Analyzing Musket Balls to Interpret a Revolutionary War Site

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ABSTRACT

During a Sunday outing in 1992, the Deep Search Metal Detecting Club collected a small number of Revolutionary War musket balls at a county park in New Jersey. Two areas of artifact concentration were generally recorded and park officials were notified. In 1993 the Monmouth County Park System had the same areas plowed to remove vegetation and a limited Phase I archaeological survey was conducted. Additional musket balls were excavated under more controlled conditions. New Jersey is known as the "Crossroads of the Revolution," and finds of this type are not unusual. A detailed analysis of the ordnance shows the vast majority of balls are 0.68–0.70 in. in diameter and exhibited no evidence of being fired. The size and surface characteristics indicate the musket balls were probably military and possibly British. The interpreted data indicate that this site was a resting place and only used for a very short period of time, possibly only overnight.

Introduction

On 5 April 1992, the Deep Search Metal Detecting Club had an outing at the Sunnyside Recreation Area on Middletown-Lincroft Road in Middletown, New Jersey. The site is a Monmouth County park where recreational facilities are planned for future development. It includes an 18th-century farmhouse and several modern outbuildings. The property has been farmed since the mid-18th century, and although no farming is being done at present, crop furrows were still visible at the time of the outing. Roads divide the farm into three sections. Sunnyside Road is a 20th-century road, but Middletown-Lincroft Road dates to colonial times.

Prior to being acquired by the Monmouth County Park System, the property was known as the Neuberger Farm. Sylvanus Grover purchased the land in 1759. Grover did not reside there, but appears to have tenant-farmed the land (Hunton 1990:2). The property was an active farm at the time of the War of Independence and continued in agriculture into the late 20th century. Therefore, the site has been substantially disturbed.

Deep Search had secured the proper permit for the day in the hopes of finding a few old coins. Work began first around the house with only a few 20th-century coins being located. Eventually one club member, who crossed Middletown-Lincroft Road to a small hill, signaled that he had found a musket ball. Shortly, the entire group was working on the hill, and additional musket balls and a few other artifacts were unearthed. Crossing Sunnyside Road yielded several more musket balls, but not as many, nor as concentrated, as in the first area.

A total of 45 balls were excavated of which 25 were made available for detailed study. The musket balls were analyzed for weight, diameter, and surface characteristics. The 25 artifacts were cleaned, numbered, and returned to the Monmouth County Park system.

Although the site discovery occurred without mapping specific artifact locations, general areas of artifact concentrations were recorded and reported in a preliminary site report (Phillips and Sivilich 1992). It was recommended that the site be plowed in two designated areas to remove the vegetation, and that a controlled study be conducted to determine specific artifact locations. The site could also be surface collected for nonmetallic artifacts.

Field Methods and Site Preparation Phase

The field investigation technique was designed to follow that used at Custer Battlefield National Monument (Scott et al. 1989:24–27). As such, the fieldwork consisted of three phases: the site preparation phase, the inventory collection phase, and the inventory analysis phase. All work was conducted by volunteers. Metal detectors and visual survey methods were utilized during the inventory collection phase. Each artifact received a unique specimen number which was coded to include the date, the excavator's initials, and a sequence number for each

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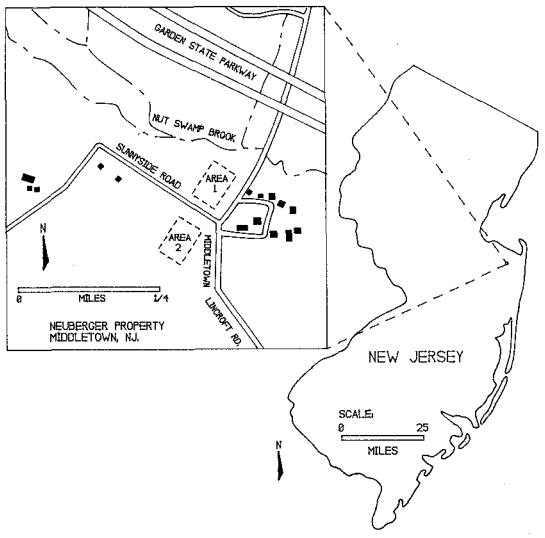

FIGURE 1. Location of the site on the Neuberger property, Middletown, New Jersey.

excavator. The site topography and surveying techniques were photographed using color prints.

