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Cover Page Footnote

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WORKED BALLAST FLINT AT APTUCXET

Barbara E. Luedtke

The gunflint industry of western Europe represents an extraordinary revival of the art of flint-knapping, which had largely disappeared from the technological repertoire of the region after the Neolithic. During the classic period of flintlock weapons in the 18th and 19th centuries, gunflint production appears to have been performed primarily by specialists. Demand for gunflints began in the 17th century, however, especially in North America, and was sometimes met by the "do it yourself" efforts of non-specialists. An assemblage recently excavated in Bourne, Massachusetts, provides an opportunity to study such efforts.

L'industrie de la pierre à fusil d'Europe occidentale représente un renouveau extraordinaire de l'art de la taille de la pierre qui était en grande partie disparu du répertoire technologique de la région après le néolithique. Durant la période classique des fusils à pierre aux XVIIIe et XIXe siècles, la production de la pierre à fusil semble avoir été assurée surtout par des spécialistes. La demande de pierres à fusil a commencé au XVIIe siècle, spécialement en Amérique du Nord, et a été parfois satisfaite par le travail de non-spécialistes. Un assemblage récemment excavé à Bourne (Massachusetts) offre l'occasion d'étudier une telle entreprise.

Introduction

The development of gunflint industries in western Europe required the reinvention of stoneworking techniques that had long been lost in that region. Skertchly's (1984) argument that the famous flintknappers at Brandon represented direct genetic and technological continuity from the Neolithic to the 19th century was effectively refuted by de Lotbinière, who pointed out that the records of that East Anglian town provide little evidence for the presence of flintworkers before 1795 (de Lotbinière 1984: vii). Elsewhere, workers did knap flint nodules into rough shape for construction, and Runnels has argued convincingly that some people in Western Europe continued to make and use flakes of stone for casual scraping and cutting tasks, and perhaps for strike-a-lights (Runnels 1982). Nevertheless, the skill involved in such stoneworking activities was minimal, compared to that required for the sophisticated blade industry documented at Brandon during the late 19th and early 20th century (Clarke 1935).

The East Anglian flintknappers only perfected their craft during the last quarter of the 18th century (de Lotbinière 1984: viii), and a variety of gunflint forms preceded the highly regular rectangles produced at Brandon (Luedtke 1999). Many of these early gunflints probably were made by specialists, but archae-

ological data from Aptucxet and from other 17th-century sites suggest that ordinary people who lacked all knowledge of how to knap stone sometimes made their own gunflints (Miller and Keeler 1986: 3-6). Understanding why they would have felt the need to do so requires a brief history of flintlock weapons.

Early Flintlock Weapons

Weapons that used sparks to ignite gunpowder existed long before flintlocks came into common use. Wheel-lock guns, which generated sparks by turning a grooved steel wheel against pyrite, were invented in the late 15th century, about the time that the first flintlock weapons were developed (Lewis 1956: 5). A variety of different types of these latter weapons were developed over the next century, including the snaphaunce, the English lock, the dog lock, the Baltic lock, and the miquelet, culminating in the development of the true flintlock gun by the beginning of the 17th century (Peterson 1957: 17). Unfortunately for archaeologists and historians of armaments, writers of the 17th century did not usually differentiate among these various types, but rather called all weapons that ignited powder by striking flint against steel snaphaunces (Peterson 1957: 17).

Despite the availability of flintlocks, the major armies of Europe continued to use matchlock weapons until late in the 17th century. A matchlock is fired by pressing a "match," actually a slowly burning piece of rope soaked in nitre, into the powder in the priming pan (Peterson 1957: 14). Loading and firing a matchlock was a long and complicated process, the light and smell of the match were not conducive to successful ambushes, and care had to be taken to prevent the match from igniting when it was not supposed to, or simply going out, especially in wind or rain (Peterson 1957: 14–17). Although flintlock weapons were faster, more dependable, and safer, matchlocks had a simple firing mechanism with few moving parts (Lewis 1956: 5), making them "cheap to make and easy to maintain" (Lindsay 1975: 16). It is also likely that the matchlock's disadvantages were not so obvious in the context of the style of warfare then prevalent in Europe. For these reasons, matchlocks continued to be the weapon of choice for European armies long after flintlock weapons were developed. For example, flintlocks were not standard weaponry in the English army until 1686, and were not in general military use until the beginning of the 18th century (Skertchly 1984: 3).

In contrast, the conditions of hunting and warfare in the American colonies favored flintlocks. While the majority of the firearms first brought by the English to Plymouth Colony were matchlock muskets (Peterson 1957: 17), some colonists, including Miles Standish, had "snaphances" (Mourt 1963 [1622]: 35), and flints are specifically mentioned as being carried aboard the *Mayflower* (Mourt 1963: 31). In addition to muskets, fowling pieces (guns with long barrels, used on stands in bird hunting) and pistols were also brought to New England by the earliest colonists, and these weapons usually used flints (Peterson 1957: 19–20). Flintlocks replaced matchlock weapons more quickly in New England than in Old England. By 1645, although matchlocks were still allowed for private use, the Plymouth General Court considered them so unreliable that they were no longer allowed for Town arms (Peterson 1957: 18). In 1677, just after King Philip's War, matchlocks were

outlawed entirely in Plymouth Colony (Peterson 1957: 18).

