2 USGS aerial photograph taken in 1968 showing the narrows of Aziscohos Lake and the location of the Vail site just offshore. Scale: ½-inch equals ¾ kilometer. (Adapted from plate 1, Gramly 1982:91)

From the pollen record of 11,000 radiocarbon years ago, the Magalloway Valley was in the process of a transition from tundra to a woodland composition characterized by abundant spruce, birch, and pine (Puryear 1996). Between 10,500 and 10,100 radiocarbon years ago the environment experienced a change that led to a dominance of spruce and alder and a decrease in arboreal taxa. The landscape remained an open woodland from 10,100 to 9,500 radiocarbon years ago. This change in vegetation, as noted by changes in the pollen zone structures, appears to be coincident with the onset followed by the decline of the Younger Dryas interval (Puryear 1996).

10.3.3 Site flaked stone artifact distributions

The flaked stone artifacts of the Vail site assemblage were distributed unevenly over an area of approximately 140 meters x 40 meters or 1¼ acres. The site consists of eight individual loci that extend for approximately 150 meters in a northwest-southeast direction running along the modern day shoreline (Figure 10.3.3). These eight artifact concentrations were termed habitation loci by the principal investigator (Gramly 1982). Loci A to F is oriented in an arc bordering what were once shallow stream courses (Figure 10.3.3) which have now been filled and leveled with eroding sands (Gramly 1982). As noted in Figure 10.3.3, the designation N0E0 of the site grid is the 0/0 origin point of the site reference grid. It resides on the shoreline and is permanently affixed such that lake level fluctuations will not interfere with its permanence. Successive contours moving westward, as shown in Figure 10.3.3, are referenced to the N0E0 grid point.

As was previously discussed, during the site visit of Reginald Bachelder with Francis Vail, Jr., a discovery of fluted projectile points was made some distance to the west of the eight identified loci. Only days before the scheduled end of the excavation, one of the site excavators from the 1980 excavation crew discovered an additional two projectile points on the surface of the sandy plain 250 meters West of the Paleoamerican encampment where the Bachelder finds were also made (not shown in figure 10.3.3). The finding of a group of four projectile points and the lack of any other type of tool suggested that this location was a killing ground where Paleoamerican hunters ambushed and harvested game over 11,000 years earlier (Gramly 1982). A broken point tip found at the kill site was later refit with a base found at one of the habitation loci.

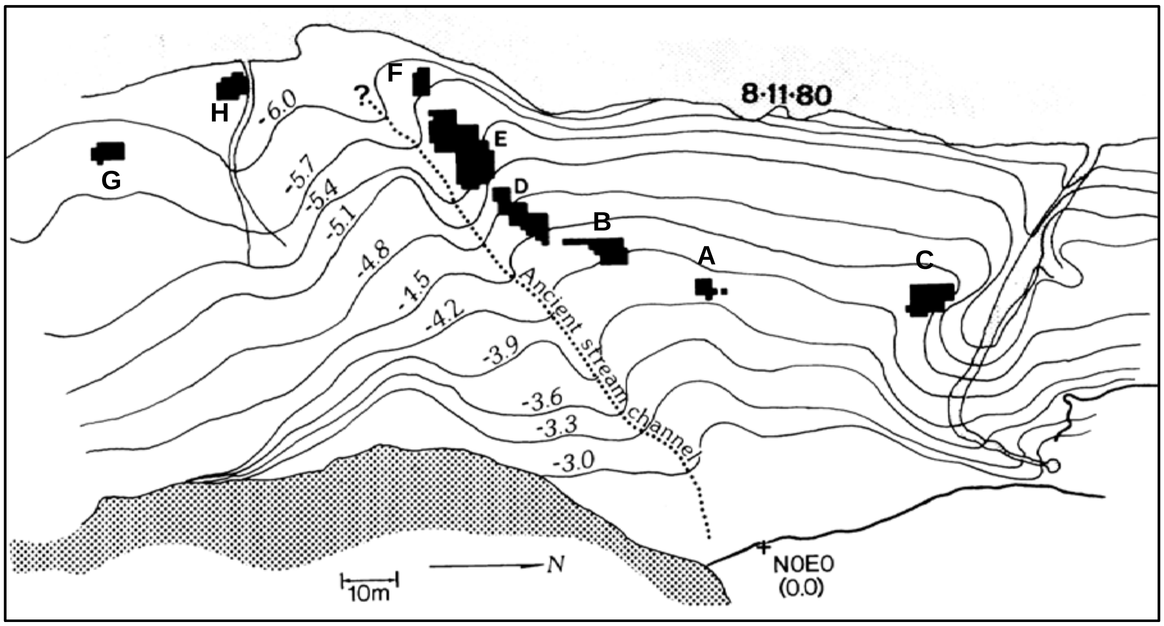


Figure 10.3.3 Contour map of the Vail habitation site. A shallow ancient stream channel flanking locus D and E was identified and is noted in the diagram. Locus C and locus H are positioned near other stream channels. The map was based upon the lake stand as of August 11, 1980. Contour interval equals 30 cm. N0E0 of the site grid resides on the shoreline, and successive contours are referenced to that grid point. (From Gramly 1982:16, Figure 4)

10.3.4 Site flaked stone artifact assemblage

Since Lake Aziscohos was formed by the damming of the Magalloway River in 1911, winter ice and summer waves have damaged the most elevated and landward portions of the Vail encampment. However, the pace of destruction was mitigated by the toughness of the forest soil at the site before the damming episode (Gramly 1982). Beneath the prior forest duff and humus zone, with a clay-like consistency, an A_2 zone formed which contained mostly the chert and rhyolite artifacts (Gramly 1982). In a discussion of tools and waste, Gramly (1982) notes that 50% of the Vail sites assemblage of flaked stone artifacts (4,694 specimens) were collected approximately 15 meters due west of Locus A and Feature 1 from lake washed sands that were the product of environmental erosion. Only 1,513 or 32% of the specimens were able to be associated with specific loci. The remainder were lumped together as un-attributable to specific loci but were included in the sites total flaked stone artifact inventory (Gramly 1982).

Excavations performed during the 1980 field season yielded 5,372 flaked stone artifacts each of which was mapped to the master grid for the site and attributed to specific geographic concentrations or loci.

Table 10.3.1 represents a summary of the lithic artifact assemblages for the combined loci at the Vail site. The tabulation includes all flaked stone artifacts acquired from the Francis Vail collection activities, those collected in the lake washed sands, and 1980 field season finds. Presentation of the assemblage is noted by tool type, number of specimens, and weight in grams. Table 10.3.2 presents the assemblage grand totals data by percentage. While the 5,372 flaked stone artifacts collected during the 1980 field season and attributed to specific concentrations or loci represents a significant archaeological find and accounts for 32% of the total, the analysis is somewhat clouded by the un-attributable artifact discoveries which account for 68%.

Later visits to the site occurring between the 1982 published documentation of the site and 2005 produced additional quantities of flaked stone artifacts that included some number additional tools and debitage. However, records of the exact additional quantities were not available for this analysis. It is estimated that the total assemblage as of 2017 is approximately 11,500 artifacts. The total count and locus counts recorded below are from the published documentation provided by Gramly (1982). From a paper published by Gramly (2010) that discusses implications for Paleoamerican behavior and band size, it appears that the ratios of tools to debitage and assemblage composition by locus remain the same. Therefore, for purposes of this analysis, the totals and their percentages from the Gramly (1982) documentation are still representative of the Vail site assemblage.

Gramly (1982) notes that every tool and tool fragment, including every waste flake that resulted from tool manufacture, resharpening, or use, was given a catalog number. While a finer mesh for sieves (1/8 inch) would have been preferred, all excavated soil was sieved through ¼ inch (6 mm) mesh in addition to the scraping of habitation loci floors in pursuit of any miniscule resharpening flakes.

Table 10.3.1 Vail site lithic artifact (combined) assemblage grand totals for the Vail site habitation site and killing ground

Tool/waste class	Number	Weight (grams)
Cutters (Utilized and retouched waste flakes)	741	2756
Trianguloid end scrapers	731	3843
pièces esquillées	544	2056
Side scrapers	162	2961
limaces	84	414
Fluted projectile points, complete and fragments	79	800
Fluted and unfluted drills	56	157
Bifaces (many fragmentary)	48	225
Tool fragments	1411	1864
Channel flakes	112	63
Hammerstones, anvils and fragments and flakes from usage and breakage.	322	24333
Debitage	4333	2038
Totals	8623	41510

Note: Adapted from Gramly (1982: 22) Table 1 and descriptive text.

Table 10.3.2 Vail site lithic artifact (combined) assemblage percent (%) grand totals for the Vail site habitation site and killing ground

Tool/waste class	Percent	Weight (grams)
Cutters (Utilized and retouched waste flakes)	9%	7%
Trianguloid end scrapers	8%	9%
pièces esquillées	6%	5%
Side scrapers	2%	7%
limaces	1%	1%
Fluted projectile points, complete and fragments	1%	2%
Fluted and unfluted drills	1%	0%
Bifaces (many fragmentary)	1%	1%
Tool fragments	16%	4%
Channel flakes	1%	0%
Hammerstones, anvils and fragments and flakes from usage and breakage.	4%	59%
Debitage	50%	5%
Totals	100%	100%

Note: Adapted from Gramly (1982: 22) Table 1 and descriptive text.

Table 10.3.3 represents a tabulation of the lithic artifact assemblages for the individual loci at the Vail site. Table 10.3.3's composition includes all flaked stone artifacts (5,372) acquired from the 1980 field season excavation but not those collected from the Francis Vail collection activities or lake washed sands. Presentation of the assemblage is denoted by tool type, locus and number of specimens. Table 10.3.4 presents the loci totals data by percentage. The tool type percentages are calculated from the individual tool quantities and the total number of tools. Debitage percentage is determined by the number of pieces and total artifact including tools. This manner of presentation was selected by Gramly (1982) to display the similarity in tool types by locus.

Table 10.3.3 Vail site artifact quantities by tool type for habitation loci

Tool/waste class	Locus								
	A	B	C	D	E	F	G	H	Totals
Cutters (Utilized and retouched waste flakes)	40	20	57	54	128	14	22	15	350
Trianguloid end scrapers	36	42	37	42	107	17	6	13	300
Pièces esquillées	22	14	16	51	143	2	22	23	293
Side scrapers	8	8	8	7	23	0	6	3	63
limaces	0	0	11	2	29	1	0	1	44
Fluted projectile points, complete and fragments	6	6	0	8	18	3	1	4	46
Fluted and unfluted drills	1	0	18	3	8	0	0	1	31
Bifaces (many fragmentary)	5	3	5	1	5	1	0	0	20
Channel flakes	6	5	11	10	42	0	0	2	76
Tools Totals	124	98	163	178	503	38	57	62	1223
Debitage	328	212	366	281	1382	142	92	140	2943
Total artifacts	452	310	529	459	1885	180	149	202	4166

Note. Adapted from Gramly (1982:49) Table 7. Tool fragments, flake fragments, hammerstones and anvils, menu points, and cataloged, unanalyzed specimens are excluded from tally totals. These exclusions reflect methodology of artifact recognition by locus. Artifact exclusions are unattributable to specific loci (Gramly 1982).

Table 10.3.4. Vail site artifact percentages (%) by tool type for habitation loci

Tool/waste class	Locus							
	A	**B**	**C**	**D**	**E**	**F**	**G**	**H**
Cutters (Utilized and retouched waste flakes)	32%	20%	35%	30%	25%	37%	39%	24%
Trianguloid end scrapers	29%	43%	23%	24%	21%	45%	11%	21%
Pièces esquillées	18%	14%	10%	29%	28%	5%	39%	37%
Side scrapers	6%	8%	5%	4%	5%	0%	11%	5%
limaces	0%	0%	7%	1%	6%	3%	0%	2%
Fluted projectile points, complete and fragments	5%	6%	0%	4%	4%	8%	2%	6%
Fluted and unfluted drills	1%	0%	11%	2%	2%	0%	0%	2%
Bifaces (many fragmentary)	4%	3%	3%	1%	1%	3%	0%	0%
Channel flakes	5%	5%	7%	6%	8%	0%	0%	3%
Tools totals (% based on N tools)	100%	100%	100%	100%	100%	100%	100%	100%
Debitage (% Based on total locus artifact count N)	73%	68%	69%	61%	73%	79%	62%	69%

Note. Adapted from Gramly (1982:49) Table 7. Tool fragments, flake fragments, hammerstones and anvils, fluted points, and cataloged, unanalyzed specimens are excluded from tally totals. These exclusions reflect methodology of artifact recognition by locus. Artifact exclusions are unattributable to specific loci (Gramly 1982).

10.3.5 Site lithic raw material sources

When initially analyzing the Vail site's tool stone source origins, Gramly (1982) believed that the majority of the raw material might have been sourced from outcrops of Cambro-Ordovician rock located at the northern end (Ledge Ridge) of the Magalloway River Valley. However, later researchers using geochemical and XRF-based geologic sourcing techniques to evaluate artifact finds at early, and middle Paleoamerican sites in northeastern North America determined that the principal tool stone source at Vail was Normanskill chert from the Hudson River Valley in New York (Kitchel 2016; Lothrop et al. 2016). Kitchel (2016), during an investigation of New England-Maritimes lithic sources including those from the Vail site, concluded based on the analysis of 10,272 lithic artifacts that 87.7% were Normanskill Hudson Valley chert. Kitchel (2016) also notes that of the nearly 12,000 analyzed artifacts from the Vail site assemblage only one item potentially may be made from Ledge Ridge chert and that was a small split stream pebble weighing 5.8 grams.

The second most common tool stone material at Vail, comprising four percent of the site's lithic assembly (n = 474), is a yellow Pennsylvania Jasper (Kitchel 2016).

Other materials at the site include several local coarse-grained specimens derived from both cobble and local bedrock sources. Tools produced from these materials were expedient in nature and of unknown function. There were no formal tools produced from these locally sourced materials found in the assemblage (Kitchel 2016). A negligible percent of the assemblage (.25%, n = 30) was made up of Munsungun chert from the Munsungun Maine quarry. Despite this small percentage of Munsungun chert, several of the artifacts were formal tools that included one fluted drill and one *piéce esquillées* (Kitchel 2016). The northern New Hampshire rhyolites, (Mount

Jasper and Jefferson) that are so abundant at early and middle Paleoamerican sites in the NEM are absent from the Vail assemblage. Table 10.3.5 enumerates the above discussed Vail site tool stone material type source identification and specimen count.

Table 10.3.5 Vail site tool stone material source identification by count.

Site Name Raw Material	Vail	%
Kineo/Traveler rhyolite	0	0
Cheshire Quartzite	0	0
Munsungun chert	29	.25
Hudson Valley Normanskill chert	10272	88.13
New Hampshire Rhyolite	0	
Pennsylvania Jasper	474	4
Quartz Crystal	14	.12
Unknown	875	7.5

Note: Adapted from Table 3–14 Kitchel (2016).

10.3.6 Features

In Gramly's (1982) analysis of the Vail site, four features were recognized at the encampment. Of the four features, only Feature 1 was unquestionably identified as a hearth. This feature was deemed particularly important because of the charcoal samples that were obtained from the feature fill and then used for radiocarbon dating of the site. Feature 1 had an average depth of 20 cm and a width of 80 cm that yielded approximately 20 g dry weight of charcoal samples in addition to several chert flake artifacts (Gramly 1982). Charcoal was dispersed throughout the feature's fill volume which otherwise was composed of sand and flake stone artifacts.

Feature 2 provided a few grams of badly abraded charcoal from one end of the pit. However, because of its location and minimal volume, Gramly (1982) opined that the feature was not used as a hearth. None of the tools and debitage in the feature showed traces of heating or fire (Gramly 1982). In addition to the usual mixture of objects found in other areas of the encampment, a large side scraper, approximately five times the weight of the average Vail site scraper, was found against the pit wall (Gramly 1982). One explanation posited was that the side scraper was stored away for future use but never reclaimed. Expanding this narrative, Gramly (1982) characterized Feature 2 as a cache pit for the storage of lithics, surplus meat, marrow bones, and other animal parts if the conditions for preservation were appropriate.

Features 3 and 4 contained no charcoal. Feature 3 contained scattered flakes and tools while Feature 4 was only a small pit. Feature 4 may have been natural in origin such as a tree throw of small size (Gramly 1982). Feature 3's physical dimensions were roughly equal to those of Feature 1 suggesting that it too may have been a hearth. However, as noted above, no charcoal was found in the feature's fill ruling out its use as a hearth.

Gramly (1982) further notes that additional features such as potential pits or hearths at the site were not overlooked because the encampment was thoroughly explored with ground penetrating radar and proton magnetometry in addition to shovel test pit sampling.

10.4 Tenant Swamp site archaeological context and characterization

The Tenant Swamp site (27CH187) is located in the town of Keene, southwestern New Hampshire where it is situated on a sandy terrace above the Tenant Swamp and Ashuelot River (Figure 10.4.1). Although the Tenant Swamp site does not meet the classical large site characterization discussed above, regarding the number of loci or artifact tallies, it is a useful mid-Paleo horizon comparison site in terms of site positioning, loci activity functions, flake stone tool types, and toolkit composition.

The site is positioned approximately 6 ½ km North of the Whipple site discussed above which is also located on the Ashuelot River. For relative positioning of the two sites in the state of New Hampshire see Figure 10.1.

Extensive archaeological testing and subsequent data analysis resulted in complete excavation and recovery of a comprehensive distribution of lithic tools, debitage, stone features, and calcined faunal bone fragments from four loci (Goodby et al. 2014). Fieldwork for data recovery was conducted between April and November 2010 and included excavation of 503 50-cm^2 shovel test pits, 70 one-m^2 excavation units, analysis of the results, and the preparation of reporting documentation.

10.4.1 Site research objectives

The Tenant Swamp's discovery, excavation, and analysis were due to permitting requirements for the construction of a local governmental structure. In advance of the construction of a new Keene middle school, federal (Section 106 of the Historic Preservation Act of 1966) and state regulations required that the proposed site location be examined for cultural heritage materials and evidence of occupation. Monadnock Archaeological Consulting, LLC performed the mandated study (Goodby 2010). Those involved in the permitting and review agencies for the proposed Keene middle school site, were the School Administrative Unit number 29, New Hampshire Division of Historical Resources, Army Corps of engineers, the Union School District of Keene-SAU 29 and the New Hampshire Department of Environmental Services.

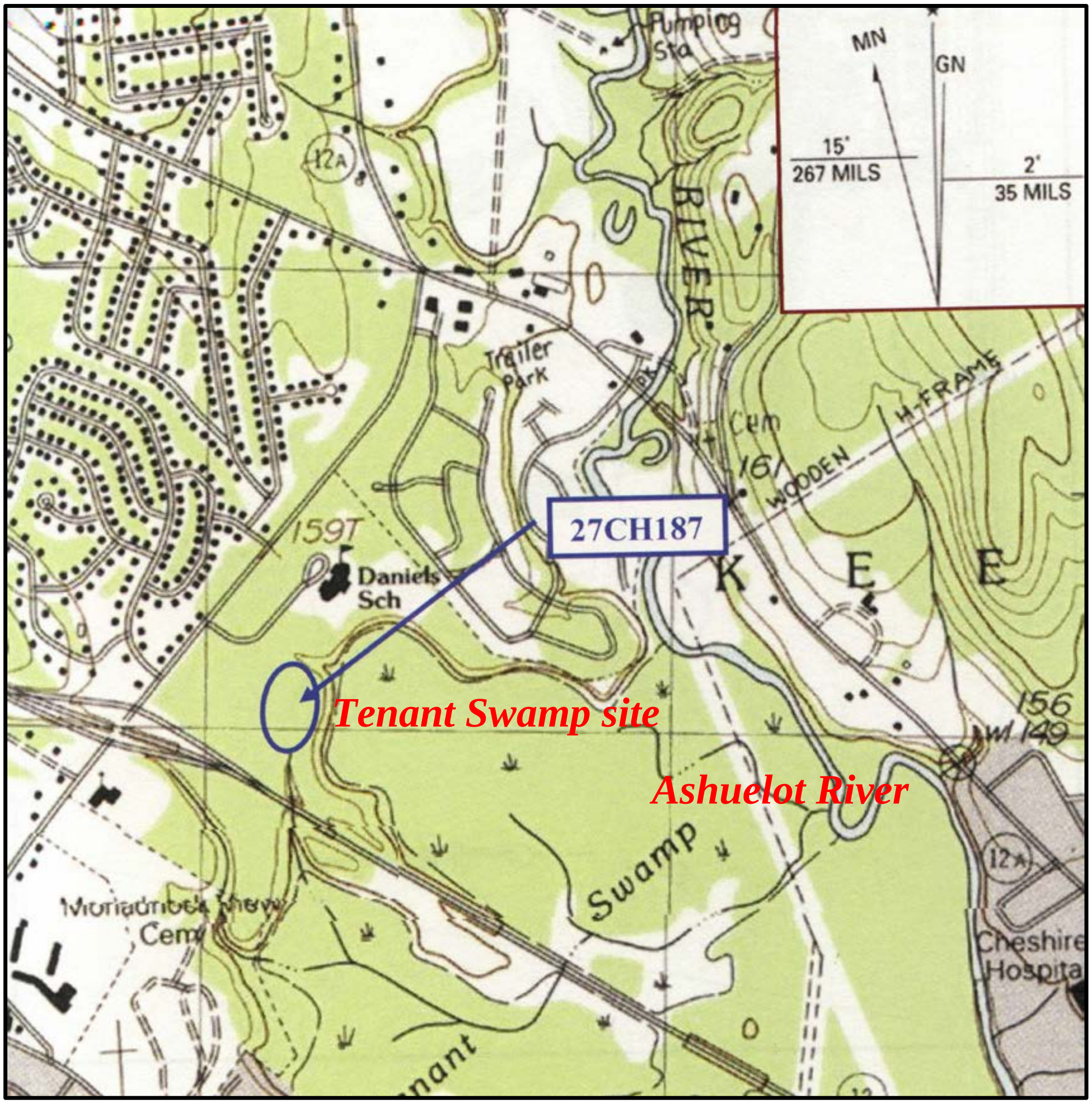


Figure 10.4.1. Tenants Swamp site location (indicated by oval as 27CH187) on USGS Keene quadrangle (scale 1:25,000). Adapted from Figure 1 Goodby et al. (2014: 130).

10.4.2 Site setting and stratigraphy

Deglaciation of the Keene Valley occurred approximately 15,000 calendar years before present. The area designated as the Tenants Swamp site formed as a glacio-lacustrine delta of the Glacial Lake Ashuelot (Dorion 2009). The melting glaciers deposited approximately 35 meters of well-sorted sands over the original lakebed preceding it's draining a few centuries after its formation. The area was then subsequently covered during the late glacial or early Younger Dryas by an aeolian layer approximately 50 cm deep composed of very fine to fine loamy sand with an absence of course fragments such as granules, pebbles, or gravels (Dorion 2009). It is in this 50 cm thick aeolian layer that the flaked stone artifacts from the Tenant Swamp site were recovered (Goodby et al. 2014).

The site area is positioned on a terrace of glacial outwash that ranges from 500 to 530 feet above sea level in elevation. The majority of the terrace is level. However, it is crosscut by steep gullies with interspersed narrow areas of wetlands that represent the northernmost extent of the terrace drainage features (Goodby et al. 2014). These gullies drain Tenant Swamp toward the Ashuelot River that is about 1 km to the southeast (Figure 10.4.1). The Tenant Swamp site soils are loamy sand and well-drained glacial outwash soil (Goodby et al. 2014). Figure 10.4.2 reveals the described soil composition of Locus 1 following completion of its excavation.

Figure 10.4.2. Example of site loamy sand soil composition. Locus 1 after completion of excavation. (From Goodby et al. 2014: 135, Figure 4)

10.4.3 Artifact distributions

Shovel testing of the Tenant Swamp site resulted in the identification of four discrete loci hypothesized to be Paleoamerican in occupation horizon (Figure 10.4.3). Each of the individual loci positions on the glacial outwash terrace is identified by red ovals in Figure 10.4.3. Locus 1 and 2 are located in very close proximity; separated from each other by approximately 6 meters (Goodby 2014). These two loci are positioned near the edge of the terrace overlooking Tenant Swamp. Locus 3 is positioned approximately 25 meters to the northwest of Locus 2 and approximately 30 meters west of the terrace edge (Goodby et al. 2014). Residing approximately 60 m north of Locus 3 and 30 meters west of the terrace edge, Locust 4 is found to be far removed from the other loci. Goodby et al. (2014) opine that it is noteworthy to recognize that these four loci may not have been the only loci on this landform and that little can be concluded from their overall spatial distribution. This is because the large majority of the terrace was shovel tested on an 8-meter grid interval. None of the four loci that were identified were more than 6 m in length. Therefore, it is possible that additional loci were present and missed by the testing protocol. It is also possible that erosion by the river, post-dating the Paleoamerican occupation, cut into the site and destroyed other potential site loci (Goodby et al. 2014). Even with these conjectures, the extent of any re-working is unknowable because there is no evidence that there were more than the four identified loci.

Flaked stone artifacts recovered from the four excavated loci that exhibited a break or snap were brought to the lab, cleaned, and then inspected for potential refits. Each tool fragment was systematically compared to every other tool fragment to determine if there was artifact conjoining evidence within loci and between loci. The results of the analysis were that some tool fragments were able to be refit within individual loci. However, there were no refits found between loci (Goodby et al. 2014).

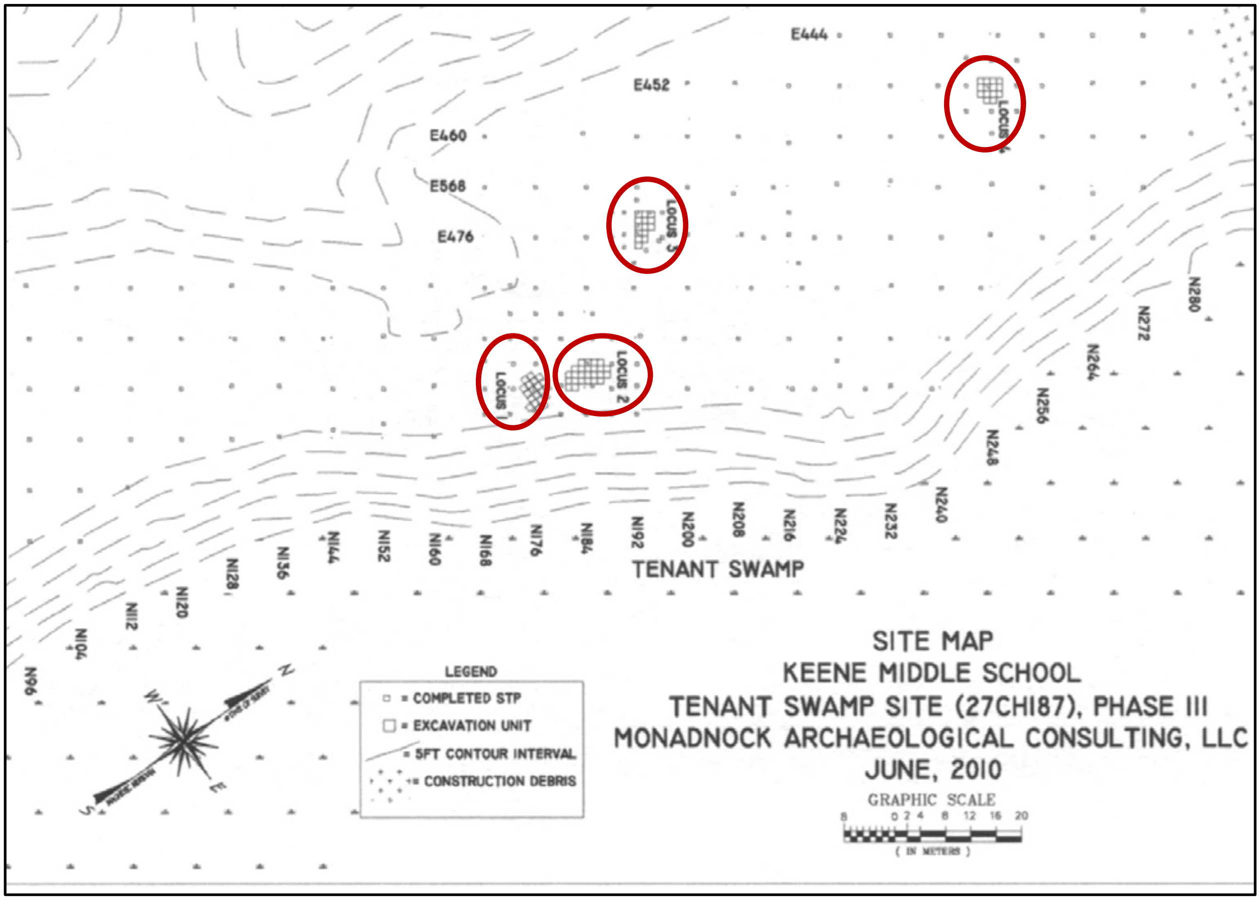


Figure 10.4.3. Tenant swamp site grid layout indicating location and positioning of loci, completed shovel test pits, and excavation units. Loci are indicated by red ovals and excavation units. Adapted from Goodby et al. (2014:132) Figure 2: phase 3 excavation plan.

10.4.4 Site and locus flaked stone artifact assemblage

The Tenant Swamp site artifact assemblage is composed of 216 flaked stone tools and 4742 pieces of lithic debitage that were removed from the four Paleoamerican loci identified during the excavation. The tool types excavated, identified and categorized are presented in Table 10.4.1 by tool type, source material type, locus, quantities, and totals. Components of the assemblage were undifferentiated bifaces, end scrapers, fluted points, gravers, Pièces esquillées, retouched and modified flakes, spokeshaves, side scrapers, undifferentiated unifaces, and a chopper.

Locus 1 is a well-defined oval artifact concentration approximately 3 x 3.5 meters in size. As shown in Figure 6.4.2 the eastern edge of Locus 1 is approximately 3 meters west of the edge of the terrace overlooking Tenant Swamp (Goodby et al. 2014). The long axis of the locus is oriented roughly in a north-south direction. The flaked stone artifact assemblage included 37 tools and 817 pieces of debitage that were almost evenly divided between chert and rhyolite.

Locus 2 was also an oval artifact concentration measuring approximately 3.5 x 5 meters in boundary and situated almost 8 meters to the north of Locus 1 and nearly 5 meters west of the slope dropping to the swamp (Goodby et al. 2014). The long axis of the locus is oriented roughly in an east-west direction. Locus 2's artifact assemblage included 60 tools and 2271 pieces of debitage. Approximately 59 % of the debitage was rhyolite, 39 % was chert, and the remaining 2 % was quartz.

Locus 3 was a circular to slightly ovoid artifact concentration measuring approximately 3 x 4 meters across and situated about 24 meters to the northwest of locus 2. It measured just about 30 meters west of the slope dropping to the swamp (Goodby et al. 2014). The long axis of the locus is oriented roughly in a northwest-southeast direction. Locus 3's artifact assemblage included 62 tools and 917 pieces of debitage. The debitage was nearly evenly divided between chert and rhyolite.

Locus 4 was a circular to slightly ovoid artifact concentration measuring approximately 3 x 3 ½ meters in outline and situated roughly 55 meters to the north of locus 3 and about 35 meters west of the slope dropping to the swamp (Goodby et al. 2014). The long axis of the locus is oriented roughly in a northeast-southwest direction. Locus 4's artifact assemblage included 57 tools and 737 pieces of debitage. Approximately 57 % of the debitage was rhyolite, 38 % was chert, and the remaining 5 % was quartz.

Table 10.4.1. Tenant Swamp site artifact assemblage by locus, tool type, major source material type, quantities, and totals.

Artifact type	Locus 1	Locus 2	Locus 3	Locus 4	Totals
Biface-undifferentiated					
Rhyolite	0	2	3	2	7
Chert	0	4	1	3	8
End scraper					
Rhyolite	4	5	2	3	14
Chert	3	0	2	1	6
Fluted point					
Rhyolite	0	0	1	0	1
Chert	0	1	0	0	1
Gravers					
Rhyolite	0	1	1	5	7
Chert	0	6	3	2	11
Pièces esquillées					
Rhyolite	2	1	0	3	6
Chert	4	2	0	2	8
Retouched/modified flakes					
Rhyolite	5	12	16	12	45
Chert	9	15	16	8	48
Miscellaneous Aphanite	0	0	0	2	2
Spokeshave					
Rhyolite	0	1	1	2	4
Chert	0	1	1	0	2
Side scrapers					
Rhyolite	0	1	2	3	6
Chert	0	0	0	3	3
Uniface-undifferentiated					
Rhyolite	3	5	2	2	12
Chert	5	1	5	4	15
Unspecified					
Rhyolite	1	0	2	0	3
Chert	1	2	3	0	6
Chopper unknown material	0	0	1	0	1
Totals	37	60	62	57	216

Note. Adapted from Goodby et al. (2014:147) Table 3: artifact types by raw material and locus.

10.4.5 Lithic raw material source analysis

A total of 4742 pieces of flake stone debitage were recovered from the four Paleoamerican loci identified at the Tenant Swamp site. Of the flaked stone artifact assemblage, 52% were rhyolites sourced from the Mount Jasper, New Hampshire quarry including a small quantity derived from Jefferson, New Hampshire cobbles. The chert debitage, 46% of the total, was identified as originating from the Munsungun Lakes quarry source area. The remaining 2% of the debitage assemblage was quartz. Table 10.4.2. provides the Tenant Swamp site material type by tools and debitage.

An aggregate of 216 stone tools was recovered from the four excavated loci at the site that included 214 flaked stone tools and tool fragments, a chopping tool of unidentified lithic source material from Locus 3 and a single fragment from a stone hammer or abrader from Locus 2 (Goodby et al. 2014). Lithic sourcing analysis for the flaked stone tools showed nearly identical quantities of rhyolite and Munsungun chert with the small remainder being quartz. Of the 195 stone tools analyzed, only seven were identified as originating in Jefferson, and no tools of Jefferson, New Hampshire rhyolite was recovered from locus 1 and 2 (Pollock 2008). The remainder of the rhyolite was sourced from the Mount Jasper, New Hampshire quarry.

Table 10.4.2. Tenant Swamp site material type by tools and debitage

Raw Material	Locus 1	Locus 2	Locus 3	Locus 4	Total
Quartz					
Tools					
Debitage	16	55	8	35	
Rhyolite					
Tools	15	25	30	32	
Debitage	402	1330	444	279	
Chert					
Tools	22	35	32	25	
Debitage	399	886	465	423	
Totals	854	2331	979	794	4958

Note. Adapted from Goodby et al. (2014: 136, 147) Table 1 and 3: artifact types by raw material and locus.

10.4.6 Faunal remains

Goodby et al. (2014) reported that 105 fragments of calcined bone were recovered from the four loci at the Tenant Swamp site. The bone fragments were recovered and identified in the center of all four loci. Loci 1 and 2 accounted for the vast majority (96%) of the calcined bone fragments. Loci 3 and 4 produced only three fragments and one fragment respectively (Goodby et al. 2014). The differences in quantities of bone fragments among loci cannot be assumed only to reflect differences in activity given the noncultural factors that contribute to the differential preservation of bone in New England-Maritimes archaeological context (Goodby et al. 2014).

10.4.7 Site features

10.4.7.1 Locus 1

Two features were identified during the excavation of locus 1 (Goodby et al. 2014). Feature 1 was characterized as a well-defined 3 cm lens of discolored soil and charcoal. The lens was depicted as oval in shape with no artifacts or faunal remains recovered from the feature. After analysis, Feature 1 was deemed to be the result of a forest fire several thousand years after the Paleoamerican occupation.

Feature 2 was a roughly linear concentration of 38 primarily granitic cobbles and pebbles ranging in size from 8 x 12 cm to pebbles measuring 3 x 4 cm. The feature was located outside of the oval artifact concentration of locus 1. No stones occurred naturally in the outwash sands that composed the soil makeup of the occupation Terrace.

10.4.7.2 Locus 2 - 4

No features were identified during the excavation of Locus 2, Locus 3, or Locus 4 noted in the documentation of the Tenant Swamp site (Goodby et al. 2014).

10.5 Conclusions.

This chapter provided characterizations for the Whipple, Bull Brook, Vail, and Tenant Swamp Paleoamerican comparison sites. The characterization approach and data for these comparative sites was presented in such a way as to make possible their analysis using the same analytical methods to be employed on the Potter site. The characterizations presented above focus on site research objectives, site setting, and stratigraphy, and the site and locus flaked stone assemblage. The latter considered composition, horizontal distribution, and vertical distribution where this information was accessible, together with any features recorded, and, in addition, broke the information down further by artifact type and source material.

The following Chapters XI, XII, and XIII begins the evaluation process of the Potter site loci data within a technological organization framework via modeling using the lithic analysis tools described in Chapter V. Chapter XIV applies the same techniques and analysis tools on the comparison site data presented in this chapter. Chapter XV goes on to discuss the analytical results from the Potter and comparison sites ending with Chapter XVI a synthesis and conclusions for the Paleoamerican occupation, adaptation and settlement patterns of the Potter, and comparison sites.

Part 5

Potter and Comparative site and loci analysis

This section of the study seeks to demonstrate the applicability and results of the previously described qualitative and quantitative models to the Potter lithic artifact assemblage. From the outcomes of these analyses inferences as to the nature of the occupants' settlement and site usage may be made for use in comparison with the previously characterized Whipple and Bull Brook sites. Organization of this section follows the pattern of addressing the four broad occupation trait categories necessary to investigate the proposed settlement pattern. Reiterating these are 1) technological organization; 2) intra-site chronology; 3) mobility patterns; and 4) settlement patterns.

The analysis of each locus uses the characterization data presented in Chapters VI, VII, and VIII. The data set includes the excavated artifact assemblage organized into the flaked stone artifact component composition, horizontal distribution as illustrated by isopleth and artifact distribution and density by 50 cm^2 excavation density plots, vertical distribution by 5 cm level and soil level transition zone, and manufactured object by source material variety. Each of these descriptive measures is presented by the tool, debitage, and material type. Sources for Jefferson region cobble, undifferentiated and Mt. Jasper rhyolite are located within a 20-30 km radius and are considered local. Collectively these lithic artifact characterizations, individually and in sum, aid in inferences relative to issues such as potential locus domestic activities conducted at the site and temporal aspects of site habitation such as occupation horizon, duration, and reoccupation.

In the analysis, the term excavated but not encompassed area refers to only that area which was excavated either as a block or shovel test pit. Encompassed area is defined as the unexcavated area adjacent to but closely surrounding that excavated but which may, however, have been part of an occupation surface.

The selection of loci to be analyzed and discussed in each of the following chapters of this section is based on observed similarities or differences of particular aspects of the loci characterization. Organization of these groupings are based on variations such as, similarity in the wide range of tool types and quantities in each locus (high tool index), narrower range and quantity of tool types (low tool index) in conjunction with a high ratio of debitage to tools, or for reasons of their diversity in small size, or unusual artifact distributions.

Chapter XI

Loci H, K/G, and C analysis

Chapter XI presents the analysis of loci H, K/G, and C. These three loci are grouped because of the similarities in their wide range of tool types and quantities (high tool index) in each locus in addition to their area size. Further, each of these loci shares similarities in the seasonal round and site usage.

11.1 Technological organization and culture horizon

Typical of the early to mid-Paleoamerican culture horizon in the Northeast, Loci H, K/G, and C's tool production and reduction sequence elements of the technological organization is based on a segmented tool blank, biface preform, fluted point, core, and flake reduction tradition. Blade technology in the New England-Maritimes (NEM) is uncommon to nonexistent during the fluted point Paleoamerican culture horizon. This technological organization places Loci H, K/G, and C's occupation somewhere during the Paleoamerican cultural horizon which ranges from 12,900 - 11,600 cal BP (Bradley et al. 2008; Lathrop et al. 2011).

11.2 Temporal aspects of site habitation

11.2.1 Occupation horizon

Evidence for the horizon designation (early, middle, or late) is reflected in the components of the assemblage, (e.g., see Table 11.1) when compared to lithic assemblages from other NEM Paleoamerican sites in terms of technology and composition (Spiess et al. 1998; Gramly and Funk 1990).

Examination of Loci H, K/G, and C's assemblage characterized by the diagnostic traits also places this occupation within the Paleo cultural horizon. Further, using projectile point fluting as opposed to basal thinning places the loci in the early to the mid-Paleoamerican horizon (Bradley et al. 2008). By way of contrast, the basal thinning trait is more prevalent during the late Paleoamerican horizon (Bradley et al. 2008).

Table 11.1 New England Maritimes Paleoamerican (NEM) lithic tool diagnostic traits Loci H, K/G, and C

Diagnostic Trait	Presence /Absence	Locus H Artifact Photo Reference Number. Figure 6.8	Locus K/G Artifact Photo Reference Number Figure 6.16	Locus C Artifact Photo Reference Number Figure 6.24
Projectile point/knife fluting on both faces from carefully prepared platforms. (Early and mid-Paleo horizon)	P	1782, 1442	1706, 1783	769, 332
Channel flakes found in tool manufacturing artifacts and debris. (Early and mid-Paleo horizon)	P	1579, 1795, 2736	1730, 1796	1129, 1764, 1817
Preform thinning by medial percussion flaking.	P	1782, 1442	1723, 1783	469, 769
Points received no additional thinning after fluting. (Early and mid-Paleo horizon)	P	1782, 1442	1783,	
Lateral grinding evident from midsection to basal ears.	P	1782, 1442	1783,	
Basal grinding common.	P	1782, 1442	1783, 1706	1783, 1706
Late Paleo horizon points are basally thinned but not fluted.	A			
High-quality lithic material	P	Munsungun, Mt. Jasper rhyolite	Munsungun, Mt. Jasper rhyolite	Munsungun, Mt. Jasper rhyolite
Spurred end scrapers	P	2728	1734	498

11.2.2 Occupation date range

To further refine and narrow the occupation date range by placement within a sub horizon, Loci H, K/G, and C will be analyzed using the morphological typological model on each of the loci's projectile points. A summary of the placement within one of the Paleoamerican sub-horizons is presented in Table 11.2.

Two diagnostic projectile point base fragments, (Table 11.2) were identified in Locus H's excavation assemblage. From the morphologically based typology (Bradley et al. 2008:141-146, Table 11.2 below) a Michaud – Neponset point type is indicated. This point type suggests a Middle Paleoamerican chronology that ranges from 12,200 to 11,600 cal yr. BP, and places Locus H occupation within this period.

Three diagnostic projectile point bases and one complete point were identified in Locus K/G's assemblage. Applying the morphologically based typology (Bradley et al. 2008:141-146), two Middle Paleoamerican Michaud–Neponset points were identified. The two remaining projectile point bases were characterized as Bull Brook points. The Bull Brook points infer that an early Paleoamerican occupation occurred sometime during 12,900 to 12,400 cal yr. BP (Bradley et al. 2008:136-141).

In Locus C's assemblage, two diagnostic projectile fluted point fragments were found. Diagnosis of projectile point fragment number 769, was arrived at through the analysis of similar overshot biface tip fluting failures. Overshot tips have been recovered from the Fisher site in southern Ontario (Storck 1991), Michaud site in Maine (Spiess and Wilson 1987), and the Jefferson III site, in Jefferson, New Hampshire (Boisvert 1998, 1999; Rusch 2012). These fragments can be identified as overshot tips because each retains a small portion of the channel flake which was once attached to the proximal portion of the piece (Spiess and Wilson 1987; Boisvert 2008). This type of failure was relatively common during the fluting of Michaud-Neponset points, and likely represents the application of a specific and widely used fluting technique. Patten (2005) has suggested that these point tips were blunted and placed on anvils while being struck at the base.

The remaining projectile point fragment (332 a midsection near tip) is untyped but exhibits signs of fluting. Since the fragment is near the tip and contains evidence of fluting, the point may cautiously be suspected to be of the Michaud–Neponset type because of the long flute typical of this point form. Michaud–Neponset point typology suggests a Middle Paleoamerican occupation occurred sometime during 12,200 to 11,600 cal yr. BP.

Table 11.2 Summary of diagnostic modal point form types and chronology excavated in Loci H, K/G, and C. Numbers are artifact catalog references found by each Paleoamerican horizon.

Chronology	Locus H	Locus K/G	Locus C
Early Paleoamerican 12,900 to 12,400 cal yr.		1783, 3271	
Middle Paleoamerican 12,200 to 11,600 cal yr.	1782, 1442	1706, 1726	332, 769
Late Paleoamerican 11,600 to 10,800 cal yr.			

Note. Adapted from Bradley et al. 2008, Lathrop et al. 2011.

11.2.3 Occupation duration

11.2.3.1 Occupation duration from occupation span index method

Locus H, K/G, and C's occupation span were first established by applying Surovell's (2009) quantitative model for the computation of the occupation span index which makes use of the proxy variables for Local/Non-Local artifacts in addition to debitage/Non-Local tools. Values for these proxy variables and their logarithmic scaling are shown in Table 11.3. Combining and averaging of the normalized proxy variable values for Local/Non-Local artifacts and Debitage/ Non-Local Tools yields an occupation span index of 12.13 with a logarithmic value of 1.08 for Locus H, 7.48 with a logarithmic value of 0.87 for Locus K/G, and 5.0 with a logarithmic value of 0.70 for locus C. An additional measure, Local/Non-local tools yield a ratio of 1.05 for Locus H, 3.44 for K/G, and 1.68 for C. The log-transformation is widely used to deal with skewed data. The log transformation can decrease the variability of data and make data conform more closely to the normal distribution for analysis.

Table 11.3. Locus H, K/G, and C occupation span computations from Surovell's (2009) quantitative model.

	H	K/G	C
Local : Non-Local	1.77	2.29	2.92
Log (Local : Non-Local)	0.25	.36	.47
Debitage : Non-Local Tools	157.95	96.94	62.79
Log (Debitage : Non-Local Tools)	2.20	1.99	1.80
Local: Non-Local Tools	1.05	3.44	1.68
Local : Non-Local Normalized	1.08	0.50	0.63
Debitage : Non-Local Tools Normalized	12.13	14.47	9.37
OSI	12.13	7.48	5.00
Log OSI	1.08	0.87	0.70
Local Artifacts	2070	1270	1659
Non-Local Artifacts	1170	555	569
Total Artifacts	3240	1839	2238
Tool Type Range	8	9	7
Waste Flake Quantity	3199	1745	2142
Material Type Range by Locus	9	9	8

Occupation span index (OSI) is an index value that is indicative of a range of occupation spans for habitation loci or total site occupations (Surovell 2009). In terms of a habitation classified loci of the Potter site, Locus H was the longest occupation based on computed values for habitation as compared to loci C (OSI, 5.0) and K (OSI, 7.48). Even though OSI is not directly indicative of an absolute timescale but rather one of relative magnitude, estimates from ethnographic and calculated loci usage in the Northeast may be used to develop a calibration relationship (Surovell 2009). When estimating a calibration factor, it is dependent upon the intensity of usage of the reference site type (Bradley, B. personal communication 2014). Short term high mobility Paleoamerican logistical and processing camp occupations can be estimated to range from one-half to two days. Using this as a rough calibration factor and a Locus H OSI of 12.13, the estimated number of occupation days ranges from 12 to 24. With a Locus K/G OSI of 7.48, the occupation days estimated number ranges from 12 to 15. Finally, as a habitation site and its usage not as intense as a processing camp, Locus C (OSI of 5) would yield an estimated number of occupation days ranging from 8 to 10 days. On a relative scale (short, medium, or long on a yearly basis), this would classify Loci H, K/G, and C as short duration occupations, potentially indicative of a forager occupation. Table 11.4 present a summary of Loci H, K/G, and C's occupation span or duration.

Table 11.4. Occupation span by locus in calibrated days and relative scale.

Locus	Occupation span index	Occupation days	Relative scale
Locus H	12.13	18 to 24	Short duration occupation
Locus K/G	7.48	12 to 15	Short duration occupation
Locus C	5.0	8 to 10	Short duration occupation

11.2.3.2 Occupation duration from revised (log-log) *ring model correlation method*

Analyzing Loci H, K/G, and C's length of occupation employing Whitelaw's (1983) logarithmic (log-log) variation of Yellen's (1977) ring model (equation 11.1), expressed in exponential form, yields a calculated number of days for an excavated or encompassed area. Equation 11.2 presents the same calculated number of days for the accretion or linear model. Table 11.5 presents a summary of the number of occupation days calculations for both excavated and encompassed areas in addition to the relative scale indicating short, medium, or long-term durations (yearly scale). On a relative measure, this would classify Loci H, K/G, and C as short duration occupations.

Equation 11.1 Number of occupation days (NOD) = 1.87*b^(.1*(area)) Exponential

Equation 11.2 Number of occupation days (NOD) = 1.87*(area) + 1.87 Linear

Table 11.5. Number of occupation days based on Whitelaw's (1983) variation of Yellen's (1977) model

Locus	Excavated area m²	Number of occupation days	Encompassed area m²	Number of occupation days	Linear occupation days	Relative scale
H	10.5	2.8	44.2	8	6.29	Short term
K/G	20	4.75	75	17	9.37	Short term
C	20	4.75	233	25.2	25.17	Short term

11.2.3.3 Occupation duration from a tool loss method

Approaching Loci H, K/G, and C's length of occupation from a tool loss calculation (Mc Ghee 1979, Spiess 1984) using Mc Ghee's ratio of 1/2.5 to 1/3 per person day (PD) yields an occupation range of 102.5 to 264 PD based on 2.5 to 3 tools lost per PD for all loci. Loci H, K/G, and C’s tool assemblages consist of 41, 71, and 87 pieces respectively. For a band size of five individuals, this would indicate a range of 20.5 to 53 days of locus occupation. For a band size of 10 individuals, this would yield a range of locus occupation of 10.25 to 26 days for a tool loss ratio of 2.5 per PD. As discussed in Chapter V, Spiess (1984) calibrates this methodology as having the potential to vary by a factor of two. Table 11.6 displays the occupation duration from the tool loss method for Loci H, K/G, and C. Each of the loci was occupied from 10 to a maximum of 26 days or 2 to 3 weeks on average for a locus tent size of 10 persons. On a relative scale Loci H, K/G, and C are considered to be short term occupations.

Table 11.6. Occupation duration from a tool loss method for loci H, K/G, and C

Locus	Number of tools	Person-days	Locus tent size of 5 persons in days	Locus tent size of 10 persons in days
H	41	102.5 to 123	20.5 to 24.6	10.25 to 12.3
K/G	71	177.5 to 213	35.5 to 42.6	17.75 to 21.3
C	87	218.5 to 264	34 to 53	17 to 26

11.2.3.4 Occupation duration summary

All models employed to estimate Loci H, K/G, and C’s occupation span, the relative magnitude OSI proxy variable, correlation ring, and tool loss per person day, when averaged, yield indications of short-term occupation. The duration for these loci occupations extends over somewhere in the vicinity of 10 to 26 days in length. There is an apparent diverging variation between the methods employed due to locus area estimates, tool loss per day assumptions and calibration factors leading to an imprecise approximation but all estimates are within an order of magnitude.

11.2.4 Distinguishing reoccupation - instances of single or multiple occupations

To address the issue of whether Loci H, K/G, and C were single or multiple occupation locations, three models were employed. First, an analysis of the stratigraphic distribution of artifacts, tools and materials types was examined. This was then followed by a heuristic model that accessed the density of assemblage per unit area in addition to the material source location. Finally, a regression correlation model was used to analyze reoccupation.

11.2.4.1 Artifact distribution stratigraphy model

Locus H's vertical assemblage distribution analysis shows that the combined tool and waste flake distribution by material (rhyolites and Munsungun chert), indicates a greater concentration of Munsungun chert appearing at Levels 3-5 while in the case of Mount Jasper and other rhyolites, peaks occur at Levels 4-7. This might suggest different depositional events at the locus which would indicate reoccupation. However, because there is significant overlap in the stratigraphy of both major material types, potentially due to the effects of a possible tree throw, a multi-occupation interpretation is not clearly supported.

Locus K/G's vertical assemblage distribution analysis shows that the combined tool and waste flake distribution by material type (rhyolites and Munsungun chert), indicates a greater concentration of Munsungun chert appearing at levels 2-3 while in the case of Mount Jasper and other rhyolites, peaks occur at levels 3-5. As noted previously this might suggest different depositional events at the locus which would indicate reoccupation. However, because there is significant overlap in the stratigraphy of both major material type artifact distributions, a multi-occupation hypothesis is not definitively supported. Nevertheless, two diagnostic projectile point types representing different Paleoamerican sub horizons indicate reoccupation.

Analysis of Locus C's vertical assemblage dispersal shows that the combined tool and waste flake distribution by major material types (rhyolites and Munsungun chert), indicates a greater concentration of Munsungun chert appearing at levels 3-8 with a slight bias towards levels 3-5. In the case of Mount Jasper and other rhyolites, peaks occur between levels 3-8. Taking into account only tool distribution by material and level, as previously noted, some quantity of Munsungun chert tools are recognized across most levels from 1 to 13 (Figure 6.23) with the bulk residing in levels 1 - 5. In the case of rhyolite tools (Figure 6.23), quantities are also identified across levels 1 to 13 but with the most substantial number occurring in levels 3 through 8.

As noted previously this might suggest different depositional events at the locus which would indicate reoccupation. However, because there is significant overlap in the stratigraphy of both major material type artifact distributions, a multi-occupation hypothesis is not definitively supported by diagnostic artifacts or ^{14}C support.

11.2.4.2 Heuristic density of artifact and material type source location model

From a heuristic or trial-and-error field experience method, reoccupied sites may often be characterized by high artifact densities coupled with relatively lower frequencies of local raw materials and debitage (Spiess et al. 1998; Gramly and Funk 1990). Loci H, K/G, and C's assemblage composition are two-thirds to three-quarters local rhyolite and one-quarter to one-third nonlocal Munsungun tools and flakes. The locus artifact density per meter squared is moderate in addition to a higher density of local rhyolite material. By these two measures indications, Loci H, K/G, and C were not reoccupied.