In early May 1993, the Monmouth County Park System plowed the locations of the two artifact concentrations as shown in the overall site location map in Figure 1. The plow furrows ran approximately parallel to Middletown-Lincroft Road. The site was then left undisturbed for several weeks to allow rain to expose any artifacts brought to the surface. Although several light rains fell, no major storms occurred prior to the survey date.

Previously surveyed reference points shown on the topographical maps provided by the Monmouth County Park System were selected (Digital Aerial Surveys 1990). The most convenient reference points were telephone poles which were clearly marked on these maps. From these reference points, horizontal control points were established in the four corners of each of the two plowed areas. The eight control points were spatially located by measuring the distance using a standard 200-ft. tape measure and taking an accurate compass bearing to a reference point. Artifact locations were also recorded using this technique and measuring to either a control or reference point. Linear measurements were recorded to the nearest 0.1 ft. and compass bearings to the nearest 0.1 degree. The compass readings were also corrected for a local magnetic deviation of 12° west as shown on U.S. Geological Survey (1981) Map N4015–W7407.5/7.5. Artifact locations were plotted using the polar coordinate system (Sivilich 1995).

Inventory Collection Phase

Excavations were conducted on 15 May and 22 May 1993 by the author and members of the Deep Search Metal Detecting Club. The excavation teams first carefully walked the site and collected exposed artifacts, which also helped in smoothing out any rough plow scars. Next, the areas were searched using electronic metal detectors. Each volunteer was assigned specific furrows which were used as transects. After the completion of a furrow in one direction, a second pass was made over each furrow by a different volunteer. This technique was useful to compensate for the variability in electronic equipment sensitivity as well as volunteer experience. This technique produced additional artifacts that would have been missed using only one pass over a transect.

The artifacts were excavated immediately by each volunteer using simple digging tools, i.e., small shovels or garden-type trowels. Each artifact was placed in a specimen bag, assigned a specimen number, and left in place. The excavation was marked with a pin flag. The artifacts were found in the approximate depth range of 0–12 in. using this method. When all excavations were completed for the day, a second team of volunteers, under the direction of the author, measured and recorded the linear distance and the compass bearing to the nearest control point. All artifacts were then collected, flags removed, and holes backfilled.

As previously stated, the existing site had been disturbed by two centuries of tilling and erosion. Examination of the stratigraphy in the small excavations showed that all excavation was within the plow zone. Therefore, recording the depth of any artifacts in this zone would yield no meaningful

TABLE 1
MUSKET BALL SIZE AND CONDITION

Spherical		Chewed		Impacted	
n	Diameter (in.)	n	Diameter (in.)	n	Diameter (in.)
0	0.60–0.65	1	0.60–0.65	1	0.60
46	0.68–0.70	4	0.68–0.70		

data. However, the horizontal location of artifacts may be analyzed and interpreted.

Inventory Analysis Phase

Various artifact types were found during the second surface collection. However, most of the artifacts were musket balls. Twenty-seven additional musket balls were found of which 25 were 0.68–0.70 in. Twenty-two of this group appeared to be not fired—"dropped"—and three were chewed. This paper discusses the analysis of the probable military artifacts excavated in both 1992 and 1993 with emphasis on the musket ball analysis. A complete list of the artifacts donated in 1992 and all of the artifacts excavated in 1993 is included in the final site report (Phillips and Sivilich 1993).

The historic military artifacts are the excavated musket balls. These artifacts are categorized as follows: (1) spherical musket balls between and including 0.60–0.65 in.—this is the type typically used in the French Charleville musket, British fusil, Dragoon carbine, etc. (Neumann 1967:36–46, 52–149); (2) spherical musket balls greater than .65 in.—this size was generally used in the British Brown Bess. John Muller (1977:14) indicates that for military service the standard size is 0.693 in. in diameter or 29 per two lb.; (3) chewed musket balls; and (4) impacted musket balls.

