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Monhantic Fort Gunflints: Continuity or Change in Mashantucket Pequot Lithic Manufacturing Patterns Due to European Contact

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Contents

Chapter 1

A Historical View of Monhantic Fort

Introduction

The goal of this study is to reconstruct Pequot behaviors related to production, maintenance, use, and discard of gunflints and other lithic tools made from European flint at the Monhantic Fort, a late seventeenth century fortified village. Monhantic Fort is located on the Mashantucket Pequot Reservation in southeastern Connecticut (figure 1) and was occupied between1675 – 1680 (Benard 2005, McBride 1993); Monhantic Fort was only occupied for a few years during King Philip's War. Further, the study should suggest whether Pequot patterns of manufacture and their technologies were altered through contact with Europeans.

The lithic assemblage for Monhantic Fort includes approximately 1,000 artifacts. These include tools such as gunflints, strike-a-lights, and utilized flakes. Also included are numerous pieces of debitage of various types such as flakes, fragments, shatter, and unmodified cobbles. Paramount to discerning if Pequot manufacturing and technology patterns at Monhantic Fort changed due to European contact necessitates the determination of several issues. First, how was the material for production acquired? Second, did production occur in one or multiple places? Third, were primary and secondary reduction accomplished in separate areas? Fourth, is there a relationship between the area(s) of production and features, such as hearths and structures, or other artifacts

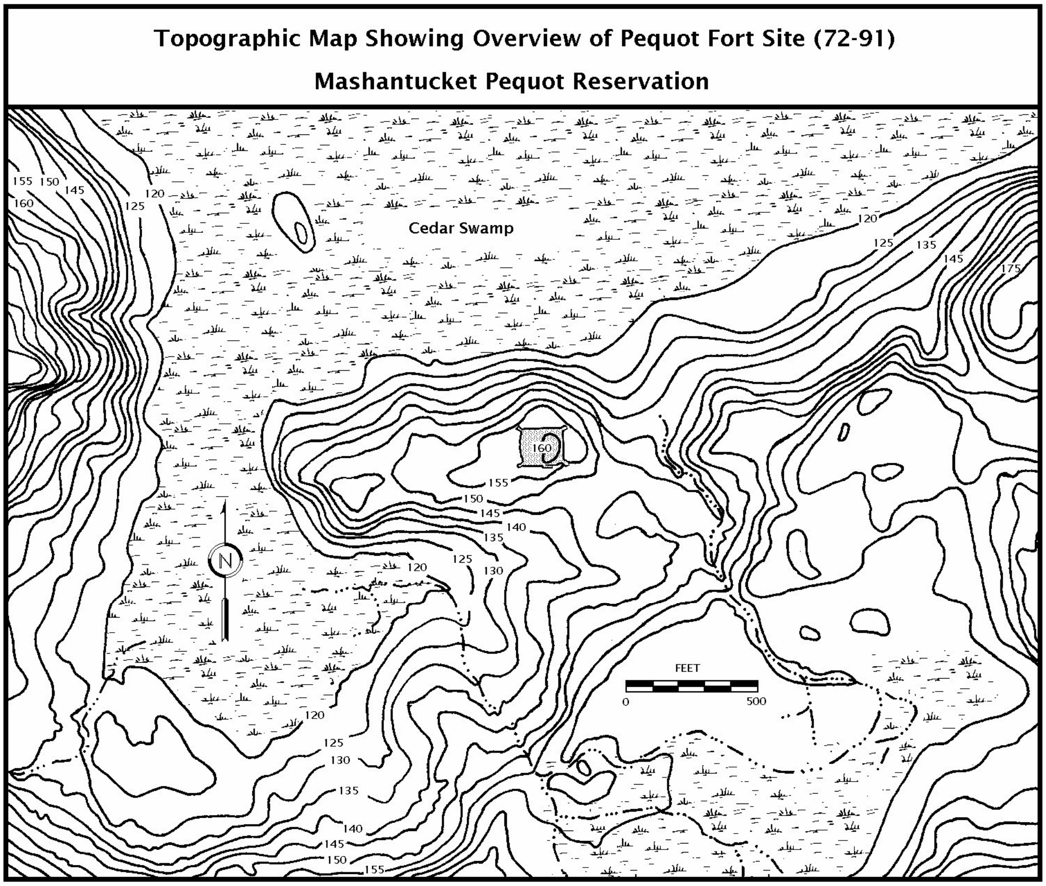

Figure 1: Location of Monhantic Fort (Courtesy of MPMRC)

suggestive of either specialist or generalist production? Finally, does tool curation in the form of reuse of a tool as a different tool, or discard patterns, inform us about Pequot technological and spatial organization? The spatial analyses of the gunflints and associated debitage, other tools made from European flint, and discard patterns, will be used to infer the nature of manufacturing, technology, and adaptation of European material goods. Also, the spatial patterning will illustrate if pre-contact patterns were retained, changed or both. Additionally, other contemporary sites and experimentally produced assemblages will be used for comparison to the Monhantic Fort assemblage to

help determine if any changes to the Pequot patterns were in accordance with pre-contact patterns.

Historical Context

Monhantic Fort was a result of the continuing power struggle for the control of southern New England. In June of 1675, King Philip's War broke out. King Philip, or Metacom, was a Wampanoag sachem and warriors under his control attacked Swansea, Massachusetts, destroying the town and killing several English (Leach 1958). The raid was in retaliation for the hanging of three Wampanoag for the murder of John Sassamon and led to full-scale war in New England (Leach 1958).

On one side of the conflict were the Wanpanoags along with the Nipmuck, Pocumtuck, Narragansett, and most Native groups of central and western Massachusetts and eastern Maine (McBride 2007). On the opposing side of the conflict were the English and their Native allies, which included the Mashantucket and Pawcatuck Pequots, the Mohegan, and the Eastern Niantic (McBride 2007). It is in this context that Monhantic Fort was built. Constructed on the Pequot reservation, which was established in1666 (McBride 1993), an archaeological survey discovered the fort 1991 (Fig. 1). It measures 190 feet by 170 feet with four bastions and was originally identified as a fortified place (McBride 1993), but is now considered a fortified village due to the type and amount of archaeological remains found there (McBride personal communication).

Chapter 2

Gunflints (and Other Tools)

Evolution of Gunflints

What can gunflints inform us about? Can we discern where they were made, who made them, and when? Can they tell us who occupied a particular site or when that site was used? Are we capable of determining where raw materials were acquired from them? By studying them, can we determine if production occurred in one or more places at a site or if primary and secondary reduction were accomplished in separate areas? Are we able to determine if there is a relationship between areas of production and certain types of features through studying them? Perhaps they were used for other purposes, and if so is it possible to tell what those purposes were? Through various means of analysis detailed in later chapters, it is possible to answer these questions, at least partially.

Gunflints have been in existence for about 400 years, since the invention of the snaphaunce in approximately 1600 followed by the flintlock in about 1625 (Hamilton and Emery 1988:4-5). When Europeans came to North America, they brought their weapons, which included the matchlock, the snaphaunce, and the flintlock. Native Americans quickly adopted the flintlock due to its advantages in warfare and hunting and it remained the standard weapon in North America until the early nineteenth century (Luedtke 1999:29). Because flintlocks were in use

for such a long span of time, gunflints are common artifacts on post-contact Native American and early historical European archaeological sites.

In 1966, John Witthoft published an article in which he delineated a typology and chronology of four types of gunflints: Nordic, Dutch, French, and English. He believed this was a tight sequence with each type replacing the previous type and at identifiable intervals (Witthoft 1966:24). Nordic flints, according to Witthoft (1966:22), were made of Danish flint, bifacially percussion flaked, square to rectangular, pillow shaped, and with bilaterally symmetrical edges instead of beveled. Dutch or Clactonian flints replaced the Nordic flints. Dutch flints were wedge shaped and made from a variety of colors of flint, which he assigned to the Low Countries (Witthoft 1966:25-26). French flints were next, replacing the Dutch, and were made using a blade technology (Witthoft 1966:28). These flints have a single edge with the heel worked into a semi-circular outline, or D shape, and are made of a yellow flint (Witthoft 1966:30). English flints are the last in the succession. Produced from blades like the French flints, the makers used a micro-burin (notching) technique for segmenting the blades into gunflints (Witthoft 1966:36). The English produced their flints from a glossy black flint and with a rectangular shape. Finally, in addition to one type of gunflint replacing the next, Witthoft believed that production of each gunflint type occurred only in the location of its name (Witthoft 1966:39). He also believed each type was a re-evolution of past stone working technology with Nordic gunflints being parallel to Lower Paleolithic, Dutch to Clacton I (also Lower Paleolithic), French blades to Upper Paleolithic, and English to Mesolithic (Witthoft 1966).

Further study has changed and refined Witthofts' typology and chronology. There are now four basic types of gunflints recognized by historical archaeologists: chip, bifacial, spall, and blade. Additionally, as detailed in the following, there are various countries of origin and manufacturing techniques for some of these types.

Chip gunflints mostly resemble a simple chunk of stone, thus their name, which fit the lock of a particular gun (Hamilton and Emery 1988:9). According to Kent (1983:31), this was the first type of gunflint, manufactured by smashing a flint nodule and using the pieces that fit the lock of a particular flintlock. They are not uniform in shape but tend to have a wedge shaped cross section and a thin straight edge parallel to the thick end (Luedtke 1999:32). According to Kent, production occurred in Europe from 1580-1665 (Kent 1983:29-32). For New England, Luedtke extends that date to 1673-1680 with the Aptucxet site and states that their production occurred elsewhere into the early eighteenth century (Luedtke 1999:32).

Bifacial gunflints are the Nordic gunflints of Witthoft's chronology/typology. According to Kent, there are no archaeologically verifiable bifacial gunflints in England, France or Northern Europe (Kent 1983:32). However, many gunflints excavated from Native American sites are bifacially flaked. This leads to the supposition that bifacial gunflints from Native American sites were not European products or copies of them, as Witthoft proposed, but an indigenous solution to gunflint supply by the Native Americans. Nevertheless, production of bifacial gunflints took place in Albania, Portugal, Spain, and possibly Bulgaria into the

nineteenth century (Kent 1983:32-33) and could have been imported into North America and used by Native Americans.

Spall gunflints, also called gunspalls and wedge gunflints, are the second type of gunflint in Witthoft's chronology/typology, which he called Dutch gunflints (Witthoft 1966:24). Their characteristics include a wedge shape, the appearance of having two smooth ventral surfaces (Luedtke 1999:33), a bulb of percussion, and unifacially retouched margins (Blanchette 1975:49). Witthoft (1966:25-26) concluded that the Netherlands produced these gunflints based on visual aspects of the material, the color and lack of chalk cortex, and an early published source. White disputed this, stating that the drift of the Riss outwash Witthoft assigned to gunspall material does not exist in the Netherlands (White 1975a:67). If production of gunspalls did not occur in the Netherlands, where did production take place? Hamilton and Emery (1988:22) cite several articles on gunspall production sites in England. De Lotbiniere (1987) details, through Board of Ordnance records, gunflint production in England from the 1660's onward. Hamilton and Emery (1988), based on their investigation of gunflints from Fort Michilimackinac, also concluded that France produced gunspalls.

The visual differences between English and French gunspalls are color and methods of production. French gunspalls were made of "a non-glossy translucent flint that ranges from light brownish gray to deep brown." (Hamilton and Emery 1988:159) and show detailed retouch on the sides and heel (Hamilton and Emery 1988). English gunspalls included white, black, blotched brown, and mottled flints, and show squared shoulders, rounded edges, and little or no

retouch (Hamilton and Emery 1988). Gunspalls were also produced in Denmark (White 1975a:71) and in North America at Fort Frederica, Georgia (Hamilton and Emery 1988:184-192).

The technique for making gunspalls involved striking large flakes from a nodule and then striking smaller flakes from those to produce the gunspalls. Hamilton (1987:142-145) provides a good description of this process as does Hamilton and Emery (1988:270-275). Production of spall gunflints began in the 1600's. Hamilton and Emery (1988:10) suggest they appeared at about the same time as the snaphaunce, or about 1600. Their terminal date would have been in the late 1700's or early 1800's (Luedtke 1999:34).

Blade gunflints are also called flake gunflints and account for Witthofts' third and fourth types, the French and English. Unlike Witthofts' previous two gunflint types, it appears that most, if not all, authors concur with him as to where production of these occurred, which was in England and France. Both produced blades struck from prepared cores (Hamilton and Emery 1988:12). The French used a glossy translucent yellowish flint to manufacture their blade flints from; they are generally single edged (Hamilton and Emery 1988:13). Additionally, they rounded the sides and heel through retouch, which gave them an overall D shape (Luedtke 1999:35). The English produced their blade flints from a dark gray to black flint without gloss (Hamilton and emery 1988:13). They are square or rectangular with a trapezoidal cross section (Luedtke 1999:37). They appear to be double edged, however, the shorter bevel is the heel (Hamilton and Emery 1988:13). They show little or no retouch and demicones of percussion are

generally present (Hamilton and Emery 1988:13). Both types often show ripple marks on their ventral surfaces and flake scar ridges on their dorsal surfaces running side to side (Luedtke 1999:37).

While the methods of manufacture of both French and English blade flints are similar, there are differences, which affect the appearance of the finished product, its morphology. These differences in appearance help archaeologists determine the location of production of blade gunflints. The differences in production that follow are from De Lotbiniere (1979:67-71). Both use a stake, which the blade rested on, and a hammer to strike the blade, causing a scissors like interaction between it and the stake. This interaction between a “wide blade” and a “pointed instrument” caused the demicones of percussion. The “wide blade” in the French method was the stake and the “pointed instrument” was the hammer; the English reversed this in their method.

The French positioned the blade with the flat ventral side on the stake and held the blade on the near side of the stake; the English reversed this. The French hammer was light and had a short round handle while the English hammer was heavier and the handle had a rectangular cross section on its upper portion. These methods of production are postulated to be the reasons French blade flints are wider from side to side than English blade flints: less control of the hammer and being careful not to hit ones thumb. If demicones were produced in the French method, and they could be, they were generally eliminated with retouch. These production methods caused French and English gunflints to have different morphologies, which aid in identification.

Exact dates of manufacture of French and English blade gunflints are unknown, as with the other types of gunflints. However, determination of a range of dates is possible. Production of French blade gunflints began as early as 1663 based on archaeological information from the Chicoutimi Site in Quebec (Blanchette 1975:49-50). The Native American contact period level of this site, in which four French blade gunflints were excavated, was isolated from later contamination due to a landslide, which covered it with three to four feet of clay (Blanchette 1975:41). An earthquake caused the landslide, which was felt throughout Canada and into New England (Blanchette 1975:43). Luedtke (1999:37) reports a severe decline in the French blade gunflint industry after 1820 with a terminal date in the 1920's.

