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Sourcing Gunflints to Their Country of Manufacture

ABSTRACT

Some 318 gunflints recently recovered from the French *barque longue*, *La Belle,* which ran aground off the coast of Texas in 1686, and an additional 405 gunflints from the related terrestrial site of Fort St. Louis offer an opportunity to research the origins of gunflints found in the colonial period Americas. Current research suggests that the best means of addressing this question is through inductively coupled plasma-mass spectrometry (ICP-MS), comparing trace-element chemical levels in European source materials with trace-element levels in gunflints found in the New World. A small number of samples from colonial sites and European source locations were submitted to evaluate the potential of this application for sourcing chert. While the initial results are encouraging, some caution is warranted.

Introduction

In September 1996, the Texas Historical Commission (THC) began excavating *La Belle*, a *barque longue* that belonged to the noted French explorer La Salle. *La Belle* was lost in Matagorda Bay during a storm in 1686 (Figure 1). The shipwreck site offered a time capsule, 309 years old, of trade goods and supplies necessary for establishing a colony in the New World. More than one million artifacts were unearthed during the excavation, including 318 gunflints, most of which were scattered across the wreckage of the ship. The gunflints were predominantly pristine, unused examples of both spall-type and blade-type specimens. As a result of its sealed and precisely dated context, this collection represents an unusually important sample of colonial period European gunflints.

FIGURE 1. Fort St. Louis and *La Belle*. (Map by Roland Pantermuehl, 2003.)

Following the discovery of eight iron cannon brought by the French and later buried by the Spanish, the THC began excavations at the related terrestrial site of Fort St. Louis in October 1999 (Figure 1). This site was the location La Salle selected to serve as an interim base until he could locate his intended destination, the mouth of the Mississippi River (Foster 1998:97). French colonists would remain at this location from 1685 to early 1689 when the local Karankawa Indians killed the last remaining inhabitants. Some 33 years later, following a resurgence of interest in the area by the French, the Spanish built Presidio Nuestra Señora de Loreto de La Bahía directly atop the ruins of the French encampment in order to prevent a French reoccupation (Bruseth et al. 2004:79).

Two separate excavations at the site of Fort St. Louis produced a collection of 405 complete and fragmented gunflints, almost all of which showed at least minimal wear and most showing heavy usage. The first excavation in 1950 conducted by the Texas Memorial Museum (TMM) resulted in the recovery of 88 specimens that have been re-analyzed. This data has been included with the more recent THC data for statistical purposes. Gunflints from the two collections can be grouped into several categories with the primary distinguishing characteristics being attributed to their differing sources of manufacture. Two hundred and seven of the THC-recovered gunflints or gunflint fragments are of the type generally attributed to either French or English origin, showing both the spall technique and the blade technique in their method of manufacture. Forty-five samples from the TMM collection display these characteristics. Both of these techniques were carried out in workshop settings where gunflints were being

Historical Archaeology, 2009, 43(2):19–30.

mass-produced for large-scale distribution. These gunflints are predominantly related to the French habitation zone of the site, which is characterized by the presence of architectural features and artifact clusters clearly related to the French occupation. The remaining 153 gunflints are of a distinctly different manufacturing technique generally attributed to sites of Spanish occupation. These samples are clearly related to the later Spanish, Presidio La Bahía occupation of the site, which is delineated by a circular pattern of artifact distribution directly associated with the internal layout of structures within the Spanish compound (Bruseth et al. 2004:86).

Of the 252 gunflints recovered from Fort St. Louis that appear to be of either French or English manufacture, 170 are of the spall-type technique and 82 are of the blade-type technique. The remaining gunflints display two characteristics that help differentiate them from the gunflints attributed to the French occupation. First, the material from which they are manufactured differs very consistently in both color and texture from that of the material attributed to the French occupation. Secondly, the technique of manufacture, while sometimes similar to the blade technique, is distinctly different from that attributed to the French occupation.

Previous Research

Very little is known about the earliest production of gunflints. John Witthoft (1966) published a seminal article on the history of gunflints, in which he presented a proposed chronology of European gunflint production. According to Witthoft's (1966:23–24) sequence, the earliest gunflints, termed Nordic, were produced from Danish flint and were extensively worked on both sides into square or rectangular forms with bilaterally symmetrical edges. Witthoft attributed the second stage in his chronology, the "wedge-shaped" flints, to Dutch makers, primarily based on range of color in the source materials. The third stage, the "D or horseshoe-shaped" gunflints that were produced using blade technology, was attributed to French makers. Witthoft assigned the final stage to English makers, who also adopted the blade technology but, unlike the French, did not round the heels of the gunflints. Witthoft's chronology was accepted by Theodore Hamilton (1968), Lee Hanson (1970), and Lyle Stone (1971), although Hamilton added as a caveat that the spall-type gunflints that Witthoft attributed to the Dutch could have been made in France or England as well. The majority of the gunflints recovered from *La Belle* fit Witthoft's description of the Dutch, wedge-shaped gunflints that are now commonly referred to as spall-type gunflints.

