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Summary

Excavations at Brandon, Suffolk, revealed a lead pad that may have been used as a backing for fine metalworking. The evidence suggests that it was used for some kind of fine metalworking but was probably not used as a backing when creating cross-hatched patterns on gold foils. The depressions on the pad were most likely created by either a die or an individual punch tool.

Keywords

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Introduction

During excavations at Staunch Meadow, Brandon, Suffolk, a lead artefact was found with impressed patterns on one surface. Jane Cowgill (pers. comm.) suggested the object may have been used as a backing material for metalworking, and so could be indicative of fine metalworking taking place on the early 8th to late 9th century settlement site (Carr *et al*. 1988), for example the production of cross-hatched gold foils for garnet jewellery. Experiments have taken place that show lead would have been a perfect backing material when creating patterns on gold foils, although no archaeological examples have ever been found (Meeks and Holmes 1985, 155). The aim of this report is to describe the lead object and discuss whether cross-hatched patterns may have been applied to gold foils using it as a backing material.

Background

The garnet jewellery found at Early Saxon sites, such as Sutton Hoo and Faversham, was made with remarkable skill. The metalworkers created finely-patterned foils and placed them behind the garnets to reflect light through the stones and highlight their natural, deep red colour (Meeks and Holmes 1985). Both gold and silver alloys were used to make foils although gold was more often used in early medieval jewellery as it was easier to work (Avent and Leigh 1977, 1-6: Tulp and Meeks 2000, 21).

The patterns on the gold foils in jewellery from various sites have been analysed to reveal that two types were used. The first was a standard pattern consisting of a simple square grid, so that the foil appeared uniformly dimpled. The second, known as a boxed pattern, consisted of a bold, square grid pattern made up of wider and deeper ridges, surrounding a number of standard squares, usually nine. The coarseness of the patterns varied, with 1 to 5 lines of depressions per millimetre found in the Sutton Hoo jewellery (Avent and Leigh 1977, 1-6).

The patterns in the foils were produced using a die. Sheets of foil, up to 50mm wide, appear to have been cut to shape first, usually larger than the garnet to be set, before being stamped with a pattern (Avent and Leigh 1977, 1-6; East 1985, 140-141). Dies used for punching patterns into foil have been found at sites in Denmark and the Netherlands. Analysis of a positive die from Tjitsma showed that it was leaded bronze and that the pattern was a fine boxed pattern, with 16 to 20 smaller boxes inside the larger ones. In some places the squares became irregular, elongated rectangles, creating a unique physical characteristic that would make it easier to spot corresponding foils, although so far no matches have been discovered (Tulp and Meeks 2000).

No dies for punching patterns into foil are known from Britain. Two positive dies have been found at Rochester and Bury St Edmunds, but these are on a much bigger scale and were used to produce patterns on metal cups by rubbing the surface of the foil against the die (East 1985, 138). At Tattershall

Thorpe a 7th century burial was discovered with two bundles containing metalworking tools and scrap material. The tools included hammers, tongs, a small anvil and tools that may have been used to punch designs in non ferrous metal (Hinton 2000). A range of tools used for fine metalworking were also found at the Anglo-Scandinavian site at 16-22 Coppergate, York, including small individual punches, one with flecks of copper alloy adhering to it (Ottaway 1992, 515-521). Tools such as these may have been in use throughout the Saxon period.

Meeks and Holmes (1985) carried out experiments in foil reproduction to discover what materials were best for constructing the dies and how they may have been created. When foils were punched whilst on a lead backing, sharply-defined patterns resulted and all the detail on the die was transferred when the foil was deeply punched. It was also clear that the thickness of the lead, and the type of material supporting the lead backing itself, were important and could vary the results considerably. For the best results gold foil was placed on a thin lead sheet, about 4mm to 8mm thick, on a solid surface, such as an iron anvil (Meeks and Holmes 1985, 155).

The site

Staunch Meadow, Brandon, is located to the west of town, south of the Little Ouse river. Excavations in 1979 and 1988 revealed that settlement was concentrated in the Middle Saxon period, although there was also a Mesolithic and Iron Age presence at the site. The site was abandoned in the 9th century and produced large quantities of undisturbed remains (Carr *et al*. 1988). The metal finds included 234 bronze pins, 3 styli, a fragment of a coptic bowl and other small finds in silver. There were only a few brooches found at Brandon and none contained garnets, although this is to be expected of a Middle Saxon site as the use of garnets in jewellery went out of fashion in the late 7th century (Avent and Leigh 1977, 1-6). Fragments of pottery crucibles, a stone ingot mould, waste fragments and cut sheets of non-ferrous metal suggest that non-ferrous metalworking was taking place on the site. Most of the industrial activity at Staunch Meadow in Brandon was dated to the Middle Saxon period. The lead pad was found on the spoilheap but it seems likely that the lead pad was either misplaced or discarded during the Middle Saxon period (Carr *et al*. 1988).