11.2.4.3 Regression correlation reoccupation model

Surovell's (2009) quantitative correlation-regression model employing proxy variables were utilized in the analysis of site and locus reoccupations. Figure 11.1 displays the regression analysis relationship between Potter site habitation loci in term of occupation span and occupation density showing a correlation of OSI and artifact density.

As predicted by the model, if the loci are single occupations, there should be a strong correlation between artifact density and OSI (ln OSI = ln artifact density m^2). If weak or no correlation is found it is likely that assemblage represents the cumulative effects of multiple occupations.

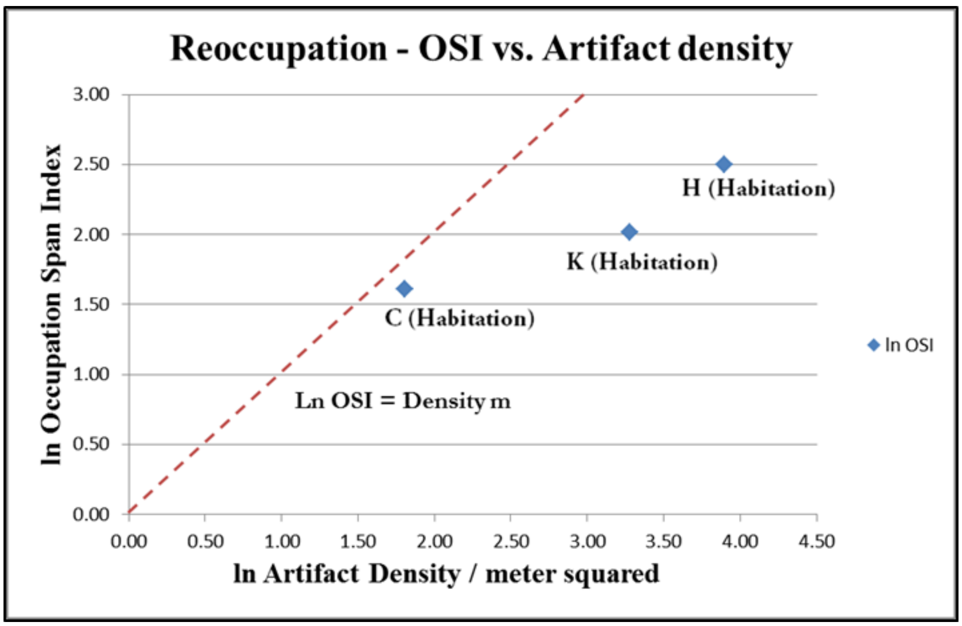


Figure 11.1 Locus H, K, and C reoccupation model data point positions.

In the instances of Loci H and C, there is a high correlation between the proxy variables in the occupation span index and in the artifact density per m^2 (r^2 =0.9209; y=.3968x+.8516), which indicates support for the hypothesis that these assemblages represent a single occupation. Viewed graphically, the data points for Loci H and C lies closer to the single occupation y = x line than the multiple occupation x-axis. In the case of Locus K/G, there is a lower correlation between the proxy variables ln occupation span index and the artifact density per m^2. The locus has a lower value of OSI versus artifact density causing the lower correlation. This suggests some level of support for the hypothesis that the assemblage represents a multiple occupation.

11.2.4.4 Distinguishing instances of single or multiple occupation summary

Two of the models applied to evaluate if Loci H and C were single or multiple occupations, i.e., a heuristic model describing high artifact densities coupled with relatively low frequencies of local raw material including debitage, and the regression correlation model essentially agree and indicate that these loci were single occupations. However, the stratigraphic distribution of artifacts, tools and materials type model is inconclusive because of vertical soil mixing.

Two of the models applied to evaluate Locus K/G indicates that it was a multiple occupation locus, i.e., multiple diagnostic projectile point morphology and regression correlation models. However, the stratigraphic distribution of artifacts, tools and materials type model is inconclusive because of vertical soil mixing.

11.3 Mobility patterns and seasonality inferences

11.3.1 Indications of mobility/sedentism

Several models developed for mobile land-use analysis based on tool flexibility, portability, specialization, and tool diversity (Kelly and Todd 1988; Meltzer 2003; Bleed 1986; Bousman 1994; Kuhn 1994), in addition to a mobility model based on core/biface ratios (Bamforth and Becker 2000) were employed to characterize the mobility or sedentism of Loci H, K/G, and C's inhabitants. Application of the models to the loci is summarized in Tables 11.7, 11.8 and 11.9 including diagnostic traits supported by locus artifact evidence and trait example photos with reference numbers.

Table 11.7 Locus H's mobility/sedentism indications based on artifact toolkit assemblage.

Model and diagnostic traits	Lithic evidence	Figure 6.8 example photo reference no.	Comments
Mobility models (Kelly and Todd 1988; Meltzer 2003; Bleed 1986; Bousman 1994; Kuhn 1995)			
1. Function of: **2. Flexible, portable tools. High residential mobility has flexible, highly portable tools.**	5 bifaces 18 modified / retouched flakes	1790, 2793, 2805, 2781, 431, 1561. 1701, 1772, 1705, 1760.	18 modified/retouched expedient flake tools and five bifaces indicative of flexible, portable tools.
3. Specialized tools. Decreasing residential mobility should have more specialized tools with less need for portability.	2 projectile points, 6 Scrapers, 1 Graver	1782, 1442. 1592, 2728, 1505. 2276	Projectile points/knife and scrapers standard elements of the toolkit. Only one specialized tool, i.e., graver.
4. Tool diversity. High residential mobility has relatively few tool types serving multiple functions. The number of moves per year negatively correlated with tool diversity.	5 tool types . .	1790, 1760, 1742, 1592, 2276	Few tool types are serving multiple functions – indicative of high residential mobility.
Mobility based on Core/Biface ratios. (Bamforth, Becker 2000)			
1. Low core/biface ratios are often linked to high mobility. **2. High ratios to more sedentary lifestyles.**	1 core 5 bifaces	1761, 1701, 1772, 1705, 1760.	Bifacial ratio 1:5 represents low core to biface ratio. Indicative of higher mobility.

Based on the parameters specified in the mobility/sedentism models discussed in Chapter V and applied above, Loci H, K/G, and C's assemblage compositions are indicative of a flexible, portable toolkit. Loci H, K/G, and C's toolkit assemblages contained modified/retouched expedient flake tools, diagnostic projectile points, bifaces, pièces esquillées, and gravers. As projected by the models, a toolkit composed of very few specialized tools, in addition to relatively few tool types (bifaces, points, and expedient flakes) serving multiple functions is further evidence of mobile inhabitants. Projectile point/knives, scrapers, and expedient flake tools are considered to be standard elements of a mobile Paleoamerican toolkit (Kelly and Todd 1988; Meltzer 2003; Bleed 1986; Bousman 1994; Kuhn 1994). Further, examining the core to biface ratios reveals proportions of 1:4, 1:5, and 1:9 respectively. These proportions represent a low ratio value that is indicative of higher inhabitant mobility (Bamforth and Becker 2000).

Table 11.8 Locus K/G's mobility/sedentism indications based on artifact toolkit assemblage.

Model and Diagnostic Traits	Lithic Evidence	Figure 6.13 Photo No.	Comments
Mobility Models (Kelly and Todd 1988; Meltzer 2003; Bleed 1986; Bousman 1994; Kuhn 1995)			
Function of: **1. Flexible, portable tools. High residential mobility has flexible, highly portable tools.**	18 Modified / Retouched Flakes 8 Bifaces	2805, 1793, 2721, 2714, 1457,1746	18 modified/retouched expedient flake tools and 8 bifaces indicative of flexible, portable tools.
2. Specialized tools. Decreasing residential mobility should have more specialized tools with less need for portability.	8 Projectile points, 31 Scrapers, 2 pièces esquillées	1783, 1457, 1723 1770, 1769, 1709. 1743	Projectile points/knife and scrapers standard elements of the toolkit. One specialized tool type, i.e., 2 pièces esquillées.
3. Tool diversity. High residential mobility has relatively few tool types serving multiple functions. The number of moves per year negatively correlated with tool diversity.	5 Tool types (Bifaces, projectile point/knives, scrapers, retouched waste flakes, and wedges.) .	2805, 1783, 1769, 1743, 1457	Few tool types serving multiple functions – indicative of high residential mobility.
Mobility based on Core/Biface ratios. (Bamforth, Becker 2000)			
4. Low core/biface ratios are often linked to high mobility. **5. High ratios to more sedentary lifestyles.**	2 Core 8 Bifaces	17511, 1457, 1746,	Bifacial ratio 1:4 represents low core to biface ratio. Indicative of higher mobility.

Employing each of the toolkit characterization models, i.e., flexible multiple portable tools, number of specialized tools, the range of tool diversity, and core biface ratios indicate that the inhabitants of Loci H, K/G, and C were by these measures a mobile as opposed to a sedentary population.

Table 11.9 Locus C's mobility/sedentism indications based on artifact toolkit assemblage.

Model and Diagnostic Traits	Flaked Stone tool Evidence	Figure 6.24 Artifact Photo Reference No.	Comments
Mobility Models (Kelly and Todd 1988; Meltzer 2003; Bleed 1986; Bousman 1994; Kuhn 1995)			
Function of: 1. Flexible, portable tools. High residential mobility has flexible, highly portable tools.	34 Modified / Retouched flakes 5 Utilized flakes 15 Bifaces	1789, 496, 950, 412, 1791,1813	34 modified/retouched expedient flake tools and 15 bifaces indicative of flexible, portable tools.
2. Specialized tools. Decreasing residential mobility should have more specialized tools with less need for portability.	3 Projectile points, 14 Scrapers, 2 pièces esquillées	769, 332, 1339, 1800, 498. 1768	Projectile points/knife and scrapers standard elements of the toolkit. One specialized tool, i.e., 2 pièces esquillées.
3. Tool diversity. High residential mobility has relatively few tool types serving multiple functions. Several moves per year are negatively correlated with tool diversity.	5 Tool types . .	496, 796, 1339, 1813, 1768	Few tool types serving multiple functions – indicative of high residential mobility.
Mobility based on Core/Biface ratios. (Bamforth, Becker 2000)			
3. Low core/biface ratios are often linked to high mobility. 4. High ratios to more sedentary lifestyles.	2 Core + frag 18 Bifaces	1812, 1798, 496,	Bifacial ratio 1:3.5 represents a low core to biface ratio. Indicative of higher mobility.

11.3.2 Mobility/sedentism based on reduction stage location distribution of debitage.

Symons (2003) adaptation of Torrence's (1992) model of mobile land-use through an analysis of lithic reduction sequences concerning spatial patterns, established that variation within metric attributes would be linked to different reduction stages, i.e., initial, further and late stages. As a predictor of mobility, stone use for a mobile population would result in reduction stages being spatially differentiated or distributed inter-site around the landscape. In contrast, most stages of stone production at sedentary residences would be concentrated at one location (Symons 2003).

Examination of Locus H’s total distribution of rhyolite debitage, using weight as a proxy for size, reveals that 3183 of 3212 pieces or 99% of the debitage is smaller than 10 grams. Using this observation of Locus H’s debitage distribution, it can be inferred that because of the scant number of larger debitage reduction pieces, initial production was performed elsewhere. If all stages, initial, further, and late, were present it would be expected that this would indicate a sedentary occupation. Locus H’s distribution of smaller later shaping, reworking or sharpening events thus indicates a mobile land-use. Further, the evidence in terms of the attributes arrayed in Table 11.10, i.e., insignificant initial primary reduction flakes, lack of cortex, dorsal scar count increases in medium to smaller flakes, and a predominance of late reduction stage products, once again, points to a mobile land-use.

Distribution of the locus’s second most present (35%) material type, Munsungun chert, exhibits an even more skewed dispersal toward smaller reduction and sharpening flakes. As is in the case of the rhyolite distribution noted above, 99% of the waste flake debitage is less than 4.5 g indicating that the Munsungun chert reduction episodes were also not an initial production but a later shaping, reworking or sharpening events. The insignificant presence of larger Munsungun chert initial reduction remnants again suggests mobile land-use.

Table 11.10 Locus H reduction stage categorization analysis of debitage assemblage.

Reduction stage category	Cortex	Dimensions and weight	Dorsal scar count	Cores
Initial reduction	Deminimus primary flakes	6 pieces (>60g) Raw material	None	0 discarded before exhausted
Further reduction	No cortex, more secondary flakes	17 pieces (>10g <60g)	Low to medium	1 core and 5 fragments present
Late reduction	Absent	3183 pieces <10g	High	Rare/Deminimus

Note: weight used as a proxy for size.

Locus K/G's total distribution of debitage, using weight as a proxy for size, reveals that 1798 of 1805 pieces or 99.6% of debitage is smaller than 6 grams. As was the case for Locus H, it can be inferred that this was not an initial production event as would be expected if all stages; initial, further and late of a sedentary occupation were present. Locus K/G's distribution of smaller later shaping, reworking or sharpening events thus indicates a mobile land-use. Table 11.11 indicates minimal initial primary reduction flakes, lack of cortex, dorsal scar count increases in medium to smaller flakes, and the predominance of late reduction stage products, all of which are indicative of a mobile land-use.

The locus's second most present material type, Munsungun (21.9%) chert, exhibits an even more skewed dispersal toward smaller reduction and sharpening flakes. Again, as is in the case of the rhyolite distribution noted above, 99% of the waste flake debitage is less than 1.8 g indicating that the Munsungun reduction episodes were also not an initial production but a later shaping, reworking or sharpening event. The negligible presence of larger Munsungun initial reduction remnants again suggests mobile land-use.

Table 11.11 Locus K/G reduction stage categorization analysis of debitage assemblage

Reduction stage category	Cortex	Dimensions and weight	Dorsal scar count	Cores
Initial reduction	Negligible primary flakes	4 pieces (>10g) Raw material	None	0 discarded before exhausted
Further reduction	No cortex, more secondary flakes	4 pieces (>4g <10g)	Low to medium	2 core and 3 fragments present
Late reduction	Absent	1797 pieces <4g	Higher	Rare/ Negligible

Note: weight used as a proxy for size.

Locus C's total distribution of debitage by weight reveals that 2129 of 2142 pieces or 99.4% of debitage is smaller than 6 grams. This debitage distribution from the chipped stone reduction episodes at the locus in addition to the increased dorsal scar count and absence of cortex on the 13 pieces larger than 6g (ranging from 6 to 18.4g), infers that this was not an initial or primary production event. Locus C's higher distribution of smaller later stage shaping, reworking or sharpening flakes and lack of early-stage debris distributed at another location (quarry) indicates a mobile land-use.

The Munsungun chert reduction episodes were also not from an initial production stage but later shaping, reworking or sharpening events. The negligible presence of larger Munsungun initial reduction remnants again suggests mobile land-use.

Table 11.12 Locus C reduction stage categorization analysis of debitage assemblage.

Reduction stage category	Cortex	Dimensions and weight	Dorsal scar count	Cores
Initial reduction	Negligible primary flakes	6 pieces (>10g) Raw material	None	0 discarded before exhausted
Further reduction	No cortex, more secondary flakes	7 pieces (>6g <10g)	Low to medium	2 core and 3 fragments present
Late reduction	Absent	2129 pieces <6g	Higher	Rare/ Negligible

In summary, Locus H, K/G and C's mobility/sedentism reduction stage evidence in terms of the attributes arrayed in Table's 11.10, 11.11, and 11.12, i.e., small number initial primary reduction flakes, lack of cortex, dorsal scar count increases in medium to smaller flakes, and a predominance of late reduction stage products points toward a mobile land-use.

11.3.3 Territorial round mobility geography and seasonality

Four models whose functioning and assumptions were detailed earlier in Chapter V, i.e. Burke et al.'s (2004), Curran and Grimes (1989), Rockwell's (2012), and Primary prey and vegetational reconstruction model are employed to attempt to define the territorial round geography and seasonality of the hunter-gatherers that occupied Loci H, K/G, and C.

The term territory refers to the geographic area exploited on a regular (seasonal, annual or multi-year) basis by a hunter-gatherer group (Burke et al. 2004). These models are based on geographic material sourcing and diachronic separation of culture horizons. During the Paleoamerican horizon, the model's authors stipulate that formal tools tend to be made of high-quality cherts, e.g., Munsungun and northern Vermont cherts, while less essential or expedient tools are made from lower quality materials (Burke et al. 2004; Curran and Grimes 1989; Goodyear 1979). This was the case in Locus H's tool type by material composition showing the preference of nonlocal material (Munsungun) for formal tools. In this locus the bulk of the Munsungun artifacts are formal tools or preforms whereas the bulk of the rhyolite tools are based on expedient retouched waste flakes.

In this analysis of the seasonal rounds, direct acquisition geographic material sourcing is assumed for the bulk of the tool stone. Minor amounts of exotic material in the assemblage are believed to have been acquired from trade or individuals joining the group. Methods and reasons for the acquisition of tool stone (direct and indirect acquisition) were given in chapter IX and are summarized here (Ellis 1989; Goodyear 1979; Jones et al. 2003:9; Meltzer 1989; and Spiess and Wilson 1987). North American Paleoamericans inhabited a relatively empty landscape at low population densities and were nonterritorial noncomplex social groups (Meltzer 1989). Because of this the inhabitants of the Potter site, who ostensibly relied on caribou hunting for subsistence, would have been able to travel unimpeded between the rhyolite and Munsungun sources. A high proportion of exotic stone in an assemblage precludes indirect acquisition because of the physical limitations on a donor group carrying two compliments of stone, i.e., one for use and one for exchange (Ellis 1989; Jones et al. 2003:9). As noted above a significant portion of the assemblage is composed of Munsungun chert, i.e., 25.43%. Traveling in their seasonal round the inhabitants of Potter could not have been certain when they would meet another band who would have a large enough stock of high-quality Munsungun chert for indirect acquisition. The reliance exclusively on exchange to provision a critical resource like lithic materials entails great risk. The risk would take the form of difficulty in coordinating exchanges between groups, especially under conditions of low population density (Jones et al. 2003:9). Given that the occupation horizons of the Potter site fall in the early to middle Paleoamerican horizon where population densities were low, indirect acquisition would have been a risky acquisition method.

11.3.3.1 Burke et al.'s model for determination of NEM Paleoamerican territorial round range

The Burke et al. (2004) model is based on geographic material sourcing and diachronic separation of culture horizon locations. As determined previously from the morphology/typology of the two Munsungun fluted point bases, Locus H and C were occupied and dated to the Michaud-Neponset middle sub-period horizon, i.e., 12,200 to 11,800 cal yr. BP. (Spiess et al. 1998; Lathrop et al. 2011). Locus K/G was occupied on one occasion during the Michaud-Neponset horizon and also during the earlier Bull Brook-West Athens Hill horizon. Burke et al. (2004) hypothesize that based on materials found at sites occupied during this period a possible band range could be identified. Lathrop et al. (2011) note that the number and range of sites from the earlier Vail/Debert time horizon had contracted to where the Northern Debert sites appear to have been abandoned thus indicating limited far northward travel.

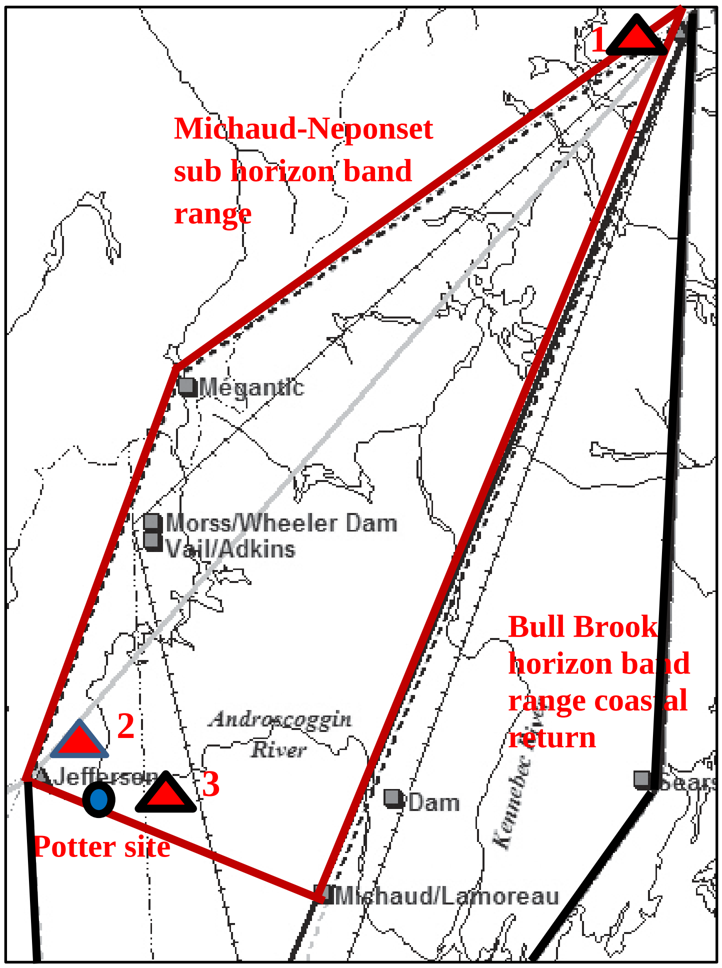


Figure 11.2 Michaud-Neponset sub horizon band range based on lithic material sourcing and diachronic separation of culture horizons. Route: Solid red line ranges from Munsungun to Michaud, Potter, Jefferson, possibly Megantic and return. Material source locations: triangles 1, Munsungun chert; 2, Jefferson rhyolite; 3, Mt Jasper rhyolite. Potter site blue-red circle. (Adapted from Burke et al. 2011:3. Figure 1)

Given these two observations, i.e., material sourcing locations, and limits of regional site occupation, the proposed Burke territorial round mobility range model for peoples of the Michaud/Neponset culture horizon would appear to describe the round of the occupants of Locus H, C, and K/G's mid-Paleoamerican occupation. The proposed Burke territorial round ranged from Lake Munsungun (summer) to Michaud to Randolph/Potter (fall-winter) following on to Jefferson and possibly Megantic with a return to Munsungun (summer). The area of this territorial circuit was 20,500 km². This circuit is based on material sourcing locations and regional site occupation (Figure 11.2).

From observations of artifact material sourcing locations and limits of regional site occupation, the proposed Burke territorial round mobility range model for peoples exhibiting technology organization characteristic of the Bull Brook horizon exhibited a more coastal return circuit. This route ranged from Lake Munsungun (summer) to Randolph/Potter via the Androscoggin River valley and Mt. Jasper for tool stone (late summer/fall), to west Athens Hill, Bull Brook (fall-winter), on to Searsmont (spring), with a return to Munsungun (summer). This possible route would appear to describe a territorial round of the occupants of Locus K/G (Black line in Figure 11.2).

As a further indication that the territorial round projected by the Burke et al. (2011) model is potentially predictive of the circuit, Table 11.13 provides the percentage of Munsungun chert found at each of the known sites. If none of this chert was found in each of the site assemblages, it would be questionable that they were on the territorial round circuit.

Table 11.13 percentage of Munsungun chert in the assemblage of territorial round sites.

Territorial round mobility range sites with Munsungun source	Percentage of Munsungun chert in the artifact assemblage
Dam	52/40
Michaud	62
Potter Loci K/G, C, H	22-35
Jefferson	3
Vail	77
Megantic	45/23

11.3.3.2 Curran and Grimes model for NEM Paleoamerican territorial round range

Table 11.14 represents the expected distribution of material types by percent to be found in NEM sites' artifact assemblage by season as predicted from the Curran and Grimes (1989) model. From the model, it would be expected that during the Michaud-Neponset middle sub horizon, Loci H, K/G, C were occupied as a spring transit site (South to North) with a northern summer embedded chert material acquisition at Munsungun. However, the lithic evidence at the Potter site does not support this proposition. If the seasonal round progressed in a counterclockwise manner, i.e., Jefferson Israel River sites to Potter to Michaud /Neponset and then onto Munsungun (Figure 11.2) for the summer, it would be expected that there would be a large portion of Jefferson rhyolites in the Potter assemblage. This larger portion of Jefferson rhyolites would then be followed by a smaller amount of Mount Jasper rhyolite (possibly acquired earlier through a special material acquisition event to the east from Potter to Mount Jasper and then returning).

Further, it would be expected that the amount of Munsungun chert would be lower at Potter than found at the Jefferson Israel River sites because of usage. However, the lithic assemblage evidence at the site does not support this hypothesis. During this phase of the circuit, the stone material assemblage at the Potter site was composed of 64-75% rhyolites and approximately 24-36% Munsungun chert. Of the rhyolites, only a small percentage of the assemblage was sourced to Jefferson which is west of the Potter site. The majority of the rhyolite in the assemblage was sourced to Mount Jasper with very little coming from Jefferson sources (low percentage). Instead of the percentage of Munsungun chert decreasing from the Jefferson Israel River sites to the Potter site, lithic evidence shows just the opposite. The percentage of Munsungun chert at Potter (approximately 24-36%) drops to, on average, 4% at the Jefferson Israel River sites. The actual lithic material evidence in the Potter assemblage supports a North-South circuit passing from Munsungun South to Michaud/Neponset, to the Potter site, and then on to Jefferson Israel River sites in a clockwise direction (Figure 11.2).

The actual lithic material quantity percentages in evidence at the Potter and Israel River sites in addition to the directional percentage variation, i.e., from North to South fall occupation or South to North spring occupation, adds to the unpredictability of this model.

Table 11.14. The expected distribution of material types found in a site's assemblage by season.

Season	Northern Cherts Munsungun, Champlain Primary Lithic	Southern Volcanics/Felsite Secondary Lithic	Cherts, Jasper, Quartzite (Opportunistic exchange/acquisition)
Summer (North)	Majority %	None	0 to Insignificant %
Fall Transit (North to South)	Majority %	None	Small %
Winter (South)	Majority-declining %	Increasing %	Small-increasing %
Spring Transit (South to North)	Majority-further declining% *Potter 24-36% Munsungun*	Significant % *Potter 64-75% Rhyolite*	Small-further increasing % *Potter 0.3% misc. cherts*

11.3.3.3 Rockwell model for determination of NEM Paleoamerican territorial round mobility range

The Rockwell (2010, 2014) model proposes that, based on the NEM hunter-gatherer toolkit composition and length of site occupation or occupation span, a prediction of the behaviors should be observable by season.

Table 11.15 Locus H, K/G, & C seasonality tool kit and occupation duration indicators

Season	Tool Kit and Occupation Span Indicators	Locus H, K/G, & C Toolkit & Occupation duration	Photo Ref No.
Winter to early spring	• A wide diversity of activities, and a wide range of tool types. • Sites occupied for an extended period and located near lithic quarries.		
Late spring and early summer	• Evidence of regular moves and short occupations. • Few activities occurring at each site, tool type range limited. • Likely a mixture of residential and logistical sites represented.		
Late summer and early fall	• Occupations contain large numbers of tools related to butchery and hide working. • Occupations likely to be short to medium in length as fall caribou hides and meat are at their prime.	• Occupation span estimate: high single-digit days to 4 weeks • Flexible, portable tools. Limited tool types serving multiple functions indicative of high residential mobility. • Toolkit related to residence, tool production/maintenance, woodworking, butchery and hide working, (Projectile points, Scrapers, chopper tools, Modified/ retouched flakes.) Microwear indicates woodworking and hide working.	. 1783, 1723 1770, 1709 1769, 1743, 2721 2805, 1793,1790, 1760, 1742, 1592, 2276

As indicated in Table 11.15, seasonality tool kit and occupation span indicators, occupations containing large numbers of tools related to butchery and hide working in addition to organic material processing (wood), likely represent late summer or early fall occupations that would be short to medium in length as fall caribou hides and meat are at their prime. Loci H, K/G and C's artifact assemblage seasonality parameters alignment with the model suggest that occupation occurred in the late summer and early fall.

11.3.3.4 Primary and vegetational reconstruction model for determination of the territorial round range

Another inferential indicator and validator of the seasonal round mobility is the reconstruction of the primary and vegetational cover of northern New England at 11,000 cal yr BP (Davis 1983; Newby et. all 2005). This model indicates that tundra covered Maine and southern Québec roughly north of 45 1/2° and included southerly extensions with higher altitudes. South-central Maine, southern New Hampshire, and Massachusetts were covered by a poplar-spruce-fir forest in addition to hardwoods such as oak and maple in southern New Hampshire and Massachusetts (Newby at all 2005). At 11,000 cal yr, BP one could expect that caribou would have wintered 10 to 50 km south of the forest boundary in south-central Maine and southern New Hampshire (Spiess 1984). This range of migratory caribou movements corresponds to the somewhat shorter, circuit from Lake Munsungun, Megantic, Jefferson/Potter, Michaud/ Lamoreaux and completing the circuit to Munsungun as described in the Burke model. During Locus K/G's early Paleoamerican occupation, the more probable caribou return route would have been along a coastal path to where Bull Brook is located.

11.4 Settlement pattern adaptations and site/loci domestic activity land-use

11.4.1 Settlement pattern adaptations: indications of Forager/Collector land use strategy

Locus H's settlement pattern adaptation system is based on Pitblado's (2003) adaptation of Binford's (1980) collector-forager continuum model. Into it, Pitblado (2003) synthesizes Kelly's (1983), Bousman's (1994), Bleed's (1986) and Kuhn's (1989) stone tool analysis of landscape utilization that indicates traits of collector-forager adaptations. Details of these diagnostic traits are enumerated in Table 11.16 including comparisons to Loci H, K/G, C toolkit assemblages. The most significant elements observed in the loci's assemblage that are characteristic of a forager's toolkit are flexible tool technology (Andrefsky 1991; Kelley and Todd 1988; Odell 2003), few specialized tools (Odell 2003, Chatters 1987), minimal tool diversity (Kooyman 2000), and micro-wear low-power magnification analysis where the primary concern is edge scarring followed by striations and polish (Kooyman 2000).

Table 11.16 Loci H, K/G, C Forager toolkit settlement pattern adaptation characterization

Forager/Residential Mobility Tool Profile	Observations on Forager Profile	Locus H K/G, and C assemblage
• **Flexible tool technological**	1. High forager/residential mobility has flexible technological as each tool will serve multiple tasks.	• Modified/retouched expedient flake tools and bifaces indicative of flexible, portable tools.
• **Few specialized tools**	2. Higher forager/residential mobility indicate less specialized tools and more need for toolkit portability.	• Projectile points, • Scrapers, • Graver.
• **Low tool diversity**	3. Few tool types serving multiple functions – indicative of high forager/residential mobility. Number of moves per year negatively correlated with tool diversity.	• 5-7 Tool types (few)
• **Microware (Odell)** **(Chatters; Odell)**	4. Individual tools show multiple wear traces as each tool serves several functions.	• Example: Clumped, medium, bifacial scars on polar coordinates 6, 7, and 8. Medium cutting tool.

Measurable manufacturing and maintenance technology characteristics of a forager's production methods are shown in Table 11.17. These were derived from the models developed by:

1. Bleed (1986), maintainable weapons;
2. Torrence (1983), time minimization;
3. Bousman (1994), make and mend technology; and
4. Nelson (1991) hafting - less attention paid to hafting than more sedentary collector populations.

In the projectile point manufacturing and maintenance measures category, a few elements of a mobile population are still discernible in the projectile point base fragments (See Chapter VI, Loci H, K/G, and C characterization data). From those elements of the point morphology (Bradley et al. 2008), that still is observable, the point measurable maximum dimensions are smaller than more sedentary populations projectile points. Nominal dimensions for point types are found in Bradley et al. (2008:126-145). That is, the widths, weight, thickness, and basal features indicate that point manufacture and maintenance were designed for flexibility and high mobility. However, in some cases the points are fragments; they do not clearly show evidence of reworking, which is one element of a residentially mobile profile. Similarly, because only base fragments are being dealt with, profile elements such as the flaking pattern, level of craftsmanship, and energy investment are not clearly discernible. Because of the unavailability of these elements of the profile in the manufacturing and maintenance measures category, the strength of the argument is lessened but is still supported from the forger/residential toolkit characteristic profiles noted below.

Table 11.17 Loci H, K/G, C Forager manufacturing technology settlement pattern adaptation characterization

Point manufacturing and maintenance models	Point/tool manufacturing profile derived from the sum of various model characteristics (forager profile)	Particular **Loci H, K/G, C** assemblage indicators to comparison profile (forager profile)
• **Weapons maintainable** • **Time minimization** • **Make and mend** • **Tools used to exhaustion** • **Less attention to hafting.** **(From Bleed 1986; Bousman 1994; Torrence 1983; Kuhn 1989; and Nelson 1991)**	1. More extensive reworking. 2. Lower craftsmanship 3. Less energy investment 4. Informal technological 5. Less grinding reflects less attention to hafting. 6. Max. dimension - Smaller 7. Basal width - Smaller 8. Maximum width - Smaller 9. Maximum thickness - Thinner 10. Concavity depth 11. Edge grinding index - Less 12. Weight – lighter	• No clearly evident reworking as some points are fragments. • Reworking evident in scraper technology. • Less thorough grinding reflects less attention to point hafting – less energy investment, fewer specialized tools/types. • Projectile points show un-patterned flaking pattern correlating with reduced craftsmanship and less energy investment • All point dimensions, widths, weight, thickness, and basal features are minimums indicating manufacture and maintenance was designed for flexibility and high mobility. • Comparisons indicate forager as opposed to sedentary profile for Locus H, K/G, and C's inhabitants.

As observed by Frison (1968), many tools recovered from archaeological sites are damaged in use or rendered unusable by re-sharpening. Implications of this are that tools left at archaeological sites may have gone through a final stage of repurposing or resharpening before abandonment. This does not mean that they were never used as a tool, but evidence of their utilization may be absent.

Fewer specialized tool types in a toolkit's profile is an indicator of forager behavior (Odell 2003; Chatters 1987). Loci H, K/G, and C's toolkits contained few specialized tools, i.e., gravers and wedges. Therefore, Loci H, K/G, and C's toolkit composition are indicative of a forager behavior settlement pattern. In sum, from the results of the models applied, Loci H, K/G, and C's settlement pattern adaptation profile is a fit to foraging.

11.4.2 Loci H, K/G, and C's activity use patterning and domestic activities

11.4.2.1 Loci H, K/G, and C's activity use patterning from attribute clusters (groups).

In the New England-Maritimes (NEM) region, five basic interpretations (Gramly and Funk 1990) of fluted point Paleoamerican sites are commonly recognized and were determined by attribute clusters or groups of site/locus characterization features (See Chapter V, section 5.6, 'Settlement pattern inference model's description and function'). These groups of site/locus characterization features were grouped into a basic descriptive model for inferring landscape activity patterning. By way of example, the selected elements used in developing the groups of characterization features or attribute clusters include entities such as:

1. toolkit artifact composition;
2. quantities of artifacts;
3. the diversity of artifacts;
4. evenness index that gives a summary value for the spread of artifact over the entire site assemblage;
5. debitage analysis, aggregate, individual size distribution quantities, and reduction location;
6. tool making material sources and quantity;
7. physical area dimensions of site/loci;
8. distances between loci;
9. geologic and geographic characterization;
10. and site/loci features.

Demonstrating how activity patterning could be applied, Shott (1986a) in a study of Mesolithic settlement types with defined profiles, concluded that it would be logical to assume that special task-oriented camps, such as hunt camps, collecting stations, or butchering sites, would have a relatively low diversity of artifacts. Rephrasing, if a narrow range of activities were performed at a particular location, one would expect to find a relatively low number of artifact types. In Shott's study, sites were classified either as base camps or extraction camps. His base camps were designated as a location where general-purpose activities were conducted, such as food preparation and processing, in addition to the maintenance of tools and shelters (Andrefsky 2005:217). Results of the study indicated that base camps had a greater range of artifact diversity than the extraction camps. Even though Shott's criteria included only four kinds of tool types, the study suggested that the lithic artifact density would be greater at base camps than at special-purpose camps.

Chatters (1987) excavated assemblages from the middle Columbia River in the Pacific Northwest to evaluate the amount of diversity in lithic assemblages by site type. Conclusions from the study showed that the values for the similarity index and evenness index were higher for residential base camps than those of a specialized hunting camp (Chatters 1987:363-366).

Loci H, K/G, and C's toolkit characterization and classification features are compiled in an attribute cluster (Table 11.18). Loci H, K/G, and C's toolkit artifact assemblages are composed of 7-8 major tool types producing a tool index of 210 to 432, (tool index = product of the number of different tool types and quantity of tools) i.e. bifaces, channel flakes, cores and core fragments, gravers, projectile point/knives, scrapers, waste flakes, and utilized, modified and/or retouched flakes. This tool range, quantity of varying tool forms, projectile points, presence of channel flakes, modified and/or retouched flakes, and debitage assemblage that covers the reduction spectrum, typically indicates a Paleoamerican habitation (Andrefsky 2005:201-223, Chatters 1987:363-366; Gramly and Funk 1990:14; Kooyman 2000:129-133; Nelson 1991:78-86; Odell 2003:188-202). Moreover, this assemblage is indicative of a tool kit employable in several differing habitation subsistence tasks such as resource preparation, processing and tool making.

As reflected in the artifact distribution shown in chapter six, and cluster Table 11.18, the tool and debitage distribution covers an area of 15.5 to 23 m², which falls within the NEM regionally small to medium Paleoamerican observed habitation site sizes.

As established earlier, Loci H, K/G, and C's artifact assemblage composition are indicative of a flexible, and portable toolkit. This conclusion was based on the parameters specified in the mobility/sedentism models discussed in Chapter V and applied above. Even though this analysis indicates that there was a narrower range of repurposable, flexible, and portable tools in the toolkit, it represents a wider range of tools than would be found in a single-purpose site. For example, at a kill-butchering site, it would be expected that the toolkit would contain several broken and complete projectile points, choppers, knives, and virtually no debitage except sharpening flakes.

Loci H, K/G, and C's tool assemblage, with the presence and quantity of tools, generally employed in a somewhat broader range of economic subsistence tasks as opposed to a single processing task, in conjunction with other attribute features, implies usage as habitation areas.

11.4.2.2 Loci H, K/G, and C's activity use patterning from a graphical attribute presentation

Loci H, K/G, and C's activity use patterning or graphical clustering is achieved through the concurrent consideration of multiple dimensions reflecting the locus' artifact assemblage and other site characteristics. The technique does not require complex multivariate handling of data or unattainable assumptions. Instead, it is based on simple graphic results which are highly interpretable and easy to understand (Kvamme 1988).

Table 11.18 Attribute cluster characterization model for **Loci H, K/G, and C**

I. Attribute groups	Locus H	Locus K/G	Locus C
Toolkit artifact types			
• **Projectile points and point fragments**	2	8	3
• **Channel flakes**	3	7	13
• **Bifaces & Biface fragments**	5	8	15
• **Cores and core fragments**	6	5	7
• **Retouched flake and Utilized waste flake**	18	18	39
• **End scraper and Side scraper**	6	31	14
• **Graver**	1	0	0
• **Wedges**		2	2
• **Number of tools in assemblage**	41	67	72
II. Classifying features			
Aggregate/individual debitage classification			
First stage reduction, nodules, cores, and large flakes	14	4	6
• **Reduction flakes greater than 8g**	29	4	7
• **Reduction flakes – small < 8g**	3183	3183	2129
• **Tool index: Range, variety, and quantity of tool types**	210	335	432
Material type sources	7	7	8
Primary & secondary source of lithic tool making material – local or exotic/remote	Mt Jasper rhyolite L Munsungun R	Mt Jasper rhyolite L Munsungun R	Mt Jasper rhyolite L Munsungun R
• **Dimensions of Locus area m² (excavated not encompassed)**	15.5	20	23
Number of artifact/activity concentrations per locus	2	1	3
Artifact and density –artifacts/ m²	210	97.4	98.3
Tool artifact and density – tools/ m²	2.6	3.55	3.78
Distance relationship between locus area clusters in meters	14	14	14
Site features and organics	0	0	0
Knapping episodes – both tools and debitage co-located	Yes	Yes	Yes
Geological and geographic characterization	Sandy glacial till	Sandy glacial till	Sandy glacial till

Inspection of Loci H, K/G, and C's activity use patterning cluster diagram, Figure 11.3, exhibits that all the generally predicted habitation site attributes (Andrefsky 2005 201:223, Chatters 1987:363-366; Gramly and Funk 1990:14; Kvamme 1988:387-393; Kooyman 2000:129-133; Nelson 1991:78-86; Odell 2003:188-202) are apparent. That is, higher tool index, a range of tool types potentially used in differing habitation subsistence tasks, the presence of channel flakes indicating projectile point tool production, and locus geographic size range. Further, the volume of reduction flakes is distributed over a larger area than a workshop or processing zone. Habitation loci exhibiting the characteristics enumerated above display a significantly different profile than processing/ workshop loci representing locations of specialized task execution.

Using the attribute cluster of the assemblage, its graphical representation, horizontal and vertical artifact distribution, in conjunction with debitage analysis provides a contextually viable interpretation of Loci H, K/G, and C's landscape usage as a habitation site.

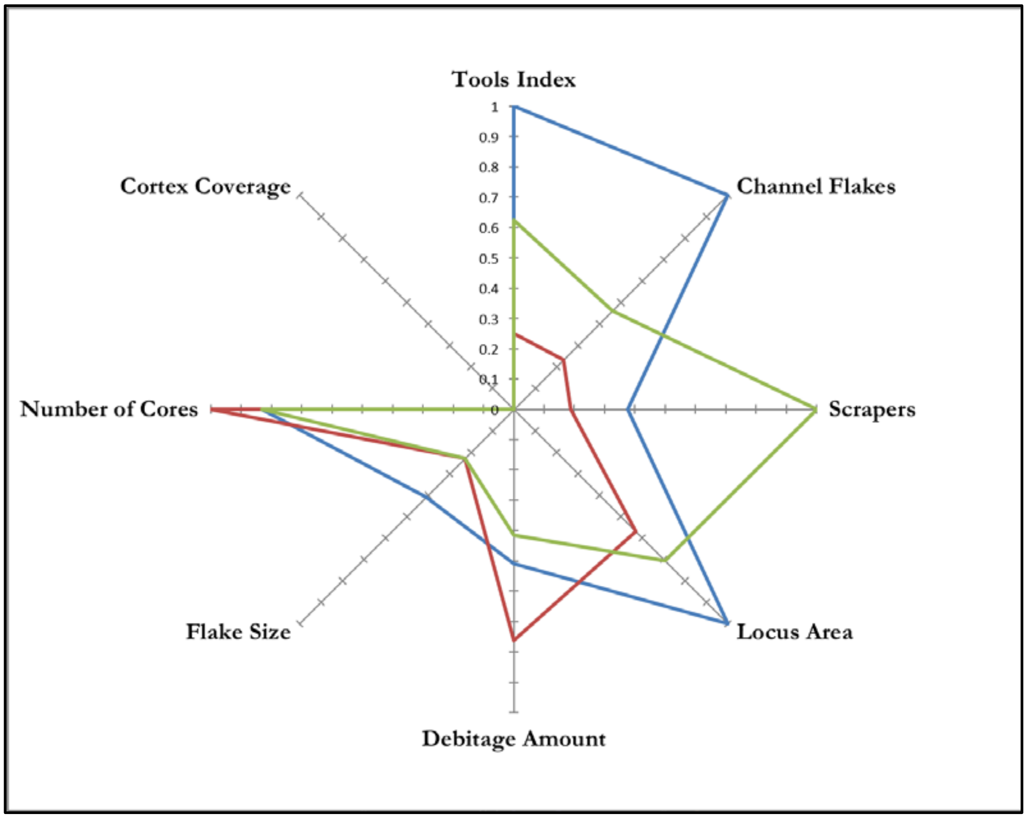


Figure 11.3. Loci H, K/G, and C domestic activity use patterning cluster diagram. Locus C green, H red, and C blue.

11.4.2.3 Microwear analysis method of landscape activities and loci usage

Tables 11.19, 11.20, and 11.21 summarizes the microwear analysis results of Loci H, K/G, and C's utilized artifacts. Many of the activities at the loci are related to transverse actions, such as scraping, planning and whittling, on medium hardness materials, which were most often interpreted as wood (Rockwell 2010, 2014). There is a bright polish on the dorsal surface of scrapers that indicates usage in scraping a soft material intensively, i.e., most likely used on hides. Longitudinal action feather scars on bifaces indicate use as a cutting implement on an indeterminate substance (Rockwell 2010).

Both debitage and formal tools were used at the Potter site. Given the results in Tables 11.19, 11.20, and 11.21 it appears that the debitage was being used for different activities than the formal tools. The results of a Yates corrected chi-square analysis suggest that there is a statistically significant difference in the uses of the tools and debitage at the Potter Site (Yates x^2=18.89, df=3, p<.001) (Rockwell 2010).

Table 11.19. Locus H tool function microwear analysis

Cat No.	Artifact Type	Material	Tool Function		Analysis Comments
2452	Flake	Rhyolite	Indeterminate	H	Dull dorsal edge polish and several small feather scars. Likely used on a soft material, but exact use is indeterminate.
1561	Retouched Flake	Rhyolite	Utilized: Indeterminate	H	A small piece of a larger utilized tool which was likely broken in manufacture. Small to medium size scars are present along the retouched edge, but the exact use of this tool is indeterminate.
1702	Retouched Flake	Munsungun	Utilized: Whittling Indeterminate	H	Polar coordinate 3 shows small feather scars and occasional snap fractures. There is no evidence for polish development or striations likely due to weathering. The piece appears to have characteristics similar to those associated with experimental whittling, but the material is unknown.
1705	Biface	Munsungun	Utilized: Cutting Indeterminate	H	Run of medium and large size hinge and step fractures at polar coordinate 7. Likely used as a cutting implement on an indeterminate substance.
1757	Scraper	Munsungun	Utilized: Scraping Soft/Hides	H	Distinct edge rounding interrupts occasional small step fractures along the working edge. There is a bright polish on the dorsal surface. Used to scrape a soft material intensively. Likely used on hides.
1772	Biface	Munsungun	Utilized: Projectile	H	Fragment of a utilized projectile point. Clear areas of bifacial damage and striations parallel to the working edge on the interior body.
1774	Retouched Flake	Rhyolite	Utilized	H	Clumped, medium, bifacial scars on polar coordinates 6,7, 8. Medium cutting tool.

Note: Adapted from Rockwell 2010.

Inspection of Loci H, K/G, and C's microwear analysis of tool use activities, as shown in Tables 11.19, 11.20, and 11.21, while not absolutely diagnostically specific, does indicate that many of the generally predicted (Andrefsky 2005 201:223, Chatters 1987:363-366; Gramly and

Funk 1990:14; Kvamme 1988:387-393; Kooyman 2000:129-133; Nelson 1991:78-86; Odell 2003:188-202) differing subsistence tasks expected in a habitation site. That is, activities such as organic material processing, cutting, scraping, and wood product fabrication are present. These types and range of activities, behaviors, toolkit compositions and tasks are not found in single function sites such as kill-butcher, processing, or workshop areas.

Table 11.20 locus K/G tool function microwear analysis

Cat No.	Artifact Type	Material	Tool Function	Locus	Analysis Comments
1458	Scraper	Munsungun	Utilized: scraping soft	K/G	Distinct edge rounding interprets occasional small step fractures along the working edge. Bright polish under on dorsal surface. Used to scrape soft material intensively
1722	Retouched Flake	Rhyolite	Indeterminate	K/G	No clear evidence of use. However, dull ventral edge polish.
1729	Retouched Flake	Rhyolite	Utilized: Whittling Indeterminate	K/G	Weathering has removed polish. The piece appears to have characteristics similar to those associated with whittling. Material unknown. Polar coordinates one and two shows medium feather scars and occasional snap fractures.
1709	Scraper	Rhyolite	Utilized: soft scraping	K/G	Small step fractures are seen on the working edge of the tool. Wear is primarily unifacial. Used to scrape an unknown soft substance
1713	Scraper	Munsungun	Utilized: Scraping wood	K/G	Scraping tool with medium and large unifacial step fractures located at coordinates eight. Used for scraping a material medium such as wood.
1714	Scraper	Munsungun	Utilized: scraping soft	K/G	Medium, clumped, feather scars on the working edge of the tool. Used to scrape an unknown soft substance.
1729	Retouched Flake	Rhyolite	Utilized: whittling	K/G	Polar coordinates one and two show medium feather scars and occasional snap fractures. Weathering removed polish. The piece appears to have been used for whittling.
1744	Retouched Flake	Munsungun	Utilized: Butchery	K/G	Feather, hinge and occasional snap fractures are located along polar coordinates five and six. Scars are small in size and occur on both surfaces of the piece. Likely used to cut or butcher animal material based on the presence of some polish.

Note: Adapted from Rockwell 2010, 2014.

Table 11.21 Locus C tool function microwear analysis

Cat No.	Artifact Type	Material	Tool Function	Locus	Analysis Comments
669	Flake	Rhyolite	Indeterminate	C	Dull polish on the dorsal surface as well as several small feather scars at polar coordinates 669.
756	Biface	Munsungun	Indeterminate	C	Broken during manufacture, edge damage may be related to platform preparation.
769	Projectile Point	Munsungun	Indeterminate	C	Projectile point tip, likely broken in the manufacture, edge damage may be related to platform preparation.
771	Scraper	Rhyolite	Indeterminate	C	Very small tool fragment with indeterminate edge damage.
772	Retouched Flake	Rhyolite	Indeterminate	C	Large retouched flake with medium sized step fractures in polar coordinates 1 and 2, unclear as to the exact use.
961	Scraper	Munsungun	Indeterminate	C	Very crude scraper fragment with a dull polish on the ventral surface.
1218	Flake	Rhyolite	Indeterminate	C	Dull polish on the ventral edge of polar coordinates 1 and 2 but no other use damage is visible,
311	Biface	Rhyolite	Utilized: Projectile	C	Fragment of a utilized projectile point, small striations running parallel to the working edge are visible on the central margins of the artifact. The piece is fragmentary and somewhat weathered but has clear evidence of utilization.
332	Projectile Point	Rhyolite	Utilized: Projectile	C	Fragment of a utilized projectile point, small striations running parallel to the working edge are visible on the central margins of the artifact. The piece is fragmentary and somewhat weathered but has clear evidence of utilization.
509	Retouched Flake	Munsungun	Utilized: Butchery	C	Run of feather and occasional snap fractures along polar coordinates 6, 7 and 8. The scars are small and bifacial. There is a light dull polish on the utilized edge. Likely used as a butchery tool
563	Retouched Flake	Munsungun	Utilized: Scraping, medium/hard	C	Close hinge and step fractures located on polar coordinates 2 and 3. Scars are small to medium in size and unifacial. Used to scrape a medium-hard material like wood or bone.
736	Retouched Flake	Munsungun	Utilized: Whittle Medium	C	A small run of medium sized snap fractures on polar coordinates 3 and 4. They are unifacial and indicate use as whittling tool likely on a material of medium hardness, likely wood given the limited polish residues.
757	Biface	Munsungun	Utilized: Scraping Wood	C	Scraping tool with medium and large unifacial, feather and hinge scars located at polar coordinates 8 and 1. Used for scraping a medium material like wood.
768	Scraper	Rhyolite	Utilized: Scraping Medium/Hard	C	Bit end has medium and large sized step and hinge fractures. Small glossy areas of polish are visible on the dorsal surface. Used to scrape a medium-hard material either wood or bone.

Table 11.22 Locus C tool function microwear analysis continued

775	**Scraper**	**Chert**	**Utilized: Scraping Medium**	**C**	**Bit end has small step fractures. Some areas of bright polish are visible on the dorsal edge. Used to scrape a medium hardness material.**
793	Biface	Rhyolite	Utilized: Indeterminate	C	The surface of this piece is heavily weathered which has removed the majority of polish and striations. There is however limited evidence that the piece was hafted from a small area of scars on polar coordinate 6. Any other use evidence on this tool remains indeterminate.
991	Flake	Rhyolite	Utilized: Scraping Wood	C	Run of unifacial feather and hinge scars is located along polar coordinates 1 and 2. The piece was likely used for light scraping of wood.
1007	Flake	Rhyolite	Utilized: Cutting Wood	C	Bifacial scars are located at polar coordinates 8, 1 and 2. The scars are close snap fractures and occasional hinges. This suggests cutting of a medium hardness material like wood.
1037	Retouched Flake	Munsungun	Utilized	C	Retouched flake shows evidence of utilization, but the wear traces are unclear and jumbled and cannot be identified to a particular action or contact material.
1289	Retouched Flake	Chert	Utilized: Cutting Indeterminate	C	Bifacial feather scars are located at polar coordinates 4 and 5. The scars are small in size. Some polish is visible but is indistinct. This was used as a cutting tool on unknown material.
1291	Retouched Flake	Munsungun	Utilized: Longitudinal Indeterminate	C	Bifacial feather and snap fractures are located at polar coordinates 1, 2, and 3. The scars are medium in size. Some polish is visible but is indistinct. This was used in a longitudinal pattern on an indeterminate surface. Weathering has made more exact characterizations impossible.
1741	Retouched Flake	Rhyolite	Utilized: Cutting Soft	C	Small feather scars can be found at polar coordinate 2 occurring on both surfaces. Used to cut a soft material, possibly hides.
1765	Retouched Flake	Munsungun	Utilized: Butchery	C	Feather and occasional snap fractures are located along polar coordinate 6. The scars are small in size and occur on both surfaces of the piece. Likely used to cut or butcher animal material based upon the presence of some polish. There is also evidence of prehension near polar coordinate 1.
1768	P.E.	Munsungun	Utilized: Wedge Medium/Hard	C	Overlapping medium and large step fractures on the bifacial working edge of the piece suggest that this piece was used as a wedge. The material it was used on is uncertain though likely medium or hard substances like wood, bone or antler.

Note: Adapted from Rockwell 2010.

