AB

Ancient Monuments Lab Report No 4321

The examination and analysis of some enamels from the Yorkshire Museum

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A total of 14 objects were examined and the metal they were made from was analysed qualitatively by X-ray fluorescence (XRF). The objects are described individually below; the analytical results appear in the table.

1 Brooch in the form of a horse (H 1396)

The enamel decoration comprises two large fields on the horse's back and belly as well as a band of five small square fields running across its forequarters. The small fields contain turquoise enamel, the back is blue while the belly now looks green, though this is probably not its original colour. The eye is now empty but probably originally contained enamel or a small inlaid sphere of glass. Round and between the enamel fields on the horse's body lies a band of tinning though the areas between the small square enamel fields are not tinned.

2 Disc brooch (B 1)

The central part of the triskele is red (with a reserved metal central spot) while the enamel fields on its arms are turquoise. The background is blue.

3 Button and loop fastener (BL 2)

The outer ring of decoration comprises thirteen petal-shaped fields separated by smaller, triangular fields. The petals are of two colours, approximately alternating. The fields are numbered clockwise, 1 and 13 being next to the loop; fields 3, 4, 6, 8, 10 and 12 are turquoise and the others of an unknown colour. The colour of the small triangular fields cannot be

determined either. The central part of the design is executed in reserved metal surrounded by turquoise enamel. The central lozenge is probably not turquoise and may be the same as the other unknown enamel on this object.

4 Button and loop fastener (BL 3)

Both inner and outer parts of the design are the same with lozenges of reserved metal separated by fields of enamel, two colours alternating. Both colours are badly decayed; one now looks pale greenish and is flakey and much of it is missing while the other looks dark brownish and is all present, though much altered. Original colours cannot be suggested.

5 Bird brooch (H 139C or H 137C)

The fields for enamel are arranged in two rows of four down the bird's back/wing. As with no.1 the area around and between the enamel fields is tinned. Traces of enamel survive in only the two bottom fields (nearest the tail); in both cases it is red.

6 Duck brooch (?H 31)

There are 6 enamel fields on each wing and a band of decoration down the back too. The bird's eyes are spots of enamel. The enamel on the wings is of two colours which alternate. They now look pale green (nearest the head) and dark green and would originally have been (probably) green and red respectively. The decoration on the back comprises 3 turquoise lozenges with between them triangles which would originally have been red; nearer the tail the lozenges are of reserved metal though the triangular enamel fields seem to continue. The eyes now look pale green like the enamel on the wings and so were probably originally green.

7 Duck brooch

Pair to no.6; colours are identical.

8 Pendant (H 2438.10)

This object is undoubtedly decorated with enamel but without conservation or x-radiography the design cannot be made out. At present no enamel colours can be suggested.

9 Finger ring (H 2440.16)

The disc on the ring contains four spots of reserved metal in a field of turquoise enamel.

10 Cockerel brooch (B 3. H 139A)

All the enamel is deeply weathered but most appears to be of a single colour, probably originally red. It fills the five small triangular fields round the back of the neck, the fields at the top of the wings and the two small fields below the yellow enamel. The long thin fields along the bottom of the wings are too badly decayed for their colour to be discerned; it would not have been either red or yellow. On the head of the bird there are two further enamel fields below the eyes which now look black (perhaps not their original colour). The centres of the eyes may have contained enamel or glass inlay (cf no.1).

11 Rectangular plate (H 2438.5; Cook Colln D38)

There were two colours of enamel, one in the seven spots down the centre and the other in the triangular fields on either side of the spots. The spots now look paler than the other enamel; a fuller description may be possible after conservation.

12 Disc brooch with lugs

The ring of enamel round the central boss is made up of alternate blocks of blue and white glass, eight of each. The enamel in the fields on the lugs

is obscured by heavy lacquering; probably not all are the same colour though some may be turquoise.

13 Plate with millefiori enamel (H 2438.11?)

The broken rectangular fields are filled with slices from a millefiori rod which is a 7 x 7 chequer-board of black and yellow. The pelta terminal is also enamelled though only part of this can be seen, the rest is obscured by metal corrosion products. What does show is a second millefiori pattern in black, red, yellow and turquoise (see drawing for details).

