Elemental Analysis of Bricks from the Peter McCutcheon House

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Abstract

In the fall of 2008, Birchwood Archaeological Services undertook an archaeological data recovery at the Peter McCutcheon Farm Site. This site is comprised of the remains of a mid 18th century brick house located in the town of Bethlehem in rural Albany County, NY. Bricks recovered from these excavations were subjected to elemental analysis using X-ray diffraction (XRF) in order to address key questions we had about the site. Results of the brick analysis from the McCutcheon house provide examples of the kinds of questions and research that can be addressed by examining often neglected materials, such as brick, through the use of XRF. A comparison of bricks with clay samples taken from a pond adjacent to the house suggests that most of the bricks were likely manufactured on site, potentially making the pond one of the earliest landscape features at the site. Results indicated that smaller bricks recovered from the base of the north fireplace were compositionally similar but not identical to the larger "moppen" bricks that comprise the fabric of the house, suggesting that they may have been manufactured in another location and that the fireplace probably represents a later remodeling episode. Finally the results also suggested that inclusions of a dark material initially thought to be coal was in fact ground up re-fired waster brick used as temper in some of the bricks.

Figure 1. This photograph of the north wall of the Peter McCutcheon House was taken by Paul Huey in 1969 and shows a combination of New World Dutch and English influences. By the early 1990s, the house had been abandoned, and in 2003 the north and east walls collapsed. The remaining walls were systematically dismantled and documented as part of the data recovery.

Why Study Bricks?

Bricks are among the most common ceramic artifacts found at historic archaeological sites, although they have been relative ignored by researchers due their apparent homogeneity and lack of research potential. In this example bricks make up a significant component of the architectural material recovered from the site. In our study, a series of macroscopic and compositional approaches were used to examine the bricks from the McCutcheon house.

Figure 2. Two of the bricks recovered from the site exhibited hand written inscriptions. One of the bricks was marked "40" while a second brick is less decipherable, but appears to say "cutch"- possibly part of the name McCutcheon. The numbering of the first brick is likely related to the brickmaking process, while the writing on the second brick may represent a name or other word, although not necessarily in English. Both of these bricks were recovered from the vicinity of the south fireplace. This area was thoroughly searched, although no additional marked bricks were identified.

XRF Analysis

Eight bricks were chosen for elemental analysis using x-ray diffraction. Four of these bricks were randomly selected from the 100 brick random sample, while two smaller sized bricks recovered from the base of the north fireplace were also selected. In addition a broken brick revealing large quantities of a black substance was chosen for analysis, as was the brick with hand written lettering.

The analysis was conducted using the Bruker AXS Handheld Tracer II©. The machine was set to "Lab Rat" mode to screen for all elements from the atomic weight of magnesium (Mg) to plutonium (Pu), at 40 kv, 3-5 micro amps, utilizing the vacuum with no filter. Readings were taken for 180 seconds at multiple points on each artifact to account for the heterogeneity of the materials. When compared in analysis, the samples were all normalized to the rhodium readings as it is rare to find rhodium on earth and its existence in the analysis is a deliberate byproduct of the manufacturing of the instrument itself.

Overall, there was surprising consistency across all the samples. The elements that dominated the bricks as well as the ceramic body were iron (Fe), silicon (Si), potassium (K), calcium (Ca), Titanium (Ti), and rubidium (Rb). Trace amounts of zinc (Zn) were found in some but not all of the samples.

One of the primary goals of the XRF analysis was determining if the bricks were made on site or if they were brought in from another location. A pond located to the southeast of the house may have been excavated in order to obtain clay source material for brick making. Such a finding would be highly significant in our interpretations, since the pond would likely represent the earliest demonstrable landscape feature at the site, predating the construction of the house. In order to test this hypothesis, two clay samples were taken from either side of the pond and used as a baseline for comparison.

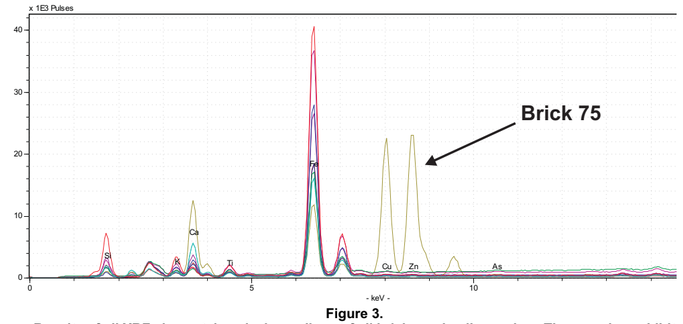

Figure 3.
Results of all XRF elemental analysis readings of all bricks and soil samples. The samples exhibit remarkable similarity, with the exception of Brick 75, represented by the khaki line in the graph.

When the samples were normalized to the rhodium readings, brick 53,54,86, the two "English" bricks, and the hand written "cutch" brick all exhibited similar elemental composition to each other as well as to the soil sample #2, collected from the east side of the pond. Results of the XRF analysis concluded that these bricks were likely all made from the same clay excavated from the pond. Soil sample #1, collected on the west side of the pond, showed similar elemental composition as the artifacts described above, but in slightly varying relative amounts. XRF analysis concluded that this brick, while varying slightly, still fit within the range of the other bricks made from the locally available clay.