The studied musket balls found during the 1992 and 1993 excavations are summarized in Table 1. In total, 52 musket balls were measured of which 96 percent were 0.68–0.70 in. in diameter. Site maps for both areas illustrating the locations of the musket balls excavated are based on Alden (1973) and are shown in Figures 2 and 3.

The musket balls were measured for weight to the nearest 0.01 g using an Ohaus electronic laboratory balance. Having only a metric dial caliper available, diameters of spherically shaped musket balls were measured to the nearest 0.05 mm and the values converted to inches. "Molded bullet diameters can be measured either across or perpendicular to the mold seams. Measurements perpendicular to the mold seam more closely approximate the standard diameter . . . ," state Babits and Mannesto (1994:3). Therefore, round ball diameters were measured perpendicular to any visible mold seams. This value was checked by measuring at 45° and 135° to any mold seams to determine if the balls were deformed or oval in cross section. No significant deformation was observed on any of the spherical musket balls; therefore, one diameter measurement was recorded for each ball.

Data Interpretation

The 96 percent of musket balls measuring 0.68–0.70 in. is an unusually large ratio of spherical musket balls to nonspherical shot as compared to other sites, such as Monmouth Battlefield State Park, excavated by the author. If the shot were in cartridge form, this ratio would suggest the presence of more than one soldier, since cartridge boxes held nine to 36 cartridges with British boxes holding 18 cartridges (Neumann and Kravic 1989:66, 69).

The musket balls were visually inspected for surface characteristics. Due to the arid nature of the sandy soil from which they were extracted, the patina was very uniformly distributed with little pitting. Close examination of the spherical ordnance showed that they exhibited very weak, if any, mold casting marks. This was especially evident with the lack of a sprue mark. However, numerous small concave, circular indentations approximately ⅛ in. in diameter or less were present on the surface of the balls. This "facetting" suggests that the musket balls were stored in contact with each other at one point, subjected to vibration and compaction. This action could cause the malleable lead balls to be indented and lose their mold and sprue features by hammering against each other. This may have