While Witthoft's article was initially well received, as more data became available, many aspects of his early hypothesis came into question. The "Nordic," bifacially worked gunflints, which Witthoft believed had been produced from Danish flint, have been found at numerous New World sites and are now more commonly thought to have been made from locally procured North American sources, using the same technology evident on arrow points made by Native Americans (Kent 1983:28–29). Most historical accounts suggest that the Dutch were buying gunflints from any available source and redistributing them for profit (Clarke 1935:40; Forrest 1983:51). No evidence is available, however, to substantiate Witthoft's belief that the Dutch were producing the wedge-shaped gunflints at any point in the evolution of the industry. Stephen White (1975:67) noted that Witthoft had misinterpreted an 1846 publication that mentions the manufacture of gunflints at the site of Stevensklint in "Zeeland." Witthoft mistakenly assumed that the article referred to the Zeeland located in the Netherlands, but White pointed out that Stevensklint is located in Zeeland, Denmark, thus drawing into question Witthoft's assertion that the spall-type gunflint was produced by the Dutch. Even though several of Witthoft's assertions were later proven incorrect, his work did successfully define the chronological sequence in which the various types of gunflints were first produced.

T. M. Hamilton, another early and respected authority, studied gunflints for four decades, and several publications during the 1980s illustrate his mastery of the subject. Hamilton was the first researcher to recognize the necessity of performing petrographic analysis to identify the national origins of gunflints (Hamilton and Emery 1988:148). In 1978, he enlisted the aid of Kenneth O. Emery, a geologist from the Woods Hole Oceanographic Institute in Massachusetts. At Hamilton's request, Emery identified lithological differences between two large

sample sets of gunflints, one from the French and English occupations of Fort Michilimackinac in Michigan and one from the discrete English occupation of Fort Frederica in Georgia.

Emery believed that the differences between French and English spall-type gunflints would have to be investigated by analyzing mechanical, rather than chemical, composition, because the geochemical properties of flint are too homogeneous for trace elements to be of value (Hamilton and Emery 1988:148–149). His analysis of thin sections of sample gunflints shows observable microscopic differences between the "French" and "English" gunflints (Hamilton and Emery 1988:246). The results indicate that "most presumed French gunflints contain coarse-grained matrix (0.03mm) and large pieces of bryozoans, whereas most presumed English gunflints contain fine-grained matrix (0.01mm), foraminiferans (mainly thin-walled planktonic ones), and fragmented mollusk shells" (Hamilton and Emery 1988:246). The samples believed to be French that contain the coarse-grained matrix and large pieces of bryozoans are attributed to the Santonian series of the Upper Cretaceous period (82–78 million years ago), while the samples with a fine-grained matrix believed to be English are attributed to the Campanian series of the Upper Cretaceous period (78–70 million years ago).

If Emery's tests are accurate, and there appears to be no reason to discount them, then Hamilton and Emery succeeded in discovering a method for distinguishing between gunflints made of materials from the Santonian and Campanian series of the Upper Cretaceous period and thus possibly identifying their countries of origin. As Emery states, however, their tests were based on samples of unknown origin. Hamilton had determined which samples were to be designated as French or English on the basis of the archaeology and history of the sites from which the samples had been recovered (Hamilton and Emery 1988:153), but as one researcher recently stated, "[We] cannot assume, for example, that gunflints found at a site known to be occupied by the French came from France and use them to characterize French flint" (Luedtke 1999:41). Regardless of whether Hamilton's assumptions were correct, Emery's analysis of the thin sections demonstrated that there were distinct differences between the two sample sets. The usefulness of this information in identifying the country of production for European gunflints may be limited. Both the Santonian and the Campanian series are known to outcrop in mainland Europe and in Great Britain (Hamilton and Emery 1988:52), which means that one cannot determine with assurance a gunflint's country of origin by using Emery's methods. For more than 20 years, the most ready means of assessing the point of manufacture for European-produced gunflints has been comparison with criteria established by these earlier researchers. In his study of gunflints from Fort Michilimackinac and Fort Frederica, Hamilton relied primarily on color, luster (or lack thereof), quality of the material, and the presence or absence of pressure flaking to determine the source of manufacture for spall-type gunflints (Hamilton and Emery 1988:28). In that study, Hamilton defines a French spall-type gunflint as a mined flint of uniform quality that is predominantly brownish in color but ranges from "a gray through gray-brown to a light brown, then through a darker brown and eventually merging into black" (Hamilton and Emery 1988:28–30). Hamilton describes an English spall-type gunflint as being manufactured from an excellent black flint with a matte finish. Additionally, the majority of English spall-type gunflints would display minimal trim work around the edges and have large flake scars on the heel (Hamilton and Emery 1988:30). Hamilton demonstrated that there is a wide range of variation in color, quality of material, and manufacturing techniques, but he failed to address the possibility of extreme variations in both material and technology among samples manufactured within a given country.

Archaeological Specimens from Fort St. Louis and *La Belle*

The gunflints found on *La Belle* and at Fort St. Louis display the use of several manufacturing techniques, with the spall and blade techniques being attributed to European manufacture in workshop settings where gunflints were mass-produced (Figure 2). At Fort St. Louis, 153 gunflints are attributed to the later Spanish occupation. These gunflints appear to have been made locally, using expedient technology, and they lack, for the most part, any signs of