Chapter XI demonstrated the applicability of the previously described qualitative and quantitative models (Chapter V) to the Potter site lithic artifact assemblage for Loci H, K/G, and C. From the outcomes of these analyses inferences as to the nature of the occupants' settlement patterns and site usage may be made for use in the characterization of Potter. Analysis of this chapter followed the design of addressing the four broad occupation trait categories necessary to investigate the proposed settlement pattern behaviors.

Chapter XII

Loci F and B analysis

Chapter XII presents the analysis loci F and B. These two loci are grouped jointly because of their narrower range and quantity of tool types in addition to the high ratio of debitage to tools. The analysis of these loci presents a characterization that is substantially different than those of Loci H, K/G, and C.

12.1. Technological organization and culture horizon

Locus F's assemblage composed of only 409 artifacts, i.e., 1 untyped fluted point, 1 channel flake, 9 bifaces, 27 scrapers, and 10 modified retouched expedient tools offers a very small sampling with which to assess the technological organization of the Locus. Even though a small sample, it is ventured that Locus F's flaked stone tool technological organization is based on a segmented tool blank, biface preform, fluted point, core and flake reduction tradition.

Locus B's assemblage of 4232 flaked stone artifacts (4200 pieces of debitage), i.e., 6 Channel flakes, 8 bifaces, 5 scrapers, 6 utilized waste flakes and 5 modified retouched expedient tools offers a very small tool sampling with which to assess the technological organization of the Locus. However, the presence of 6 Channel flakes and eight biface fragments would suggest Locus B's stone tool production and reduction sequence of technological organization is also based on a staged biface (multiple stage preform), fluted point, core and flake reduction tradition as found in other site loci (Lothrop et al. 2016). The fluted point technological organization identified in the artifact assemblage places Loci F and B's occupation range somewhere during the Paleoamerican horizon (12,900 - 10,800 cal BP).

12.2 Temporal aspects of site habitation

12.2.1 Occupation horizon

Loci F and B's flaked stone tool grouping displayed in Table 12.1 indicates the presence or absence of particular traits as well as example photo references (Figures 7.7 and 7.14). Correlation of the locus's assemblage with the diagnostic traits of the NEM Paleoamerican horizon provides validation Loci F and B's placement within it (Gramly and Funk 1990; Spiess et al. 1998).

Table 12.1 New England Maritimes Paleoamerican lithic tool diagnostic traits Loci F and B

Diagnostic Trait	Locus F Presence/ Absence	Locus B Presence/ Absence	Artifact Catalog Number (Examples)
• **Projectile point/knife fluting on both faces from carefully prepared platforms. (Early and mid-Paleo horizon)**	P	A	339
• **Channel flakes found in tool manufacturing artifacts and debris. (Early and mid-Paleo horizon)**	P	P	546, 1340, 1333
• **High-quality lithic material**	P	P	Munsungun, Mt. Jasper rhyolite
• **Spurred end scrapers**	P	P	603, 501, 89

12.2.2 Occupation date range

The only diagnostic available in Locus F's assemblage for dating purposes is an untyped Mt. Jasper rhyolite fluted projectile point fragment (Figure 7.7 reference number 339) and one channel flake which would place it somewhere in the early to the mid-Paleo horizon (12,900 - 11,600 cal BP).

The diagnostic available in Locus B's assemblage for dating purposes is six channel flake fragment fragments shown in Figure 7.14, reference numbers 1340, 1333. This would place Locus B somewhere in the early to mid-Paleo sub horizons (12,900 - 11,600cal BP).

12.2.3 Occupation duration

As will be discussed in the Locus F landscape usage and domestic activities section, use of this locus is hypothesized to be a material processing as opposed to a habitation area because of its limited tool type range, a large number of scrapers and bifaces present in addition to use wear indications.

Similarly, in the Locus B landscape usage and domestic activities section, use of this Locus was conjectured to be a stone tool production as opposed to a habitation area. Therefore, using the various methods for estimating occupation duration would not provide any meaningful estimate or information concerning Loci F and B's occupation duration. This is because processing or tool making workshops are generally associated with a habitation locus. It is unknown which habitation locus either of these loci is associated with.

12.2.4 Distinguishing reoccupation - instances of single or multiple occupations

To determine whether Locus F was a single or multiple occupation area, an argument was developed that, even though at a small differential, the stratigraphic positioning of the bifaces, scrapers and retouched flakes were found concentrated at different levels thus indicating reoccupation. This stratigraphy differential suggests that the same area was utilized as a workshop area for different functions on more than one occasion separated longitudinally as indicated by the significant number of biface fragments, scrapers, and utilized/retouched flakes found clustered at different levels. The argument supporting this hypothesis is further developed in the Locus F landscape usage and domestic activities section.

There is no stratigraphic differentiation by level of material type or artifact, nor linear regression relationship between Locus C's (nearest habitation locus) occupation span and occupation artifact density evidence to suggest reoccupation of Locus B.

12.3 Mobility patterns and seasonality inferences

Since Locus F is put forward to be a processing area and Locus B is postulated to be a tool production area, and both are most likely associated with one of the habitation loci. Loci F and B would likely have the same mobility patterns and seasonality inferences as discussed for loci H, K/G, and C.

12.4 Settlement pattern adaptations and site/loci domestic activity land-use

12.4.1 Locus F landscape usage and activities from attribute clusters.

Observations from the application of the landscape feature matrix to Loci F and B's artifact assemblages based on attribute clusters are displayed in Table 12.2. From the table, it is noted that the artifact assemblage for Locus F is composed of three major tool types, i.e., 27 scrapers, 9 biface fragments, and 10 modified and/or retouched waste flakes. Typically, this narrow tool range and numerous quantities of particular tool types indicate something different than a habitation location is to be expected (Andrefsky 2005 201:223, Chatters 1987:363-366; Gramly and Funk 1990:14; Kvamme 1988:387-393; Kooyman 2000:129-133; Nelson 1991:78-86; Odell 2003:188-202).

Table 12.2 attribute cluster characterization model Loci F and B

I Attribute Clusters	Locus F	Locus B
Artifact types		
• Projectile points and point fragments	1	0
• Channel flakes	1	6
• Bifaces	0	0
• Biface fragments	9	8
• Cores and core fragments	0	1
• Retouched flake	10	5
• Utilized waste flake (Channel)	1	6
• End scraper	14	3
• Side scraper	2	1
• Untyped scraper	11	1
• Uniface and Uniface fragments	0	0
• Drill	0	0
• Pieces esquillées	2	0
• Number of tools in assemblage	50	32
• Waste flakes	366	4200
II Classifying features		
Aggregate debitage classification		
• First stage reduction, nodules, cores, and large flakes >38	7 Very large 1st	2 large 1st
• Reduction flakes greater than 8 g to 38 g.	10	8
• Reduction flakes <8g, >4g		7
• Reduction flakes – small <4 g	349	4185
Range, variety, and quantity of tool types	6	3
Material type sources	6	6
• The primary source of lithic tool making material – local or exotic	Mt Jasper rhyolite Local	Mt Jasper rhyolite Local
Dimensions of Locus area m² (excavated not encompassed)	11	16.25
Number of artifact/activity concentrations per Locus	1	2
Artifact and density –artifacts/ m²	39.2	261
Tool artifact and density – tools/ m²	4.5	2.0
Distance relationship between Locus area clusters in meters	14	10
Site features and organics	0	0
Knapping episodes – both tools and debitage co-located	Yes	Yes
Geological and geographic characterization	Sandy glacial till	Sandy glacial till

As indicated by the artifact distribution Figures 7.1, 7.2 and 7.3, the tool and debitage distribution covers a relatively small area. Further, the distance of this locus relative to the habitation Locus C is approximately 15 meters. From field observations of numerous Paleoamerican sites, workshop/tool manufacturing/ processing sites are often found 15 to 30 m from habitation sites.

This assemblage configuration, with the presence, quantity, and distribution of tool types, is generally thought to be employed in the processing of materials such as foodstuffs, hides, bone, or wood. A materials processing toolkit generally consists of a higher number of specific tools such as end scrapers, or side scrapers, or drills, or wedges in addition to other classifying features. This characterization infers a potential landscape usage as a workshop or processing area (Andrefsky 2005 201:223, Chatters 1987:363-366; Gramly and Funk 1990:14; Kvamme 1988:387-393; Kooyman 2000:129-133; Nelson 1991:78-86; Odell 2003:188-202).

An argument could be advanced that because of the low artifact count in locus F's assemblage, that this was the result of the intensity of use. However, when an evenness calculation is performed, its result is skewed toward the 0.0 end of the range (1.0 to 0.0) meaning that only one or two types of artifact account for the specimens in the population. Shannon-Weaver (1948) diversity analysis yields the same conclusion.

$$\text{Evenness} = (n_{i/}n)(\log n_{i/}n)/\text{Log}_s$$

where: n_i = the number of artifacts for each type

n = the number of artifacts for all types

s = the number of artifact types.

The disparity in size between some fluted point Paleoamerican residential sites have long been known (Deller 1989; Gramly and Funk 1990). “Actual excavations of small and large Paleoamerican sites reveal similar ranges of tool classes and debitage - a clear indication that activities were not qualitatively different” (Gramly and Funk 1990). There is, of course, a bottom limit to the number of artifacts in an assemblage where interpretation becomes meaningless. What that limit is appears to be subjective. Locus F’s artifact assemblage composition diverges from those of loci H, K/G, and C habitation characterizations. Therefore, locus F can be considered as something other than a low-intensity habitation site.

In an attempt to bring finer resolution to Locus F landscape usage, additional analysis of assemblage tool configuration and vertical distribution are considered. As noted, the lithic tool range of the locus is rather narrow and represented mostly by a significant number of scrapers, biface fragments and modified or retouched flakes. Even though there is a low waste flake count, an analysis of the debitage indicates a noteworthy number of flakes in the weight category of 8 g to 31.8 g and greater (See Table 12.2. Of the 366 debitage pieces, 7 were over 31.8 g, 10 pieces ranged between 8 g and 31.8 g, and 349 were less than 8 g. It was unusual to find initial stage reduction pieces at other loci at the site). This potentially suggests some level of material testing, early-stage reduction, or biface production episode (number of bifaces, 9, per 416 total artifacts) took place at some time at this location. To ascertain if there was a correspondence between biface fragments and rhyolite reduction flakes, Locus F’s horizontal tool and debitage spatial quantity distributions were reexamined. The assessment showed no significant correlation of either bifaces or scrapers with the quantity of debitage placement by 50 cm quad. Data used for this analysis were extracted from the overall Potter site database. Construction of the database and its component categories was discussed in Chapter IV.

However, when the vertical distribution by level for bifaces and scrapers in addition to material type was considered, it is seen that the bulk of the rhyolite biface fragments and scrapers are found in levels three through seven (Table 12.3). In the case of the Munsungun and untyped rhyolite scrapers, the majority are found in levels one through four. Even though there is overlap at level three and to some extent level four, this stratigraphy differential potentially suggests that the same area was utilized on more than one occasion separated longitudinally as a workshop area for different functions as indicated by the significant number of biface fragments, scrapers, and utilized/retouched flakes found concentrated at different levels. In one case, perhaps in an earlier episode, it was used as a cobble testing or tool biface/preform production area and in a different period a processing area for woodworking and/or hides.

Table 12.3 biface and scraper distribution by material type and 5 cm level

	Bifaces			Scrapers				
Level	Munsungun	Mount Jasper Rhyolite	Biface Total	Chert	Mt. Jasper Rhyolite	Munsungun	Untyped Rhyolite	Scraper Total
1						2	1	3
2		1	1	1	1	9	1	12
3		3	3			3		3
4		2	2			2		2
5		1	1		2		1	3
6	1		1		1	1		2
7		1	1		2			2
Grand Total	1	8	9	1	6	17	1	27

This hypothesis is challenged by the fact that the sample size is small and differences due to chance are reasonably high. Also, disturbance by cryoturbation and bioturbation is also a factor. That said, there is an appearance of a pattern of Munsungun chert being more common in the upper levels. The horizontal distribution, moreover, should be less prone to disruption in that the distance of movement there is potentially much broader than the 30 to 35 cm movement vertically. This is supported by the recovery of three refitting scraper fragments (catalog #s 501, 502, 503), broken by exposure to high heat, that was found in adjacent quadrants in levels 1 and 2. As noted earlier in the horizontal assemblage distribution (Figure 7.2) there are two horizontally distinct clusters present in the Locus F, spaced less than a meter apart; one on a Southwest to Northeast axis and the other on an east-west alignment.

Locus usage and activities characterization developed from the application of the landscape feature matrix to Locus B's artifact assemblage based on attribute clusters is also presented in Table 12.2. From the table, it is noted that the assemblage is composed of only three major tool types, i.e., 8 biface fragments, 5 scrapers, and 11 utilized or retouched waste flakes. Typically, (Andrefsky 2005 201:223, Chatters 1987:363-366; Gramly and Funk 1990:14; Kvamme 1988:387-393; Kooyman 2000:129-133; Nelson 1991:78-86; Odell 2003:188-202) this narrow of a tool range, low quantity of tools, and large number of waste flakes (4200) indicate structural differences between habitation or materials processing loci characterizations. Locus B's assemblage configuration, i.e., channel flakes, the minimal presence of tool types and a minor quantity of tools, a significant number of biface fragments in addition to high numbers of reduction flakes and a relatively small locus area (16.25 m^2) infers a landscape usage as a flaked tool manufacturing/workshop area. The absence of complete preforms and projectile points with fluting produced in manufacture indicates the work products were most likely curated from the site.

12.4.2 Locus F landscape usage and activities from graphical attribute cluster presentation

When viewed from the graphical cluster perspective the potential dual usage of Locus F becomes more apparent. Processing sites are defined by a low to moderate tool index value, a significant volume of a particular tool type such as scrapers, few pieces of debitage, and occupy relatively small areas. Processing loci represent locations of specialized task execution. Inspection of Locus F's landscape usage cluster diagram shows that all of the generally predicted processing site attributes are apparent, i.e., low tool index, the absence of channel flakes, the large number of scrapers, low volume of reduction flakes and a small area. However, an anomaly in terms of a significant vector of flake size is visible in Figure 12.1 inferring that something else occurred at this Locus in addition to the generally accepted attribute cluster profile for a specialized task area. The sample size is comparatively small, barely 400 flakes and the influence of a chance episode of atypical behavior might have such an effect.

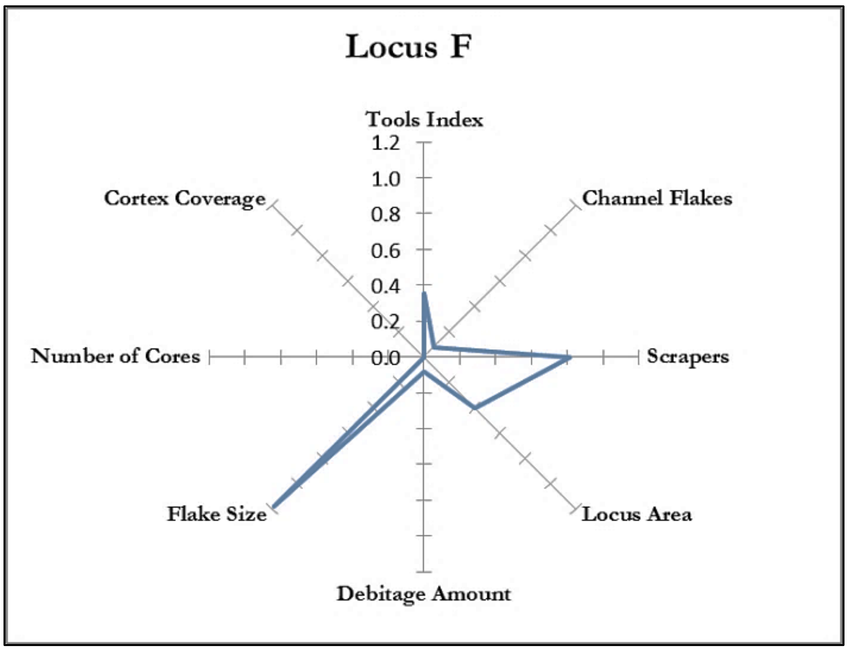


Figure 12.1 Locus F domestic activity use patterning cluster diagram.

Loci C and F are physically located close together but are distinctly different in nearly all categories. The two most prominent characteristics are tool diversity and artifact inventory size. Even without the graphical cluster perspective, the diverse and intense nature of Locus C's assemblage leads to the interpretation that it was a multipurpose encampment, likely that of a household or family band. Superficially at least it is comparable to some of the loci at the Bull Brook site (see Robinson et al. 2012), the Jefferson II site (Benney Basque 2010), and the Jefferson III site (Rusch 2012).

Locus F stands quite distinct as a processing location. It is further supported by the microwear analysis that shows a focus on woodworking. The differences between loci prompt an interesting hypothesis, that is – were these two areas somehow related to one another? Was Locus F a satellite to Locus C where some specific activity, such as the manufacture of wooden hafts was perhaps, carried out? No cross-mends or refits of broken artifacts have been made between the two loci, so it is not possible to use that line of investigation to suggest such contemporaneity and connectedness.

When Locus B is viewed from the graphical cluster perspective (Figure 12.2) the potential usage of the area becomes more apparent. Flaked tool manufacturing/workshop sites are defined by a low tool index value, insignificant volume of a particular tool type and number of tools, high number of pieces of debitage, and occupy relatively small areas as opposed to habitation loci. Inspection of Locus B's landscape usage cluster diagram shows the entire generally predicted workshop site attributes, i.e., low tool index, the presence of channel flakes, insignificant number of any specialized tool, the high volume of reduction flakes and a small area (Andrefsky 2005 201:223, Chatters 1987:363-366; Gramly and Funk 1990:14; Kvamme 1988:387-393; Kooyman 2000:129-133; Nelson 1991:78-86; Odell 2003:188-202) .

No cross-mends or refits of broken artifacts have been made between Locus B and nearest habitation loci C as well as H, so it is not possible to use that method of analysis to suggest contemporaneity or connectedness.

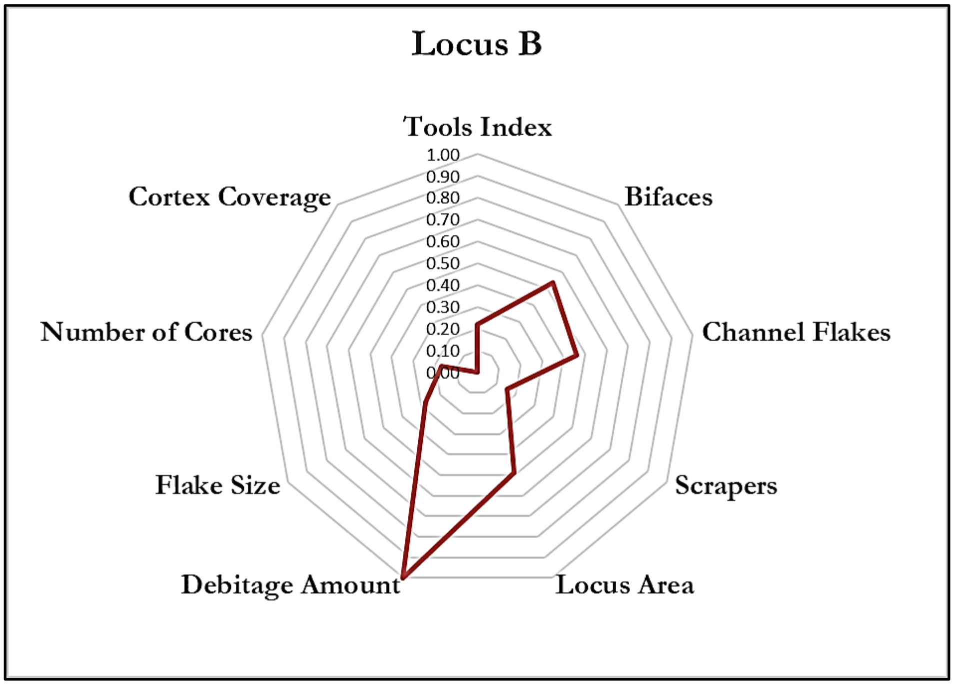


Figure 12.2 Locus B domestic activity use patterning cluster diagram.

12.4.3 Microwear analysis method of landscape activities and loci usage

Summarized in Table 12.4 are Locus F's microwear analysis results of utilized artifacts. Many of the activities for both bifaces and scrapers at the locus are related to transverse actions, such as scraping, planing and whittling, on medium hardness materials, which were most often interpreted as wood (Rockwell 2010).

Assessment of Locus F's microwear analysis of tool use activities, as shown in Table 12.4, confirms that many of the generally predicted attributes for multipurpose processing of wood products, in addition to a cobble testing, and tool making locus.

Table 12.4 Locus F's microwear analysis results of utilized artifacts.

Catalog Number	Specimen Type	Raw Material	General Use	Block Location	Wear Description
501, 502, 503	Scraper	Munsungun	Indeterminate	F	Very light indeterminate damage to the working edge. Dull polish on the ventral surface, broken into three pieces.
603	Scraper	Chert	Utilized: Scraping Wood	F	Hinge and step fractures are located along the bit end of the tool and are medium to large in size. Polish is also clearly visible. Used to scrape wood. Results are in agreement with those found by Dr. Marilyn Shoberg (2006).
631	Scraper	Munsungun	Utilized: Indeterminate	F	A run of medium and large-sized feather scars. There is a well-developed polish, but there appear to be multiple overlapping wear traces which make exact identification difficult.
765	Scraper	Rhyolite	Utilized: Scraping Wood	F	The working edge has clear polish and edge rounding as well as primarily unifacial feather and hinge scars which are medium in size. This tool was used to scrape wood. Results are in agreement with those found by Dr. Marilyn Shoberg (2006).
778	Biface	Munsungun	Utilized: Scraping Wood	F	Polar coordinates 2, 3 and 4 have a broken line of step fractures and some areas of edge crushing. Damage is primarily unifacial. Used to scrape a medium material, likely wood from the presence of polish on the surface.
887	Scraper Fragment	Rhyolite	Utilized: Transverse Unknown	F	This scraper fragment contains the majority of the working edge and has small and medium step and hinge fractures. While clearly used in a transverse motion some weathering has removed polish and striations as well as some flaking evidence making more exact identifications problematic.
888	Retouched Flake	Munsungun	Utilized: Unknown Action and Material	F	Retouched flake shows evidence of utilization, but the wear traces are unclear and jumbled and cannot be identified to a particular action or contact material.

Note: Adapted from Rockwell 2010.

Locus B's microwear analysis (Rockwell 2010) of utilized tool use activities is summarized in Table 12.5. Since the Locus displays the attributes of a stone tool making workshop area, analysis of the utilized flake tools, indicating cutting of soft material, suggests that they may have been used at another Locus and brought to Locus B then discarded during tool making activities.

Another alternative is that a food or hide processing activity also occurred at the locus although the scraper count is low.

Table 12.5 Locus B's microwear analysis results of utilized artifacts.

Catalog Number	Specimen Type	Raw Material	General Use	Block Location	Wear Description
221	Flake	Rhyolite	Indeterminate	B	The piece shows clear evidence of utilization along polar coordinates 1 and 2, but the wear itself is an indeterminate.
208	Flake	Rhyolite	Utilized: Cutting Soft	B	Small, bifacial feather scars located on polar coordinate 6 and 9. Soft cutting tool.
1127	Flake	Quartz	Utilized: Cut Soft	B	Polar coordinates 8 and 1 have several small snap and feather scars. This was used to cut a soft material; more exact identification is not possible due to weathering.

Note: Adapted from Rockwell 2010, 2014.

Chapter XII presented the analysis of the Potter site lithic artifact assemblage for Loci F, and B using the qualitative and quantitative models discussed in Chapter V. The outcomes of these analyses may now be used in the characterization of Potter.

Chapter XIII

Locus M, J, A, D, and E analysis

Chapter XIII completes the archaeological analysis of the Potter site's Loci M, J, A, D, and E following the same format as used in Chapters XI and XII. Loci M, J, A, D, and E are grouped collectively for reasons of their variety in terms of their small size either in the number of artifacts or area covered, an unusual horizontal artifact distribution, or single material type artifact assemblage.

Locus M and J analysis

13.1 Technology organization and culture horizon

Locus M (1424) and J's (554) assemblage of artifacts, i.e., channel flakes, biface, scrapers, projectile point (J), and modified retouched expedient tools offer a very small tool sampling with which to assess the technology organization of each locus. As found in other loci at the site the presence of Channel flakes, projectile point (J), and a biface fragment would suggest Loci M and J's stone tool production and reduction sequence of technology organization is based on a staged biface, fluted point, core, and flake reduction tradition. The fluted point technology organization of the assemblage places Locus M and J's occupation range somewhere during the early, mid, and late segments of the Paleoamerican horizon (12,900-10,800 cal BP).

13.2 Temporal aspects of site habitation

13.2.1 Occupation horizon

Loci M and J's flaked stone tool diagnostic traits enumerated in Table 13.1 indicates the presence or absence of particular traits as well as example photo reference (Figure 8.9).

Table 13.1 New England Maritimes Paleoamerican lithic tool diagnostic traits Locus M

Diagnostic Trait	Locus M Presence/ Absence	Locus J Presence/ Absence	Artifact Catalog Number (Examples)
• **Projectile point/knife fluting on both faces from carefully prepared platforms. (Early and mid-Paleo horizon)**	A	P?	1397
• **Channel flakes found in tool manufacturing artifacts and debris. (Early and mid-Paleo horizon)**	P	P	1777, 1510, 1786, 1785, 2206, 1379
• **High-quality lithic material**	P	P	Munsungun, Mt. Jasper rhyolite
• **Spurred end scrapers (Side scrapers, P)**	A	P?	3522, 3527, 1381, 470

The presence of NEM lithic tool diagnostic trait attributes (channel flakes, spurred end scrapers (J) and high-quality lithic material) as shown in Table 13.1 indicates that Loci M and J's occupation placement is in the Paleoamerican horizon.

13.2.2 Occupation date range

The only diagnostic available in Locus M and J's assemblage for dating purposes is channel flake fragment (Figure 8.9, reference numbers 1777, 1510, 1786, 1785, and Figure 8.17, reference numbers 2206, 1379, and 1766) which would place it somewhere in the early to mid-Paleoamerican sub horizons (12,900 - 11,600 cal BP).

13.2.3 Occupation duration

As will be argued in the Locus M landscape usage and domestic activities section, use of this locus is inferred to be a short term overnight to a few days hunting stand occupation where later stage projectile point reduction and finishing, as opposed to longer-term habitation or material processing activities, occurred.

Although varying, all of the models employed to estimate Locus J's occupation span, the relative magnitude OSI proxy variable, correlation ring, and tool loss per person day, yield indications of a short-term occupation for this locus that extends over somewhere in the neighborhood of single-digit days to three plus weeks in length.

Results of the OSI proxy variable model (locus J OSI of 10.04), yielded an estimated number of occupation days ranging from 3.5 to 10 days. The correlation ring model classifies Locus J as a short duration occupation. The tool loss per person model day yielded a range of locus occupation of 5.25 to 6.3 days.

13.2.4 Distinguishing reoccupation - instances of single or multiple occupations

There is no stratigraphic differentiation by level of material type or artifact, nor linear regression relationship between Locus M and J's occupation span and occupation artifact density evidence to suggest reoccupation of these loci.

13.3 Mobility patterns and seasonality inferences

13.3.1 Indications of mobility/sedentism

Since Loci M and J are postulated to be a short term overnight to a few days hunting stand (M) or small seasonal occupation (J), it is most likely that they would have the same mobility patterns and seasonality inferences as discussed for loci H, K/G, and C.

13.3.2 Mobility/sedentism based on reduction stage location distribution of debitage.

Examination of Locus J's total distribution of debitage, using weight as a proxy for size, reveals that 524 of 529 pieces or 99.3% of debitage is smaller than 3 grams. In the case of Locus M's overall debitage distribution, 1414 of 1414 pieces or 100% of debitage is smaller than 2 grams. Using this observation of the debitage distribution resulting from the remnants of the lithic reduction episode at the locus, it can be inferred that these were not initial production events as would be expected if all stages; initial, further, and late of a sedentary occupation were present. Locus M and J's distribution of smaller later shaping, reworking or sharpening events thus indicates a mobile land-use.

13.4 Settlement pattern adaptations and site/loci domestic activity land-use

13.4.1 Locus M landscape usage and activities from attribute clusters.

Locus usage and activities characterization developed from the application of the landscape feature matrix to Loci M and J's artifact assemblages based on attribute clusters is presented in Table 13.2. From the table, it is noted that the assemblages are composed of only a few major tool types, i.e., biface fragment, scrapers, and utilized and retouched waste flakes in addition to channel flakes that are not considered as tools but byproducts of point production. Typically, (Andrefsky

2005 201:223, Chatters 1987:363-366; Gramly and Funk 1990:14; Kvamme 1988:387-393; Kooyman 2000:129-133; Nelson 1991:78-86; Odell 2003:188-202) this narrow of a tool range, low quantity of tools, and large number of waste flakes (1414) indicate something different than a longer-term habitation or logistical materials processing location.

As indicated by the artifact distribution shown in Figures 7.1, 7.2, 7.3, 7.8, 7.9, and 7.10 the tool and debitage distribution covers a relatively small area, i.e., 6.25 m^2 for Locus M and 6 m^2 for Locus J. The distance of this locus relative to the closest habitation Loci C and H is approximately 50+ m. Field observations of numerous NEM Paleoamerican sites, workshop/tool manufacturing, and logistical processing areas are often found 15 to 30 m from habitation sites. Locus M is over 50 m distant from other loci at the site and does not appear to conform to that type of domestic activity land-use.

Locus M's assemblage configuration of channel flakes, minor quantity, and type of tools, biface fragment, medium numbers of small (< 2.4g) single material variety (Munsungun chert) reduction flakes implies that a later stage projectile point tool production episode occurred. These attributes in addition to a small hearth feature containing artifacts and surrounding higher density of waste flakes infer a short duration hunting stand occupation where later stage projectile point reduction, fluting, and finishing occurred. The absence of preforms and projectile points produced in manufacture indicates work products were curated from the site.

Locus J's combined landscape usage and activities based on the previously discussed activities model is compiled in attribute cluster Table 13.2. Locus J is considered to be small when viewed in terms of artifact count, as compared to other loci at the site. Its' geographic surface area, however, is comparatively large when the J Block at the western end of the locus and scattered scrapers and projectile point at the other are included.

Table 13.2 attribute cluster characterization model locus M and J

I Attribute Clusters	Locus M	Locus J
Artifact types		
• Projectile points and point fragments	0	1
• Channel flakes	4	3
• Bifaces / Biface fragments	1	5
• Cores and core fragments	0	1
• Retouched flake and utilized waste flakes	3	4
• End scraper / side scraper	2	11
• Untyped scraper	0	0
• Uniface and Uniface fragments	0	0
• Drill	0	0
• Pièces esquillées	0	0
• Number of tools in assemblage	11	25
• Waste flakes	1414	530
II Classifying features		
Aggregate debitage classification		
• First stage reduction from nodules, cores, and large flakes	0 large 1st	0
• Reduction flakes greater than 8 g	0	1
• Reduction flakes <8g, >2g	0	4
• Reduction flakes < 2g	1414	525
Range, variety, and quantity of tool types index	50	120
Material type sources	6	7
• The primary source of lithic tool making material – local or exotic	Munsungun, exotic	Rhyolite, local & Munsungun, exotic
Dimensions of Locus area m² (excavated not encompassed)	6.25	6
Number of artifact/activity concentrations per locus	1	2
Artifact and density –artifacts/ m²	2210.7	910.4
Tool artifact and density – tools/ m²	1.6	3.55
Distance relationship between locus area clusters in meters	50	14
Site features and organics	1	0
Knapping episodes – both tools and debitage co-located	Yes	Yes
Geological and geographic characterization	Sandy glacial till	Sandy glacial till

The total artifact counts for Locus J sum only to 554 pieces thus making an assessment of its landscape usage and activities problematic. Because the artifact concentrations of the locus are separated by such a large area, when the block J artifacts (west) and the scattered cluster of scrapers, waste flakes, plus projectile point fragment (east) are considered separately, the two areas yield quite separate pictures of usage (toolmaking in the west and material processing in the east). Another consideration is to include them together with the hypothesis that perhaps they were separated by a simple habitation shelter although there is no feature evidence to support it.

Even though a small sampling, Locus J's tool range, the quantity of varying tool forms, projectile point, the presence of channel flakes, modified and/or retouched flakes, and debitage assemblage that covers the small end of the reduction spectrum, suggests a short-term Paleoamerican field camp or seasonal small residential occupation usage.

13.4.2 Locus M landscape usage and activities from graphical attribute cluster presentation

When viewed from the graphical cluster perspective the potential usage of the area is also suggestive. Flaked tool manufacturing/workshop sites are defined by a low tool index value, insignificant volume of a particular tool type and number of tools, higher number of pieces of debitage, and occupy relatively small areas as opposed to longer-term habitation loci. Inspection of Locus M's landscape usage cluster diagram (Figure 13.1) shows the entire generally predicted fluted point workshop site attributes, i.e., low tool index, the presence of channel flakes, insignificant number of any specialized tool, a higher volume of reduction flakes and a small area. These attributes in smaller quantities in addition to the identification of a hearth feature infers a short duration hunting stand occupation where later stage projectile point reduction, fluting, finishing, and resharpening occurred.

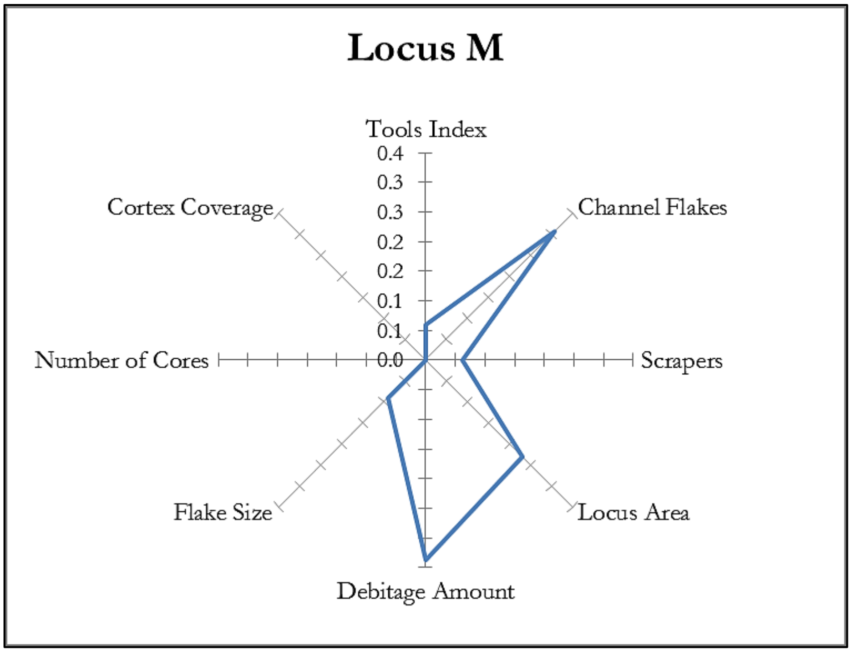


Figure 13.1 Locus M activity use patterning cluster diagram.

No cross-mends or refits of broken artifacts have been made between Locus M and nearest habitation Loci C as well as H, so it is not possible to suggest contemporaneity or connectedness.

Inspection of Locus J's landscape usage cluster diagram, Figure 13.2, exhibits that all of the generally predicted (Andrefsky 2005 201:223, Chatters 1987:363-366; Gramly and Funk 1990:14; Kvamme 1988:387-393; Kooyman 2000:129-133; Nelson 1991:78-86; Odell 2003:188-202) small habitation site attributes are apparent, i.e. higher tool index, a range of tool types used in differing habitation subsistence tasks, presence of channel flakes, and range including volume of reduction flakes distributed over a larger area. Habitation loci exhibiting the characteristics enumerated above display a significantly different profile than processing/ workshop loci representing locations of specialized task execution as would be noted if Locus J were separated into an East and West locus.

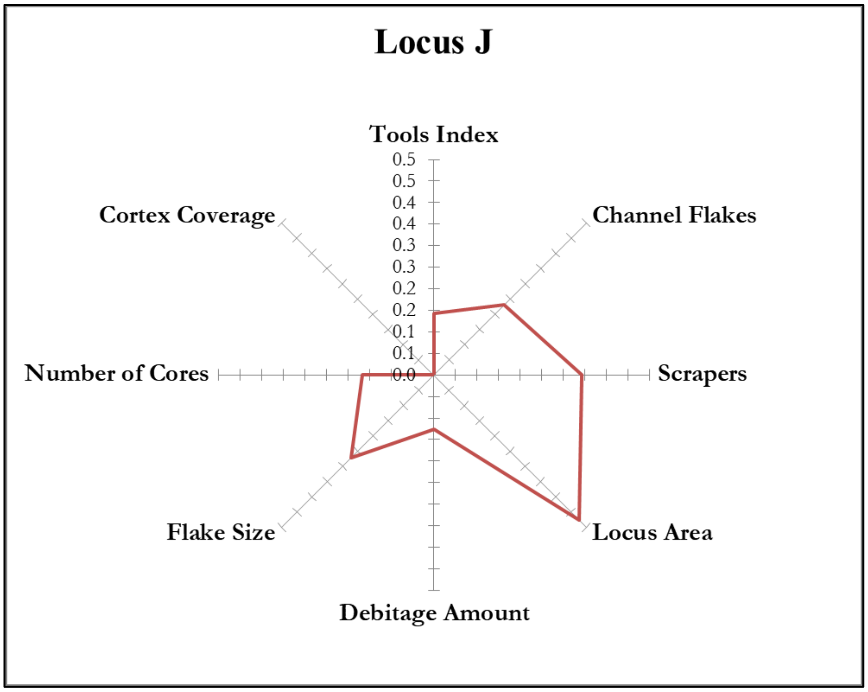


Figure 13.2 Locus J activity use patterning cluster diagram.

13.4.3 Microwear analysis method of landscape activities and loci usage

Locus M's microwear analysis (Rockwell 2010) of utilized tool use activities is summarized in Table 13.3. Since the locus displays the attributes of a stone tool making workshop area, analysis of the utilized flake tools, indicating cutting of soft material, suggests that they may have been used at another locus and brought to Locus M then discarded during tool making activities. Because there were so few samples of flakes or tools showing microwear, no conclusions can be realistically drawn.

Table 13.3 Locus M's microwear analysis results of utilized artifacts.

Catalog Number	Specimen type	Raw material	General use	Block Location	Wear Description
1773	Biface	Munsungun	Utilized: Indeterminate Hard	M	Severe edge crushing can be seen at polar coordinates 6, 7, and 8. It is unclear what activity and upon what contact material this artifact was used but it was likely a hard substance given the intensity of the damage.
2508	Flake	Munsungun	Utilized	M	Small, bifacial feather scars located on polar coordinate 4. Soft cutting tool.

Note: Adapted from Rockwell 2010.

Table 13.4 summarizes the microwear analysis results of Locus J's utilized artifacts. Many of the activities at the locus are related to transverse actions, such as scraping, or whittling, on medium hardness materials, which were interpreted as wood (Rockwell 2010, 2014). The bifacial fragment (catalog number 1361) has some roughening on all edges and striations along the interior body that runs parallel to the edges. This appears to have been used as a projectile point; however, the wear traces are light and appear to have minimal overall damage. There is also no evidence for an impact fracture on the point tip (Rockwell 2010, 2014).

Both informal retouched flake and formal tools (scrapers and biface/projectile point) were used at the Potter site for subsistence activities. Inspection of Locus J's microwear analysis of tool use activities, as shown in Table 13.4, suggests that some of the generally predicted differing subsistence tasks expected in a short-term habitation site are present.

Table 13.4 locus J tool function Microwear analysis

Cat No.	Artifact Type	Material	Tool Function	Locus	Analysis Comments
1373	Scraper	Rhyolite	Indeterminate	J	Edge flaking and damage may be due to trampling and lacks diagnostic use traces.
1759	Retouched Flake	Munsungun	Indeterminate	J	Dull dorsal edge polish but otherwise no clear evidence of use.
1361	Biface	Rhyolite	Utilized: Projectile Point	J	This bifacial fragment has some roughening on all edges and striations along the interior body that runs parallel to the edges. This appears to have been used as a projectile point however the wear traces are light and appear to have minimal overall damage. There is also no evidence for an impact fracture on the point tip.
1364	Scraper	Chert	Utilized: Scraping/ Cutting Wood	J	Bit end has small step fractures. Some areas of bright polish are visible on the dorsal edge. Used to scrape a medium hardness material, likely wood. There is also evidence that this piece was used as a cutting tool on the same substance; there is a line of fractures on polar coordinates 2 and 3.
1767	Scraper	Rhyolite	Utilized: Wedge Wood	J	While morphologically described as a scraper there appears to be evidence for this tool use as a wedge on a medium material, likely wood. There are medium-sized hinge and step fractures occurring on both surfaces of the working edge.

Note: Adapted from Rockwell 2010.

Locus A analysis

13.5 Temporal aspects of site habitation

13.5.1 Occupation horizon

Locus A's flaked stone tool grouping displayed in Table 13.5 indicates the presence or absence of particular traits as well as example photo reference (Figure 8.19). As noted earlier, Locus A's assemblage was disturbed by commercial excavation and is incomplete. Locus A is included for completeness of the overall site analysis, but because of its small artifact count and incomplete artifact assemblage, no critical analysis was performed.

Table 13.5 New England Maritimes Paleoamerican lithic tool diagnostic traits Locus A

Diagnostic Trait	Presence/ Absence	Artifact Catalog Number (Examples)	Artifact Photograph Ref. Number
• **Projectile point/knife fluting on both faces from carefully prepared platforms. (Early and mid-Paleo horizon)**	A		
• **Channel flakes found in tool manufacturing artifacts and debris. (Early and mid-Paleo horizon)**	P	55, 191, 1034	55, 191, 1034
• **High-quality lithic material**	P	Munsungun, Mt. Jasper rhyolite	
• **Spurred end scrapers**	A		

The presence of NEM lithic tool diagnostic trait attributes (channel flakes and high-quality lithic material) as shown in Table 13.5 indicates that Locus A's occupation placement is in the Paleoamerican horizon.

13.5.2 Occupation date range

The only diagnostic available in Locus A's assemblage for dating purposes is 3 channel flake fragments (Figure 8.19, reference numbers 55, 191, 1034) which would place it somewhere in the early to mid-Paleoamerican sub horizons (12,900 - 11,600 cal BP).

Locus D and E analysis

13.6 Locus D and E artifact composition

Locus D and E are included for completeness of the analysis, but because of their small artifact counts and widely scattered artifact distribution, no critical analysis was attempted. Locus E's artifact composition is made up of one biface, one scraper, one modified/retouched waste flake and 458 waste flakes distributed over an area of 4 m in length by 1 m in width. In the case of Locus D its artifact composition is represented by only 40 pieces and is comprised of 2 bifaces, 1 projectile point fragment, 1 utilized waste flake, 34 waste flakes, and 1 modified/retouched waste flake in 6 m^2 of excavated area but scattered over a rectangle 18 m length by 1 m in width.

13.7 Temporal aspects of site habitation

13.7.1 Occupation horizon

Locus D and E's flaked stone tool grouping displayed in Table 13.6 indicates the presence/absence of diagnostic traits. The lack of NEM lithic tool diagnostic trait attributes (fluted projectile points, channel flakes and spurred end-scrapers) as shown in Table 13.6 indicates that Locus D and E's occupation cannot place it in the Paleoamerican horizon or any other.

Table 13.6 New England Maritimes Paleoamerican lithic tool diagnostic traits Locus D and E

Diagnostic trait	Presence /absence	Catalog No. example
• **Projectile point/knife fluting on both faces from carefully prepared platforms. (Early and mid-Paleo horizon)**	A	
• **Channel flakes found in tool manufacturing artifacts and debris. (Early and mid-Paleo horizon)**	A	
• **High-quality lithic material**	P	Munsungun, Mt. Jasper rhyolite
• **Spurred end scrapers**	A	

13.7.2 Occupation date range

There are no diagnostics available in Locus D and E's assemblage for dating purposes.

13.8 Settlement pattern adaptations and loci domestic activity land-use

13.8.1 Locus D and E landscape usage and domestic activities

Because of the small number of artifacts represented in both Locus D and E's assemblage and the wide, and narrow dimensions of each locus, no definitive representation can be ventured with any surety. A few speculations that I propose are; first that these artifacts are associated with the larger habitation Locus C as outliers or small workshop areas. Secondly, because of the wide, and narrow extent of the defined area for each locus suggests that they may, in fact, just be arbitrary discards that occurred during one of the occupations of the site. Thirdly, because of the number of waste flakes in the Locus E assemblage, it might be suggested that a rhyolite tool production or maintenance activity occurred. And finally, it might even be entertained this odd collection of waste flakes and few non-waste flake artifacts are a cleanup episode deposition from Locus C. There is no clear supporting evidence clearly indicating that Locus D and E's artifact assemblage can be ascribed to activities other than a rhyolite flake reduction occurred in the vicinity or nearby Locus E.

Chapters XI, XII, and XIII detailed the analysis of each of the Potter sites previously characterized loci data. The analysis followed the pattern of addressing the four broad occupation trait categories necessary to investigate the hypothesized behavioral and settlement patterns using the quantitative and qualitative models introduced in chapter V.

In the chapter that follows, the Paleoamerican comparison sites data for Bull Brook, Whipple, Vail, and Tenant Swamp will be investigated for the same behavioral and settlement patterns using the same methodology.

Chapter XIV

Comparison site analysis

Chapter XIV presents the analysis of the comparison sites Whipple, Bull Brook, Vail, and Tennant Swamp. The chapter seeks to demonstrate the applicability of the previously described qualitative and quantitative models to the comparison sites lithic artifact assemblages. From the outcomes of these analyses inferences as to the nature of the comparison site occupants' settlement patterns and their site usage may be made for use in the assessment of the previously analyzed Potter site loci. Organization of the following analysis follows the pattern of addressing the four broad occupation trait categories necessary to investigate the proposed settlement patterns.

Whipple site analysis

14.1 Technological organization and cultural horizon

The Whipple site's stone tool production and reduction sequence elements of the technological organization are based on a segmented tool blank, biface preform, fluted point, core, and flake reduction tradition. As expected, no blade production technology was identified in the assemblage. As was the case in the Potter site analysis, the fluted point technology places The Whipple site's occupation date range somewhere during the early to mid-Paleoamerican horizon (12,900 - 11,600 cal BP).

Analysis of Whipple's artifact assemblage enumerated in Table 14.1, indicating the presence or absence of particular diagnostic traits, as well as the artifact photo examples (Figure's

14.5, 6, and 7), provides evidence of a correlation with the diagnostic characteristics for the New England Maritimes Paleoamerican horizon (Gramly and Funk 1990; Spiess et al. 1998).

Table 14.1. NEM Paleoamerican lithic tool diagnostic traits for the Whipple site

Diagnostic Trait	Presence/ Absence	Artifact examples
Projectile point/knife fluting on both faces from carefully prepared platforms. (Early and mid-Paleo horizon)	P	Figure 14.5 projectile point forms row 1-4
Channel flakes found in tool manufacturing artifacts and debris. (Early and mid-Paleo horizon)	?	Fluting evident on points row 1-4
Preform thinning by medial percussion flaking.	P	Points row 1-4
Points received no additional thinning after fluting. (Early and mid-Paleo horizon)	P	Points row 1-4
Lateral grinding evident from midsection to basal ears.	P	
Basal grinding common.	P	
Late Paleo horizon points are basally thinned but not fluted.	A	
High-quality lithic material	P	Munsungun, Hardaway, and Cheshire cherts
Spurred end scrapers	P	1734

To further refine Whipple's positioning in the Paleoamerican horizon, the use of projectile point fluting as opposed basal thinning places the site in the early to the mid-Paleoamerican horizon (Bradley et al. 2008).

14.2 Temporal aspects of site habitation

14.2.1 Occupation date range

In Whipple's excavated assemblage, one complete and four diagnostic projectile point bases in addition to three projectile point ear fragments (Figure 14.5) were identified. Curran's (1984) plate I show the one complete fluted projectile point (row 1, left), four fluted projectile point base fragments (row 1, right; rows 2 and 3) and a sizeable late-stage projectile point preform base (row 4). From the morphologically based typology (Bradley et al. 2008:126-128), the points were identified as Kings Road-Whipple. Kings Road-Whipple points suggest an early Paleoamerican occupation that occurred sometime during the chronological range of 12,900 to 12,500 cal yr BP.

14.2.2 Occupation duration

14.2.2.1 Occupation duration: occupation span index method

Values for Surovell's (2009) quantitative model for occupation span index by proxy variables cannot be computed because the model requires numerical quantities for both local and remote material sources in the artifact assemblage. As described in Chapter X, the material composition of the Whipple site artifact assemblage was made up of Munsungun chert (77%), Hathaway formation chert, and Cheshire formation quartzite (23%). The Munsungun chert source is located approximately 720 km from the Whipple site. Likewise, both the Hathaway and Cheshire material sources are located about 240 km from Whipple. As can be seen from these distances, none of the material sources in the Whipple assemblage can be considered local. Therefore, Surovell's (2009) model for calculating occupation span is not applicable.

14.2.2.2 Occupation duration from revised (log-log transformed) ring model correlation method

Analyzing Whipple's length of occupation employing Whitelaw's (1983) exponential form variations of Yellen's (1977) ring model, in addition to the linear arrangement of Yellen's (1977) model yielded the values displayed in Table 14.2. The results of both models are presented for completeness even though Whitelaw's (1983) analysis showed that for a small site or locus areas, the linear model more closely represented the data. Application of the exponential model, as discussed in Chapter V, is most appropriate for larger site or loci areas. The exponential form more closely fit the multiple data sets that Whitelaw (1983) analyzed to determine the relationship between people and space in hunter-gatherer camps. Again, as discussed earlier, all models are descriptive models, designed to produce an equation giving the best fit to the data on which they were tested. These models provide an order of magnitude indicator of occupation duration and not an absolute value. They are employed to indicate whether the occupation was short, medium, or long-term in nature. In the case of Locus, A, B, and C, all models show a short-term occupation in the neighborhood of one week for the Whipple sites' loci.

1. Number of occupation days (NOD) = .1*(area) + 1.87 Linear form
2. Number of occupation days (NOD) = $1.87 * b\char`^ (.1 * (area))$ Exponential form

Table 14.2. Occupation length in days from, linear, and exponential form of Whitelaw's (1983) dual model technique for people and space in hunter-gatherer camps.

Locus	Area m^2	Linear form	Exponent form b = 1.4, a = .1
Locus A	57	7.37	12.72
Locus B	40	5.67	7.18
Locus C	38	5.47	8.72

14.2.2.3 Occupation duration: tool loss method

Approaching Whipple's loci length of occupation from a tool loss calculation using Mc Ghee's (1979) and Spiess' (1984) model for Loci A and B, yields a person day occupation duration of 85 to 108 days. This calculation is based on one tool lost per 2.5 to 3 days per person (Mc Ghee 1979, Spiess 1984). Whipple's Locus A and B tool assemblages each consists of 34 pieces. For a band size of five individuals, this would indicate a range of 17 to 20.4 days of locus occupation duration. For a band size of ten individuals, this would indicate a range of 9.5 to 10.8 days of locus occupation duration. Locus C’s tool assemblage consists of 36 pieces yielding a 90 to 108-person day occupation duration range. For a locus tent size of five individuals, this would indicate a range of 18 to 21.6 days of locus occupation. For a locus tent size of ten individuals, this would point towards a range of 9.5 to 10.8 days of locus occupation duration.

Occupation duration statistics and calculations for each of the Whipple sites’ loci are presented in Table 14.3. Results from the application of this model indicate that the occupation duration ranged from 10 to 18 days and thus would be considered as short-term occupations.

Table 14.3. Occupation duration by locus from the Mc Ghee’s (1979) and Spiess’ (1984) model

Locus	Number of tools	Person-days	Locus tent size five persons	Locus tent size of 10 persons
A	34	85 - 102	17 – 20.4	8.5 – 10.2
B	34	85 - 102	17 – 20.4	8.5 – 10.2
C	36	90 - 108	18 – 21.6	9.0 – 10.8

14.2.2.4 Occupation duration summary

Both of the applicable models employed to estimate Whipple’s loci occupation span, the revised ring model correlation method, and tool loss per person day, yielded indications of a short-term occupation for the Whipple site loci that extends over somewhere in the neighborhood of single-digit days to three weeks, or short term in length

14.2.3 Distinguishing reoccupation - instances of single or multiple occupations

Addressing the issue of whether Whipple's loci were a single or multiple occupation locations, three models are employed, i.e., the stratigraphic distribution of artifacts, the density of assemblage per unit area, and, a regression correlation model.

14.2.3.1 Artifact distribution stratigraphy model

Results from the excavation of the three loci identified at the site (Locus A, B, and C) did not indicate any stratigraphic differentiation or distribution by artifact or material types, i.e., projectile points, scrapers, or utilized flakes. Some number of debitage flakes drifted down in the soil column due to bio or cryoturbation. Although some lithics were recovered in the plowzone, most of the artifacts were concentrated at 2 to 6 cm beneath the plowzone. The bulk of the artifact finds were located between 16 and 35 cm below the ground surface.

There were no intersite refits found thus bringing into question the contemporaneous occupation of any of the loci. The principal excavator of the site, Curran (1984), speculated that the individual loci had not been reoccupied. However, it was hypothesized that on the site basis, Whipple site had been reoccupied. It was unclear what the period was between any locus occupation.

Reoccupied sites may be characterized by high artifact densities coupled with relatively lower frequencies of local raw materials and debitage (Spiess et al. 1998; Gramly and Funk 1990). As described above, the material composition of the Whipple site artifact assemblage was made up of Munsungun chert (77%), Hathaway formation chert, and Cheshire formation quartzite (23%) – all remote. The sites' artifact density per m^2 is considered to be moderate to low in addition to a high density of remote cherts and quartzite. By these two measures indications, Whipple may have been reoccupied on a site basis during the Paleoamerican horizon.

