Use-Wear Under Fire: An Experimental Use-Wear and Functional Analysis of Gunflints

Colin P. Quinn, Department of Anthropology, University of Michigan

Abstract

Despite their ability to aid in reconstructing past economic and social practices in the historical periods, remarkably few studies have looked at gunflints. In this study, experimental tests were conducted using various raw materials to analyze use-wear patterns and to examine gunflint firing reliability. Through experimental archaeological techniques, it is argued that macroscopic and microscopic use-wear patterns are not attributable to firing intensity. Additionally, a range of effectiveness for gunflints is experimentally verified, along with variation in firing reliability based on raw materials and production techniques.

Introduction

Despite their ability to assist in reconstructing past technological, economic, and social practices at historic period sites, there have been relatively few archaeological studies performed on gunflints. Most research focused on gunflints have concentrated on identification of an artifact as a gunflint, the gunflint's country of origin, and other descriptive attribute of these implements. This study addresses the dearth of information on use-life and use-wear patterns of gunflints. Previous archaeological and experimental research had concluded that unifacial step flaking associated with smoothing of the worked edges is the prototypical gunflint use-wear pattern (Kenmotsu 1990). This pattern has been classified as unique to gunflints and has allowed archaeologists to categorize artifacts in a collection that exhibited these wear patterns as gunflints, and also estimate their use-life based on the kind and severity of use-wear present.

This research project was designed to evaluate if there is indeed a unique use-wear pattern that increases systematically each time the flint strikes the frizzen. Using microscopic and macroscopic observation techniques, use-wear patterns a modern experimental sample are documented in an attempt to reconstruct artifact use-life. Accurate assessments of use-life devised from controlled experimental samples ideally could be compared with archaeologically recovered gunflints to provide an important tool for archaeologists looking to reconstruct economic and social behavior in the past. Additionally, if use-wear analyses were accurate, archaeologists could evaluate if gunflints were being used differently in varying regional and cultural contexts. As the results of this research project will show, these idealized applications of microscopic use-wear analyses are currently (and potentially permanently) unreliable in their assessment of gunflint use-life. Based on numerous historic and methodological factors related to the use of gunflints, the manufacturing process of these artifacts, and limitations of certain archaeological analyses, microscopic use-wear studies are unable to quantify use-wear intensity and equate it to firing intensity. Instead, other variables such as angle that the gunflint strikes the frizzen and quality of the gunflint raw material, affect microscopic and macroscopic use-wear patterns more than intensity of use.

Another topic that this study addresses is one that has been somewhat overlooked in experimental archaeological literature; firing reliability. Experimental research was conducted to determine if differences in raw material and manufacturing processes affected the likelihood of shots being fired. Firing reliability was evaluated by comparing the number of charges lit and the number of times the flint strikes the frizzen. Studies of differences in the numbers of shots fired per gunflint can lead to a more accurate understanding of variables that contribute positively and negatively towards successful shots. Additionally, testing firing reliability may allow archaeologists to quantify the relative amount of utility in one gunflint edge which can provide researchers with an estimate of firing reliability for each gunflint edge before it would be advantageous to retouch or discard the gunflint. Based on experimental replication, I argue that blade-core manufacturing with Brandon flint provides more firing reliability than machine cut agate due to physical properties of each type, and that gunflints are effective for 50 strikes against the frizzen, which equates to roughly 20 firings.

Background

Gunflint production started in the 1600s with the invention of snaphance guns (Lenk 1965). Manufacture of flintlock rifles began in 1650 (Chapel 1962). The gunflint itself was used to produce a spark to ignite the black powder in the frizzen pan of a flintlock rifle (Hamilton 1964. All gunflints were manufactured abroad, primarily in specialist workshops in France and England, and were then imported into the United States (Woodward 1960). Gunflints of French origin were the most common in the United States until 1790, when production of Brandon flint in England began (Kenmotsu 1990). English Brandon flints rapidly replaced French flints as the gunflint of choice for people in the United States. The distinction between flint sources has often been based on color (e.g., Witthoft 1966:30,36), though this can be problematic as different sources can produce similar color flints (Luedtke 1999). Gunflint manufacturing techniques changed from gunspall production to blade-core production c. 1790, and only recently have gunflints been mass-produced by machine cutting.