The lead pad

The lead pad is circular with a diameter of 64 mm and is 14 mm thick. On the surface there are two clear imprints of patterns consisting of a number of squares and rectangles sunk into the surface of the lead. Each set of imprints measures 11mm (6 boxes) by 10mm (5 boxes). There are additional, less clear imprints on the surface of the artefact including other faint patterns. There is a ridge around the circumference of the pad which is up to 1mm high

in places. The back of the lead pad is slightly concave in shape and has a ridge on one edge (see bottom of right hand image in figure 1).

Figure 1: Front and back of the Brandon lead pad.

The Brandon lead pad was examined using light microscopy and scanning electron microscopy (SEM). At high magnification, the pattern appeared to be a standard one, as no further detail was observed (Figure 2 and 3). In each patterned area, some of the depressions are almost square while others are clearly rectangles and together these different shaped individual depressions have created a pattern, the same for both sets of marks (Figure 4). Overall, each pattern has two rows of large, almost square, depressions followed by a row of thinner rectangles and then two more rows of large, almost square, marks. Patterns of this type were observed in the gold foil in jewellery found at Sutton Hoo although the patterns seen on the Brandon lead pad are very coarse and crude in comparison. The individual Brandon pad depressions are large and measure more than a millimetre across while some of the Sutton Hoo foils have 3 lines of punch marks to a millimetre (East 1985, 130-131). The depressions are all of variable depth but none is more than 0.5mm deep. The edges of the depressions are also varied, with some sharp but others more rounded. The bases of many of the marks are flat but a few, particularly in the thin rectangular row, are angular and almost ‘V’-shaped at the bottom. Twisting also seems to have occurred and some of the square impressions have been distorted. The irregular shapes of some marks may have been only partial impressions and if the punch had been hit harder, or the pad had been completely even, it might have given a full impression.

Figure 2: Upper set of depressions in figure 1, showing the pattern.

Figure 3: The lower set of depressions in figure 1, with a similar pattern

There are other marks on the Brandon lead pad that appear to have been made in antiquity. These include a large cut into the surface, 16mm long by 1mm wide, and three dents in the edge, around 9mm in length, almost opposite the cut. SEM images show that the pad was probably used after these marks were made as their edges seem to have distorted slightly.

Discussion

The Brandon lead pad is a convenient size for delicate metalworking. The raised edges seem to have been deliberately left, perhaps because they could be used to hold a foil or a small item while it was being worked. The almost flat base and ridge would have made it easy to hold the lead pad on the edge of a solid surface while working.