The only anomaly noted was Brick 75, one of the four randomly selected bricks. This brick showed a pattern of similar elements as those above, but also containing significant amounts of zinc (Zn) and copper (Cu). XRF analysis concluded that the brick may not have been manufactured locally, although the clay may have had different tempering agents added to the matrix.

Results of the XRF analysis concluded that the bricks from the McCutcheon House were likely manufactured locally, with the possible exception of Brick 75. While it is impossible to say with absolute certainty that the bricks were made from clay obtained on site, results between the bricks and the clay samples appear highly correlative. Whether they were all manufactured at the McCutcheon property would depend on data ascertaining the extent of the particular soil matrix in that locale. It is possible that if the bricks in particular were all made at the property that the difference in size between the large "house" bricks and the smaller north fireplace bricks could illustrate multiple events of brick manufacturing by different individuals. It is also possible that some were made on site and that the smaller fireplace bricks may have been manufactured on a nearby property and brought to the site.

Figure 4. This reconstruction of the front (east) facade of the McCutcheon House is based on archaeological evidence and surviving photographs. Dendrochronology of the structural timbers suggests that the structure was constructed around 1786, the year McCutcheon obtained his lease. Several of the beams dated between 1735-1736, suggesting that some members were recycled from an earlier structure in the vicinity.

Brick Size

One of the more interesting aspects of this study is the unusual size of the bricks that once comprised the McCutcheon house. In the Albany area, most of the brick houses from the same period were manufactured from much smaller brick. A typical example is the Van Hosen House, dating to c. 1750 in Columbia County, which had bricks 13/4 x 33/4 x 8 inches (Stevens 2005:49). These bricks are very much in keeping with traditional, "English" sized bricks found both in the Old and New World. The dimensions of bricks that comprise the McCutcheon house more closely match those known as "Moppen" or "Utrecht" brick. Dimensions of this style of brick vary, and the term "Moppen" has also been defined as any large, red soft mud brick. Van den Hurk (2006:171) notes that moppen brick was the largest bricks of the five sizes of bricks in Holland, measuring a much as 24.5 x 12.3 x 6.8 cm (9.6 x 4.8 x 2.7 inches).

Brick size has long been discounted as a useful dating attribute except in the most general of ways (South 1964; Sopko 1982; Gurke 1987). Shrinkage due to drying and subsequent firing likely accounts for most of the variability in size. However, measurements may still be useful in determining the size of brick that the makers were trying to obtain. A total of 100 bricks were randomly selected for measurement using digital calipers (Table 1). Each brick was numbered and weighed, and distinctive attributes such as temper, the presence of animal tracks and other characteristics were noted.

Four of the bricks have imprints resulting from rainfall, while five had evidence of sand along the top of the bricks, suggesting that they were sand struck during the molding process. Human finger prints were clearly noted on two examples, while five showed evidence of animal tracks. While not exclusively part of the 100 brick sample, bricks recovered from the McCutcheon house showed evidence of several species, including one or more cats, dogs and raccoons. No human or livestock footprints were noted.

Two of the bricks showed evidence of heavy cracking, and several were noted as being malformed and imperfect, suggesting poor and variable quality. It is unclear if this variability reflects inexperience on the part of the brickmaker, poor quality of the clay source, or poor environmental conditions at the time of firing. Brick size may also play a factor in the quality of the brick, since larger, denser brick would require a longer burn in order to fully set up. It seems likely that a combination of factors contributed the size and variability of the bricks found at the site.

Table 1.
Measurements from a random sample of bricks recovered from the Peter McCutcheon House

	Length	Width	Mass	Thickness
Minimum	20.2	10.0	6.0	2.68
Maximum	23.0	12.0	8.0	3.50
Mean	21.682	11.008	7.036	3.0101

All measurements in centimeters

Elemental Study of Brick Temper

Also tested were dark nodules of temper in a split brick which were originally hypothesized to be coal pebbles. Analysis by the XRF instrument indicated that it was composed of the same elements in the same relative amounts as the above discussed brick samples, and is most likely previously fired waster brick temper.

Of the 100 randomly selected bricks from the above sample, 35% showed visible evidence of this refired brick on at least one exterior side. Refired brick was most commonly found on only one or two sides, although six bricks showed evidence of dust and small fragments of temper on all six sides. While not a precise measure of the relative volume of the temper material within the fabric of the bricks, it does suggest that not all bricks were tempered, and that varying amounts of refired brick were used during the successive firings at the site.

Figure 5. Brick showing dark colored tempering material identified as over-fired brick.

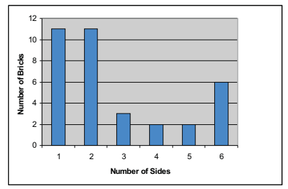

Figure 6. Graph showing the frequency of bricks showing eviedence of tempering on their exterior.

Assuming that the bricks were made on the site, it seems unlikely that the bricks would have been tempered until after the initial firings occurred, thus creating the overfired brick necessary to produce the temper. Brick manufacturing was an evolving process, with constant modifications being necessary throughout the mining, mixing and firing processes to ensure that the proper results were obtained. Bricks recovered from the Peter McCutcheon house are the result of this evolutionary process, although the chronology of these events and the causes necessitating some of these changes is still speculative.

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