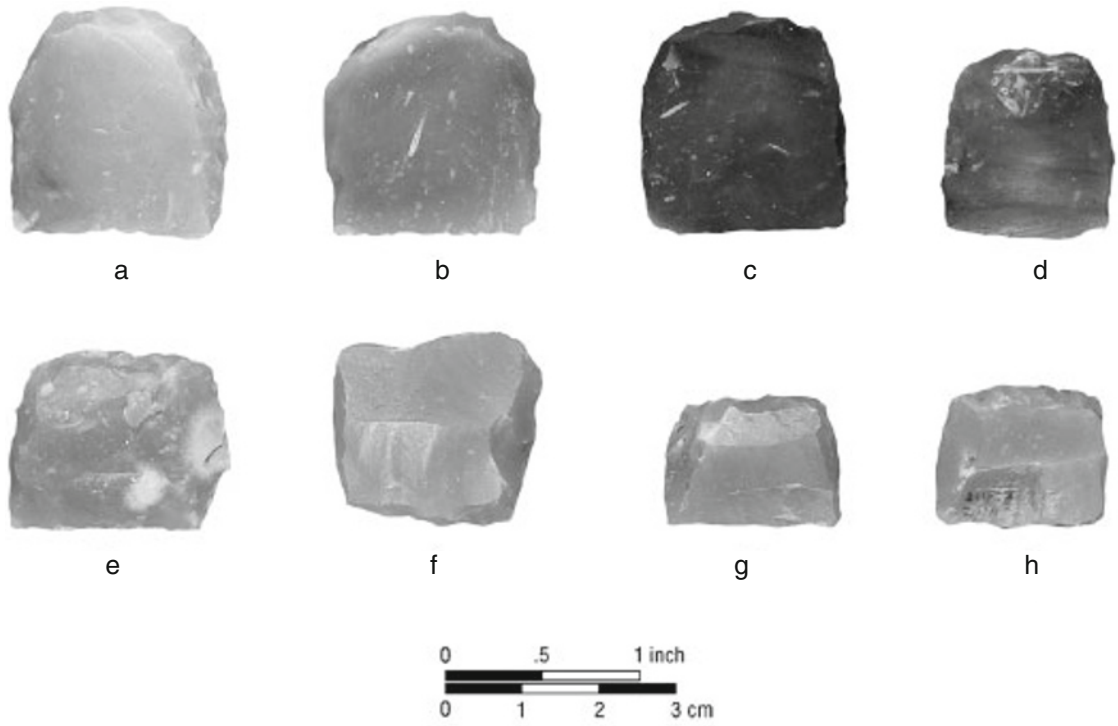

FIGURE 2. Gunflints from *La Belle* and Fort St. Louis: (*a–d*) spall-type gunflints; (*e–h*) blade-type gunflints. (Photo by Bill Pierson, 2006.)

the uniformity associated with mass production (Figure 3).

On *La Belle,* 296 of the gunflints recovered were produced using the spall technique; the remaining 22 display the use of the blade technique. The spall-type gunflint is thought by many to predate the blade-type gunflint (Witthoft 1966; Hamilton 1968; White 1975), but the timeframe for the transition has yet to be delineated. Blade-type gunflints have been found in association with spall-type gunflints at the site of Chicoutimi, within a sealed context and with a terminus date of 1663, indicating that the beginning date for the production of the blade-type gunflint is much closer to that of the spall-type gunflint than many researchers have speculated (Blanchette 1975:43). Additionally, at the site of Fort Pentagoet, occupied from 1635 to 1674, 65% of the gunflints recovered are of the blade type, which further supports an early beginning date for the production of blade-type gunflints (Faulkner 1986:83). The fact that blade-type gunflints were recovered from the sealed context of *La Belle* offers further solid evidence that blade-type gunflints were being produced much earlier than has been postulated by others (Whitthoft 1966:36; Honerkamp and Harris 2005:105).

At Fort St. Louis, 135 spall-type gunflints were found. The size and uniformity of production align well with the samples recovered from *La Belle,* and it is assumed that these gunflints were part of the assemblage brought by the French. Many of these gunflints were recovered from isolated French proveniences at the site, a finding that further supports this assumption. While the size and morphological characteristics of the collections from Fort St. Louis and *La Belle* align nicely, a marked difference exists in the colors present between the two collections.

European blade-type gunflints were found on both *La Belle* and at Fort St. Louis. Of the 22 blade-type gunflints recovered from *La Belle,* all appeared to have been produced from a gray to grayish light brown material. Sixty-three blade-type gunflints were recovered from Fort St. Louis, all of which were manufactured from a blond to light brown material. Of special interest within the group of 105 monochromatic spall-type gunflints recovered from *La Belle* was

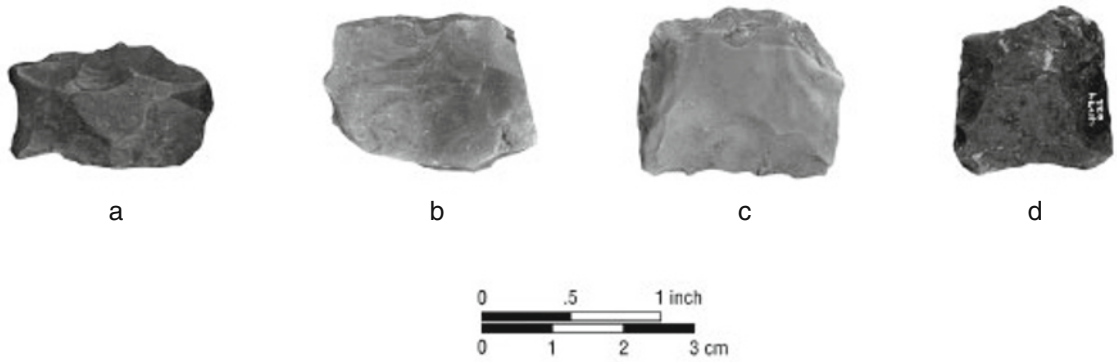

FIGURE 3. Locally produced Spanish gunflints from Fort St. Louis. (Photo by Bill Pierson, 2006.)