Flintlock weapons were not used only by English settlers in New England; despite strict laws forbidding the sale of guns to native peoples, Bradford complained in 1628 that "the Indians are full of peeces all over, both fouling peeces, muskets, pistols, etc." (Bradford 1962: 142). Archaeology provides some support for this assertion; a gunflint, powder flasks, lead balls, and a flintlock musket dated to the period 1620–1640 were found in graves at the West Point Ferry site in Narragansett territory (Simmons 1970: 42); a gunflint, musket ball, and lead cylinders probably meant as gun ammunition were found at RI-1000, a mid-17th-century Narragansett burial site in Rhode Island (Turnbaugh 1984: 99); and gunflints, gun parts, and shot were recovered from the Burr's Hill site, a Wampanoag burial ground dated mainly from the early 1600s to about 1675 (Gibson 1980: 22).

Early Gunflints

Documentary data relevant to the early gunflint industries are scarce at best, but it seems likely that the demand for gunflints followed a trajectory similar to that for flintlock weapons during the 17th century. Demand for both would have been low at the start of the century but would have increased steadily, with a sharp upturn near the end of the century after the armies of Europe adopted flintlock weapons. This upturn would surely have spurred expansion, and maybe reorganization, of the gunflint industries, perhaps encouraging a shift from part-time to full-time production. In other words, gunflint making may not have been a viable occupation until the late 17th century, and gunflint production may have been irregular or episodic before then.

A number of different types of gunflints are known to have been used throughout the 17th century, and efforts have been made to use these types as chronological indicators (Witthoft 1966). More than one type is present in most archaeological assemblages of the period, however, confounding efforts to produce simple chronologies. It may be more useful to think of the 17th century as a time of

experimentation during which a variety of traditions of gunflint manufacture existed, most of them overlapping in time. Some of these were specialist traditions involving skilled gunflint makers, but there were also non-specialists who made gunflints with varying degrees of skill. The most important traditions for 17th-century New England were the French, the British, the native, and the "do-it-yourself" traditions. The first three will be outlined briefly, and the fourth will be discussed in some detail.

Documentary evidence suggests that the French gunflint industry may have begun as early as 1643 (White 1975: 70), and archaeological evidence supports a mid-17th-century origin. Typical French flints were found in a pre-1663 context at Chicoutimi (Blanchette 1975: 50) and in contexts dated 1670–1674 at Pentagoet (Faulkner and Faulkner 1987: 153). French gunflints were made on blades. After the proximal and distal portions of the blade were removed, one side was retouched from the ventral surface to form a rounded heel, resulting in a D- or horseshoe-shaped gunflint.

In England, the gunflint industry appears to have begun as a by-product of chalk extraction for the production of lime mortar (de Lotbiniere 1980: 154–155). Initial gunflint production may have been on an ad hoc basis, but the government began purchasing flints in the mid-17th century (de Lotbiniere 1980: 155) and demand must have climbed steeply after 1686, when flintlock weapons became standard in the army. Some of these early gunflints may have been purchased from France, but English flints are specified in an order dated 1704 (de Lotbiniere 1980: 156). Though early gunflint production seems to have been focused in the Thames Valley region, secondary centers of gunflint production existed in several locations near Salisbury and in Suffolk (Shepherd 1972: 233).

The gunflints being produced in England during the 17th century (continuing through the 18th and into the early 19th centuries) were of the spall or "early wedge" type (de Lotbiniere 1984: vi). Many were made from relatively small round or oval nodules. One end of the nodule was removed and this surface was used as a striking platform to remove a large decortication flake. Smaller decortica-

tion flakes were removed from the sides of this surface, and then round flakes were removed using striking platforms along the sides of the prepared face (Hamilton 1980: 142). The distal end of the flake was retouched and straightened to become the working edge, while the bulb of percussion functioned as the heel of these flints. Spall type gunflints may also have been made in France (Hamilton and Emery 1988: 31) and they were certainly made in the colonies, probably most often by people who also dealt with other aspects of the manufacture and repair of weapons. For example, flint debitage and well-made spall type gunflints were concentrated within and around the smithy at Pentagoet, where guns were also being repaired during the 1635–1654 occupation (Faulkner and Faulkner 1987: 148–154). Well-made spall type gunflints were also being produced from ballast flint by military personnel at Fort Frederica, in Georgia, which was occupied by the British from 1736 to 1748 (White 1975: 71; Hamilton and Emery 1988: 192).

Though the very beginnings of the French and English gunflint manufacturing traditions are poorly documented, neither can be proved to have been in existence before about 1640, and they may not have been producing enough for large-scale export until decades later. Thus for much of the 17th century, flintlock weapons were being used, but gunflints were not being produced in large quantities in Europe. In the American colonies, where flintlocks were especially popular, shortages of gunflints may have occurred, thus forcing some people to make their own gunflints.

Native people were well prepared to do so, as they simply adapted the traditional stoneworking skills they had used previously for making projectile points and knives. Thus, gunflints made by native peoples are usually bifacially worked, on local cherts or ballast flint, and could take rectangular or rounded form but were usually square (Witthoft 1966: 21, 23; Kent 1983: 34).

European colonists, on the other hand, had no indigenous stoneworking tradition to call on, and so had to improvise. After all, "any piece of broken flint (i.e., an edge without cortex) will serve to draw sparks from a hardened piece of steel" (Kent 1983: 31), and thus

Figure 1. Plan of the 1995 excavations at the Aptucxet Trading Post Museum.

"17th-century spalls took all sorts of forms, many of them fashioned by unskilled knappers from any available nodule, and it is common to find examples that are little more than slightly tapering chunks of stone" (Noël Hume 1969: 220). These have been called chip gunflints (Kent 1983: 36) and the name is apt. This "do-it-yourself" gunflint tradition is well represented by the assemblage excavated recently at Aptucxet in Bourne, Massachusetts, which will be described in detail below.