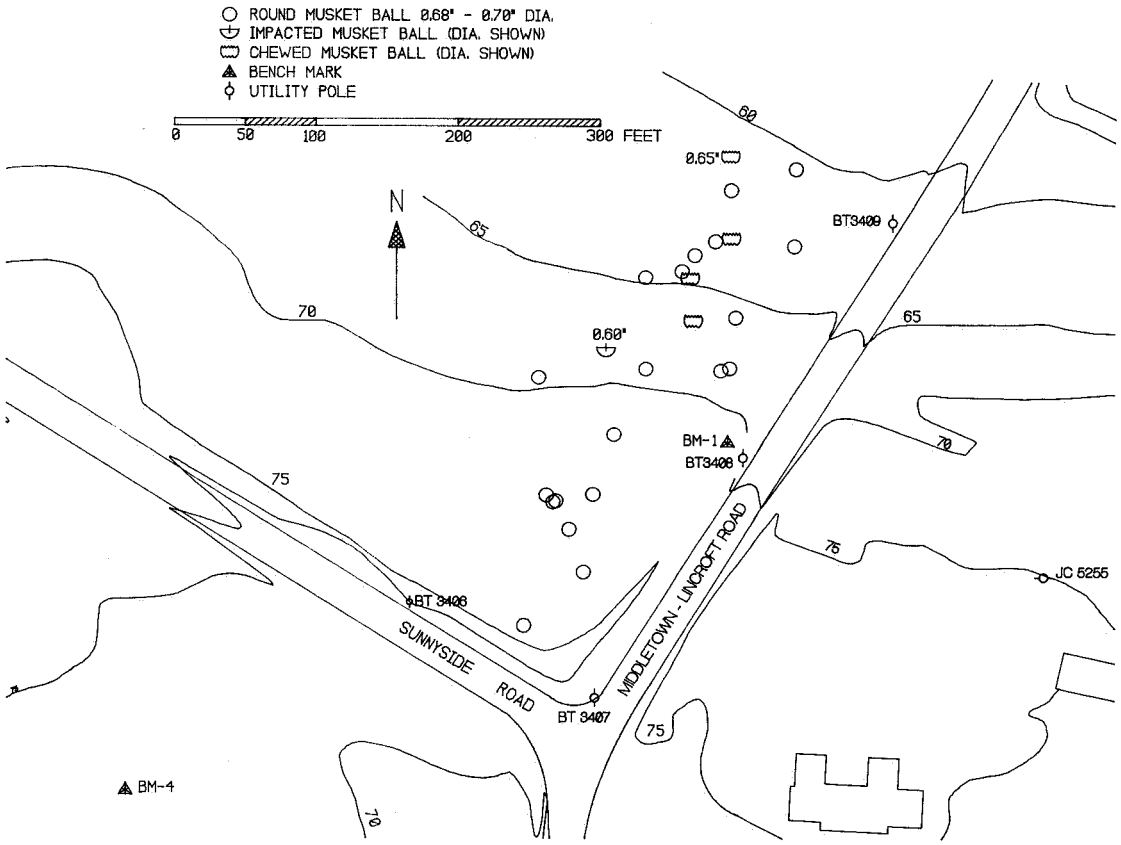

FIGURE 2. Map of Area 1.

occurred prior to being made into cartridges. No distortions were observed in the ball diameters. Firearm signatures on discharged bullets are called "land-and-groove marks" for rifled arms or "smooth bands around the ball circumference" for smoothbore weapons (Scott and Fox 1989:52). No smooth bands or scars, that might indicate the balls were fired from a smoothbore musket, were noted. Therefore, it was concluded that these projectiles were dropped or discarded. The musket balls made available for measurement from the April excavation and all of the balls excavated in May were analyzed. The diameters of the 46 spherical balls were measured, and the results are shown as a histogram in Figure 4. The diameters of the irregularly shaped musket balls were determined empirically. Based on a study by the author of a large sample of spherical musket balls excavated in a variety of sites in New Jersey, an average density of 10.479 gm/cc has been calculated (Sivilich 1995). As shown in Figure 5, the weight of a musket ball is measured and the diameter can be calculated using this density value as follows:

$$\text{Diameter in inches} = 0.223204 \times (\text{Weight in grams})^{1/3}$$

The 0.68–0.70-in. diameter is consistent with numerous musket balls excavated by the author during the Monmouth Battlefield archaeological study in progress over the past several years. They are generally, but not exclusively, associated with the British infantry skirmish sites when found in concentrations (Sivilich 1995).