Previous research has focused a variety of topics ranging from spatial distribution analyses (Hamilton 1960) to economic investigations (Russell 1957). Barbara Luedtke (1999) has investigated what makes a good gunflint, and many of her variables such as working edge and size, do show evidence of variation in efficiency along with aesthetic decision making processes by gunflint users. Nancy Kenmotsu's (1990) research project added a dimension of use-wear analysis to the literature. Kenmotsu microscopically examined 38 gunflints from modern and archaeological contexts and proposed a use-wear pattern for gunflints based on her observations, and her insightful study suggested that additional work would be a fruitful avenue of research (Kenmotsu 1990; Luedtke 1999). The previous work on gunflints conducted by these researchers and a host of others increase the visibility of gunflint studies while barely scratching the surface of potential technological, economic, and social issues that can be addressed with gunflints. It is in this light that this study attempts to build upon previous gunflint studies with the aide of controlled experimental replication of gunflint technologies.

Materials and Methods

To formulate a modern sample of gunflints for the experimental work, a flintlock rifle and gunflints first had to be obtained. Twenty gunflints were purchased for this study: ten English Brandon gunflints manufactured with blade and core technology and ten gunflints machine cut from Brazilian agate. Archaeologist and flintlock enthusiast Dr. James Bellis (University of Notre Dame) donated his homemade flintlock rifle for use in the experiments. Fine grained black powder was also used in the frizzen pan, though no projectiles were loaded into the weapon.

First, a gunflint was fitted into the cock. The frizzen pan was then loaded with a small amount of black powder. Then the frizzen pan was covered with the frizzen, the cock was pulled back, and the trigger was pulled. This action created sparks which had the opportunity to light the black powder in the frizzen pan. A successful shot is attained when the sparks produced from the flint striking the frizzen ignite the black powder in the frizzen pan. In use, this ignition would then light black powder in the barrel, firing the round. For this experiment, the barrel was not loaded with powder or a round because a lighting of the frizzen pan's black powder almost assuredly would guarantee a shot to be fired. Each flint was used for a specific number of shots. Six flints from each raw material (English Brandon flint and Brazilian agate) were used. One flint of each material was not shot to provide a control specimen. The other five flints struck the frizzen 10 times, 20 times, 50 times, and 100 times. Each time, it was recorded whether the sparks produced by the flint striking the frizzen resulted in a successful shot.

For microwear analysis, a 10–70 power light microscope, the same power as used by Kenmotsu (1990), was used for analysis of the use-wear patterns. Each modern gunflint was examined microscopically and a Lithic Use-Wear Pattern data sheet (Figure 1), modeled on Kenmotsu's (1990) and Ahler's (1979) data collection sheet, was completed for each gunflint. The Lithic Use-Wear Pattern data sheet examined the presence or absence of blunting, smoothing, polishing, step-fracturing, crushing, flat flaking, striations, and residue on the edges of the gunflints. The definition of these use-wear terms was taken from Ahler (1979).

Raw Material	English / Brandon Flint
Number of times fired	20
Date	11/30/03
Researcher	Colin Quinn
Wear Type	
Blunting	0(0)
Polishing	0(0)
Step-fracturing	3(0)
Crushing	4(1)
Flat Flaking	4(1)
Striation	0(0)
Residue	Metal
Number of worked edges	4
Number of used edges	1

Figure 1. Lithic use-wear pattern data sheet.

Expectations

Use-Wear

Based on previous studies, I expected to find a number of characteristics of the gunflints that would signify uniform use-wear. First, it was expected that use-wear patterns would become more severe as use-life increased. Severity of gunflint use-wear patterns would be indicated by macroscopic observation and by high levels of step fracturing, blunting, and polishing on the working surface. It was also expected that the use-life of the gunflints, specifically the number of times it has been fired, could be determined through microscopic analysis. In Kenmotsu's (1990) research, 100 percent of the working edges of the gunflints exhibited step fracturing. It was expected that this work would reflect her data, and that all worked edges would have step fractures.

Finally, in Kenmotsu's (1990) study, analysis of use-wear was not limited to gunflint edges that had been used to strike the frizzen. She included all edges that exhibited use-wear, not differentiating between firing use-wear and manufacturing use-wear. In this study, the number of edges used and which edges struck the frizzen is known. It was expected that the used edges would have more severe use-wear patterns than the unused edges, especially in blunting, crushing, and step-fracturing.