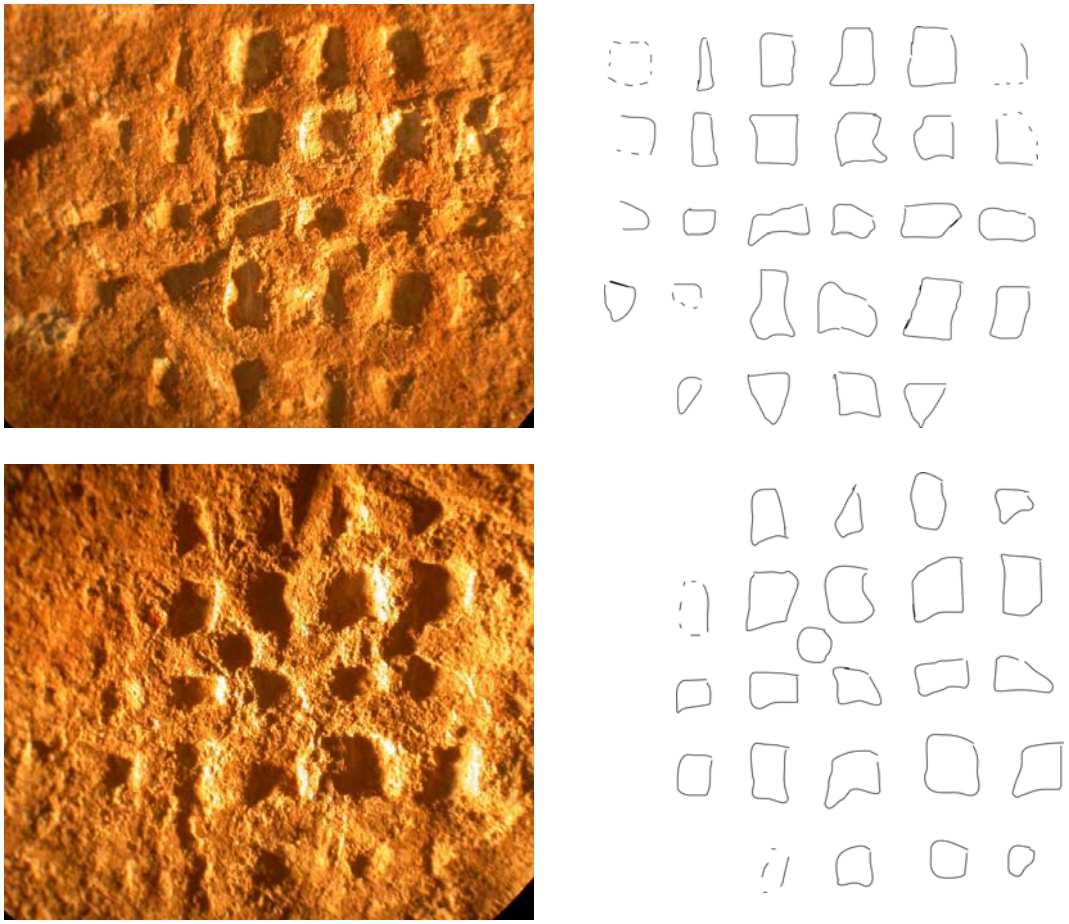

Figure 4: Close up photographs of top) Figure 2 and bottom) Figure 3 with a diagram showing the shape and sizes of the individual impressions.

There are three possible theories as to how the sets of marks on the Brandon pad were produced. The first is that the punch had a narrow rectangular face that had been cut to produce a line of upstanding squares. This would have produced one line of square depressions and would have been moved across the work piece to produce several parallel lines of marks (Figure 5b). This theory, like the die theory above, is supported by the similar shapes and sizes of the depressions but also accounts for the shift in alignment in the second pattern. The square depressions are more consistently aligned from left to right (Figure 4) indicating that, if a linear punch was used, it would have consisted of 6 squares. The narrower rectangular depressions, with their almost 'V' shaped bases, may indicate that the punch was used at an angle to create a thinner line; otherwise another tool would have been required. The main case against a line die being used was the irregularities, such as twisting, which occur within the line of punch marks. These are then not repeated throughout the design creating a row of similarly shaped twisted depressions which indicates that a line die could not have been used to create the patterns.

The second possible explanation is that each depression was made individually by a single tool (Figure 5a), resulting in a coarse pattern made up of different-shaped indentations. The pattern could have been made using tools similar to the iron punches found at Coppergate, York, which match the

size and shape of the individual impressions on the Brandon lead pad (Ottaway 1992, 517). At Brandon a copper alloy, tapered, square-sectioned rod was found, which could have acted as an individual punch tool (Tester and Anderson 2002, A-31). One indication that each depression resulted from an individual punch tool was that they are all of varying depths and shapes and some twist in different directions. The thin vertical row (Figure 4) is also repeated on both design and would have required another tool to create. When compared to the other pattern, most of the irregularly shaped depressions are almost the same and occur in the same locations; this would be extremely difficult to replicate by eye.

The third possibility is that a die of some sort was used to stamp a pattern on a thin object backed by the lead pad (Figure 5c). This theory is supported by the fact that the two sets of marks look very similar and are the same size. The shapes of the individual depressions in each pattern are also very similar and in some cases traits are repeated between the two. If a die did produce the marks, then it would probably have been a punch with a face about 10mm across with two sets of parallel groves cut into it at right angles to each other leaving a grid of upstanding rectangles. The problem with this theory is that, in one set of marks, one of the lines of depressions (Figure 4, bottom) is at a slightly different angle to the other lines but this is not repeated in figure 2 where they are all fairly parallel. However differences in the spacing may have occurred due to the unevenness of the lead pad, accidental twisting of the die during use or distortion after stamping. If a die was used to create both patterns it would explain some irregularities that occur in the same location in both patterns, this would be extremely difficult to replicate using individual punches. The partial pattern (Figure 4, below) may indicate a failed stamping as the depressions on one side of the pattern are deeper and the depressions seem to fade. This indicates that the die was used at an angle and may explain why there is two sets of depressions as if the first failed they may have tried again.