The English started production of blade gunflints later than the French. De Lotbiniere gives a date of 1775 when the Board of Ordnance ordered 200,000 "flints of a New Construction," which he suggested were blade gunflints (1987). Witthoft (1966:29-30) notes that Revolutionary War sites contain French blade gunflints, but not English. This suggests that production of English blade gunflints was not yet substantial or there were technical problems with them. According to Luedtke (1999:39), the output of English blade gunflints from Brandon peaked in the 1850's. A terminal date has not come about for them as their production continues to the present.

In addition to France and England, production of blade gunflints occurred in other countries. Witthoft (1966:39) notes two gunflints from Russian St. Michael in Alaska, which he described as thick and massive, made from course blades,

and finished in the French style. The flint was described as, "porous, mat surfaced, non-glossy chalk flint, light grey to grey-black in color, with many tiny whitish blotches and dots." (Witthoft 1966:39). He stated that the material is most likely from Galicia in Russian Poland (Witthoft 1966:39).

Non-Pequot Native American Production Methods

In the early contact period, which varied across regions, Native Americans still maintained intact lithic production traditions. With their acquisition of flintlock firearms, these methods of production extended to include gunflints for their new weapons. Although there were many production methods available, the most common was pressure flaking, which transformed small flakes of various materials into serviceable gunflints of differing shapes, sizes, and qualities.

Witthoft (1966:22) had stated that the bifacial gunflints of the Native Americans were very expertly flaked. Kent disagreed. He said that while some were well made, most were not, with many having humps due to thinning flakes not passing over the center (Kent 1983:34). They tended to be roughly square or rounded and had a low angle of edge trimming (Kent 1983:34). The bifacial Native American gunflints from Texas that Kenmotsu studied had all four margins bifacially pressure flaked, had a biconvex cross section, and were sub-rectangular in outline (Kenmotsu1990:01).

Native Americans used a number of different types of material for their gunflints. According to Witthoft (1966:22), most gunflints from Long Island were made of quartz; the Seneca used Onondaga Chert (Witthoft 1966:22). Those in

Kenmotsu's study were from Ouachita Mountain flints (Kenmotsu 1990:101). Fifty percent of the gunflints from Pennsylvania in Kent's study were of native material including local gray and black cherts, Onondaga Chert, Pennsylvania jasper, chalcedony, and quartz (Kent 1983:34). Behm et al (1985:176) cite tentatively identified Native American gunflints from Wisconsin of Hixton Silicified Sandstone, while Hirst (1991:62) presents a possible Native American gunflint from Iowa made from Maynes Creek Chert. Additionally, Native Americans used European ballast flint, mostly mottled gray and white, with the source most likely being England (Kent 1983:34). In short, Native Americans used whatever lithic material was available to them for their bifacial gunflints. Production dates of bifacially flaked gunflints the Northeast range from about 1625 to 1700, with production continuing further west into the nineteenth century (Kent 1983:34).

Gunflint Identification

The positive identification of an artifact as a gunflint is not always easy. Particularly vulnerable to misidentification are chip, bifacial, and spall gunflints. Luedtke notes that many chip type gunflints do not look like gunflints at all and are most likely under identified (Luedtke 1999:31). She also suggested that bifacial gunflints might be under-recognized and identified as scrapers or wedges (Luedtke 1999:41) while spall type gunflints are somewhat similar to scrapers (Luedtke 1999:33). White (1975b:64), citing Hanson, stated that after re-examination most of the Native American lithic assemblage identified as scrapers from Macon Plateau in Georgia were identified as gunflints. Behm et al

(1985:176-177) suggested that several artifacts from Wisconsin are Native American unifacial gunflints made from Hixton Silicified Sandstone, a material many consider unsuitable for gunflints. Experimentation later proved its suitability for use as gunflints (Behm et al 1985).

Hirst (1991) illustrated the difficulties of positively identifying an artifact as a gunflint. In attempting to discern the function of a specific artifact from Iowa, he used four methods of investigation including morphological characteristics, context, use wear, and consultation with other archaeologists (Hirst 1991:62). From his analysis, he determined that the morphological characteristics of the artifact were within the range of variation of both end scrapers and aboriginal gunflints (Hirst 1991:63). Context was not helpful due to use of the area from Paleo-Indian through early historic times (Hirst 1991:63). Usewear analysis showed characteristics of both end scrapers and gunflints (Hirst 1991:64). Finally, consultation with ten archaeologists was inconclusive as to what the artifact was. Two were certain it was an end scraper and two were certain it was a gunflint while three thought it was a probable end scraper and three a probable gunflint (Hirst 1991:64). Additionally, several said it originally was made as an end scraper and then modified into a gunflint (Hirst 1991:64). In the end, identification of the artifact returned to either an end scraper or gunflint (Hirst 1991:64).

As previously noted, certain types of gunflints are similar in morphology to scrapers and wedges, or just do not resemble gunflints. Additionally, gunflints also share characteristics with strike-a-lights (Luedtke 1998, Runnels 1994).

Fortunately, production of lithic artifacts from Monhantic Fort was from European ballast flint, which precludes their misidentification as pre-contact tools. Their Identification as gunflints or strike-a-lights was thus largely based on usewear.

The use wear that an artifact displays can be diagnostic of its function. Nancy Kenmotsu (1990) initiated a study of thirty-eight gunflints, twenty-two from archaeological contexts and sixteen modern, to determine if gunflints exhibited a uniform pattern of use wear. She identified five expected types of use wear. The first was a consistent crushing or heavy step flaking of the working edge caused by contact with the frizzen, which became greater with use (Kenmotsu 1990:105). Second, was a uniform pattern of wear across the working edge due to repetitive use (Kenmotsu 1990:105). The third type of use wear included step flaking on the upper surface of the working edge and striations, smoothing, and polish on the lower surface (Kenmotsu 1990:105-106). The upper surface of a gunflint is the part that faces upward, as toward the sky, when the flint is in the flintlocks' vise. Conversely, the lower surface of the gunflint faces downward toward the ground when installed in the flintlocks' vise. Fourth was the presence of blunting on the working edges (Kenmotsu 1990:106). Finally, evidence of rejuvenation of the gunflint in the form of multiple working edges or edge retouch was expected (Kenmotsu 1990:106-107).

The expected types and severity of use wear that Kenmatsu predicted she would find on gunflints did not all pan out. First, step flaking of the working edge proved universal while crushing did not, especially on the archaeological sample (Kenmotsu 1990:108). This was attributed to the longer use (number of shots) of

modern gunflints compared to archaeological specimens (Kenmotsu 1990:109). Second, substantiation of a uniform pattern of wear on the working edge did not occur due to edge rejuvenation and flaws in the material (Kenmotsu 1990:109-110). Third, step flaking on the upper surface of the working edge was also universal (Kenmotsu 1990:110). Striations were only present on three of the modern gunflints, attributable again to length of use (Kenmotsu 1990:110). Smoothing was apparent on two thirds of the modern and archaeological sample but was not limited to the lower surface of the working edge (Kenmotsu 1990:110-111). Fourth, blunting occurred but not to the extent expected (Kenmotsu 1990:111-112). Fifth, rejuvenation of the gunflints by turning or flipping them and by edge retouch was common (Kenmotsu 1990:112). Additionally, two other patterns of use wear took place during the study. These included the presence of wide, flat flakes on the lower surfaces of the working edge, and metal and leather residue on the gunflints (Kenmotsu 1990:112-113). In summation, Kenmotsu determined the use wear of a gunflint included unifacial step flaking, smoothing of the working edges, flat flaking, rejuvenation, some blunting and crushing, and metal and leather residue

Strike-a-Lights

Strike-a-lights poses a similar dilemma for purposes of artifact identification, as they are similar to gunflints in morphology. Runnels (1994), describes them as rectangular, oval, or round with most being rectilinear. Additionally, he stated that historically England produced them with the same methods used in English

blade gunflint production and in France with the same method used for gunspall production (Runnels 1994). Luedtke (1998) noted that at Aptucxet, strike-a-lights were extremely variable in shape and any piece of flint could be used for this purpose, including used-up or broken fragments of gunflints. Essentially, strike-a-lights have the same morphology as gunflints. To further confuse identification, Feder (1984) noted that Europeans mentioned a similarity between European gunflints (which look like strike-a-lights) and Native scrapers.

Gunflints were also used for other purposes as needed. Luedtke (1999:32) stated that all the different types of gunflints were at times reused as strike-a-lights when no longer useful as gunflints, likely due to insufficient sparking or breakage. Barnes stated that three of ten gunflints found on the LaVase Island site were used as strike-a-lights (Barnes, 11).

Citing Hamilton and Fry, Barnes listed the use wear characteristics of a strike-a-light: The area used in striking will be concave, a bifacial striking edge will be formed from turning the flint over to get a sharper edge, and the concave bifacial striking edge will only have a few large flake removals with most flakes being small (Barnes, 7). Runnels (1994:11) identified use wear on strike-a-lights as, "Large areas of bifacial and invasive flaking with scattered splintering and crushing…" He defined splintering as "the overlapping and scaled appearance of the flake scars…which is typically found on opposing edges of the tool." (Runnels 1994:11). Metallic marks in the form of short streaks perpendicular to the working edge were also noted (Luedtke 1998, Runnels 1994). Runnels also listed a range of sizes for strike-a-lights. They were from 15-50mm long, 13-

58mm wide, and 5-45mm thick (1994:11), which encompasses the range of sizes for gunflints. Luedtke noted that the strike-a-lights from Aptucxet were within these parameters but tended toward the small end (1998:43). Although similar in morphology, there are differences in use wear between gunflints and strike-a-lights. Strike-a-lights show a concave striking area, bifacial, and invasive flaking; gunflints generally do not.

Utilized Flakes

By 1675, the Pequot had long incorporated a wide range of European material culture into their society. In particular, metal items, such as knives, had replaced their lithic counterparts (Feder 1984). Thus, the last stone tool type to be discussed in this study, utilized flakes, is a somewhat surprising category. Perhaps the Pequots never gave up using them or maybe they just rediscovered the usefulness of sharp-edged debitage. Regardless, excavation of utilized flakes of European flint occurred at Monhantic Fort. For this study utilized flakes are defined as flakes or other debitage that show patterned use wear other than that described for gunflints or strike-a-lights.

Summary

Gunflints have been in existence for approximately 400 years. Firearms that utilized gunflints existed in North America for most of that time. Gunflints effectually became a ubiquitous artifact on many archaeological sites, both European and Native American. The problem, however, are that many gunflints

resemble other artifacts, such as scrapers, thus leading to the misidentification of various artifacts. Nevertheless, through the understanding of production methods, use wear patterns, and morphology, misidentification of gunflints from the archaeological record should be less common.

Chapter 3

Analysis Methods

Macroscopic, Microscopic, and Replicative

I accomplished the analyses in this thesis with several different methods. These methods are broadly described as macroscopic, microscopic, and replicative. Macroscopic approaches include measurements, such as length, width, thickness, and weight, along with color. Additionally, the use of a hand lens up to 10x can be used in macroscopic approaches. As noted by Andrefsky (2004), macroscopic analysis is much less time consuming, and less revealing of details, than microscopic analysis.

In addition to the macroscopic analysis, I also conducted a microscopic analysis of the artifacts. Specifically, this was a low-power (<100x) analysis. A stereomicroscope with magnification up to 40x was used. I used this method to determine if an artifact had usewear, how much, and what type. I did not conduct a high-powered (>100x) microscopic analysis.

I used macroscopic methods to conduct a typological analysis of the debitage. In particular, I utilized the Sullivan and Rozen typology (1985). This was used to determine the production methods used to produce the gunflints. Replication was the final analysis method used. After determining the method of production, I replicated gunflints using the same method and subjected the results to the same analyses for comparison.

Experimental Production of Gunflints

I designed an experiment to replicate chip type gunflints and the resultant debitage, as found at Monhantic Fort. The flint used in these experiments was black English flint from Brandon, England. I chose this flint for its high quality, demonstrated workability, and longstanding use in the gunflint industry. Additionally, while the Pequot used ballast flint, most likely from English ships, that material was unavailable to me, so I substituted the commercially mined Brandon flint.

For the experiments the flint nodules chosen, the reduction method, and the products are reflective of those found in the archaeological collection from Monhantic Fort. The unworked ballast flint nodule found at the Fort was small, 71.8 grams; therefore, the Brandon flint nodules used in the experiments were the smallest I could obtain. The reduction method used at Monhantic Fort appears to have been a form of the bipolar technique, as show through analysis described below, so this flintknapping method was used for my experiments. The Pequots at the Fort were only producing gunflints from their ballast flint; consequently, this was the only tool I attempted to produce. As there was no evidence for bifacial reduction or decortication before knapping at Monhantic Fort, I did not include these procedures in my experiments.

The tools used during the replication included a basalt anvil 243mm long x 200mm wide x 99mm thick. Its weight was 5352.389 grams. Three hammerstones were also used. Hammerstone number one was quartzite, hemispherical with a flat bottom, 146mm long x 125mm wide x 84mm thick, and

weighed 1900 grams. Hammerstone number two was quartzite, semi-cylindrical, 92mm long x 86mm wide x 58mm thick, and weighed 794 grams. Hammerstone number three was quartzite, roughly cylindrical, 76mm long x 48mm wide x 54 mm thick, and weighed 298 grams. All nodules were knapped by being placed on the basalt anvil and smashed with a hammerstone. Pieces meeting the criteria for gunflints were removed. Larger pieces were further reduced using the same bipolar technique. All material produced from these experiments were collected on a tarp and saved. Analysis was done on each individual nodule and then on all as an aggregate.

Originally, I chose the three smallest nodules of Brandon flint that I had for my experiments. Nodule 1 was 131.5mm long X 80.11mm wide X 81.27 mm thick. I chose not to use it due to its overall amoebic shape, which potentially would have reduced its usefulness. Nodule 2 was 144.95mm long X 67.17mm wide X 68.69mm thick. Its shape was roughly cylindrical and it weighed 740.035 grams. This made it almost ten times larger than the unmodified cobble found at Monhantic Fort, which weighed 71.8g. Finally, nodule 3 was 87.11mm long X 50.81mm wide X 42.59mm thick. It was roughly cylindrical in shape and weighed 263.524g, or almost four times larger than the unmodified Monhantic cobble. Although these nodules were much larger than those likely used at Monhantic Fort, they were the smallest ones available to me.

