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A Comparative Analysis of Paleoindian and Terminal Archaic Lithic Assemblages from Southeastern Connecticut to Determine Diagnostic Debitage Attributes

Colleen McAlister
University of Connecticut - Storrs, colleen.mcalister@gmail.com

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Honors Thesis in Anthropology/Archaeology

Advisors: Dr. Kevin McBride, Dr. Natalie Munro, Zachary Singer
Department of Anthropology

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I. Abstract

The Paleoindian and Terminal Archaic periods can be differentiated on the basis of projectile point typology. This study was conducted to determine whether these two stone tool production periods could also be distinguished based solely on debitage, or the by-products of stone tool production. Goals included accurately analyzing and classifying stone tool flakes from an Early Paleoindian site, a Late Paleoindian site, and two Terminal Archaic sites, based on morphology, material, and possible geographical sources. The methods used here will help future researchers to classify sites as Paleoindian or Terminal Archaic in the initial site exploration phase.

II. Introduction to Lithics and Methods of Analysis

The production and use of stone tools by past humans is an important area of study within the discipline of archaeology. The study of these tools is facilitated by their excellent preservation at various sites, as well as the large number of both tools and flakes, or "debitage," produced. Categorization of tools into typologies also contributes to the ease and efficiency with which these archaeological materials can be analyzed. Lithic typologies aid archaeologists in tracing the span of various cultures both in geographic space and in duration of time in which they lived and produced tools. For example, archaeologists have defined the range of the Clovis point technology as extending from the Southwestern United States throughout much of the continent. By determining a set of characteristics that qualified a projectile point as "Clovis," and by analyzing points found at sites across the country to qualify them as "Clovis points," or not, archaeologists were able to trace the spread of this lithic technology (Bradley *et al* 2008).

While prehistoric peoples most likely did not create stone tools with such strict "categories," in mind, the classification of typologies is very useful for studying human behavior.

Another important point is that no technology is necessarily "more advanced," or "less advanced," than any other. Different groups of prehistoric humans found ways of making stone tools to suit their specific needs and to best adapt to their environments. Very different lithic traditions could serve the same purpose efficiently. For example, this study focuses on the differences between Paleoindian and Terminal Archaic lithic technologies. These two groups of prehistoric humans had markedly different projectile point traditions, with the Paleoindians producing fluted points and Terminal Archaic peoples making points of the Broad Spear tradition. Even within the Paleoindian period there are variations in style. Early Paleoindian technology is characterized by fluted points, while Late Paleoindian technology is characterized by collaterally flaked, lanceolate points that are basally-thinned, but not necessarily fluted in the same way as Early Paleoindian points (Bradley *et al* 2008: 152). The explanation for the differences in technologies between Paleoindian and Terminal Archaic peoples is that they innovated different ways to make projectile points that were most effective for the needs of their particular groups. The needs of their particular groups that manifested in the types of stone tools that they each used also tells archaeologists about the process of manufacture.

Archaeologists view stone tool use as a process, with the first step being obtainment of raw materials. Andrefsky summarizes it in this way: "The sequence from stone tool procurement to stone tool discard is decided by cultural influences, situational constraints, and raw-material accessibility." (Andrefsky 2005: 39). When analyzing lithics, all of these factors need to be considered to create the most accurate reconstruction of past human behavior. The range of available raw materials, and the ones selected by past people, tell archaeologists about where these people may have lived and their geographic range. Lithic sourcing is a difficult process, but being able to make an educated guess as to where people obtained their raw materials informs on important questions such as group size, seasonal movement patterns, and trade networks. The types of tools that various groups made also reveals their degree of sedentism. This process of procurement, use, and ultimate discard also provides insights into subsistence strategies and tasks such as hunting and food processing (Andrefsky 2005). Even the act of discarding a utilized flake or broken tool tells archaeologists about the way ancient people made and used them. These steps, beginning with raw material acquisition, will now be discussed in further detail.

Raw material analysis is an essential component of the study of lithics. The types of stone that prehistoric peoples made their tools from can provide information as to where they lived and how far and how often their group traveled. Some types of stone are preferred for making stone tools because of the regular, predictable way in which they break. Obsidian is a volcanic rock, and chert is a semi-translucent, cryptocrystalline rock of ideal fracturing quality (Wilmsen 1970: 25). Obsidian is not locally available in New England and thus tools made with this material are not found in sites in the area, but chert is locally available. This high-quality stone fractures easily and predictably and was thus ideal for making fluted points by Paleoindians, because their tools required expert production skill and were very particular in design. Indeed, chert artifacts are very common at the relatively low number of Paleoindian sites in New England, and fluted points were most often made with this material. However, the source of this chert remains unknown. Scholars have speculated that the chert found in New England Paleoindian sites came from the Hudson Valley in New York State (Burke 2004: 6). Other possible sources include the Musungun area in Maine (Burke 2004: 4). Efforts to pinpoint the raw material sources are ongoing. The fact that this chert may have come from sources outside southeastern Connecticut, where Paleoindian tools were found, indicates that Paleoindian peoples traveled away from these places and brought their tools with them. This shows a degree of organization in their mobility patterns, as noted by Wilmsen, "The procurement of exotic materials must have entailed some effort and some sort of coordinating mechanism must have been developed…to ensure acquisition…" (Wilmsen 1970: 66). Wilmsen also notes that, "…later peoples [to Paleoindians]…were content to use…a great variety of local materials." (Wilmsen 1970: 66). That is to say, Terminal Archaic peoples acquired their raw materials more locally, and were perhaps more sedentary than Paleoindians. Chert, although not a locally available material, was still used by Terminal Archaic peoples. Jones (1997) notes that black chert debitage at the Hidden Creek site was produced by Terminal Archaic peoples. However, they have been known to also use local raw materials that were not as preferable for stone tool making, such as rhyolite, and argillite (Singer, personal communication). The types of raw materials used by prehistoric peoples to make their stone tools depended on the movement, or lack of it, of their social units, as well as on the sources where these raw materials were located and their fracture properties.

Another stage in the process of a stone tool's life is production. Flintknapping is the process by which stone tools are made from a prepared core or a large block of stone. The two main types of tools, unifacial and bifacial, undergo different stages of production and are used for different purposes. A stone tool is produced with a specific purpose in mind, as noted by Andrefsky (2005). Unifacial tools, such as endscrapers, blades, and utilized flakes, are only modified on one side and are used for tasks such as cutting and scraping animal hides and plant processing. Bifacial tools, such as projectile points, are modified by humans on both sides of the tool and are used for tasks such as hunting animals. More often than not, prehistoric peoples produced both unifacial and bifacial tools. These two stone tool types also produce different debitage flakes, which is part of what this study aims to examine. The production of bifacial tools requires more time and the expenditure of greater effort. Many types of unifacial tools require little effort and time to produce, and are often used only once and then discarded. These types are known as “expedient tools.” (Andrefsky 2005). Other unifaces such as endscrapers require greater effort in production, and are retouched and used multiple times. These are known as “curated tools,” (Andrefsky 2005). Bifaces are also included in the category of “curated tools.” The ratio of expedient to curated tools in any given assemblage could reveal information about a particular group’s degree of mobility. In other words, “…mobile groups prefer multifunctional, readily modifiable and portable tools to decrease the risk of uncertainty.” (Andrefsky 2005: 157). By this logic, archaeologists expect to find more curated tools in the assemblages of mobile groups and more expedient tools in those of semi-sedentary or sedentary groups, who could produce these tools quickly and could afford to discard them shortly after use. Because they did not know what they may have encountered in their movements around the landscape, it is likely that mobile groups did not want to be caught without a useable tool in their possession at any given time. Sedentary groups had their raw material sources close by, and were familiar with their surrounding landscape. They could afford to make expedient tools, because they could easily return to their source of raw material. A tool’s production, as well as its usage, provides insights into the lives of prehistoric peoples.