Firing Reliability

First, it was expected that the reliability of the gunflints would decrease with an increase in the number of times the flint struck the frizzen. Second, drawing upon U.S. military records, it was expected that a gunflint edge would only be reliable for 20 rounds (Chapel 1962). It has been put forth in archaeological literature that light serrations on the working edge produced during the knapping process increase the number of sparks sent into the frizzen pan, resulting in more successful shots (Kenmotsu 1990). It was therefore expected that the English Brandon flint manufactured using the blade-core technology would fire more consistently than the machine cut gunflints. Finally, it was expected that the English Brandon flint would produce a larger number of successful shots because of its popularity for nearly 100 years as the premier gunflint material.

Results

Use-Wear

Upon completion of the experimental portion of the project, the gunflints were analyzed under a microscope and data recorded on Lithic Use-Wear Pattern data sheets. The information from the data

sheets is summarized in Table 1. Used edges are those that actually made physical contact with the frizzen. Worked edges are any edge on the gunflint that exhibits fracture patterns. This includes fractured edges due to the manufacturing process in addition to the one used edge.

Blunting was found in four (66.7%) of the Brazilian worked edges and two (7.7%) of the English worked edges. There were no recorded instances of smoothing of the edges in this experimental study. Two (33%) of the Brazilian edges, the ones that were fired over 20 times, exhibited polishing while there was no polishing found on the English gunflints. Step-fracturing was found in four (66.7%) Brazilian agates and nineteen (73.1%) English flint edges. Crushing was recorded on 2 (33.3%) of the Brazilian edges and fourteen (53.8%) of the English edges. Four (66.7%) of the Brazilian worked edges had flat flaking, while all 26 (100%) edges of the English flints had flat flakes removed. Striation was non-existent in the Brazilian agate (0%), but it was found on two (7.7%) English gunflint edges. The most common residue found on the gunflints was metal. Metal was found on one (16.7%) Brazilian gunflint and all six (100%) English gunflints. Three (50%) of the Brazilian gunflints had a black residue on the worked edge, though it was not found on the English gunflints.

Analysis of the used edges of the gunflints was also recorded. Four (80%) of the used edges of Brazilian agate had blunting, while there were no occurrences (0%) of blunting on the English Brandon flint. There were two (40%) used edges of the Brazilian gunflints that had polishing and zero (0%) English gunflints exhibited that type of use-wear. The Brazilian agate and Brandon flint both had three (60%) used edges that had step-fracturing. One (20%) of the Brazilian gunflints and two (40%) of the English flints had crushing along the used edge. Flat flaking was present on four (80%) of the Brazilian agate used edges and on all 5 (100%) of the Brandon flint used edges. While there were no striations (0%) on the Brazilian gunflint used edges, striations were present on one (20%) of the English gunflint's used edges.

Firing Reliability

Each time the gunflint struck the frizzen it was noted if that contact produced sparks that ignited the black powder in the frizzen pan. The relative frequency of successful shots is shown in Figure 3. In this chart, the average number of successful firing is computed per five shot increment. The best five shot increment for the Brazilian gunflints produced two successful firings (40%) and it occurred seven times: shots 6 to 10, shots 16 to 20, shots 21 to 25, shots 31 to 35, shots 36 to 40, shots 46 to 50, and shots 81 to 85. The best five shot increment for the English gunflints was from shots 31 to 35 when it averaged 4.5 out of five (90%). On average, at any given five-shot increment, it is 80% likely the English Brandon flint is at least equal in reliability, and usually more reliable, than the Brazilian agate. The average number of successful firings per 100 shots for the Brazilian agate was 25.2. Over the same 100 shot period, the English Brandon flint averaged 37.0 successful firings. For the English gunflints, the average number of times the flint has to strike the frizzen to fire 20 rounds is between 30 and 35 times. The Brazilian gunflints, on average, fire 20 rounds in 65 to 70 shots, about half as reliable.