The Aptucxet Trading Post Museum Site

During the summer of 1995, an archaeological field school from the University of Massachusetts, Boston, surveyed and tested a 12-acre property in Aptucxet owned by the Bourne Historical Society (Luedtke 1997). Most of our excavation focused on a house foundation traditionally designated as the location of the Aptucxet Trading Post (FIG. 1). Craig Chartier will include a full analysis of our excavations in this area in his forthcoming MA thesis, but brief background information on the site will be given here.

In 1627, Pilgrims from Plymouth Colony established a trading post at Aptucxet, on the west side of Cape Cod, in order to facilitate trade with natives and with the Dutch (Bradford 1962: 134). The original building was apparently destroyed by a storm in 1635, but by then Plymouth Colony had established a number of additional trading houses elsewhere in New England and was not dependent on Aptucxet (Cranmer 1990: 20–23). The trading post at Aptucxet may or may not have been rebuilt after the storm, but was almost certainly gone by the 1650s (Cranmer 1990: 21). In 1852 Dr. John Batchelder and William Russell tested part of a double cellar hole which underlies the current Museum building, and announced that they had rediscovered the Aptucxet Trading Post (Keene 1973: 167). The Bourne Historical Society acquired the property in 1922, and Percival Hall Lombard performed extensive excavations in and near these foundations from 1926 through 1929. Lombard was convinced that most of the artifacts he excavated dated to the early 17th century (Lombard 1968), and his findings were used to reconstruct the structure.

Several scholars have pointed out that the form of the structure and some of the material culture associated with it appear to be later than the Trading Post period (e.g., Cranmer 1990: 54–55). The 1995 excavations, focused on the feature-rich yard to the south of the foundation and several trash dumps to the west, produced ceramics, pipes, and other artifacts clearly dating to the late 17th and early 18th centuries. Whether or not the Aptucxet Trading Post was located at this spot, a later Euroamerican farmstead certainly was located here. Furthermore, the colonial site overlaps part of a prehistoric site with at least a Middle Woodland component (Luedtke 1997). Prehistoric artifact density increased toward the canal, suggesting that much of this early site was destroyed by construction of the Cape Cod Canal.

We assumed that careful study of the raw materials, form, and distribution of the stone artifacts from the site would easily allow us to separate those made by natives from those made by the English colonists. Specifically, we expected that the stone tools left by native peoples would take familiar forms (MHC 1984), would be made of locally available materials such as quartz, rhyolite, argillite, and quartzite, and would be concentrated on the portion of the site closest to the canal. On the other hand, we expected that the English stone tools would consist mainly of gunflints and whetstones, the former would be made on European flints, and all would be concentrated near the building foundation.

We soon learned that the process of separating native from English stone tools was neither as simple nor as straightforward as expected, for several reasons. First, the English settlers sometimes re-used native artifacts. Portions of several stone pestles of native manufacture were re-used as whetstones and then discarded in the colonists' trash dumps, and the base of a quartz projectile point had apparently been re-used as a strike-a-light. Second, English colonists also appear to have sometimes used local raw materials to make both gunflints and whetstones. Third, some of the 79 flint tools and debitage we excavated showed the battered and waterworn outer surface typical of ballast flint, a lithic resource which would have been available both to

Europeans and to the native peoples who frequented this area throughout the Contact Period.

Ballast flint can be found at many ports along the eastern coast of North America, from New Brunswick to the Caribbean (Emery et al. 1968: 1226), and could have been collected by the English on the same Buzzard's Bay beaches where they sought the shellfish and fish whose remains were so abundant in the trash deposits at Aptucxet (Luedtke 1997). Beaches were also a prime source of raw materials for the native peoples of New England who frequented the coastal zone (e.g., Luedtke 1994: 67), however, and they would surely have noticed this interesting new material. Stoneworking peoples all over the world have been quick to adapt their traditional techniques to new materials such as glass (e.g., Deal and Hayden 1987: 271–273) and porcelain (e.g., Tindale 1985: 23–24) when they became available. Indeed, flint tools definitely made by native peoples have been found at other Contact Period sites (e.g., Thomas 1990: 388, 547–552; Bunker and Potter 1997) and a broken Levanna point, probably made on ballast flint and probably burned, was excavated at the 17th-century Alden House site in Duxbury, Massachusetts (Eric Johnson, personal communication, 1997).

Although both natives and colonists in New England would have had access to ballast flint, careful examination of the assemblage excavated at Aptucxet clearly indicates that it was worked by the English. First, as indicated in Figure 1, the distribution of ballast flint is tightly correlated with the house foundation and associated trash dumps; most of the flint fragments were found within 10 m of the foundation, and only two were found further than 30 m from the foundation. None were found in the area near the canal where prehistoric artifacts were most abundant. Second, marks of metal hammers can be seen on some pieces. It is very unlikely that native peoples would have abandoned their traditional hammerstones and antler flakers in favor of metal hammers in the early 17th century, during the Trading Post period. By the late 17th century, those natives who had managed to survive King Philip's War were keeping a very low profile and would have

been unlikely to be found making stone tools in the yard of a Euroamerican farm. Finally, the Aptucxet ballast flint debitage indicates remarkably poor knapping skills, especially given the high quality of this raw material compared to local quartz or felsite. To the eyes of someone used to studying native workmanship, these flint artifacts represent shockingly poor quality work.