a group of 83 that range in color from dark gray to black. Because none of the spall-type gunflints recovered from the related terrestrial site of Fort St. Louis possess this dark gray to black color, it was postulated that some or possibly all of these samples from *La Belle* had been exposed to certain conditions underwater for more than 300 years that caused the material to blacken over time. To explore this theory, 10 of the dark gray to black spall-type and 5 of the blade-type gunflints from *La Belle* were selected for testing. The 15 samples were submerged in a solution of 3% hydrogen peroxide for a 10-day period. Previous testing of submerged ceramics that were turned black due to prolonged exposure to underwater conditions showed that a 10% hydrogen peroxide solution would successfully remove the black staining from the material (Hamilton 1996:20). A solution of less than 5% hydrogen peroxide is recommended for stone objects (Hamilton 1996:21). For this testing procedure, an over-the-counter 3% solution was selected. As a means of verifying the active state of the hydrogen peroxide used for the testing, a weathered copper penny was submerged in a beaker with a small amount of the solution prior to testing the flint specimens. The penny turned to a bright copper color within two hours, indicating that the solution was active. Five samples of black flint collected from Brandon, England, along with five samples of lighter, gray-colored gunflint samples from the site of Fort St. Louis were subjected to the same testing as an additional control. The assumption was that the additional samples were previously unaltered, and therefore the hydrogen peroxide solution would not alter their color. All samples were photographed and color matched with the Munsell Color Chart prior to the testing procedure.

As suspected, the control samples from Brandon, England, and from Fort St. Louis remained unaltered by their submersion in the hydrogen peroxide solution. Additionally, 7 of the 15 samples from *La Belle* remained unaltered. In total, eight samples were altered in color as a result of their submersion in the solution. Of the 10 spall-type gunflints tested, 5 showed a change in color. Of these five, three showed significant alteration in color, generally changing from a dark gray to black to a medium greenish gray. Three of the five blade-type gunflints tested displayed significant color alteration, with the remaining two showing no change. The blade-type gunflints that changed in color became a light to medium brown. Both the spall-type and blade-type samples that changed in color were seen to fall within the spectrum of color present among the samples from the site of Fort St. Louis as a result of the testing. From this testing it was concluded that the original postulation that many of the gunflints from *La Belle* had changed in color due to prolonged submersion was correct. These results further illustrate the problems inherent to identifying the source of manufacture for gunflints based on color of material.

Sourcing

As Hamilton and Emery's petrographic research demonstrated, at least two different geological series, the Santonian and the Campanian, formed veins of chert that were mined

to produce gunflints in Europe. The color and quality of the chert found in these veins are variable, but the basic trace-element contents are apparently quite consistent. It is precisely this homogeneity of source material that makes the attribution of gunflints to their production source so problematic. Chert, in general, is made up of more than 97% silica, with trace-element concentrations close to or below detection levels (Neff 2005). Despite the relative homogeneity of chert found throughout much of western Europe and England, recent testing using inductively coupled plasma-mass spectrometry (ICP-MS) on several samples from various locations in England and France shows that subtle variations in the chemical composition can distinguish one region from the next (Rockman et al. 2003:8).

ICP-MS is not a new technology, but improvements to the process have only recently increased its applicability to the problem of sourcing European chert. The process in which a sample material is atomized and ionized in a charged argon gas torch is now so sensitive that it can consistently detect almost the full suite of elements in the periodic table at concentrations as low as a few parts per million (Rockman et al. 2003:3). The two methods of preparing samples for testing are laser ablation and acid digestion. Laser ablation (LA-ICP-MS) is virtually nondestructive and is gaining in popularity over acid digestion, which results in the obliteration of a 1–2 g sample. Probably the most significant recent advance in LA-ICP-MS technology is the reduction of changes in the operating parameters, which previously fluctuated from one run to the next. Additionally, LA-ICP-MS now has "the ability to reproduce data generated by other bulk analytical techniques" (Speakman and Neff 2005:4).

As an initial step in identifying the origins of the gunflints recovered from *La Belle* and Fort St. Louis, source materials from Europe were collected by the author. Samples from a large pile of gunflint-production debris were collected from a site in Porcherioux, France, a small annex on the outskirts of Meusnes, France. Meusnes is known as the center of French gunflint production, beginning sometime around 1650 and continuing through to the early-20th century (Emy and de Tinguy 1978). Additional samples were collected from the township of Brandon, Suffolk County, England, known to be the English center of gunflint production from at least the late-18th century and well into the 20th century. France and England are historically known to be the two primary producers of gunflints for export to the Americas and are presumed to be the most likely sources of European gunflints manufactured during the time of La Salle's expedition. These core samples, along with 43 gunflints from *La Belle* and Fort St. Louis, were sent to the Institute for Integrated Research in Materials, Environments, and Societies (IIRMES) at California State University, Long Beach, for LA-ICP-MS testing. Additionally, for comparative purposes, three gunflints from the known English context of Fort Frederica, St. Simon Island, Georgia, were borrowed from the National Park Service, Southeast Archeological Center, Tallahassee, Florida, and were tested at the same time. Since petrographic analysis had already been proven unsuccessful in identifying sources of production for European gunflints in earlier research (Hamilton and Emery 1988), it was eliminated as an otherwise obvious first step.