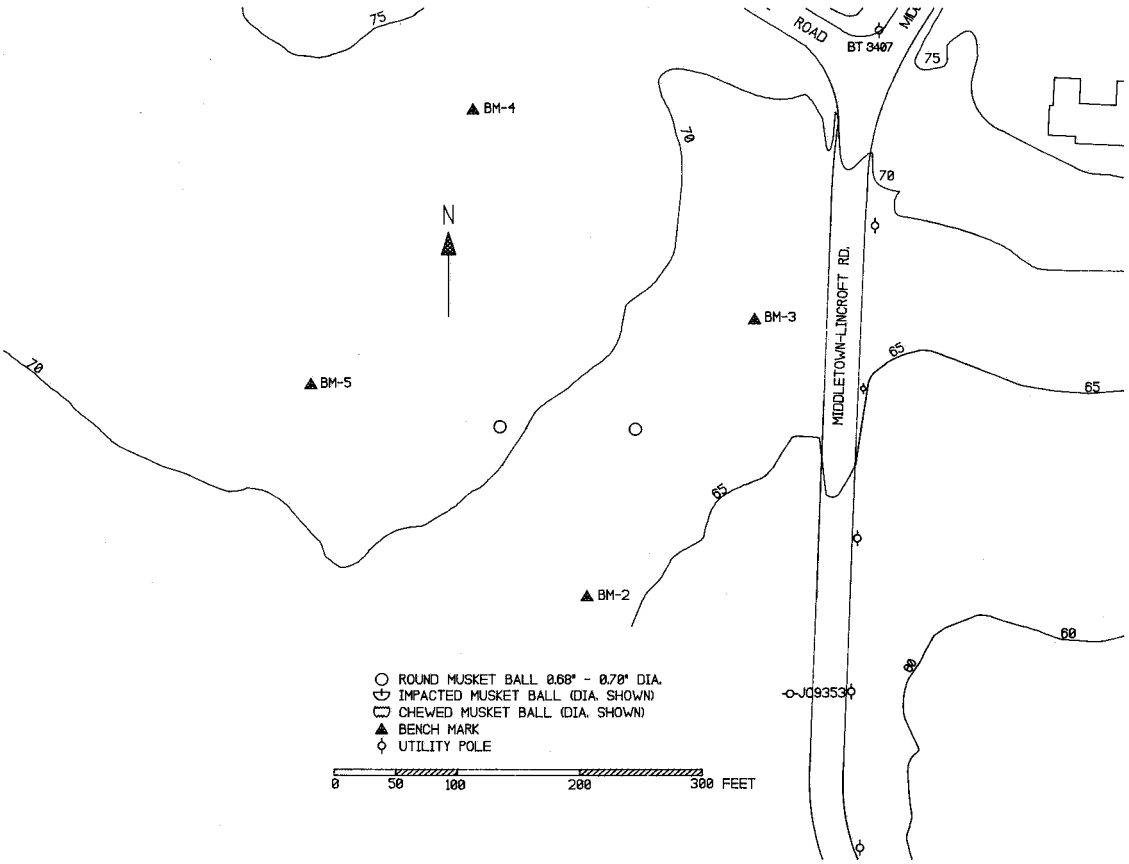

FIGURE 3. Map of Area 2.

Chewed musket balls are usually associated with field surgery to help bear pain vis-à-vis "bite the bullet" (Peterson 1968:170). Two of the five chewed musket balls have deep molar impressions which may be an indication that they were bitten by persons who were wounded. The remaining "chewed" musket balls exhibited shallow teeth marks around their entire surface. They might be attributed to pain or boredom, or possibly to promote salivation on a hot, arid day. If the latter situation were the case, it may possibly suggest that the occupation of the site took place during a summer month. A number of lightly chewed balls also have been found on Monmouth Battlefield. The day

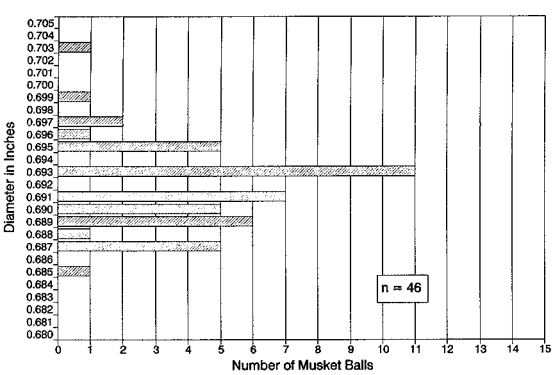

Figure 4. Measured diameters of spherical musket balls excavated at the Neuberger site.