When I began the experiment, I had three hammerstones. After a very short period, it became evident that hammerstone number 2 was ineffectual; it was too small for good smashing and too big for finishing and therefore its use was

discontinued. During the knapping process, which was bipolar, two classes of flakes were removed from the debitage, as previously noted. The first were those that could be used as is for a gunflint, with dimensions ranging from approximately 20mm X 20mm to approximately 34mm X 34mm. The second class of flakes removed from the debitage was those slightly larger than 34mm X 34mm, which could be trimmed down to size using direct percussion. If they were too large, reduction would continue using the bipolar technique.

All material, with the exception of the removed flakes, was passed through a ¼" screen, just as it would be in the field. The debitage collected in the screen was kept separate. The debitage that passed through the ¼" screen was then passed through a 2mm sieve. The debitage collected in the sieve was kept separate, as was the debitage that passed through the sieve.

For both nodules, all material was collected and placed into six categories. These are: useable flakes as is, useable flakes after trimming, large unusable

	Nodule 2		**Nodule 3**	
	Weight (g)	Percentage	Weight (g)	Percentage
Useable as is	88.669	11.98	51.365	19.49
Useable after trimming	121.833	16.46	22.715	8.62
Large unusable flakes	238.382	32.21	0	0
1/4" Screen	204.54	27.64	147.28	55.89
2mm Sieve	51.13	6.91	21.044	7.99
Passed through 2mm sieve	34.097	4.61	16.312	6.19
Totals	738.651	99.81	258.716	98.18

Table 1: Experimental Production

pieces, collected in the ¼" screen, collected in the 2mm sieve, and passed through the 2mm sieve. The weight and percentages for all categories for both nodules is shown above (table 1).

It is interesting to note that even though this was a controlled experiment, and all material was collected on a tarp, a small percentage, .6% total for both nodules combined, was unaccounted for. Additionally, 11.5% of nodule 2 and 14.2% of nodule 3 were unrecoverable using only the standard ¼" screen as used in the field (table 2).

	Nodule 2		**Nodule 3**	
	Weight (g)	Percentage	Weight (g)	Percentage
Unrecoverable using 1/4" Screen only	85.227	11.5	37.356	14.2

Table 2: Unrecoverable Experimental Production

Use and Analysis of Experimental Gunflints

After experimentally producing gunflints similar to those excavated at Monhantic Fort and Aptucxet Trading Post, the next step was to use them to see how they functioned and the types of use wear produced. Were they capable of firing a flintlock? Were they reliable enough (did they produce sufficient sparks to fire the weapon every time they were used) for people who were at war, whose lives would depend on them? To determine this I designed an experiment, which would prove or disprove the usefulness and reliability of this type of gunflint.

For this experiment, I chose four gunflints at random from those previously experimentally produced, one gunflint from each of the four experimental production categories: useable as is nodule 2, useable after trimming nodule 2,

useable as is nodule 3, and usable after trimming nodule 3. The gunflints (see Figure 4) were 2-7T (useable as is nodule 2), 2-15T (useable after trimming nodule 2), 3-6T (useable as is nodule 3), and 3-7T (useable after trimming nodule 3). I tested each gunflint in the lock of a reproduction seventeenth century English Doglock Musketoon from Loyalist Arms in Harrietsfield, Nova Scotia, Canada.

The testing procedure was simple and straightforward. A piece of leather was used to help hold the flints in the doglock's vice. The lock was then cocked, the frizzen lowered over the pan, and then the trigger was pulled. Through careful observation and experience in using this type of weapon, I determined if the ensuing shower of sparks was sufficient to cause ignition. While somewhat subjective due to the lack of powder in the pan, there were identifiable clues as to the efficacy of the flint, which included the size of the shower of sparks and the residue left in the pan from the sparks. Additionally, Kenmotsu (1990:104-105) stated there are several morphological criteria of a gunflint that can greatly improve its functionality. These criteria include: a relatively even and uniform working edge, a relatively flat lower surface to help retain it in the vice, light serrations on the working edge such as those produced during retouch, and the size and shape of the gunflint particularly a bevel that is neither steep nor short. Finally, the experiment was designed to go to one hundred test firings if the flint was determined to be able to last that long by turning, flipping, and retouch.

Gunflint 2-7T worked very well. On the first useable edge, it had five out of ten shots that provided good sparks, two that were minimal and would probably

not have resulted in ignition, and three that produced no sparks at all. The first shot produced no sparks and caused the flint to shear when it hit the frizzen. This had the effect of straightening the edge, which then produced good sparks. Edge #1 was small and this probably led to its short lifespan.

I then rotated gunflint 2-7T 180 degrees end to end for the next working edge. This edge was slightly larger than the first and much thicker. On the first shot it blunted the working edge but produced excellent sparks. This continued until the seventh shot when the flint moved in the vise and produced no sparks. After readjusting the flint in the vise it provided effective, but minimal, sparks for the next four shots. The flint was then flipped 180 degrees top to bottom for working edge #3.

Working edge number 3 of gunflint 2-7T produced mostly excellent to good sparks for thirty-nine shots with only one adjustment. On its thirty-ninth shot, in addition to producing good sparks, the flint fell out of the vise. I declined to replace the flint back into the vise. Had this happened during battle a soldier would simply replace it with another flint. As an interesting note, upon removing the flint from the vise after working edge 1 was finished, I noted a deep V flake scar on the lower side of the working edge but did not quantify it. This flake scar was gone upon examining gunflint 2-7T after completing the experiment. In its place was a straight line of apparent use wear, which likely was caused by the rear of the flint, working edge #1, receiving forceful blows by the rear of the vise as working edges #2 and #3 struck the frizzen.

Gunflint 2-15T was the next gunflint used. The shape of this gunflint more closely resembled that of a spall gunflint than did gunflint 2-7T, which looked more like a chunk of rock than a gunflint. Gunflint 2-15T worked very well after an inauspicious beginning. The first three shots produced good sparks but the fourth did not. On the fifth and sixth shots the working edge shattered followed by two good shots and then one, which broke a large chunk off the working edge. The flint was rotated 90 degrees and worked well for twelve shots. The next shot was poor and likely would not have produced ignition. Retouching edge #1 with a quartz pebble found on the ground straightened out the working edge and reduced the length of the flint. This worked well for several more shots when I flipped the flint to edge #3. This edge worked well for 51 shots when it was flipped back to edge #2, which produced good sparks through shot 100 when the flint was removed. This flint would have continued producing excellent sparks particularly if flipping between edge #2 and edge #3 continued. The flipping seemed to straighten the edge and increase use life by making the flipped edge functional.

Gunflint 3-6T also looked similar to a gunspall. It produced good sparks for the first fifteen shots after which it was ineffectual. This gunflint showed slight usewear at the heel from contact with the back of the vise even though the leather padded it. It seemed that flints with similar dimensions as this one would work well as they would last approximately twenty shots and could then be discarded without flipping, rotating, or retouch.

Gunflint 3-7T was the final gunflint in the experiment. It was truly a chunk and has complete cortex coverage on the dorsal side. It was not in contact with the rear of the vise during testing. It produced useable sparks for 34 shots before it became necessary to remove it from the vise. Due to its shape and thickness, there was only one useable edge, as it would not fit into the vice in any other way. In addition, due to the cortex the gunflint only had one working edge available. This gunflint worked very well.

Gunflint 3-6T was the thinnest of the four, which seemed to be the reason it did not last long. Gunflint 3-7T was the thickest and had only one working edge. Its thickness was one reason for only one working edge; when it wore down its edge angle became too sharp. Gunflint 2-7T had three working edges, which increased its usefulness by flipping. Gunflint 2-15T also had three working edges but was thinner than 2-7T and 3-7T. Through flipping and retouch, 2-15T lasted the longest of the four experimental gunflints.

So, what does this experiment show? If nothing else, it proved that homemade, chip type gunflints are capable of firing a flintlock musket. Beyond that, how useful are they and how reliable? Additionally, was there anything unexpected in the function or wear of these gunflints?

This type of gunflint, the chip gunflint, would be very useable from the results of my experiment. Gunflint 2-7T lasted for fifty-three shots in my experiment before falling out of the vise and causing its removal from the experiment. Gunflint 2-15T lasted for one hundred shots. Both were still useable. Gunflint 3-7T lasted for thirty-four shots before I considered it used up. Gunflint 3-6T had

the shortest use-life, lasting fifteen shots before it no longer produced an appropriate spark shower for ignition.

Why are these numbers important? They are important because in 1846 the U.S. Army issued one flint for every twenty rounds (Chapel 1962:71). This allowed soldiers to not wasting time flipping, rotating, or retouching a flint in battle when replacing it is a faster and more likely safer, alternative. These chip gunflints would fit into this pattern of replacement well.

How reliable were they? As previously mentioned, three out of four gunflints in my experiment lasted over twenty shots. Gunflint 3-7T lasted thirty-four shots without rotating, flipping, or retouch. Gunflint 2-7T lasted fifty-three shots but was flipped and rotated. Gunflint 2-15T was flipped, rotated, and retouched and lasted the full one hundred shots of the experiment. Gunflint 3-6T, however, only lasted for fifteen shots. Only two of these gunflints, 3-6T and 3-7T, came close to or exceeded the twenty shot standard without some type of adjustment.

Two items of interest were noted during the experiment. The first was that when a gunflint was flipped 180 degrees top to bottom to take advantage of a second working edge it appeared as if the second edge was “straightened” and it functioned well. In addition, when reflipped back to the original working edge, the same occurred. This edge straightening also eliminated much of the visible use wear from that particular edge. The second item was use wear produced at the heel of the flint. Gunflint 3-6T, which had not been rotated end to end, had what appeared to be use wear on the heel. This was from contact with the screw at the back of the vise even though it was padded with leather. This wear could

easily be confused as a second working edge or worse, as the result of use as a strike-a-light as the wear was actually "U" shaped damage to the heel of the gunflint. Trubowitz (91-92) also noted this when using blade gunflints. Gunflint 3-6T was noticeably thinner and lighter than the other three gunflints in the experiment and I suggest that the damage occurred due to its thinness, as would likely be the cause for the blade gunflints.

Finally, using a gunflint is a reductive activity. After use, they are smaller and lighter than before use. Upon contacting the frizzen the removal of small pieces of the gunflint occurs, however, that is not the only part of the reduction. Sometimes larger pieces break off or the flint shears off due to invisible defects. In addition, retouching of the flints for edge rejuvenation reduces the size of the flint. The following chart shows the amount of reduction that occurred on the four experimental gunflints form use. By weight, this reduction ranged between 7.2% (2-15T) and 0.1% (3-7T), with the remaining gunflints expressing about 1.5% reduction.

	Before Use				**After Use**			
	Length (mm)	Width (mm)	Thickness (mm)	Weight (g)	Length (mm)	Width (mm)	Thickness (mm)	Weight (g)
2-7T	22.83	30.73	13.34	8.79	22.66	30.11	13.34	8.662
2-15T	38.41	32.76	11.47	16.559	30.31	32.26	11.45	15.369
3-6T	25.42	29.82	7.27	5.993	25.29	29.82	7.26	5.91
3-7T	25.05	29.99	14.58	16.379	25.02	29.99	14.58	16.366

Table 3: Experimental Gunflints

Chapter 4

Gunflints and Other Tools Present

Gunflints

Figure 2: photo by Scott Williams.

Four Native produced gunflints from Monhantic Fort.

Upper left: MPMRC catalog #14514 – 17.64mm x 22.71mm x 11.47mm, 4.7 grams.

Upper right: MPMRC catalog # 9749 – 16.36mm x 17.93mm x 6.99mm, 2.1 grams.

Lower left: MPMRC catalog # 5733B – 21.56mm x 24.82mm x 9.12mm, 5.6 grams.

Lower right: MPMRC catalog # 6727 – 18.16mm x 22.1mm x 6.54mm, 2.756 grams.

The following table contains data on all the gunflints from Monhantic Fort. Determination of the artifact's use as a gunflint was based on use wear.

Cat #	Type	Variety	Weight	Length	Width	Thickness	Thermal	Cortex	Reuse	Edge Angle	Color
9749	European flint	Native gunflint	2.1	16.36	17.93	6.89	None	no	None	55	Mottled Grey
11165	European flint	Native gunflint	0.95	12.89	12.45	5.36	calcined	no	None	N/A	White
9700	European flint	spall gunflint	3.4	18.38	22.69	7.71	None	no	None	54, 60, 53	Tan/Brown
10946	European flint	Native gunflint	0.338	9.52	8.95	3.84	None	no	scraper	Heel	Dark Grey
7494	European flint	Native gunflint	3.585	21.86	18.02	9.20	None	yes	None	62	Mottled Grey
11402	European flint	Native gunflint	2	19.21	19.15	5.04	None	yes	None	43	Brown
18976	European flint	spall gunflint	2.973	18.12	21.53	7.20	calcined	yes?	None	54	Burned/Grey
7394	European flint	spall gunflint	1.943	14.88	14.60	5.60	None	no	None	58, 49	Brown
7706	European flint	Native gunflint	1.672	12.71	17.75	5.68	None	yes	None	44, 50	Tan
19292	European flint	Native gunflint	1.039	12.28	18.95	4.48	calcined	no	None	58	White
7409	European flint	spall gunflint	1.458	20.35	14.85	4.66	calcined	yes	None	N/A	White
19444	European flint	Native gunflint	3.1	19.45	19.81	8.51	calcined	yes	strike a light	56, 56, 58	White
7157	European flint	Native gunflint	2.90	16.47	20.71	10.17	calcined	no	None	N/A	White
15915	European flint	spall gunflint	2.32				None	no	None	N/A	N/A
12885	European flint	spall gunflint	3.7	17.24	23.67	8.20	burned	no	strike a light	55	Grey
4176	European flint	Native gunflint	2.74	23.59	17.26	6.91	calcined	no	None	56, 53, 41, 48	White
12205	European flint	Native gunflint	1.171	12.92	11.01	7.46	None	no	None	N/A	N/A
13109	European flint	spall gunflint	2.9	19.68	19.52	6.28	None	no	None	50	Grey
4508	European flint	Native gunflint	0.80	16.52	12.01	2.98	None	no	None	56	Grey
11069	European flint	spall gunflint	0.35	12.54	7.95	3.63	None	no	None	Heel	Brown
4150	European flint	spall gunflint	1.081	18.92	12.16	5.21	burned	no	strike a light	50	Burned
14370	European flint	Native gunflint	4.3	21.27	24.06	9.78	None	no	None	46	Mottled Grey
8783	European flint	Native gunflint	1.946	19.64	17.81	6.79	calcined	no	None	41	White
11136	European flint	Native gunflint	0.15	5.03	14.12	4.28	None	no	None	Heel	Tan
9353	European flint	Native gunflint	1.226	13.42	15.55	6.22	None	yes	None	Heel	Grey
13294	European flint	Native gunflint	1.74	20.24	20.36	7.41	None	no	None	N/A	Tan