14.2.3.3 Regression correlation reoccupation model

Surovell's (2009) regression analysis relationship between the Whipple site loci in terms of occupation span and occupation density does not show a correlation of OSI and artifact density. To develop an index value for an occupation span, there must be both a local and remote material source. As previously discussed, all materials in the site's artifact assemblage are from remote locations. Therefore, Surovell's (2009) regression analysis model is not applicable.

14.2.3.4 Distinguishing reoccupation summary. Two of the models applied to evaluate Whipple's reoccupation status indicate that it was potentially reoccupied on a site basis on more than one occasion. The models that have provided this indication were the artifact distribution stratigraphy model and the heuristic density of artifact and material type sourcing location model. Finally, an early Woodland occupation (A Meadowood component of the Early Woodland period, 3000-2100 BP) was identified at the site. The location of this occupation did not impact or overlap with the Paleoamerican loci (Curran 1984).

14.3 Mobility patterns and seasonality inferences

14.3.1 Indications of mobility/sedentism

The Whipple site's mobility/sedentism indications based on site artifact tool assemblage is summarized in Table 14.4. It contains 16 plus modified/retouched expedient flake tools, 1 complete and 4 projectile point basal fragments, 14 preforms, 18 bifaces, 52 scrapers, 1 fluted drill, 1 chopper, and two *pièces esquillées*. Analysis using the diagnostic models discussed (Kelly and Todd 1988; Meltzer 2003; Bleed 1986; Bousman 1994; Kuhn 1994), points toward an assemblage that is indicative of a flexible, portable toolkit. Also, as projected by the models, a toolkit composed of very few specialized tools, in this case, two pieces esquillées, one chopper, and one drill in addition to relatively few tool types (Bifaces, points, and expedient flakes) serving multiple functions is further evidence of mobile inhabitants.

Table 14.4. Mobility/sedentism indications based on Whipple site artifact tool assemblage.

Model and Diagnostic Traits	Lithic Evidence	Figure 14.5, 6, & 7 Photo No.	Comments
Mobility Models (Kelly and Todd 1988; Meltzer 2003; Bleed 1986; Bousman 1994; Kuhn 1994)			
Function of: **6. Flexible, portable tools. High residential mobility has flexible, highly mobile tools.**	16+ Modified / Retouched Flakes 18 Bifaces 14 preforms	Figure's 14.5, 14.6 and 14.7	16+ modified/retouched expedient flake tools and eight bifaces indicative of flexible, portable tools.
7. Specialized tools. Decreasing residential mobility should have more specialized tools with less need for portability.	5 Projectile points/fragments, 52 Scrapers, 2 pièces esquillées 1 drill, 1 chopper.	Figure's 14.5, 14.6 and 14.7	Projectile points/knife, expedient flake tools, and scrapers are standard elements of the toolkit. Two specialized tool type, i.e., 2 pièces esquillées and 1 drill.
8. Tool diversity. High residential mobility has relatively few tool types serving multiple functions. The number of moves per year negatively correlated with tool diversity.	5 Tool types (Bifaces, projectile point/knives, scrapers, retouched waste flakes, and wedges.) .	Figure's 14.5, 14.6 and 14.7	Few tool types are serving multiple functions – indicative of high residential mobility.
Mobility based on Core/Biface ratios. (Bamforth, Becker 2000)			
9. Low core/biface ratios are often linked to high mobility. **10. High ratios linked to more sedentary lifestyles.**	0 Core 18 Bifaces		Not calculable

Employing each of the toolkit characterization models, i.e., flexible multiple portable tools, number of specialized tools, the range of tool diversity, and core biface ratios indicate that the inhabitants of Whipple were by these measures mobile as opposed to a sedentary group.

14.3.2 Mobility/sedentism based on reduction stage location distribution of debitage.

No description of the Whipple site’s debitage distribution by dimensions or weight as a proxy for size was noted in the published literature for the site. What was provided was the cumulative amounts of debitage per site and loci. The total site debitage assemblage contained 38,000 pieces of which Locus A contained the largest count at 30,000 pieces, followed by Locus C at 6000 pieces, and Locus B with 2000 pieces. As noted earlier, there was no lithic material from local sources in the artifact assemblage. With the Munsungun chert source located over 700 km away and the Hathaway and Cheshire material sources situated approximately 240 km from Whipple, it is doubtful that large cobbles were transported to the site. From the assemblage composition of 18 bifaces and 14 preforms is more than likely that the early stages of reduction were done at the quarry sites. Therefore, from the assumptions above it would be expected that all steps, initial, further and late, were not present in the assemblage. Whipple’s debitage distribution would appear to be from smaller later stage shaping, reworking or sharpening events and thus indicates a mobile population land-use.

14.3.3 Territorial round mobility geography and seasonality

Four models whose functioning and assumptions were detailed earlier, i.e., Burke et al.'s (2004), Curran and Grimes (1989), Rockwell’s (2012), and Primary prey and vegetational reconstruction model are employed to attempt to define the territorial round geography and seasonality of the hunter-gatherers that occupied Whipple.

14.3.3.1 Burke et al.'s model for determination of NEM Paleoamerican territorial round range

As previously determined from the morphology/typology of assemblage fluted points, Whipple was reoccupied sometime during the Kings Road-Whipple early Paleoamerican sub horizon (12,900 to 12,400 cal yr BP). During this time horizon, Burke et al. (2004) hypothesized that based on materials found at sites occupied during this period two possible band ranges could be identified. Applying the Burke et al. (2004) model, two alternatives are suggested. In alternative I, the route (solid red lines) ranged from Lake Munsungun (summer) to Michaud, to Pt Sebago (late summer-fall), to Whipple (fall-winter), on to Lake Champlain for the Hathaway and Cheshire material sources (spring), followed by a return to Munsungun (summer).

From observations of artifact material sourcing locations and limits of regional site occupation, Burke et al. (2004) also proposed a second alternative territorial round mobility range model. The people exhibiting technology organization characteristic of the Kings Road-Whipple horizon exhibited a preference for a more coastal return circuit (Burke et al. 2004). The second proposed alternative (II), shown by the dashed red line in Figure 14.1, ranges from Munsungun (summer) to Searsmont to Bull Brook (late summer-fall), to Whipple (fall-winter), to Hathaway and Cheshire material sources (spring), possibly to Megantic and return to Munsungun (summer). These two possible routes would appear to describe the territorial rounds of the occupants of the Whipple site (Figure 14.1).

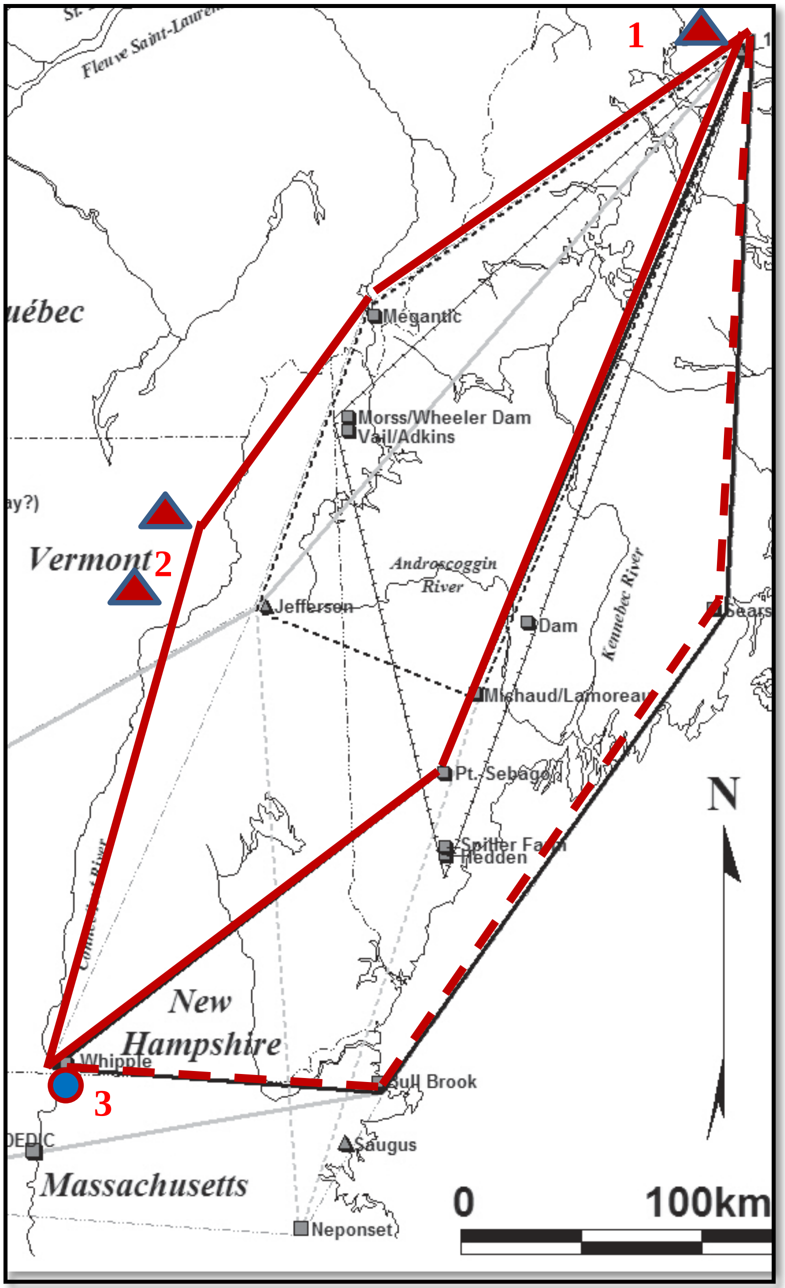


Figure 14.1. Kings Road-Whipple sub horizon band range based on lithic material sourcing and diachronic separation of culture horizons. Alternative I: Solid red line ranges from Munsungun to Michaud, Pt Sebago, Whipple (fall-winter) to Hathaway and Cheshire material sources (spring), possibly to Megantic and return to Munsungun. Alternative II: Dashed red line ranges from Munsungun to Searsmont to Bull Brook to Whipple (Fall-Winter) to Hathaway and Cheshire material sources (Spring), possibly to Megantic and return to Munsungun (Summer). Material source locations: red triangles 1) Munsungun chert; 2) Hathaway chert and Cheshire quartzite; 3) Whipple site blue-red circle. (Adapted from Burke et al. 2004.)

Table 14.5 provides the percentage of Munsungun chert source material found at each of the known sites. Presence of the Munsungun chert indicates the potential validity of the circuit. If none of this source chert was found in each of the site assemblages, it would be questionable if that site was on the territorial round course.

Table 14.5. Percentage of Munsungun chert in the assemblage of territorial round sites

Territorial round mobility range sites with Munsungun source	Percentage of Munsungun chert in the artifact assemblage
Munsungun	97
Searsmount	28
Michaud	62
Pt Seago	93
Whipple	77
Vail	.25
Bull Brook	58
Megantic	45/23

14.3.3.2 Curran and Grimes model for determination of NEM Paleoamerican territorial round range

Table 14.6 represents the expected distribution of material types by percent to be found in NEM sites' artifact assemblage by season as predicted from the Curran and Grimes (1989) model. From the model, it would be expected that during the Kings Road-Whipple early sub horizon, Whipple was occupied as a wintering to spring transit site (South to North) with a northern summer embedded chert material acquisition at Munsungun.

Table 14.6. Expected distribution of material types to be found in NEM sites by season

Season	Northern Cherts Munsungun, Champlain Primary Lithic	Southern Volcanics/Felsite Secondary Lithic	Cherts, Jasper, Quartzite (Opportunistic exchange/acquisition)
Summer (North)	Majority % *Munsungun Hathaway and Cheshire*	None	Hathaway and Cheshire 23 %
Fall Transit (North to South)	Majority %	None	Small %
Winter (South)	Majority-declining %	Increasing %	Small-increasing %
Spring Transit (South to North)	Majority-further declining% *Whipple 77% Munsungun Hathaway and Cheshire 23 %*	Significant % *Whipple 0% Rhyolite*	Small-further increasing %

14.3.3.3 Rockwell model for determination of NEM Paleoamerican territorial round range

As indicated in Table 14.7, the seasonality tool kit and occupation span indicators model, occupations containing large numbers of tools related to butchery and hide working in addition to organic material processing (wood), likely represent late summer or early fall occupations. The occupations would be short to medium in length when fall caribou hides and meat are at their prime. Whipple's artifact assemblage seasonality parameters support the Rockwell (2014) model and suggest that occupation occurred in the late summer and early fall.

Table 14.7. Rockwell model seasonality tool kit and occupation span indicators

Season	Tool Kit and Occupation Span Indicators	Whipple's Toolkit & Occupation Span	Photo Ref No.
Winter to early spring	• A wide diversity of activities, a wide range of tool types. • Sites occupied for an extended period and located near lithic quarries.		
Late spring and early summer	• Evidence of regular moves and short occupations. • Few activities occurring at each site, tool type range limited. • Likely a mixture of residential and logistical sites represented.	• Occupation span estimate: high single-digit days to 2 weeks • Flexible, portable tools. Limited tool types are serving multiple functions indicative of high residential mobility. • Toolkit related to residence, tool production/maintenance, woodworking, butchery and hide working, (5 Projectile points, 52 Scrapers, tools, 16 Modified/ Retouched Flakes.) • Curran (1984) indicates woodworking and hide working.	
Late summer and early fall. Possibly into late fall	• Occupations contain large numbers of tools related to butchery and hide working. • Occupations likely to be short to medium in length as fall caribou hides and meat are at their prime.	• 5 Projectile points/knives, 52 Scrapers, tools, 16 Modified/ Retouched Flakes, chopper, and wedges • 10 to 30 days loci occupation durations.	Figure's 14.5, 14.6 and 14.7

14.3.3.4 Primary prey and vegetational reconstruction model for determination of NEM Paleoamerican territorial round range

As noted, at 12,500 cal yr BP, Maine and southern Québec including southerly extensions at higher altitudes were tundra covered. South-central Maine, southern New Hampshire, and Massachusetts were covered by a poplar-spruce-fir forest in addition to hardwoods such as oak and maple in southern New Hampshire and Massachusetts (Newby et al. 2005).

It could be expected that caribou, traveling between northern calving and southerly wintering grounds, would have wintered 10 to 50 km south of the forest boundary in south-central Maine and southern New Hampshire (Newby et al. 2005; Spiess 1984). This range of migratory caribou movements corresponds to the circuits from Lake Munsungun and return as described in the Burke model. However, because Whipple was situated on the edge of the poplar-spruce-fir forest, the caribou herds would have wintered in smaller groups than that would have been found in the more northerly mixed tundra terrain (Spiess 1984).

14.4 Settlement pattern adaptations and site/loci domestic activity land-use

14.4.1 Settlement pattern adaptations: indications of forager/collector land use strategy

Whipple's settlement pattern traits indicate a forager adaptation. This assessment is based on the details of the diagnostic traits outlined in Table 14.8 with comparisons to Whipple's assemblage artifacts that exhibit these characteristics.

Table 14.8. Whipple forager/collector settlement pattern adaptation characterization

Forager/residential mobility tool profile	Observations on forager profile	Whipple's assemblage
• **Flexible tool technology**	1. High forager/residential mobility has flexible technology as each tool will serve multiple tasks.	• 18 modified/retouched expedient flake tools and 18 bifaces indicative of flexible, portable tools.
• **Few specialized tools**	2. Higher forager/residential mobility indicate less specialized tools and more need for toolkit portability.	• 5 Projectile points, • 52 Scrapers, • 2 pièces esquillées.
• **Low tool diversity**	3. Few tool types are serving multiple functions – indicative of high forager/residential mobility — the number of moves per year negatively correlated with tool diversity.	• 7 Tool types (few)
• **Microware (Odell) (Chatters; Odell)**	4. Individual tools show multiple wear traces as each tool serves several functions.	• Figure's 14.5, 14.6 and 14.7

The most noteworthy elements observed in the locus's assemblage that are characteristic of a forager's toolkit are flexible tool technology, few specialized tools, minimal tool diversity, maintainability, and make - mend technology.

Whipple's tool manufacturing technology settlement pattern adaptations (Table 14.9) shows that projectile points and fragments (Figure 14.5) were manufactured to minimum nominal dimensions. Nominal dimensions for NEM point types are found in Bradley et al. (2008:127). When compared to sedentary populations points, they are smaller, i.e., widths, weight, thickness, and basal features, indicating point manufacture and maintenance was designed for flexibility and high mobility. Even though there were a minimal time and energy savings, an inspection of the point base fragments shows less thorough basal and edge grinding reflecting lesser attention to point hafting and less energy investment. Culturally identified point and point fragments do not clearly show evidence of reworking. However, Figure 14.5 row 1 left, exhibits a complete projectile point/knife that does show reworking, which is an element of a residentially mobile profile. Finally, fewer specialized tools types are found in Whipple's loci toolkit assemblages confirming another of the forager/collector profile indicators of a forager activity pattern (Table 14.8). In sum, Whipple's loci settlement pattern adaptation profile is a fit to foraging behavior.

Table 14.9. Whipple's tool manufacturing technology settlement pattern adaptation characterization

Point manufacturing and maintenance models	Point/tool manufacturing profile derived from the sum of various model characteristics (forager profile)	Particular Whipple Loci assemblage indicators in comparison to profile (forager profile)
• **Weapons maintainable** • **Time minimization** • **Make and mend** • **Tools used to exhaustion** • **Less attention to hafting.** **(From Bleed 1986; Bousman 1994; Torrence 1983; Kuhn 1989; and Nelson 1991)**	13. More extensive reworking. 14. Lower craftsmanship 15. Less energy investment 16. Informal technological 17. Less grinding reflects less attention to hafting. 18. Max. dimension - Smaller 19. Basal width - Smaller 20. Maximum width - Smaller 21. Maximum thickness - Thinner 22. Concavity depth 23. Edge grinding index - Less 24. Weight – lighter	• One clear evidence of reworking. Reworking evident in scraper technology. • Less thorough grinding reflects less attention to point hafting – less energy investment, fewer specialized tools/types. • Projectile points show un-patterned flaking pattern correlating with reduced craftsmanship and less energy investment • All point dimensions, widths, weight, thickness, and basal features are minimums indicating manufacture and maintenance was designed for flexibility and high mobility. • Comparisons indicate forager as opposed to sedentary profile for Whipple's inhabitants.

14.4.2 Whipple's landscape use patterning and domestic activities

14.4.2.1 Whipple's *activity use patterning from attribute clusters (groups).*

Whipple's landscape usage and activities patterning based on the previously introduced attribute cluster or group model is compiled in attribute Table 14.10. The table presents the data for all three defined site loci (A, B, and C). The tool range for each locus, i.e., the quantity of varying tool forms, projectile points, the presence or absence of channel flakes, modified or retouched flakes, debitage assemblage, and classifying features typically indicates a Paleoamerican habitation usage (Gramly and Funk 1990; Spiess et al. 1998). A habitation campsite/locus is defined as a place with multiple activity areas and where a variety of daily maintenance activities took place (Andrefsky 2005 201:223, Chatters 1987:363-366; Gramly and Funk 1990:14; Kvamme 1988:387-393; Kooyman 2000:129-133; Nelson 1991:78-86; Odell 2003:188-202).

Further, this assemblage is indicative of a tool kit employable in several differing habitation subsistence tasks such as resource preparation, processing and tool making. However, there are several elements in the Whipple site assemblage missing or unreported in the published documentation for the site. For example, there is no reporting on the number of channel flakes found, distribution by size of the debitage assemblage other than the aggregated total, and the presence, absence or quantity of cores. In Locus A, analyzed earlier, the Kings Road-Whipple points suggest an early Paleoamerican occupation that occurred sometime during the chronological range of 12,900 to 12,500 cal yr BP. The morphology of this point type exhibits fluting on both sides of the tool. With the large quantity of debitage (30,000 pieces), 12 bifaces, and 11 preforms, it might be expected that the main activity that occurred at this locus was tool making. However, there is no reporting of channel flakes in this locus.

While the data presented in Whipple's attribute cluster for Locus A indicates a habitation area, where the toolkit was generally employed in a somewhat broader range of economic subsistence tasks as opposed to a single processing task, with the additional data it would be a stronger argument.

Table 14.10. Whipple site usage attribute cluster characterization model

I. Attribute groups	Locus A	Locus B	Locus C
Toolkit artifact types			
• **Projectile points and point fragments and fluted Bifaces / Biface fragments**	12	3	3
• **Preforms**	11	1	2
• **Fluted drill**	1	0	0
• **Channel flakes unspecified**	?	?	?
• **Cores and core fragments unspecified**	?	?	?
• **Retouched flake and Utilized waste flake**	10	12	4
• **End scraper and Side scraper**	9	18	19
• **Wedges**	2	0	0
• **Chopper**	1	0	0
Number of tools in assemblage	44	34	36
II. Classifying features			
Aggregate/individual debitage classification			
• **First stage reduction, nodules, cores, and large flakes**	?	?	?
• **Reduction flakes greater than 8g**	?	?	?
• **Reduction flakes – small < 8g**	30,000	2,000	6,000
Tool index: Range, variety, and quantity of tool types	301	215	170
Material type sources	7		
• **Primary & secondary source of lithic tool making material – local or exotic/remote**	Hathaway, Cheshire, and Munsungun remote	Hathaway, Cheshire, and Munsungun remote	Hathaway, Cheshire, and Munsungun remote
Dimensions of Locus area m² (excavated not encompassed)	66	26	36
Number of artifact/activity concentrations per locus	1	1	1
Artifact and density –artifacts/ m²	4546	78	168
Tool artifact and density – tools/ m²	.67	1.31	1
Distance relationship between locus area clusters in meters	7	5	5
Site features and organics	Hearth, bone, debitage, charcoal.	No	Hearth, bone, debitage, charcoal
Knapping episodes – both tools and debitage co-located	Yes	Yes	Yes
Geological and geographic characterization	Sandy glacial till	Sandy glacial till	Sandy glacial till

Locus B was deemed to be a processing area, because of the large number of scrapers and flake tools present in the toolkit, where scraping activities are presumed to have been dominant. There is no data in the cluster to indicate what was being processed at this locus, i.e., hides, woodworking, or some other material. Again, as was the case with the toolkit assemblage, the data was unpublished or missing.

Locus C's activity area characteristics may also be categorized as a processing locus. Because of the close association of burned bone fragments and the number of scrapers, it may be suggested that the tool use was related to the processing of fauna. It could also be hypothesized that Locus C was a habitation locus based on a somewhat similar tool distribution even though the biface, preform, and debitage quantities were significantly lower, and the number of scrapers was greater than in Locus A that was classified as a habitation locus. However, from the model, what these differences in biface, preform, scraper, and debitage counts only indicated was that there were different activities performed at Loci A and C.

14.4.2.2 Whipple's landscape usage and activities from graphical attribute cluster presentation

Figure's 14.2, 14.3, and 14.4 present the Whipple site's loci usage and activities from a graphical attribute cluster perspective. Figure 14.2, Locus A's activity use patterning cluster diagram, exhibits some of the predicted habitation site attributes, i.e., higher tool index, a range of tool types used in differing habitation subsistence tasks, and a higher volume of reduction flakes distributed over a larger area. Habitation loci exhibiting the characteristics enumerated above display a significantly different profile than processing/ workshop loci representing locations of specialized task execution.

As observed earlier, data concerning toolkit assemblage items such as channel flakes, cores, and flake size differentiation were not recorded in the published site information and therefore were not available to include in Locus A's domestic activity use patterning diagram. By way of an example, if the data were available concerning the existence and number of channel flakes and cores included in locus A's tool manufacturing activities, the diagram would more closely resemble that of a habitation locus described in the model and those found at the Potter site.

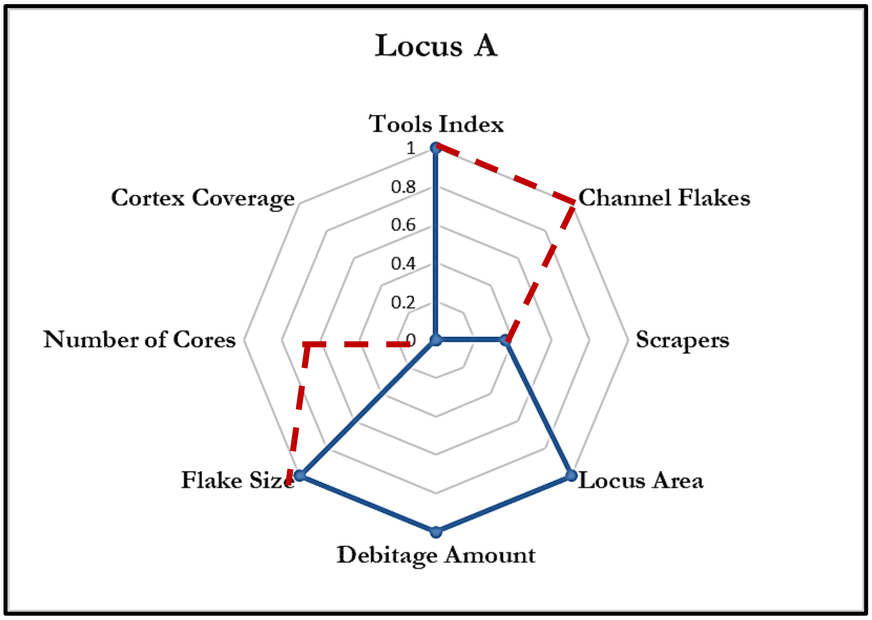


Figure 14.2. Whipple Locus A domestic activity use patterning cluster diagram.

Graphically, this hypothesized added information is illustrated by the addition of the red dashed lines in Figure 14.2. As can be seen through these additions, Locus A would be seen as a place with multiple activity areas and where a variety of daily maintenance activities took place, i.e., a habitation campsite/locus.

From the data available for Locus B, it's activity use patterning cluster Figure 14.3 would indicate that it represented a processing area. The indications from the diagram showed a significantly greater number of scrapers, a low number of debitage flakes, lack of cores and channel flakes (not identified in the literature but perhaps absent) and a smaller activity area. Locus B has a tool index that is lower than Locus A's.

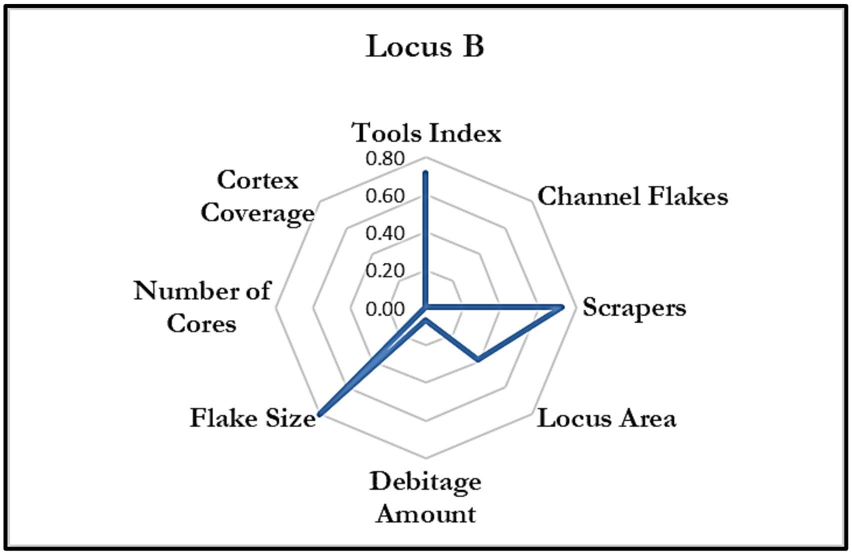


Figure 14.3. Whipple Locus B domestic activity uses patterning cluster diagram.

Again, as was the case for locus B, from the data available for Locus C (Figure 14.4), it's activity use patterning cluster indicates that it also represents a processing area. The indications from the diagram showed a significantly higher number of a single tool type, i.e., scrapers, lower number of flakes, absence of cores, channel flakes, and a smaller activity area.

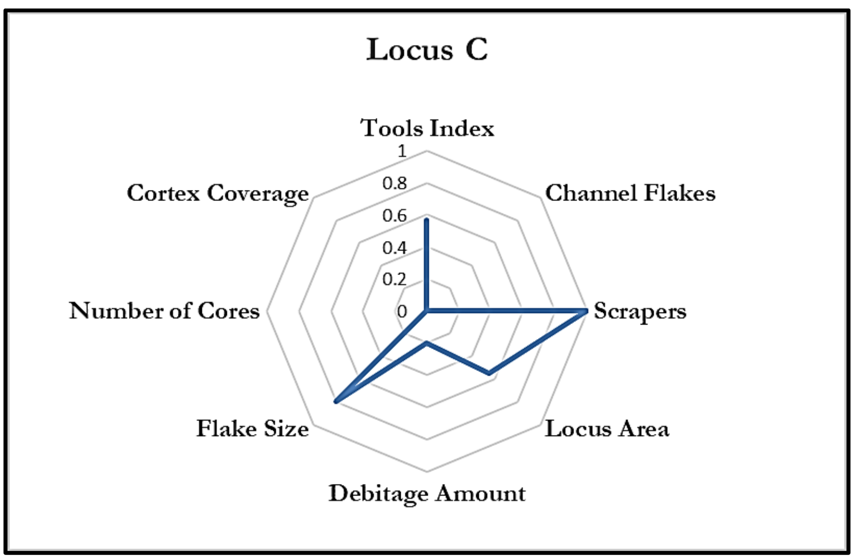


Figure 14.4 Whipple Locus C domestic activity use patterning cluster diagram.

14.4.2.3 Microwear analysis method of landscape activities and loci usage

No microwear analysis was performed at this site.

14.4.2.4 Whipple's landscape use patterning and domestic activities (Curran 1984 activity area concentrations)

Curran (1984) provided an analysis of locus activity area characterization in her discussion of the Whipple site. In it is she suggested that Locus A's occupation duration was relatively short and that the intensity of the activity there was rather low. Further, she defined Locus A as a campsite or habitation area where a variety of daily maintenance activities took place (Wilmsen 1968 type II categorization in Curran 1984). Also, because the locus had a moderately diverse tool assemblage and a large debitage count (30,000 pieces), its emphasis was on stone tool manufacturing.

Locus B, because of its large number of scrapers and flake tools, was deemed to be a processing area where scraping activities were presumed to have been dominant (Curran 1984). No comment was given as to what was being processed at this locus (hides, woodworking or something other).

Curran's (1984) activity area characteristics also categorized Locus C as a processing locus. Because of the close association of burned bone fragments and the number of scrapers, Curran (1984) suggested that tool use was related to the processing of fauna as represented from the bones identified. Curran (1984) also hypothesized that Locus C was a habitation locus based on a somewhat similar tool distribution as that of Locus A. She made this hypothesis regarding Locus C even though the biface, preform, and debitage quantities were significantly lower, and the number of scrapers was substantially higher than in Locus A. However, what these differences in biface, preform, scraper, and debitage counts only indicated was that there were different activities performed at Loci A and C.

To validate Whipple's locus activity area characteristics, an analysis, shown below in Table 11.23, was performed to measure both the diversity and evenness of the sites tool artifact assemblage. The diversity measurement is based on the Shannon-Weaver information theory equation (14.1) that evaluates each locus' tool assemblage breadth. The larger the diversity or entropy number indicates an extensive and broader variety of tools as might be found in habitation sites. The smaller the diversity or entropy number signifies a narrower range of tools as might be found in a processing site.

Equation 14.1 $\quad \text{Diversity} = \sum_{i}^{n} p_i \log(p_i)$

Table 14.11. Diversity and evenness validation of Whipple's locus activity area characterization

Locus	Diversity or Entropy	Locus	Evenness or Equitability
Locus A	.72735	**Locus A**	.86067
Locus B	.49327	**Locus B**	.70571
Locus C	.54187	**Locus C**	.73287

From the values of diversity indicated in Table 14.11, Locus A's value suggests a broader range of tool types then Locus B or C. The broader tool range is indicative of a site usage as a habitation locus. The diversity values for Locus B and C are quite similar and driven by a smaller assortment of tool types and a significant number of scrapers or singular tool type, thus indicating use as some type of processing locus (Curran 1984).

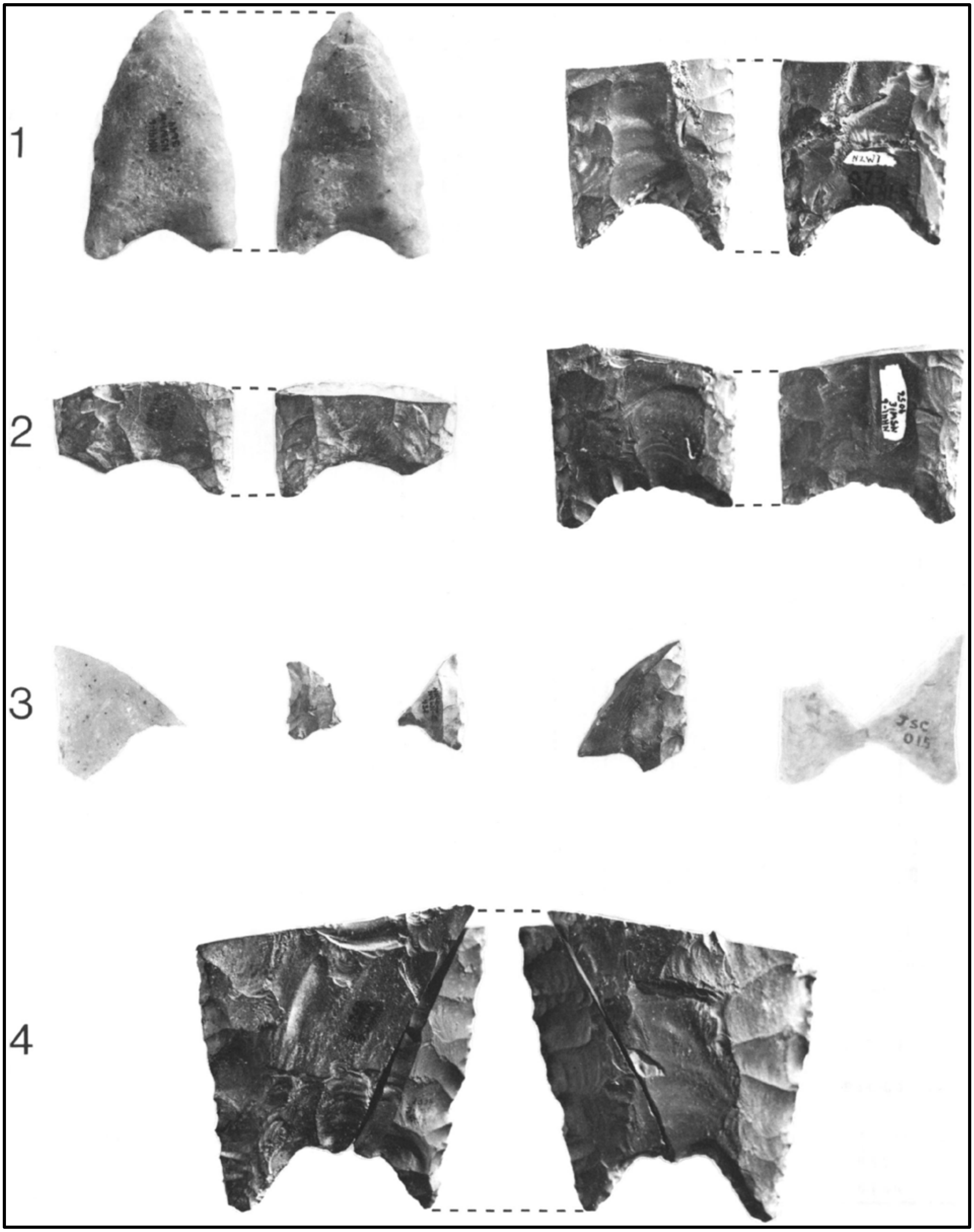


Figure 14.5. Whipple Site fluted projectile points. Reworked complete point (row 1, left), fluted projectile point basal fragments (row 1, right; rows 2 and 3) and large late-stage projectile point preform base (row 4). (From Curran 1984:34, PLATE 1.)

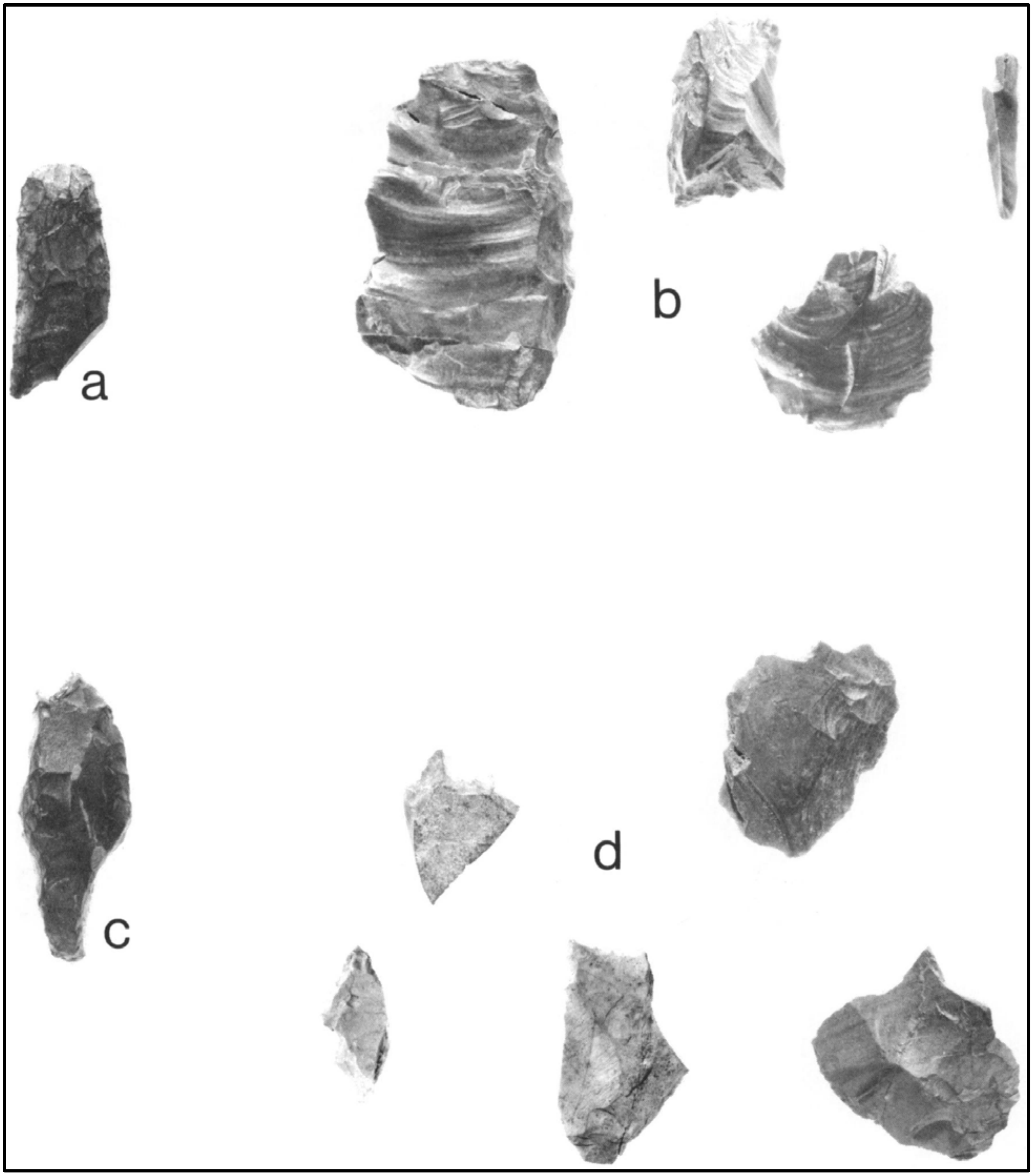


Figure 14.6. Fluted bifacial drill (incomplete; a), wedges (*pièces esquillées*) and fragments (b), flake shaver (c) and gravers (d), Whipple Site. (From Curran 1984:38, PLATE 5.)

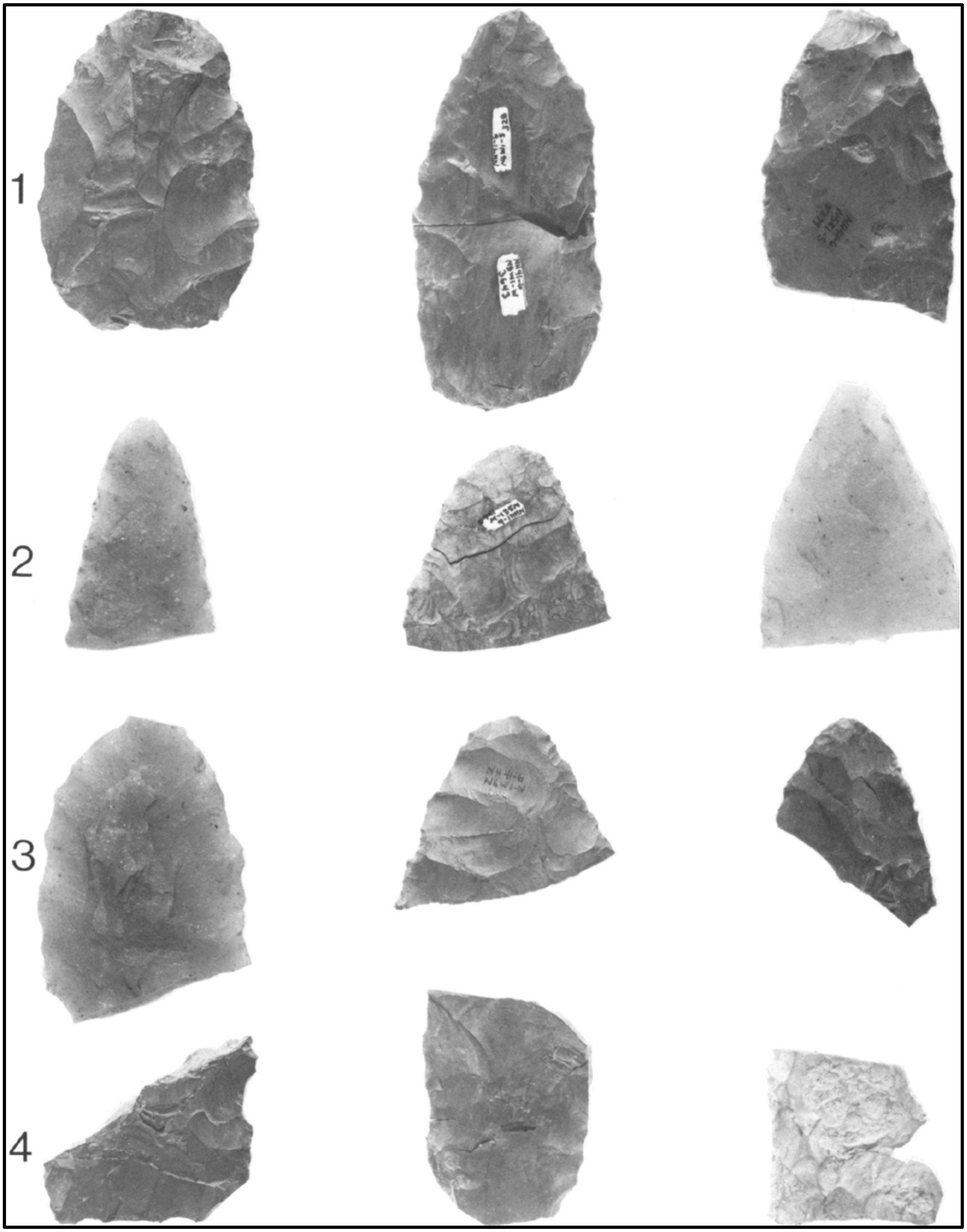


Figure 14.7. Projectile point preforms (row 1, left and center) and fragments (row 1, right; rows 2-4), Whipple Site. (From Curran 1984:35, PLATE 2.)

14.5 Technological organization and cultural horizon

The Bull Brook site's technological organization of stone tool production and reduction sequence elements are based on a tool blank, biface preform, fluted point, core, and flake reduction tradition. As anticipated for NEM Paleoamerican sites, no blade production technology was identified in the assemblage (Lothrop et al. 2016). As was the case in the Potter site analysis, the fluted point technology places the Bull Brook site's occupation date somewhere during the Paleoamerican horizon from 12,900 to 10,800 cal BP (Bradley et al. 2008).

Analysis of Bull Brook's artifact assemblage enumerated in Table 14.12, indicating the presence or absence of particular diagnostic traits, provides evidence of a correlation with the diagnostic attributes for the New England Maritimes Paleoamerican horizon (Gramly and Funk 1990; Lothrop et al. 2016; Spiess et al. 1998).

Table 14.12. NEM Paleoamerican lithic tool diagnostic traits for the Bull Brook site

Diagnostic Trait	Presence/ Absence	Artifact examples
Projectile point/knife fluting on both faces from carefully prepared platforms. (Early and mid-Paleo horizon)	P	See Figure 10.25, Chapter X.
Channel flakes found in tool manufacturing artifacts and debris. (Early and mid-Paleo horizon)	P	
Preform thinning by medial percussion flaking.	P	
Points received no additional thinning after fluting. (Early and mid-Paleo horizon)	P	
Lateral grinding evident from midsection to basal ears.	P	
Basal grinding common.	P	
Late Paleo horizon points are basally thinned but not fluted.	A	
High-quality lithic material	P	Munsungun, Normanskill chert, Hadyston Jasper, and NH. Rhyolites. All remote sources
Spurred end scrapers	P	Figure 10.25

Further refining of Bull Brook's positioning in the Paleoamerican horizon, it is observed that the use of projectile point fluting as opposed basal thinning places the locus in the early to the mid-Paleoamerican horizon 12,900 to 11,600 cal BP (Bradley et al. 2008).

14.6 Temporal aspects of site habitation

14.6.1 Occupation date range

In Bull Brook's excavation assemblage, 54 complete diagnostic projectile points, 42 fluted bases, and 186 fragments or preforms were identified. Figure 10.2.5 displays a range of the Bull Brook diagnostic artifacts including one of the representative fluted projectile points. From the morphologically based typology (Bradley et al. 2008:136-141), the points were identified as a Bull Brook-West Athens Hill modal point form. Bull Brook-West Athens Hill points indicate an early Paleoamerican occupation that occurred sometime during the chronological range of 12,900 to 12,400 cal yr BP.

14.6.2 Occupation duration

14.6.2.1 Occupation duration: occupation span index method

Values for Surovell's (2009) quantitative model for occupation span index by proxy variables cannot be computed because the model requires numerical quantities for both local and remote material sources in the artifact assemblage. The material composition of the Bull Brook site artifact assemblage was made up of Munsungun chert, Normanskill chert, Hadyston Jasper, and New Hampshire rhyolites (Robinson et al. 2009). The majority of Bull Brook's lithic artifacts come from at least 250 km away (Robinson et al. 2009). As is apparent from these distances, none of the material sources in the Bull Brook assemblage can be considered to be local. Therefore, Surovell's (2009) model for calculating occupation span is not applicable.

14.6.2.2 Occupation duration from revised ring model correlation method

Analyzing Bull Brook's length of occupation using Whitelaw's (1983) exponential variation of Yellen's (1977) ring model, yields a calculated 65 days of occupation duration based on an excavated area of 7854 m^2 for all 36 loci (Curran 1984:40 Table 2). Since there was no published data available on actual area sizes for each of 36 Loci at Bull Brook, an assumption was made for calculation purposes that an area of 218 m^2 (7854 m^2 / 36 loci = 218 m^2) would be used for each locus. Application of the exponential model, as discussed in Chapter V, was most appropriate for larger site areas (approximate implied value: areas greater than 80 m^2. Whitelaw 1983:56-57). The results of the original Yellen (1977) linear form which is more applicable to the smaller area loci are included for comparison purposes. The base b equals 1.2. The equations, one and two, recorded below for the number of occupation days are expressed in the exponential and linear forms.

1. Exponential form Number of occupation days (NOD) = $1.87 * b^{.1*(218)} = 99$
2. Linear form. Number of occupation days (NOD) = $.1*(218) + 1.87 = 23$

As will be discussed further on, Bull Brook's seasonal round occupation was analyzed by Robinson et al. (2009) to have been a late fall through winter residence. The calculated values of two to three months stay at the site approximates Robinson et al.'s (2009) conclusions.

14.6.2.3 Occupation duration: tool loss method

Approaching the Bull Brook site's length of occupation from a tool loss calculation using Mc Ghee's (1979) and Spiess' (1984) model for all site loci, yields a person day occupation duration of 13,037 to 15,750 days. This calculation is based on one tool lost per 2.5 to 3 days per person (Mc Ghee 1979; Spiess 1984). The total of Bull Brook's loci tool assemblages consists of 5215 pieces. For an extended family or multifamily group band size of 20 individuals per lodging structure or tent, would indicate a range of 108 to 131 days of site habitation duration. The number of habitation loci at Bull Brook was estimated to be six (Gramly 2010:5, Robinson et al. 2009:429-430). Occupation duration statistics and calculations for the Bull Brook's sites loci are presented in Table 14.13. Results from the application of this model indicate that an occupation duration that ranged from 108 to 131 days would be considered as a medium-term occupation.

Table 14.13. Occupation duration by locus from the Mc Ghee's (1979) and Spiess' (1984) model

Locus	Number of tools	Person-days	Multifamily lodge group occupation duration
6 habitation loci	5215	13,037-15,750	108 to 131 days

14.6.2.4 Occupation duration summary

Of the models employed to estimate Bull Brook's loci occupation span, the revised exponential ring model correlation method, and tool loss per person day, yield indications of a medium-term occupation for the site that extended in the neighborhood of two to three months plus in length.

14.6.3 Distinguishing reoccupation - instances of single or multiple occupations

Addressing the issue of whether Bull Brook's loci were a single or multiple occupation locations, three models are employed, i.e., the stratigraphic distribution of artifacts, the density of assemblage per unit area, and, a regression correlation model.

14.6.3.1 Artifact distribution stratigraphy model

Results from the excavation of the loci identified at the site (36 loci) did not indicate any significant variation by vertical stratigraphic differentiation or distribution by artifact or material type. However, there was horizontal differentiation in the toolkits found between loci located inside and outside of the site ring structure. Loci situated within the ring indicated a higher density of projectile points, bifaces, channel flakes, and preforms. Loci on the outside of the ring structure assemblage contained a higher quantity of end scrapers, gravers, side scrapers, and wedges. The two sets of loci from the outer and inner ring provided a large sample of artifacts that indicated a difference in loci activities dependent on the positioning.

There were multiple intersite refits found thus demonstrating the contemporaneous occupation of the site loci. The principal excavators of the site, Byers, Eldridge and Vacarro brothers (Robinson et al. 2009) speculated that the individual loci had not been reoccupied. However, it was unclear what the period was between any locus occupation due to differing potential arrival times of the participants on site for the communal event. It was hypothesized that on a site basis, Bull Brook had not been reoccupied. It is unknown nor is there any evidence that one or more of the sites' loci were reoccupied after the communal hunt event.

14.6.3.2 Heuristic density of artifact and material type sourcing location model

Reoccupied sites may be characterized by high artifact densities coupled with relatively lower frequencies of local raw materials and debitage (Spiess et al. 1998; Gramly and Funk 1990). As described above, the material composition of the Bull Brook site artifact assemblage was all from distant remote sources. The sites' loci artifact density per m^2 is considered to be moderate to high in addition to a high density of remote cherts. By these two measures indications, i.e., high artifact density and high debitage count, Bull Brook did not show evidence of reoccupation on a site basis during the Paleoamerican horizon.

14.6.3.3 Regression correlation reoccupation model

Surovell's (2009) regression analysis relationship between the Bull Brook site loci in terms of occupation span and occupation density does not show a correlation of OSI and artifact density. To develop an occupation span index value, there must be both a local and remote material source. As previously discussed, all materials in the site's artifact assemblage are from remote locations. Therefore, Surovell's (2009) regression analysis model is not applicable.

14.6.3.4 Distinguishing reoccupation summary.

Two of the models applied to evaluate Bull Brook's reoccupation status in addition to the number of tool refits between loci indicate that it was not reoccupied on a site basis on more than one occasion. The models that provided this indication were the artifact distribution stratigraphy model and the heuristic density of artifact and material type sourcing location model.

14.7 Mobility patterns and seasonality inferences

14.7.1 Indications of mobility/sedentism

The Bull Brook site's mobility/sedentism indications based on the site's flaked stone tool assemblage is summarized in Table 14.14. Bull Brook's tool assemblage contains 54 Projectile points, 42 fluted bases, 186 fragments or preforms, 1463 Scrapers, 414 pièces esquillées, 69 drills, and 126 flake shavers. Analysis using the diagnostic models discussed (Kelly and Todd 1988; Meltzer 2003; Bleed 1986; Bousman 1994; Kuhn 1994), points toward an assemblage that is indicative of a flexible, portable toolkit. However, two additional factors enter into the Bull Brook mobility discussion. First of all, there was a somewhat larger number of specialized tool types in the Bull Brook tool assemblage, i.e., pièces esquillées, flake shavers, gravers, and drills, than in the Potter, Vail, Tenants Swamp and Whipple site assemblages (flake shavers, and smaller numbers of gravers). Eight tool types make up the Bull Brook assemblage versus five to six types in the other comparison sites potentially indicating a slightly more sedentary occupation. The other factor to take into consideration is the longer habitation span of the site and its constituent loci (greater than 90 days). Taking these factors into account, it is suggested that the inhabitants of Bull Brook were an aggregation of mobile foragers that spent an extended time period (fall-winter) engaged in a communal hunt. Further discussion of this suggested mobility pattern will be considered further on in the Bull Brook site usage section.

Table 14.14. Mobility/sedentism indications based on site artifact tool assemblage.