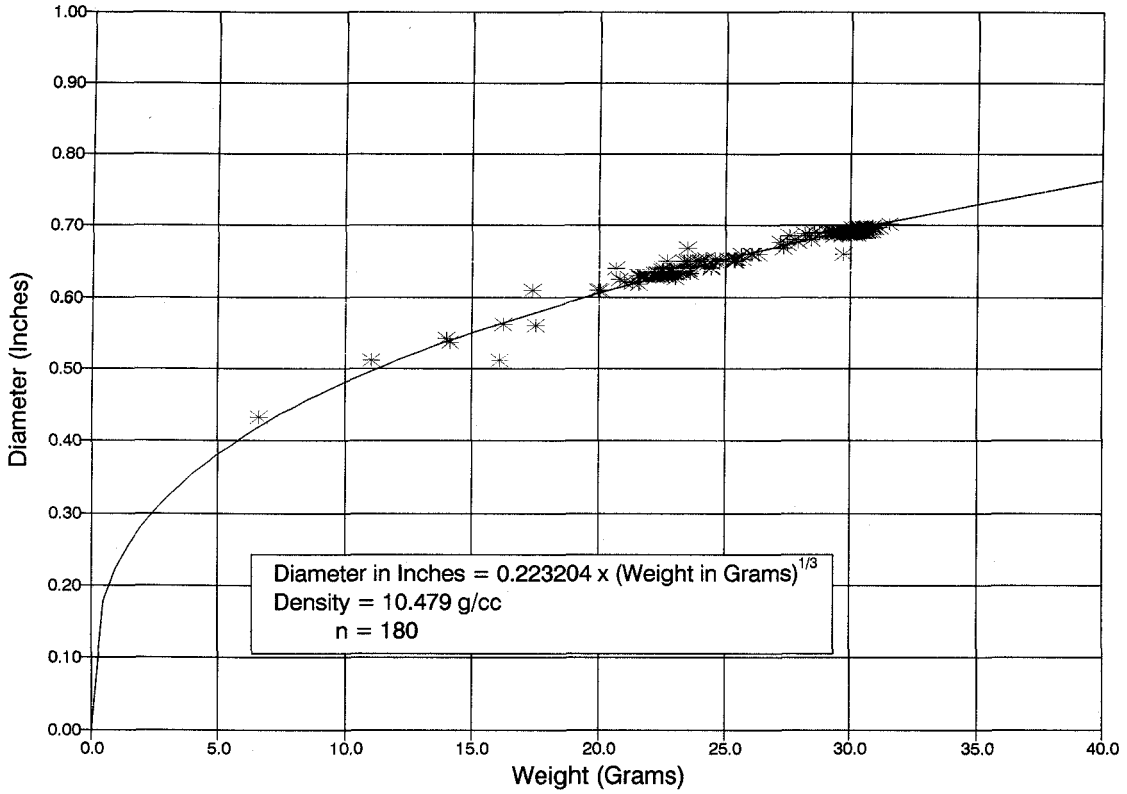

FIGURE 5. Spherical musket ball diameter versus weight.

of the Battle of Monmouth, 28 June 1778, was reported by Joseph Plumb Martin (1988:127) as "the mouth of a heated oven seemed to me to be but a trifle hotter than this ploughed field; it was almost impossible to breathe."

All musket balls found in Area 1 (Figure 2) were in a long, narrow band stretching nearly 400 ft. and almost exactly parallel to Middletown-Lincroft Road. It is doubtful that the balls were spread over this linear distance by plowing, although some displacement from the initial deposition is reasonable. The presence of chewed balls and the linear spread of the artifacts strongly suggests a military formation.

The horizontal distribution of the few musket balls found in Area 2 was more random. It is the opinion of the author that musket balls found in Area 2 (Figure 3) may have come from soil removed during the construction of Sunnyside Road which may have been spread over the farmland, thus randomly scattering the musket balls. Their original location may, in fact, have been at the hill crest in Area 1 which was cut to produce a level grade for Sunnyside Road.

It is interesting to note that no evidence was found to suggest a long-term or overnight camp. No fire pit features such as discolored soils or fire-cracked or thermally altered rocks were found. No kaolin or ball pipe fragments were found in either area.

Hypothesis

It is hypothesized that the Neuberger site was the location of an 18th-century military camp or stop-

ping place that was used for a very short period of time. This site appears to have been used by the British military and is possibly associated with the retreat from the Battle of Monmouth.

Monmouth County had much activity during the Revolutionary War. Numerous skirmishes took place between the British and Continental armies, as well as between Loyalist and Patriot militia units. Eight skirmishes are recorded in Middletown, New Jersey (Alden 1973). Military sites in Monmouth County have yielded small quantities of artifacts mostly found by amateurs or collectors using metal detectors. The most common artifacts are musket balls. Obviously, most projectiles found at skirmish sites should have varying degrees of deformation from impact.