After the raw materials are acquired and the tool is produced, it is used for the subsistence-related tasks for which it was intended, depending on what type of tool it is. After repeated usage the tool will become dull and will lose accuracy and efficiency. Consequently, the toolmaker needs to retouch the tool. Both bifacial and unifacial tools require retouch, and produce distinct retouch flakes. The knapper drives small flakes off of the utilized edge of the tool when resharpening it. This process of retouch can also be used to repair broken tools, or to remake them for a different purpose than originally intended (Shott 1989: 18). The process of retouch would have been essential for prehistoric peoples who needed useful tools for obtaining food, and ultimately, for survival. It is important to understand the purposes of usage as well as the process of retouch in studying stone tools. Another step in the process of their use life is discard.

Archaeology is essentially the examination of past peoples' refuse. This may seem somewhat unusual, but it can actually tell a lot about the way people in the past lived. If a tool had been retouched or broken to the point that it was no longer useful, it was discarded. A large part of an archaeological assemblage is made up of trash –broken or spent tools, or the by-products of production: "debitage." This category includes waste flakes, mistakes made in the production of tools, retouching flakes, and reduction flakes. Although debitage may at first seem to be simple stone pieces, these flakes reveal much information about stone tool production when interpreted correctly. Projectile point typologies and types of tools are useful in classifying a site or a layer of occupation as belonging to a certain group of prehistoric people. As stated by Andrefsky, "Different temporal periods or cultural traditions are recognized at sites or in collections by diagnostic artifact types." (Andrefsky 2005: 74). However, these diagnostic artifacts often make up only a very small percentage of any given assemblage. Debitage is much more common, and so the ability to classify an assemblage based on the features of its largest component would be very useful.

The lithic features described here, as well as the process of analysis, will be incorporated into this study of Paleoindian and Terminal Archaic assemblages from the Mashantucket Pequot Reservation in southeastern Connecticut. First, however, I provide a background on both the Paleoindian and Terminal Archaic cultural traditions.

III. The Paleoindian Peoples of New England

The earliest inhabitants of the New England region are known as the 'Paleoindians.' These people first entered into the area around 12,800 cal BP (Lothrop *et al* 2011: 560), and may have made their way via a northern corridor near Lake Ontario, or through the southern route of the Susquehanna Valley (Lothrop *et al* 2011: 560). This date coincides with the onset of the Younger Dryas, a period of rapid cooling in climate that took place here (Lothrop *et al* 2011: 562). A colder climate during this almost 1,000-year period meant that the vegetation and animal species that existed were different from those in New England today. Paleoenvironmental reconstructions have determined that New England was covered by a "closed coniferous forest," during this period, with herds of caribou roaming the landscape (Lothrop *et al* 2011: 562). It is likely that Paleoindians relied heavily on caribou for subsistence, as evidenced by the presence of calcined caribou bone at Paleoindian sites such as the Bull Brook site in Ipswich, Massachusetts (Spiess *et al* 1985). Hunting caribou, and perhaps other mammals, would have been an important part of the Paleoindian lifestyle. Groups of hunters anticipated caribou herds in the hopes of making a kill (Burch 1972: 346). Paleoindian hunters had to be ready when the herds approached, and this meant that their tools had to be fully prepared and usable. Paleoindians exemplify the model of a mobile hunting and gathering group who invested great amounts of effort into making curated tools that would always be ready and would have a long uselife. They occupied sites for a short amount of time, and sometimes returned to areas on a seasonal basis (Singer, personal communication). While this lifestyle endured for many thousands of years, as did the tools made to suit it, the Paleoindians experienced a significant climate change that also changed the way they produced stone tools.

The end of the Younger Dryas cooling episode occurred between 11,700 and 11,600 cal BP (Lothrop *et al* 2011: 562). As temperatures became comparatively warmer, the landscape changed as well. New species such as deer are thought to replace caribou as the primary object of Paleoindian hunters, and evidence of even more closed forest with species of oak and pine trees appears (Lothrop *et al* 2011). Paleoindians maintained their mobile hunting and gathering lifestyle, but their tool-making techniques changed drastically. It is this shift in stone tool production methods that characterizes the difference between the Early Paleoindian and the Late Paleoindian periods in the archaeological record.

In a debitage analysis such as this, it is important to first understand the diagnostic tools that past humans were trying to create. In the case of Paleoindians, there are two distinct projectile point forms. The Early Paleoindian period is characterized by the production of fluted points (Figure 1). These points are curated tools made by highly skilled individuals, and were prepared so that the last flake – called the "channel flake," – could be driven from the proximal end to the distal end, or the base of the point to the tip (Singer, personal communication). This would make a flat, smooth surface that would be advantageous in hafting the point onto a spear. Channel flakes have a unique appearance. Flake scars are visible on both edges, and are oriented perpendicular to the bulb of percussion and the platform where the channel flake was driven off of the bifacial point. The scars are made from the lateral edges towards the medial ridge of the flake. In this way channel flakes are easily recognizable, but are exceedingly rare.

Figure 1. Fluted Point Base Fragment from Ohomowauke. Photo Courtesy of Zac Singer.

Channel flakes and fluted points are unique elements of the Paleoindian archaeological record. Early Paleoindian points may be basally concave, and may have "ears," on their bases. Some typologies are Kings Road-Whipple, Vail-Debert, Bull Brook-West Athens Hill, and Michaud-Neponset (Lothrop *et al* 2011: 552). In discussing a site from this period Odell notes that, "Biface thinning flakes, biface retouch flakes, and channel flakes from fluting Paleoindian points dominated the assemblage…" (Odell 2003: 122). While fluted points and channel flakes are diagnostic of the Early Paleoindian, they are not limited to this period. The Late Paleoindian has fluted points, but it also contains an entirely different projectile point typology.

In Late Paleoindian occupational episodes fluted points and channel flakes do exist, but are varied from the Early Paleoindian points. They may have multiple, side by side flutes or may have had channel flakes removed, but then reworked so as not to be fluted (Jones 1997). One example is the Hidden Creek site in Mashantucket, Connecticut that will be discussed in detail later in this study. Brian Jones noted that there were projectile point fragments with two flutes, either side-by-side or refitted, and that this was characteristic of Late Paleoindian points (Jones 1997). However, the Late Paleoindian period is also characterized by a unique projectile point typology as well. These are lanceolate, parallel-sided points with the absence of any fluting. Some typologies include Agate Basin and St. Anne-Varney (Lothrop *et al* 2011: 552). These points are extremely narrow and have flat bases and parallel stems, in contrast to the Early Paleoindian concave bases and eared points. This contrast is very noticeable, and numerous factors could have accounted for the change in style. Bradley proposes that, "One possible interpretation is that the change from hunting of herd animals in more open landscapes to pursuit of solitary prey such as moose and deer in more closed forests perhaps contributed to this abandonment of fluting technology." (Lothrop *et al* 2011: 562-563), (Bradley *et al* 2008). Regardless of the reason for the change, it resulted in the production of different points. These two periods share tool forms such as endscrapers and other unifaces. This study will examine the types of debitage from both the Early and Late Paleoindian from two sites, as well as compare them with the debitage produced from the tools of the Terminal Archaic.