Model and Diagnostic Traits	Lithic Evidence	Comments
Function of: **11. Flexible, portable tools. High residential mobility has flexible, highly portable tools.**	Numerous modified/retouched Flakes 282 Bifaces 186 fragments/preforms	18 modified/retouched expedient flake tools and eight bifaces indicative of flexible, portable tools.
12. Specialized tools. Decreasing residential mobility should have more specialized tools with less need for portability.	54 Projectile points 42 fluted bases, 186 fragments or preforms, 1463 Scrapers, 414 pièces esquillées 69 drills, 126 flake shavers 189 gravers	Projectile points/knife, expedient flake tools, and scrapers standard elements of the toolkit. Four specialized tool type, i.e., 414 pièces esquillées, 126 flake shavers, 189 gravers, and 69 drills.
13. Tool diversity. High residential mobility has relatively few tool types serving multiple functions. The number of moves per year negatively correlated with tool diversity.	8 Tool types (Bifaces, projectile point/knives, scrapers, retouched waste flakes, pièces esquillées, flake shavers, gravers, and drills.) .	Higher number of specialized tools than reported at Potter, Vail, Tennent Swamp, and Whipple. However, few tool types are serving multiple functions – indicative of moderate residential mobility.
14. Low core/biface ratios are often linked to high mobility. **15. High ratios linked to more sedentary lifestyles.**	0 Core reported 282 Bifaces	Not calculable

Each of the toolkit characterization models, i.e., flexible multiple portable tools, number of specialized tools, and the range of tool diversity, indicates that the inhabitants of Bull Brook were a moderately mobile as opposed to a sedentary population.

14.7.2 Mobility/sedentism based on reduction stage location distribution of debitage.

No description of the Bull Brook site's debitage distribution by dimensions or weight as a proxy for size was documented in the published literature for the site. What was provided was the cumulative amounts of debitage per site and loci. The total site debitage assemblage contained 36,475 pieces. As stated earlier, there was no lithic material from local sources in the artifact assemblage. As documented previously, the material composition of the Bull Brook site artifact assemblage was made up of Munsungun chert, Normanskill chert, Hadyston Jasper, and New Hampshire rhyolites (Robinson et al. 2009). The greater part greater part of Bull Brook's lithic sources come from at least 250 km away (Robinson et al. 2009). From an assemblage composition of 282 bifaces and preforms it is more than likely that the early stages of reduction were done at the quarry sites. Therefore, from the assumptions above it would be expected that all stages, initial, further and late, were not present in the assemblage. Bull Brook's debitage distribution would appear to be from medium and smaller later stage reduction shaping, reworking or sharpening events thus indicating a mobile population land-use.

14.7.3 Territorial round mobility geography and seasonality

Four models whose functioning and assumptions were detailed earlier, i.e., Burke et al.'s (2004), Curran and Grimes (1989), Rockwell's (2012), and Primary prey and vegetational reconstruction model are employed to attempt to define the territorial round geography and seasonality of the hunter-gatherers that occupied Bull Brook.

14.7.3.1 Burke et al.'s model for determination of NEM Paleoamerican territorial round range

As previously determined from the morphology/typology of assemblage fluted points, Bull Brook was occupied sometime during the Bull Brook early Paleoamerican sub horizon (12,900 to 12,500 cal yr BP). As proposed by Robinson et al. (2009) and discussed further on under the site usage section, Bull Brook was occupied as a single communal caribou hunting event involving multiple extended family bands.

From the diversity of the material sources identified at the site, it would be doubtful that the seasonal round that extended from Munsungun Maine to the Jasper chert sites in Pennsylvania would have been attempted in one season. It is more likely that there were at least two or more bands that participated in the communal hunt aggregation at Bull Brook. During this time horizon, the Burke et al. (2004) model hypothesizes that based on materials found at sites occupied during this period that two possible band ranges could be identified.

Applying the Burke et al. (2004) model, two alternatives are suggested. In alternative I the northerly route, (solid red oval) ranged from Lake Munsungun (9) (summer) to Michaud, to Pt Sebago (late summer-fall), to Bull Brook (fall-winter), on to New Hampshire rhyolite material sources (10) (spring), followed by a return to Munsungun (9) (summer). As another northerly route alternative, the transit from Munsungun to Bull Brook may have extended eastward toward and along the east coast as well.

The proposed alternative for a second band route (II), shown by the northeast to southwest red oval in Figure 14.8, ranges from Bull Brook to include material acquisition from the Normanskill/Hudson Valley chert (11) and Pennsylvania Jasper sources (12) (southerly route).

Table 14.15 provides the percentage of Munsungun chert source material found at each of the known sites. Presence of the Munsungun chert indicates the potential validity of the northern circuit. If none of this source chert was found in each of the site assemblages, it would be questionable if that site was on the territorial round route.

Table 14.15. Percentage of Munsungun chert in the assemblage of territorial round sites

Territorial round mobility range sites with Munsungun source	Percentage of Munsungun chert in the artifact assemblage
Munsungun	97
Searsmount	28
Michaud	62
Pt Sebago	93
Bull Brook	77
Vail	.25
Bull Brook	58
Megantic	45/23

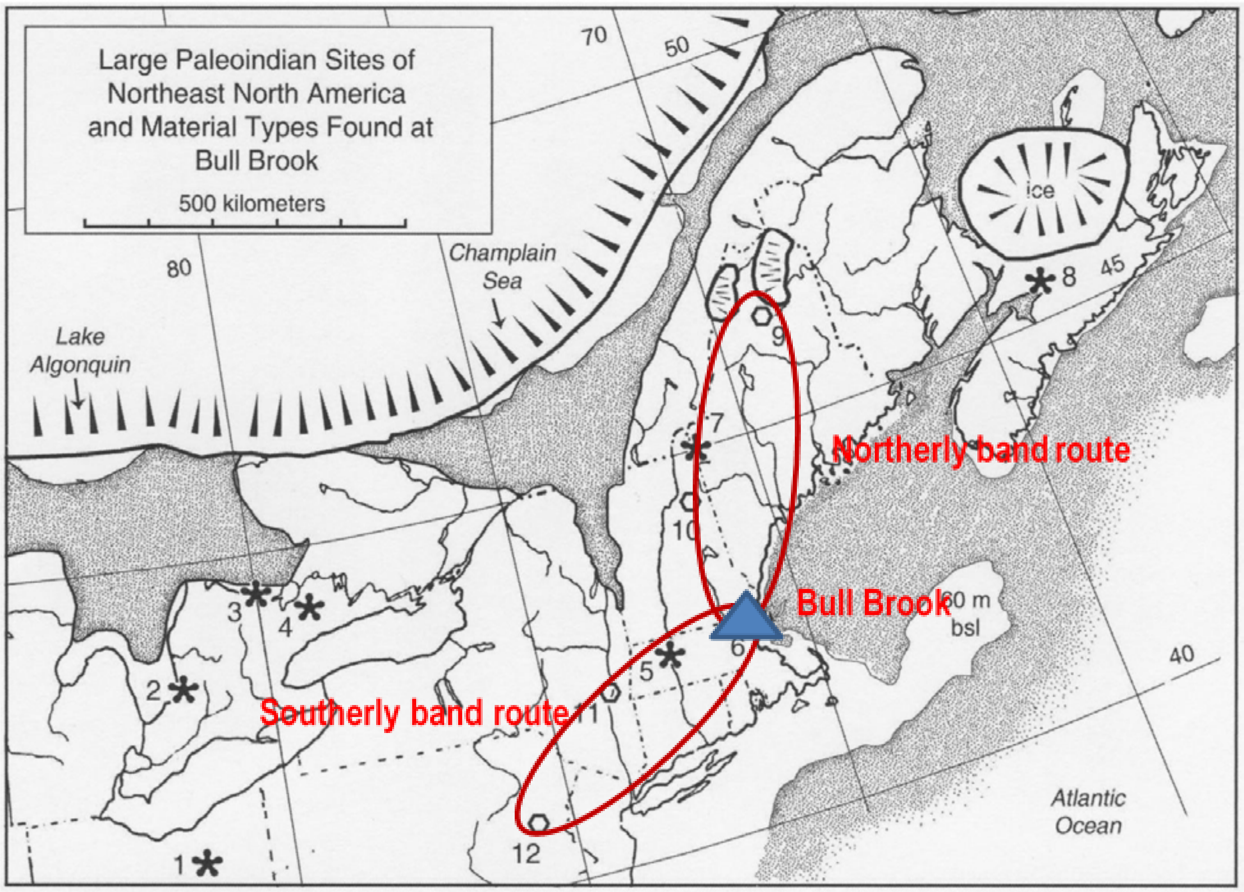


Figure 14.8. Map of Northeast North America showing major glacial features from 11,500 to 10,500 radiocarbon years B.P., with locations of "large" Paleoamerican sites (stars) and main lithic sources (hexagons) found at the Bull Brook site. Sites: (1) Nobles Pond, (2) Parkhill, (3) Fisher, (4) Udora, (5) Dedic/Sugarloaf, (6) Bull Brook, (7) Vail, (8) Debert. Lithic sources: (9) Munsungun Chert, (10) New Hampshire spherulitic rhyolite, (11) Normanskill/Hudson Valley Chert, (12) Pennsylvania Jasper. The first Possible band seasonal route that includes material acquisition from Munsungun (9) and New Hampshire rhyolite sources (10) from the north is the northerly route oval. The 2nd possible band route that includes material acquisition from the Normanskill/Hudson Valley chert (11) and Pennsylvania Jasper sources (12) is the southerly route oval. The blue triangle marks the location of the Bull Brook aggregation site. (Adapted from Robertson et al. 2009:426 Figure 2.)

14.7.3.2 Curran and Grimes model for determination of NEM Paleoamerican territorial round range

The Curran and Grimes (1989) model represent the expected distribution of material types by percent to be found in NEM site's artifact assemblages by season. As predicted from the Curran and Grimes (1989) model, it would be expected that during the Bull Brook-West Athens Hill early sub-horizon, that Bull Brook was occupied by a band as a fall to wintering site (North to South to North) with a northern summer embedded chert material acquisition at Munsungun. At the same time, at this proposed single occupation aggregation site, another band traveled from the southwest to the northeast with material from the Normanskill/Hudson Valley and Pennsylvania Jasper sources. The two or more bands then occupied Bull Brook as a communal hunting aggregation site.

14.7.3.3 Rockwell model for determination of NEM Paleoamerican territorial round range

As indicated in Table 14.16, the seasonality tool kit and occupation span indicators model, occupations containing large numbers of tools related to butchery and hide working in addition to organic material processing such as wood, likely represent late summer or early fall occupations.

Table 14.16. Rockwell model seasonality tool kit and occupation span indicators

Season	Tool Kit and Occupation Span Indicators	Bull Brook's Toolkit & Occupation Span
Winter to early spring	• A wide diversity of activities, a wide range of tool types. • Sites occupied for an extended period and located near lithic quarries.	
Late spring and early summer	• Evidence of regular moves and short occupations. • Few activities are occurring at each site, tool type range limited. • Likely a mixture of residential and logistical sites represented.	• Occupation span estimate: 90 plus days • Flexible, portable tools. Limited tool types are serving multiple functions indicative of high residential mobility. • Toolkit related to residence, tool production/maintenance, woodworking, butchery and hide working, (Projectile points, Scrapers, tools, 1 Modified/ Retouched Flakes.)
Late summer and early fall and possibly to late fall	• Occupations contain large numbers of tools related to butchery and hide working. • Occupations likely to be short to medium in length as fall caribou hides and meat are at their prime.	• 54 Projectile points • 42 fluted bases, 186 fragments or preforms, • 1463 Scrapers, • 414 pièces esquillées, 69 drills, • 126 flake shavers • 189 gravers 90 plus days loci occupation durations. Medium occupation duration.

The occupations would be short to medium in length when fall caribou hides and meat are at their prime. Bull Brook's artifact assemblage seasonality parameters support the Rockwell (2014) model and suggest that occupation occurred in the late summer and early fall.

14.7.3.4 Primary prey and vegetational reconstruction model for determination of NEM Paleoamerican territorial round range

As noted earlier, at 12,500 cal yr BP, Maine and southern Québec including southerly extensions at higher altitudes were tundra covered. South-central Maine, southern New Hampshire, and Massachusetts were covered by a poplar-spruce-fir forest in addition to hardwoods such as oak and maple in southern New Hampshire and Massachusetts (Newby et al. 2005). As observed in the territorial round mobility and seasonality discussion, one of the potential return routes from Munsungun to Bull Brook followed a coastal path. From faunal remains at sites along this coastal path, caribou herds also use this route (Spiess et al. 1984).

It could be expected that caribou, traveling between northern calving and southerly wintering grounds, would have wintered 10 to 50 km south of the forest boundary in south-central Maine, southern New Hampshire, and northern coastal Massachusetts (Newby et al. 2005; Spiess 1984). This range of migratory caribou movements corresponds to the circuit from Lake Munsungun and return along the coast as described in the Burke model. Robinson et al. (2009) hypothesized that the Bull Brook site was situated in a coastal microenvironment. Robinson et al. (2009) further suggested there was a "now submerged maritime island just east of Bull Brook that may have provided both large numbers of caribou and a highly predictable intercept point in an unusual coastal microenvironment toward the southern end of the caribou range" (Pelletier and Robinson 2005). Additionally, it was observed that Bull Brook lay some 300 km south of the parkland/tundra border and that this was within the range of long-distance or barren ground caribou migration (Spiess 1984:281). However, complicating the primary prey discussion is that Bull Brook, as noted, is positioned in the forest boundary where it is also expected that Woodland caribou in addition to the barren ground variety could have been found. It is unclear which type of primary prey, i.e., barren ground or woodland variety of caribou, or both, was being pursued in the communal hunt.

14.8 Settlement pattern adaptations and site/loci domestic activity land-use

14.8.1 Settlement pattern adaptations: indications of forager/collector land use strategy

Bull Brook's settlement pattern traits indicate a forager adaptation aggregation for purposes of a communal hunt. This assessment is based on the details of the diagnostic traits outlined in Table 14.17 with comparisons to Bull Brook's assemblage artifacts that exhibit these attributes.

Table 14.17. Bull Brook forager/collector settlement pattern adaptation characterization

Forager/Residential Mobility Tool Profile	Observations on Forager Profile	Bull Brook's assemblage
• **Flexible tool technology** • **Few specialized tools** • **Low tool diversity** • **Microware (Odell)** **(Chatters; Odell) No microwear analysis in published data**	1. High forager/residential mobility has flexible technology as each tool will serve multiple tasks. 2. Higher forager/residential mobility indicate less specialized tools and more need for toolkit portability. 3. Few tool types are serving multiple functions – indicative of high forager/residential mobility — the number of moves per year negatively correlated with tool diversity. 4. Individual tools show multiple wear traces as each tool serves several functions.	• 54 Projectile points • 42 fluted bases, 186 fragments or preforms, • 1463 Scrapers, • 414 pièces esquillées • 69 drills, • 126 flake shavers • 189 gravers • 8 Tool types (few but more than Potter, Vail, and Tennant Swamp.) • No microwear analysis found in published data.

The most noteworthy elements observed in the locus's tool assemblage that are characteristic of a forager's toolkit are flexible tool technology, few specialized tools, minimal tool diversity, maintainability, and make - mend technology (Bleed 1986; Bousman 1994; Torrence 1983; Kuhn 1989; and Nelson 1991).

Bull Brook's tool manufacturing technology settlement pattern adaptations (Table 14.18) indicates that projectile points and fragments were manufactured to minimum nominal dimensions. Nominal dimensions for NEM point types are found in Bradley et al. (2008:136-141). When compared to sedentary populations points, they are smaller, i.e., widths, weight, thickness, and basal features, indicating point manufacture and maintenance was designed for flexibility and high mobility.

Table 14.18. Bull Brook's tool manufacturing technology settlement pattern adaptation characterization

Point manufacturing and maintenance models	Point/tool manufacturing profile derived from the sum of various model characteristics (forager profile)	Particular Bull Brook assemblage indicators in comparison to profile (forager profile)
• **Weapons maintainable** • **Time minimization** • **Make and mend** • **Tools used to exhaustion** • **Less attention to hafting.** **(From Bleed 1986; Bousman 1994; Torrence 1983; Kuhn 1989; and Nelson 1991 models)**	1. More extensive reworking. 2. Lower craftsmanship 3. Less energy investment 4. Informal technological 5. Less grinding reflects less attention to hafting. 6. Max. dimension - Smaller 7. Basal width - Smaller 8. Maximum width - Smaller 9. Maximum thickness - Thinner 10. Concavity depth 11. Edge grinding index - Less 12. Weight – lighter	• Clear evidence of reworking. Reworking also evident in scraper technology. • Less thorough grinding reflects less attention to point hafting – less energy investment, fewer specialized tools/types. • Projectile points show un-patterned flaking pattern correlating with reduced craftsmanship and less energy investment • Point dimensions, widths, weight, thickness, and basal features are minimums indicating manufacture and maintenance was designed for flexibility and high mobility. • Comparisons indicate forager as opposed to sedentary profile for Bull Brook's inhabitants. However, site occupation considered medium in length (90 plus days)

Even though there were a minimal time and energy savings, an inspection of the point base fragments shows less thorough basal and edge grinding reflecting lesser attention to point hafting and less energy investment. Culturally identified point and point fragments do clearly show evidence of reworking. (See Figure 10.25, Chapter X). In sum, Bull Brook's site settlement pattern adaptation profile is a fit to foraging behavior even though it was an aggregation occupation for communal hunting.

14.8.2 Bull Brook's landscape use patterning and domestic activities

14.8.2.1 Bull Brook's activity use patterning from attribute clusters (groups).

Bull Brook's landscape usage and activities patterning based on the previously introduced attribute cluster or group model is compiled in attribute Table 14.19. The table presents the data for three defined site loci groupings (total site, interior loci, and exterior loci). This is the only loci grouping arrangement that was provided by Robinson et al. (2009) in the published literature for the Bull Brook site. Figure 14.9 displays the site's ring structure showing the biface group dominated interior loci and the end scraper dominated exterior loci.

From the attribute cluster Table (14.18) a few interesting observations that might provide insight into the activity patterning can be made. Those loci within the interior of the site ring structure contain nearly two times as many flake shavers, channel flakes, and fluted drills than loci outside the ring.

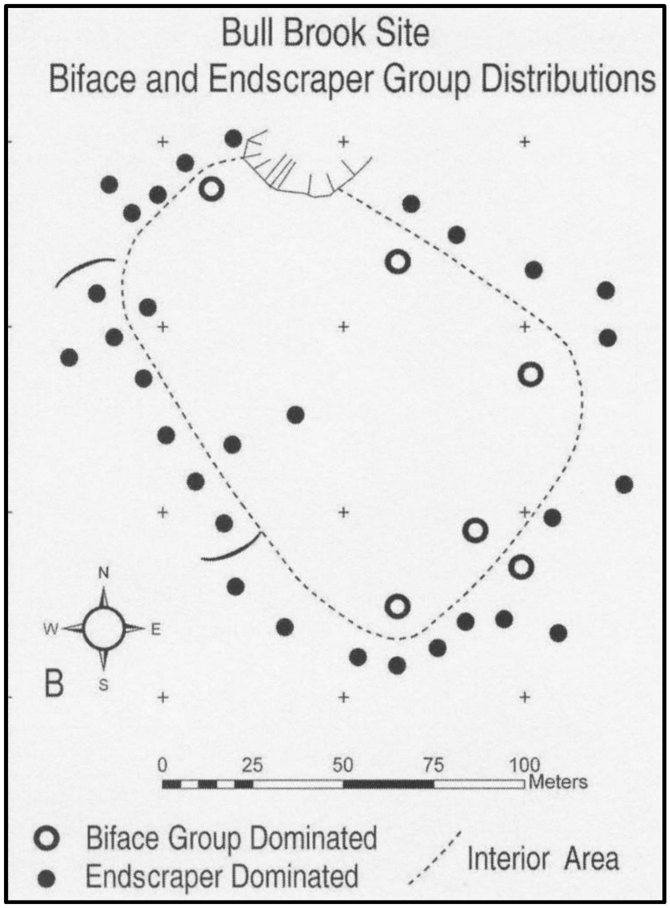


Figure 14.9. Revised Bull Brook site plan and the distribution of the biface-group and end scraper-dominated loci. (From Robinson et al. 2009:436 figure 6.)

The loci outside of the ring structure contain nearly three times as many wedges, gravers, end scrapers, and side scrapers. This suggests that the activities between these two groups of loci may have been different. Because of the greater number of channel flakes located within the interior loci, it might be speculated that these were tool-making activity areas. With the higher concentration of scrapers in the exterior loci, it also might be thought that this was a group of processing loci.

Table 14.19. Bull Brook site usage attribute cluster characterization model

I. Attribute groups	Total site	Interior loci	Exterior loci
Toolkit artifact types			
• **Projectile points and point fragments, fluted bifaces/biface fragments, and preforms**	282	127	155
• **Flake shavers**	126	81	45
• **Fluted drill**	69	48	21
• **Channel flakes**	122	103	19
• **Cores and core fragments unspecified**	?	?	?
• **Retouched flake and Utilized waste flake**	Numerous	Numerous	Numerous
• **End scraper**	1113	203	910
• **Side scraper**	350	93	257
• **Wedges**	414	75	339
• **Graver**	44	32	157
Number of tools in assemblage	2543	659	1884
II. Classifying features			
Aggregate/individual debitage classification			
• **First stage reduction, nodules, cores, and large flakes**	?	?	?
• **Reduction flakes greater than 8g**	?	?	?
• **Reduction flakes – small < 8g**	36,475	17,169	19,306
Tool index: Range, variety, and quantity of tool types	20,344	5,272	15,072
Material type sources	7		
• **Primary & secondary source of lithic tool making material – local or exotic/remote (All remote from the site)**	Munsungun, Normanskill, Hadyston, and NH. Rhyolites.	Munsungun, Normanskill, Hadyston, and NH. Rhyolites.	Munsungun, Normanskill, Hadyston, and NH. Rhyolites.
Dimensions of Locus area m² (excavated not encompassed)	18,333	49	49
Number of artifact/activity concentrations per locus	?	?	?
Artifact and density –artifacts/ m²	27	55.7	189
Tool artifact and density – tools/ m²	.67	2.05	2.27
Distance relationship between locus area clusters in meters	7	5	5
Site features and organics	Hearth, bone, charcoal.	Hearth, bone, charcoal No	Hearth, bone, charcoal
Knapping episodes – both tools and debitage co-located	Yes	Yes	Yes
Geological and geographic characterization	Sandy glacial till	Sandy glacial till	Sandy glacial till

The attribute cluster modeling of the interior and exterior loci toolkit configurations imparts some scant insight into what the activity patterning might have been at the site. However, what actually occurred at each of the 36 loci in terms of their use as a habitation, tool making, or processing loci is unknown, nor can it be predicted with any degree of confidence without the total data set.

14.8.2.2 Bull Brook's landscape usage and activities from graphical attribute cluster presentation

With the loci organized as exhibited in the attribute cluster table (14.9) no meaningful graphical representation of the landscape usage and loci activities can be performed without the total data set.

14.8.2.3 Microwear analysis method of landscape activities and loci usage

No microwear analysis was conducted at this site.

14.8.2.4 Bull Brook's landscape use patterning and domestic activities (From Robinson et al. (2009) site activity area concentrations summary)

Robinson et al. (2009) provided a summary analysis of the locus activity area and site usage in their discussion of the Bull Brook site.

> *"In this paper we conclude that Bull Brook represents a single organized event, supporting the excavators' interpretation of 50 years ago. The conclusion is reinforced by recognition of concentric activity zones within the ring-shaped settlement plan. With preserved caribou bone and present paleogeographic and environmental reconstructions, we propose that the site was most likely associated with communal hunting and a caribou drive. Our working model is that the exposure of Jeffreys Ledge at the maximum low stand of sea level provided both the habitat for summer grazing and a highly predictable fall migration to the mainland. In this model we emphasize the complementary relationship of environmental and*

social factors. A briefly exposed island during the Younger Dryas cold period provided the resource base, while social arrangements made the communal event possible, influencing the spatial configuration of social activities on the landscape and within the settlement area" Robinson et al. (2009).

14.9 Technological organization and cultural horizon

The Vail site's stone tool production and reduction sequence elements of the technological organization are also based on a segmented tool blank, biface preform, fluted point, core, and flake reduction tradition (Lathrop 2016). Typical of the region and NEM horizon, no blade production technology was identified in the assemblage. As was the case in the Potter site analysis, the fluted point technology places The Vail site's occupation range somewhere during the Paleoamerican horizon (12,900 - 11,600 cal BP).

Analysis of Vail's artifact assemblage enumerated in Table 14.20, indicating the presence or absence of particular diagnostic traits, as well as the artifact photo examples (Figure's 14.13, and 14.14), provides evidence of a correlation with the diagnostic qualities for the New England Maritimes Paleoamerican horizon (Gramly and Funk 1990; Lathrop 2016; Spiess et al. 1998).

Table 14.20. NEM Paleoamerican lithic tool diagnostic traits for the Vail site

Diagnostic Trait	Presence/ Absence	Artifact examples
Projectile point/knife fluting on both faces from carefully prepared platforms. (Early and mid-Paleo horizon)	P	Figure 14.13 and 14.14 projectile point forms
Channel flakes found in tool manufacturing artifacts and debris. (Early and mid-Paleo horizon)	P	Figure 14.13 and 14.14
Preform thinning by medial percussion flaking.	P	Figure 14.13 and 14.14
Points received no additional thinning after fluting. (Early and mid-Paleo horizon)	P	Figure 14.13 and 14.14
Lateral grinding evident from midsection to basal ears.	P	
Basal grinding common.	P	
Late Paleo horizon points are basally thinned but not fluted.	A	
High-quality lithic material	P	Munsungun, Normanskill chert, and Pennsylvania Jasper.
Spurred end scrapers	P	

Further refining of Vail's positioning in the Paleoamerican horizon, it can be observed from Table 14.20 that the use of projectile point fluting as opposed basal thinning places the locus in the early to the mid-Paleoamerican horizon (Bradley et al. 2008).

14.10 Temporal aspects of site habitation

14.10.1 Occupation date range

In the Vail site's excavated stone tool assemblage, 79 diagnostic complete and fragmented projectile point bases (Figure 14.13, 14.14) were recognized. From the morphologically based typology (Bradley et al. 2008:130-135), the points were identified as Vail-Debert style. Vail-Debert points suggest an early Paleoamerican occupation that occurred sometime during the chronological range of 12,900 to 12,400 cal yr BP.

14.10.2 Occupation duration

14.10.2.1 Occupation duration: occupation span index method

Values for Surovell's (2009) quantitative model for occupation span index by proxy variables cannot be computed because the model requires defined quantities for both local and remote material sources in the artifact assemblage. As described in Chapter X, the material composition of the Vail site artifact assemblage was made up of Normanskill chert (88.13%), Pennsylvania Jasper (4%), Munsungun (.25%), and unknown material (7.67%). The Munsungun chert source is located approximately 370 km from the Vail site. Likewise, the Hudson valley Normanskill chert material source is situated roughly 600 km from Vail. However, there were a few local coarse-grained specimens made from cobble and local bedrock sources found at the site (Kitchel 2016). The few tools produced from these materials were expedient flakes and of unknown function. As can be seen from these distances, none of the material sources in the Vail assemblage can be considered local. Because Vail's toolkits were produced mainly of material from remote sources, and that no tools except a few expedient flakes were fashioned from local material, the production of tools from a local source is not taken into consideration. Therefore, Surovell's (2009) model for calculating occupation span is not applicable.

14.10.2.2 Occupation duration from revised ring model correlation method

Analyzing Vail's length of occupation using Yellen's (1977) linear and Whitelaw's (1983) exponential variation of Yellen's (1977) ring model, yields a calculated 3.37 to 10.87 days of occupation duration using the linear model. The exponential model returns a value of 3.10 to 38.63 days. (See Table 14.21.)

1. Number of occupation days = .1*(area) + 1.87 = 3.37 to 10.87. Linear form.
2. Number of occupation days = . 1.87*b^(.1*(area)) = 3.10 to 38.63. Exponential form.

Table 14.21. Occupation duration for the Vail site loci

Locus	Area m^2	Linear form	Exponential b=1.4, c= .1
Locus F	15	3.37	3.10
Locus A	16	3.47	3.20
Locus G	23	4.17	4.05
Locus H	27.5	4.63	4.70
Locus B	30	4.87	5.13
Locus D	41	5.97	7.43
Locus C	50	6.87	10.05
Locus E	90	10.87	38.63

The linear model appears most appropriate for loci with areas from 16 to 50 m². The exponential model is more suitable for application to sites with an area of 90 m² such as locus E (Whitelaw's 1983). However, Gramly (1982:49-51) posits that locus E was occupied on 3 to 4 occasions and because of this the tool count and area were inflated by the reoccupation process. Therefore, use of the linear model results for all loci would appear to be appropriate. Both approaches indicate that occupations at the site loci were short term in length.

14.10.2.3 Occupation duration: tool loss method

Approaching Vail's loci length of occupation from a tool loss calculation using Mc Ghee's (1979) and Spiess' (1984) model for Loci A thru H, yields a person day occupation duration of 114 to 1509 days. This calculation is based on one tool lost per 2.5 to 3 days per person (Mc Ghee 1979, Spiess 1984). For a locus tent size of five individuals, this would indicate a range of 19 to 301 days of locus occupation duration. For a locus tent size of 10 individuals, this would suggest a range of 9.5 to 151 days of locus occupation duration. Occupation duration statistics and calculations for each of the Vail's sites loci are presented in Table 14.22

Table 14.22. Occupation duration by locus from the Mc Ghee's (1979) and Spiess' (1984) model

Locus	Number of Tools	2.5 Person days	3 Person-days	A locus tent size of 5 persons	A locus tent size of 10 persons
Locus A	124	310	372	62.0-74.4	31.0-37.2
Locus B	98	245	294	49.0-58.8	24.5-29.4
Locus C	163	408	489	81.5-97.0	40.8-48.9
Locus D	178	445	534	89.0-106.8	44.5-53.4
Locus E	503	1258	1509	251.5-301.8	125.7-150.9
Locus F	38	95	114	19.0-22.8	9.5-11.4
Locus G	57	143	171	28.5-34.2	14.3-17.1
Locus H	62	155	186	31.0-37.2	15.5-18.6

As stated above, Gramly (1982:49-51) suggested that Locus E was occupied on 3 to 4 occasions. Therefore, the locus tool count and area were inflated through the reoccupation process. If the multi-occupation occurred as speculated by Gramly, the tool count would be reduced by a factor of 3 to 4. Reduction by this factor would put the tool count number at a quantity comparable to those of Loci F, G, and H, that was deemed by Gramly (1982:49-51) to be single occupation events, while also reducing the number of person-days by the same factor. Taking into account the reoccupation of Locus E and other loci, results from the application of this model denoting that the occupation duration ranged from 14 to 30 days, would be considered to be a short-term occupation.

14.10.2.4 Occupation duration summary

Both of the models employed to estimate Vail's loci occupation span, i.e., the revised exponential ring model correlation method, and tool loss per person day, yield indications of a short-term occupation for these loci that extends over somewhere in the neighborhood of high single-digit days to four weeks in length.

14.10.3 Distinguishing reoccupation - instances of single or multiple occupations

Addressing the issue of whether Vail's loci were occupied on single or multiple occasions, three models are employed, i.e., the stratigraphic distribution of artifacts, the density of assemblage per unit area, and, a regression correlation model.

14.10.3.1 Artifact distribution stratigraphy model

Results from the excavation of the eight loci identified at the site (Loci A thru H) did not indicate any significant stratigraphic differentiation or distribution by artifact types or material type, i.e., projectile points, scrapers, or utilized flakes. Gramly (1982:47) observed that if artifact appears to be mixed up or displaced, it is an outcome of living done on the spot. What he implies is that even though there was reoccupation of a locus, it occurred during the next season's occupation without leaving any stratigraphic evidence other than the mixing of artifacts.

There were intersite refits found but not between all loci, thus bringing into question the contemporaneous occupation of some of the loci. The principal excavator of the site, Gramly (1982), speculated that some of the individual loci might have been occupied contemporaneously. However, he hypothesized that on the site basis, Vail had been reoccupied on numerous occasions. It was unclear what the period was between any locus occupation. Gramly (1982) further opined that the Vail site was reused on a seasonal basis as long as the caribou passed through the region.

14.10.3.2 Heuristic density of artifact and material type sourcing location model

Reoccupied sites may be characterized by high artifact densities coupled with relatively lower frequencies of local raw materials and debitage (Spiess et al. 1998; Gramly and Funk 1990). As described above, the composition of all of the Vail sites' artifact assemblage was made up of material from remote sources. The sites' tool density per m^2 is considered to be moderate to high in addition to a high density of remote cherts. By these two measures, indications are that Vail may well have been reoccupied on a site basis during the Paleoamerican horizon.

14.10.3.3 Regression correlation reoccupation model

Surovell's (2009) regression analysis relationship between the Vail site loci in terms of occupation span and occupation density does not show a correlation of OSI and artifact density. To develop an occupation span index value, there must be both a local and remote material source. As previously discussed, all materials in the site's artifact assemblage are from remote locations. Therefore, Surovell's (2009) regression analysis model is not applicable.

14.10.3.4 Distinguishing reoccupation summary.

Only one of the models applied to evaluate Vail's reoccupation status indicated that it was potentially reoccupied on a site basis on more than one occasion. The model that provided this indication was the heuristic density of artifact and material type sourcing location model. The artifact distribution stratigraphy model did not show clear stratigraphic evidence of reoccupation. However, Gramly (1982:47) hypothesized that due to the significantly higher tool density per unit area of some of the loci, that they had been reoccupied on subsequent hunting seasons. Furthermore, the hunting season in the Magalloway River Valley only lasted for approximately two weeks during the caribou herd passage (Binford 1979:256). Because of this, it reduces the possibility of a long-term habitation occurrence explaining the high tool density at some of the site loci (Locus C, D, and E). Further, a Ste. Anne-Varney point, dating to 2000 years later during the late Paleoamerican horizon, was found at the site further indicating reoccupation (Figure 14.15).

14.11 Mobility patterns and seasonality inferences

14.11.1 Indications of mobility/sedentism

The Vail site's mobility/sedentism indications based on site artifact tool assemblage is summarized in Table 14.23. Analysis using the diagnostic models discussed previously (Kelly and Todd 1988; Meltzer 2003; Bleed 1986; Bousman 1994; Kuhn 1994), points toward an assemblage that is indicative of a flexible, portable toolkit. Also, as projected by the models, a toolkit composed of very few specialized tools, in this case, pieces esquillées, limaces, and drills in addition to relatively few tool types (Bifaces, points, and expedient flakes) serving multiple functions is further evidence of mobile inhabitants.

Table 14.23. Mobility/sedentism indications based on site artifact tool assemblage.

Model and Diagnostic Traits	Lithic Evidence	Comments
1. Function of: **2. Flexible, portable tools. High residential mobility has flexible, highly portable tools.**	250 Modified / Retouched Flakes 20 Bifaces	Modified/retouched expedient flake tools and bifaces indicative of flexible, portable tools.
3. Specialized tools. Decreasing residential mobility should have more specialized tools with less need for portability.	46 Projectile points/fragments, 363 Scrapers, 293 pièces esquillées 31 drills, 1 chopper.	Projectile points/knife, expedient flake tools, and scrapers standard elements of the toolkit. Two specialized tool type, i.e., pièces esquillées (wedges), limaces and drills.
4. Tool diversity. High residential mobility has relatively few tool types serving multiple functions. The number of moves per year negatively correlated with tool diversity.	7 Tool types (Bifaces, projectile point/knives, scrapers, retouched waste flakes, wedges, and drills.) .	Few tool types are serving multiple functions – indicative of high residential mobility.
5. Low core/biface ratios are often linked to high mobility. **6. High ratios are linked to more sedentary lifestyles.**	0 Cores 18 Bifaces	Not calculable

Employing each of the toolkit characterization models, i.e., flexible multiple portable tools, few numbers of specialized tools, the limited range of tool diversity, and core biface ratios indicate that the inhabitants of Vail were by these measures mobile as opposed to a sedentary group.

14.11.2 Mobility/sedentism based on reduction stage location distribution of debitage.

No description of the Vail site's debitage distribution by dimensions or weight as a proxy for size was noted in the published literature for the site. What was provided was the cumulative amounts of debitage per site and loci. The total site debitage assemblage contained 2943 pieces. What is interesting to note is that the tool count for the entire site was 1223 pieces and that the debitage, was only 2943 pieces. These counts provide a ratio of tools to debitage of just 2.41. This low ratio indicates that only finishing and sharpening flakes likely makes up the debitage count. With the Normanskill chert, Pennsylvania Jasper, Munsungun, and unknown material located hundreds of km from Vail, it is doubtful that large cobbles were transported to the site. From the assemblage composition of bifaces and preforms, it is more than likely that the early stages of reduction were done at the quarry sites. Therefore, from the assumptions above it would be expected that all phases, initial, further and late, were not present in the assemblage. Vail's debitage distribution would appear to be from smaller later stage shaping, reworking or sharpening events thus indicates a mobile population land-use.

14.11.3 Territorial round mobility geography and seasonality

Four models whose functioning and assumptions were detailed earlier, i.e., Burke et al.'s (2004), Curran and Grimes (1989), Rockwell's (2012), and Primary prey and vegetational reconstruction model are employed to attempt to define the territorial round geography and seasonality of the hunter-gatherers that occupied Vail.

14.11.3.1 Burke et al.'s model for determination of NEM Paleoamerican territorial round range

As previously determined from the morphology/typology of assemblage fluted points, Vail was reoccupied sometime during the Vail-Debert early Paleoamerican sub horizon (12,900 to 12,400 cal yr BP). During this time horizon, Burke et al. (2004) hypothesized that based on materials found at sites occupied during this period possible band ranges could be identified. Applying the Burke et al. (2004) model, two alternatives are suggested. In the first alternative, the route (solid black oval) ranged from Eastern Pennsylvania (Winter to early spring) northward to the Hudson River Valley where the Normanskill chert (88.13 % of the assemblage at Vail) was acquired. From the Hudson River Valley, the band continued Northeast toward to the Vail site and possibly passed the Whipple and Tenant Swamp sites in western Massachusetts. From the Vail site, they carried on the hunt moving further Northeast to the Munsungun chert source area (.25 % of the assemblage at Vail site) followed by a return southward in the fall and perhaps revisiting the Vail site.

A critique of this route can be based upon the low quantities of Pennsylvania Jasper and Munsungun chert in the flaked stone artifact assemblage. The Pennsylvania Jasper represents only 4% of the Vail sites assemblage while the Munsungun chert represents only .25%. These low quantities may well be accounted for in other ways. It could be suggested that those quantities of material were brought by individuals joining the band during its travels, or that special work parties acquired the stone, or the band acquired the material from down the line trade, or even from an earlier occupation of the site. Further, the distance between Eastern Pennsylvania and northern Maine is 1127 km one-way. This travel distance is unlikely to have occurred in addition to setting up hunting camps along the way that may have been occupied from days to weeks.

For the second alternative, the route (solid red oval) may have ranged from the Hudson River Valley (Winter to early spring) where the Normanskill chert was acquired. From the Hudson River Valley, the band continued Northeast toward the Vail site. Again, the band may have passed the Whipple and Tenant Swamp sites in western Massachusetts. From the Vail site, they may have continued the hunt moving further Northeast followed by a return southward in the fall. As in the first alternative, it might be implied that the material was introduced by individuals joining the band during its travels, or that special work parties acquired the stone, or the band acquired the material from down the line trade. The distance from the Hudson River Valley to the Vail site is approximately 535 km one-way which would appear to be a more manageable circuit. These two potential routes would seem to describe the territorial round of the occupants of the Vail site (Figure 14.10).

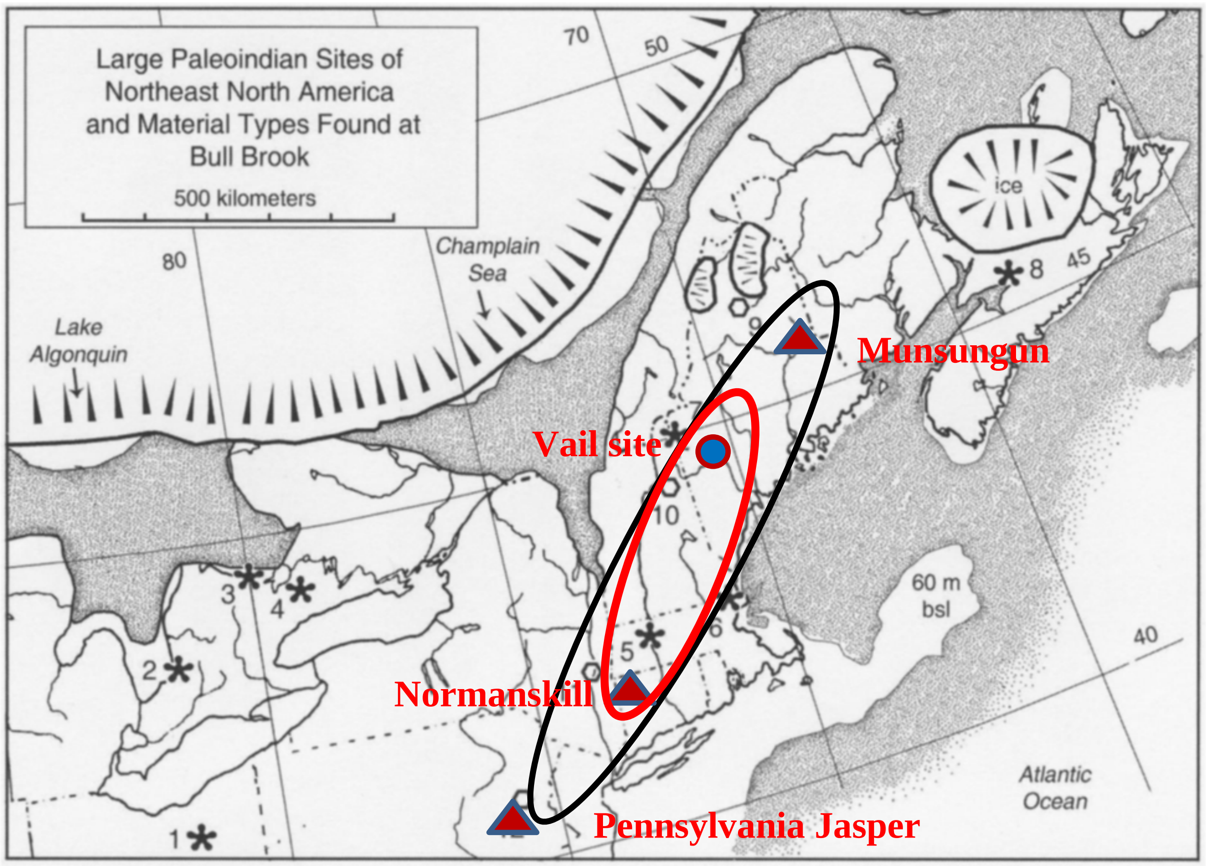


Figure 14.10. Map of Northeast North America showing major glacial features from 11,500 to 10,500 radiocarbon years B.P., with locations of "large" Paleoamerican sites (stars) and primary lithic sources (hexagons) found at the Vail site. Sites: (1) Nobles Pond, (2) Parkhill, (3) Fisher, (4) Udora, (5) Dedic/Sugarloaf, (6) Bull Brook, (7) Vail, (8) Debert. Lithic sources: (9) Munsungun Chert, (10) New Hampshire spherulitic rhyolite, (11) Normanskill/Hudson Valley Chert, (12) Pennsylvania Jasper. Possible first band seasonal route includes the material acquisition of Pennsylvania Jasper (12) and then Normanskill/Hudson Valley chert (11) from the South following on to the Vail site and then further on to Munsungun. Possible 2nd band route includes material acquisition from the Normanskill/Hudson Valley chert (11) and travels to the Vail site with additional potential hunt stops along the route. Jasper and Munsungun chert were acquired by alternative methods. The blue circle with red outline marks the location of the Vail site. (Adapted from Robertson et al. 2009:426 Figure 2.)

14.11.3.2 Curran and Grimes model for determination of NEM Paleoamerican territorial round range

Table 14.24 represents the expected distribution of material types by percent to be found in a NEM sites' artifact assemblage by season as predicted from the Curran and Grimes (1989) model. From the model, it would be expected that during the Vail-Debert early sub horizon, Vail was occupied as a wintering to spring transit site (South to North) with a possible return (North to South). In this case, the Curran and Grimes (1989) model is ineffective in predicting the seasonal round because of the lack of a dominant northern chert from Munsungun or the Vermont Hardaway formation. In the model, it is expected that during the seasonal round Northern cherts would be the dominant source. However, it appears that the band that occupied Vail did not take advantage of any of these stone materials in their seasonal round. As noted earlier, only one-quarter of a percent of the northerly Munsungun chert was found in the Vail sites assemblage, and that was potentially acquired indirectly. Therefore, it does not appear that there was a direct acquisition of northerly chert material during the summer portion of the seasonal round thus rendering the model's conclusions suspect even though the Vail occupation may have been a spring transit site.

Table 14.24. Expected distribution of material types to be found in NEM sites by season

Season	Northern Cherts Munsungun, VT Hardaway cherts	Southern Volcanics/Felsite Secondary Lithic	Cherts, Jasper, Quartzite (Opportunistic exchange/acquisition)
Summer (North)	Majority (.25%) *Munsungun Minority*	None *Normanskill chert 88+%*	PA Jasper, Munsungun
Fall Transit (North to South)	Majority %	None	Small %
Winter (South)	Majority-declining %	Increasing %	Small-increasing %
Spring Transit (South to North)	Majority-further declining% *Vail 88+% Normanskill chert.*	Significant % *Vail 0% Rhyolite 0%*	Small-further increasing %

14.11.3.3 Rockwell model for determination of NEM Paleoamerican territorial round range

As indicated in Table 14.25, the Rockwell (2014) model of seasonality toolkit and occupation span indicators, Vail's activities likely represent a late summer or early fall occupation. The reasoning behind this prediction is based on indications that toolkits containing large numbers of tools related to butchery and hide working in addition to organic material processing are present. These indicators in addition to occupation durations that are short to medium in length point to a late summer early fall placement when fall caribou hides and meat are at their prime.

Table 14.25. Rockwell (2014)model seasonality tool kit and occupation span indicators

Season	Tool Kit and Occupation Span Indicators	Vail's Toolkit & Occupation Span
Winter to early spring	• A wide diversity of activities, a wide range of tool types. • Sites occupied for an extended period and located near lithic quarries.	
Late spring and early summer	• Evidence of regular moves and short occupations. • Few activities are occurring at each site, tool type range limited. • Likely a mixture of residential and logistical sites represented.	• Occupation span estimate: high single-digit days to 4 weeks • Flexible, portable tools. Limited tool types are serving multiple functions indicative of high residential mobility. • Toolkit related to residence, tool production/maintenance, woodworking, butchery and hide working, (46 Projectile points, 363 Scrapers, tools, 350 Modified/ Retouched Flakes.) • Gramly (1983) indicates woodworking and hide working.
Late summer and early fall. Possibly into late fall	• Occupations contain large numbers of tools related to butchery and hide working. • Occupations likely to be short to medium in length as fall caribou hides and meat are at their prime.	• 46 Projectile points/knives, 363 Scrapers, tools, 350 Modified/ Retouched Flakes, chopper, and wedges • 10 to 30 days loci occupation durations.

Vail's artifact assemblage seasonality parameters align with the Rockwell (2014) model. The indicators suggest that the occupation occurred during the late summer to early fall or even possibly late spring to early summer due to the overlap of indicators by season. However, the late summer early fall occupation seems to be favored because the toolkit contains large numbers of tools related to butchery and hide working (350 cutters and 363 scrapers in addition to 46 projectile points).

14.11.3.3 Primary prey and vegetational reconstruction model for determination of NEM Paleoamerican territorial round range

As noted earlier, at 12,500 cal yr BP, Maine and southern Québec including southerly extensions at higher altitudes were tundra covered. The Vail site is positioned in northern Maine near the New Hampshire and Canadian borders. This geography situates the site in an area of tundra (represented by high sedge pollen percentages) and to the north of spruce woodlands. South-central Maine, southern New Hampshire, and Massachusetts were covered by a poplar-spruce-fir forest in addition to hardwoods such as oak and maple (Newby et al. 2005).

It could then be expected that caribou, traveling between northern calving and southerly wintering grounds, would have passed the Vail site on their way to the wintering habitat located 10 to 50 km south of the forest boundary in south-central Maine and southern New Hampshire (Newby et al. 2005; Spiess 1984). This range of migratory caribou movements corresponds to the circuits from northern Maine and return as described in the Burke model.

14.12 Settlement pattern adaptations and site/loci domestic activity land-use

14.12.1 Settlement pattern adaptations: indications of forager/collector land use strategy

Vail's settlement pattern traits indicate a forager adaptation. This assessment is based on the details of the diagnostic traits outlined in Table 14.26 with comparisons to Vail's assemblage artifacts that exhibit these attributes.

Table 14.26. Vail forager/collector settlement pattern adaptation characterization

Forager/Residential Mobility Tool Profile	Observations on Forager Profile	Vail's assemblage
• **Flexible tool technology**	5. High forager/residential mobility has flexible technology as each tool will serve multiple tasks.	• 350 Cutters, modified/retouched expedient flake tools, and 20 bifaces indicative of flexible, portable tools.
• **Few specialized tools**	6. Higher forager/residential mobility indicate less specialized tools and more need for toolkit portability.	• 46 Projectile points, Standard • 52 Scrapers, Standard. • 293 pièces esquillées, 44 limaces, 31 drills
• **Low tool diversity**	7. Few tool types are serving multiple functions – indicative of high forager/residential mobility — the number of moves per year negatively correlated with tool diversity.	• 7 Tool types (few)
• **Microware (Odell) (Chatters; Odell)**	8. Individual tools show multiple wear traces as each tool serves several functions.	

The most noteworthy elements observed in the locus's assemblage that are characteristic of a forager's toolkit are flexible tool technology, few specialized tools, minimal tool diversity, maintainability, and make - mend technology.

Vail's tool manufacturing technology settlement pattern adaptations (Table 14.27) shows that projectile points and fragments (Figure 14.13 and 14.14) were manufactured to minimum nominal dimensions. Nominal dimensions for NEM point types are found in Bradley et al. (2008: 130-135). When compared to sedentary populations points, they are smaller, i.e., widths, weight, thickness, and basal features, indicating point manufacture and maintenance was designed for flexibility and high mobility. Even though there were a minimal time and energy savings, an inspection of the point base fragments shows less thorough basal and edge grinding reflecting lesser attention to point hafting and less energy investment. Culturally identified point and point fragments do clearly show evidence of reworking. Complete projectile points as shown in Figure's 14.13 and 14.14, exhibit evidence of the reworking, which is an element of a residentially mobile profile. Finally, fewer specialized tools types are found in Vail's loci tool assemblages confirming another of the forager/collector profile indicators of a forager activity pattern (Table 14.27). In sum, Vail's loci settlement pattern adaptation profile is a fit to foraging behavior (Bleed 1986; Bousman 1994; Torrence 1983; Kuhn 1989; and Nelson 1991).

Table 14.27. Vail's tool manufacturing technology settlement pattern adaptation characterization

Point manufacturing and maintenance models	Point/tool manufacturing profile derived from the sum of various model characteristics (forager profile)	Particular Vail Loci assemblage indicators in comparison to profile (forager profile)
• **Weapons maintainable** • **Time minimization** • **Make and mend** • **Tools used to exhaustion** • **Less attention to hafting.** **(From Bleed 1986; Bousman 1994; Torrence 1983; Kuhn 1989; and Nelson 1991)**	1. More extensive reworking. 2. Lower craftsmanship 3. Less energy investment 4. Informal technological 5. Less grinding reflects less attention to hafting. 6. Max. dimension - Smaller 7. Basal width - Smaller 8. Maximum width - Smaller 9. Maximum thickness - Thinner 10. Concavity depth 11. Edge grinding index - Less 12. Weight – lighter	• One clear evidence of reworking. Reworking evident in scraper technology. • Less thorough grinding reflects less attention to point hafting – less energy investment, fewer specialized tools/types. • Projectile points show un-patterned flaking pattern correlating with reduced craftsmanship and less energy investment • All point dimensions, widths, weight, thickness, and basal features are minimums indicating manufacture and maintenance was designed for flexibility and high mobility. • Comparisons indicate forager as opposed to sedentary profile for Vail's inhabitants.

14.12.2 Vail's landscape use patterning and domestic activities

14.12.2.1 Vail's *activity use patterning from attribute clusters (groups).*

Vail's landscape usage and locus activities patterning based on the previously introduced attribute cluster or group model is compiled in attribute Table 14.28. The Vail site as excavated and recorded by Gramly (1982) was characterized as having eight loci. Table 14.28 presents the data for the eight loci organized into two groups defined as group A, B, C, D, E, and group F, G, H. The reasoning for this bimodal organization is that Gramly (1982) identified the first group as reoccupied habitation loci whose characterizations were comparable. Similarly, the second group of loci was also identified by Gramly (1982) as habitation loci that were occupied on only one occasion. Inspection of the attribute cluster Table 14.28 and Table 10.3.3 shows the broad similarities of tool types and distributions across loci in the first group (A to E). Gramly (1982:48-54) states that each of the reoccupations was for the same purpose, i.e., a seasonal caribou harvest. He further reasoned that on each reoccupation the inhabitant's toolkits were similar. Therefore, a reoccupied loci's tool assemblage increased in quantity because the same tool types were brought and discarded each season.

Further, the tool range for each locus in group A to E, i.e., the quantity of varying tool forms, projectile points, the presence of channel flakes, cutters, modified and/or retouched flakes, the debitage assemblage, and classifying features typically indicates a Paleoamerican habitation usage (Gramly and Funk 1990; Spiess et al. 1998). A habitation campsite/locus is defined as a place with multiple activity areas and where a variety of daily maintenance activities took place (Andrefsky 2005 201:223, Chatters 1987:363-366; Gramly and Funk 1990:14; Kvamme 1988:387-393; Kooyman 2000:129-133; Nelson 1991:78-86; Odell 2003:188-202).