It is well documented and known that the American forces had a variety of weapons. As stated by J. Dodsley (1778:19) in discussing the number of American casualties at Trenton and Princeton, "to this may also be added the various make of their small arms, which being procured, as chance or opportunity favoured them, from remote and different quarters, were equally different in size and bore, which rendered being fitted with ball upon any general scale impracticable." This is confirmed by the variety of musket ball diameters excavated at Monmouth Battlefield that can be directly associated with American fire (Sivilich 1995).

The common terminology used to describe arms and shot are caliber and diameter. The inside diameter of a musket barrel is called the bore of the gun. Caliber refers to this diameter and is expressed in 0.01-in. increments, i.e., .69 or .75 caliber muskets. Shot is described in inches of diameter such as a 0.63-in. musket ball. The difference between the musket caliber and the ball diameter is called windage. Musket balls are generally 0.05–0.10 in. smaller than the musket bore to facilitate fast loading and reducing the risk of fouling (Neumann 1967:52). When black powder is fired, it burns inefficiently, leaving a residue on the inside of the barrel. Repeated firing causes powder fouling which reduces the available diameter of the barrel. If a ball has insufficient windage, it can become jammed in a gun and must be mechanically extracted with a worm or ball puller. Therefore, by adding an estimated windage value to the ball diameter, the gun caliber can be estimated.

A large number of dropped musket balls in a variety of diameters have been excavated at Monmouth Battlefield State Park. Most of these "drops" exhibit well-defined sprue marks and mold parting lines unlike the musket balls excavated at the Neuberger site. All 0.69-in. musket balls found at the Neuberger site show no evidence of being fired. This diameter ball is consistent with Brown Bess muskets. The surface characteristics of these balls suggest that they were possibly stored in a container such as a wooden box during transportation. This method of storage was used by the American army as shown in an inventory of military stores for 7 September 1781 which lists "Boxes of Musquet Balls" separately from "Musquet Cartridges" (Frothingham 1781). It is highly probable that the British army also stored musket balls in the same manner and likely transported this ammunition from Britain by ship (Hogg and Batchelor 1975:15). The ball size and damage suggest the site was possibly a British camp associated with one of the Middletown skirmishes or from the retreat to Sandy Hook after the Battle of Monmouth. According to Smith "the route was via the Middletown-Lincroft Road through Nut Swamp and Oak Hill" (Smith 1964:25), which would take the British army across the Neuberger property. On 29 June 1778, they camped in Middletown near Nut Swamp. However, the exact locations of the Middletown area campsites are not known.

Area 1 would have been an excellent location for a rest or campsite for several reasons: (1) It has soft sand with very little pebble or stone, which is good ground for sleeping and has excellent drainage; (2) It is near water, being next to the Nut Swamp Brook, which would be especially important for the exhausted troops who just fought at Monmouth in exceedingly hot weather and marched approximately 10 mi. on dusty dirt roads; (3) Area 1 is at an elevation where one can see in both directions of the road—not knowing the location of the Continental Army, it would be very important to cover their rear; and (4) Assuming the modern Middletown-Lincroft Road is at the same location as the 18th-century road, the bridge crossing the brook is

probably at or near the original bridge site—bridges are strategic and easily defended since the enemy is placed in a narrow environment with little or no cover.

Conclusions

It appears from the site maps that the original camp was situated in Area 1. If it extended to the southwest across Sunnyside Road into Area 2, then the construction of this modern road would have cut across the site, causing further disturbance. Therefore, Area 2 probably represents the outer fringes of the camp, or possibly soil removed from the road cut and distributed across the farm fields. This would explain why only a small number of period artifacts were found over such a large area. Further study of earlier topographic maps as well as the pre-construction road survey maps should show if the original hill were cut and leveled.

Although the Neuberger site events are conjectural, several important conclusions can be drawn. This was obviously a military site. The tenure of habitation was probably short. The vast majority of musket balls measured 0.69 in., and they exhibited little evidence of mold scars or sprue cuts. The balls have small concave indentations on their surfaces indicating that they were probably stored in a wooden box and subjected to vibration such as being transported. These data suggest that the site was possibly occupied by British troops.

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