IV. The Terminal Archaic Peoples of New England

The peoples of the Terminal Archaic period occupied the New England region from around 5000 BP to 3000 BP (Ritchie 1965). Ritchie describes these people as living in "…relative isolation of a simple, self-reliant hunting group, mobile within its limited territory." (Ritchie 1965: 138). Although Terminal Archaic peoples were mobile, they were more sedentary than Paleoindians. The raw materials and projectile points used in the Terminal Archaic period are different from those used by the Paleoindians. Terminal Archaic peoples created stone tools of the "Broad Spear," tradition (Ritchie 1965). Their points were not fluted, nor were they lanceolate in shape. They had straight stems, some were corner-notched, and others were side-notched (Figure 2). They are noticeably broader and more triangular than the thin, lanceolate points of the Late Paleoindian.

Figure 2. Snook Kill Projectile Point Base Fragment from Ohomowauke. Photo by Colleen McAlister.

Typologies include Otter Creek, Vosburg, Brewerton, Lamoka, Normanskill, and Snook Kill (Dragoo 1993). Not only the point forms, but also the raw materials are noticeably different in the Paleoindian and Terminal Archaic periods. The disparity in raw materials will be further discussed in the debitage analysis.

V. The Mashantucket Pequot Reservation

Both of the sites examined in this study are located on the Mashantucket Pequot Reservation in southeastern Connecticut. This reservation holds great promise for research because "Archaeological surveys and excavations at Mashantucket have documented a continuous record of occupation from the Paleoindian period…through the twentieth century." (Jones and McBride 2006: 267). It is a unique situation where many different periods of occupation can be studied in such a small geographical area. In the 30 years since archaeological excavation began on the reservation, 250 sites have been found, containing 200 prehistoric components (Jones and McBride 2006: 267). The Hidden Creek site, with Late Paleoindian and Terminal Archaic components, is within the reservation and was excavated by Brian Jones and his team in the 1990s. The site is located on a hillside next to a stream, and is composed of two main activity areas that were excavated. The site known as Ohomowauke is also on the reservation, and was excavated by the University of Connecticut Summer Field School in 2012. It is also located on a hillside next to a stream. Test pits were dug throughout the site, followed by excavation in the form of a large trench at Locus A, and several smaller excavated areas at Loci B, C, and D at the time of this study. Ohomowauke is currently under excavation. This site contains what appears to be an Early Paleoindian component, most likely related to the Michaud-Neponset phase (Singer, personal communication) as well as a possible Archaic component. This study examines the debitage collected from these sites.

VI. Research Questions

This research investigates the following questions:

- How do the diagnostic tools of the Early and Late Paleoindian and the Terminal Archaic lithic traditions translate into the debitage each produces?
- What lithic reduction/retouch techniques were used to produce the debitage?
- What are characteristic features of each set of flakes (material, number, weight, flake scars, etcetera), and how can they be distinguished by time period?
- How can the answers to these questions be applied to further archaeological research?

VII. Thesis Statements

The purpose of this study is to aid in future archaeological research, by attempting to recognize diagnostic debitage traits from these two lithic traditions in New England. Comparisons will be drawn between the components within each of the sites, as well as between the two Paleoindian components and the two Terminal Archaic components.

The following hypothesis will be examined here: diagnostic features of both Paleoindian and Terminal Archaic debitage can be determined based on raw material, flake scar orientation, and types of flakes present in the respective assemblages. This hypothesis will be examined through the lithic assemblages of the Hidden Creek site (72-163), which contains a Late Paleoindian and a small Terminal Archaic component, and through the Ohomowauke site (72-137), which contains an Early Paleoindian and a Terminal Archaic component.

VIII. Presentation of Data

The abbreviations used in the 'Flake Type' Tables are defined here:
FF – Flake Fragment
CF – Channel Flake/Channel Fragment
SBRF –Small Bifacial Retouch Flake
LBRF – Large Bifacial Retouch Flake
AD – Angular Debris
URF – Unifacial Retouch Flake
PBRF – Proximal Bifacial Retouch Flake
ESR – Endscraper Retouch Flake
PTF/PF – Parallel Thinning Flake
BRED – Bifacial Reduction Flake

Table 1: Hidden Creek Debitage Organized by Raw Material

Material	Number	Percentage of Assemblage	Avg Weight
Chert	3717	94.221%	0.161
Jasper	4	0.101%	0.114
Argillite	7	0.177%	0.123
Quartzite	1	0.025%	0.01
Mudstone	18	0.456%	0.228
Rhyolite	1	0.025%	2.028
Slate	180	4.563%	0.253
Unclassified	17	0.431%	0.353
Total	3945	100%	0.409

Table 2: Hidden Creek Debitage Organized by Flake Type

Type	Number	Percentage of Assemblage	Avg Weight
FF	1697	43.016%	0.0660805
CF	3	0.076%	0.19566667
SBRF	424	10.748%	0.07504048
LBRF	23	0.583%	0.52431818
Debris	76	1.926%	0.02664474
AD	41	1.039%	1.70380488
URF	200	5.070%	0.03862
??	473	11.990%	0.18342699
BF	11	0.279%	0.38681818

BR	1	0.025%	0.205
BRDF	47	1.191%	0.25746809
CFF	51	1.293%	0.2024
DS	3	0.076%	6.053
ESR	230	5.830%	0.07764716
Fragment	2	0.051%	86.1205
LBR	1	0.025%	0.508
Other Unifacial	1	0.025%	0.006
PBRF	557	14.119%	0.14557587
PBRF, CFF	1	0.025%	0.21
PF	1	0.025%	n/a
PP	1	0.025%	n/a
PTF	32	0.811%	0.1385625
SBFR	6	0.152%	0.07
Spokeshave	1	0.025%	0.946
UF	3	0.076%	n/a
UFF	4	0.101%	0.02575
UFR	7	0.177%	0.36771429
Unifacial Retouched Flake Frag	1	0.025%	0.172
Unclassified	47	1.191%	0.22525
Total	3945	100%	3.805049559

Table 3: Ohomowauke Locus A Debitage Organized by Raw Material

Material	Number	Percentage of Assemblage	Average Weight
Chert	325	34.834%	0.140
Chalcedony	25	2.680%	0.528
Argillite	2	0.214%	0.265
Jasper	10	1.072%	2.266
Rhyolite	13	1.393%	3.635
Quartzite	147	15.756%	2.753
Quartz	315	33.762%	2.540
Crystal Quartz	88	9.432%	0.384
Smokey Quartz	3	0.322%	9.517
Siltstone	1	0.107%	4.3
Basalt	1	0.107%	1.11
Serpentine	1	0.107%	0.07
Igneous	1	0.107%	114.23
Sedimentary	1	0.107%	0.85

Total	933	100%	10.185

Table 4: Ohomowauke Locus A Debitage Organized by Flake Type

Flake Type	Number	Percentage of Assemblage	Average Weight
FF	362	38.800%	0.321
CF	11	1.179%	0.391
PBR	48	5.145%	0.402
SBRF	182	19.507%	0.134
LBRF	14	1.501%	1.695
PT	4	0.429%	0.125
Debris	26	2.787%	0.861
AD	244	26.152%	3.611
BRED	7	0.750%	3.92
Pe Spall	5	0.536%	0.935
Bipolar	2	0.214%	1.89
URF	1	0.107%	0.03
PRED	4	0.429%	8.2575
Split Cobble	3	0.322%	14.837
Secondary Reduction	1	0.107%	1.63
Blade	1	0.107%	3.51
Uncategorized	18	1.929%	17.427
Total	933	100%	3.528