Flintworking Technology at Aptucxet

The ballast flint at Aptucxet was apparently worked almost entirely by the technique appropriately termed "nodule smashing" (Boksenbaum 1980: 12), which is a variety of bipolar percussion flaking. In this latter technique "the flintknapper reduces the core by placing a small nodule on an anvil and applying a massive blow parallel to its vertical axis" (Kuijt, Prentiss, and Pokotylo 1995: 117). It should be pointed out that the term "anvil" in this context refers to any hard surface, such as a rock, although metal anvils could have been used. Bipolar percussion has been used by many stone tool making societies, especially in parts of the world where raw material is scarce and had to be used intensively, or where raw material was available only in small nodules (Kuijt, Prentiss, and Pokotylo 1995: 117). Both of these circumstances probably apply to Aptucxet, but I would add a third circumstance as well: bipolar percussion will be used when the stoneworkers do not know any better techniques.

Ballast flint may have been a relatively scarce resource. Although numerous cobbles of ballast flint can still be found on some beaches, such as those adjacent to Pemaquid in Maine, I have not found them to be very common on the beaches of eastern Massachusetts. Furthermore, many of the available ballast flint cobbles are indeed small, and bipolar percussion is virtually the only way to break small round pebbles (Binford and Quimby 1963: 277). Even native peoples may have used this method in the initial stages of working such small nodules. Once the pebble was split, however, native stone workers would surely have switched to techniques such as soft hammer percussion or pressure flaking to form and finish their tools. The

Aptucxet ballast flint debitage shows no signs of these procedures, and in fact several small core remnants suggest that the Aptucxet knappers did not understand even the basic principles of knapping. Flint preserves and displays percussion cones beautifully, and such marks on the core remnants indicate that the Aptucxet knappers were hitting the cores repeatedly in inappropriate places. Multiple percussion marks occur adjacent to obtuse edges, or too far in from the edge to remove a flake. In other words, nodule smashing appears to have been virtually the only stoneworking technique the Aptucxet knappers had at their disposal.

Nodule smashing is probably an obvious solution for non-specialists who wish to make simple stone tools. Boksenbaum found nodule smashing to be a common technique in Mesoamerican villages as early as the Pre-classic, where it was used by ordinary people to produce sharp-edged flakes for casual cutting and scraping tasks (Boksenbaum 1980: 13). Meanwhile, stoneworking specialists in those same Mesoamerican societies produced exquisite and uniform obsidian blades, as well as extraordinary and intricate obsidian and chert eccentrics.

Nodule smashing was apparently adequate to produce the rudimentary tools being made at Aptucxet. The entire flint assemblage, consisting of 79 pieces, was sorted into gunflints, strike-a-lights, and debitage, primarily on the basis of the use wear visible under low power magnification (10× to 45×). Flint fragments were classified as debitage if they did not show any obvious use wear. In order to classify the rest, I first examined as many gunflints and strike-a-lights as I could find, in collections at U Mass Boston and elsewhere, in order to become familiar with the type of wear these tools exhibit. The working edges of the gunflints I studied showed chipping, crushing, and battering that usually extended onto both faces of the working edge, although this was complicated by the fact that the working edge had usually been retouched unifacially. Kenmotsu examined a much larger assemblage and found that gunflints were typified by the following kinds of use wear, in order of abun-

dance: 1) step flaking (usually unifacial); 2) smoothing (usually bifacial); and 3) crushing and flat flakes (Kenmotsu 1990: 111). She did note that bifacial wear was more common on pistol flints, because of the way the flint impacts the frizzen (Kenmotsu 1990: 104). A third source of use wear information is a series of photographs of gunflints taken in the course of their use; these show considerable variation but bifacial flaking and crushing are typical, though usually more developed on one face than the other (Hamilton and Emery 1988: 163–178).

Only one strike-a-light was available to me for study, and most of the use wear on it consisted of steeply angled flaking that was usually unifacial, or bifacial but on different portions of the edge. Metal marks were also very common, often showing as short streaks perpendicular to the working edge. Runnels described use wear on a series of ethnographic strike-a-lights as typified by "bifacial and invasive flaking with scattered splintering and crushing" (Runnels 1994: 11). Most of his examples had been used on more than one edge, and had visible streaks of iron as well. Obviously, strike-a-light use wear will be different if the flint is struck against the key than if the key is struck against the flint, and both procedures appear to have been used at Aptucxet. One additional complication is the fact that some tools may have been used first as gunflints and then as strike-a-lights.

The Aptucxet flint ranges in color from black (10YR2/2), to gray (10YR6/2, 10YR5/2) to brownish gray (10YR4/2), with a small number of tan to golden (10YR4/4, 10YR5/4) pieces (Munsell 1973). Of the entire assemblage, 80 percent fall in the black to gray range, 11 percent in the yellow to tan range, 3 percent were red or pink, and 6 percent were burned to the point that original color could not be determined. These proportions were relatively similar for gunflints, strike-a-lights, and debitage. The presence of multiple fragments of flint in some provenience units encouraged me to try refitting, or cross-mending, but this was not very successful. Only two pieces could be matched, and these will be described below. Although flint color

Figure 2. Chip type gunflints from Aptucxet, Massachusetts: a, EU 15/60-65 SW (dorsal); b, TH/5/10-20 (dorsal); c, EU 4/30-35 NW (dorsal); d, EU 5/60-65 SW (dorsal); e, EU 10/20-25 NW (dorsal); f, EU 15/20-30 (dorsal); g, EU 9/40-50 (dorsal); h, EU 11/55-60 F. 13 (dorsal); i, EU 15/60-65 SW (ventral); j, TH/5/10-20 (ventral); k, EU 4/30-35 NW (ventral); l, EU 5/60-65 SW (ventral); m, EU 10/20-25 NW (ventral); n, EU 15/20-30 (ventral); o, EU 9/40-50 (ventral); p, EU 11/55-60 F. 13 (ventral).

and inclusions can vary a great deal within nodules, my best guess is that about 25 small nodules are represented in the flint assemblage we excavated.