14514	European flint	Native gunflint	4.7	17.64	22.71	11.47	burned	no	None	53	Burned
16096	European flint	Native gunflint	0.628	14.21	11.68	3.08	None	no	None	N/A	N/A
6727	European flint	Native gunflint	2.756	18.16	22.10	6.54	None	yes	None	64	Brown/Tan/Red
16226	European flint	Native gunflint	0.8	14.51	10.57	5.37	burned	no	None	48,45	Grey
7316	European flint	Native gunflint	4.463	18.38	27.73	7.80	None	no	strike a light	44	Light Grey/Tan
21018	European flint	Native gunflint	1.40	18.60	14.13	5.80	None	no	None	52, 50	Dark Grey
8769	European flint	Native gunflint	2.40	18.34	15.37	7.85	None	no	None	56	Tan/Yellow
2933	European flint	spall gunflint	4.194	23.31	23.94	6.59	calcined	no	None	40	White
6618	European flint	spall gunflint					None	no	None	N/A	N/A
5606	European flint	Native gunflint	1.51	13.49	20.30	5.39	None	no	None	41, 50	Dark Grey
5733B	European flint	Native gunflint	5.60	21.56	24.82	9.12	None	no	None	50, 49	Dark Grey
5733B	European flint	Native gunflint	0.80	8.25	18.16	6.01	None	no	None	46	Dark Grey
7859	European flint	Native gunflint	3.10	20.88	15.21	7.90	None	no	None	45, 48, 52, 56	Black/Tan
5700	European flint	spall gunflint	3.436				None	no	None	N/A	N/A
7376	European flint	spall gunflint	4.83				None	no	None	N/A	N/A
6359A	European flint	Native gunflint	1.903	14.80	20.92	6.36	burned	no	None	48	Burned
6365	European flint	Native gunflint	2.714	23.58	22.15	6.05	calcined	no	None	N/A	N/A
5821	European flint	Native gunflint	4.44	22.82	18.20	10.48	None	no	None	N/A	N/A
5806	European flint	Native gunflint	3.52	18.48	25.10	8.18	None	no	strike a light	52	Burned
4652	European flint	spall gunflint	0.979	13.55	18.98	4.11	burned	yes	None	Heel	Tan/Burned
4291	European flint	spall gunflint	1.012	12.12	17.24	3.79	None	no	None	Heel	Tan
6109	European flint	Native gunflint	1.90	16.33	15.80	7.65	calcined	yes	None	N/A	N/A
5297	European flint	Native gunflint	1.221	10.56	19.38	5.91	None	no	None	N/A	Dark Grey
312	European flint	spall gunflint	1.151	17.40	13.07	4.67	None		None	47	Burned
948	European flint	Native gunflint	1.869	24.86	13.28	5.66	None	yes	None	43, 46	Grey
7840	European flint	Native gunflint	1.118	14.22	10.98	7.39	burned	yes	None	52	Grey/Burned
22554	European flint	Native gunflint	3.40	14.24	26.78	8.07	None	yes	None	56	Dark Grey/ Amber

7858	European flint	Native gunflint	1.876	19.48	17.55	6.48	None	yes	None	58, 60	Dark Grey Mottled
9050	European flint	Native gunflint	3.50	22.37	16.50	9.13	calcined	no	None	63	White

Table 4: Monhantic Fort Gunflints

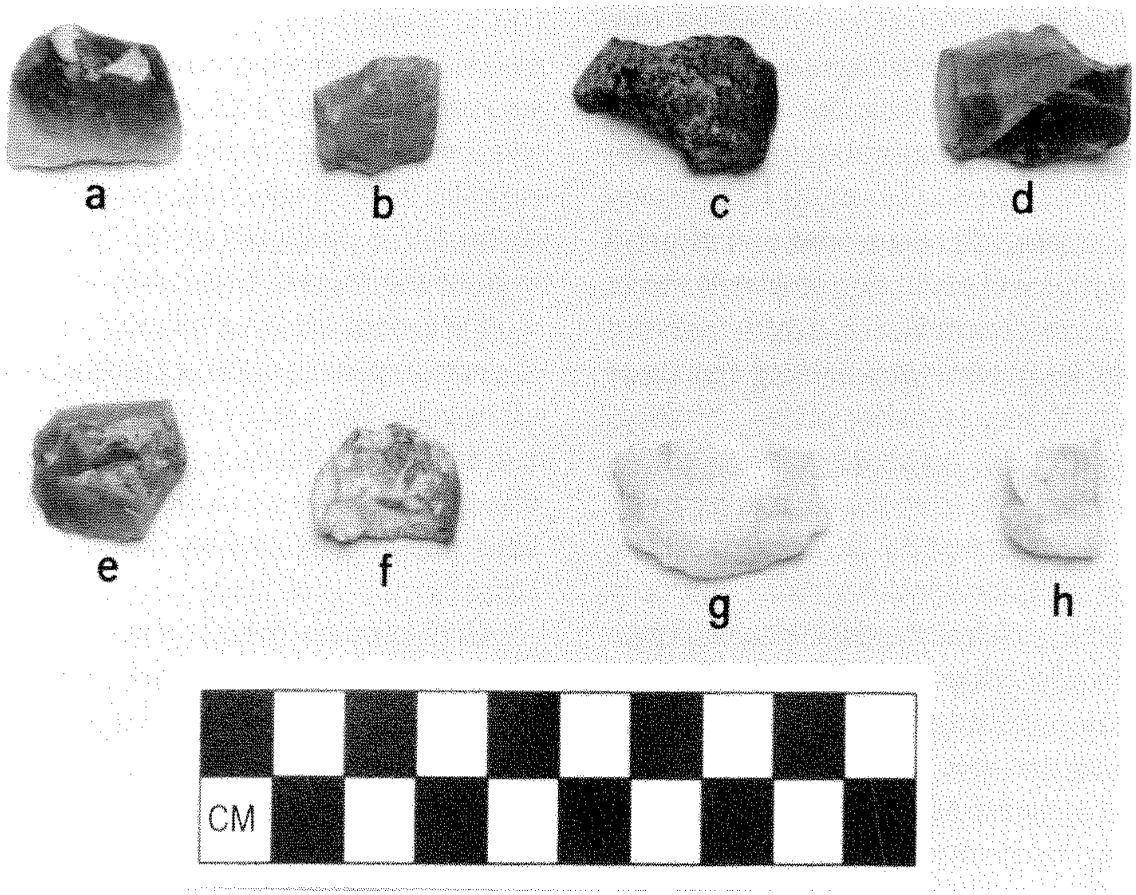

Figure 3: Chip type gunflints from Aptucxet, Massachusetts: a, EU 15/60-65 SW; b, TH 5/10-20; c, EU 4/30-30 NW; d, EU 5/60-65 SW; e, EU 10/20-25 NW; f, EU 15/20-30; g, EU 9/40-50; h, EU 11/55-60F (all dorsal) (Luedtke, 1998).

The following table contains data on all the gunflints from Aptucxet Trading Post.

Cat #	Type	Variety	Weight	Length	Width	Thickness	Thermal	Cortex	Reuse	Edge angle	Color
EU13	European Flint	Chip	4.692	22.38	18.8	9.5	N	Y	N	30	Black
EU 15	European Flint	Gunspall	2.537	16.3	24.48	5.7	N	Y	N	40	Grey

EU 4	European Flint	Chip	4.599	28.93	15.97	8.93	N	Y	N	30	Black
EU5	European Flint	Chip	3.707	27.1	16.37	7.41	N	N	N	30,30	Brown/Grey
EU 10	European Flint	Chip	3.769	21.81	15.71	9.64	N	N	N	35	Light Grey
EU 15	European Flint	Chip	1.839	20.89	14.08	7.2	Calcined	Y	N	N/A	White
EU11	QUARTZ	Chip	3.409	29.09	16.95	5.34	N	N	N	33	White
EU 11	QUARTZ	Gunflint Fragment	2.316	13.81	14.23	10.53	N	N	N	40	White
T2 STP7	European Flint	Gunflint Fragment	0.569	14.85	7.92	6.4	N	N	N	30	Black/Grey
TH STP5	European Flint	Gunspall Fragment	2.238	18.27	13.72	6.62	N	N	N	34	Blonde
TG STP6	European Flint	Gunflint Fragment	1.197	14.48	14.83	6.4	N	N	SAL	42	Blonde

Table 5: Aptucxet Trading Post Gunflints

Figure 4: Replicated gunflints: upper left 2-7; upper right 3-7; lower left 2-15; lower right 3-6 (all used).

Photo by Scott Williams

The following table contains data on all the replicated gunflints.

Nodule	Number	Flake Type	Cortex	Weight	Length	Width	Thickness	Edge Angle
2	1T	Gunflint	N	15.981	34.39	36.66	11.5	66
2	2T	Gunflint	Y	8.676	25.01	30.77	14.27	53
2	3T	Gunflint	N	8.472	20.66	28.53	13.87	83
2	4T	Gunflint	Y	8.091	24.82	26.74	14.09	70
2	5T	Gunflint	Y	12.477	27.71	35.83	13.42	56 +53
2	6T	Gunflint	Y	10.851	27.07	40.02	11.58	66
2	6AT	Complete	N	0.57	22.87	15.18	2.2	Detached flake
2	7T	Gunflint	Y	8.79	22.83	30.73	13.34	67
2	8T	Gunflint	N	4.698	27.92	27.16	7.06	63
2	9T	Gunflint	Y	10.057	31.45	32.13	10.37	57 +70
2	10T	Gunflint	Y	17.844	33.22	28.34	16.13	66
2	11T	Gunflint	Y	13.813	37.75	30.65	13.52	57
2	12T	Gunflint	Y	15.592	29.49	29.7	17.06	62
2	13T	Gunflint	N	14.232	29.82	32.62	12.12	77
2	14T	Gunflint	Y	9.709	21.73	31.22	13.18	66
2	15T	Gunflint	Y	16.559	38.41	32.76	11.47	60
2	16T	Gunflint	Y	6.643	20	30.39	10.55	62
2	17T	Gunflint	N	13.508	28.66	27.84	13.71	63
2	18T	Gunflint	Y	6.832	22.04	28.19	11.17	65
2	19T	Gunflint	Y	7.068	21.73	30.25	8.81	65
3	1T	Gunflint	N	9.12	22.59	27.41	15.69	61
3	2T	Gunflint	Y	8.8	27.24	28.98	11.64	60
3	3T	Gunflint	Y	15.609	29.75	29.54	17.42	63 + 68
3	4T	Gunflint	Y	5.562	25.47	30.25	8.88	57
3	5T	Gunflint	Y	6.251	22.96	28.56	11.94	68
3	6T	Gunflint	Y	5.993	25.42	29.82	7.27	70
3	7T	Gunflint	Y	16.379	25.05	29.99	14.58	73
3	8T	Gunflint	Y	6.332	22.32	28.63	11.87	60

Table 6: Replicated Gunflints

The following table contains data on all the Monhantic Fort strike –a –lights and utilized flakes. Determinations of use of an artifact as a strike-a-light or utilized flake was based on use wear.

Cat#	Type	Variety	Weight	Length	Width	Thickness	Thermal	Cortex	Reuse	Edge Angle	Color
10741	European flint	strike a light	1.934	24.32	14.37	5.72	No	yes	None	N/A	N/A
9965	European flint	strike a light	0.578	14.17	10.75	2.91	No	no	None	N/A	N/A
10683	European flint	strike a light	1.179	22.96	15.16	4.58	No	yes	None	N/A	N/A

7703	European flint	strike a light	0.798	16.86	10.16	5.08	No	yes	None	N/A	N/A
18837	European flint	strike a light	0.245	8.93	10.65	2.38	No	no	None	N/A	N/A
15570	European flint	strike a light	1.472	16.36	15.79	5.65	No	no	None	N/A	N/A
9460	European flint	strike a light	1.335	19.75	17.72	4.37	No	yes	None	N/A	N/A
12519	European flint	strike a light	2.7	12.91	18.20	11.67	No	yes	None	N/A	N/A
21001	European flint	strike a light	0.95	12.67	14.56	4.20	burned	yes	None	N/A	N/A
1377	European flint	strike a light	0.479	12.75	11.04	6.01	No	no	None	N/A	N/A
5978	European flint	strike a light	3.89	23.63	21.60	11.03	No	yes	None	N/A	N/A
506	European flint	strike a light	0.716	13.54	14.33	4.93	No	yes	None	N/A	N/A
965	European flint	strike a light	0.868	15.37	9.53	5.18	calcined	no	None	N/A	N/A
1046	European flint	strike a light	4.107	28.14	11.61	13.20	burned	yes	None	N/A	N/A
10848	European flint	utilized flake	0.204	9.81	6.29	3.91		no	None	N/A	N/A
7497A	European flint	utilized flake	0.70	15.17	13.12	3.37		yes	None	N/A	N/A
7814	European flint	utilized flake	0.55	14.77	8.85	4.79		yes	None	N/A	N/A
10874	European flint	utilized flake	1.405	15.33	16.00	5.70		no	None	N/A	N/A
19239	European flint	utilized flake	0.779	11.75	7.95	7.02		yes?	None	N/A	N/A
18180	European flint	utilized flake	1.00	12.35	13.19	5.08		no	None	N/A	N/A
7384	European flint	utilized flake	1.229	20.27	14.77	3.91	calcined	no	None	N/A	N/A
7698	European flint	utilized flake	0.474	11.33	10.99	4.62		no	None	N/A	N/A
18775	European flint	utilized flake	0.806	9.72	13.56	6.19		no	None	N/A	N/A
19194	European flint	utilized flake	0.15	8.26	7.12	1.61		no	None	N/A	N/A
19210	European flint	utilized flake	0.593	15.93	15.31	3.45	calcined	yes	None	N/A	N/A
19177	European flint	utilized flake	1.375	18.30	15.91	6.15		no	None	N/A	N/A
7432A	European flint	utilized flake	1.266	14.83	16.57	5.87		yes	None	N/A	N/A
9224	European flint	utilized flake	0.356	16.69	8.20	3.45	calcined	yes	None	N/A	N/A
17594	European flint	utilized flake	0.039	4.14	7.47	1.36		no	None	N/A	N/A
16433	European flint	utilized flake	0.33	14.05	7.44	3.93		yes	None	N/A	N/A

21943	European flint	utilized flake	0.65	14.56	10.12	4.05		yes	None	N/A	N/A
1662	European flint	utilized flake	0.909	14.52	14.42	5.82	calcined	no	None	N/A	N/A
1788	European flint	utilized flake	2.333	18.00	11.83	10.05	calcined	no	None	N/A	N/A
2374	European flint	utilized flake	0.665	12.84	10.06	5.30	calcined	no	None	N/A	N/A
7149	European flint	utilized flake	1.851	25.06	20.90	4.90		yes	None	N/A	N/A
6109	European flint	utilized flake	1.59	25.46	15.25	4.90		no	None	N/A	N/A
1024	European flint	utilized flake	0.675	12.83	12.03	3.70		yes	None	N/A	N/A

Table 7: Monhantic Fort Strike-a-lights and Utilized Flakes

The following table contains data on all the Aptucxet Trading Post strike-a-lights.