Table 1. Summary of Experimental Lithic Use-Wear Pattern Data

MODERN GUNFLINT SAMPLE	TYPE OF USE WEAR						RESIDUE	# OF WORKED EDGES
	BLUNTING	POLISHING	STEP-FRACTURE	CRUSHING	FLAT-FLAKING	STRIATION		(USED EDGES)
Brazil 0	0 (0)	0 (0)	1 (0)	1 (0)	0 (0)	0 (0)	None	1 (0)
Brazil 5	1 (1)	0 (0)	1 (1)	0 (0)	1 (1)	0 (0)	Black	1 (1)
Brazil 10	0 (0)	0 (0)	0 (0)	1 (1)	1 (1)	0 (0)	None	1 (1)
Brazil 20	1 (1)	0 (0)	1 (1)	0 (0)	1 (1)	0 (0)	Black	1 (1)
Brazil 50	1 (1)	1 (1)	1 (1)	0 (0)	0 (0)	0 (0)	Black	1 (1)
Brazil 100	1 (1)	1 (1)	0 (0)	0 (0)	1 (1)	0 (0)	Metal	1 (1)
Total	*4 (4)*	*2 (2)*	*4 (3)*	*2 (1)*	*4 (4)*	*0 (0)*		*6 (5)*
Percent	*66.7% (80%)*	*33.3% (40%)*	*66.7% (60%)*	*33.3% (20%)*	*66.7% (80%)*	*0% (0%)*		
English 0	0 (0)	0 (0)	3 (0)	0 (0)	4 (0)	0 (0)	Metal	4 (0)
English 5	0 (0)	0 (0)	3 (1)	1 (0)	5 (1)	0 (0)	Metal	5 (1)
English 10	0 (0)	0 (0)	3 (1)	4 (1)	5 (1)	1 (1)	Metal	5 (1)
English 20	0 (0)	0 (0)	3 (0)	4 (1)	4 (1)	0 (0)	Metal	4 (1)
English 50	0 (0)	0 (0)	4 (1)	3 (0)	4 (1)	0 (0)	Metal	4 (1)
English 100	2 (0)	0 (0)	3 (0)	2 (0)	4 (1)	1 (0)	Metal	4 (1)
Total	*2 (0)*	*0 (0)*	*19 (3)*	*14 (2)*	*26 (5)*	*2 (1)*		*26 (5)*
Percent	*7.7% (0%)*	*0% (0%)*	*73.1% (60%)*	*53.8% (40%)*	*100% (100%)*	*7.7% (20%)*		

Discussion

Use-Wear

The macroscopic and microscopic analysis revealed no consistent use-wear patterns produced on gunflints. The only use-wear pattern that was found on all used English gunflints is flat flaking, yet this was also found on the English gunflint that was not fired (as a result of the manufacturing process). In Brandon flint, the action of the flint striking the frizzen creates step flaking, crushing, and sometimes striations and blunting. The severity of this use-wear, however, is highly variable, in contrast to the first expectation of use-wear patterns. Upon macroscopic and microscopic analysis, it was clear that the English gunflint that was fired 10 times had a higher severity of step-fractures, crushing, flat flaking, and striation on the used edge than the English gunflint that was fired 100 times (Figure 2). The English gunflint that was fired 100 times had no step fracturing, blunting, crushing, or striations on the worked edge, compared with the gunflint shot 10 times that had crushing, striations, and step fracturing on the working edge. The Brazilian gunflints were even less predictable, as the presence or absence of flat flaking, step-fracturing, crushing, and blunting did not increase systematically. The metal residue that was left on all of the English gunflints yet only one Brazilian gunflint might suggest that the Brandon flint is harder or less brittle than the Brazilian agate. The one type of wear that seems to increase with shots fired is polishing in the Brazilian agate, but Kenmotsu (1990) suggests that polishing in the archaeological record may not be found, as the gunflints are usually discarded or retouched before

they develop this severe type of use-wear. This high variability in the severity of use-wear makes it nearly impossible to determine the number of times a gunflint has been used. Factors, such as differences in individual gunflint shape and size and orientation in relation to the frizzen, appear to account for the lack of a uniform use-wear pattern that increases systematically through use.

The results rendered reconstructing use-life and site economics from the gunflints fruitless. Retouching an edge removes all of the worn material, regenerating that edge for further use. At present, it cannot be determined how many times an edge has been retouched, and in turn, the number of shots fired cannot be calculated, though this may be another avenue for research in the future.

The expectation of the presence of step-fracturing on all worked edges was also not supported by the data. Only 66.7% of the Brazilian agate edges and 73.1% of the English Brandon flint edges had step-fractures, far below the 100% found in Kenmotsu's project. This is once again evidence that there is no uniform use-wear pattern associated with gunflints.