The primary objectives of this initial testing were to determine whether trace-element levels found in the sample set would be measurable and whether between-source differences would be large enough to allow the gunflints to be matched to their potential European flint sources (Neff 2005). The IIRMES lab supplemented the European source samples submitted for testing, which were relatively few in number (13), with statistical data from previously tested European flint sources. French, British, and Danish source samples, numbering 79, had been previously submitted by Christopher Stephenson of the Virginia Department of Historic Resources, which permitted a reliable assessment of the range of chemical variation within each area (Stephenson et al. 2007).

The results of the initial LA-ICP-MS testing, based on bivariate comparisons of concentrations of uranium, aluminum, strontium, and arsenic, indicate that the samples submitted cluster into three groups shown within ellipses that indicate a 90% statistical likelihood of association (Figure 4) (Neff 2005). As has been mentioned earlier, chert is made up of more than 97% silica. The fact that the ellipses shown in Figure 4 overlap is indicative of the high level of similarity present in the chemical signatures

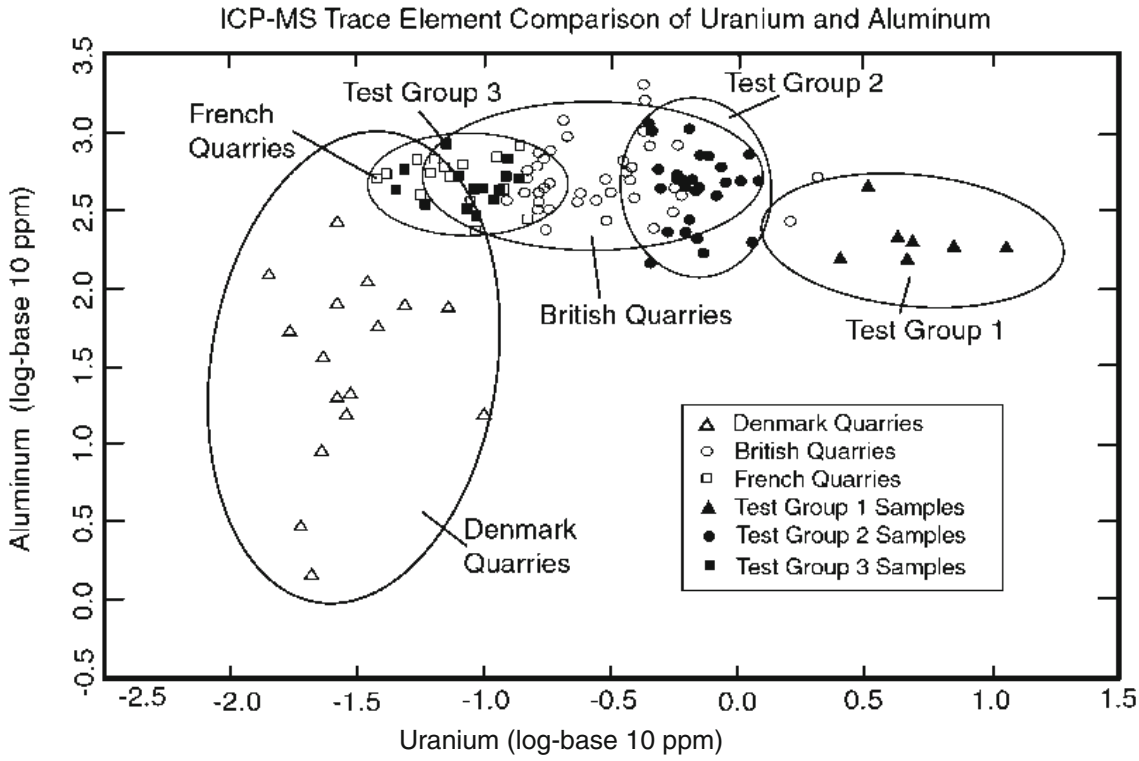

FIGURE 4. Bivariate plot comparing trace-element levels of uranium and aluminum in the samples. (Graph after Neff 2005.)

of all chert. The differences evident in the ICP-MS trace element comparison are because ICP-MS testing can measure variations in parts per million and overlaps in the signatures of samples collected from a common geological series (Santonian and Campanian series in the case of most European samples) that outcrop in two separate geographical regions, even though located several hundred miles apart. It is precisely for this reason that the ICP-MS analysis has proven useful.

ICP Group 1 is represented by a distinct set of 7 samples from Fort St. Louis and includes gunflints possibly produced at the site by the resident Spanish occupants or their native conscripts, presumably from core material gathered locally (Figure 5). This group, which is differentiated from the other two by significantly higher levels of uranium, displays no overlap whatsoever with submitted European source samples or previously tested European samples (Neff 2005). The samples falling into this group were produced using techniques not seen in the production of the spall-type or blade-type samples recovered from *La Belle*. Additionally, the source material is drastically different in texture and color from the European samples. While color and texture are admittedly unreliable indicators, the production method along with the ICP analysis of this group of samples seem to support the initial interpretation that these were probably made locally from locally procured material.