Cat #	Type	Variety	Weight	Length	Width	Thickness	Thermal	Cortex	Reuse	Edge angle	Color
TH STP6	Quartz	Strike-a-Light	2.657	22.73	16.9	6.34	None	No	None	42	White
EU 4	Quartz	Strike-a-Light	4.33	25.31	18.18	6.67	None	No	None	32,37,40	White
EU12	Quartz	Strike-a-Light	4	28.88	18.47	5.76	None	No	None	30	White
EU10	European Flint	Strike-a-Light	1.594	17.38	14.42	7.41	None	No	None	35	Brown
EU 11	European Flint	Strike-a-Light	1.829	18.47	18.02	5.56	None	Yes	None	28	Black
EU10	European Flint	Strike-a-Light	2.349	23.21	14.06	9.13	BURNED	No	None	N/A	Grey/Brown

Table 8: Aptucxet Trading Post Strike-a-lights

Chapter 5

Usewear

Usewear Patterns

Positive identification of gunflints from archaeological contexts can be problematic, as previously mentioned. In her paper, Kenmotsu (1990) developed a five-point expected usewear pattern for gunflints based on a literature review of lithic usewear patterns. As stated before, this expected usewear pattern included: crushing and/or heavy step flaking of the working edge, uniform patterns of wear on the working edge, step flaking of the upper surface of the working edge and smoothing or polish on the lower surface, blunting of the working edge, and rejuvenation of the gunflint by turning, rotating, or retouch (Kenmotsu 1990). What she discovered was somewhat different. Her research revealed a usewear pattern which consisted of unifacial step flaking, smoothing of the working edges, flat flaking, rejuvenation, some blunting and crushing, and metal and leather residue (Kenmotsu 1990).

To help in future identification of gunflints from archaeological contexts I will compare Kenmotsu's usewear pattern to what I found from the Monhantic Fort, Aptucxet Trading Post, and my replicated gunflints. The Aptucxet Trading Post Museum Site was excavated in 1995 (Luedtke 1998). It is suggested that the site is the location of the former trading post, which was established in 1627 by the Pilgrims to facilitate trade with the Natives and the Dutch (Luedtke 1998). It was destroyed by a storm in 1635, rebuilt, but abandoned by the 1650's (Luedtke

1998). The excavation concentrated on a house foundation traditionally designated as the location of the trading post, the yard to the south of the foundation, and trash dumps to the west (Luedtke 1998).

For clarity, I will define the terms used. Step flaking and crushing as used here, is the small, hinge terminated irregular step flaking along an edge (Ahler 1979), which through repetition attains a crushed appearance. Step flakes are generally wider than they are long. Smoothing and polishing are similar types of abrasive wear with smoothing causing a more rounded appearance and polish being a more intense form of smoothing that reflects light (Ahler 1979). Blunting is defined as unpatterned fracturing or pulverization of a tool surface (Ahler 1979). Flat flaking is the removal of wide, flat flakes with feathered of hinged terminations (Kenmatsu 1990).

Monhantic Fort Gunflints

The usewear pattern of the gunflints from Monhantic Fort verifies what Kenmotsu (1990) found in her study. The majority of the gunflints showed unifacial step flaking with flat flaking on the lower surfaces of the working edges (caused by contact with the frisson).

	Step Flaking	Smoothing	Flat Flaking	Rejuvenation	Blunting	Residue	Crushing
Monhantic	36	19	34	14	15	0	6

Table 9: Monhantic Gunflint Usewear

Smoothing of the working edge occurred on 35% of the artifacts while blunting occurred on 27%. Twenty-five percent of the artifacts showed rejuvenation through turning or rotating. Crushing was evident on only 10% of the artifacts. There was no residue on any of the Monhantic Fort gunflints. However, it should be noted that lithic artifacts are washed in the lab at the Mashantucket Pequot Museum and Research Center before analysis so any residues they might have contained would likely be washed away.

Aptucxet Trading Post Gunflints

For the Aptucxet Trading Post gunflints unifacial step flaking and flat flaking of the lower surfaces of the working edge dominated the usewear pattern. Almost half of the specimens exhibited some crushing while smoothing and blunting

	Step Flaking	Smoothing	Flat Flaking	Rejuvenation	Blunting	Residue	Crushing
Aptucxet	9	3	10	1	3	0	5

Table 10: Aptucxet Gunflint Usewear

occurred on approximately one-third. Only one gunflint showed evidence of rejuvenation. This pattern is very similar to that observed by Kenmatsu (1990).

Replicated Gunflints

For the replicated gunflints, the usewear pattern also verifies Kenmotsu's (1990) results. All four specimens exhibited unifacial step flaking and flat flaking on the lower surfaces of the working edges. Three specimens also showed

smoothing of the working edges. Crushing occurred on half the gunflints. Rejuvenation in the form of turning or rotating also occurred on half of the artifacts. It should be noted that one edge of one of the replicated gunflints was retouched but showed no evidence of that upon final examination. Finally, three gunflints showed traces of metallic residue.

	Step Flaking	Smoothing	Flat Flaking	Rejuvenation	Blunting	Residue	Crushing
Replicated	4	3	4	2	0	3	2

Table 11: Replicated Gunflint Usewear

Discussion

The usewear patterns from Monhantic Fort, the Aptucxet Trading Post, and the replicated gunflints all verify what Kenmatsu (1990) discovered. Gunflints do exhibit an overall use wear pattern, which can aid in identifying gunflints from archaeological contexts. This pattern consists of unifacial step flaking in conjunction with flat flaking of the lower surface of the working edge and smoothing of the working edge. In addition, rejuvenation is common. Blunting and crushing may also occur but are much less common. Finally, residue from metal and leather may be left on gunflint surfaces if they have not been washed.

This usewear pattern gives archaeologists the ability to look at an artifact that might be hard to identify, due to morphological similarities to other types of artifacts, and apply a use wear pattern to what they are seeing. This should make identifying whether an artifact is a gunflint, a scraper, or a strike-a-light easier, particularly if the site has both prehistoric and historic components. In general, use wear for strike-a-lights show a concave striking area, bifacial, and

invasive flaking while scrapers generally contain striations, patterned micro and macro fractures, and polish.

Chapter 6

Analysis of Lithic Assemblages

Monhantic Fort Assemblage

The assemblage of European lithic material from Monhantic Fort consists of 957 artifacts (Fig. 5): 91 are classified as tools and 866 as debitage. The tools are divided into three types: gunflints, which are subdivided into Native and European produced (based on morphology), strike-a-lights, and utilized flakes. The debitage is divided into ten classes: angular shatter, bipolar, complete flakes, proximal fragments, medial fragments, distal fragments, split flakes, blades, core fragments, and unmodified cobbles. Attributes noted for all artifacts include the presence or absence of cortex, thermal alteration, weight, length, and thickness. In addition, termination type and platform type have been noted where appropriate.

To ensure mutual understanding of the meanings of the classifications used for both the tools and debitage, their definitions as used in this analysis are provided. According to Luedtke (1999:29) a gunflint is, “A fragment of highly siliceous (and thus very hard) stone, usually oval or square and with a wedge shaped or trapezoidal cross section…” Kenmatsu identified them as, “a small sub-rectangular, wedge-shaped artifact manufactured from flint or chert…” (1990:93). While these are the basic definitions, a little more precision is needed. Luedtke (1999) noted five types of gunflints: chip, bifacial, spall, French blade, and English blade. Of these, only two types appear in the Monhantic Fort

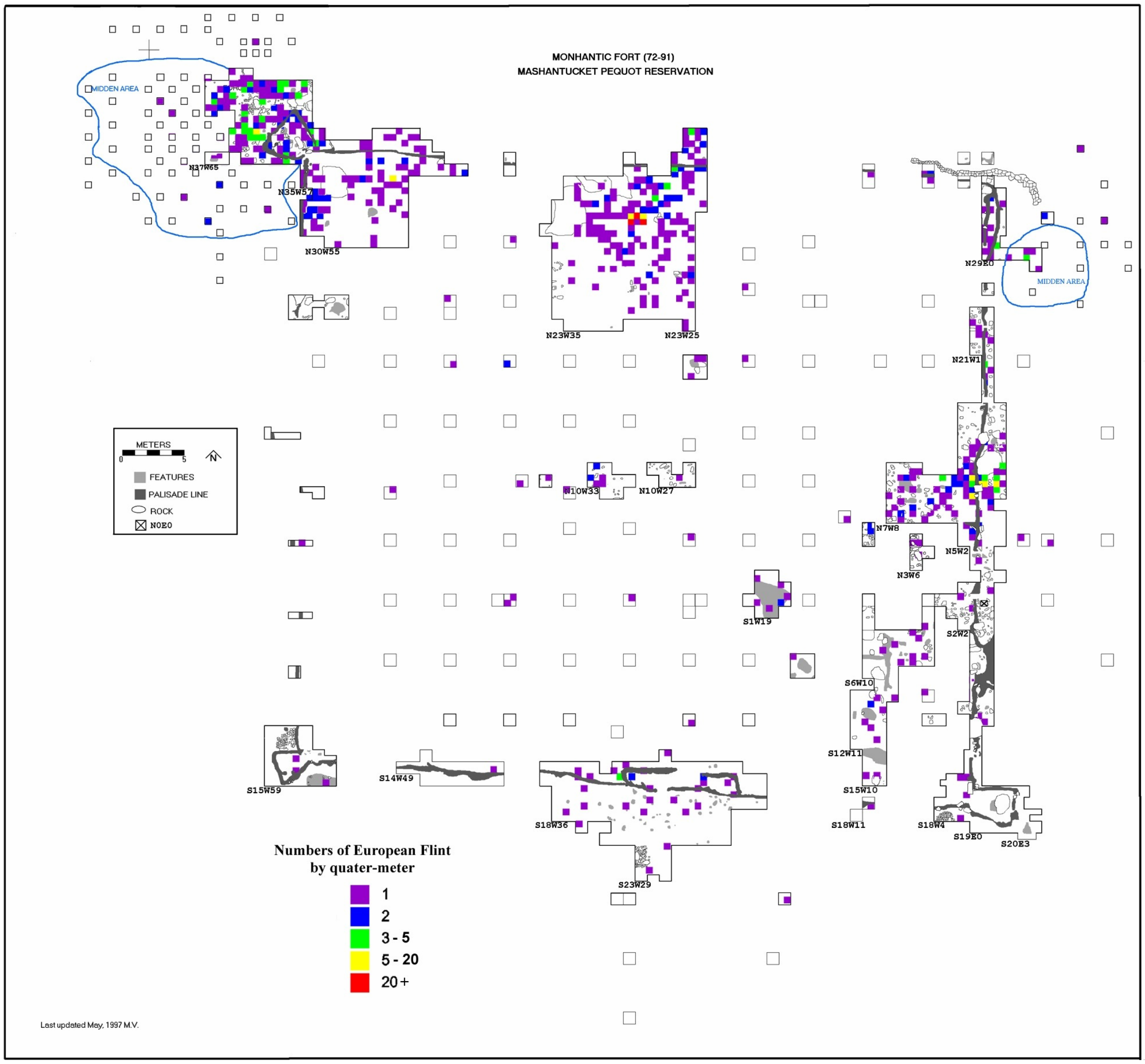

Figure 5: Monhantic Fort European Lithic distribution (Courtesy MPMRC)

assemblage, the chip and the spall, which have previously been described in detail. Strike-a-lights similarly have been previously described, as has the final tool type in this assemblage, the utilized flake. In order to determine if an artifact was used as a gunflint or strike-a-light, the use wear visible under low powered magnification was analyzed.

The definitions for the debitage are standard and generally follow Andrefsky (2004). Complete flakes contain a striking platform, bulb of percussion, end in a

feather, hinge, or plunging termination, and lateral margins are intact. Lateral breaks can be present if they do not interfere with accurate width measurements. Proximal fragments contain a striking platform and bulb of percussion, but end with a step termination. Medial fragments are all broken specimens with no proximal end and a stepped distal end. Distal fragments contain no striking platform and have an intact distal end with either a feather, hinged, or plunging termination. Bipolar flakes are generally elongated and contain bulbs of percussion or points of applied force at both ends, and may have intersecting ripple marks from both proximal and distal ends. Angular shatter is defined as non-orientable flakes or fragments, frequently blocky, which contain no discernable single ventral surface. Blades are at least twice as long as they are wide and have roughly parallel margins. Split flakes are broken longitudinally, retain a portion of platform or point of applied force, and have an identifiable termination. Cores contain negative flake scars and may or may not have negative bulbs of percussion and cortex; they are the pieces from which flakes and other debitage are removed. In this paper, they are referred to as core fragments as they tend to be small due to the size of the raw material. An unmodified cobble is a piece of raw material that has not been worked or modified.

Methods of Analysis

Monhantic Fort contains an interior area of over 30,000 square feet (McBride 1993). With a European flint assemblage of 957 pieces, scattered both inside

and outside the fort walls, the first step was to identify concentrations of artifacts. Three areas of European flint concentrations were identified for analysis (Fig. 6). The next step was determining what process to use to analyze the debitage; Sullivan and Rozen's (1985) debitage analysis approach was chosen for the analysis.

Sullivan and Rozen's approach simplifies the handling of debitage for analysis in two ways. First, it eliminates non-tool and tool debitage categories; determination of primary, secondary, and tertiary are eliminated. Second, through a hierarchical key all debitage is sorted into four categories: complete flake, broken flake, flake fragment, and debris (Sullivan and Rozen 1985). Their key is based on three technological attributes: the presence or absence of a single interior surface, the presence or absence of a point of applied force, and intact or not intact margins (Sullivan and Rozen 1985). By applying this method to lithic collections from two separate projects they found that generally debitage resulting from core reduction contains high percentages of complete flakes and debris while those resulting from tool manufacture have high percentages of proximal and distal flake fragments (Sullivan and Rozen 1985). Using this typology, they were able to discriminate between areas of core reduction and tool manufacture. The Sullivan and Rozen Typology (SRT) was chosen because of its simplicity and ease; all debitage is sorted into four mutually exclusive groups.