Table 5: Ohomowauke Locus B Debitage Organized by Raw Material

Material	Number	Percentage of Assemblage	Average Weight
Chert	66	48.175%	0.260
Jasper	1	0.730%	0.02
Rhyolite	6	4.380%	0.465
Quartzite	7	5.109%	1.089
Quartz	38	27.737%	1.072
Crystal Quartz	18	13.139%	0.513
Siltstone	1	0.730%	1.07
Total	137	100%	0.641

Table 6: Ohomowauke Locus B Debitage Organized by Flake Type

Type	Number	Percentage of Assemblage	Average Weight
FF	64	46.715%	0.539
PBR	11	8.029%	0.253
SBRF	21	15.328%	0.086
LBRF	2	1.460%	1.32
Debris	3	2.190%	0.18
AD	24	17.518%	1.178
Bipolar	1	0.730%	2.06
URF	8	5.839%	0.099
Uncategorized	3	2.190%	1.757
Total	137	100%	0.830

Table 7: Ohomowauke Locus C Debitage Organized by Raw Material

Material	Number	Percentage of Assemblage	Average Weight
Chert	44	8.818%	0.339
Chalcedony	5	1.002%	0.6
Argillite	1	0.200%	7.36
Jasper	34	6.814%	1.695
Rhyolite	23	4.609%	2.616
Quartzite	133	26.653%	4.143
Quartz	89	17.836%	4.705
Crystal Quartz	35	7.014%	1.213
Unclassified	135	27.054%	3.751
Total	499	100%	2.936

Table 8: Ohomowauke Locus C Debitage Organized by Flake Type

Type	Number	Percentage of Assemblage	Average Weight
FF	138	27.655%	0.603
PBR	11	2.204%	0.872
SBRF	14	2.806%	0.387
LBRF	2	0.401%	0.94
PTF	1	0.200%	0.04
Debris	10	2.004%	0.527
AD	93	18.637%	4.963
BRED	36	7.214%	3.816
PE Spall	3	0.601%	0.957

URF	29	5.812%	0.398
PRED	1	0.200%	12.22
ESR	2	0.401%	0.02
Unclassified	159	31.864%	5.861
Total	499	100%	2.431

Table 9: Ohomowauke Locus D Debitage Organized by Raw Material

Material	Number	Percentage of Assemblage	Average Weight
Chert	48	25.131%	0.153
Chalcedony	2	1.047%	0.175
Argillite	1	0.524%	0.25
Jasper	82	42.932%	0.310
Rhyolite	2	1.047%	0.08
Quartzite	3	1.571%	3.47
Quartz	5	2.618%	1.872
Crystal Quartz	2	1.047%	0.16
Unclassified	46	24.084%	0.529
Total	191	100%	0.778

Table 10: Ohomowauke Locus D Debitage Organized by Flake Type

Type	Number	Percentage of Assemblage	Average Weight
FF	65	34.031%	0.377
CF	7	3.665%	0.369
PBR	25	13.089%	0.157
SBRF	21	10.995%	0.162
PT	4	2.094%	0.348
Debris	9	4.712%	0.364
AD	4	2.094%	1.99
BRED	7	3.665%	0.728
URF	2	1.047%	0.25
Unclassified	47	24.607%	0.608
Total	191	100%	0.535

IX. Data Analysis

i. Hidden Creek

The Hidden Creek site contains a Late Paleoindian and a Terminal Archaic component. Using the relative depths of the finds, as well as the categories of raw material, Brian Jones theorizes that the Late Paleoindian component is made up of grey-green chert, dark green chert, tan chert, jasper, siltstone, and white chert (Jones 1997: 52). In addition, Jones states that the Terminal Archaic portion of the assemblage is made up of argillite, slate, white chert, and black chert (Jones 1997: 52). Table 1 shows that chert makes up 94% of the debitage from Hidden Creek, and this is no surprise when approaching the assemblage from a Paleoindian perspective. As previously stated, Paleoindians were highly mobile and could access lithic raw materials from faraway sources. They preferred to use chert for tool making, because it breaks in a predictable manner. The purported sources of chert for tools and debitage found in this area is the Hudson Valley in New York State (Jones 1997), about 130 miles distant. Paleoindians were highly mobile and could have traveled this distance carrying raw materials and then made or retouched their tools at the Hidden Creek site. The distance of the sources, however, does create an interesting problem when evaluating the Terminal Archaic contexts. What could explain the use of black chert by the Terminal Archaic peoples, who were not as mobile as Paleoindians and had no known local sources of this material in southeastern Connecticut? This black chert may have been highly valued by Terminal Archaic peoples who inhabited the Hidden Creek site – partly because it was accessed infrequently. Alternatively, the dark green, grey-green, and tan chert utilized by the Paleoindians may have come from a different source than the black chert utilized by the Terminal Archaic peoples. It is evident that chert remained a preferred material for making tools by the peoples of the Terminal Archaic, because of its flaking properties. While the Paleoindians at Hidden Creek made use of a variety of cherts and other high-quality materials like jasper, Terminal Archaic peoples here used argillite and slate for their tools, as is shown by the debitage. Terminal Archaic peoples made use of more local materials, while Paleoindians traveled more frequently to gain access to higher quality lithic raw materials. The use of chert in both time periods is significant, as well as is the number of channel flake fragments.

Table 2 illustrates a large frequency of channel flakes (n=3, 0.076% of the assemblage) and channel flake fragments (n=51, 1.293% of the assemblage) at Hidden Creek. Jones (1997) explains that biface fragments with multiple flutes were found at this site. He also states that this technique of multiple fluting is characteristic of the Late Paleoindian period (Jones 1997). Because channel flakes are rare at Paleoindian sites, 51 channel fragments is a highly significant number and supports the idea that the “multiple fluting,” technique was being used to manufacture tools. Why they used this method is unkown (Singer, personal communication), but it is unique to the Late Paleoindian period. Multiple fluting could have been an attempt to advance the original fluting technique, or a way to secure a projectile point in a different type of haft. The use of the multiple fluting technique evidenced by the high number of channel flake fragments is an important feature of the Hidden Creek assemblage, as well as is the presence of parallel thinning flakes.

The Late Paleoindians made unfluted projectile points as well. These are the lanceolate bifaces referred to by Jones in his Hidden Creek site report (1997). They are made using a technique called “collateral flaking,” in which flakes are driven in towards the median plane of the flake from it’s lateral edges (Boisvert and Bennett 2004). These flakes are referred to as “parallel thinning flakes,” and are important because they are diagnostic of the Late Paleoindian period. In his analysis of the 27-HB-1 site and the Varney Farm Site in Maine, archaeologist

Richard Boisvert determined that an assemblage was from the Late Paleoindian period on the presence of these parallel thinning flakes (Boisvert and Bennett 2004). At Hidden Creek, 32 parallel thinning flakes made up 0.811% of the assemblage (Table 2). The presence, and high frequency, of these parallel thinning flakes show that the parallel flaking technique was used to make lanceolate parallel stem points at Hidden Creek.