Aptuxet Gunflints

Nine items identified as gunflints are shown in Figure 2, and are described in Table 1. All are oriented with heel to the top and working edge pointing down. Only two of the gunflints in this sample appear likely to have been imported from Europe. One (FIG. 2a) is a spall type gunflint made on dark gray flint, showing the classic characteristics of this type. It was found in EU 15, 30–35 cm deeper than one of the chip gunflints, but in an area where earlier excavations and landscaping have caused considerable disturbance. The other (FIG. 2b) appears to be a remnant of a French gunflint made on yellow flint, though the extent of the use wear makes it difficult to be certain. This gunflint was apparently heavily used until it broke, and then both of the broken sections were used some more, one as a gunflint and the other (discussed below) as a strike-a-light. They were found in provenience units about 10 m apart.

The rest are apparently of local manufacture, and are examples of the chip gunflints described by Kent (Kent 1983: 38). One (T2/7/0–10) is only a fragment, so its dimensions are given in brackets in Table 1. The small size of these gunflints suggests that they may have been used in pistols. For example, Hamilton and Emery state that 18th-century pistol or tradegun flints were usually less than 20 mm in width, tradegun flints were 20–28 mm, flints for fowlers and carbines were 28–34 mm, and musket flints were greater than 34 mm (Hamilton and Emery 1988: 20).

Fundamentally, it appears that the Aptuxet ballast flint knappers smashed nodules and then looked through the resulting fragments to find those that had a wedge-shaped cross-section and a relatively straight edge located opposite, and parallel to, the thick end of the wedge. Other attributes could vary considerably, but although the Aptuxet gunflints appear heterogeneous, they are actually fairly uniform for some attributes (TAB. 1). Length, measured from heel to working edge,

is rather surprisingly consistent, though again, this may be a function of the stage at which the gunflints were discarded because they had become too short to work properly. Thickness is also fairly consistent, though width varies a great deal. Spine angle, the angle of the wedge itself, is usually smaller than the angle of the working edge, which conforms fairly well to the 60° angle said to be optimal for gunflint edges (de Lotbiniere 1984: xi). The shape of the working edge could vary somewhat, both in plan and profile view, but most were straight. Flake striking platforms were most often at the heel, but could also be at the sides. Remnants of cortex are common. The spatial distribution of gunflints included all sides of the foundation, but most were found to the south in the area that would have been the backyard of the homestead.

Aptuxet Strike-a-Lights

Strike-a-lights were even more variable than the chip gunflints made at Aptuxet; virtually any piece of flint could be used for this purpose. As mentioned above, some may have been used-up or broken fragments of gunflints. The ones that appeared to have been used most heavily had rather obtuse angles on the worked edge, but fairly thin flakes were also sometimes used. Table 2 shows the range of attributes. As there is no standard orientation of these tools, length in this case is simply the longest dimension. Shape and cross section are both very approximate; the nearest geometric form was used, but none of these tools are truly symmetrical. Most were used on more than one edge, and most had remnants of cortex.

There is no evidence that early strike-a-lights were expected to take a particular form. "In seventeenth century sites, there is no typological difference between a gunflint and a flint used against a fire-steel. They can only be distinguished from one another by use-marks" (Witthoft 1966: 30). More formal strike-a-lights were produced later, as a by-product of the gunflint industry. Some authors state that strike-a-lights can be distinguished from gunflints by the fact that flake scars on the dorsal surface run longitudinally, or parallel to the length, rather than perpendicular as in gun-

Table 1. Aptucxet gunflint attributes.

Catalog #	Raw Material	Length (mm)	Width (mm)	Thickness (mm)	Spine Angle	Edge Angle	Edge Plan	Edge Profile	Cross Section	Platform Location	P/A Cortex
Degrees											
EU 15/60-65SW	med. gray flint	17.10	24.50	5.90	30.00	50.00	straight	sl. convex	wedge	heel	heel
T H/5/10-20	honey flint	13.40	18.10	7.40	40.00	80.00	sl. convex	straight	wedge	side	no cortex
T 2/7/0-10	med. gray flint	7.70	5.20*	5.40*	*	*	*	*	*	side	platform
EU 4/30-35 NW	black flint	16.20	29.00	9.00	50.00	50.00	straight	straight	wedge	sides; bipolar	dorsal face
EU 5/60-65 SW	med. gray flint	16.20	27.80	8.00	45.00	50.00	straight	straight	wedge	heel	no cortex
EU 10/20-25 NW	med. gray flint	15.90	21.70	9.70	30.00	55.00	straight	straight	wedge	heel	no cortex
EU 15/20-30	burned flint	14.80	21.10	8.60	40.00	45.00	straight	sl. convex	wedge	heel	on side
EU 9/40-50	white quartz	17.50	31.50	6.10	30.00	50.00	convex	straight	wedge	sides; bipolar	no cortex
EU 11/55-60 F.13	white quartz	14.70	14.40	10.70	35.00	70.00	straight	straight	wedge	heel	heel
Mean		15.73	23.51	8.18	37.50	56.25					
Standard Deviation		1.35	5.79	1.68	7.56	12.17					

* gunflint fragment, data not available.