There were differences in the use-wear analysis between the two raw materials and production techniques. The Brazilian agate had much more use-wear in the categories of blunting and polishing, while the Brandon flint had more edges with crushing, flat flaking, and striations. The template for use-wear patterns that Kenmotsu suggests does not take into account raw material. The results from this

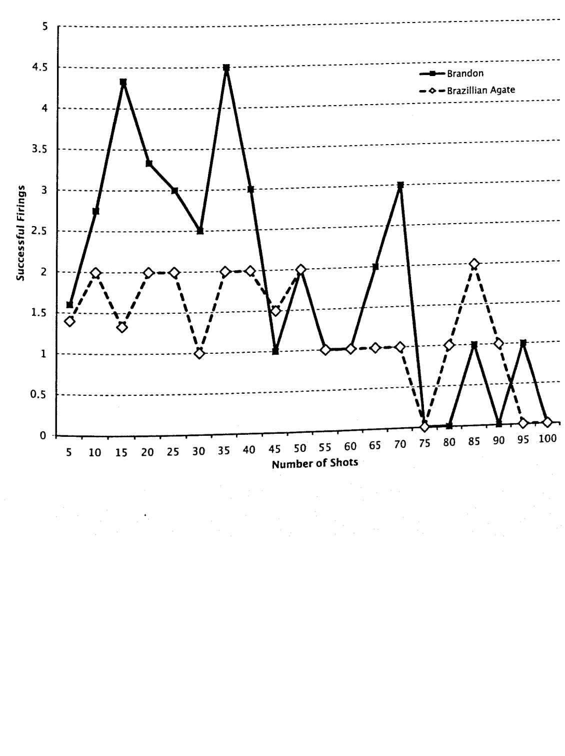

Figure 2. Relative frequency of successful shots.

experiment, however, show that gunflint material and production technique impact the presence or absence of use-wear.

When comparing the percentage of worked edges with particular use-wear patterns to the percentage of used edges with those same patterns, there is no glaring disparity. If use, rather than manufacturing process, is allegedly producing the wear patterns, then it is expected that the used edges would have significantly more wear. That is not the case in this study. For the English gunflints, the presence of use-wear patterns does not appear linked to the edge used. For example, there were two instances in blunting in the English flints, yet neither of them was on a used edge. Similarly, 53.8% of the worked edges exhibited crushing, but only 40% of the used edges showed the same. The percentage of step-fracturing was nearly identical. Increasing use-wear patterns along the used edge do not occur.

The presence of residue on the gunflint does not necessarily correlate with use-wear. In the Brazilian agate, some of the samples had black residue, most likely a result of the powder, and only one had metal on the surface. Lack of residue is not an indicator of lack of use. Presence of residue is likewise not an indicator of use. In the English Brandon gunflints, there was metal residue found on the gunflint that was not fired. The residue most likely was a result of the blade-core manufacturing process, and not a result of striking the frizzen.

Another problem with a use-wear analysis of gunflints is found in the military literature. Soldiers often fell into the habit of needlessly snapping the cock, which severely shortened the use-life of a flint (Hicks 1937). This activity would undoubtedly leave use-wear on the gunflint that is unrelated to firing of the weapon.

An important difference between this study and previous gunflint use-wear studies is in distinct knowledge of used edges verses unused edges. As shown above, apparent "use-wear patterns" are found on unused edges in addition to used edges. Kenmotsu (1990), however, did not distinguish between used and unused edges. The gunflints in her study were acquired without specific knowledge as to which edges had been used, creating a situation where all fracture patterns on the gunflints appeared to be the products of use, though this may not be the case. By separating the used from the worked edges, a more accurate set of data was developed for identifying use-wear patterns.

Firing Reliability

In tracking the flint's ability to light the black powder in the frizzen pan, it was observed that the peak effectiveness of each material was between shots 10 and 40. After the gunflint had struck the frizzen more than 50 times, it became wholly unreliable and would likely have been discarded or rejuvenated through retouch. This result supported the first expectation of firing for the project. For example, in shots 1 to 50 of the English gunflint that was fired 100 times, 27 successful firings of the black powder were produced. In contrast, shots 51 to 100 of that same flint produced only 9 successful firings. It is unlikely that in the practice, gunflint edges would be shot more than fifty times before utilization of another edge or retouching.

Perhaps the most conspicuous result of the firing experiments was the failure rate of the gunflints. The flintlock rifle's efficiency varies from gunflint to gunflint, and when people needed a sure shot, gunflints were likely to fail to fire. The average number of times the flint strikes the frizzen in order to produce 20 successful firings is 30 to 35 for English Brandon flints and 65 to 70 for the Brazilian agate. When all of the gunflints in this study are combined, the average number of shots to shoot 20 rounds is around 50. This agrees with the reliability expectation that each gunflint edge only produces quality sparks for the first 50 shots.