Another feature of interest in this assemblage is the amount of endscraper retouch flakes (ESRs) – 230 in total, which translates to 5.830% of the assemblage (Table 2). Endscrapers are a type of unifacial tool that could be held in the hand or hafted. They would have been used for tasks such as scraping animal hides. Such a high number of ESR flakes is unique to Hidden Creek, compared to the four Ohomowauke Loci, and indicates that perhaps scrapers were in frequent use and frequent repair at this particular location.

ii. Ohomowauke Locus A

Thirty-four percent (n=325) of the debitage assemblage of Locus A at Ohomowauke is comprised of chert (Table 3). Again, this is the predominant material as it was at the Hidden Creek site. However, quartz and quartzite are also found in high frequencies in Locus A, amounting to 33.8% and 15.8% of the assemblage, respectively. Quartz and quartzite were likely found locally (Singer, personal communication), but are of significantly lesser quality for tool making. It is unclear whether Terminal Archaic or later peoples were using the quartz and quartzite (Singer, personal communication). As mentioned previously, they do not have as regular of flaking properties as more fine-grained materials like chert. Chert continues to be the material in the highest concentration and when compared with the types of flakes found at Locus A, points to a Paleoindian occupation.

Eleven channel flake fragments were found at Locus A (Table 4), which is quite a few, but not enough to indicate the multiple fluting technique practiced by the Late Paleoindians,. It is likely that this locus dates to the Early Paleoindian period. The recovery of one fragment from a single-fluted point supports this notion (Singer, personal communication). Proximal bifacial retouch (PBR), small bifacial retouch (SBR) and large bifacial retouch (LBR) flakes make up a significant portion of the assemblage, 5.145%, 19.507%, and 1.501%, respectively (Table 4). Retouching is a secondary process in tool making, and occurs either right after the tool form has been completed or when it has been in use and needs to be re-sharpened. Therefore, it is safe to say that this secondary process of retouch happened in Locus A. This could mean that the tools were made at another location and were finished here, or had been in use already. There were only 4 parallel thinning flakes in Locus A, strongly indicating that it was not a portion of the site frequented by Late Paleoindian tool manufacturers.

iii. Ohomowauke Locus B

Chert also dominates the assemblage from Locus B at Ohomowauke (48.2%). The amount of quartz and crystal quartz is also significant, amounting to 27.737% and 13.139%, respectively (Table 5). The percentage of chert in Locus B is greater than Locus A, and at just under half of the assemblage suggests that Locus B may have been an activity area similar to Hidden Creek – where chert could have been used by multiple groups over time. A high percentage of chert in Locus A of Ohomowauke and Hidden Creek correlates with the presence of channel flakes, but this is not the case at Locus B.

The absence of channel flakes and channel flake fragments at Locus B is highly significant. This means that fluting techniques were not being employed in this area of the site.

It is true that Paleoindians may have inhabited the area around Locus B but no channel flakes were found. Nevertheless, the high concentrations of channel flakes in other areas of the sites suggest there would be some evidence of fluting technology if Paleoindians had inhabited Locus B. Proximal bifacial retouch and small bifacial retouch flakes are present in significant amounts. (Table 6) The high concentrations of quartz and crystal quartz and the absence of channel flakes could mean that Terminal Archaic or other later groups of people inhabited this Locus, and Paleoindians did not. The discovery of points from the Broad Spear tradition also supports the idea that Terminal Archaic peoples may have used the area of Locus B for projectile point manufacturing.

iii. Ohomowauke Locus C

The debitage from Locus C contains a great amount of chert and jasper. This is significant because there are such high concentrations of each found in the *same area*. There are 44 chert flakes and 34 jasper flakes, amounting to 8.818% and 6.814% of the assemblage, respectively (Table 7). Both chert and jasper are not found locally to southeastern Connecticut, and the sources are likely located in New York and Maine for chert and Pennsylvania for jasper (Jones 1997) or at the very least a “southern-dervied,” source for jasper (Curran 1999: 16). Therefore, these materials can be considered “exotic,” and were likely obtained by Paleoindians. William Ritchie, a prominent archaeologist in New York, supports this idea. “Commonly the material is exotic to the region where the point was found…testifying to the nomadism of their [Paleoindians’] lives.” (Ritchie 1965: 6). The chert and jasper found at Locus C is likely the by-product of Paleoindian tool manufacture. This evidence is important despite the fact that there are high percentages of quartz and quartzite (low quality, local materials) at Locus C as well.

Thirty-six bifacial reduction flakes (BRED) were found in Locus C, making up 7.2% of the total assemblage (Table 8). Reduction is a primary technique in stone tool making, which indicates that some of the tools were in the first stages of manufacture at this location. This means that the raw material may have been obtained nearby. This could suggest a technique of later peoples than the Paleoindians, such as the Terminal Archaic. However, the prevalence of jasper endscrapers and Munsungun chert endscrapers at Locus C (Singer, personal communication) seems to point to a Paleoindian occupation. Locus C has the highest concentration of unifacial retouch flakes (URF) of any of the four Loci (Table 8). This is interesting to note, because it may mean that Locus C was an "activity area," for retouching unifacial tools. However, both Paleoindians and Terminal Archaic peoples used unifacial tools, and so this does not indicate much in the way of determining who produced them.

iv. Ohomowauke Locus D

Like Locus C, the assemblage from Locus D exhibits high quantities of chert and jasper. In Locus D, however, these two materials are even more common than in Locus C, and the amounts of quartz and quartzite are reduced. There are 48 chert flakes, which translates to 25.1% of the assemblage, and 82 jasper flakes, which translates to 42.9% of the assemblage of Locus D (Table 9). The combination high quantities of the exotic, high-quality chert and jasper suggest that they were left by the Paleoindians.

Seven channel flakes/channel flake fragments were found at Locus D (Table 10). This is even stronger evidence for a Paleoindian occupation than at Locus C, where no channel flakes were found. The raw material and flake types of the Locus D assemblage present some of the strongest evidence for a Paleoindian occupation at the Ohomowauke site.

X. Debitage Analysis

The samples discussed here were chosen for individual analysis because they exhibited the features that were representative of the debitage found in the Hidden Creek and Ohomowauke assemblages. When comparing the Hidden Creek assemblage with the four Ohomowauke assemblages, it is important to state that 1/8-inch screens were used at Hidden Creek and at Ohomowauke Loci A and B, but ¼-inch screens were used at Ohomowauke Loci C and D. This means that smaller debitage were probably collected in greater quantities at Ohomowauke Loci A and B, and Hidden Creek. Below are the representative samples from Hidden Creek and Ohomowauke.

i. Endscraper Retouch Flakes (ESR)

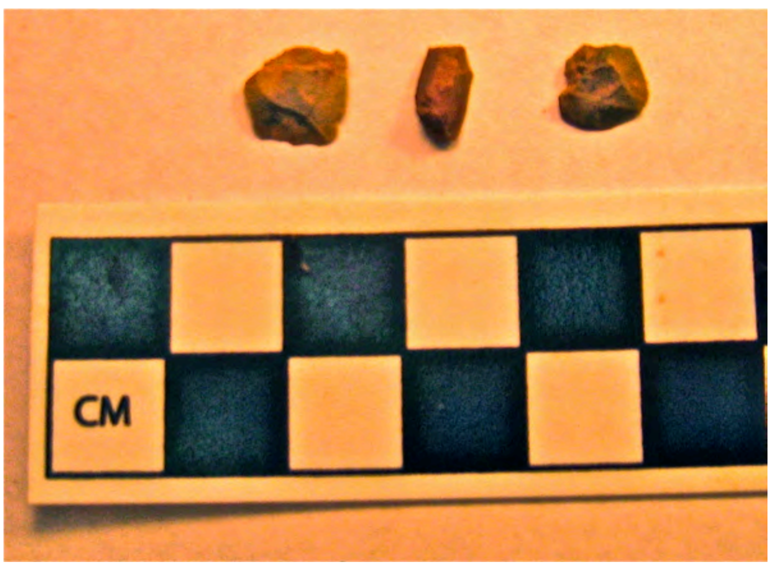


Figure 3. Dark Green Chert Endscraper Retouch Flakes (ESRs). Hidden Creek. Photo by CM.