ICP Group 2 contains 25 spall-type gunflints submitted from Fort St. Louis and *La Belle* (Figure 6). Group 2 samples fall within the range of variation displayed by the British source samples on most projections of the data (Neff 2005). While most of the Group 2 samples fall within the variation shown for the British sources, it should be noted that they closely cluster at one end of the British source ellipse (Figure 4). As can be seen in Figure 4, the French source samples as well as the samples from ICP Group 3 also group together at one end of the larger ellipse of the British source samples. This may

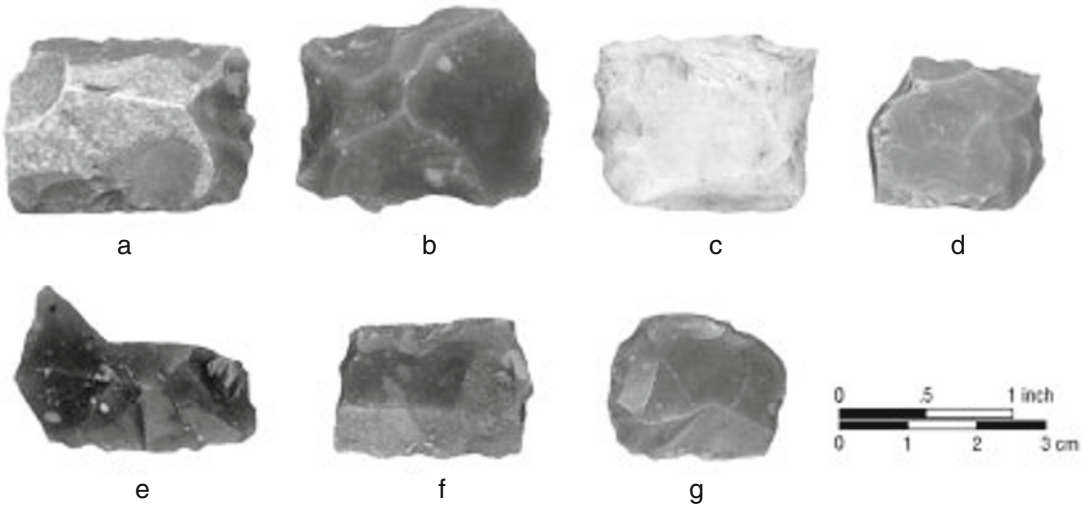

FIGURE 5. Gunflint samples from ICP Group 1. (Photo by Bill Pierson, 2006.)

well indicate that the Group 2 samples were produced from a common material whose source has not yet been tested but whose trace element signature falls closely within the parameters indicated for the British samples tested. Whether these samples originated from British material sources is unclear at this point. What seems evident from the graph in Figure 4 is that this material does not match the material from the French, Danish, or ICP Group 1 samples. The fact that this material is so closely related to the British source material should, at the very least, indicate a European source.

ICP Group 3 contains 14 blade-type gunflint samples, both gray and brown to blond in color, submitted from Fort St. Louis and *La Belle* and includes three blond, blade-type samples from Fort Frederica (Figure 7). The compositional variation in Group 3 displays an almost identical match to that of the analyzed source samples from Meusnes, France (Figure 4). Because these samples show an extremely close match for all 45 elements accounted for in the ICP testing, they can be attributed with a reasonably high level of confidence to France and perhaps even to a specific production site in Meusnes (Neff 2005). It is apparent from these results that gray and blonde samples display virtually identical trace-element signatures, a finding that supports the view that researchers should be cautious in attempting to source gunflints based on color.

Conclusion

The assignment of gunflints recovered in the colonial Americas to production loci has long relied upon criteria established in earlier research. The methods used to establish these criteria, however, are shown to have serious flaws. While these earlier studies provide valuable insights into techniques of gunflint manufacture, they cannot be relied upon exclusively to satisfactorily determine the sources of production, not even to a national level as is sometimes claimed. It has only been through the recent advancement of LA-ICP-MS testing that a quantitatively verifiable means of determining the production sources of gunflints recovered in the Americas has been established.

The LA-ICP-MS testing conducted on a limited set of samples from *La Belle* and Fort St. Louis suggests three locations as origins of manufacture. As has been commonly claimed for many years, the blond blade-type gunflints appear to be of French production. The samples submitted for testing resulted in an almost identical match with the core samples from Meusnes, France. Falling into this same category, several gray to grayish brown blade-type gunflints recovered from *La Belle* also showed a nearly identical match with the French source material from Meusnes. Additionally, three blond blade-type samples from Fort Frederica also fell into the group that closely mirrored the Meusnes source material. Since the