Further, this assemblage is indicative of a tool kit employable in several differing habitation subsistence tasks such as resource preparation, processing and tool making.

Table 14.28. Vail site usage attribute cluster characterization model

I. Attribute groups	Locus A, B, C, D, & E	Locus F, G, & H
Toolkit artifact types		
• Projectile points and point fragments and fluted Bifaces / Biface fragments	41	6
• Preforms	0	0
• Fluted drill	30	1
• Channel flakes	74	2
• Cores and core fragments unspecified	?	?
• Cutters, Retouched flake and Utilized waste flake	299	51
• End scraper and Side scraper	218	45
• Wedges	246	47
• Limaces	42	2
Number of tools in assemblage	1066	157
II. Classifying features		
Aggregate/individual debitage classification		
• First stage reduction, nodules, cores, and large flakes	?	?
• Reduction flakes greater than 8g	?	?
• Reduction flakes – small < 8g	2569	374
Tool index: Range, variety, and quantity of tool types	1298	259 avg
Material type sources	3	3
• Primary & secondary source of lithic tool making material – local or exotic/remote	Normanskill PA. Jasper Munsungun remote	Normanskill PA. Jasper Munsungun remote
Dimensions of Locus area m² (excavated not encompassed)	45 avg	22 avg
Number of artifact/activity concentrations per locus	?	?
Artifact and density –artifacts/ m²	81	171
Tool artifact and density – tools/ m²	24	7
Distance relationship between locus area clusters in meters	4	30
Site features and organics	Hearth, bone, debitage, charcoal.	No
Knapping episodes – both tools and debitage co-located	Yes	Yes
Geological and geographic characterization	Sandy glacial till	Sandy glacial till

However, upon further inspection of table 14.28, a distribution difference is observed in Loci F, G, and H that brings into question Gramly's (1983) identification of the loci as habitation occupations. Loci F, G, and H have the bulk of their tool artifacts placed in three categories, i.e., cutters, side scrapers, and wedges. While similar to loci in group A to E in having other tool types, their quantities in Loci F, G and H are quite low. It would appear that the activities at the Loci F, G, and H were concerned with butchering, cutting and processing activities rather than daily all-around habitation activities including tool making and maintenance.

It may also be observed from the table and earlier characterizations of the Vail site artifact quantities by tool type, that none of the loci assemblages in group A to E were skewed toward a specialized activity such as processing or tool making. This observation is based on the lack of evidence of a single or narrow quantity of single-purpose tools used exclusively for a processing task.

14.12.2.2 Vail's landscape usage and activities from graphical attribute cluster presentation

Figure's 14.11, and 14.12 presents the Vail site's loci usage and activities from a graphical attribute cluster perspective. Figure 14.11, Locus A through E's activity use patterning cluster diagram, exhibits some of the predicted habitation site attributes, i.e., higher tool index, a range of tool types used in differing habitation subsistence tasks, and a higher volume of reduction flakes distributed over a larger area (Andrefsky 2005 201:223, Chatters 1987:363-366; Gramly and Funk 1990:14; Kvamme 1988:387-393; Kooyman 2000:129-133; Nelson 1991:78-86; Odell 2003:188-202). Habitation loci exhibiting the characteristics enumerated above display a significantly different profile than processing or workshop loci representing locations of specialized task execution.

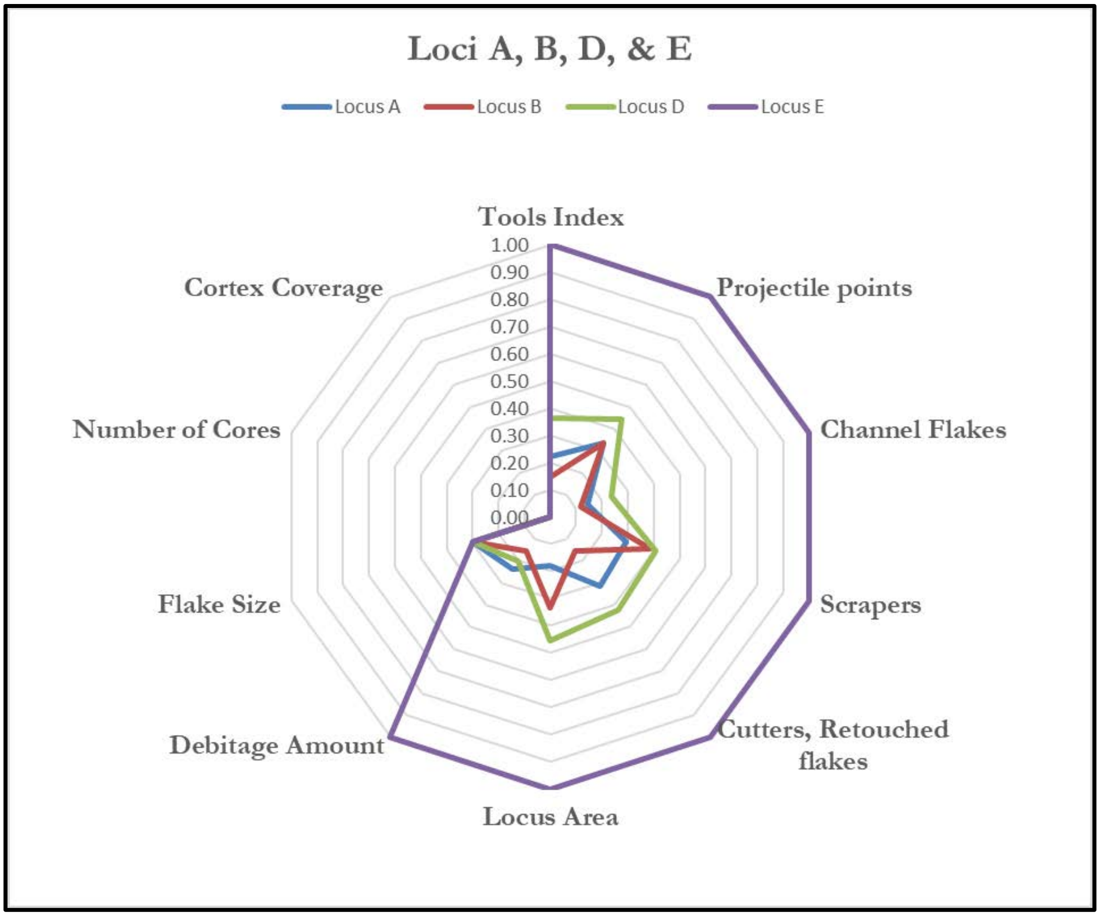


Figure 14.11. Vail Locus A to E domestic activity use patterning cluster diagram.

Figure 14.12, Locus F through H's activity use patterning cluster diagram, exhibits some of the predicted processing or specialized task implementation site attributes, i.e., lower tool index, a range of tool types used in specific processing tasks, and a lower volume of reduction flakes distributed over a smaller area. From the diagram (Figure 14.12) it may be observed that Vail site artifact quantities by tool type, that of the loci assemblages in group F to H were skewed toward a specialized activity such as processing of hides (cutters, scrapers, and wedges).

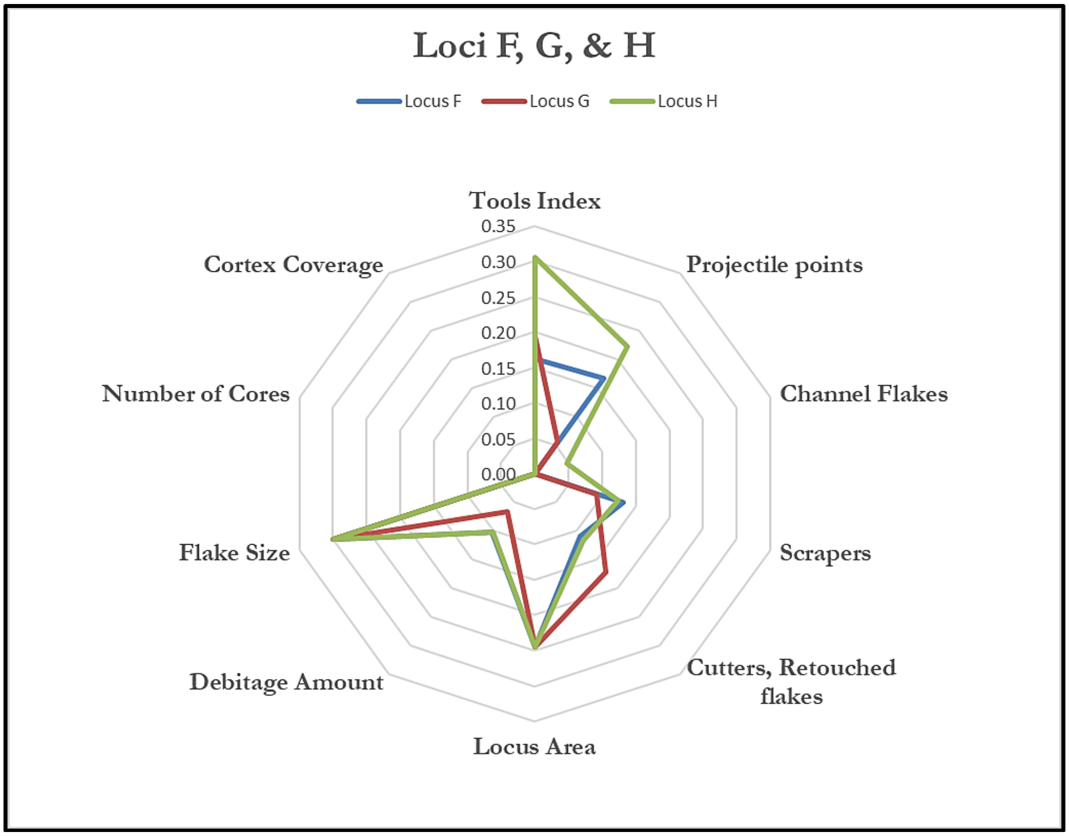


Figure 14.12. Vail Locus F to H domestic activity use patterning cluster diagram.

14.12.2.3 Microwear analysis method of landscape activities and loci usage

No microwear analysis was performed at this site.

14.12.2.4 Vail's landscape use patterning and domestic activities: Shannon-Weaver analysis

To validate Vail's locus activity area characteristics, an analysis, shown below in Table 14.29, was performed to measure both the diversity and evenness of the sites tool artifact assemblage. The diversity measurement is based on the Shannon-Weaver information theory equation (14.2) that quantifies each locus' tool assemblage breadth. The larger the diversity or entropy number indicates an extensive and broader variety of tools as might be found in habitation sites. The smaller the diversity or entropy number implies a narrower variety of tools as might be found in a processing site.

$$\text{Equation 14.2} \quad \text{Diversity} = \sum_i^n p_i \log(p_i)$$

Table 14.29. Diversity and evenness validation of Vail's locus activity area characterization

Locus	Diversity or Entropy
Locus A - E	0.7797
Locus F, G, H	0.6754

From the values of diversity indicated in Table 14.29, Loci A through E's value shows a broader range of tool types then Loci F through H (0.7797). The extensive tool range is indicative of site usage as a habitation locus. The diversity values for Loci F, G, and H (0.6754) are lower and driven by a smaller range of tool types and a significant number of cutters, scrapers, and wedges or narrow tool type range, thus potentially indicating use as some type of processing locus. The Shannon-Weaver analysis indicates that Loci A through E's diversity value is 15% larger than the value for Loci F, G, and H.

This analysis aside, because the occupations were short and the tool distributions were skewed to a few types, perhaps it the intensity of locus use that caused the skew that is observed in the data and graphic representation.

Figure 14.13. Examples of Vail site projectiles showing the characteristics of the Vail-Debert morphology (from Gramly 2010:12)

Figure 14.14. Examples of Vail site projectiles showing the attributes of the Vail-Debert morphology (from Gramly 2010:13)

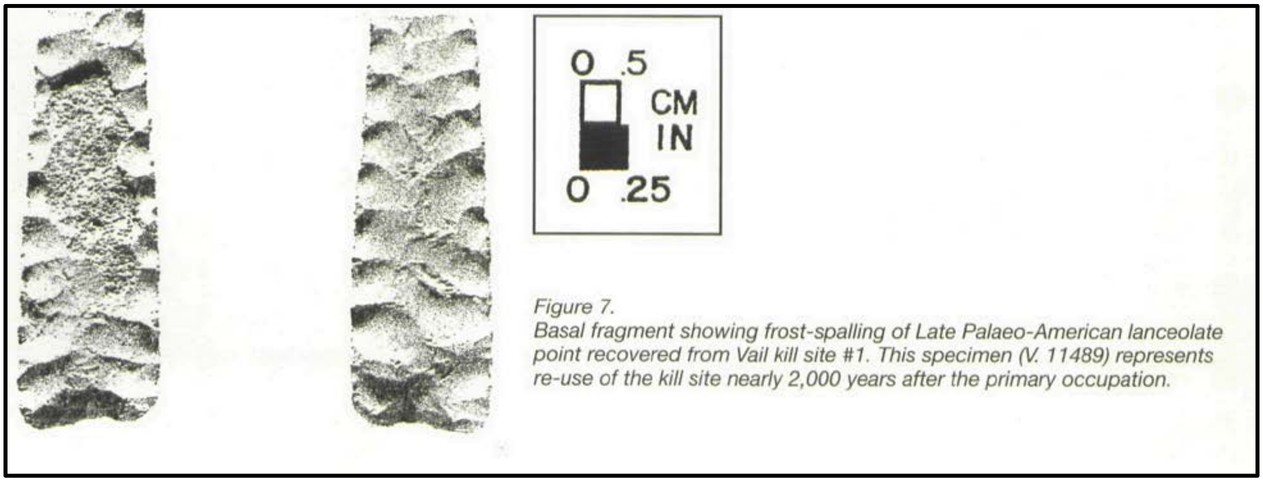


Figure 14.15. Example of Vail site lanceolate projectile point from the late Paleoamerican horizon 2000 years after the primary occupation showing the characteristics of the Ste. Anne-Varney morphology (from Gramly 2010:11 Figure 7)

Tenant Swamp site analysis

14.12 Technological organization and cultural horizon

As was the case with the NEM Paleoamerican sites analyzed thus far, the Tenant Swamp site's stone tool production and reduction sequence components of the technological organization are based on a tool blank, biface preform, fluted point, core, and flake reduction tradition. As anticipated, no blade production technology was identified in the assemblage. As was the case in the Potter site analysis, the fluted point technology places The Tenant Swamp site's occupation range somewhere during the Paleoamerican horizon (12,900 - 10,800 cal BP).

Analysis of Tenant Swamp's artifact assemblage enumerated in Table 14.30, indicating the presence or absence of particular diagnostic traits, as well as artifact photos (Figure's 14.19, 14.20, 14.21, 14.22, and 14.23), provides evidence of a correlation with the diagnostic traits for the New England Maritimes Paleoamerican horizon (Gramly and Funk 1990; Spiess et al. 1998).

Table 14.30. NEM Paleoamerican lithic tool diagnostic traits for the Tenant Swamp site

Diagnostic Trait	Presence/ Absence	Artifact examples
Projectile point/knife fluting on both faces from carefully prepared platforms. (Early and mid-Paleo horizon)	P	Figure 14.19,14.20, projectile point and fragment
Channel flakes found in tool manufacturing artifacts and debris. (Early and mid-Paleo horizon)	P	Fluting evident on points
Preform thinning by medial percussion flaking.	P	Points
Points received no additional thinning after fluting. (Early and mid-Paleo horizon)	P	Points row
Lateral grinding evident from midsection to basal ears.	P	
Basal grinding common.	P	
Late Paleo horizon points are basally thinned but not fluted.	A	
High-quality lithic material	P	Munsungun, Munsungun chert
Spurred end scrapers	P	Figure 14.23

To further refine Tenant Swamp's positioning in the Paleoamerican horizon, it can be seen that the use of projectile point fluting as opposed basal thinning places the locus in the early to the mid-Paleoamerican horizon (Bradley et al. 2008).

14.13 Temporal aspects of site habitation

14.13.1 Occupation date range

In Tenant Swamp's excavated assemblage, one diagnostic projectile point base in addition to one projectile point ear fragment (Figure's 14.19, 14.20 and 14.21) was identified. From the morphologically based typology (Bradley et al. 2008:141-146), the points were identified as Michaud-Neponset. Michaud-Neponset points suggest a mid-Paleoamerican occupation that occurred sometime during the chronological range of 12,200 to 11,600 cal yr BP.

14. 13.2 Occupation duration

14. 13.2.1 Occupation duration: occupation span index method

Values for Surovell's (2009) quantitative model for occupation span index by proxy variables cannot be computed because the model requires numerical quantities for both local and remote material sources in the artifact assemblage. As described in Chapter X, the material composition of the Tenant Swamp site artifact assemblage was made up of Munsungun chert, and Mt. Jasper rhyolite. The Munsungun chert source is located approximately 720 km from the Tenant Swamp site. Likewise, the Mt. Jasper rhyolite material source is located nearly 270 km from Tenant Swamp. As can be seen from these distances, none of the material sources in the Tenant Swamp assemblage can be considered local. Therefore, Surovell's (2009) model for calculating occupation span is not applicable.

14. 13.2.2 Occupation duration from revised (log-log) *ring model correlation method*

Analyzing Tenant Swamp's length of occupation employing Whitelaw's (1983) exponential form variations of Yellen's (1977) ring model, in addition to the linear form of Yellen's (1977) model yielded the values displayed in Table 14.31. As noted previously, Whitelaw's (1983) analysis showed that for a small site or locus areas, the linear model more closely represented the data. Application of the exponential model is most suitable for larger site areas. As discussed earlier, all the models are descriptive, designed to produce an equation giving the best fit to the data on which they were tested. These models provide an order of magnitude indicator of occupation duration and not an absolute value. They are employed to indicate whether the occupation was short, medium, or long-term in nature. In the case of Locus, 1, 2, 3 and 4, all models indicate a short-term occupation in the neighborhood of days to one week plus for the Tenant Swamp sites' loci.

Number of occupation days (NOD) = .1*(area) + 1.87. Linear form

Number of occupation days (NOD) = 1.87*b^.1* (area) Exponential form.

Table 14.31. Occupation length in days from logarithmic, linear, and exponential form of Whitelaw's (1983) dual model technique for people and space in hunter-gatherer camps.

Locus	Area m^2	Linear form	Exponent form b = 1.4, c = .1
Locus 1	10.5	2.92	2.66
Locus 2	17.5	3.62	3.37
Locus 3	12	3.07	2.80
Locus 4	10.5	2.92	2.66

14.13.2.3 Occupation duration: tool loss method

Occupation duration statistics and calculations for each of the Tenant Swamp's sites loci are presented in Table 14.32. Results from the application of this model indicate that the occupation duration ranged from 9 to 19 days for a locus tent size of ten persons and would be considered as a short-term occupation.

Table 14.32. Occupation duration by locus from the Mc Ghee's (1979) and Spiess' (1984) model

Locus	Number of Tools	Person-days	Locus tent size five persons	Locus tent size of 10 persons
1	37	93 - 111	18.5 – 22.2	9.3 – 11.1
2	60	150 - 186	30.0 – 36.0	15 – 18.0
3	62	155 - 108	31.0 – 37.2	15.5 – 18.6
4	57	143 - 171	28.5 – 34.2	14.3 – 17.1

14.13.2.4 Occupation duration summary

Both of the applicable models employed to estimate Tenant Swamp's loci occupation span, the revised ring model correlation method, and tool loss per person day, yielded indications of a short-term occupation for the Tenant Swamp loci that extends over somewhere in the neighborhood of single-digit days to three weeks, or short term in length.

14.13.3 Distinguishing reoccupation - instances of single or multiple occupations

Addressing the issue of whether Tenant Swamp's loci were a single or multiple occupation locations, three models are employed, i.e., the stratigraphic distribution of artifacts, the density of assemblage per unit area, and, a regression correlation model.

14.13.3.1 Artifact distribution stratigraphy model

Results from the excavation of the four loci identified at the site (Locus 1, 2, 3, and 4) did not indicate any stratigraphic differentiation or distribution by artifact types or material type, i.e., projectile points, scrapers, or utilized flakes. There was no evidence of a plowzone, or other historical or modern disturbance noted in the soil profiles. The vast majority of the Tenant Swamp Paleoamerican artifacts were found in the B horizon between 20 and 40 cm below the surface (Goodby et al. 2014:131).

There were no intersite refits found thus bringing into question the contemporaneous occupation of any of the loci. There were, however, some tool fragments refits within individual loci (Goodby et al. 2014). The principal excavator of the site, Goodby et al. (2014), hypothesized that the individual loci had not been reoccupied.

14.13.3.2 Heuristic density of artifact and material type sourcing location model

Reoccupied sites may be characterized by high artifact densities coupled with relatively lower frequencies of local raw materials and debitage (Spiess et al. 1998; Gramly and Funk 1990). As described above, the material composition of the Tenant Swamp site artifact assemblage was made up of Munsungun chert, and Mount Jasper rhyolite. Both of these sources are considered to be remote from the tenant Swamp site. The sites' artifact density per m^2 is considered to be low in addition to high densities of remote chert and rhyolite. By these two measures indications, Tenant

Swamp may not have been reoccupied on a loci basis during the Paleoamerican horizon. However, there is no evidence of contemporaneous occupation of any of the individual loci. Therefore, on a site basis, if there was a significant time difference between the occupation of each locus, then indications might suggest that Tenant Swamp may have been reoccupied on a seasonal basis.

14.13.3.3 Regression correlation reoccupation model

Surovell's (2009) regression analysis relationship between the Tenant Swamp site loci in terms of occupation span and occupation density does not show a correlation of OSI and artifact density. To develop an index value for an occupation span, there must be both a local and remote material source. As previously discussed, all materials in the site's artifact assemblage are from remote locations. Therefore, Surovell's (2009) regression analysis model is not applicable.

14.13.3.4 Distinguishing reoccupation summary.

The artifact distribution stratigraphy model indicates there was no evidence of reoccupation of an individual locus. However, Tenant Swamp may have been potentially reoccupied on a site basis on more than one occasion because there is no evidence of contemporaneous intrasite loci occupations.

14.14 Mobility patterns and seasonality inferences

14.14.1 Indications of mobility/sedentism

The Tenant Swamp site's mobility/sedentism indications based on site artifact tool assemblage is summarized in Table 14.33. It contains 93 modified/retouched expedient flake tools, 1 projectile point base, and ear fragment, 1 chopper, 15 bifaces, 29 scrapers, 6 spokeshaves, 1 chopper, 18 gravers, and 14 *pièces esquillées*. Analysis using the diagnostic models discussed

(Kelly and Todd 1988; Meltzer 2003; Bleed 1986; Bousman 1994; Kuhn 1994), points toward an assemblage that is indicative of a flexible, portable toolkit. Also, as projected by the models, a toolkit composed of very few specialized tools, in this case, pieces esquillées, one chopper, and spokeshaves in addition to relatively few tool types (Bifaces, points, scrapers and expedient flakes) serving multiple functions is further evidence of mobile inhabitants.

Table 14.33. Mobility/sedentism indications based on site artifact tool assemblage.

Model and Diagnostic Traits	Lithic Evidence	Figure No.	Comments
Mobility Models (Kelly and Todd 1988; Meltzer 2003; Bleed 1986; Bousman 1994; Kuhn 1995)			
Function of: **16. Flexible, portable tools. High residential mobility has flexible, highly portable tools.**	93 Modified / Retouched Flakes 15 Bifaces	Figure's 14.19, 14.20, 14.21, 14.22, and 14.23)	93 modified/retouched expedient flake tools and eight bifaces indicative of flexible, portable tools.
17. Specialized tools. Decreasing residential mobility should have more specialized tools with less need for portability.	2 Projectile points/fragments, 29 Scrapers, 14 pièces esquillées 6 spokeshaves 1 chopper.	Figure's 14.19, 14.20, 14.21, 14.22, and 14.23)	Projectile points/knife, expedient flake tools, and scrapers standard elements of the toolkit. Two specialized tool type, i.e., 14 pièces esquillées and 6 spokeshaves.
18. Tool diversity. High residential mobility has relatively few tool types serving multiple functions. The number of moves per year negatively correlated with tool diversity.	7 Tool types (Bifaces, projectile point/knives, scrapers, retouched waste flakes, and wedges.) .	Figure's 14.19, 14.20, 14.21, 14.22, and 14.23)	Few tool types are serving multiple functions – indicative of high residential mobility.
Mobility based on Core/Biface ratios. (Bamforth, Becker 2000)			
19. Low core/biface ratios are often linked to high mobility. **20. High ratios linked to more sedentary lifestyles.**	0 Core 18 Bifaces		Not calculable

Employing each of the toolkit characterization models, i.e., flexible multiple portable tools, number of specialized tools, the range of tool diversity, and core biface ratios indicate that the inhabitants of Tenant Swamp were by these measures mobile as opposed to a sedentary group.

14.14.2 Mobility/sedentism based on reduction stage location distribution of debitage.

No description of the Tenant Swamp site's debitage distribution by dimensions or weight as a proxy for size was noted in the published literature for the site. What was provided, however, was the cumulative amounts of debitage per site and loci in addition to the tool to flake ratios.

Table 14.34. The tool to flake ratio for Tenant Swamp site loci

	Locus 1	Locus 2	Locus 3	Locus 4
Tool to debitage ratio	1:23	1:36	1:16	1:12

The low tool to debitage ratios in shown Table 14.34 reflects secondary and tertiary flake reduction with no indication of primary tool manufacture (Goodby et al. 2014:135). It is believed that these ratios reflect the maintenance and reworking of existing tools. These low ratios also indicate that tool manufacturing was not the primary activity at any of the Tenant Swamp loci (Goodby et al. 2014:135).

With the Munsungun chert source located over 700 km away and the Mount Jasper rhyolite material sources situated approximately 270 km from Tenant Swamp, it is doubtful that large cobbles were transported to the site. From the assemblage composition of bifaces, it is more than likely that the early stages of reduction were done at the quarry sites. Therefore, from the assumptions above it would be expected that all steps, initial, further and late, were not present in the assemblage. Tenant Swamp's debitage distribution would appear to be from smaller later stage shaping, reworking or sharpening events thus indicating a mobile population land use.

14.14.3 Territorial round mobility geography and seasonality

Four models whose functioning and assumptions were detailed earlier, i.e., Burke et al.'s (2004), Curran and Grimes (1989), Rockwell's (2012), and Primary prey and vegetational reconstruction model are employed to attempt to define the territorial round geography and seasonality of the hunter-gatherers that occupied Tenant Swamp.

14.14.3.1 Burke et al.'s model for determination of NEM Paleoamerican territorial round range

As previously determined from the morphology/typology of assemblage fluted points, Tenant Swamp was occupied sometime during the Michaud-Neponset mid-Paleoamerican sub horizon (12,200 TO 11,600 cal yr BP). During this time horizon, Burke et al. (2004) hypothesized that based on materials found at sites occupied during this period two possible band ranges could be identified. Applying the Burke et al. (2004) model, two alternatives are suggested. In alternative I, the route (solid red lines) ranged from Lake Munsungun (summer) to Michaud, to Pt Sebago (late summer-fall), to Tenant Swamp (fall-winter), followed by a return to Munsungun (summer) via Mount Jasper (Figure 14.16).

From observations of artifact material sourcing locations and limits of regional site occupation, Burke et al. (2004) also proposed a second alternative territorial round mobility range model. The people exhibiting technology organization characteristic of the Michaud-Neponset horizon showed a preference for a more coastal return circuit (Burke et al. 2004).

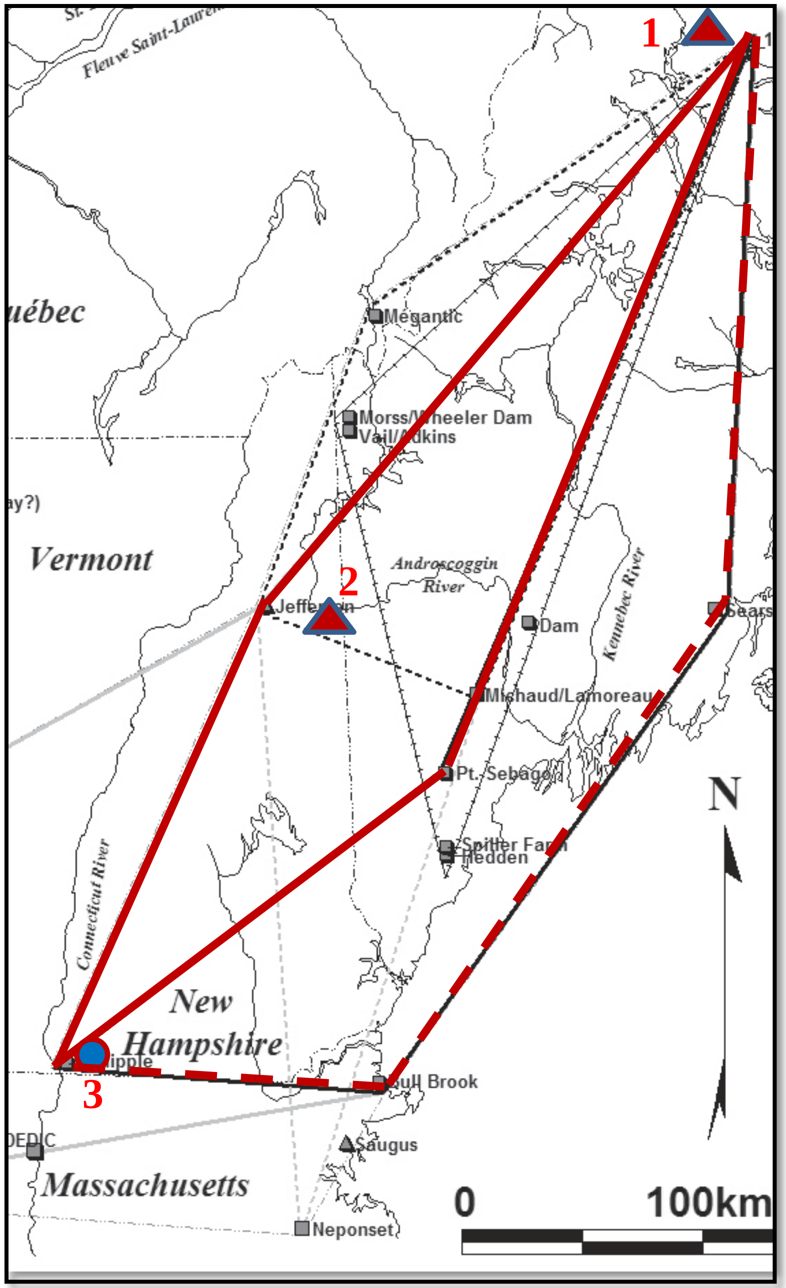


Figure 14.16. Michaud-Neponset sub horizon band range based on lithic material sourcing and diachronic separation of culture horizons. Alternative I: solid red line ranges from Munsungun to Michaud, Pt Sebago, Tenant Swamp (fall-winter) to Mt. Jasper material source (spring) and return to Munsungun. Alternative II: Dashed red line ranges from Munsungun to Searsmont to Bull Brook to Tenant Swamp (Fall-Winter) to Mt. Jasper material source (Spring) and return to Munsungun (Summer). Material source locations: triangles 1) Munsungun chert; 2) Mt. Jasper rhyolite; 3) Tenant Swamp site blue-red circle. (Adapted from Burke et al. 2011.)

The second proposed alternative, shown by the dashed red line in Figure 14.16, ranges from Munsungun (summer) to Searsmont to Bull Brook (late summer-fall), to Tenant Swamp (fall-winter), then to Mt. Jasper for rhyolite resupply (spring) and return to Munsungun (summer). These two possible routes would appear to describe the territorial round of the occupants of the Tenant Swamp site (Figure 14.16).

Table 14.35 provides the percentage of Munsungun chert source material found at each of the known sites. Presence of the Munsungun chert indicates the potential validity of the circuit. If none of this source chert was found in each of the site assemblages, it would be questionable if that site was on the territorial round route.

Table 14.35. Percentage of Munsungun chert in the assemblage of territorial round sites

Territorial round mobility range sites with Munsungun source	Percentage of Munsungun chert in the artifact assemblage
Munsungun	97
Searsmount	28
Michaud	62
Pt Sebago	93
Tenant Swamp	46
Vail	.25
Bull Brook	58

14.14.3.2 Curran and Grimes model for determination of NEM Paleoamerican territorial round range

Table 14.36 represents the actual distribution of material types by percent found in the Tenant Swamp site's artifact assemblage by season as predicted from the Curran and Grimes (1989) model. From the model, it would be expected that during the Michaud-Neponset mid-Paleoamerican sub horizon, Tenant Swamp was occupied as a fall to winter (North to South) or spring transit site (South to North) with a northern summer embedded chert material acquisition at Munsungun.

Table 14.36. Expected distribution of material types to be found in NEM sites by season

Season	Northern Cherts Munsungun, Primary Lithic	Southern Volcanics/rhyolite Secondary Lithic	Cherts, Jasper, Quartzite (Opportunistic)
Summer (North)	Majority % *Munsungun*	Rhyolite % high – nearly equal to Munsungun.	Quartz
Fall Transit (North to South)	Majority %	Rhyolite % still high but declining %	Small %
Winter (South)	Majority-declining %	declining %	Small-increasing %
Spring Transit (South to North)	Majority-further declining% *Tenant Swamp 46% Munsungun*	Significant % *Tenant Swamp 51% Rhyolite*	Small-further increasing 2 %

14.14.3.3 Rockwell model for determination of NEM Paleoamerican territorial round range

As indicated in Table 14.37, the seasonality tool kit and occupation span indicators model, occupations containing large numbers of tools related to butchery and hide working in addition to organic material processing (wood), likely represent late summer or early fall occupations.

Table 14.37. Rockwell model seasonality tool kit and occupation span indicators

Season	Tool Kit and Occupation Span Indicators	Tenant Swamp's Toolkit & Occupation Span
Winter to early spring	• A wide diversity of activities, a wide range of tool types. • Sites occupied for an extended period and located near lithic quarries.	
Late spring and early summer	• Evidence of regular moves and short occupations. • Few activities are occurring at each site, tool type range limited. • Likely a mixture of residential and logistical sites represented.	• Occupation span estimate: high single-digit days to 2 weeks • Flexible, portable tools. Limited tool types are serving multiple functions indicative of high residential mobility. • Toolkit related to residence, tool production/maintenance, woodworking, butchery and hide working, (Projectile points, scrapers, tools, modified/ retouched flakes.) • Goodby et al. (2014) indicates woodworking and hide working.
Late summer and early fall. Possibly into late fall	• Occupations contain large numbers of tools related to butchery and hide working. • Occupations likely to be short to medium in length as fall caribou hides and meat are at their prime.	• 5 Projectile points/knives, 52 Scrapers, tools, 16 Modified/ Retouched Flakes, chopper, and wedges • 10 to 30 days loci occupation durations.

The occupations would be short to medium in length when fall caribou hides and meat are at their prime. Tenant Swamp's artifact assemblage seasonality parameters support the Rockwell (2014) model and suggest that occupation occurred in the late summer and early fall.

14.14.3.4 Primary prey and vegetational reconstruction model for determination of NEM Paleoamerican territorial round range

It could be expected that caribou, traveling between northern calving and southerly wintering grounds, would have wintered 10 to 50 km south of the forest boundary in south-central Maine and southern New Hampshire (Newby et al. 2005; Spiess 1984). This range of migratory caribou movements corresponds to the circuits from Lake Munsungun and return as described in the Burke model. However, because Tenant Swamp was situated on the edge of the poplar-spruce-fir forest, the caribou herds would have wintered in smaller groups that would have been found in the more northerly mixed tundra terrain (Spiess 1984).

14.15 Settlement pattern adaptations and site/loci domestic activity land-use

14.15.1 Settlement pattern adaptations: indications of forager/collector land use strategy

Tenant Swamp's settlement pattern traits indicate a forager adaptation. This assessment is based on the details of the diagnostic traits outlined in Table 14.38 with comparisons to Tenant Swamp's assemblage artifacts that exhibit these characteristics.

The most noteworthy elements observed in the locus's assemblage that are characteristic of a forager's toolkit are flexible tool technology, few specialized tools, minimal tool diversity, maintainability, and make - mend technology.

Table 14.38. Tenant Swamp forager/collector settlement pattern adaptation characterization

Forager/Residential Mobility Tool Profile	Observations on Forager Profile	Tenant Swamp's assemblage
• **Flexible tool technology** • **Few specialized tools** • **Low tool diversity** • **Microware (Odell) (Chatters; Odell)**	1. High forager/residential mobility has flexible technology as each tool will serve multiple tasks. 2. Higher forager/residential mobility indicate less specialized tools and more need for toolkit portability. 3. Few tool types are serving multiple functions – indicative of high forager/residential mobility — the number of moves per year negatively correlated with tool diversity. 4. Individual tools show multiple wear traces as each tool serves several functions.	• 93 modified/retouched expedient flake tools and 18 bifaces indicative of flexible, portable tools. • 2 Projectile point fragments, • 29 Scrapers, • 14 pièces esquillées. • 7 Tool types (few) • Figure's 14.19, 14.20, 14.21, 14.22, and 14.23)

Tenant Swamp's tool manufacturing technology settlement pattern adaptations (Table 14.39) shows that projectile points and fragments (Figures 14.19, 14.20, and 14.21) were manufactured to minimum nominal dimensions. Nominal dimensions for NEM point types are found in Bradley et al. (2008:141-142). When compared to sedentary populations points, they are smaller, i.e., widths, weight, thickness, and basal features, indicating point manufacture and maintenance was designed for flexibility and high mobility. Even though there were a minimal time and energy savings, inspection of the point base fragments shows less thorough basal and edge grinding reflecting lesser attention to point hafting and less energy investment. Culturally identified point and point fragments do not clearly show evidence of reworking. Finally, fewer specialized tools types are found in Tenant Swamp's loci tool assemblages confirming another of the forager/collector profile indicators of a forager activity pattern (Table 14.39). In sum, Tenant Swamp's loci settlement pattern adaptation profile is a fit to foraging behavior.

Table 14.39. Tenant Swamp's tool manufacturing technology settlement pattern adaptation characterization

Point manufacturing and maintenance models	Point/tool manufacturing profile derived from the sum of various model characteristics (forager profile)	Particular Locus Tenant Swamp assemblage indicators to comparison profile (forager profile)
• **Weapons maintainable** • **Time minimization** • **Make and mend** • **Tools used to exhaustion** • **Less attention to hafting.** **(From Bleed 1986; Bousman 1994; Torrence 1983; Kuhn 1989; and Nelson 1991)**	1. More extensive reworking. 2. Lower craftsmanship 3. Less energy investment 4. Informal technological 5. Less grinding reflects less attention to hafting. 6. Max. dimension - Smaller 7. Basal width - Smaller 8. Maximum width - Smaller 9. Maximum thickness - Thinner 10. Concavity depth 11. Edge grinding index - Less 12. Weight – lighter	• One clear evidence of reworking. Reworking evident in scraper technology. • Less thorough grinding reflects less attention to point hafting – less energy investment, fewer specialized tools/types. • Projectile points show un-patterned flaking pattern correlating with reduced craftsmanship and less energy investment • All point dimensions, widths, weight, thickness, and basal features are minimums indicating manufacture and maintenance was designed for flexibility and high mobility. • Comparisons indicate forager as opposed to sedentary profile for Tenant Swamp's inhabitants.

14.15.2 Tenant Swamp's landscape use patterning and domestic activities

14.15.2.1 Tenant Swamp's *activity use patterning from attribute clusters (groups).*

Tenant Swamp's landscape usage and activities patterning based on attribute cluster or group model are compiled in attribute Table 14.40. The table presents the data for all four defined site Loci 1, 2, 3, and 4. The tool range for Loci 2, 3, and 4, i.e., the quantity of varying tool forms, i.e., projectile points, the presence or absence of channel flakes, modified and/or retouched flakes, debitage assemblage, and classifying features typically indicates a Paleoamerican habitation usage (Gramly and Funk 1990; Spiess et al. 1998). A habitation campsite/locus is defined as a place with multiple activity areas and where a variety of daily maintenance activities took place (Andrefsky 2005 201:223, Chatters 1987:363-366; Gramly and Funk 1990:14; Kvamme 1988:387-393; Kooyman 2000:129-133; Nelson 1991:78-86; Odell 2003:188-202).

The Michaud-Neponset style fluted point fragments identified in Locus 2 and 3, suggests that all 4 loci probably date to the middle Paleoamerican (Bradley et al. 2008), even though there was no diagnostic evidence found in Locus 3 or 4 (Goodby et al. 2014:157). Small quantities of quartz debitage, but no quartz tools, were recovered at each locus.

Similarities among Loci 2, 3, and 4, includes a lack of emphasis on stone tool manufacture, a high tool to flake ratio, and a low number of bifaces. These similarities suggest that generally comparable activities took place at each locus and that they likely were occupied at the same point in the seasonal round. From these observations, it appears that hide processing was a dominant activity at the site as a whole (Goodby et al. 2014:157).

However, there are some noteworthy differences in Locus 1 as it stands out from the other three loci in its significantly lower number of tools, the absence of some formal tool types, i.e., gravers, spokeshaves, and side scrapers, in addition to the dearth of bifaces. At the same time, it had the highest number of end scrapers and wedges, suggesting that a focused, narrower range of processing activities took place there (Goodby et al. 2014:158).

Table 14.40. Tenant Swamp site usage attribute cluster characterization model

I. Attribute groups	Locus 1	Locus 2	Locus 3	Locus 4
Toolkit artifact types (major)				
• **Projectile points and point fragments, fluted**	0	1	1	0
• **Bifaces / biface fragments**	0	6	4	5
• **Fluted drill**	0	0	0	0
• **Channel flakes unspecified**	0	0	0	0
• **Cores and core fragments unspecified**	0	0	0	0
• **Retouched flake and utilized waste flake**	14	27	32	20
• **End scraper and side scraper**	7	6	6	10
• **Pièces esquillées (wedges)**	6	3	0	5
• **Chopper**	0	0	1	0
• **Spokeshave**	0	2	2	2
Number of tools in the assemblage (including undifferentiated unifaces not listed above. Goodby et al. 2014)	37	60	62	57
II. Classifying features				
Aggregate/individual debitage classification				
• **First stage reduction, nodules, cores, and large flakes**	0	0	0	0
• **Reduction flakes greater than 8g**	0	0	0	0
• **Reduction flakes – small < 8g**	817	2271	917	738
Tool index: Range, variety, and quantity of tool types	148	420	372	399
Material type sources	7			
• **Primary & secondary source of lithic tool making material – local or exotic/remote**	Mt. Jasper rhyolite & Munsungun remote	Mt. Jasper rhyolite & Munsungun remote	Mt. Jasper rhyolite & Munsungun remote	Mt. Jasper rhyolite & Munsungun remote
Dimensions of Locus area m² (excavated not encompassed)	10.5	17.5	12	10.5
Number of artifact/activity concentrations per locus	1	1	1	1
Artifact and density –artifacts/ m²	81..3	133.2	81.6	75.6
Tool artifact and density – tools/ m²	3.5	3.4	5.2	5.4
Distance relationship between locus area clusters in meters	4	6	15	60
Site features and organics	Bone, debitage, charcoal.	Bone (Bulk of bone found in loci 1 and 2	2 pieces of bone	2 pieces of bone
Knapping episodes – both tools and debitage co-located (Mostly maintenance and sharping)	Yes	Yes	Yes	Yes
Geological and geographic characterization	Sandy glacial till	Sandy glacial till	Sandy glacial till	Sandy glacial till

14.15.2.2 Tenant Swamp's landscape usage and activities from graphical attribute cluster presentation

Figure's 14.17 and 14.18 presents the Tenant Swamp site's loci usage and activities from a graphical attribute cluster perspective. Locus 2, 3, and 4's are combined in Figure 14.17 because of the similarities in their attributes. From the combined figure it can be seen that many of the same predicted habitation site attributes, i.e., higher tool index, a range of tool types used in differing habitation subsistence tasks, and a higher volume of reduction flakes distributed over a larger area are present. (Andrefsky 2005:201-223, Chatters 1987:363-366; Gramly and Funk 1990:14; Kvamme 1988:387-393; Kooyman 2000:129-133; Nelson 1991:78-86; Odell 2003:188-202). Habitation loci exhibiting the characteristics enumerated above display a significantly different profile than processing or workshop loci that represent locations of specialized task execution.

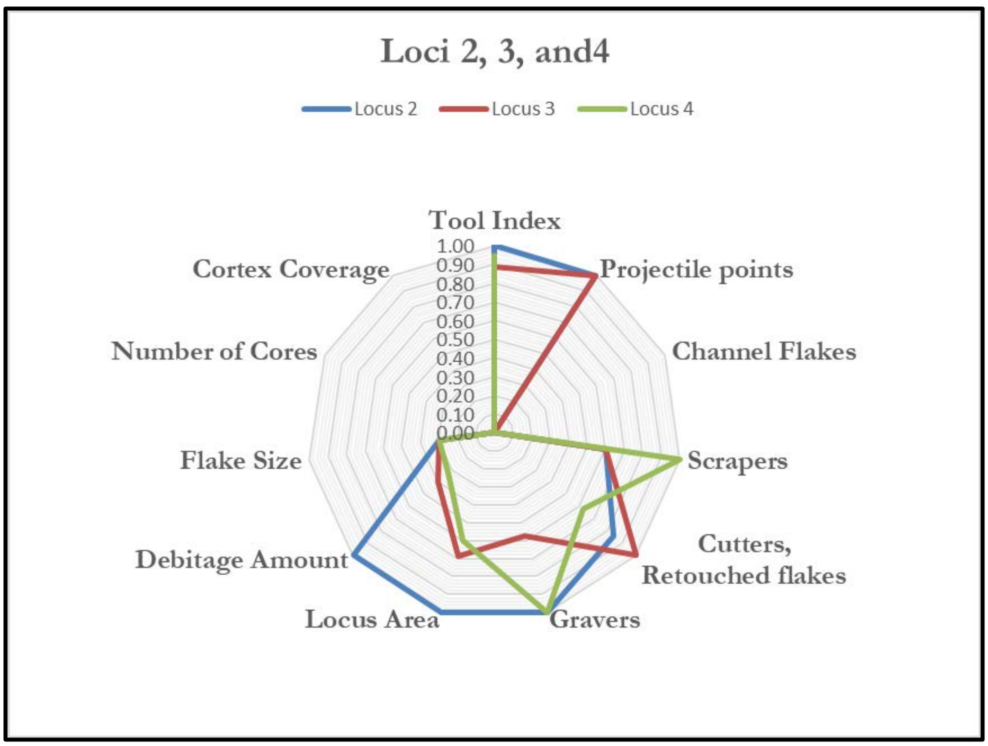


Figure 14.17. Tenant Swamp Locus 2, 3, and 4 domestic activity use patterning cluster diagram.

Locus 1's, activity use patterning cluster is shown in Figure 14.18 suggests that it represents a processing area due to the larger number of just a few tool types. In case of Locus 1 these tool types are scrapers and retouched flakes. The diagram (Figure 14.18) indicates a disproportionally large number of scrapers, cutters, and retouched flakes, and similarly a low quantity of debitage, lower tool index, a lack of cores, projectile points, and channel flakes, in conjunction with a smaller activity area.

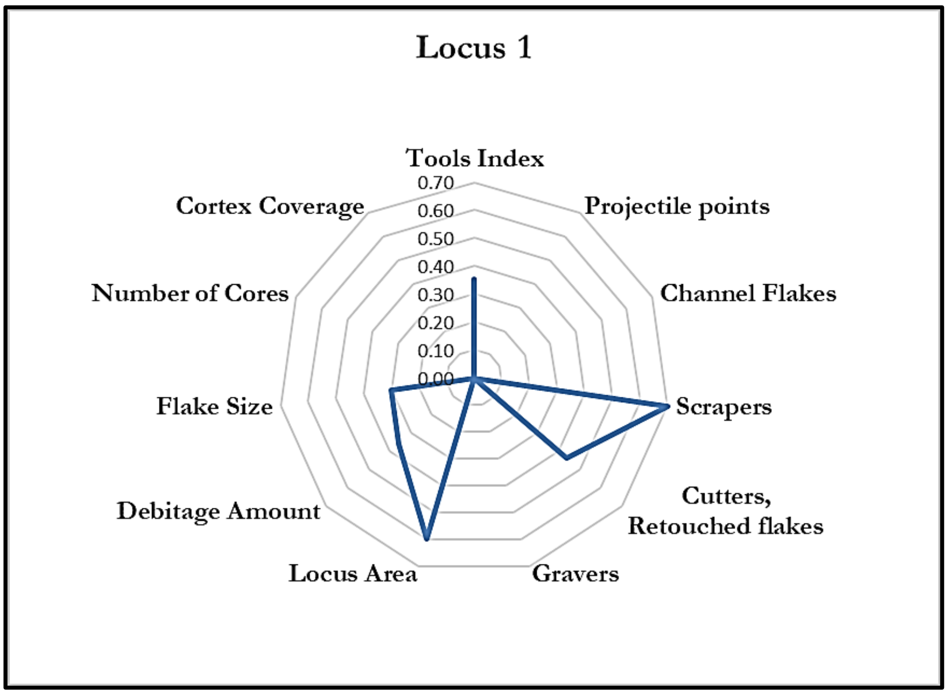


Figure 14.18. Tenant Swamp Locus 1 domestic activity use patterning cluster diagram.

14.15.2.3 Microwear analysis method of landscape activities and loci usage

The conclusions above were supported by the results of the microwear analysis, which showed evidence of hiding scraping and a lack of tool making in all four loci. Together with the relatively high number of unifacial tools, microwear suggested that hide processing was a dominant activity at the site as a whole.

14.15.2.4 Tenant Swamp's landscape use patterning and domestic activities: Shannon-Weaver analysis

To validate Tenant Swamp's locus activity area characteristics, an analysis, shown below in Table 14.41, was performed to measure the diversity or entropy of the sites tool artifact assemblage. The diversity measurement is based on the Shannon-Weaver information theory equation (14.1) that measures each locus' tool assemblage breadth. The greater the diversity or entropy number indicates a wider and broader variety of tools as might be found in habitation sites. The smaller the diversity or entropy number indicates a narrower variety of tools as might be found in a processing site. (Andrefsky 2005:201-223, Chatters 1987:363-366; Gramly and Funk 1990:14; Kvamme 1988:387-393; Kooyman 2000:129-133; Nelson 1991:78-86; Odell 2003:188-202).

Equation 14.3 $$\text{Diversity} = \sum_{i}^{n} p_i \log(p_i)$$

Table 14.41. Diversity validation of Tenant Swamp's locus activity area characterization

Locus	Diversity or entropy
Loci 2, 3, and 4	.6282
Locus 1	.4451

From the value of diversity indicated in Table 14.41, Loci 2, 3, and 4's value shows a broader range of tool types then Locus 1. The broader tool range is indicative of site usage as a habitation locus. The diversity value for Locus 1 is significantly lower than those of Loci 2, 3, and 4 and is driven by a smaller range of tool types or lower number of tools, thus indicating use as some category of processing locus such as hide scraping (Andrefsky 2005:201-223, Chatters 1987:363-366).

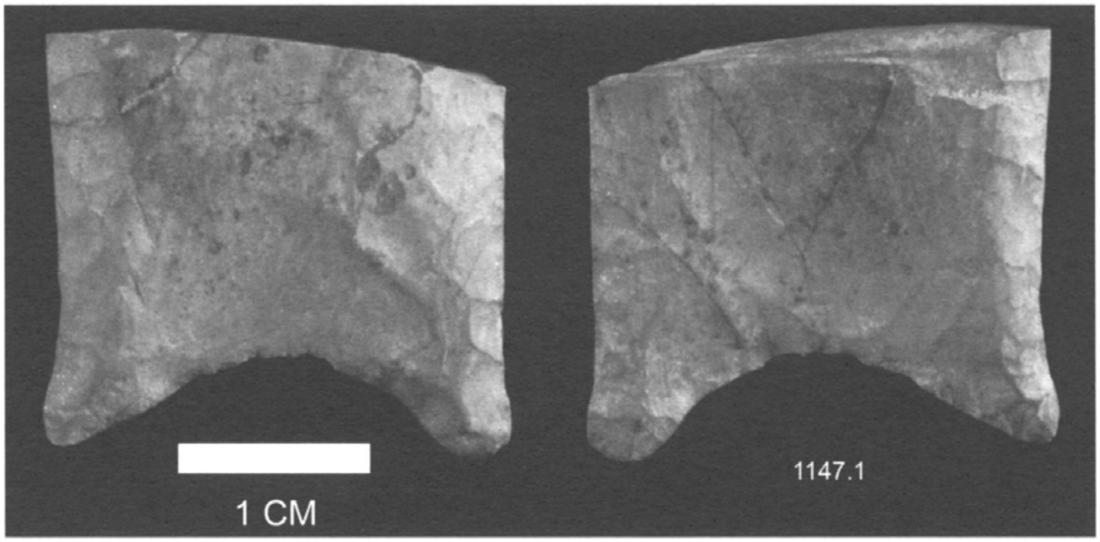


Figure 14.19. Fluted point base from Locus 2, obverse and reverse views. (From Goodby et al. 2014:140).