Figure 4. Black Chert Unifacial Retouch Flake (URF) from Ohomowauke. Photo by CM.

Figure 5. Red/Multicolored Chert URF from Ohomowauke. Photo by CM.

As previously stated, endscraper retouch flakes (ESRs) make up a large part of the Hidden Creek assemblage, which also contains several endscrapers as well. In the site report, Jones (1997) states that roughly 20 ESRs were found per tool. This study examined all of the ESRs from Hidden Creek, and came to the conclusions that most are rounded in shape, with a concave ventral side that is the "negative," of the convex scraping edge of the tool (Fig. 3). The dorsal side of many of the ESRs showed evidence of previous flake removals. This makes sense because endscrapers were heavily used, frequently retouched, and could produce 20 retouch flakes for every 1 tool. These ESRs are very similar to the black chert unifacial retouch flakes (URF) from Locus B of Ohomowauke Site (Fig. 4). These are also round, with a concave ventral side and previous removals on the dorsal side. This indicates a standardized endscraper tool form – a conclusion supported by the actual tools from both Hidden Creek and Ohomowauke. A standard tool form would likely produce very similar retouch flakes. However, the ESRs from Hidden Creek are different than the red chert URFs from Locus C of Ohomowauke (Fig. 5). The Locus C URFs are not of the rounded shape, and seem to show evidence of another previous flaking method that left the URF with an "indent." This is markedly different from the other 2 examples of ESR/URF, and leads to the conclusion that while debitage categorization is useful, the parameters for inclusion are not always so strict. Since each of these examples of ESR/URF seem to have come from a Paleoindian occupation, it can be concluded that Paleoindian debitage assemblages are characterized by a high frequency of ESR/URF, and that *most* of these are of the rounded, concave form.

ii. Proximal Bifacial Retouch Flakes (PBR)

Figure 6. Dark Green Chert PBRs from Hidden Creek. Photo by CM.

As displayed in Figure 6, PBRs come in many shapes and sizes, and so it is difficult to establish a somewhat "standardized," flake form as was the case with the ESRs. However, there are certain characteristics that are common to the full range of PBRs from Hidden Creek. These flakes, especially the larger ones, have a visible platform – the striking surface where the flint knapper hit the tool to remove the flake. One interesting feature to note is that these PBRs seem to have evidence of previous removals that show up in an almost channel-flake like manner. One must remember that although Hidden Creek is a Late Paleoindian site, points were still being fluted, albeit using slightly different techniques. The previous removals resemble the removals on a channel flake in the way that they are removed from the lateral edge to the medial ridge. This phenomenon was noted on not one, but several of these PBRs. This indicates that other flake removals – such as PBRs – may have been set up or prepared for by Paleoindian tool makers in a very similar way to channel flakes. Since there is not overwhelming evidence, some of these could simply be channel flake fragments that were categorized incorrectly.

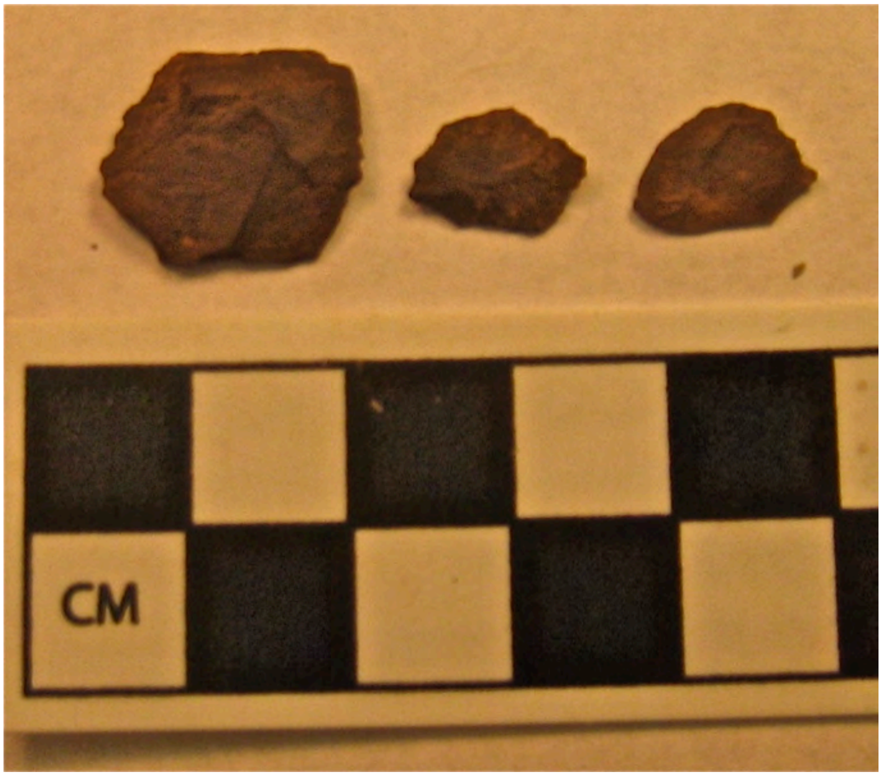


Figure 7. Brown/Black Chert PBRs from Hidden Creek. Photo by CM.

Re-evaluation of three brown/black chert PBRs from Hidden Creek confirms their previous classification as "Archaic," (Fig. 7). This is because Archaic points, and especially Terminal Archaic points, were much larger and thicker than Paleoindian points. The removed flakes should therefore be proportionally larger. In addition, as Jones (1997) has stated, the black chert at Hidden Creek was most likely used by Terminal Archaic peoples.

iii. Small Bifacial Retouch Flakes (SBR)

Figure 8. Chert SBR from Ohomowauke Locus A. Photo by CM.

Figure 9. Red Jasper SBR from Ohomowauke Locus D. Photo by CM.

Although these two small bifacial retouch flakes have different compositions, this study has previously stated that both chert and jasper are high-quality materials and are preferable for tool making. They also come from non-local sources to southeastern Connecticut. Therefore, they were likely used by Paleoindians who were more mobile. Both of these SBRs, and many of the others in the assemblages, show evidence of very small previous removals, if any at all. This means that SBRs were produced in the latter stages of retouch. Since Paleoindian projectile points are thin and narrow, it is likely that many SBRs were produced in the thinning process. Paleoindians were skilled toolmakers and so they would have worked to make their points as fine and as sharp as possible. That is why even the smallest retouch flakes, like these SBRs, have evidence of even finer retouch previously performed on the tools. These SBRs also show signs of usewear, from the edges of the tool. They were then knapped off to retouch the edges.

iv. Large Bifacial Retouch Flakes (LBR)

Figure 10. Grey/Green Chert LBR from Ohomowauke. Photo by CM.

Paleoindians were skilled toolmakers, as evidenced by the fluted point tradition. These points would require a great deal of retouch to stay sharp to effectively hunt animals. Figure 10 illustrates one example of a large bifacial retouch flake that would have been knapped off of a biface, which may have been a projectile point. This, as well as many other LBRs in the assemblages, has a definite platform. This is consistent with the stage of retouch, when a few, large flakes would have been knapped off before the smaller, finer flakes towards the end. This, like many of the other LBRs, does not show definite signs of previous flake removals. While there would have been previous removals in the reduction stage, the tool was likely used, the surface smoothed out, and thus the removals from the reduction stage made not as obvious.

v. Bifacial Reduction Flakes (BRED)

Figure 11. Quartzite Bifacial Reduction Flakes from Ohomowauke. Photo by CM.