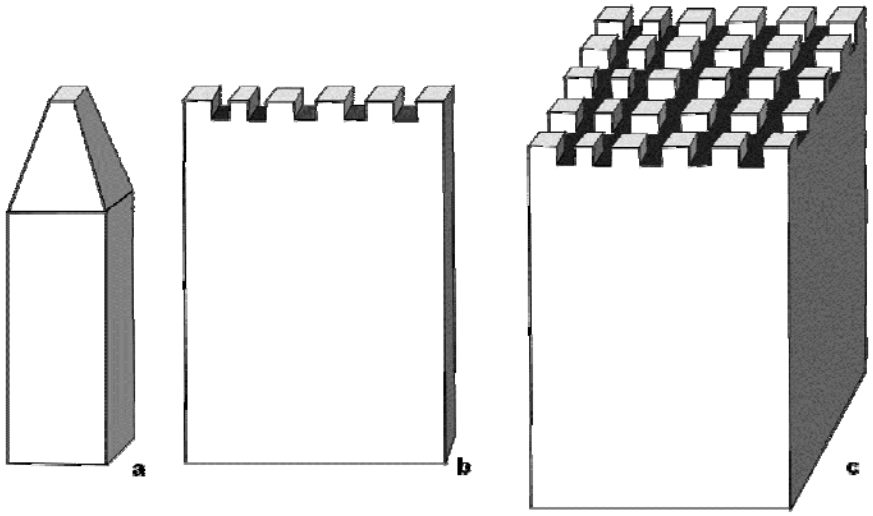

Figure 5: The three different types of punch tools.

The many different depths and shapes of the depressions probably reflect the angle at which the die or tool was held and the force applied. If the lead pad was used as a backing whilst thin sheet metal was being decorated using the punch, the varying thickness of this metal and the softness and evenness of the lead backing, would affect the depressions produced. However the sharp edges of the depressions suggest that the punch may have been tried out directly on the pad prior to being used on other metals; the fainter marks on the surface may be the impressions left when something was placed between the die and the pad.

It is unlikely that the lead pad from Brandon was used for creating cross-hatched foils, to back garnets, for several reasons. The dies from the Netherlands and Denmark for making gold foils are slightly larger than the patterned areas on the Brandon pad, ranging in size from 18mm wide to 22mm. The patterns created by these dies were also much finer, with between 4 and 5 lines per millimetre, and far more regular. The pattern on the Brandon pad is coarser than any known dies or gold foils that have been found elsewhere, although a similar style of pattern was found on the Sutton Hoo helmet, foil no 19, which also had elongated punch marks in the middle with larger ones on either side (Meeks and Holmes 1985, 146). Lastly, the other evidence for metalworking from Brandon is for non-ferrous alloys, rather than precious metals, and post-dates the period when garnet jewellery with backing cross-hatched gold foils was most fashionable in the late 7th century (East 1985, 139-140).

If the lead pad was not used as a backing for creating cross-hatched patterns on gold foils then it must have been used in some other industrial process. Stamped pottery was also common up to the late Saxon period and some of the designs used are similar to the patterns on the pad, although much coarser (Briscoe 1981). Some leather objects were decorated by damping the surface of the tanned leather and stamping a design with a fairly sharp metal, antler or wooden tool, but Quita Mould (pers. comm. 2005) thinks it is unlikely to have been used in leather production. There was no evidence for pottery production or leather working at Brandon, but evidence of copper alloy working, such as sheet and off-cuts, was recovered (Carr *et al*. 1988). The most likely explanation is that the pad was used in some kind of fine copper alloy working, although none of the copper alloy waste or objects found at Brandon had impressions similar to those found on the lead pad (Anderson pers. comm. 2005). This is supported by the faint depressions present on the entire surface of the lead pad which indicate that something, such as sheet metal, was placed between the die and the pad.

Conclusion

The Brandon lead pad appears to have been used as a backing for working non-ferrous alloys but the impressions on the pad are unlikely to have resulted from the production of cross-hatched patterns on gold foils for jewellery. It is difficult to know whether the pattern was created using a full die or a single

punch tool, although the similarity between the irregularities in both patterns suggests that a die was used.

Lead pads used in fine metalworking are rare archaeological finds, although a Roman example has been identified by Angela Wardle at Gresham Street in London (pers. comm.). The discovery of the Brandon lead pad and any future lead pads will therefore add to our understanding of fine metalworking in the past.

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