Table 2. Aptucxet strike-a-light attributes.

Catalog #	Raw Material	Length (mm)	Width (mm)	Thickness (mm)	Spine Angle	Edge Angle	Shape	Cross Section	Edges Battered	P/A Cortex	P/A Metal Marks
T G/6/20-30	honey flint	16.40	15.20	6.80	30.00	40.00	triangle	wedge	2	A	A
EU 2/30-35 NE	black flint	31.80	16.00	4.90	60.00	60.00	diamond	parallelogram	2	P	A
EU 9/55-60 SE	burned flint	21.70	15.70	10.40	30.00	40.00	triangle	triangle	2	A	P
EU 9/95-100 SW	med. gray flint	15.30	14.00	14.00	30.00	30.00	rectangle	lenticular	2	A	P
EU 9/95-100 SE	dk. gray flint	21.60	15.70	10.10	60.00	80.00	triangle	dome	2	P	P
EU 10/20-25 NW	dk. gray flint	17.20	14.80	7.30	70.00	70.00	triangle	wedge	2	A	A
EU 10 25-30 SW	med. gray flint	23.60	11.40	9.30	70.00	80.00	rectangle	triangle	2	A	A
EU 11/30-35 NW	dk. gray flint	18.90	17.60	5.00	varies	varies	rectangle	wedge	2	P	A
EU 12/55-60 NE	med. gray flint	43.40	23.30	10.50	varies	varies	irregular	wedge	2	A	A
T F/6/30-40	gray quartz	20.90	17.80	6.40	varies	90.00	irreg. rectangle	rectangle	4	A	P
T H/6/20-30	white quartz	22.90	17.70	6.30	40.00	80.00	irreg. rectangle	wedge	3	A	P
EU 4/15-20 NE	white quartz	25.20	18.80	6.90	50.00	80.00	irreg. rectangle	parallelogram	3	A	A
EU 12/25-30 NE	white quartz	27.20	19.20	5.80	50.00	50.00	rectangle	lenticular	3	P	P
Mean		23.55	16.71	7.21	49.00	63.64					
Standard Deviation		7.49	2.90	2.20	15.95	20.63					

Table 3. Aptuxet flint debitage and attributes of shape and size.

Flake Type	2-3 cm	1-2cm	0.5-1cm	0.5cm	Total
Normal		3	9	1	13
Chaotic	2	15	7		24
Blocky	3	1	1		5
Bipolar		4	1		5
Orange Slice		1	1		2
Broken Across	1	4	5	1	11
Split Lengthwise		2	1		3
Total	6	30	25	2	63

flints (Clarke 1935: 54; Skertchly 1984: 36-37). Others state that gunflints found to be irregular were "recycled" as strike-a-lights (Smith 1960: 60). Runnels illustrates a museum collection of 18th- through 20th-century strike-a-lights, or tinderflints, and they show a considerable variety of shapes, though most are rectangular. Somewhat less common in his assemblage are oval or U-shaped strike-a-lights. They also come in a variety of sizes; lengths range from 15-50 mm with the median at 30, widths from 13-58 with the median at 25, and thicknesses from 5-45, with the median at 9.5 mm (Runnels 1994: 11). The Aptuxet strike-a-lights fall within these ranges, although at the smaller end. Strike-a-lights are distributed at this site primarily to the south and west of the foundation; three were found in a deep trash dump northwest of the foundation, along with ashy waste that may have been the residue from smithing activities.

Aptuxet Debitage

As Table 3 shows, most of the 63 flakes in this assemblage are small, measuring between 0.5 and 2 cm in maximum dimension. This may be another indication of raw material scarcity, which would have encouraged knappers to work each piece of flint until it was too small to work further. The same table shows how the assemblage is characterized by flake type. For this study, a normal flake was defined as one which had both a dorsal and ventral face as well as a striking platform and a termination. Chaotic flakes did not possess these usual flake features, and in fact many were non-orientable, so that it was impossible to determine the direction from which force

had been applied. Intersecting faces and multiple cones of percussion were also found on such chaotic flakes (Boksenbaum 1980: 14-15). High proportions of broken and non-orientable fragments, many of which retain cortex, are said to be very characteristic of bipolar percussion (Kuijt, Prentiss, and Pokotylo 1995: 123-124). Blocky chunks also lacked obvious flake characteristics, and most were probably small core remnants. Bipolar flakes were usually elongated and had platforms and bulbs of percussion at both ends. They are classic indicators of the bipolar percussion technique (cf. Binford and Quimby 1963). "Orange slice" flakes are curved and wedge-shaped, like a segment of an orange. Finally, broken flake fragments were separated into those broken across the flake, and those broken lengthwise, which are also known as split flakes. The only comparable published assemblage of which I am aware is that from the St. John's site in St. Mary's City, Maryland, which was only divided into primary and trimming flakes. The authors comment, however, that there is "no evidence for a standardized, sequential manufacturing process" (Miller and Keeler 1986: 8), and this statement certainly describes the Aptuxet debitage as well.

Only 13, or 20.6 percent of the total, are the normal flakes that would dominate assemblages produced by native knappers. For comparison, 88 percent of the felsite flakes and 78.6 percent of the quartz flakes attributed to the Middle Woodland component at Aptuxet were classified as normal flakes. Debitage was distributed slightly more widely than gunflints or strike-a-lights at the site, but was most dense in the backyard and in historical trash deposits.