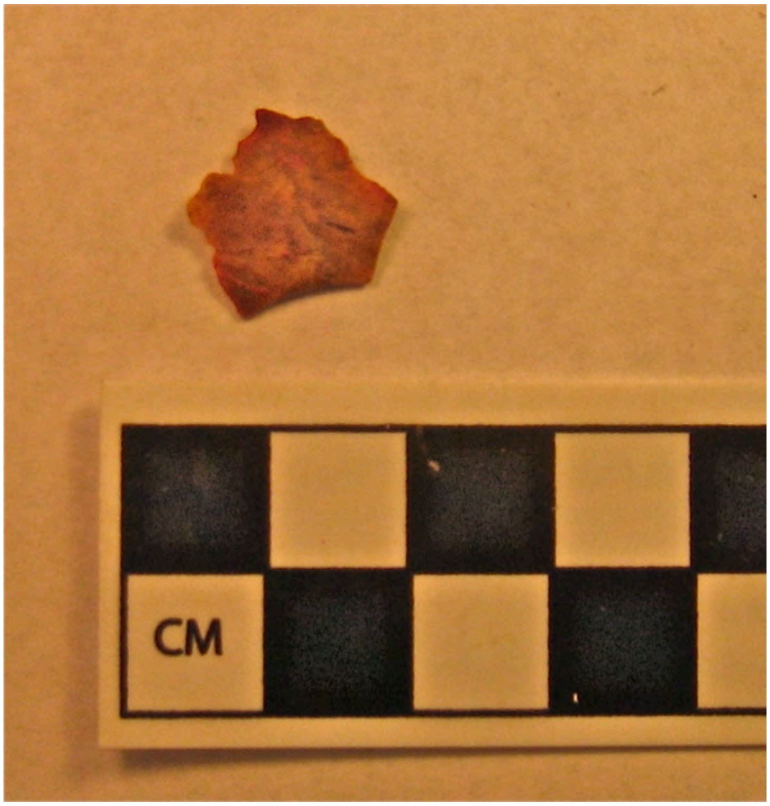


Figure 12. Red/Yellow Jasper Bifacial Reduction Flake from Ohomowauke. Photo by CM.

It is expected that the mobile Paleoindian hunter-gatherers acquired their lithic raw material from sources far from southeastern Connecticut, and then transported them to sites like Hidden Creek and Ohomowauke. It is likely that tools were already preforms by the time the Paleoindians arrived in southeastern Connecticut, but nevertheless there is evidence that the early stages of reduction took place at these sites (Fig. 12). These reduction flakes are large and thick. It is interesting that quartzite bifacial reduction flakes (Fig. 11) are found in Locus C, which was dominated by chert and jasper. These quartzite bifacial reduction flakes were not used by Paleoindians, and were most likely not made by Terminal Archaic peoples. There were several Middle Archaic quartzite Neville points found at Ohomowauke, and this may mean that these quartzite flakes were made by Middle Archaic peoples. This also explains the presence of bifacial reduction flakes because tools made from materials of a nearby source would likely have been in the early stages of reduction at this site.

vi. Parallel Thinning Flakes (PT)

Figure 13. Brown Chert Parallel Thinning Flake from Hidden Creek. Photo by CM.

Parallel Thinning flakes are diagnostic of the Late Paleoindian period, and the lanceolate, parallel-flaked, square-based points. They are usually very small and thin, but the flake in Figure 13 is a bit larger than normal. This, and the other parallel thinning flakes from Hidden Creek, has a definite platform where it was struck by the knapper. It remains thin for the entire length of the flake, and has jagged edges. Another characteristic of a parallel thinning flake is the medial ridge, although it has no removals coming from the lateral edges as a channel flake does. Parallel thinning flakes were made by a specific process – thinning the edges of the projectile point – and so it stands to reason that they will have a more or less standardized form, much like the endscraper retouch flakes.

vii. Channel Flake Fragments (CF)

Figure 14. Dark Green Chert Channel Flake Fragment from Hidden Creek. Photo by CM.

Figure 15. Chert Channel Flake Fragment from Ohomowauke. Photo Courtesy of Zac Singer.

Channel flakes are diagnostic of the Paleoindian period, especially the early part. They are characterized by flake scars that run from the lateral edges to the medial ridge of the flake. These flake scars are perpendicular to the direction of the platform and bulb of percussion. Because the channel flake is the last flake removed to form the flute, it shows evidence of all the previous removals along its medial ridge. It is then knapped off of the point from the proximal end. Channel flakes are usually thin, although some can be a bit thicker. They are always narrow, by nature of the appearance of the flute, their “negative,” and are parallel-sided. These unique attributes have been well established, and the channel flakes from Hidden Creek (Fig. 14) and Ohomowauke (Fig.15) comply with the characteristic features.

XI. Conclusion

The Paleoindian and Terminal Archaic periods are separated in North American Prehistory by thousands of years, and have very different cultural traditions in terms of lithic artifacts. They are easily differentiated on the basis of their projectile point styles, with Early Paleoindians producing fluted points, Late Paleoindians making lanceolate, parallel-flaked points and points with multiple flutes, and Terminal Archaic peoples using the Broad Spear tradition. However, projectile points are not found in great frequency. The majority of any given lithic assemblage is usually made up of debitage. This study attempted to identify diagnostic debitage features that can be used to differentiate each of these cultural traditions. The data was first analyzed based on the relative proportions of raw materials. This analysis supports the conclusion that Paleoindians were accessing more high-quality materials like chert and jasper, while Terminal Archaic peoples used more locally available materials like argillite. The graphs below that quantify the relative amounts of each raw material at Hidden Creek and the four Ohomowauke Loci show that chert is the most prevalent material. Table 11 shows that chert is the predominant raw material used at Hidden Creek. Table 12 shows that chert also dominated the assemblage at Locus A, with a noticeable component of quartz and quartzite as well. Table 13 shows a similar trend for Locus B, with chert and quartz the most prevalent materials. Table 14 for Locus C and Table 15 for Locus D show the significant combination of chert and jasper debitage at these two loci that strongly supports a Paleoindian occupation. With the interpretation by Jones (1997) that stated that Terminal Archaic peoples used black chert at Hidden Creek, it is fair to say that they could have used chert at Ohomowauke as well. The significant amount of chert at all of these sites shows that it was used frequently by both Paleoindians, and possibly by Terminal Archaic peoples.