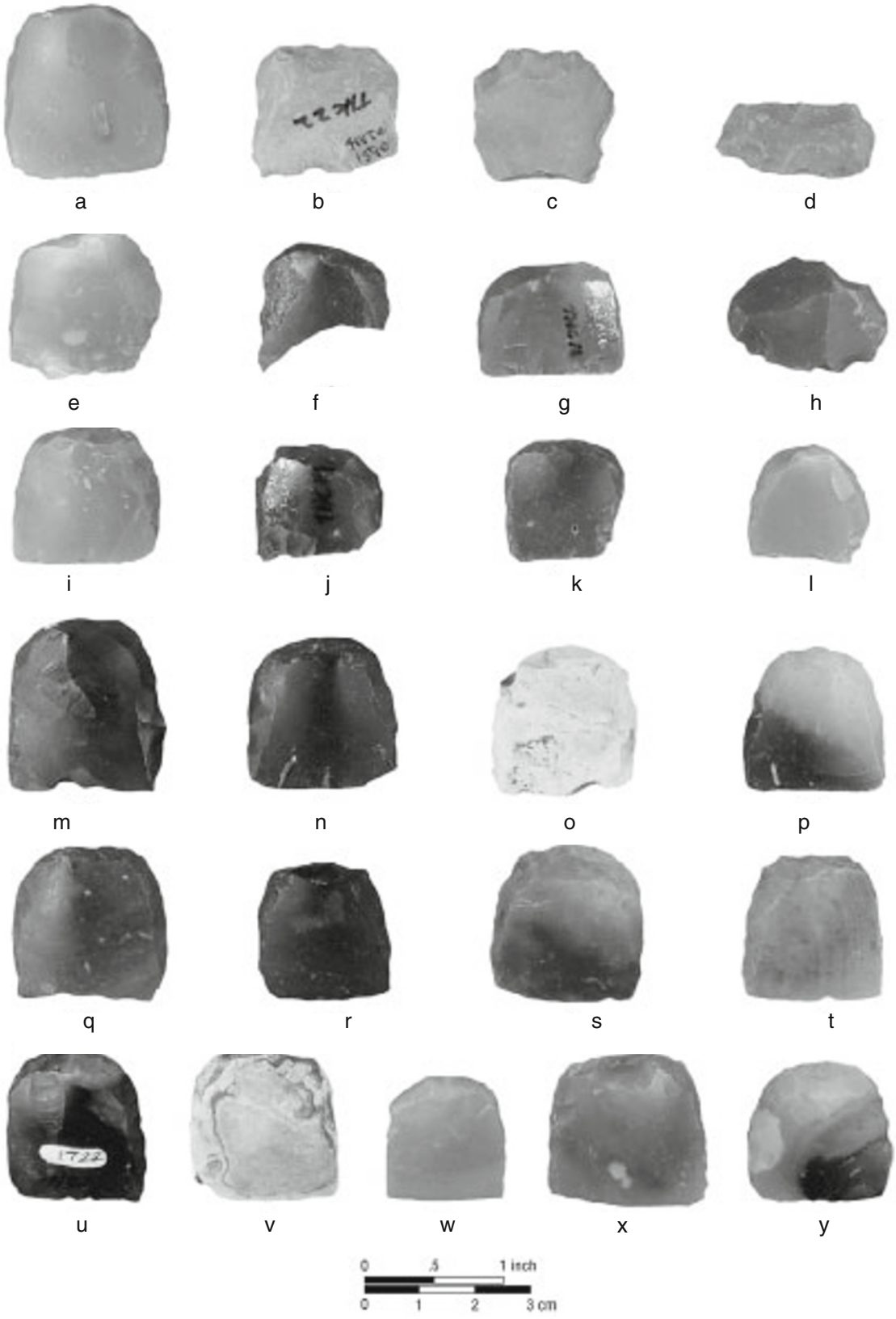

FIGURE 6. Spall-type gunflints from ICP Group 2. (Photo by Bill Pierson, 2006.)