However, it is not without its problems. Prentiss (1998) looked at the reliability and validity of the SRT. Through a series of experimental debitage assemblages in obsidian, he determined that the SRT was reliable; the data generated through

it were consistent. It was not valid, however, as the variability between assemblages was so great that distinctive assemblages could not be identified. Kuijt et al. (1995) used a modified version of the SRT to assess bipolar reduction. They compared an experimental assemblage with an archaeological one with relative success but cautioned that the utility of the SRT should still be viewed with skepticism. Morrow (1997) suggested that the SRT was not useful due to the inconsistency of results and since flake breakage could occur due to post-depositional sources, such as trampling. He does indicate that shatter (debris) is an exception and appears to be almost exclusively from heavy percussion flaking during early primary reduction. Amick and Mauldin (1997) stated that reduction type does not seem to reflect flake breakage type frequencies and thus the SRT alone is not a useful means of analysis. They do state that raw material, skill of the knapper, and skill of the analyst introduce bias into the variation in flake breakage categories. Finally, Bradbury and Carr (1995) conducted a series of eleven lithic reduction experiments using Fort Payne chert and determined that the SRT was not suited for use as an interpretive tool. They suggested that it was useful for determining initial descriptive groups that could be used to choose technological attributes for specific problems. Additionally, they suggest using multiple methods for debitage analysis.

The next method of analysis used was the calculation of the Minimum Number of Flakes (MNF). The MNF is calculated by adding together all complete flakes, proximal fragments, and half of the split flakes, as it is a measure based on the fact that all flakes originally had platforms (Holdaway and Stern 2004).

The MNF represents the smallest number of complete flakes in an assemblage while taking breakage into account. Flake breakage was next analyzed by comparing the proportion of medial fragments to proximal and distal fragments.

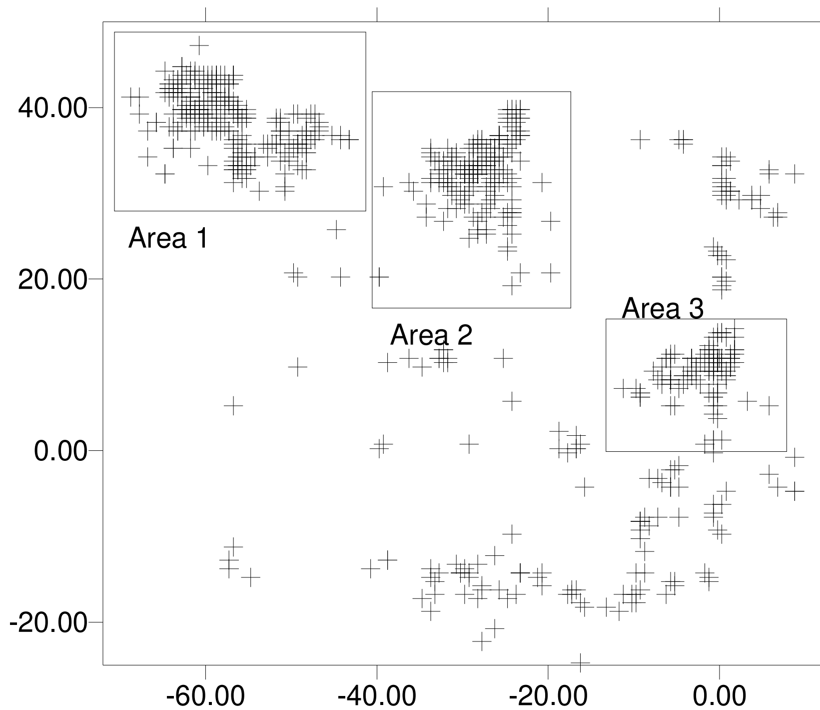

Figure 6: Areas of European flint concentration

A higher proportion of medial fragments relative to proximal and distal fragments indicate a greater degree of breakage (Holdaway and Stern 2004). Flake fragmentation was used to check the accuracy of complete flake identification. Since flake fragmentation can produce only one proximal fragment for every distal fragment, their ratio should approximate 1:1; significant deviation from this ratio is a possible indicator of misidentification of complete flakes as proximal fragments (Holdaway and Stern 2004). Finally, the ratio of MNF to tools was used to infer selectivity in the choice of flakes used for tools.

This analysis will start by looking at the complete debitage assemblage. It will then proceed to the debitage of individual areas of concentration followed by the distribution of tools. The analysis will finish with the technological analysis of the previous data.

Monhantic Fort Debitage Assemblage

Complete Debitage Assemblage

The complete European lithic assemblage from Monhantic Fort (Fig. 5) contains 812 pieces of debitage, not including core fragments or unmodified cobbles, which have been sorted into the following categories by count and percentage:

Category	Count	Percentage
Complete Flakes	100	12.3
Proximal Fragments	167	20.6
Medial Fragments	94	11.6
Distal Fragments	39	4.8
Bipolar Flakes	37	4.6
Angular Shatter	341	42
Blades	2	0.2
Split Flakes	32	3.9
Total	812	100

Table 12: Monhantic Fort Debitage Sorted into Standard Categories

These categories are readily transferable to the four SRT categories: complete flakes, broken flakes, flake fragments, and debris. The complete flake category includes complete flakes, bipolar flakes, blades, and one-half of the split flakes. The broken flake category includes all the proximal fragments. Flake fragments

include both medial and distal fragments. Finally, debris includes angular shatter. After sorting into SRT categories the count and percentage of each are:

Category	Count	Percentage
Complete Flakes	155	19.5
Broken Flakes	167	21
Flake Fragments	133	16.7
Debris	341	42.8
Total	796	100

Table 13: Monhantic Fort Debitage Sorted into SRT Categories

The Monhantic Fort assemblage is highly dominated by debris; however, flake fragments are the least common with complete flakes and broken flakes intermediary to the other two. All flakes were included in this analysis including microdebitage.

The MNF for the complete assemblage was computed next. In addition to complete flakes and proximal fragments, bipolar flakes, blades, and one-half of the split flakes were included in the count. The MNF is 322 and represents the minimum number of complete flakes available for use as tools (assuming flakes were the desired product). The degree of estimated flake breakage is somewhat low for the assemblage as a whole as indicated by a ~ .46:1 ratio of medial fragments to proximal and distal fragments. Flake fragmentation is high as shown by the 4.3:1 ratio of proximal to distal fragments. The MNF to tools ratio is 3.5:1.

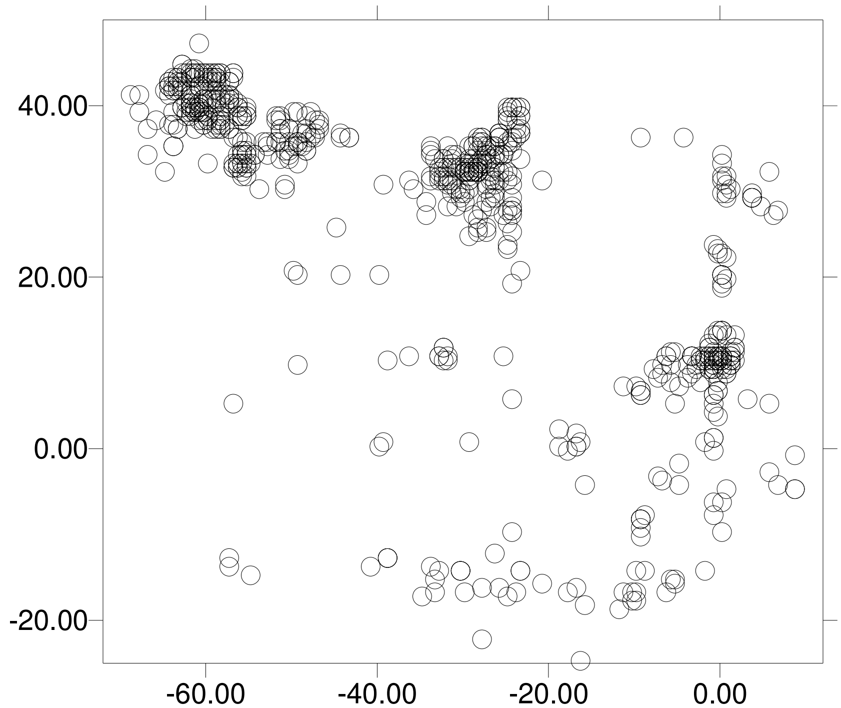

Figure 7: European lithic debitage

Area 1 Debitage

Area 1 encompasses the area both inside and out of the northwest bastion, which includes the forge. It has the second largest concentration of European flint in the fort. There are 265 pieces of debitage which have been sorted into the following categories by count and percentage:

Category	**Count**	**Percentage**
Complete Flakes	38	14.3
Proximal Fragments	47	17.7
Medial Fragments	28	10.6
Distal Fragments	10	3.8
Bipolar Flakes	16	6
Angular Shatter	111	41.9
Blades	2	0.8
Split Flakes	13	4.9
Total	265	100

Table 14: Area 1 Debitage Sorted into Standard Categories

Sorted into SRT categories the count and percentage are:

Category	Count	Percentage
Complete Flakes	60	23.4
Broken Flakes	47	18.4
Flake Fragments	38	14.8
Debris	111	43.4
Total	256	100

Table 15: Area 1 Debitage Sorted Into SRT Categories

Debris also dominated the assemblage from Area 1 and the complete flake category, while considerably smaller, is the next most common class. Flake fragments are the smallest group in Area 1. The MNF for Area 1 is 109. The degree of estimated flake breakage for Area 1 is also low at a ratio of ~ .5:1. The flake fragmentation ratio for Area 1 is slightly higher than for the complete assemblage at 4.7:1. The MNF to tools ratio is 3.6:1

Area 2 Debitage

Area 2 is east of Area 1 and includes a wigwam site and associated midden; it has the highest concentration of European flint in the fort. Its 308 pieces of debitage are sorted into flake type categories by count and percentage (Table 16) and SRT categories by count and percentage (Table 17).

Debris and broken flakes dominate Area 2 debitage, while complete flakes are the smallest category. The MNF for this area is 114. The degree of estimated flake breakage for Area 2 is somewhat lower with a ratio of ~ .45:1. Flake fragmentation for this area is high at 6:1. The MNF to tools ratio is 8.1:1.

Category	Count	Percentage
Complete Flakes	25	8.1
Proximal Fragments	84	27.3
Medial Fragments	44	14.3
Distal Fragments	14	4.5
Bipolar Flakes	9	2.9
Angular Shatter	122	39.6
Blades	0	0
Split Flakes	10	3.3
Total	308	100

Table 16: Area 2 Debitage Sorted Into Standard Categories

Category	Count	Percentage
Complete Flakes	39	12.9
Broken Flakes	84	27.7
Flake Fragments	58	19.1
Debris	122	40.3
Total	303	100

Table 17: Area 2 Debitage Sorted Into SRT Categories

Area 3 Debitage

Area 3 is approximately midway on the eastern wall of the fort and is a wigwam site. It contains 126 pieces of debitage. Sorted by count and percentage they are:

Category	Count	Percentage
Complete Flakes	25	19.9
Proximal Fragments	26	20.6
Medial Fragments	10	7.9
Distal Fragments	10	7.9
Bipolar Flakes	6	4.8
Angular Shatter	45	35.7
Blades	0	0
Split Flakes	4	3.2
Total	126	100

Table 18: Area 2 Debitage Sorted Into Standard Categories

Sorted into SRT categories by count and percentage:

Category	Count	Percentage
Complete Flakes	33	26.6
Broken Flakes	26	21
Flake Fragments	20	16.1
Debris	45	36.3
Total	124	100

Table 19: Area 3 Debitage Sorted Into SRT Categories

For Area 3, debris is also the largest category and the complete flake category is the next largest. The MNF is 53 and the degree of estimated flake breakage is very low with a ratio of ~ .28:1. Flake fragmentation is not as high as the other areas with a 2.6:1 ratio. The MNF to tools ratio is 4.4:1.

Monhantic Fort Tool Assemblage

Monhantic Fort contained 91 artifacts (Fig. 8) identified as tools produced from European flint. The tools include gunflints, both Native and European produced, strike-a-lights, and utilized flakes. As might be expected from a fortified village, gunflints make up the largest proportion of all tools with 55, or 60.4%. Thirty-nine were Native produced and account for 70.9% of all gunflints. The remaining 16 are European gunspalls. Thirteen tools were identified as strike-a-lights, which accounts for 14.3% of all tools. Although the Pequot had long incorporated metal tools, 23 utilized flakes of European flint, 25.3% of all tools, are included in the assemblage. Finally, 6 tools, or 6.6%, show reuse as

other tools; five were reused as a strike-a-light and one as a scraper. The distribution of tools by area is as follows:

Area 1

Type	Count
Native Gunflints	10
European Gunflints	2
Strike-a-lights	4
Utilized Flakes	14
Total	30
Tools Reused	2

Table 20: Area 1 Tools

Area 2

Type	Count
Native Gunflints	5
European Gunflints	4
Strike-a-lights	3
Utilized Flakes	2
Total	14
Tools Reused	2

Table 21: Area 2 Tools

Area 3

Type	Count
Native Gunflints	7
European Gunflints	2
Strike-a-lights	2
Utilized Flakes	1
Total	12
Tools Reused	1