Table 4. Aptucxet flint debitage and raw material attributes.

Color	No Cortex	White Cortex	Battered Cortex	Weathering Rind	Total
Gray/Black	22	6	4	3	35
Gray-brown	12	3			15
Tan/Honey	4	1		2	7
Red/Pink	1	1			2
Burned	3		1		4
Total	42	11	5	5	63

Table 4 shows the debitage sorted by flint color and by cortex type. Both the range of colors and the variety of cortex remnants are compatible with ballast flint. Furthermore, while uniform coloring was an important characteristic of the flint nodules chosen by gunflint specialists (Luedtke 1999b), ballast flint varies greatly in quality and often has spots, fossils, and areas that are opaque or of a different color. The debitage from Aptucxet shows this motley variety.

Unfortunately, we cannot easily determine the original source of this ballast. Dutch, French, and English ships all frequented Buzzard's Bay during the 17th century, and any of these ships could also have taken on ballast in places other than their home ports. Most of the Aptucxet flint is gray or black, and a popular rule of thumb is that black flint is from England and blond or honey-color flint is from France (e.g., Noël Hume 1969: 220). Like many such generalizations, there is a kernel of truth, especially with regard to the later specialist-made gunflints. Black and gray are indeed the most common colors for flint from southern England, including the important deposits near Brandon. Black and gray flint can also be found in many other parts of Europe, however, including Denmark (Micheelsen 1966), Sweden (Lidmar-Bergstrom 1986: 191), Germany (Schmid 1986: 3), and France, where it was sometimes made into gunflints (Smith 1960: 49). Larick reports that blonde and black flint nodules alternate in beds throughout the Upper Cretaceous sequences in the Perigord region (Larick 1986: 113). In fact, black and gray are the most common flint colors throughout the Chalk

Flint deposits, probably because of the way the chalk flint forms (Luedtke 1992: 29–31).

Blond or honey-colored flint is less common, and is indeed strongly represented in the flint deposits near St. Aignan, where the French gunflint industry was concentrated (Smith 1960: 69). This color is also available elsewhere in Europe, however, including Italy (Woodall, Trage, and Kirchen 1997). In fact, yellow, orange, brown, pink, and red flint are especially common in beach and stream gravels, due to groundwater staining (Shepherd 1972: 122). These are exactly the types of sources likely to be loaded for ballast. Thus, it is not surprising that Emery found microfossils to be a more promising means than color for distinguishing flints from the different parts of Europe (Emery 1980). Such studies have not been done on the Aptucxet flint, leaving its ultimate source up in the air.

Quartz at Aptucxet

One final surprise of the Aptucxet lithic assemblage was the realization that the knappers who worked the ballast flint apparently tried their hand at the quartz as well. At first, the quartz and felsite flakes found in the historical trash dump areas were all assumed to have been created by the prehistoric inhabitants of the site, and deposited along with soil scraped up from elsewhere to fill the trash pits. Close examination of some of the quartz debitage revealed pebble fragments with the same distinctive metal hammer marks seen on the flint, however. Before this discovery, the quartz debitage from the entire area had already been classified as either flakes or

Table 5. Comparison of quartz debitage from prehistoric vs. historical contexts.

<i>Provenience</i>	<i>Quartz Flakes</i>	<i>(%)</i>	<i>Quartz Shatter</i>	<i>(%)</i>
STPs Near Canal	22	(78.6)	6	(21.4)
EUs and STPs Near Foundation	33	(35.9)	59	(64.1)

shatter (blocky chunks without clear flake features). As Table 5 indicates, quartz debitage found in the area where the prehistoric component predominates has a higher proportion of normal flakes, while the debitage associated with the house foundation and historical trash dumps included more blocky shatter. This finding strongly supports the idea that quartz was also being worked by the nodule smashing technique. As quartz pebbles would have been available on the same beaches as the ballast flint, it is not really surprising that their spark-making properties were tested.

Two wedge-shaped quartz fragments showed the same usewear as the gunflints, and were classified with them (FIG. 2g, h). Several others, including one that was clearly the reworked base of a stemmed point, showed the wear typical of strike-a-lights. All were distributed in the same trash deposits as the flint tools. Though quartz might seem a very unpromising raw material for producing sparks, Witthoft reports native-made gunflints made from quartz pebbles on Long Island, New York (1966: 22), and quartz gunflints are also known from Pennsylvania (Kent 1983: 34).

Why Home-made Gunflints?

It has been suggested above that "do-it-yourself" gunflints were made because imported gunflints were unavailable or in short supply, but other explanations are also possible. For example, gunflints may have been easily available but relatively expensive in the 17th century, encouraging poor people to make their own. It is also possible that expectations for gunflint performance at this time were so low that they were easily satisfied, even by non-uniform gunflints. Finally, the Aptucxet assemblage might represent idiosyncratic experimentation, the product of an early example of the stereotypical frugal and independent Yankee. Further information is available to evaluate some of these possibili-

ties, which are obviously not mutually exclusive.

The least likely hypothesis is that the cost of gunflints prevented the people living at Aptucxet in the late 17th century from buying them. The types of ceramics and other artifacts excavated indicate that the people who experimented with ballast flint were very comfortable, though not wealthy (Dowd 1998). On the other hand, flint debitage was especially strongly associated with the servants' quarters at the St. John's site, suggesting that cost may have been a motivator there (Miller and Keeler 1986: 10).