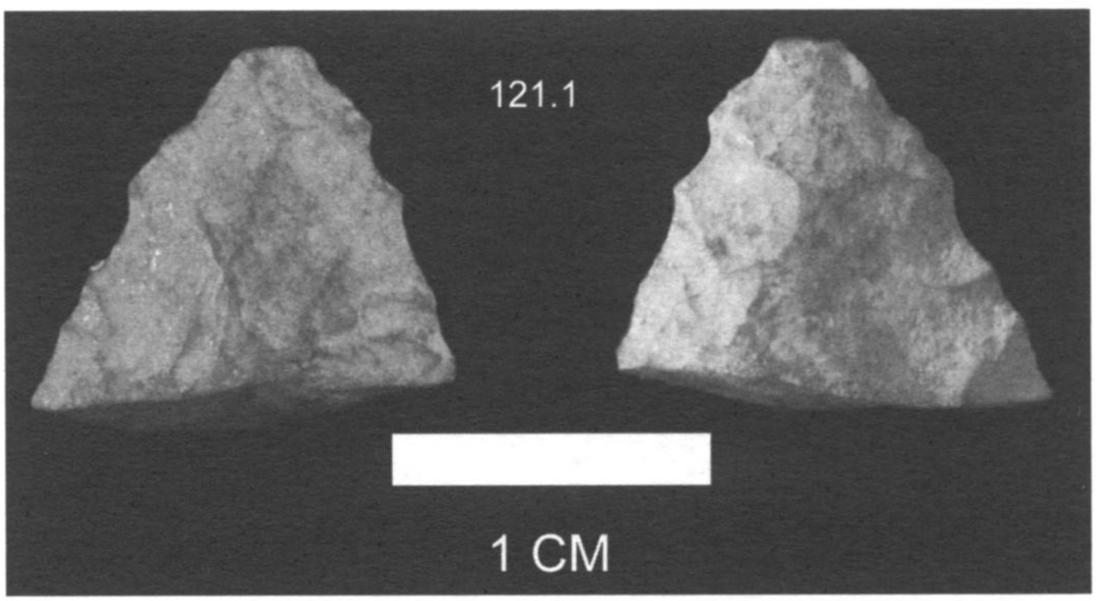


Figure 14.20. Projectile point tip from Locus 3. (From Goodby et al. 2014:141).

Figure 14.21. Fluted point ear from Locus 3, obverse and reverse views. (From Goodby et al. 2014:145).

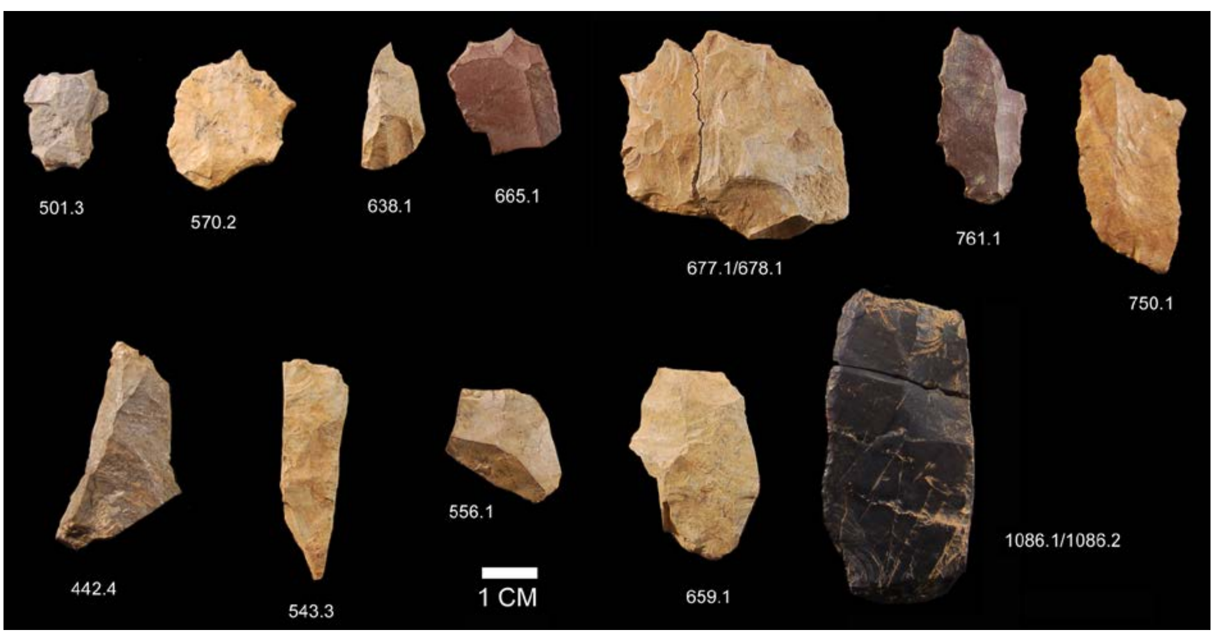


Figure 14.22. Gravers (top row) and *Pièces esquillées* (bottom row) from Locus 4. (From Goodby et al. 2014:152).

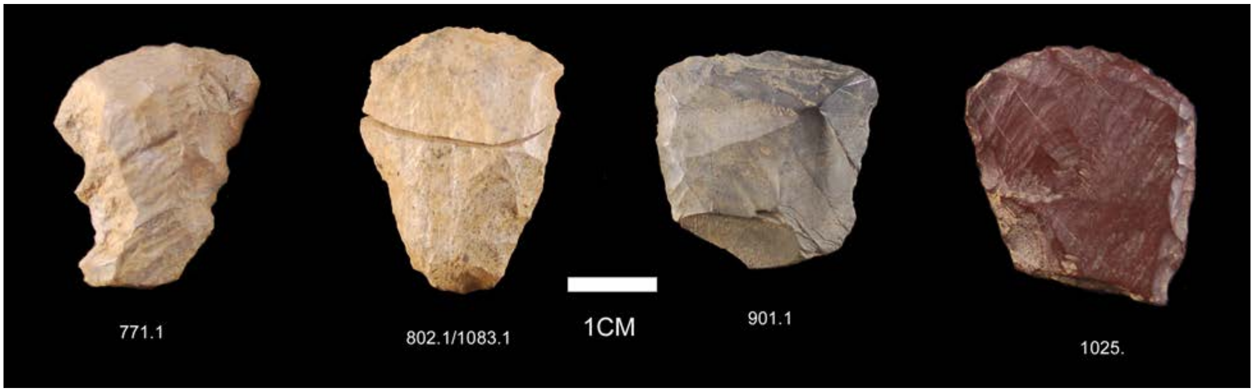


Figure 14.23. End scrapers from Locus 3. (From Goodby et al. 2014:145).

Part 6

Results, discussion, and conclusions

This part of the investigation presents the summary results, interpretations, and conclusions of the analysis into the Potter site, a Paleo-cultural occupation in the White Mountains of NH, and its loci. The details of the preceding section (part 5) are pulled together here in order to draw out the broader issues. Topics addressed include interpretations of the Potter site cultural adaptations and settlement patterns analyzed in the previous section. Finally, this section portrays the overall conclusions drawn from the analysis and its results from the testing of the research problem hypothesis of the study for validation. Further, additional research areas are identified.

Chapter XV presents and discusses the results of several patterns that emerged from the analysis (Chapters XI to XIV) of the Potter and comparison site loci for their cultural acclimatization and settlement behaviors. The first of emergent patterns was that all of the Potter site loci were dated to the early or middle Paleoamerican horizon (12,900-11,600 cal yr BP) and then abandoned with no evidence of reoccupation during the later Archaic or Woodland horizons. However, it is reasonable to expect that the Potter site was reoccupied at different times as part of a seasonal round event occurring during the Paleoamerican horizon. This observation is driven by the lack of intrasite tool refits.

Another pattern that was observed was that the Potter site's loci short-term occupation durations could be interpreted as indicating that the occupants exhibited a forager residential rather than a logistical mobility pattern (see Binford 1980). Further, all loci at Potter site exhibited similar technological organization based on a highly segmented tool blank, biface, fluted point, reduction sequence, and core and flake tradition. Finally, the chapter describes how each of the Potter loci that exhibited similar attributes was grouped into a habitation, flake stone tool production, or processing (food, wood and hide) activity area based on their artifact (toolkit) assemblage similarities.

In the same way, from the analysis results, indications are that the comparison site's loci were also occupied during the early or middle Paleoamerican horizon (12,900-11,600 cal yr BP). However, all the comparison site's except Bull Brook were reoccupied during the same Paleoamerican or a later cultural horizon. The Whipple, Vail, and Tenant Swamp site's loci short-term occupation spans likewise indicated that the occupants exhibited a forager residential rather than a logistical mobility pattern. All of the comparison site loci displayed similar technological organization as was the case at the Potter site. Again, the comparison site loci technological organization was based on a tool blank, biface, fluted point, reduction sequence, and core and flake tradition. Each of the comparison site's loci, exhibiting similar attributes, were grouped into functional activity areas by the principle excavators who analyze their site. The loci characterization of similarities or differences were demonstrated through the use of Shannon-Weaver and chi-squared analysis.

The research problem and objectives of the study and the result of their analysis conclusions are detailed in Chapter XVI. The research problem hypothesis as outlined in Chapter I is reexamined for its validation in light of the results from the application of qualitative and quantitative modeling methodology to the site's artifact assemblage. The tested research problem in this study responded to the following issues.

1. The periods and the extent to which the Potter site was occupied during the late Pleistocene to early Holocene Paleoamerican timescale.

2. How the site should be classified as one of those few, but large aggregation sites as characterized by Dincauze (1993),
3. If not one of these site characterizations, what does this site represent in terms of settlement pattern organization and scope of activities pursued during the occupation.
4. How, specifically, Northeastern Paleoamerican groups moved across the White Mountains landscape at this site – through systems of residential mobility, logistical mobility, or both?

Chapter XV

The results of the Potter and comparison site analysis

15.1 Potter site Locus C, K/G, and H's analysis results summary

Chapter XV summarizes and discusses the results of the analysis presented in Chapters XI through XIV for the Potter and comparison site's loci. The results and interpretation of their cultural adaptations and settlement pattern behaviors are organized by the four broad occupation behavioral trait categories used in the analysis. Restating these are 1) technological organization; 2) intra-site chronology; 3) mobility patterns; and 4) settlement patterns. Several behavior patterns that emerged from the analysis are discussed and interpreted.

For completeness, each of the occupation behavioral trait categories begins with reference to the models that were employed in the analysis and interpretation. An operational description of the models was provided in Chapter V.

The first three Loci (C, K/G, and H) are grouped because of their similarities in the wide range of tool types and quantities in each locus in addition to their area size. Two Loci K and G were grouped together because of their close proximity as discussed in Chapter VI and are referenced as K/G in the analysis.

15.1.1 Technological organization and culture horizon

The analysis models used were NEM technological organization (Lathrop et al. 2011; Bradley et al. 2008.)

Loci C, K/G, and H's tool production and reduction sequence components of their technological organization are based on a tool blank, biface preform, fluted point, core and flake reduction tradition. Blade technology was not found in the loci. The absence of blade technology is expected during the fluted point Paleoamerican culture horizon in the New England-Maritimes (NEM). This technological organization places Loci C, K/G, and H's occupation somewhere during the Paleoamerican cultural horizon that ranges from 12,900 - 10,800 cal BP or more specifically, the early to mid-Paleoamerican period (12,900 – 11,600 cal BP).

The technological organization of tool production and reduction sequence elements are clearly unique to the New England-Maritimes (NEM) Paleoamerican horizon. For example, projectile point fluting and the lack or use of blade technology in addition to morphology differences differentiate it technologically from that found in later NEM cultural horizons. This technological organization indicator provides a positive guide to the Potter and comparison site's occupation horizon. Further, the NEM technological organization is also differentiated geographically. This is seen in the Great Lakes Region Clovis derivative technology that derives from an earlier horizon to the west of the NEM.

15.1.2 Temporal aspects of site habitation

15.1.2.1 Occupation horizon

The analysis models used were the Diagnostic traits matrix (Bradley et al. 2008; Gramly and Funk 1990; Spiess et al. 1998).

The analysis of Loci C, K/G, and H's flaked stone artifact assemblage characterized by diagnostic traits (Presented in Chapter 11, see Table 11.1) further confirms the placement of the site's loci occupation within the Paleoamerican cultural horizon. Additionally, the inclusion of the presence or absence of specific diagnostic traits then refines the temporal placement of loci C, K/G, and H into the early to the mid-Paleoamerican horizon.

The presence of the projectile point fluting trait as opposed to basal thinning provides the reasoning for the placement of the loci into the early to the mid-Paleoamerican period (Bradley et al. 2008).

15.1.2.2 Occupation date range

The analysis models used were the morphologically based typology (Bradley et al. 2008:136-141, 141-146. See Table 11.2).

From the morphologically based typology model, the date range for Loci C, K/G, and H is further narrowed by the presence of Michaud–Neponset point types. This point type suggests a Middle Paleoamerican horizon that ranges from 12,200 to 11,600 cal yr. BP. Additionally, a Bull Brook point type was also discovered in Locus K/G, pointing toward an even earlier occupation. The Bull Brook point form indicates an early Paleoamerican horizon that ranged from 12,900 to 12,400 cal yr. BP.

The occupation date range provided through the application of the morphologically based typology model to the Loci C, K/G, and H projectile points confirms that these loci were occupied during the mid-Paleoamerican horizon. The Bull Brook point form substantiated an occupation of Locus K/G during the early-Paleoamerican period. With both Michaud–Neponset and Bull Brook point types having been found at Locus K/G indicates that the locus and site were reoccupied during the early and middle-Paleoamerican horizons.

15.1.2.3 Occupation duration

The analysis models used were the occupation duration from occupation span index (Surovell 2009), revised exponential form ring model correlation (Whitelaw's 1983), and tool loss model (Mc Ghee 1979, Spiess 1984).

All of the models utilized to analyze Loci C, K/G, and H's occupation duration, i.e., the relative magnitude OSI proxy variable, exponential form correlation ring, and tool loss per person day provided indications of short-term occupations (see Chapter V for operational descriptions). The results generated from the models indicate that the occupants stay extended over high single-digit days to four weeks in length.

These short-term occupation durations or spans are characteristic of mobile forager as opposed to a logistical collector behavior. It is likely that the occupants of Loci C, K/G, and H were in pursuit of migrating caribou as part of their seasonal round. Ethnographically Binford (1979) observed that the Nunamiut obtained a significant percentage of their yearly food in 15 days during the spring caribou migration and 15 days during the fall caribou migration. The short-term occupation duration at Loci C, K/G, and H corresponds with the expected passage of the caribou migration past the site.

15.1.2.4 Distinguishing reoccupation - instances of single or multiple occupations

The analysis models used were the artifact distribution stratigraphy (Spiess et al. 1998)., the heuristic density of artifact and material type source location(Gramly and Funk 1990), and regression correlation reoccupation models (Surovell 2009).

Two of the models, i.e., the heuristic model and the regression correlation model (see Chapter V), were applied to evaluate if Loci H and C were the results of single or multiple occupations. The result from both models essentially agree and indicate that these loci were single occupations. The results of the stratigraphic distribution of artifacts, tools and materials type model were inconclusive because of vertical soil mixing (see Chapter XI). However, in the case of Locus K/G, two diagnostic projectile point types representing different Paleoamerican sub horizons indicated reoccupation of that locus.

Because both Michaud–Neponset and Bull Brook point types were found at Locus K/G indications are that the locus and site were reoccupied during the early and middle-Paleoamerican horizons.

15.1.3 Mobility patterns and seasonality inferences

15.1.3.1 Indications of mobility/sedentism

The analysis models used (see Chapter V) were the mobile land-use analysis based on tool flexibility (Bleed 1986), portability (Kelly and Todd 1988), specialization (Bousman 1994; Kuhn 1995), reduction sequence distribution Symons (2003), and tool diversity and core/biface ratios (Bamforth and Becker 2000).

Loci C, K/G, and H’s stone tool assemblage composition are indicative of a flexible, portable toolkit. This is founded on the parameters specified in the mobility/sedentism models discussed in Chapter V. Furthermore, the reduction stage debitage location evidence (Table 11.5), i.e., insignificant initial primary reduction flakes, lack of cortex, dorsal scar count increases in medium to smaller flakes, and a predominance of late reduction stage products, once again, points to a mobile as opposed to a sedentary land-use. Also, examining the core to biface ratio reveals that a proportion of approximately 1:5 represents a low value that is likewise indicative of higher inhabitant mobility (Bamforth and Becker 2000).

All of the models applied to test for mobility or sedentism clearly indicate that the occupants of Loci C, K/G, and H were highly mobile foragers as opposed to sedentary collectors.

15.1.3.2 Territorial round mobility geography and seasonality

The analysis models used (see Chapter V) were Burke's territorial round (Burke et al.'s 2004), material type and quality Curran and Grimes (1989), Rockwell's (2012, 2014) seasonality parameters, and the primary and vegetational reconstruction models.

The proposed Burke et al. (2004) territorial round describes a potential circuit for the occupants of Loci C, K/G, and H. The seasonal round (Figure 11.4) ranged from Lake Munsungun (summer) to Michaud to Randolph/Potter (fall-winter) following on to Jefferson and possibly Megantic with a return to Munsungun (summer). The area of this territorial circuit is 20,500 km^2.

The Burke et al. (2004) model was developed from the analysis of the lithic sourcing data for several early Paleoamerican sites in northeastern North America. Burke et al. (2004) suggest that Paleoamericans obtained most of their raw materials using an embedded strategy (Binford 1979) but did not discount the possibility of logistical trips to quarries or a combination of both procurement strategies. Further, Burke et al. (2004) take the term territory to refer to the geographic area exploited on a regular (seasonal, annual or multi-year) basis by a hunter-gatherer group. There is no stipulation in the application of Burke's model that the round was based on an exact seasonal, annual or multi-year timeframe. However, there are seasonal indicators based on the caribou migration patterns.

Application of Rockwell's (2012) seasonality toolkit parameters to Locus H’s artifact assemblage suggests that occupation occurred in the late spring or early summer or even possibly later. Loci C and K/G’s, seasonality indicates a late summer or early fall occupation. Similarly, the primary and vegetational reconstruction model confirms the described directional extent. A proportion of the range of migratory caribou movements approximates the circuit described above.

Analysis of the territorial round mobility geography and seasonality based on embedded material procurement indicates a geographic path extending from somewhere south of the Potter site to Lake Munsungun in the north. A judicious conclusion would be that this diversity in pattern reveals at least a part of the annual round of groups operating in the region during the early and mid-Paleoamerican period.

The round-trip distance between these two points of the circuit is approximately 680 miles and could be covered in 170 days at a pace of 4 miles per day. This would leave 195 days for other foraging and pausing activities such as lodging and hunting. Further, from the toolkit assemblages and the quality of the caribou meat and hides procured during the hunt it may be suggested that seasonality can be inferred.

15.1.4 Settlement pattern adaptations and site/loci domestic activity land-use

15.1.4.1 Settlement pattern adaptations: indications of forager/collector land use strategy

The analysis models used (see Chapter V) were flexible tool technology (Andrefsky 2005 201:223; Bleed 1986; Kelley and Todd 1988; Odell 2003), few specialized tools (Odell 2003, Chatters 1987), minimal tool diversity (Kooyman 2000), and micro-wear low-power magnification analysis (Kooyman 2000).

In sum, from the results of the models applied, Loci C, K/G, and H's settlement pattern adaptation profile is a fit to foraging behavior. The most significant elements (Chapter11, Table 11.10) observed in Loci C, K/G, and H's assemblages that are characteristic of a forager's toolkit are flexible tool technology, few specialized tools, minimal tool diversity, and micro-wear.

With short occupation spans and flexible toolkits, the inhabitants of Loci C, K/G, and H reflect behaviors that are representative of foragers as opposed to sedentary collectors.

15.1.4.2 Activity use patterning and domestic activities from attribute clusters (groups).

The analysis models used (see Chapter V) were attribute clusters (Gramly and Funk 1990), toolkit artifact composition (Shott 1986), graphical interpretation (Kvamme 1988:387-393), the microwear analysis method of landscape activities (Rockwell 2010; 2014), and diversity-entropy models (Shannon-Weaver 1948).

From the attribute cluster analysis of Loci C, K/G, and H's artifact assemblage, its graphical representation, horizontal and vertical artifact distribution, in conjunction with debitage analysis provides a contextually viable interpretation of the loci's landscape usage as habitation sites. Further, Shannon-Weaver (1948) and chi-squared analysis demonstrated that the values of the loci's diversity and evenness index were higher for residential camps than those of a specialized hunting camp, toolmaking, or processing site/loci (Andrefsky 2005:201-223; Chatters 1987:363-366).

The loci's assemblage, with the presence, diversity, and quantity of tools, generally employed in a somewhat broader range of economic subsistence tasks as opposed to a single *processing task, in conjunction with other attribute features such as physical area dimensions of site/loci, site/loci features, supports the habitation loci interpretation.*

15.2 Potter site Loci F and B analysis results summary

Loci F and B are grouped jointly because of their narrower range and quantity of tool types in addition to the high ratio of debitage to tools.

15.2.1 Technological organization and culture horizon Locus F

The analysis models used (see Chapter V) were NEM technological organization (Lathrop et al. 2011; Bradley et al. 2008.)

Even though Locus F's flaked stone tool assemblage is represented by a small sample, it is hazarded that its technological organization is based on a segmented tool blank, biface preform, fluted point, core and flake reduction tradition. The fluted point technological organization identified in the artifact assemblage places Locus F's occupation range somewhere during the Paleoamerican horizon (12,900 - 10,800 cal BP).

The technological organization of tool production and reduction sequence elements are unique to the New England-Maritimes (NEM) Paleoamerican horizon. Projectile point fluting and the lack or use of blade technology in addition to morphology differences differentiate it technologically from that found in later NEM cultural horizons.

15.2.2 Temporal aspects of site habitation

15.2.2.1 Occupation horizon

The analysis models used (see Chapter V) were Diagnostic traits (Bradley et al. 2008; Gramly and Funk 1990; Spiess et al. 1998).

Correlation of Locus F's assemblage with the diagnostic traits of the NEM Paleoamerican horizon (Table 12.1) corroborates the locus' placement within it (Gramly and Funk 1990; Spiess et al. 1998).

The presence of the projectile point fluting trait as opposed to basal thinning provides the reasoning for the placement of the loci into the early to the mid-Paleoamerican period (Bradley et al. 2008).

15.2.2.2 Occupation date range

The analysis models used (see Chapter V) were morphologically based typology (Bradley et al. 2008:136-141, 141-146. See Table 11.2).

The only diagnostic artifact available in Locus F's assemblage for dating purposes is an untyped Mt. Jasper rhyolite fluted projectile point fragment which places it somewhere in the early to the mid-Paleoamerican horizon (12,900 - 11,600 cal BP).

15.2.2.3 Occupation duration

Locus F is hypothesized to be a satellite material processing as opposed to a habitation area. Therefore, using the various methods for estimating occupation duration would not provide any meaningful estimate or information.

15.2.2.4 Distinguishing reoccupation - instances of single or multiple occupations

The analysis model used (see Chapter V) was artifact distribution stratigraphy.

The stratigraphy differential of Locus F suggests that the same area was utilized as a workshop area for different functions on more than one occasion separated longitudinally or reoccupied.

This result is indicated by the significant number of biface fragments, scrapers, and utilized/retouched flakes found clustered at different levels.

15.2.3 Mobility patterns and seasonality inferences

Since Locus F is put forward to be a processing area and most likely associated with one of the habitation loci, it would have the same mobility patterns and seasonality inferences as discussed for Loci H, K/G, and C.

15.2.4 Settlement pattern adaptations and site/loci domestic activity land-use

15.2.4.1 Locus F landscape usage and activities from attribute clusters.

The analysis models used (see Chapter V) were flexible tool technology (Andrefsky 2005 201:223; Odell 2003), Toolkit composition (Kelley and Todd 1988), few specialized tools (Odell 2003:188-202; Chatters 1987:363-366), tool diversity index (Kooyman 2000; Shannon-Weaver 1948).

From the attribute cluster table (Table 12.2), it is noted that Locus F's artifact assemblage is composed of only three major tool types, i.e., scrapers, modified and/or retouched waste flakes, and biface fragments. Typically, this narrow tool range and numerous quantities of particular tool types (scrapers and retouched waste flakes) indicate something other than a low-intensity habitation occupation occurred at this locus. As indicated in Figures 7.1, 7.2 and 7.3, the tool and debitage distribution cover a relatively small area. Locus F's assemblage configuration, with the presence, quantity, and distribution of tool types, including its small surface area is generally thought to be employed as a workshop for the processing of materials such as foodstuffs, hides, bone, or wood. This artifact assemblage composition diverges from those of Loci H, K/G, and C habitation characterizations as measured by the Shannon-Weaver and evenness index values.

Because Locus F's assemblage is composed of a narrow tool range and numerous quantities of scrapers and retouched waste flakes, it is characterized as a workshop area. As noted earlier, the stratigraphy differential of Locus F suggests that the same area was utilized as a workshop area for different functions on more than one occasion separated longitudinally or reoccupied.

15.2.4.2 Locus F landscape usage and activities from graphical attribute cluster presentation

The analysis model used (see Chapter V) was the graphic approach to clustering (Kvamme 1988:387-393).

Inspection of Locus F's landscape usage cluster diagram shows that most of the generally predicted processing site attributes are apparent, i.e., low tool index, the absence of channel flakes, the large number of scrapers, low volume of reduction flakes and a small area.

The graphical attribute cluster rendering supports the proposed use of the locus as a workshop.

15.2.4.3 Microwear analysis method of landscape activities and loci usage

The analysis model used (see Chapter V) was Microwear analysis (Rockwell 2010, 2014).

Summarized in Table 12.4 are Locus F's microwear analysis results of utilized artifacts. Many of the activities for both bifaces and scrapers at the locus are related to transverse actions, such as scraping, planning and whittling, on medium hardness materials, which were most often interpreted as wood (Rockwell 2010, 2014).

Assessment of Locus F's microwear analysis of tool use activities confirms that many of the generally predicted attributes for multipurpose material processing, tool making, and cobble testing encampment are present.

15.2.5 Technological organization and culture horizon Locus B

The analysis model used (see Chapter V) was the NEM technological organization (Lathrop et al. 2011; Bradley et al. 2008).

The presence of six channel flakes and eight biface fragments suggests that Locus B's stone tool production and reduction sequence of the technological organization is based on a staged biface (multiple stage preform), fluted point, core, and flake reduction tradition as found in other site loci (Lothrop et al. 2016). The fluted point technological organization identified in the artifact assemblage places Locus B's occupation range somewhere during the Paleoamerican horizon (12,900 - 10,800 cal BP).

The technological organization of tool production and reduction sequence elements derive from the New England-Maritimes (NEM) Paleoamerican horizon. Projectile point fluting and the *lack or use of blade technology in addition to morphology differences differentiate it technologically from that found in later NEM cultural horizons.*

15.2.6 Temporal aspects of site habitation

15.2.6.1 Occupation horizon

The analysis model used (see Chapter V) was the diagnostic traits matrix (Bradley et al. 2008; Gramly and Funk 1990; Spiess et al. 1998).

The presence of NEM lithic tool diagnostic trait attributes (channel flakes and spurred end scraper) as shown in Table 12.5, are sufficient to indicate that Locus B's occupation placement is in the Paleoamerican horizon, though not sufficient to be more specific within this broader time frame.

Although it is difficult to be more specific, the presence of channel flakes is suggestive of an early to mid-Paleoamerican occupation horizon.

15.2.6.2 Occupation date range

The analysis models used: morphologically based typology (Bradley et al. 2008:136-141, 141-146).

The only diagnostic available in Locus B's assemblage for dating purposes is six channel flake fragments (Figure 7.14).

The presence of the channel flakes would place the locus occupation somewhere in the early to mid-Paleo sub horizons (12,900 - 11,600 cal BP). 15.2.6.3

15.2.6.3 Occupation duration

Locus B's landscape usage was conjectured to be a stone tool production as opposed to a habitation area based on its limited tool type range, a large number of waste flakes (4197), bifaces, channel flakes, hammerstone and limited locus area (Chapter XIII).

Therefore, using the various methods for estimating occupation duration would not provide any meaningful estimate or information concerning occupation duration.

15.2.6.4 Distinguishing reoccupation - instances of single or multiple occupations

There is no evidence of stratigraphic differentiation by level of material or artifact type to suggest reoccupation of this locus.

15.2.7 Mobility patterns and seasonality inferences

Since Locus B is postulated to be a tool production area, it was most likely associated with one of the habitation loci. Therefore, it would likely share the same mobility patterns and seasonality inferences as discussed for Loci H, K/G, and C.

Therefore, firmer conclusions cannot be drawn.

15.2.8 Settlement pattern adaptations and site/loci domestic activity land-use

15.2.8.1 Landscape usage and activities from attribute clusters.

The analysis models used (see Chapter V) were attribute clusters (Gramly and Funk 1990), toolkit artifact composition (Shott 1986), graphical interpretation (Kvamme 1988:387-393), diversity-entropy models (Shannon-Weaver 1948) and chi-squared analysis.

Locus B's usage and activities characterization developed from the application of the landscape feature matrix to the locus' artifact assemblage based on attribute clusters are presented in Table 12.6. The narrow tool range, low quantity of tools, and a large number of waste flakes (4200) indicate that this locus was used for something other than a habitation or materials processing location.

Application of Shannon-Weaver (1948) and chi-squared analysis demonstrated that the values of the loci's diversity and evenness index were lower for workshop or tool making locus than for a residential camp (Andrefsky 2005:201-223; Chatters 1987:363-366).

Locus B's assemblage configuration, i.e., channel flakes, the minimal presence of tool types and a minor quantity of tools, a significant number of biface fragments in addition to high numbers of reduction flakes, all infer a landscape usage as a flaked tool manufacturing workshop.

15.2.8.2 Locus B's landscape usage and activities from graphical attribute cluster presentation

Inspection of Locus B's landscape usage cluster diagram shows the entire generally predicted workshop site attributes, i.e., low tool index, the presence of channel flakes, insignificant number of any specialized tool, the high volume of reduction flakes and a small area.

The graphical attribute cluster rendering supports the proposed use of locus B as a flaked tool manufacturing workshop.

15.2.8.3 Microwear analysis method of landscape activities and loci usage

The analysis models used (see Chapter V) were microwear analysis (Rockwell 2010, 2014), toolkit artifact composition (Shott 1986), Graphic approach to clustering (Kvamme 1988:387-393), diversity-entropy models (Shannon-Weaver 1948) and chi-squared analysis.

Locus B's microwear analysis (Rockwell 2010) of utilized tool use activities is summarized in Table 12.7. Although the Locus displayed the attributes of a stone tool making workshop area, analysis of the utilized flake tools, indicated cutting of soft material.

The cutting of soft material suggests that the utilized flake tools may have been used at another locus and brought to Locus B for maintenance then discarded during tool making activities. A second alternative is that a food or hide processing activity also occurred at the locus although the scraper and cutter count evidence is low. A final alternative is that the loci accumulation is the result of multiple occupations although there is no evidence for this alternative.

15.3 Locus M, J, A, D, and E analysis results

Loci M, J, A, D, and E are grouped collectively for reasons of their variety in terms of their small size either in the number of artifacts or area covered, features, unusual horizontal artifact distribution, or single material type artifact assemblage.

15.3.1 Technology organization and culture horizon Locus M and J

The analysis model used (see Chapter V) was the NEM technological organization (Lathrop et al. 2011; Bradley et al. 2008).

As identified in other loci at the site the presence of channel flakes and biface fragments would loosely suggest Locus M, and J's stone tool production and reduction sequence of technology organization are based on a biface, fluted point, core, and flake reduction tradition. The fluted point technology organization of the assemblage places Locus M and J's occupation range somewhere during the Paleoamerican horizon (12,900-10,800 cal BP).

The technological organization of tool production and reduction sequence elements are typical of the New England-Maritimes (NEM) Paleoamerican horizon. The channel flakes that are representative of projectile point fluting in addition to morphology differences differentiate it technologically from that found in later NEM cultural horizons.

15.3.2 Temporal aspects of site habitation

15.3.2.1 Occupation horizon

The analysis model used (see Chapter V) was the diagnostic traits matrix (Bradley et al. 2008; Gramly and Funk 1990; Spiess et al. 1998).

The presence of NEM lithic tool diagnostic trait attributes (channel flakes and high-quality lithic material) as shown in Table 10.3 indicates that Locus M and J's occupation placement is in the early Paleoamerican horizon.

Although it is difficult to be more specific, the presence of channel flakes and high-quality lithic material is suggestive of an early to mid-Paleoamerican occupation horizon.

15.3.2.2 Occupation date range

The analysis models used: morphologically based typology (Bradley et al. 2008:136-141, 141-146).

The only diagnostic available in Locus M's assemblage for dating purposes is four channel flake fragments which place it somewhere in the early to mid-Paleo sub horizons (12,900 – 11,600 cal BP).

Similarly, in Locus J's assemblage, there are three channel flake fragments which place it somewhere in the early to mid-Paleo sub horizons (12,900 - 11,600 cal BP)

The presence of the channel flakes places both locus's occupation somewhere in the early to mid-Paleo sub horizons (12,900 - 11,600 cal BP).

15.3.2.3 Occupation duration

The analysis models used (see Chapter V) were occupation duration from occupation span index (Surovell 2009), revised exponential form ring model correlation (Whitelaw's 1983), and tool loss methods (Mc Ghee 1979, Spiess 1984).

Locus M is inferred to be a short term overnight to a few days hunting stand occupation where later stage projectile point reduction and finishing, as opposed to longer-term habitation or material processing activities, occurred.

Although with varying results, all of the models employed to estimate Locus J's occupation span, yields a duration that extends over single-digit days to three weeks in length.

15.3.2.4 Distinguishing reoccupation - instances of single or multiple occupations

The analysis models used (see Chapter V) were artifact distribution stratigraphy (Spiess et al. 1998)., the heuristic density of artifact and material type source location (Gramly and Funk 1990), and regression correlation reoccupation models (Surovell 2009).

There is no stratigraphic differentiation by level of material or artifact type, nor linear regression relationship between Locus M or J's occupation span and occupation artifact density evidence to suggest reoccupation of these loci.

There is no evidence to suggest reoccupation of these loci.

15.3.3 Mobility patterns and seasonality inferences

The analysis models used (see Chapter V) were the mobile land-use analysis based on tool flexibility (Bleed 1986), portability (Kelly and Todd 1988), specialization (Bousman 1994; Kuhn 1994), reduction sequence distribution (Symons (2003), and tool diversity and core/biface ratios (Bamforth and Becker 2000).

Loci M and J are hypothesized to be a short term few days hunting stands, field camps or small seasonal occupations. Because of this, it is most probable that they would have the same mobility patterns and seasonal round as discussed for loci H, K/G, and C. Loci M and J's distribution of smaller later stage shaping, reworking or sharpening flakes indicates a mobile land-use.

All of the models applied to test for mobility or sedentism indicate that the occupants of loci M and J were highly mobile foragers as opposed to sedentary collectors.

15.3.4 Settlement pattern adaptations and site/loci domestic activity land-use

15.3.4.1 landscape usage and activities from attribute clusters.

The analysis models used (see Chapter V) were attribute clusters (Gramly and Funk 1990), and toolkit artifact composition (Shott 1986).

Locus M's assemblage configuration of channel flakes, low quantity, and type of tools, as well as moderate numbers of a small (< 2.4g) single material variety (Munsungun chert) reduction flakes implies that a later stage projectile point tool production/maintenance episode occurred.

These attributes in addition to a small hearth feature containing artifacts and surrounding higher density of waste flakes infer a short duration hunting stand occupation where later stage projectile point reduction, fluting, and finishing took place.

Locus J is considered to be small when considered in terms of artifact count. The locus' combined stone tool assemblage configuration, with the presence and quantity of tools, commonly employed in a somewhat broader range of economic subsistence tasks as opposed to a single processing task in conjunction with other attribute classifying features, infers a landscape usage as a short-term Paleoamerican field camp or small residential occupation usage.

15.3.4.2 Locus landscape usage and activities from graphical attribute cluster presentation

Inspection of Locus M and J's landscape usage cluster diagrams (Chapter XII) shows that the entire generally predicted fluted point hunting stand/tool refurbishment attributes were present. These attributes are a low tool index, the presence of channel flakes, an insignificant number of any specialized tool, a higher volume of reduction flakes and a small area. No cross-mends or refits of broken artifacts have been made between Locus M or J and nearest habitation loci, so it is not possible to suggest contemporaneity or connectedness to other site loci.

The attributes described above in smaller quantities in addition to the identification of a hearth feature in Locus M infers a short duration hunting stand occupation where later stage projectile point reduction, fluting, finishing, and resharpening occurred. Another interpretation of the small assemblage characterization could be the intensity of use. However, a short-term hunting stand interpretation would still hold.

15.3.4.3 Microwear analysis method of landscape activities and loci usage

Because Locus M displays the attributes of a short duration hunting stand occupation with a stone tool making/maintenance event, analysis of the utilized flake tools, indicating cutting of soft material, suggests that they may have been fabricated and used at another site and brought the locus to then discarded during tool making activities. Because there were so few samples of flakes or tools showing microwear, no conclusions can be realistically drawn.

Both informal retouched flake and formal tools (scrapers and biface/projectile points) were used at the Potter site for subsistence activities. Inspection of Locus J's microwear analysis of tool use activities, as shown in Table 13.8, suggests that some of the generally predicted differing subsistence tasks expected in a short-term habitation site are present (Rockwell 2010, 2014).

15.4 Locus A, D, and E analysis results

15.4.1 Locus A, D, and E artifact composition

Locus A's artifact assemblage was disturbed by the commercial excavation of a gravel pit and is incomplete. Locus A is included for completeness of the overall site analysis, but because of its small artifact count and partial artifact assemblage, the minimal critical analysis was performed.

Similarly, Locus D and E are also included for completeness of the analysis, but because of their small artifact counts and widely scattered artifact distribution, the minimal critical analysis was attempted.

15.4.2 Temporal aspects of site habitation

15.4.2.1 Occupation horizon

The presence of NEM lithic tool diagnostic trait attributes (channel flakes and high-quality lithic material) as shown in Table 13.9 indicates that Locus A's occupation placement is in the Paleoamerican horizon.

The lack of NEM lithic tool diagnostic trait attributes (fluted projectile points, channel flakes and spurred end-scrapers), except for the same material types as used in other dated Potter loci, as shown in Table 13.10 indicates that Locus D and E's occupation cannot be reliably placed in the Paleoamerican horizon or any other.

15.4.2.2 Occupation date range

The only diagnostic available in Locus A's assemblage for dating purposes are three channel flake fragments which would place it somewhere in the early to mid-Paleo sub horizons (12,900 - 11,600 cal BP).

There are no diagnostic artifacts available in Locus D and E's assemblage for dating purposes.

15.4.3 Settlement pattern adaptations and loci domestic activity land-use

15.4.3.1 Locus A, D, and E landscape usage and domestic activities

As remarked above, Locus A was disturbed through commercial gravel mining activities and did not represent a complete assemblage for analysis. From the remaining tool and debitage composition, it might be suggested this may have been short term hunting stand or perhaps a toolmaking workshop.

As characterized in detail in the Chapter XIII analysis of Locus D and E's assemblage, because of the small number of artifacts represented in assemblage and the wide, and narrow dimensions of each locus, no definitive representation can be ventured with any surety. A few settlement pattern adaptations and loci domestic activity land-use alternatives were proposed in Chapter XIII.

15.5 Whipple, Bull Brook, Vail, and Tennant Swamp comparative site analysis results

This section summarizes the results of the Whipple, Bull Brook, Vail, and Tennant Swamp comparison sites analysis. The following results presentation follows the same pattern of organization as the analysis of the Potter and comparative sites. That is, the four broad occupation trait categories necessary to investigate the hypothesized settlement patterns.

15.5.1 Technological organization and cultural horizon

The analysis model used (see Chapter V) was NEM technological organization (Lathrop et al. 2011; Bradley et al. 2008.)

The Whipple, Bull Brook, Vail, and Tenant Swamp site's stone tool production and reduction sequence elements of the technological organization are all based on a tool blank, biface preform, fluted point, core, and flake reduction tradition. As expected, no blade production technology was identified in any of the assemblages. As was the case in the Potter site analysis, the fluted point technology places the Whipple, Bull Brook, Vail, and Tenant Swamp site's loci occupation date range somewhere during the early to the mid-Paleoamerican horizon (12,900 -

11,600 cal BP). This date range places the comparison sites occupation horizon contemporaneous with that of the Potter site.

The technological organization of tool production and reduction sequence elements are typical of the New England-Maritimes (NEM) Paleoamerican horizon. The fluted projectile points and channel flakes that are representative of projectile point fluting in addition to point morphology differences differentiate it technologically from that found in later NEM cultural horizons.

15.5.2 Temporal aspects of site habitation

15.5.2.1 Occupation date range

The analysis model used (see Chapter V) was the morphologically based typology (Bradley et al. 2008:126-154).

In Whipple's excavated assemblage, one complete and four diagnostic projectile point bases (Figure 14.5) were identified. The points were categorized as Kings Road-Whipple. Kings Road-Whipple points suggest an early Paleoamerican occupation that occurred sometime during the chronological range of 12,900 to 12,400 cal yr BP.

From the morphologically based typology (Bradley et al. 2008), Bull Brook's projectile points were identified as a Bull Brook-West Athens Hill modal point form. This point form indicates an early Paleoamerican occupation that occurred sometime during the chronological range of 12,900 to 12,400 cal yr BP.

In the Vail site's excavated stone tool assemblage, 79 diagnostic complete and fragmented projectile point bases were found. From the morphologically based typology, the points were identified as Vail-Debert style. Vail-Debert points indicate an early Paleoamerican occupation that occurred sometime during the chronological range of 12,900 to 12,400 cal yr BP.

In the Tenant Swamp site's excavated stone tool assemblage, two diagnostic fragmented projectile point bases were found. From the morphologically based typology, the points were categorized as Michaud-Neponset style. Michaud-Neponset points indicate a mid-Paleoamerican occupation that occurred sometime during the chronological range of 12,200 to 11,600 cal yr BP.

The occupation date ranges provided through the application of the morphologically based typology model to the Tennant Swamp comparison site's projectile points confirm that this site's loci were occupied during the mid-Paleoamerican horizon. The Kings Road-Whipple, Bull Brook, and Vail-Debert point forms substantiated an occupation of Whipple, Bull Brook, and Vail, during the early-Paleoamerican period.

15.5.2.2 Occupation duration

The analysis models used (see Chapter V) were occupation duration from occupation span index (Surovell 2009), revised exponential form ring model correlation (Whitelaw's 1983), and tool loss methods (Mc Ghee 1979, Spiess 1984).

The pertinent models utilized to estimate Whipple's, Bull Brook's, Vail's, and Tenant Swamp's loci occupation span yielded indications as shown in Table 15.1. All loci showed occupation durations from single-digit days to three weeks or short term in length except Bull Brook. Bull Brook's occupation duration spanned two to three months plus and can be characterized as a medium-term in length.

Table 15.1 Whipple, Bull Brook, Vail, and Tenant Swamp occupation spans

Site	Occupation span (duration)
Whipple loci	Single-digit days to three weeks or short term in length
Bull Brook loci	Two to three months plus in length or medium term in length
Vail loci	High single-digit days to four weeks in length or short term in length.
Tenant Swamp loci	Single-digit days to three weeks, or short term in length.

15.5.2.3 Distinguishing reoccupation - instances of single or multiple occupations

The analysis models used (see Chapter V) were artifact distribution stratigraphy (Spiess et al. 1998)., the heuristic density of artifact and material type source location (Gramly and Funk 1990), and regression correlation reoccupation models (Surovell 2009).

Whipple's reoccupation status signifies that it was reoccupied on a site basis on more than one occasion during the Paleoamerican horizon. There was, however, no artifact refit evidence to indicate contemporaneous loci occupations. As a further indication of reoccupation, an early Woodland habitation (Fagan 2005) (A Meadowood component of the Early Woodland period, 3000-2100 BP) was found at the site.

Vail was also reoccupied on a site basis on more than one occasion. Gramly (1982:47) based this conclusion on the fact that due to the significantly higher tool density per unit area of some of the loci, that they had been reoccupied on subsequent hunting seasons (see Chapter XIV). Further, a Ste. Anne-Varney point, dating to 2000 years later during the late Paleoamerican horizon, was found at the site further indicating reoccupation (Figure 14.15).

In the case of Tenant Swamp, the artifact distribution stratigraphy model indicates there was no evidence of reoccupation of an individual locus. However, Tenant Swamp may have been potentially reoccupied on a site basis on more than one occasion due to the supposition that the site's occupants were seasonal foragers on a seasonal round and that there is no evidence of contemporaneous intrasite loci occupations.

The Bull Brook case is notably different than Whipple's, Vail's, and Tenant Swamp's seasonal site reoccupations. Bull Brook's reoccupation characterization results indicate that it was not reoccupied on a site or locus basis on more than the one occasion. There was no evidence of reoccupation based on the contemporaneousness of the point morphology found in the habitation loci and the number of tool refits found between loci.

15.5.3 Mobility patterns and seasonality inferences

15.5.3.1 Indications of mobility/sedentism

The analysis models used (see Chapter V) were mobile land-use analysis based on tool flexibility (Bleed 1986), portability (Kelly and Todd 1988), specialization (Bousman 1994; Kuhn 1994), reduction sequence distribution Symons (2003), and tool diversity and core/biface ratios (Bamforth and Becker 2000).

The Whipple, Vail, and Tenant Swamp site's mobility/sedentism indications based on site artifact tool assemblage summarized in Table 14.4, 14.23, and 14.33 indicate that the inhabitants of these sites were by these measures a mobile as opposed to a sedentary group. Also, as projected by the models, a toolkit composed of very few specialized tools, and relatively few tool types that serve multiple functions is further evidence of mobile inhabitants.

The Bull Brook site's mobility/sedentism indications based on the site's flaked stone tool assemblage is summarized in Table 14.14. Analysis using the diagnostic models points toward an assemblage that is indicative of a flexible, portable toolkit. However, two further factors enter into the Bull Brook mobility characterization. First, there was a somewhat larger proportion of specialized tool types in the Bull Brook toolkit assemblage. Eight tool types make up the Bull Brook assemblage versus five to six types in the other comparison sites potentially indicating a slightly more sedentary occupation. The second factor taken into consideration is the longer habitation span of the site and its constituent loci (greater than 90 days). From these factors, it is suggested that the inhabitants of Bull Brook were an aggregation of mobile foragers that spent an extended time period (fall-winter) engaged in a communal hunt.

Based on site artifact tool assemblages the Whipple, Vail, and Tenant Swamp site's mobility/sedentism indications suggest that the inhabitants of these sites were mobile as opposed to a sedentary group. However, in the case of Bull Brook, it is suggested that the inhabitants were an aggregation of mobile foragers that spent an extended time period (fall-winter) engaged in a communal hunt.

15.5.3.2 Territorial round mobility geography and seasonality

The analysis models used (see Chapter V) were Burke's territorial round (Burke et al.'s 2004), material type and quality Curran and Grimes (1989), Rockwell's (2010, 2014) seasonality parameters, and the primary and vegetational reconstruction models.

During the Kings Road-Whipple time horizon, it was hypothesized that based on materials found at sites occupied during this period (Burke et al. 2004) two possible band ranges could be identified (see Figure 14.1). In alternative I, the route ranged from Lake Munsungun (summer) to Michaud, to Pt Sebago (late summer-fall), to Whipple (fall-winter), on to Lake Champlain for the Hathaway and Cheshire material sources (spring), followed by a return to Munsungun (summer).

The second proposed alternative, ranges from Munsungun (summer) to Searsmont to Bull Brook (late summer-fall), to Whipple (fall-winter), to Hathaway and Cheshire material sources (spring), possibly to Megantic and return to Munsungun (summer). These two possible routes would appear to describe the territorial round of the occupants of the Whipple site (see Figure 14.1).

Bull Brook was occupied as a single communal caribou hunting event involving multiple extended family bands. From the Burke et al. (2004) model, two territorial round alternatives are suggested (see Figure 14.8). In alternative I the northerly route, ranging from Lake Munsungun to Michaud, to Pt Sebago to Bull Brook, on to New Hampshire rhyolite material sources, followed by a return to Munsungun. As another northerly route alternative, the transit from Munsungun south to Bull Brook may have extended eastward toward and along the east coast as well.

The proposed alternative for a second southerly band route (II), shown by the northeast to southwest red oval in Figure 14.8, ranges from Bull Brook to include material acquisition from the Normanskill/Hudson Valley chert and Pennsylvania Jasper sources.

Vail was occupied sometime during the Vail-Debert early Paleoamerican sub horizon (12,900 to 12,400 cal yr BP). During this time horizon, by application the models, two alternatives are suggested. In the first alternative, the route (see Figure 14.10) ranged from Eastern Pennsylvania (Winter to early spring) northward to the Hudson River Valley where the Normanskill chert was acquired. From the Hudson River Valley, the band continued Northeast toward to the Vail site and possibly passed the Whipple and Tenant Swamp sites in western Massachusetts. From the Vail site, they carried on the hunt moving further Northeast to the Munsungun chert source area followed by a return southward in the fall and perhaps revisiting the Vail site.

For the second alternative, the route may have ranged from the Hudson River Valley (Winter to early spring) where the Normanskill chert was acquired. From the Hudson River Valley, the band continued Northeast toward the Vail site. From the Vail site, they may have continued the hunt moving further Northeast followed by a return southward in the fall. As in the first alternative, it might be implied that the material was introduced by individuals joining the band during its travels, or that special work parties acquired the stone, or the band acquired the material from down the line trade.

During the mid-Paleoamerican horizon, based on materials found at Tenant Swamp's loci two possible band ranges can be suggested. In alternative I, the route ranged from Lake Munsungun (summer) to Michaud, to Pt Sebago (late summer-fall), to Tenant Swamp (fall-winter), followed by a return to Munsungun (summer) via Mt Jasper (see Figure 14.16). The second proposed alternative (II), ranges from Munsungun (summer) to Searsmont to Bull Brook (late summer-fall), to Tenant Swamp (fall-winter), then to Mt. Jasper for rhyolite resupply (spring) and return to Munsungun (summer). These two possible routes would appear to describe the territorial round of the occupants of the Tenant Swamp site (see Figure 14.16).

From the seasonality tool kit and occupation span indicators models, occupations containing large numbers of tools related to butchery and hide working in addition to organic material processing (wood), likely represent late summer or early fall occupations. In the case of Bull Brook, perhaps it may have even extended into late fall and early winter,

Analysis of the territorial round mobility geography and seasonality-based prey migration and on embedded material procurement indicates a geographic path that conformed to the location of the material sources found in that site's toolkits. Each of the comparison sites contained different combinations of material varieties and quantities, thus showing differing potential *seasonal rounds or round segments. A judicious conclusion would be that this diversity in pattern reveals at least a part of the annual round of groups operating in the region during the early and mid-Paleoamerican period.*

15.5.4 Settlement pattern adaptations and site/loci domestic activity land-use

15.5.4.1 Settlement pattern adaptations: indications of forager/collector land use strategy

The analysis models used (see Chapter V) were flexible tool technology (Andrefsky 2005 201:223; Kelley and Todd 1988; Odell 2003), few specialized tools (Odell 2003, Chatters 1987), minimal tool diversity (Kooyman 2000), and micro-wear low-power magnification analysis (Kooyman 2000).

Whipple's, Bull Brook's, Vail's, and Tenant Swamp's settlement pattern traits indicate a forager adaptation. This assessment is based on the details of the diagnostic traits outlined earlier in Chapter V and then compared to the collective site's artifact assemblages that exhibit these characteristics.

15.5.4.2 Whipple's landscape use patterning and domestic activities

15.5.4.2.1 Activity use patterning from attribute clusters (groups).

The analysis models used (see Chapter V) were attribute clusters (Gramly and Funk 1990), toolkit artifact composition (Shott 1986), the Microwear analysis method of landscape activities (Rockwell 2010; 2014), chi-squared analysis and diversity-entropy models (Shannon-Weaver 1948).

Whipple's landscape usage and activities patterning based on the previously introduced attribute cluster data for Locus A indicates usage as a habitation area, where the toolkit was generally employed in a broader range of economic subsistence tasks. From the assemblage, it may be inferred that the main activity that occurred at this locus was tool making or repair. Locus B was judged to be a processing area, because of the large number of scrapers and flake tools present in the toolkit, where scraping activities are presumed to have been dominant. Finally, Locus C's activity area characteristics may also be categorized as a processing locus. Because of the close association of burned bone fragments and the number of scrapers, it may be suggested that the tool use was related to the processing of fauna.

Bull Brook's landscape usage and activities patterning based on the site's attribute cluster or group model is compiled in attribute Table 14.19. The table presents the data for three defined site loci groupings (total site, interior loci, and exterior loci). Loci within the interior of the site ring structure contain nearly two times as many flake shavers, channel flakes, and fluted drills than loci outside the ring. The loci outside of the ring structure contain nearly three times as many wedges, gravers, end and side scrapers. This suggests that the activities between these two groups of loci may have been different. Because of the greater number of channel flakes located within the interior loci, it might be speculated that these were tool-making activity areas. With the higher concentration of scrapers in the exterior loci, it also might be thought that this was a group of processing loci.

The Vail site is characterized as having eight loci. Vail's landscape usage and locus activities patterning based on the attribute cluster model (Table 14.28), presents the data for the eight loci organized into two groups defined as group A, B, C, D, E, and group F, G, H. The reasoning for this bimodal organization is that Gramly (1982) identified the first group as reoccupied habitation loci whose characterizations were comparable. Similarly, the second group of loci was also identified by Gramly (1982) as habitation loci that were occupied on only one occasion. Further, the tool range for each locus in group A to E, i.e., the quantity of varying tool forms, projectile points, the presence of channel flakes, cutters, modified and/or retouched flakes, the debitage assemblage, and classifying features typically indicates a Paleoamerican habitation usage (Gramly and Funk 1990; Spiess et al. 1998).

A distribution difference is observed in Loci F, G, and H that brings into question Gramly's (1983) identification of the loci as habitation occupations. Loci F, G, and H find the majority of their tool artifacts resident in three categories, i.e., cutters, side scrapers, and wedges. While similar to loci in group A to E in having other tool types, their quantities in Loci F, G and H are quite low. From this toolkit configuration, it may be implied that the activities at the Loci F, G, and H were concerned with butchering, cutting and processing activities rather than daily all-around habitation activities including tool making and maintenance.