Table 22: Area 3 Tools

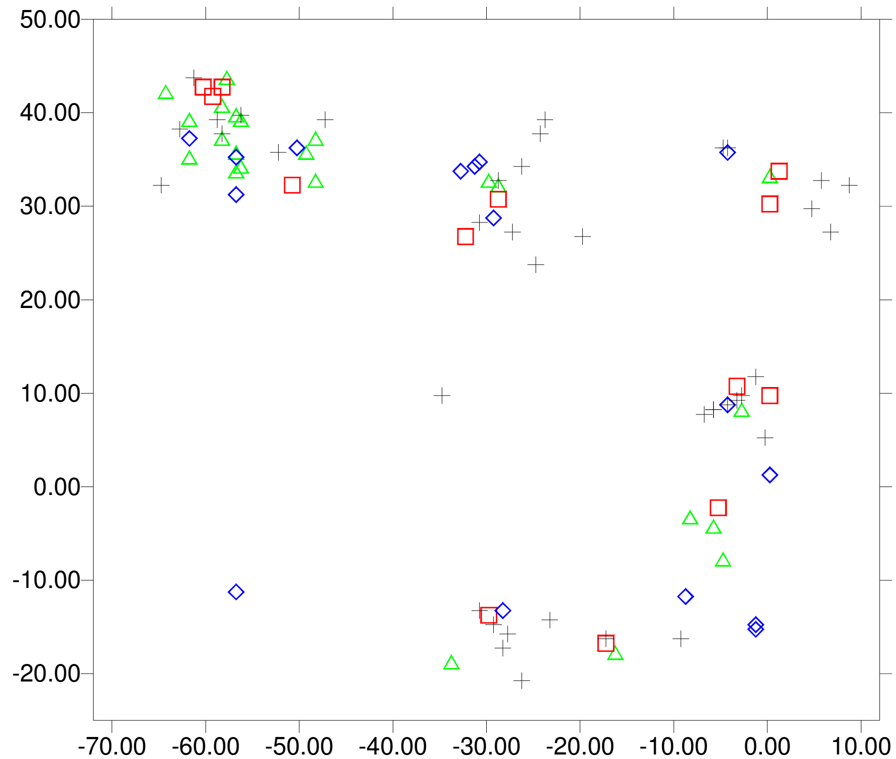

Figure 8: Distribution of Monhantic tools Produced from European Flint

Technological Analysis

Applying the SRT to the Monhantic Fort assemblage revealed some interesting observations. According to Sullivan and Rozen (1985), primary (core) reduction should be dominated by complete flakes and debris, while secondary reduction (tool manufacture) should have high percentages of proximal and distal flake fragments. For the complete assemblage, debris and complete flakes totaled 62.3% while proximal and distal fragments totaled 25.4%, suggesting a technology dominated by core reduction. However, proximal fragments and complete flakes were approximately equal, which would suggest that some

amount of secondary reduction occurred, thus a technologically mixed assemblage. The flake fragmentation ratio, which is 4.3:1 for the complete assemblage, can account for this and indicates that complete flakes might have been misidentified as proximal fragments, which can easily occur if flakes terminate in step fractures. If this happened, the complete flake category would be increased and the indications of primary reduction would be strengthened. Additionally, a reduction in proximal fragments due to misidentification would increase the estimated flake breakage ratio, which is .49:1 for the complete assemblage. An increased estimated flake breakage ratio would be suggestive of breakage due to trampling, which is likely due to the nature of the site, a fortified village. Conversely, the high number of proximal fragments could also be accounted for as unprepared platforms on cores on which a hard hammer was used (Prentiss 2001). Finally, the ratio of the MNF to tools is 3.5:1. If utilized flakes are removed, the ratio is 4.7:1, which indicates that the Pequots were highly selective in their choice of which flakes to use for tool production. Contrarily, it could indicate that flakes were not necessarily what they were trying to produce. Overall, it is suggested that core reduction was the primary lithic technology pursued at Monhantic Fort.

The analysis for Area 1 is similar to the complete assemblage. Debris and complete flakes account for 66.8% of the debitage and proximal and distal fragments total 21.5%, which suggests primary reduction. Unlike the complete assemblage, Area 1 contains more complete flakes than proximal fragments; however, the flake fragmentation ratio is only slightly higher at 4.7:1, again

indicating the possibility of complete flakes being misidentified as proximal fragments. The suggestion for primary reduction would be strengthened if this happened and also would increase the estimated flake breakage ratio, which would be suggestive of breakage due to trampling. The ratio of MNF to tools is 3.6:1 with utilized flakes and 6.8:1 without. This shows either a higher degree of selectivity in the Pequot's choice of flakes used for tools in Area 1 or that they were not necessarily trying to produce flakes. For Area 1 it is suggested that core reduction was the focus of lithic production.

The SRT percentages for Area 2 are different than for Area 1 and the complete assemblage. While complete flakes are low, 12.9%, debris is still high at 40.3%, for a joint total of 53.2%. Proximal and distal fragments equal 31.8%, which suggests a mixed assemblage. The flake fragmentation ratio is higher than Area 1 and the complete assemblage at 6:1. This indicates the possibility of complete flakes being misidentified as proximal fragments strengthening the suggestion for primary reduction and increasing the estimated flake breakage ratio, which would be suggestive of breakage due to trampling. The MNF to tool ratio is 8.1:1 with utilized flakes and 9.5:1 without. Area 2 illustrates an even greater selectivity in the Pequot's choice of flakes used for tools or, more likely, that flakes were not necessarily what they were after. Core reduction as a primary strategy is again suggested.

Area 3 is also similar to the complete assemblage in SRT categories. Debris and complete flakes account for 62.9% of debitage and proximal and distal fragments equal 28.5%. However, the flake fragmentation ratio, 2.6:1, and the

estimated flake breakage ratio, .28:1, are much lower, which suggests that misidentification of complete flakes as proximal fragments did not happen and also that breakage due to trampling in this area is less likely. The MNF to tools ratio is 4.4:1 with utilized flakes and 4.8:1 without, which suggests that the Pequot's were very selective in their choice of flakes used for tools or that flakes were not what they desired. Core reduction is suggested as the main lithic strategy employed in Area 3.

In summary, according to the SRT, the Monhantic Fort debitage assemblage is mainly the result of core reduction as a primary strategy. However, it also demonstrates some characteristics of tool production, especially when analysis is done on an individual area. In particular, the SRT analysis of Area 2 suggests that tool production occurred along with core reduction. As Area 2 is a wigwam site it intuitively suggests that secondary reduction (tool production) would be more likely to take place there than at other areas. This illustrates that reduction strategies throughout Monhantic Fort varied according to how the location was utilized. Furthermore, it shows the importance of analyzing the component parts, the various areas, in addition to the whole. Finally, this demonstrates that the SRT is capable of discerning between primary and secondary reduction.

Aptucxet Trading Post Assemblage

The Aptucxet Trading Post assemblage contains 88 artifacts, of these 17 are tools and 71 are debitage. Five of the tools are made of quartz, which leaves 12 tools and 71 pieces of debitage, or 83 artifacts, made of European flint. There

are three types of tools in the assemblage: chip gunflints, one European gunspall, and strike-a-lights.

The debitage was divided into seven classes: Angular shatter, bipolar, complete flakes, proximal fragments, medial fragments, distal fragments, and split flakes. The attributes noted for all artifacts include the presence or absence of cortex, thermal alteration, weight, length, thickness, and where appropriate, termination type and platform type. Additionally, for the gunflints and strike-a-lights the number of used edges, edge angles, and color were noted. As with the Monhantic Fort assemblage analysis, the Sullivan and Rozen Typology (SRT), minimum number of flakes (MNF), flake breakage, flake fragmentation, and MNF to tools ratio was utilized. The analysis is on the complete assemblage only.

Aptucxet Trading Post Debitage Assemblage

The complete Aptucxet Trading Post assemblage contains 71 pieces of debitage, which have been sorted into the following categories by count and percentage:

Category	Count	Percentage
Complete Flakes	5	7
Proximal Fragments	8	11.3
Medial Fragments	7	9.9
Distal Fragments	2	2.8
Bipolar Flakes	13	18.3
Angular Shatter	31	43.7
Split Flakes	5	7
Total	71	100

Table 23: Aptucxet Trading Post Debitage Sorted into Standard Categories

These categories are readily transferable to the four SRT categories: complete flakes, broken flakes, flake fragments, and debris. After sorting into SRT categories the count and percentage of each are:

Category	Count	Percentage
Complete Flakes	21	30.4
Broken Flakes	8	11.6
Flake Fragments	9	13.1
Debris	31	44.9
Total	69	100

Table 24: Aptucxet Trading Post Debitage Sorted into SRT Categories

Debris dominated the Aptucxet Trading Post assemblage at 44.9%. It was followed in descending order by complete flakes, flake fragments, and broken flakes. The MNF for the assemblage was computed next and contained complete flakes, proximal fragments, one-half of the split flakes, and the bipolar flakes. The MNF for the assemblage is 29. The degree of estimated flake breakage is somewhat low at a .7:1 ratio of medial fragments to proximal and distal fragments. The flake fragmentation is high with a 4:1 ratio of proximal to distal fragments. The MNF to tool ratio is 1.7:1.

Aptucxet Trading Post Tool Assemblage

Aptucxet Trading Post contains seventeen artifacts identified as tools produced from European flint and quartz. The tools include one European gunspall, ten chip gunflints, two of which were made of quartz, and six strike-a-lights, three of which were made of quartz. The gunflints make up the largest

group of tools at 64.7% of the total number. The strike-a-lights make up 35.3% of the tools. What is interesting is that quartz is the material used in 29.4% of all tools. Finally, one gunflint was reused as a strike-a-light.

Type	Count
Chip Gunflints	10
European Gunspalls	1
Strike-a-lights	6
Total	17
Tools Reused	1

Table 25: Aptucxet Trading Post Tools

Technological Analysis

Applying the SRT to the Aptucxet Trading Post assemblage produced similar, though more pronounced trends than at Monhantic Fort. Again, primary (core) reduction should have high percentages of complete flakes and debris while secondary (tool manufacture) reduction should have high percentages of proximal and distal flake fragments (Sullivan and Rozen 1985).

The Aptucxet Trading Post assemblage was dramatically dominated by debris and complete flakes, which accounted for 75.3% of the assemblage. Proximal and distal fragments made up only 14.5% of the assemblage. This suggests a core reduction technology.

Proximal fragments and complete flakes were approximately equal, however, which would suggest that some amount of secondary reduction occurred, thus a technologically mixed assemblage. This can be accounted for by the flake fragmentation ratio, which is 4:1 for the complete assemblage, and indicates that

complete flakes were possibly misidentified as proximal fragments. If this happened, the complete flake category would be increased and the suggestion for primary reduction would be strengthened. Additionally, a reduction in proximal fragments due to misidentification would increase the estimated flake breakage ratio, which is .7:1 for the assemblage. An increased estimated flake breakage ratio would be suggestive of breakage due to trampling, which is likely due to the nature of the site, a trading post. Conversely, the high number of proximal fragments could also be accounted for as unprepared platforms on cores on which a hard hammer was used (Prentiss 2001). Finally, the MNF to tools ratio is 1.7:1. This suggests that at Aptucxet they were not very selective about what flakes they used for tools. It also suggests that the original piece or pieces of raw material were small and they just did not get many flakes or other suitable pieces. Overall, it is suggested that core reduction, for gunflint production, was the primary lithic technology pursued at the Aptucxet Trading Post.

To summarize, the debitage assemblage from the Aptucxet Trading Post is mainly the result of core reduction as a primary strategy, according to the SRT. Additionally, some small amount of secondary reduction likely also occurred. Unlike at Monhantic Fort, the Aptucxet Trading Post showed a greater trend toward primary reduction and a correspondingly lesser amount of secondary reduction. This difference between Aptucxet and Monhantic Fort is possibly due to the Europeans at Aptucxet having no lithic production skills while the Pequot at Monhantic Fort perhaps retaining some of their traditional lithic skills.

Experimental Lithic Debitage Assemblage

The experimental lithic assemblage contains 664 artifacts. Of these, 27 are tools, four are flakes from the hammerstones, and 633 are debitage. The tools are of one type, chip gunflints, and all are made from Brandon flint. This debitage was also divided into nine classes: angular shatter, bipolar, complete flakes, proximal fragments, medial fragments, distal fragments, split flakes, blades, core fragments. The attributes noted for all artifacts include the presence or absence of cortex, weight, length, thickness, and where appropriate, termination type and platform type. Additionally, for the gunflints the number of potential edges and edge angles were noted. Finally, as in the previous analysis, the Sullivan and Rozen Typology (SRT), minimum number of flakes (MNF), flake breakage, flake fragmentation, and MNF to tools ratio was utilized. The analysis will start by looking at the complete assemblage followed by the individual nodules.

Complete debitage assemblage

The complete experimental lithic assemblage contains 616 pieces of debitage, not including core fragments, which were sorted into flake type categories by count and percentage (Table 26). These categories are readily transferable to the four SRT categories by count and percentage (Table 27). The categories are complete flakes, broken flakes, flake fragments, and debris.

Category	Count	Percentage
Complete Flakes	82	13.3
Proximal Fragments	109	17.7
Medial Fragments	109	17.7
Distal Fragments	56	9
Bipolar Flakes	38	6.2
Angular Shatter	187	30.4
Blades	2	0.3
Split Flakes	33	5.4
Total	616	100

Table 26: Experimental Lithic Debitage Sorted into Standard Categories

Category	Count	Percentage
Complete Flakes	139	23.2
Broken Flakes	109	18.1
Flake Fragments	165	27.5
Debris	187	31.2
Total	600	100

Table 27: Experimental Lithic Debitage Sorted into SRT Categories

The experimental lithic assemblage was dominated, although only slightly, by debris. It was followed in descending order by flake fragments, complete flakes and broken flakes.

The MNF for the experimental assemblage was computed next. In addition to complete flakes, proximal fragments, and one half of the split flakes, blades and bipolar flakes were included in the count. The MNF is 248 for the experimental assemblage. The degree of estimated flake breakage is somewhat low at a .66:1 ratio of medial fragments to proximal and distal fragments. The flake fragmentation is low with a 1.95:1 ratio of proximal to distal fragments. The MNF to tool ratio is very high at 9.2:1.

Nodule 2 Debitage

Nodule 2 was the larger of the two nodules used in the experiment. It weighed 740.035g and was nearly three times as large as nodule 3. There are 490 pieces of debitage from nodule 2 which were sorted into eight categories by count and percentage:

Category	Count	Percentage
Complete Flakes	67	13.7
Proximal Fragments	80	16.3
Medial Fragments	95	19.4
Distal Fragments	42	8.6
Bipolar Flakes	23	4.7
Angular Shatter	157	32
Blades	2	0.4
Split Flakes	24	4.9
Totals	490	100

Table 28: Nodule 2 Debitage Sorted into Standard Categories

These were then sorted into SRT categories by count and percentage:

Category	Count	Percentage
Complete Flakes	104	21.8
Broken Flakes	80	16.7
Flake Fragments	137	28.7
Debris	157	32.8
Total	478	100

Table 29: Nodule 2 Debitage Sorted into SRT Categories

Nodule 2 was very similar to the assemblage as a whole with debris being the largest category. It was followed by flake fragments, complete flakes, and broken flakes. The MNF for nodule 2 is 184. The degree of estimated flake

breakage is low at .78:1. The flake fragmentation ratio is also low at 1.9:1. The MNF to tool ratio is very high at 9.7:1.