The U.S. Army issued one gunflint per 20 rounds in 1846 (Chapel 1962). Interviews with modern flintlock rifle enthusiasts have shown that a single gunflint usually can shoot close to 200 rounds (Kenmotsu 1990). Kenmotsu concludes that modern people using gunflints are able to maintain a longer use-life of their flints than people 150 years ago. I believe that Kenmotsu's conclusion does not take into account other factors. Modern enthusiasts often have a number of high quality flints in their kits. The mass production of gunflints in the nineteenth century could have limited the quality of individual flints. Low quality flints may not have had alternate edges to be utilized through retouching and flipping the gunflint over. In addition, in a military situation, it is much easier to simply change gunflints than try and rejuvenate them. To retouch a gunflint, the soldier would need to have additional materials in their kit, such as a stone or antler billet. The size and weight of the gunflints would make it much more attractive to carry around many of them than retouching tools. It also takes less time to change a gunflint than to retouch it. In a battle, that may mean the difference between life and death. If it was a cost/benefit decision on carrying more gunflints than may be needed, the benefits of having extra gunflints outweighed the cost of losing one's dinner, or even losing one's life (Luedtke 1999).

The raw material and manufacturing methods played a large role in predicting the success of a shot. The blade-core manufactured English Brandon flint outperformed the machine cut Brazilian agate, often at a successful firing rate of 2:1. This result was as expected, because the light serrations, which are thought to increase the number and quality of sparks, on the working edge that are produced through the knapping process of blade-core technology are absent in the machine cut material. Further investigation, isolating one of the two variables, raw material and manufacturing process, can show to what extent each affects the gunflint's quality.

Retouch Patterns and the Potential of Curational Studies of Gunflints

Many lithic analysts have worried about inaccuracies inherent in microscopic use-wear analyses (Andrefsky 2008). Microwear analyses are often plagued by inconsistent recognition by analysts resulting in a high amount of variability and limited replicibility in these methods, which place the results of these analyses on scientifically shaky ground. Even if many of these concerns are set aside, other factors in the use-life of gunflints that affect microwear intensity forces researchers to question whether microscopic use-wear analyses are as reliable as required for anthropological archaeological investigations.

Rather than abandon all hope for assessing the intensity of use-life in gunflints, new methodological techniques must be developed. One increasingly popular means of investigating lithic artifact life cycles and usage patterns are curational analyses (Andrefsky 2008). The concept of curation has been defined as the ratio of realized to maximum utility of lithic artifacts (Shott 1996; Shott and Sillitoe 2005) and has interpretive benefit for understanding lithic technological organization in the past (Quinn et al. 2008). The benefit of this definition of curation is that it is easily quantifiable and provides researchers with a valuable tool for measuring retouch intensity on lithic artifacts. Measurements of curation, referred to as curation indices, quantify morphological changes on flint objects as a result of use or intentional retouch and resharpening. Curation indices are contextually specific and must be developed while taking into account the manufacturing techniques, form and function of the tool, and retouch techniques of the specific artifact type in question (Quinn et al. 2008). Some curation indices quantify retouch intensity by measuring flake invasiveness (i.e., Andrefsky 2008; Clarkson 2002), others quantify specific morphological changes throughout the uselife of tools (i.e., Kuhn 1990), and others use allometric estimations of original tool size to estimate the amount of material that has been removed from the tool (i.e., Davis and Shea 1998; Eren et al. 2005; Quinn et al. 2008).

It may be possible to develop a curation index for gunflints that would incorporate the theoretical and methodological advances of retouch studies into gunflint research. For an adequate curation index to be developed for gunflints, several factors must be experimentally tested and archaeologically verified. First, researchers must determine which morphological characteristics of gunflints contain information about the ratio of realized to maximum utility of these artifacts. Some of these characteristics may be related to flaking patterns or changes in certain morphological dimensions of the gunflint as a result of retouch. To assess this morphological change, a variety of potential indices can be developed and tested using an experimentally produced assemblage to determine which index, or combination of indices, most accurately measures retouch in a controlled environment.