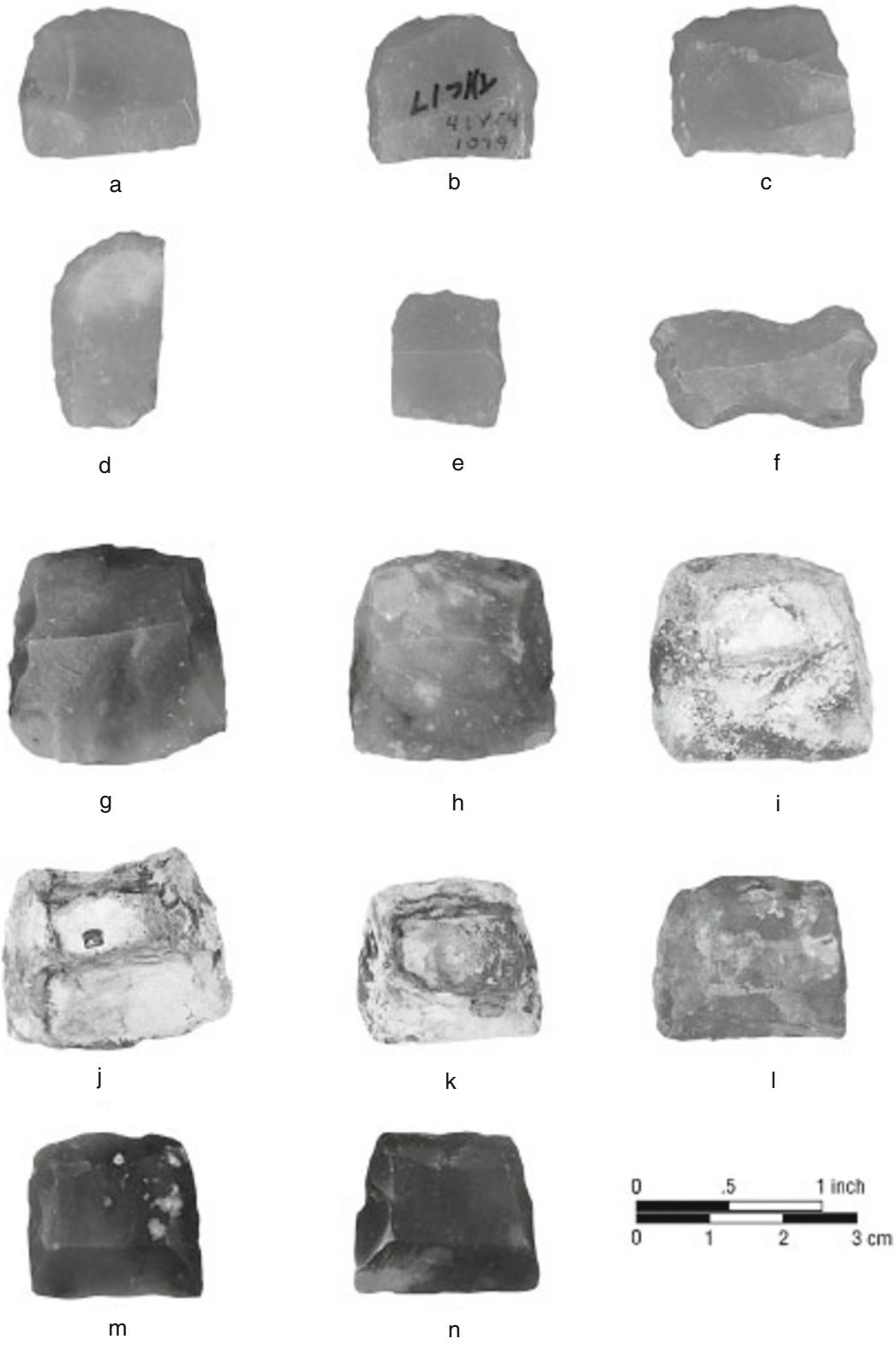

FIGURE 7. Blade-type gunflints from ICP Group 3. (Photo by Bill Pierson, 2006.)

size of the Fort Frederica sample set is small, it is strongly suggested that more samples from this site be tested in the future to substantiate these initial findings.

The second location indicated by the LA-ICP-MS testing as a possible source of spall-type gunflint production is Britain. Many of the spall-type samples tested showed trace-element concentrations suggestive of British manufacture but not with the near-identical alignment seen with the blade-type samples from Meusnes. The fact that this group of samples does cluster tightly suggests that they are probably from a single common source. The additional fact that the samples identified as definitely being of French origin cluster together tightly and also fall into the larger ellipse of the British source material should imply the need for caution in assigning the place of origin for the ICP Group 2 samples. It is therefore only suggested that these gunflints were manufactured in Britain. The research suggests that the exact source of manufacture of these gunflints has yet to be identified and that additional source materials from manufacturing sites in both France and England should be gathered and tested.

Several of the gunflint specimens from Fort St. Louis fell into a separate group, ICP Group 1 (Figure 4), and are attributed to an "unidentified source." These specimens differ from the other groups in manufacturing technique and in visible characteristics of the material. It is suspected that either the Spanish inhabitants who were posted at the presidio or local native Indians who were conscripted into service by the Spanish used locally procured source material to manufacture the gunflints that fall into this group. Lithic debitage found in close association with living quarters at the site offers archaeological support for this hypothesis (Bruseth et al. 2004:88).

These results derive from only a small, preliminary set of specimens, but their implications are obvious. Almost without doubt, the blade-type gunflints from *La Belle* and Fort St. Louis are of French manufacture and thus provide the earliest production date for blade-type gunflints from a verified French source. The LA-ICP-MS testing demonstrated with little equivocation that by at least the early 1680s the French were producing blade-type gunflints from both gray and blond source materials and exporting them to the colonial Americas. These blade-type gunflints exhibit several variations, showing single-ridged and double-ridged examples in both gray to grayish brown and blond materials. The gray and blond materials can be associated with a common production area, thus weakening the argument that the country of production can be accurately identified based on material color alone. While the source of production for the spall-type gunflints remains less certain, the initial, and admittedly limited, testing indicates that spall-type gunflints from this period were being produced in either France or England. It also becomes apparent from these findings that the dating of gunflints based on morphological characteristics is highly suspect.

Clearly, more research is needed in the field of gunflint sourcing. Since the geological features that produce the chert used in gunflint production are known to outcrop in England as well as mainland Western Europe, it is difficult to determine the source of production without a near-identical match in trace-element concentrations. It is suggested that a match between the blade-type gunflints and French source data has been achieved in the present study, but the author is somewhat reticent to claim such a match for the spall-type gunflints. LA-ICP-MS testing provides a quantitatively verifiable method for sourcing gunflints, but because of the homogeneous nature of European flint sources, a great deal of work remains to be done. It nevertheless seems reasonable to expect that further testing could result in an accurate assignment of all the gunflints from *La Belle* and Fort St. Louis to their sources of production.

Acknowledgments

The author thanks James Bruseth, director, Archeology Division, Texas Historical Commission, for support and encouragement through the completion of this article. Special thanks go to Jay Blaine who gave invaluable advice at the very onset of this research and who offered comments on an earlier version of this article. The author also acknowledges John Ehrenhard and Briget Beers of the National Park Service, Southeast Archeological Center, Tallahassee, Florida, for graciously loaning the entire Fort Frederica gunflint collection for comparative purposes and for allowing samples to be used in the ICP-MS testing. Thanks also

to the reviewers of this article for their succinct and insightful suggestions and comments on the original draft. Further thanks go to Hector Neff of the Institute for Integrated Research in Materials, Environments, and Societies at California State University, Long Beach, for conducting the ICP-MS analysis as well as for offering advice and comments on this article.

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