Tenant Swamp's landscape usage and activities patterning attribute cluster for the site's four loci is shown in attribute Table 14.40. The tool range for loci 2, 3, and 4, i.e., the quantity of varying tool forms, projectile points, the presence or absence of channel flakes, modified and/or retouched flakes, debitage assemblage, and classifying features typically indicates a Paleoamerican habitation usage (Gramly and Funk 1990; Spiess et al. 1998).

The similarities among Loci 2, 3, and 4, includes a lack of emphasis on stone tool manufacture, a high tool to flake ratio, and a low number of bifaces. These similarities suggest that generally comparable activities took place at each locus and that they likely were occupied at the same point in the seasonal round. From these observations, it appears that hide processing was a dominant activity at the site as a whole (Goodby et al. 2014:157).

However, there are differences in Locus 1 as it stands out from the other three loci in its significantly lower number of tools, and the absence of some of the formal tool types found in Loci 2, 3, and 4. At the same time, Locus 1 had the highest number of end scrapers and wedges, suggesting that a focused, narrower range of processing activities took place there (Goodby et al. 2014:158).

From the activity use patterning attribute clusters analysis, the Whipple, Bull Brook, Vail, and Tenant Swamp sites exhibited similar site organization and loci usage. Each of the site's loci was characterized as habitation, processing or workshop/tool making areas. Aside from the formal analysis, loci function, as characterized by the principal investigators of the site and noted in their documentation, generally agreed with the analysis performed.

15.5.4.2.2 Whipple's landscape usage and activities from graphical attribute cluster presentation

The analysis models used (see Chapter V) were attribute clusters (Gramly and Funk 1990), toolkit artifact composition (Shott 1986), graphical interpretation (Kvamme 1988:387-393).

Whipple site's loci usage and activities from a graphical attribute cluster perspective are presented in Figure's 14.2, 14.3, and 14.4. Locus A's activity use patterning cluster diagram exhibits some of the predicted habitation site attributes, i.e., higher tool index, a range of tool types used in differing habitation subsistence tasks, and a higher volume of reduction flakes distributed over a larger area.

Locus B's site activity use patterning cluster (Figure 14.3) indicates that it represents a processing area. The indications from the diagram showed a significantly higher number of scrapers, a low number of debitage flakes, lack of cores and channel flakes (not identified in the literature but perhaps absent) and a smaller activity area.

Locus C's (Figure 14.4) activity use patterning cluster indicates that it also represents a processing area. The indications from the diagram showed a significantly higher number of a single tool type, i.e., scrapers, lower number of reduction flakes, the absence of cores, channel flakes, and a smaller activity area.

The Whipple site's loci usage and activities from a graphical attribute cluster perspective show the expected characteristics of habitation (Locus A) and processing (Loci B and C) activity areas.

With the Bull Brook loci organized as exhibited in the attribute cluster table (14.9) no meaningful graphical representation of the landscape usage and loci activities can be performed without the total data set.

The Vail site's Loci A through E's activity use patterning cluster diagram exhibits some of the predicted habitation site attributes, i.e., higher tool index, a range of tool types used in differing habitation subsistence tasks, and a higher volume of reduction flakes distributed over a larger area. From the patterning cluster diagram (Figure 14.12) it may be seen that the Vail site toolkit composition in loci F to H is skewed toward a specialized activity such as processing of hides (cutters, scrapers, and wedges).

The Vail site's loci usage and activities from a graphical attribute cluster perspective show the expected characteristics of habitation (Loci A through E) and processing (Loci F to H) activity areas.

From Tenant Swamp's combined graphical attribute cluster (Figure 4.17) for loci 2, 3, and 4, it can be observed that many of the same predicted habitation loci attributes, i.e., higher tool index, a range of tool types used in differing habitation subsistence tasks, and a higher volume of reduction flakes distributed over a larger area are present.

Differing from Loci 2, 3, and 4, Locus 1's, activity use patterning graphical cluster suggests that it represents a processing area due to the larger number of just a few tool types. In the case of Locus 1, the narrowed variety of tool types are scrapers and retouched flakes.

The Tenant Swamp site's loci usage and activities from a graphical attribute cluster perspective show the expected characteristics of habitation (Loci 2, 3, and 4) and processing (Locus 1) activity areas.

15.5.4.2.3 Microwear analysis method of landscape activities and loci usage

No microwear analysis was performed at the Whipple, Bull Brook, or Vail sites,

At Tenant Swamp, the conclusions relative to loci usage activities were supported by the results of microwear analysis (See chapter XIV) which showed evidence of hiding scraping and a lack of tool making in all four loci (Rockwell 2010, 2014).

Together with the relatively high number of unifacial tools, microwear suggested that hide processing was a dominant activity at the site as a whole.

15.5.4.2.4 Shannon-Weaver analysis of landscape use patterning and domestic activities

The calculated values for Shannon-Weaver diversity analysis of the Whipple, Vail, and Tenant Swamp sites (Chapter XIV) indicate that some loci show a broader range of tool types than others. In general, a broader tool type range and quantities of formal tools are indicative of a habitation loci usage. The diversity value for other site loci is significantly lower than those of habitation loci and are driven by a smaller range of tool types and lower number of tools, thus indicating use as some category of workshop or processing locus such as hide scraping (Andrefsky 2005:201-223, Chatters 1987:363-366). The application of chi-squared analysis on site loci flaked stone artifact assemblages also demonstrates the differences between habitation, toolmaking, and processing loci.

Shannon-Weaver diversity, evenness, and chi-squared analysis demonstrate that there are observable differences in the Whipple, Bull Brook, Vail, and Tenant Swamp site's loci artifact assemblages and toolkits than would be expected by the intensity of use alone.

15.6 Potter and comparison site interpretation and discussion

15.6.1 Potter site interpretation and discussion

After analyzing the Potter site loci for their cultural adaptations and settlement patterns, i.e., technological organization, intra-site chronology, mobility and settlement patterns using quantitative and qualitative modeling, several outlines emerge. Tables 15.2 and 15.3 catalog a summary characterization of each locus's cultural and settlement adaptations as analyzed in Part 5, Chapters XI to XIV.

Of the 11 Potter site loci analyzed three (C, H, and K/G) have been classified as habitation locations with occupation durations lasting one to four weeks. Two Loci (J and M) are categorized as very short-term overnight to a few days hunting camps with tool maintenance episodes. Locus B because of its large debitage assemblage, and possibly E, are classified as stone tool production workshops. However, Locus E's classification may be questionable because of its minimal assemblage scope. Locus F is characterized as a material processing location. Finally, two loci are unanalyzed because of other factors such as disturbed or incomplete assemblages (A) or extremely small sample size (D).

As observed in almost all the loci at the site, no matter what landscape activities were carried out, fluted projectile points, channel flakes, and bifaces in addition to biface fragments are present. These indicate that stone tool production and technological organization is based on a tool blank- biface-fluted point, reduction sequence, and core and flake tradition.

The fluted point technology of the assemblages places the sites loci occupation range somewhere during the early to the mid-Paleoamerican horizon (12,900 - 11,600 cal BP). From projectile point morphological dating (Bradley et al. 2008), Loci C, H, K/G, and J specifically indicate occupations during the mid-Paleoamerican horizon (12,200 - 11,600 cal BP). There were no indications of an occupation postdating this horizon. Also, there is no evidence of contemporaneous occupation of any of the loci. Further, occupations at the Potter site were interpreted as short term in duration and thus appeared to have been by foragers following a seasonal round as opposed to a more sedentary logistical collector in strategy.

15.6.1.1 Potter Habitation loci

At the four habitation loci (C, H, K/G, and J), stone tool technological organization is grounded in a biface, fluted point, and core and flake reduction practice as noted above. As expected, blade production technology was not found in the assemblages. Both formal and informal tools were produced and used in each locus. In addition to later-stage flaked stone tool production, activities such as tool maintenance were performed as well as the curation of the manufactured tools.

From the fluted projectile point morphology (Bradley et al. 2008) and channel flakes identified in each habitation locus, the occupation date range was estimated to occur between 12,200 and 11,600 BP or mid-Paleoamerican horizon. In the case of locus K/G, which showed signs of reoccupation, it was determined from diagnostic evidence that there was an earlier occupation in the early Paleoamerican horizon (12,900 to 12,400 BP). However, the similar mid-Paleoamerican horizon occupation dates attributed to each locus should not be construed as contemporaneous occupations. There has been no evidence of refitting between loci found intrasite.

All models employed to estimate occupation duration for each locus, the relative magnitude OSI proxy variable, correlation ring, and tool loss per person day, yield indications when averaged, of short-term occupations that extend over somewhere in the neighborhood of 16 to 33 days for locus C, 7 to 21days for locus H, 6 to 21 days for Locus K/G, and 3 plus for Locus J in length. Estimates for Loci B, E, and F were not pertinent as these loci were regarded as toolmaking or processing areas related to one of the habitation loci. There is a level of divergence between the methods employed due to locus area estimates, tool loss per day assumptions and calibration factors leading to an imprecise estimate but still within an order of magnitude.

All the models used to gauge whether the inhabitants that occupied the various habitation loci were a mobile or sedentary group point toward a mobile forager settlement pattern. The most significant elements observed that are characteristic of a forager's toolkit are flexible tool technology, few specialized tools, minimal tool diversity, a micro-wear indication of multiple tool functions, weapons maintainability, make and mend technology, in addition to lesser attention to hafting that would be observable in a more sedentary population. As a contra indication, the number of moves per year negatively correlates with tool diversity. As noted earlier in Chapters XI to XIII, tool diversity was high for all habitation loci and lower for workshop or processing areas. Another indication apparent in each of the habitation loci was the distribution of debitage sizes recovered in each locus' artifact assemblage. There was little evidence of a primary reduction in terms of flake size and cortex coverage that would indicate all stages of stone tool production took place at any of the loci as might be expected of a sedentary population. Although, even a sedentary site might not show primary flakes if it was some distance from a lithic source.

Employable in several differing habitation subsistence tasks, these loci stone tool assemblages are indicative of a flexible tool kit used for such functions as resource preparation, processing, and wood tool making. The tool and debitage distribution covered areas of 23 m^2 (C), 10 m^2 (H), 20 m^2 (K/G), and 6 m^2 (J). These fall within NEM regionally small to medium Paleoamerican observed habitation locus proportions (Spiess et al. 1998).

As enumerated in the basic descriptive model, Paleoamerican habitation sites and loci are defined by a high tool index value, a significant volume of a multiple tool types such as scrapers, wedges, limaces, modified/retouched and utilized waste, points, channel flakes, substantial amounts of debitage, and they also occupy medium to larger geographic areas. Habitation loci exhibiting the characteristics enumerated above display a significantly differing profile than processing/workshop loci representing locations of specialized tasks. Potter’s Loci C, H, and K/G’s assemblage configuration share the habitation profile noted above.

Locus M includes a small hearth feature containing artifacts that indicates an additional landscape activity, i.e., a short duration hunting stand occupation where a later stage projectile point reduction, fluting, and finishing episode occurred. Being over 50 m distant from other loci at the site, it would appear this locus was a standalone short-term occupation with a tool making episode and that it was not connected to other loci.

Graphic profiles of habitation site attributes for Loci C, H, K/G, M, and J are illustrated in Chapter’s XI, XII, and XIII and show the similarity of each locus’ attribute profile.

15.6.1.2 Tool making loci

As discussed earlier (see Chapters XI, XII, and XIII), identification of Paleoamerican landscape activities and site loci type usage in the NEM indicates that a low tool index value defines flaked tool manufacturing/workshop sites. Furthermore, there is an insignificant volume of any particular tool type, and the number of tools, a high number of pieces of debitage, and also that workshop areas occupy relatively small areas as opposed to habitation loci. Inspection of Locus B and possibly E's landscape usage attribute clusters and diagram shows workshop site attributes, i.e., low tool index, the presence of channel flakes (except for E), insignificant number of any specialized tool, the high volume of reduction flakes and a small area.

Locus B and E’s occupation date range may be similar in horizon but not necessarily contemporaneous. The only diagnostic artifacts available in locus B for dating purposes is channel flake fragments, which place them somewhere in the early to mid-Paleo sub horizons (12,900 - 11,600 cal BP).

Occupation duration, mobility patterns, and seasonality inference modeling for tool production loci only provide meaning when considered in conjunction with an associated habitation locus. An exception to this is when another activity occurred, which is distinguishable stratigraphically as in the case of the processing locus F. In this case, there are indications of an earlier episode where the locus was used as a tool biface/preform production testing area and at another time period a processing area for wood or hides.

15.6.1.3 Processing locus

Locus F’s assemblage configuration, with the presence and quantity of tools such as end scrapers, side scrapers, drills, and wedges in addition to other classifying features, indicate a landscape usage as a processing area or perhaps a workshop on another occasion. These tools are generally employed in the processing of foodstuffs, hides, bone, and wood products. The micro-wear analysis supports this position with indications of woodworking activities.

From the untyped fluted point, channel flake, bifaces, a large number of scrapers (27), and modified retouched expedient flake tools (10) Locus F's technological organization, follows that of other loci at the site. The fluted point technology organization identified in the artifact assemblage places Locus F's occupation range somewhere during the early to mid-Paleoamerican horizon (12,900 - 11,600 cal BP). Other intra-site chronological issues such as occupation duration are not meaningful because of the nature of its use as a processing area. While there were no refits between nearby habitation loci, Locus F being situated nearest to Locus C was potentially related to it as a workshop or processing satellite. The distance of Locus F relative to the habitation Locus C is approximately 15 m. If that assumption is applied the occupation date range would be of the mid-Paleoamerican horizon.

Because Locus F is hypothesized to be a processing area and most likely associated with one of the habitation loci, it would have the same associated mobility patterns and seasonality inferences as discussed for Loci H, K/G, and C.

As discussed in more detail in Chapter XII's analysis of Locus F's characteristics, the vertical stratigraphic differential suggests that the same area was utilized on more than one occasion. Separated longitudinally Locus F was used as a workshop area for different functions as indicated by the significant number of biface fragments, scrapers, and utilized/retouched flakes found concentrated at different levels. In one case, perhaps in an earlier episode, it was used as a tool biface/preform production area and in a different time period a processing area for wood or hide working. Support for the woodworking observation is found in the micro-wear analysis for this locus.

When viewed from the graphical cluster (Figure 12.1) perspective the potential dual usage of the area becomes more apparent. Processing sites are defined by a low to moderate tool index value, a significant volume of a particular tool type such as scrapers (27), few pieces of debitage, and they also occupy relatively small areas. Processing loci represent locations of specialized task execution. Inspection of locus F's landscape usage cluster diagram shows all of the generally predicted processing site attributes are apparent, i.e., low tool index, the absence of channel flakes, a large number of scrapers, low volume of reduction flakes and a small area. However, an anomaly in terms of a significant vector of flake size is visible in Figure 12.1 indicating that something else occurred at this locus in addition to the generally accepted specialized task area. The sample size is comparatively small, scarcely 400 flakes and the influence of a chance episode of atypical behavior such as cobble testing or knapping episode might have such an effect.

15.6.2 Comparison site interpretation and discussion

Four regional sites from the Paleoamerican horizon were selected as comparison sites to aid in the determination and evaluation of the Potter site regarding its large site classification and functional behavior interpretations (Table 15.3). Of the four sites analyzed three (Whipple, Vail, and Tenant Swamp) have been classified as short-term episodic reuse habitation locations with occupation durations lasting from one to four weeks. One archaeological interpretation for large episodic reuse sites in the New England-Maritimes is defined as an accumulation of sequential visits at places favored for intercepting migrating caribou (Dincauze 1996; Funk 1973; MacDonald 1971; Walthall 1952). The fourth regional comparison site, Bull Brook, is categorized as medium-term communal hunting aggregation that lasted from two to three months.

As was the case for the Potter site and all of the comparison sites, no matter what landscape functions or activities that were carried out, the presence of fluted projectile points, channel flakes, and bifaces and biface fragments indicate that stone tool production and technological organization is the same. The fluted point technology of the artifact assemblages places the Whipple, Bull Brook, and Vail loci occupations all within the early Paleoamerican horizon (12,900 - 12,500 cal BP). From the Michaud-Neponset projectile point morphological dating (Bradley et al. 2008) it is indicated that Tenant Swamp's occupations occurred during the mid-Paleoamerican horizon (12,200 - 11,600 cal BP).

In the case of Tenant Swamp, there are no indications of an occupation postdating the mid-Paleoamerican horizon. Also, there is no evidence of contemporaneity of occupation for any of the loci. Bull Brook was also not reoccupied during the Paleoamerican horizon or any other period after that. This is because Bull Brook was a single occupation medium-term communal hunting aggregation with numerous intrasite flaked stone refits and no artifact evidence of later occupation. The Vail and Whipple sites were deemed to have been reoccupied on a seasonal basis for intercepting migrating caribou during the Paleoamerican horizon. In the case of Whipple, there is even evidence of an occupation that occurred during the Woodland period (see Chapter XIV).

At each of the sites, there was artifact evidence that the inhabitants were mobile foragers that used portable, flexible and maintainable toolkits. Also, multiple activities occurred at each of the sites that included general habitation, material processing, and tool making. From their technological organization, it appears that most of the tool making was based on secondary biface reduction, thinning, fluting, finishing, and maintenance activities. Primary reduction activities are assessed to have taken place at quarry locations (see Chapter XIV).

From the calcined bone recovered at the Whipple, Bull Brook, Vail, and Tenant Swamp sites, it appears that the primary prey species was caribou. These animals traveled on a seasonal basis from the north tundra landscape they occupied in the summer to a southern New Hampshire and northern Massachusetts forest area for the winter (see Chapter XIV).

15.7 The similarities and differences between the Potter and comparison site behavioral patterns

What do the analysis results of the Whipple, Bull Brook, Vail, and tenant Swamp sites reveal about the nature of the Potter site and its loci? Listed below are the similarities, differences, and unknown cultural adaptations and settlement patterns between the comparison sites Whipple, Bull Brook, Vail, and Tenant Swamp and the Potter site.

15.7.1 Similarities

Technological organization, tool stone, and toolkit characteristics

1. The technological organization of all the sites was similar.
2. All the sites contain formal tools made from high-quality chert lithic materials.
3. All the sites used both formal and expedient tools.
4. All of the site's toolkits were designed and manufactured for portability and flexibility.

Occupation horizon

1. All the comparison sites including Potter were inhabited during the Paleoamerican horizon.
2. All the sites were occupied during the early or mid-Paleoamerican sub-horizon or both.

Mobility, style of occupation and duration

1. All the sites and their loci, with the exception of Bull Brook (medium term), were short term occupations lasting from single digit days to four weeks in length.
2. All the sites exhibited evidence of habitation, processing, and tool maintenance activities.

3. All the sites except Bull Brook exhibited signs of reoccupation. However, even though the sites may have been reoccupied on a seasonal or some other sequence grounds, reoccupation on an individual locus basis was not uniformly found. At the Vail site, it was presumed that a number of its loci were reoccupied seasonally. At the Potter site locus, K/G showed signs of reoccupation during the early and mid-Paleoamerican horizons.
4. As established from the short-term site occupations, it is probable that the inhabitants of Potter and its comparison sites used the landscape as foragers.

Location and subsistence/environment

1. All the sites fall on the path of a seasonal round.
2. All the sites lie on one of the seasonal migration routes for caribou, i.e., the primary prey source.
3. All the sites shared a geographic terrain feature advantage (high ground or a choke point topography or both) for the interception and hunting of caribou.

15.7.2 Differences and unknowns

Location and subsistence/environment

1. Even though the Potter site was on a caribou migration path no prey species bone evidence was identified in the excavations. This was in all probability due to the acidic nature of the soil where evidence of bone from any animal species would have been destroyed.
2. What the totality and distribution of the site inhabitant's subsistence pattern and prey species on their seasonal round other than caribou and small game are unknown.

Mobility, style of occupation and duration

1. Where the inhabitants wintered in the region and for how long is unclear. It is also unknown if they followed an aggregation or a dispersal wintering strategy.

15.8 The Potter site in context

As can be seen, through the great number of similarities between the Potter and comparison sites, it would appear that Potter can take its place in the NEM regional Paleoamerican settlement pattern behaviors as an episodic reuse site (Dincauze 1993, 1996) for the interception and hunting of caribou. This observation is supported by the site's analysis and the characterization of its occupation horizon, duration, technological organization, foraging behavior, seasonal round, geographic configuration, and site activities. Further, if as hypothesized that caribou was a primary prey species and that their passage through the site region lasted for only weeks each year, then it can clearly be seen that Potter's inhabitants must simply have been foragers on a seasonal subsistence round.

One of the research questions posed in Chapter I was, because of its remarkable and relatively large artifact assemblage, can the site be classified as one of those few, but large aggregation sites as characterized by Dincauze (1996)? We now have an answer to this question through the application of qualitative and quantitative models (see Figures 15.2 and 15.3 for summary of analysis). Potter is an "episodic reuse site" of accumulations of subsequent visits at places favored for intercepting migrating caribou (Dincauze 1996; Funk 1973; MacDonald 1971; Walthall 1952).

Table 15.2. Summary depiction of Potter loci cultural adaptations and settlement patterns (Loci C-J)

Behavior analysis	Locus C	Locus H	Locus K/G	Locus J
Technological Organization				
Production Trajectory	Biface, fluted point, core and flake reduction tradition	Biface, fluted point, core and flake reduction tradition	Biface, fluted point, core and flake reduction tradition	Biface, fluted point, core and flake reduction tradition
Formal vs. Informal tools	Formal / Informal 46% formal	Formal / Informal 42% formal	Formal / Informal 71% formal	Formal / Informal 83% formal
T.O. Activity & Behavior MANA	Production, maintenance, expedient use, discard	Production, maintenance, expedient use, discard	Production, maintenance, expedient use, discard	Production, maintenance, expedient use, discard
Temporal Aspects				
Occupation Date range	12,200 -11,600	12,200 -11,600	12,900 -12,400 12,200 -11,600	12,900 -11.600
Occupation Horizon	Mid Paleoamerican horizon	Mid Paleoamerican horizon	Early/Mid Paleoamerican horizon	Early / Mid Paleoamerican horizon
Occupation span	16-33 days	7-21 days	6-21 days	3-10 days
Reoccupation	N	N	Y/N	N
Mobility - Sedentism				
Debitage stage location	Distributed Medium-small	Distributed Medium-small	Distributed Medium-small	Distributed Medium-small
Toolkit Design	Flexible Portable	Flexible Portable	Flexible Portable	Flexible Portable
Maintainable vs reliable	Maintainable	Maintainable	Maintainable	Maintainable
Make / Mend	*Mend*	*Mend*	*Mend*	*Mend*
Core biface ratio	Low	Low	Low	Low
Mobility band range	20k km²	20k km²	20k km²	20k km²
Seasonality	Early Fall	Early Fall	Early Fall	Early Fall
Settlement Patterns Loci Land Use Activities				
Attribute cluster tool configuration	Habitation	Habitation	Habitation	Habitation or Processing (split locus)
Graphical cluster presentation	Medium-high, tool index, channels flakes, high flake count, high area, cores present.	Medium-high, tool index, channels flakes, high flake count, high area, cores present	Medium-high, tool index, channels flakes, high flake count, high area, cores present	Medium-high, tool index, channels flakes, high flake count, high area, cores present
Microwear analysis	Butchery Cutting, scraping wood, bone, hide	Cutting, scraping of hide and wood, utilized projectile point, whittling	Butchery cutting, scraping of hide, soft, wood, whittling	Scrapping/cutting wood, wedge, utilized projectile point
Non waste flake (tool) /Waste flake #	91/2135	41/3199	82/1757	25/527

Table 15.2. Continued. Summary depiction of Potter loci cultural adaptations and settlement patterns (loci B – F)

Behavior analysis	Locus B	Locus M	Locus E	Locus F
Technological Organization				
Production Trajectory	Biface, fluted point, core and flake reduction tradition	Biface, fluted point, core and flake reduction tradition	Biface, fluted point, core and flake reduction tradition	Biface, fluted point, core and flake reduction tradition
Formal vs. Informal tools	Formal / Informal present. Formal. Small number of Uni. /flake tools.	Formal / Informal Present. Formal. Small number of Uni. /flake tools.	Formal / Informal Present	Formal / Informal 83% formal
T.O. Activity & Behavior MANA	Production, maintenance, core, curation	Production, maintenance, core, curation	Production, maintenance, Curation	Maintenance, expedient use, discard
Temporal Aspects				
Occupation Date range	12,900 -11,600	12,900 -11,600	No diagnostic	12,900 -10,800
Occupation Horizon	Paleoamerican fluted point tradition	Paleoamerican horizon tradition	NA	Paleoamerican horizon
Occupation span	NA	NA	NA	NA
Reoccupation	No	No	No	No
Mobility - Sedentism				
Debitage stage location	Distributed Medium-small	Distributed Medium-small	Distributed Medium-small	Distributed Medium-small
Toolkit Design	Flexible Portable	Flexible Portable	NA	Flexible Portable
Maintainable vs reliable	Maintainable	Maintainable	NA	Maintainable (Sharping)
Make / Mend	NA	NA	NA	NA
Core biface ratio	Low	Low	No cores	No cores
Mobility band range	20k km²	20k km²	20k km²	20k km²
Seasonality	NA	NA	NA	NA
Settlement Patterns Loci Land Use Activities				
Attribute cluster tool configuration	Stone Tool Making	Stone Tool Making	Stone Tool Making	Processing material
Graphical cluster presentation	High flake count, cores, low tool index, channel flakes, hammer stones	High flake count, cores, low tool index, channel flakes, hammer stones	Medium flake count, low tool index, no channel flakes, no hammer stones	Low tool index, low debitage count, & high special tool values, resharpening flakes.
Microwear analysis	Cutting soft material,	Utilized hard material,	NA	Scrapping/cutting wood
Non waste flake (tool) /Waste flake #	27/4197	8/1413	3/458	48 (26 scrapers) /359

Table 15.3. Summary depiction of comparison site's cultural adaptations and settlement patterns

Behavior analysis	Whipple	Bull Brook	Vail	Tenant Swamp
		Technological Organization		
Production Trajectory	Biface, fluted point, core and flake reduction tradition	Biface, fluted point, core and flake reduction tradition	Biface, fluted point, core and flake reduction tradition	Biface, fluted point, core and flake reduction tradition
Formal vs. Informal tools	Formal / Informal	Formal / Informal	Formal / Informal	Formal / Informal
T.O. Activity & Behavior MANA	Production, maintenance, expedient use, discard	Production, maintenance, expedient use, discard	Production, maintenance, expedient use, discard	Production, maintenance, expedient use, discard
		Temporal Aspects		
Occupation Date range	12,900 -12,400	12,900 -12,400	12,900 -12,400	12,200 to 11,600
Occupation Horizon	Early Paleoamerican horizon	Early Paleoamerican horizon	Early Paleoamerican horizon	Mid Paleoamerican horizon
Occupation span	7-21 days	2-3 Months	8-28 days	7-21 days
Reoccupation	N loci Y site	N	Y loci and site	N loci Y site
		Mobility - Sedentism		
Debitage stage location	Distributed Medium-small	Distributed Medium-small	Distributed Medium-small	Distributed Medium-small
Toolkit Design	Flexible Portable	Flexible Portable	Flexible Portable	Flexible Portable
Maintainable vs reliable	Maintainable	Maintainable	Maintainable	Maintainable
Make / Mend	*Mend*	*Mend*	*Mend*	*Mend*
Core biface ratio	Not available	Not available	Not available	Not available
Mobility band range Seasonality	Early Fall	Early Fall to early winter	Early Fall	Early Fall
		Settlement Patterns Loci Land Use Activities		
Attribute cluster site use configuration	Habitation and processing	Habitation, processing, and tool making workshop	Habitation and processing	Habitation and processing
Graphical cluster presentation	Habitation: high, tool index, channel flakes, high flake count, high area. Processing: low tool index, high count of processing tools (scrapers, cutters)	Habitation: high, tool index, channel flakes, high flake count, high area. Processing: low tool index, high count of processing tools (scrapers, cutters) Toolmaking: high debitage count	Habitation: high, tool index, channel flakes, high flake count, high area. Processing: low tool index, high count of processing tools (scrapers, cutters), smaller area	Habitation: high, tool index, channel flakes, high flake count, high area. Processing: low tool index, high count of processing tools (scrapers, cutters), smaller area
Microwear analysis	No Microwear analysis performed	No Microwear analysis performed	No Microwear analysis performed	Scrapping/cutting wood, wedge, utilized projectile point
Nonwaste flake (tool) /Waste flake #	N/A	N/A	N/A	N/A

Chapter XVI

Conclusions and further research

The goal of this study was to evaluate the Potter site's inhabitants' lifeways, using flaked stone tool analysis modeling, and to determine a response to the question; what kind of a site was Potter? Was Potter, as defined by Dincauze's (1993) large site taxonomy, a single large seasonal hunting aggregation, single occupation marshaling event, seasonal episodic reuse or alternatively, a seasonal social aggregation site type? An answer to this question was suggested in Chapter I in the form of a hypothesis that can now be tested.

16.1 Research problem objectives and categories

To investigate this query, analysis, evaluation and hypotheses testing of Potter and comparison sites centered on the research problems used to interpret the Paleoamerican cultural lifeways and adaptations exhibited during the site occupation. As detailed in Chapter I, the research categories tested fell under four broad categories: technological organization, temporal placement, settlement pattern, and site activities.

16.2 Research hypotheses

Formulation and statement of this study's hypotheses to be tested center on the research objectives employed in the interpretation of the Paleoamerican cultural lifeways and adaptations exhibited during the Potter site occupation., The objectives to be tested fall into four broad categories as noted above.

16.2.1 Hypotheses statement

The following is an enumeration of the hypotheses, null and alternative, which will be tested in comparison to results found from the analyses of the Paleoamerican cultural lifeways and adaptations of the Potter site occupation. The results of the investigation's analysis in relation to the hypothesis statements are given below each of the enumerated sections. The key interpretive issue is the relative size of the site and how such a site was accumulated.

16.2.2 Null Hypotheses

It is hypothesized that the Potter sites archaeological interpretation of the Paleoamerican cultural lifeways and settlement patterns in the White Mountains of New Hampshire, using Dincauze's (1996) significant large site interpretive taxonomy, is episodic reuse or accumulations of single sequential visits. These stays occurred at places favored for intercepting migrating caribou herds (Dincauze 1996; Funk 1973; MacDonald 1971; Walthall 1998). For this hypothesis to be upheld it would be expected that specific elements of; 1) temporal aspects; 2) Mobility patterns and seasonal inferences; 3) Settlement pattern adaptions and site/loci land use activities; 4) and technological organization would exhibit expected outcomes when tested. Detailed below are the expected outcomes by enumerated topic. Each of the Potter site loci and comparison sites (Whipple, Bull Brook, Vail, and Tenant Swamp) were assessed in terms of the evaluation criteria categories utilizing their associated flaked stone tool analysis behavioral models to arrive at a characterization to test the study's hypotheses.

16.2.3 Temporal aspects

It is hypothesized that The Potter site was an episodic reuse palimpsest of multiple occupations dating from differing sub-horizons of the Paleoamerican culture horizon (12,900 to

10,800 cal BP), inhabited for differing occupation lengths. If so, it would be expected that there should be differing sub-horizon dates for the sites individual loci occupations. Some loci would be expected to have been occupied between an early sub-horizon (12,900 to 12,400 cal yr BP), a mid-sub-horizon (12,200 to 11,600 cal BP), or late-sub-horizon component date (11,600 to 10,800 cal BP) (Bradley et al. 2008; Lothrop et al. 2016).

16.2.3.1 Temporal placement: tested hypothesis conclusion

Beginning with temporal aspects; for those loci where diagnostics (projectile points and channel flakes) were available (Loci C, H, K/G, F, B, M, A, and J) indications are that occupations occurred during the Paleoamerican horizon (12,900 to 10,800 cal yr BP). Further resolution of the sub-horizons from morphological considerations of projectile points indicates that occupations occurred in the early and mid-Paleoamerican sub-horizons. This, in turn, indicates reoccupation at Locus K/G (12,900 to 12,400cal yr BP for the first occupation and 12,200 to 11,600 cal year BP for the second). Contemporaneous occupation of the habitation Loci (C, H, K/G, M, and J during the mid-Paleoamerican horizon) was not detectable due to the lack of intrasite stone tool refits and resolution of the morphological/typological dating method. A weak indicator of non-contemporaneous occupation is the variation in the length of habitation loci occupation span. Conversely, there is nothing to indicate that one inhabitant group may have left earlier or stayed longer.

Despite the extensive sampling of the site using shovel test pits, no artifacts younger than the Paleoamerican horizon were identified indicating the site was abandoned and not used by later Archaic or Woodland cultural groups. However, there were no diagnostic artifacts identified in the artifact assemblages for Loci D and E with which to verify that these originated from the

Paleoamerican horizon other than the favored tool stone (rhyolite and Munsungun) that was present and was similarly found in the other datable Paleoamerican horizon site loci.

In conclusion, as hypothesized, the Potter site loci and thus the whole Potter site was occupied during the early to the mid-Paleoamerican horizon (12,900 to 11,600 cal BP) for short duration occupation spans and never reoccupied outside of the Paleoamerican period.

16.2.4 Mobility patterns and seasonal inferences

Regarding mobility patterns and seasonal rounds, to qualify as a Paleoamerican episodic reuse palimpsest of multiple occupations site type (Dincauze 1993 taxonomy), it is expected that inhabitants would have a forager profile, (sensu Binford 1980) where inhabitants move to resources and exhibit high residential mobility. The frequency of hunter-gatherer residential mobility is defined and constrained by the rate of local resource depletion (Kelly 1992; Venkataraman et al. 2017). If so, the toolkit of a mobile forager population, as opposed to more sedentary collector inhabitants, would reflect this by differences in kit composition (Kuhn 1994). The forager toolkit would be expected to contain, flexible highly portable tools, relatively few tool types serving multiple functions, low core/biface ratios, and extensive reworking. Reduction stages present in loci tool and debitage assemblages are expected to be spatially differentiated that is, the primary blank reduction occurred at another location such as a tool stone source quarry (Symons 2003).

The expected seasonal round indicator for this mobility pattern is the percentage of tool stone material varieties from multiple locations found in the artifact assemblage. At the site, this would be expected to be Mount Jasper dike rhyolite and Jefferson cobble rhyolites in addition to Munsungun chert from Maine.

The Potter site lies on a potential caribou migration path from the Connecticut River Valley northward along the Androscoggin toward the Vail site in Northwestern Maine (Curran 1984, 1987). When caribou migration was in evidence from its southern wintering territory to northerly calving grounds, it was possible that the migration passed by the Potter site in both directions depending upon seasonal movements. Site occupation was expected to have occurred during the fall season because of the availability of primary prey (caribou) and caribou hide quality for use as clothing material and shelter coverings.

Caribou herd sizes vary from season to season due to ecological issues such as predator population (wolves), availability of nourishment, birth rates, climate variation in addition to other factors, leaving only a finite number of animals available for harvesting (Spiess 1979). This means that it would take a determinate amount of time for a migrating herd, depending upon its population size, to pass an intercept point such as a hunting site. In an ethnographic study of the Nunamiut by Binford (1979), he noted that the yearly caribou hunt season lasted for approximately 30 days: 15 days during the spring migration and 15 days during the fall migration. It would, therefore, be expected that the occupation span of the Potter site's inhabitants would be limited in time because of the narrow window of opportunity for harvesting a passing caribou herd migration. At present, a major secondary subsistence prey to caribou that would allow the inhabitants of the Potter site to be year-round occupants has not been identified in the region. Given the probability of a short occupation span and the need to find alternate subsistence options, it is expected that the inhabitants of the Potter site followed a seasonal round settlement-subsistence system.

16.2.4.1 Mobility patterns and seasonal settlement systems tested hypothesis conclusion

Evidence of differing debitage reduction stage distribution over physically separated geographic site locations, toolkit design of few multifunction tools, maintainable versus reliable tool production decisions, core biface ratios, in addition to the relatively short occupation spans, indicates that the Potter inhabitants were a mobile forager population. Band range based on material source locations of site artifacts as expressed in Burke's et al. (2004) and Curran and Grimes (1989) models indicate a north-south route from Munsungun to Michaud to Potter to Jefferson on to Megantic and returning to Munsungun.

In conclusion, the occupation spans for the habitation Loci C, H, K/G, J, and M, based on the results of three independent models, denote a range of "days" to" four weeks." This supports their use as short term seasonal round loci/sites for the interception and hunting of caribou herds.

16.2.5 Settlement pattern adaptions and site/loci land use activities

If as hypothesized, Potter was an episodic reuse multiple occupation site (Dincauze 1993 taxonomy), it is expected that loci occupation spans would be relatively short. Evidence of reoccupation of the site and loci would also be anticipated. Occupation spans would differ in length (shorter) from those of a large single event or pioneering/marshaling aggregation site type (longer). Further, it would not be expected to see tool refits between individual Potter site habitation category (tent) loci as this would be indicative of contemporaneous occupation dates as found in single or longer-term aggregation sites (Gramly 1982: 50-51; Robinson 2009).

Similarities and differences in land-use or activity functions at each site locus are expected to be revealed by the composition and variability of the artifact assemblages in addition to tool microwear indications. Signatures for varying site typologies are based on a study of 70 North American hunter-gatherer societies of 14 site types and 84 attributes performed by Newell and Constandse-Westermann (1996:373). This site type and attribute range were further refined regarding potential stone tool assemblage representation by Jones (2008). Habitation loci are expected to exhibit a high tool index or wide range and quantity of tool types. Further, habitation loci are also expected contain channel flakes from projectile point production, scrapers used in processing functions, somewhat larger locus area than processing or tool production loci (depending on occupation span length), significant debitage volume, a broader range of reduction flake sizes, and some number of cores.

Processing loci are expected to exhibit a low tool index, no channel flakes, high concentrations of scrapers or single-function tools, a small to medium locus area, low debitage amounts from resharpening, small flake sizes, and no cortex coverage on early-stage reduction flakes.

Tool production loci are expected to show evidence of low tool index, multiple stages of reduction, cores, bifaces, and multiple sizes of reduction and sharpening flakes; in addition to a medium to small locus area (Newell and Constandse-Westermann 1996:373; Gramly and Funk 1990; Jones 2008). Also, byproducts of production are anticipated such as hammerstones, channel flakes, large quantities of debitage, and a small number of cores.

Generally, at both large and small eastern Paleoamerican sites, it is observed that the relative elevation of the sites is greater when compared to the surrounding terrain. Relative elevation in conjunction with a treeless tundra-like environment suggests a site function of an elevated lookout and/or camp for game hunting (Gramly 1982, 1984: Gramly and Funk 1990; Curran 1987).

16.2.5.1 Settlement patterns landscape usage activities tested hypothesis conclusions

Settlement pattern analysis indicates that the inhabitant’s occupations were short term in duration and that the site was reoccupied only during the Paleoamerican horizon and perhaps on a seasonal basis. Further, the site location was selected for its elevation above the valley floor and its constriction topography. The site and loci landscape activities at the Potter site indicate varying occupation behaviors occurred. The three habitation Loci C, H, and K/G were found to have high tool index values, significant numbers of multiple tool types such as scrapers, wedges, modified/retouched and utilized waste flakes, points, channel flakes, substantial amounts of debitage, and occupied medium to larger geographic areas than processing/workshop locations. These are considered indications of a habitation type of occupation. Loci M and J were judged to be very short occupation duration hunting stands. Two Loci, B and E, exhibited a low tool index or small quantities of tools and tool types in addition to a large debitage count and a wider range of reduction flake sizes. This configuration is considered an indication of a stone tool production site or locus. Locus F exhibits yet another assemblage profile that has a low tool index in addition to low debitage counts and high special tool values. This configuration is considered an indication of a material processing site or locus. As further support for these conclusions, Rockwell's (2012, 2014) microwear analysis provided additional confirmation of a number of these loci use activities. Differences in toolkit configuration diversity indices; thus, loci function were demonstrated through the application of Shannon-Weaver (1948) analysis.

Overall, the short-term site and loci occupation landscape activities as shown by defined attribute cluster classifications and graphical presentation indicate at least three distinct activity functions occurred at the Potter site. Evidence from the analyses indicates the presence of loci for habitation, tool making, in addition to the material processing of hide, soft material (food) and wood products.

16.2.6 Technological organization

The hypothesized technological organization of the Potter Site Paleoamerican inhabitants was based on selection and application of strategies for decisions concerning material sourcing, production sequence events, tool formality, tool use, resharpening, reuse, curation, material movement through the site, and discard. Assemblage analysis of early and middle Paleoamerican sites of the Northeast and the Northern Great lakes (Deller and Ellis 1992a:87–92; Ellis 2008) observe that fluted point sites not connected with quarries typically produce assemblages containing broken and resharpened tools, small debris from late-stage biface reduction and edge repair of unifaces. These assemblage attributes suggest that early and middle Paleoamerican groups employed a highly segmented reduction sequence, producing standardized tool blanks and biface preforms for specific morphological tool types (Lothrop et al. 2016).

If so, the Potter inhabitant's tool production would be based on a staged tool blank, biface, preform, fluted point, core and flake reduction tradition. Production ratios of tools to debitage and flake size for tools produced from exotic cherts would be expected to be smaller than those produced from local rhyolite material. This circumstance owes to the fact that reduction sequence stages were limited to secondary reduction, thinning, edging and resharpening as primary reduction stages were performed some 300 kilometers distant at the Munsungun quarry site in addition to the desire to preserve limited quantities of a superior flaking material (Curran and Grimes 1989; Spiess et al. 1998). Ratios of tools to debitage and flake sizes for the local rhyolite materials are expected to be somewhat larger because of their readier availability than the exotic Munsungun chert. It would be expected that all stages from preform blank reduction to biface and finished tool production would be present and would include intermediate and later stage reduction sequences. Toolkits found and manufactured at the site should be comprised of bifacial and unifacial technology and composed of both formal and expedient tools. Large site flaked stone assemblages, i.e., Bull Brook, Tenant swamp, Whipple, and Vail have been found to contain both formal and informal or expedient flake tools. Expedient tools were utilized for “as needed” tasks such as cutting, wood shaving and occasional scrapping (Nelson 1991; Gramly 2014, Spiess and Wilson 1998; Robinson 2009; Goodby 2011; Curran 1984, 1987). Formally curated lithic tools would have been brought into, or produced locally, and then taken away from the site. It is expected that the Potter sites’ flaked stone tools would be specifically designed and manufactured for transportability, versatility, flexibility, reliability, long use-life, efficiency, and maintainability (Bleed 1986; Bousman 1994; Kuhn 1989; Kelly and Todd 1988; Bamforth and Becker 2000). In General, informal, or expedient tools would be manufactured, used, and discarded at the site over a relatively short time period.

16.2.6.1 Technological organization tested hypothesis conclusions

The technological organization, even though spread over two Paleoamerican horizons, shows no indication of a significant detectable shift except the morphology of projectile points. Tool production during both the early and mid-Paleoamerican horizons was based on a staged tool blank, biface preform, fluted point, core and flake reduction practice. Production ratios of tools to the quantity of debitage and flake size for tools produced from exotic cherts (Munsungun) were smaller, indicating reduction sequence stages were limited to secondary reduction, thinning, edging and resharpening. Ratios of tools to debitage and flake sizes for the local rhyolite materials (Mount Jasper and Jefferson) were somewhat larger indicating stages from preform blank reduction to biface and finished tool production but limited to a few early, although mostly intermediate and later reduction stages.

Toolkits found and manufactured at the Potter site were comprised of bifacial and unifacial technology and composed of both formal and expedient tools. Formal stone tools were brought into, produced locally, maintained, and taken away from the site. Again, from a production, maintenance, material in material out, and curation (sensu Binford 1973:227-254) view as expressed through MANA analysis, results were relatively uniform across loci. Flaked stone tools that were specifically designed and manufactured for transportability, versatility, flexibility, reliability, long use-life, efficiency and maintainability were found at each site locus.

In summary and as hypothesized, Potter's technological organization was based on a flexible and portable toolkit composed of bifacial, unifacial and expedient tools. This toolkit was manufactured from high-quality chert and rhyolites in a staged production sequence ranging from tool blanks to finished fluted projectile points. As seen from the analysis of Potter and the comparison sites, the major change in the technological organization over the entire Paleoamerican horizon (2100 years) was the evolution of projectile point morphology and the introduction of the flake shaver tool.

16.2.7 Alternative hypotheses

The alternative hypotheses need not be considered as the null hypotheses has been upheld by the analysis.

The overarching significance of the Potter site can thus be seen as a rare aggregation site with multiple loci where mobile Paleoamerican foragers returned on a seasonal or generational basis to harvest caribou. The site adds to the corpus of rare artifact material finds from this period and region. Within this context, it is now possible to place the Potter site in the Whipple, Bull

Brook, Vail, and Tenant Swamp regional site behavioral framework. From this positioning, an idea of the significance and classification of this site can now be presented.

16.3 Potter, Whipple, Bull Brook, Vail, and Tenant Swamp classification in the Dincauze (1993) taxonomy

As designated in Chapter I, one of the research objectives was to determine what type of site Potter is in relationship to the Dincauze (1993, 1996) large site taxonomy. Since Potter is part of the early to mid-Paleoamerican regional NEM landscape, it is also important to understand where the Whipple, Bull Brook, Vail, and Tenant Swamp comparison sites are classified for contrast.

Curran (1979) and Grimes et al. (1984) suggested a repeated occupancy by a family unit at the Whipple site. They based their conclusion on the differences in tool stone and toolkit composition between the site's loci. In light of this conclusion, Grimes et al. (1984) proposed that Whipple, Bull Brook, Bull Brook II, and Wapanucket-8 are components of a Bull Brook phase based on the geological, typological and lithological correlation. Grimes (1984) concludes that the Whipple site, within or near the interface of two mating networks, would represent a mechanism for maintaining an open exchange of information, gifts, and personnel as characterized in the Dincauze (1993) "seasonal social aggregation interpretation model."

Robinson et al. (2008) conclude that Bull Brook represents a single organized event with a Dincauze (1993, 1996) classification as a "single large seasonal hunting aggregation." From the calcined preserved caribou bone and environmental and paleo-geographic reconstructions, Robinson et al. (2009) proposed that the site was most likely connected to communal hunting and a caribou drive.

Alternatively, Dincauze (1993, 1996) classified Bull Brook as a “pioneering site” where it was a marshaling area for people who settled into concentrated places used for the gathering, arranging and allocating of resources and information, preparatory to dispersing in smaller groups into a new region.

The Vail (Gramly 1982) and Tenant Swamp sites (Goodby 2010, 2014) principal investigators classified these sites as “seasonal episodic reuse sites” in the Dincauze (1993, 1996) classification taxonomy. The occupants of both sites were deemed to be mobile foragers in search of caribou on their seasonal round. The occupation durations for both the sites loci were short term corresponding to migration patterns of the caribou herd on a seasonal basis.

The key geographical position of the Potter site is a clear factor in its role within the canon of sites from this period and region. Each of the sites discussed shared the geographic advantage of an elevated observation platform or a constricting landform structure for the observation and interception of caribou herds.

From the analysis offered in this study, Potter was not a single large seasonal hunting aggregation, single occupation marshaling event, or alternatively, a seasonal social aggregation site type as defined by Dincauze (1993) but is interpreted as a “seasonal episodic reuse-site” at a natural topographical funnel point between ecozones. As observed above the Vail and Tenant Swamp sites were interpreted as “episodic reuse sites”, as was the Potter site. However, even though there were many similarities, the sites differ in physical configurations (number of loci and geographical positioning), quantities and distribution of artifacts, toolkit configurations, tool stone materials, and occupation horizons.

16.4 Further research suggestions

Based upon the results of this Potter site study the author suggests several avenues of inquiry that might provide further clarification to aspects of specific loci. Indications from the analysis of Locus F with its 26 scrapers, pointed toward its use as a wood processing locality. However, nine bifaces and one channel flake were also found in the assemblage. Extending excavation around Block F may provide further insight into the proposed functional use as a tool making workshop in conjunction with or overlapping the wood processing activity in addition to occupation time horizon differences. In a like manner, additional excavation near Blocks D and E may yield additional diagnostic artifacts that could lead to locus dating and land-use activities.

The use wear analysis performed by Rockwell (2010) was based on a sampling of the major loci based on the size of artifact counts. A further avenue of research would be to increase the sample sizes of already sample loci and include analysis of un-sampled Loci D and E.

The four sites used as reference sites, i.e., Whipple, Bull Brook, Vail, and Tenant Swamp, provided examples of the Dincauze (1993) taxonomy, with which Potter was to be compared. In the Potter analysis, seasonal round sites were suggested. Including similar detailed analyses of the sites that lie on the proposed circuit (Munsungun, Michaud, Jefferson, and Megantic) would now provide further insight into mobility and settlement patterns of the early and mid-Paleoamerican horizons in the region.

16.5 To a better understanding of the post-glacial peopling of the White Mountains of New Hampshire

We conclude this study by returning to the quotation by Binford (1983:109) which opened the thesis. Paraphrasing, an archaeologist’s view of the past is restricted to excavated sites that represent discrete, isolated points in the landscape. These stationary views are quite different than the reality of the people’s dynamic lifeways. For highly mobile hunter-gatherers it is postulated that “each of the sites presents a limited, biased picture of the whole range of activities, depending upon its unique position within a regional system of behavior.” Binford (1983).

To place the Potter site into a regional system of behavior, a response to the research question; “what kind of a site was Potter?” had to be developed. Before the analysis provided in this study was completed, what this site represented was purely conjecture. For example, twenty km to the west of the Potter site lay a collection of Paleoamerican sites known as the Israel River complex (Boisvert 1998). Each of the six identified sites in the complex was a short-term encampment for the procurement and processing of caribou. One of the conjectures was that Potter represented a logistical collector type aggregation site in a collector subsistence-settlement system (Binford 1980). In this scenario, the Israel River sites represented resource procurement sites where special work groups moved the resources to consumers at the Potter site.

Moving from conjecture to the investigation of this very rare site now provides a clearer picture of the behavioral patterns of the Paleoamerican foragers who achieved their subsistence through prey harvesting in the White Mountains of New Hampshire. After analyzing the Potter site and its loci, the inhabitant’s cultural adaptations and settlement patterns have become more distinct. Potters inhabitant’s technological organization, intra-site chronology, mobility, and settlement patterns determined from quantitative and qualitative modeling established that the site was a short term seasonal episodic reuse site where foragers moved consumers to goods with frequent residential moves.

Two related questions may be proposed in conjunction with the results of this study. Firstly, how do the analysis of the Potter site and its results affect our understanding of the New England Maritimes Paleoamerican period? Secondly, and related, what does this study contribute to our understanding of the Paleoamerican period in general?

Over recent years several theoretical approaches have offered frameworks for regional Paleoamerican studies. Within these frameworks, numerous research themes have contributed to our knowledge of Paleoamerican lifeways in the region, i.e.., the environment, technological organization, settlement patterns; chronology and dating, lithic material sourcing and use, and regionalization (Spiess et al. 1998). This study of the Potter site moves the discussion of regional Paleoamerican lifeways in New Hampshire away from the traditional culture-historical perspective, that is generally more descriptive than interpretive in substance, to a functional/cultural ecological framework that addresses cultural and behavioral issues.

While the Israel River complex and the Potter site were known, no concerted effort was made to document and discuss Paleoamerican lifeways and behaviors in the Israel and Moose River valleys of the White Mountains of New Hampshire prior to this study. Through this study, we have gained greater insight into the technological organization, temporal understanding, mobility, and settlement patterns of the region.

From the research and analysis of the Potter sites archaeological context, several behavioral patterns were identified. Surprisingly, many of these behavioral characteristics were quite similar to those found at other early and mid-Paleoamerican sites. The pattern of similarities observed and discussed earlier was the short loci/site occupation durations, the reoccupation of the site on some chronological sequence, technological organization, toolkit composition, functional usage of loci and the primary prey species harvested to name a few. Interestingly, the similarity of these patterns held even though the Potter site is located in an upland valley of the White Mountains versus the Whipple, Tenant Swamp, and Bull Brook sites that are at much lower elevations near sea level. Thus, demonstrating that some of the forager's behaviors were cultural as opposed to only ecologically determined.

Sites such as Whipple, Bull Brook, Vail, Tenant Swamp, and Potter are very rare pre-contact archaeological finds in the New England Maritimes region. What makes them even rarer still is that these five sites were occupied during the early to mid-Paleoamerican (12,900 - 11,600 cal BP) horizon. Curran and Grimes (1989) described models for the movement of caribou and humans in the interior of the New England-Maritimes region. Caribou moved from their wintering grounds in the forested areas of central Massachusetts northward through the Connecticut River Valley to their summer breeding grounds (Curran and Grimes 1989; Spiess 1979). As described in their model some of the caribou herd split off and moved through the Highlands of New Hampshire's White Mountains. The connected Israel and Moose River valleys were one of these corridors in which the Potter site was identified and investigated.

The significance of this study is that even though there is only very rudimentary and imperfect data and models from which to infer Paleo-settlement pattern systems in the Northeast, modeling and analyzing the Potter site artifact record added testable clarity and understanding of the settlement organization data obtained from this site. Beyond this site, the information derived contributes to refining the understanding of broader regional patterns and allow for the development of more detailed models that might be tested in the future. Further and more specifically, results generated by analysis of this site offer a framework and additional interpretative data to be applied to the identification of Paleoamerican settlement organization of residentially or logistically mobile foragers in the White Mountains of New Hampshire.

While focusing on a geographically specific study, the results of this work may find applicability to other regions that emerged from the last glacial maximum (LGM) where Paleoamericans established lifeways during the Younger Dryas fluted point episode. In summary, the Potter site can now be better understood within its regional context, and it can contribute to our understanding of the human exploitation of other regions of the continent as a whole during this period.

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