Once curation indices have been adequately tested, they can be applied to a sample of archaeologically recovered gunflints to address a suite of anthropologically and archaeologically relevant questions. Among the issues that curation based analyses of retouch intensity can address are site economics, battlefield reconstruction, and comparisons of retouch patterns by different groups or communities. A quantified measure of retouch intensity for each gunflint may reflect how many times a particular gunflint has been fired. As this study has shown, gunflint edges are reasonably reliable for firing up to 20 rounds. If researchers develop a way to measure how many times an edge has been retouched (or at least a measurement that could be compared with other gunflints), then archaeologists can begin to understand how intensively individual gunflints were used. This avenue of investigation must still account for many of the issues of firing intensity that have been raised in this paper, such as the effects of non-firing-related snapping of the gun cock, raw material quality, and angle of striking, before larger comparisons of retouch intensity are undertaken. With more experimental and archaeological research in this area, however, the relative importance of each of these factors may be investigated and potentially controlled for in any curation index for gunflints. Future curation research that addresses spatial and temporal variability in retouch patterns will make research into a wide variety of research topics possible and the importance of gunflint studies will increase exponentially.

Conclusion

This study has shown that there is no unique use-wear pattern that increases systematically each time the flint strikes the frizzen. Other variables, such as raw material, manufacturing process, angle at which the flint strikes the frizzen, and variability in different guns also affect the severity of use-wear patterns, calling into question interpretations of firing intensity based on macroscopic and microscopic analyses.

Due to a lack of systematic use-wear patterns, archaeologists are unable to categorize the use-life of gunflints in the archaeological collection when using microscopic use-wear analyses. Conclusions about cultural processes, such as site economics, which may have been supported by gunflints use-life reconstruction in the archaeological collection, cannot be made using this technique. Gunflint rejuvenation, uneven use-wear, and alternative use-wear forming activities keep archaeologists from knowing how many times a gunflint has been fired. However, future research in curation may provide archaeologists with the adequate tool kit with which to address these larger anthropological questions.

Experimental research showed that gunflint edges are only reliable for about 50 shots, or 20 rounds. This is in line with the historical military documents of the nineteenth century. It was also seen that raw material and manufacturing process dictate how effective a gunflint will be. Gunflints are surprisingly inconsistent, with most gunflints only successfully firing 40% to 60% of the time.

There are many questions about gunflints that have yet to be asked or answered. Further study into ideal raw materials and production techniques can be completed in order to find the optimal gunflint morphology. Gunflints, while found on many archaeological sites, have not at this point been adequately examined for their insights into cultural processes such as economics and cultural identity, and that step, among other methodological and theoretical advances, will lead to a better understanding of historical archaeological sites.

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Current Archaeological Investigations and Activities of the Fort St. Joseph Archaeological Project

Michael Nassaney, Erin Claussen, and Meghan Cook

The period from May 2007 through April 2008 witnessed a number of significant developments that have important implications for the future of the Fort St. Joseph Archaeological Project (hereafter the "project"). Begun in 1998, the project is a long-term multi-disciplinary initiative designed to investigate and interpret the material remains of Fort St. Joseph and related sites, promote the relevance of archaeology and history for service learning, and engage the community in the process. In May 2007, the City of Niles appointed a Fort St. Joseph Archaeology Advisory Committee to recommend future directions for collaborative research in the practice of community-based archaeology. The success of the project is measured in part by increases in public visibility and opportunities for community input and participation. The purpose of this report is to summarize the activities conducted by members of Western Michigan University's Department of Anthropology under the auspices of the project, particularly in regards to fieldwork, public education, and public outreach.

One of the goals of the project is to identify the locations of archaeological sites that may be associated with Fort St. Joseph. Toward this end, we are interested in conducting survey along the St. Joseph River in Niles Township where previous work and documentary sources suggest the locations of related eighteenth and nineteenth century sites. We obtained permission to survey about 50 acres of agricultural fields where two sites (20BE12 and 20BE55) had been previously recorded. Site 20BE12, also known as Weesaw's village, was thought to have been occupied in the first half of the nineteenth century by a local Potawatomi group. Less information is known about 20BE55 though the site files suggest that it contained evidence of Native American burials.

No evidence of mortuary activity (e.g., human bones) was noted in our survey. However, we did identify a 40 m × 50 m domestic debris scatter of predominantly ceramics, window pane glass, and bricks, with smaller amounts of shell, flakes, nails, and mortar. These artifacts probably represent the remains of a household.