Nodule 3

Nodule 3 was the smaller of the two nodules used in the experimental lithic reduction and weighed 263.524g. There are 126 pieces of debitage which have been sorted into eight categories by count and percentage:

Category	Count	Percentage
Complete Flakes	15	11.9
Proximal Fragments	29	23
Medial Fragments	14	11.1
Distal Fragments	14	11.1
Bipolar Flakes	15	11.9
Angular Shatter	30	23.8
Blades	0	0
Split Flakes	9	7.2
Totals	126	100

Table 30: Nodule 3 Debitage Sorted into Standard Categories

These were then sorted into SRT categories by count and percentage:

Category	Count	Percentage
Complete Flakes	27	23.7
Broken Flakes	29	25.4
Flake Fragments	28	24.6
Debris	30	26.3
Total	114	100

Table 31: Nodule 3 Debitage Sorted into SRT Categories

Again, the largest category was debris, which was followed by broken flakes, flake fragments, and complete flakes. No category was dominant, however, with all being almost equal. The MNF for nodule 3 is 64. The degree of estimated flake breakage is very low at .33:1. The flake fragmentation ratio is low at 2.1:1. The MNF to tool ratio is high at 8:1

Technological Analysis

Applying the SRT to the experimental debitage assemblage produced trends similar to those for the Monhantic Fort assemblage. As the experiment was mainly core reduction in the form of bipolar reduction the assemblage, according to Sullivan and Rozen (1985), should have been dominated by complete flakes and debris. If the assemblage had been mainly tool manufacture, proximal and distal flake fragments would be present in high percentages according to Sullivan and Rozen (1985). For the complete experimental debitage assemblage, debris and complete flakes totaled 54.4% while proximal and distal fragments totaled 27.5%. Proximal fragments and complete flakes were approximately equal, which would suggest that some amount of secondary reduction occurred, which did, thus a technologically mixed assemblage dominated by core reduction. The high number of proximal fragments could also be accounted for as platforms on the core were unprepared and a hard hammer was used (Prentiss 2001). The later is more in line with the low flake fragmentation ratio of 1.95:1. For the assemblage as a whole, cortex was present on 43.5% of all artifacts, which suggests that the nodules used in the experiment were small. Finally, the MNF

to tools ratio is very high at 9.2:1, which suggests that flakes were not the intended product. Indeed, flakes were not the intended product in this experiment as most, if not all, of the gunflints would likely be categorized as angular shatter, chunks, or bipolar fragments.

The analysis for nodule 2 is similar to the complete assemblage. Debris and complete flakes account for 54.6% of the debitage while proximal and distal fragments total 25.5%. Unlike the complete assemblage, nodule 2 contains more complete flakes than proximal fragments. The flake fragmentation ratio is also low at 1.9:1. The MNF to tools ratio is very high at 9.7:1, again suggesting that flakes were not the intended product. For nodule 2, core reduction is suggested as the focus for lithic reduction.

Nodule 3 is different in its SRT percentages from nodule 2 and the complete assemblage. Debris is low at 26.3% with debris and complete flakes totaling just 50%. Proximal and distal fragments total a high 37.7%. The flake fragmentation ratio is only slightly larger at 2.1:1. The MNF to tools ratio is very high at 8:1, which suggests that flakes were not the intended product. Although core reduction is suggested as the main form of reduction, secondary reduction is also suggested due to the high percentage of proximal and distal fragments.

To summarize, the experimental lithic debitage assemblage was exactly what the SRT would predict for a mixed assemblage of mainly core reduction with a slight amount of tool production. Complete flakes and debris dominated the assemblage. However, by applying the SRT to the debitage of the individual nodules in the experiment the SRT was shown to be capable of discerning where

tool making occurred in conjunction with core reduction, specifically which nodule (see tables 29 and 31). These results are similar to those for the Monhantic Fort assemblage, which also showed areas of core reduction in conjunction with tool making, further strengthening the suggestion that the debitage assemblage at Monhantic Fort was produced through mainly core reduction using a bipolar technique.

Chapter 7

Conclusions

The primary economic unit for the Pequots prior to contact was the household (McBride 1984). Benard's (2005) analysis indicated that even though Monhantic Fort was a fortified village, the household was still the primary economic unit. As such, lithic production at the fort generally appears to be primarily a non-specialist activity; two of the areas of European flint concentrations, Areas 2 and 3, are wigwam sites. In Area 2, lithic production took place outside the domestic structure in the area where a storage/refuse pit and hearths were located. The same appears to have occurred in Area 3; production took place outside the structure near hearths in what was likely a male centered activity area (Benard 2005).

Area 1 is different. Located inside and outside the northwest bastion, a forge was located there as demonstrated by the concentration of slag. It has been suggested that blacksmiths, who frequently repaired guns, also produced gunflints (Luedtke 1998, 1999; Carter 1997). At Monhantic Fort this also appears to be true as Area 1 contains the second largest European flint concentration in the fort. Unlike the wigwam sites, this indicates a European adaptation and at least a degree of specialist production.

Bamforth et al (2005) suggest that non-domestic hearths and other features in the outer areas of a camp were used for more dangerous or messy activities, such as flintknapping. While the data from Areas 2 and 3 do not support his

model, those of other locations of flint knapping do. This is suggested for Area 1 as part of it is located near the northwest bastion along the palisade wall and has several hearths. However, there are other European flint scatters within the fort that have not been discussed which fit the non-domestic and outer area description. One is located along the palisade wall near the northeast wall intersections, but has no hearth features. Another is located near the southeast bastion and contains the palisade walls and hearth features. The last includes the main entrance, located in the south-central area of the fort, but it contains no hearths. All four areas are outside of domestic space where activities such as flintknapping could be segregated, generally supporting Bamforth's model of production.

Stone tool use and discard appear to follow the patterns outlined by Binford (1979). Gunflints would be classified as personal gear and while many were produced at Monhantic Fort, it is likely they were not used within the fort itself. However, they were discarded within the fort at the wigwam sites, near the northwest, northeast, and southeast bastions, and the main entrance. According to Binford (1979), worn out personal gear discard took place within a residential camp not in the field where they would be used. The Monhantic Fort gunflints are well worn. Binford's observations indicate that it should not be surprising that gunflint discard took place within the fort; the discard of strike-a-lights also followed this pattern.

Utilized flakes were found in all three areas; however, they are most concentrated in the outer areas, not in domestic areas as might be expected.

They are particularly concentrated in Area 1. Area 1 contains the forge and while metal tools were likely available, perhaps cutting and scraping activities were performed equally well with the sharp edges from the gunflint debitage.

The Pequots also practiced tool curation in the form of reuse or recycling (Binford 1979; Kelly 1988). Six gunflints in the assemblage evidence multiple usewear patterns. Five were used as strike-a-lights and one as a scraper. Luedtke (1998) noted that at Aptucxet some gunflints were also recycled as strike-a-lights.

The Pequots clearly made gunflints at Monhantic Fort, but the question remains as to what type or types of weapons they were used in. Hamilton and Emery (1988) stated that different types of weapons used different sizes of gunflints, measured side to side, as their locks were different sizes. Muskets used flints greater than 34mm, fowlers and carbines between 28mm and 34mm, trade guns from 20mm to 28mm, and pistols less than 20mm (Hamilton and Emery 1988). Of the 55 gunflints in the assemblage, 35 are less than 20mm side to side, 16 are between 20mm and 28mm, none are greater than 28mm, and four were unavailable for measuring. This suggests that most were used in pistols and the rest in smaller caliber long arms. However, as all are worn these conclusions may be premature. If proper sized gunflints were unavailable, whether European or Native made, a flint that was “close” could be made to work with extra padding in the locks’ vice. In other words, worn, undersized gunflints could be used in larger arms in a pinch.

Although width was an important consideration when choosing gunflints, two other dimensions also appeared to have been of importance to the gunflint makers at Monhantic Fort and the Aptucxet Trading Post. Those two dimensions were weight and thickness.

The mean for weight for the gunflints from Monhantic Fort was 2.280 grams with a standard deviation of 1.343. Those from the Aptucxet Trading Post had a mean of 2.807 grams with a standard deviation of 1.343. For Thickness, the Monhantic Fort gunflints had a mean of 6.595mm with a standard deviation of 1.943. The gunflints from Aptucxet Trading Post had a mean of 7.606mm with a standard deviation of 1.757. In comparison, the mean for the weight of the replicated (unused) gunflints was 10.161 grams with a standard deviation of 4.373. For thickness, the mean was 12.097mm with a standard deviation of 3.246.

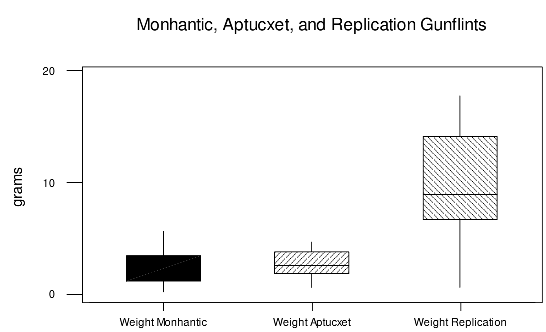

Figure 9

This pattern is important as it strengthens the argument that the people at Monhantic and Aptucxet were producing gunflints for specific size locks. As previously stated, those were smaller locks, likely used on pistols or smaller long guns. In addition, it appears that people in both places used similar type firearms. The weight and thickness of the replicated gunflints differed by such a

large margin because they were produced not for a specific lock size but to accommodate all lock sizes.

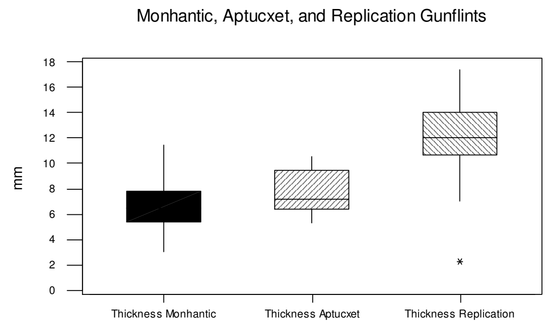

Figure 10

If bipolar reduction were used at Monhantic Fort to produce gunflints it would not be surprising. Lithic technology in eastern North America degenerated during the late prehistoric period with bipolar reduction becoming more prevalent (Jeske 1992). Native groups in southern New England also used bipolar technology in their quartz lithic industries during the Woodland Period (Brian Jones, personal communication). Due to the rapid replacement of stone tools by metal and drastic population reductions of the 17th century, if the Pequots retained any lithic technology by 1675 it would have likely been a relatively simple bipolar one.

Energetic efficiency has been suggested as the reason that lithic technological organization became centered on bipolar reduction (Jeske 1992). Essentially, he stated that the use of bipolar reduction might be an indicator of energy stress on a population. This was particularly true when access to raw material was limited while energy needed for social activities, such as increasing sedentism, political alliances, and warfare, necessitated the efficient use of energy and resources. All of these conditions would apply to the Pequots in 1675.

Bipolar reduction has also been suggested as a method used when access to raw material is limited (Jeske 1992) and when available material was small in size (Andrefsky 1994a). Both of these conditions again applied to the Pequots. Their raw material was European flint, which could have been collected from ballast dumps while they pursued other activities like food procurement, or they could have received it in trade. Luedtke (1998) noted that the nodule size of European flint cobbles available on the beaches of eastern Massachusetts were small. Emery et al (1968) stated that nodule size of ballast flint ranged from 2-9cm in diameter while Rose (1968) noted nodules in New York up to twenty inches across. Two unused flint nodules were recovered at the fort and both were smaller than fist-sized. In general, nodule size was small and access limited.

The debitage from bipolar reduction is similar to that from Monhantic Fort. Jeske (1992) demonstrated experimentally that large quantities of shatter and non-orientable fragments were produced. Morrow (1997) said that large quantities of small flakes and waste are produced through bipolar reduction. Kuijt et al (1995) stated that the most important attributes of bipolar reduction were the small size of debitage and large proportion of pieces with cortex. Thirty-six percent of the lithic assemblage from Monhantic Fort contains cortex.

At Aptucxet, Luedtke (1998) stated that the ballast flint debitage indicated extremely poor knapping skill and suggested that it was accomplished by a variety of bipolar flaking called nodule smashing. Boksenbaum (1980) described this method as an alternative, non-specialist stone working strategy employed in

the Basin of Mexico by villagers to produce sharp flakes as part of their household production. He went on to identify a number of anomalous flake types resulting from nodule smashing, most of which occur in the Monhantic Fort assemblage. While sharp flakes might not have been the Pequots desired target, nodule smashing also produces a lot of debris and angular shatter, which are frequently sub-rectangular and therefore useful for gunflints. As Andrefsky (1994b) noted, non-retouched flakes and bipolar shatter have been shown to be effective for most tasks. It seems likely that the Pequots at Monhantic Fort practiced nodule smashing. If gunflint production was introduced to the Pequots by their blacksmith, it is likely that he learned from a European blacksmith who probably also used nodule smashing as gunflint production methods were highly guarded in Europe.

To summarize, it is suggested that spatial patterning and technological organization of lithic production at Monhantic Fort indicates a continuation of Native patterns as suggested by Benard (2005) and Binford (1979). However, European influences are present. First, material for gunflint production, European flint, likely was acquired at waterfront locations from ballast dumps during activities such as food procurement (shellfish collecting). Also, it is possible to have occurred during trade, both of which were normal Pequot activities prior to European arrival. Second, lithic production occurred in multiple places, particularly near domestic spaces, which is suggestive of a pre-contact generalist pattern. Conversely, the area near the forge and other locations of less intensive lithic reduction could not be called domestic space, and are more

suggestive of a European influenced specialist production pattern. Third, formal tool manufacture, or secondary reduction, does not appear to have been a factor at Monhantic Fort; the only tools that showed any formalization or retouch were the European produced gunflints. Fourth, it is suggested that there was a relationship between areas of production and features, such as hearths and structures. Areas 2 and 3 were wigwam sites and lithic production occurred outside of the domestic structures where storage pits and hearths were located, which suggests a generalist, pre-contact pattern. However, Area 1, which contained the forge, did not contain a domestic structure and this is suggestive of a specialist, likely male production pattern, probably influenced by European contact. Fifth, the recycling of tools and patterns of discard are also suggestive of a continuation of pre-contact patterns as suggested by Binford (1979). Sixth, it is suggested that the main lithic reduction strategy employed at Monhantic Fort is of primary, or core, reduction. Specifically, I believe a variety of bipolar reduction termed nodule smashing was likely the method used to produce targeted gunflint blanks. Finally, I suggest that, despite some indications of external influence, the Pequot at Mashantucket Fort did not appreciably change their patterns of manufacture due to European contact.

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