It does seem very likely that 17th-century flintlock weapon users were willing to accept fairly high misfire rates. We expect a gun to fire every time we pull the trigger, but during the 17th century flintlock technology was still very new and fallible for many reasons. Misfires also were not usually fatal, as they were generally quiet and did not alarm the prey. Some hunters even believed the flash was helpful in that it caused curious ducks to raise their heads from the water, thus increasing the chance of hitting them (Skertchly 1984: 3-4). Skertchly experimented with the late square variety of gunflints fired in a pistol, and concluded that 30 shots would be about all you could expect from a flint; he also found that misfires were relatively common, even with new flints (Skertchly 1984: 4). It also seems likely that the Aptucxet gunflints were used in pistols, which were probably not the primary hunting weapons. Misfires would thus be even less crucial in this case.

The distribution of the flint assemblage suggests that much of it may date to a fairly short time period, lending some support to the "frugal Yankee" hypothesis. Although we excavated a total of 162 50 x 50 cm shovel test pits and 14 1 x 1 meter squares at the site, 31 of the 79 pieces of flint, including a gunflint and a strike-a-light, came from just three adjacent squares. These squares were excavated

through a trash deposit that can be dated to the period of 1673 to 1680, on the basis of ceramics and pipes (Craig Chartier, personal communication, 1997). Thus, it is possible that experiments with making gunflints were a short-lived phenomenon at Aptucxet, perhaps just one person's efforts. Flint was also found in virtually every unit to the south of the house foundation, however, so we cannot rule out experimentation over a long period, and by more than one person.

The fact that do-it-yourself gunflints are not unique to Aptucxet does suggest that a more general cultural process is involved. Many other early colonial sites on the East Coast have produced evidence that flint was being worked into gunflints locally by Europeans, perhaps some of whom were known to the people at Aptucxet. Spalls made from ballast flint were excavated at the R.M. site in Plymouth, Massachusetts, which is dated 1635–1675 (Blanchette 1980: 69). Emery et al. report that flint debitage, most likely from ballast flint, was excavated from a hut near Provincetown, Massachusetts, associated with pipes and coins dated between 1688 and 1720 (Emery et al. 1968: 1225). Cranmer interprets the considerable quantity of gray flint debitage to mean that the English were also making some of their own gunflints at Cushnoc, a trading post on the Kennebec River (now in Maine) established by Plymouth Colony from 1628–1661 (Cranmer 1990: 94). Gray flint debitage suggestive of local gunflint manufacture was found associated with both the 17th- and 18th-century occupations at Pemaquid, Maine (Bradley and Camp 1994: 68).

Further afield, the St. John's site in St. Mary's City, Maryland, has been mentioned repeatedly above, as it provides the best comparison for the Aptucxet assemblage. Miller and Keeler (1986) give perhaps the most thorough description of 710 fragments of flint tools and debitage from this site, which was occupied from 1638 through 1715. Chip gunflints were more common in the early features at this site, but were found in features of all time periods (Miller and Keeler 1986: 10). As at Aptucxet, spall and French blade type gunflints were also found, though the chip gunflints predominated. The authors attribute this to shortages, noting that "stocks of imported

flints are very rarely noted in merchants' inventories or account books from the seventeenth and early eighteenth century Chesapeake" (Miller and Keeler 1986: 12).

Summary

It is likely that "do-it-yourself" gunflints may be more common than we realize at 17th-century sites in the eastern U.S., but have been under-recognized by archaeologists because of their non-uniform shapes. As Figure 2 indicates, over-all appearance is not diagnostic for chip gunflints, but they can be fairly easily identified under low-power magnification by the presence of battering on their edges. Archaeologists would be well advised to look closely at their 17th-century assemblages for evidence of chip gunflints, as a number of interesting questions would benefit from further research. First, is the do-it-yourself gunflint primarily a coastal phenomenon, inspired by the presence of the ballast flint that was clearly the "right" material for gunflints? Native peoples apparently carried ballast flint considerable distances inland (cf. Bunker and Potter 1997) but did European peoples also do so? Did colonists further inland ever make chip type gunflints from locally available cherts, or from other siliceous rocks? Were poor people more likely to make their own gunflints, or did shortages cross-cut economic categories? Is there additional documentary evidence for gunflint shortages?

In summary, it is argued here that military demand for gunflints beginning at the end of the 17th century led to a renaissance of flint-knapping skills among specialists in France, England, and elsewhere in Europe. This new stoneworking tradition continued well into the 20th century, though it was clearly in decline by the time it was documented at Brandon in East Anglia in the late 19th century. Here, full-time flintknapping specialists developed a blade core technology of which any Upper Paleolithic knapper would have been proud, to produce gunflints so standardized and uniform that they could only be a product of the Industrial Revolution (Luedtke 1999b). Yet large-scale gunflint production involving full-time specialists was primarily an 18th- and early 19th-century phenomenon in both

France and England, probably fueled by the almost continuous warfare of that period. Before the 18th century, it seems likely that gunflints were produced on a much smaller scale, perhaps as a cottage industry, which may have been sufficient to supply the European market, where flintlock weapons were used primarily for upper class sporting purposes in this period (de Lotbiniere 1980: 154).

Flintlock weapons had become standard and indispensable for both subsistence and defensive purposes in the American colonies decades before they were adopted by the armies of Europe, however, and this apparently created a demand for gunflints that was greater than the available supply of imported flints. For this reason, some colonists made some of their own gunflints from ballast flint. Far from regaining the knapping skills of their Neolithic ancestors, the English colonists at Aptuxet used a crude but simple expedient to meet their needs.

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