Table 11

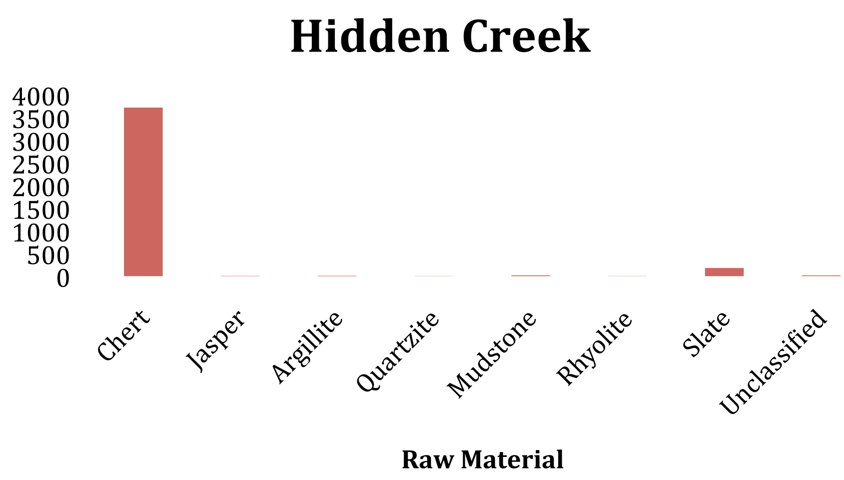


Table 12

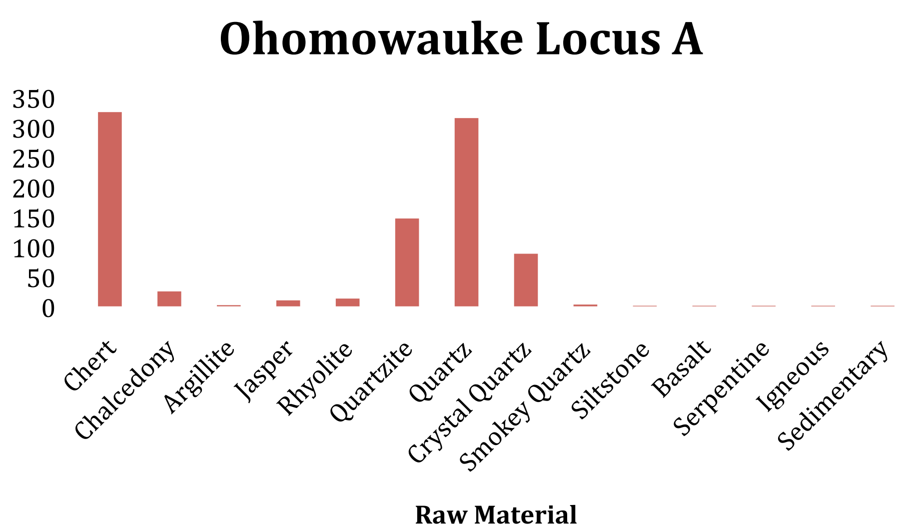


Table 13

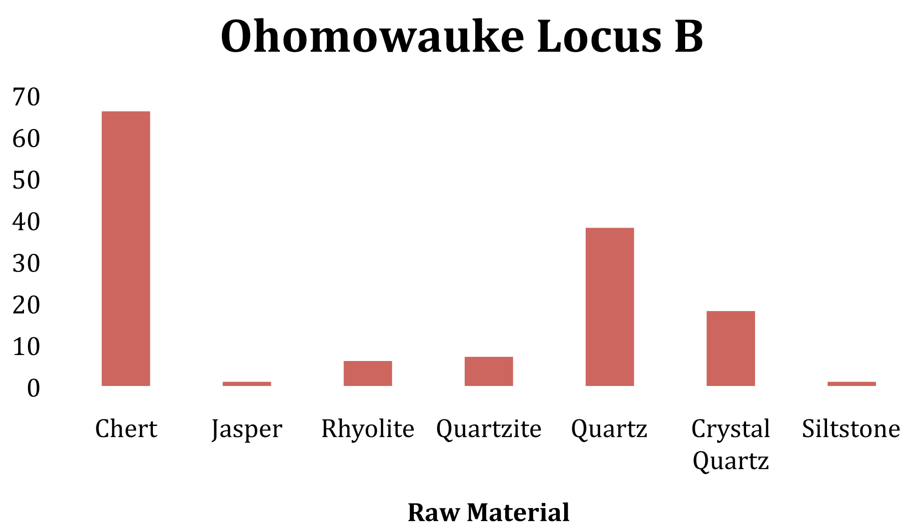


Table 14

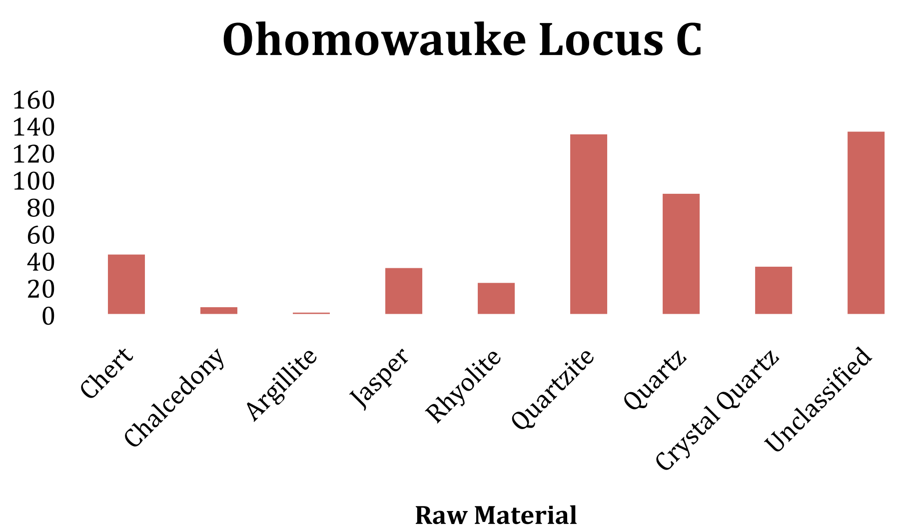
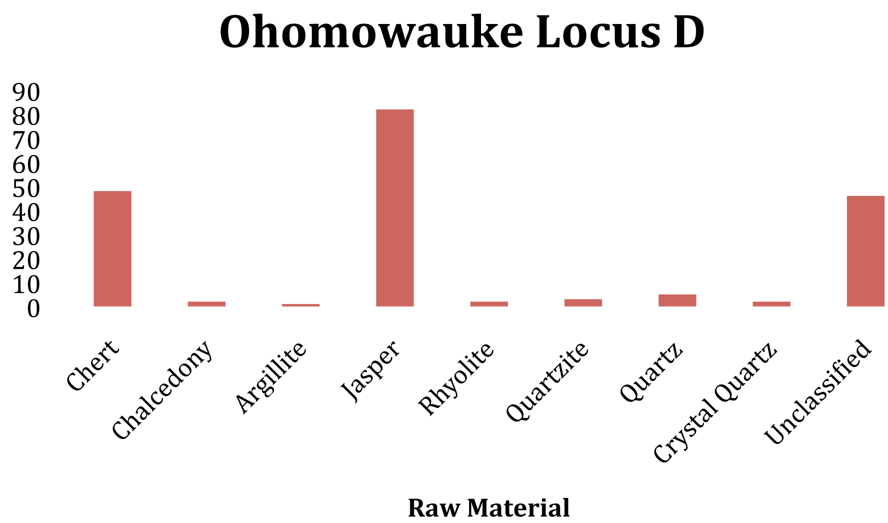


Table 15



This portion of the analysis also dealt with percentages of each flake type found in the assemblages. Likewise, while channel flakes are a good indicator of a Paleoindian occupation, small and proximal bifacial retouch flakes also point towards secondary tool making processes far from the lithic sources. While broad generalizations cannot be made, and it is more difficult to identify diagnostic characteristics than with projectile points, certain features of debitage also can allow the various cultural traditions to be identified. Such features include perpendicular flaking of the channel flake, larger flakes in the Terminal Archaic, and channel flake-like flaking on proximal bifacial retouch flakes of the Paleoindian period. The hope is that these methods and debitage features can be used in future archaeological research.

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