14 Disc brooch (B 2)

There are two rings of enamel round a central boss. The outer one is made up of alternating blocks of white and blue, originally eight of each, while the inner one was probably originally all red. (The blue glass which can be seen there probably comes from the outer enamel field).

Table of analytical results

Object No	Alloy
1	Bronze
2	Brass/gunmetal
3	Leaded bronze
4	Leaded gunmetal
5	Brass/gunmetal
6	Gunmetal
7	Gunmetal
8	Brass

9	Bronze
10	Gunmetal
11	Brass/gunmetal
12	Brass/gunmetal
13	Leaded bronze/gunmetal
14	Brass

Notes:- Brass = copper + zinc

Bronze = copper + tin

Gunmetal = copper + zinc + tin

Discussion of analytical results

Most objects contained detectable amounts of tin, zinc and lead in addition to copper, but in widely varying proportions. Alloys which are mainly copper and tin are called bronzes, those which are mainly copper and zinc are brasses while alloys which contain significant amounts of both tin and zinc are described as gunmetals. Bronzes and gunmetals containing large amounts of lead are also found; they are described as leaded alloys. Where more than one name appears in the table there is uncertainty in interpreting the analytical results and an intermediate composition is thought most likely.

The most notable point to come out of the analyses is the wide range of alloys used to make the objects. Many British-made enamelled brooches are heavily leaded bronzes, while contemporary Continental examples tend to contain more zinc (Bayley and Butcher 1981, Fig 7). This is however not a universal pattern as about half the trumpet brooches analysed in another study (Bayley forthcoming) were shown to be made of zinc-rich copper alloys and trumpet brooches, many of which are enamelled, are thought to be of British manufacture. While some of the

objects examined here may well be of British manufacture, at least some are probably of continental origin.

References

Bayley, J (forthcoming) Copper alloys and their use in Iron Age and Roman Britain. Proc. 1984 Archaeometry conference.

Bayley, J and Butcher, S (1981) Variations in alloy composition of Roman brooches. Revue d'Archeometrie, supplement, 29-36.

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15 Harness fitting

The central disc is divided into four quadrants, each filled with enamel. Those nearer the ends are blue and (probably) white while the fields nearer the sides were both probably originally red.

16 ?Handle (H.141.129)

The panel of enamel is made up of a line of four heart-shaped fields with a border down each side. All the enamel is blue.

17 ?Handle (H.141.130)

Pair to no. 16. The enamel is all one colour - probably blue.

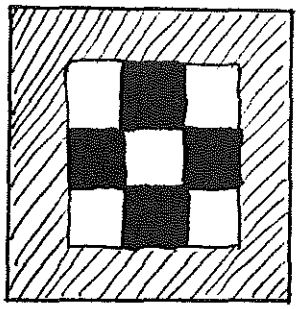
All three objects are leaded bronzes.

Site No 173

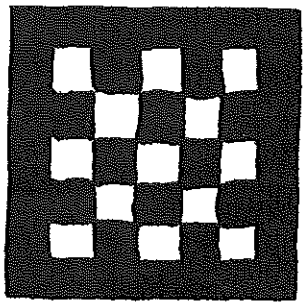
Second addendum to AML Report No 4321

18 Large stud (from Station Hotel, York in 1878)

The face of the stud has five fields of enamel; a central circular one and around it four concentric rings divided from each other by reserved metal. The central field has a chequerboard pattern of two alternating millefiore squares, patterns A and B, illustrated below. Moving outwards, the first ring is made up of millefiori blocks of pattern C and the second ring is plain turquoise enamel. The third ring is millefiori blocks of pattern A while the outermost ring is made up of distorted and decayed millefiori blocks of pattern D. The metal is leaded bronze. The exposed metal on the front of the stud may originally have been tinned though no positive evidence for this can be seen at present.



A



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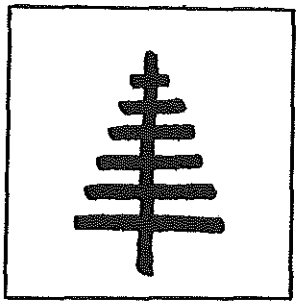
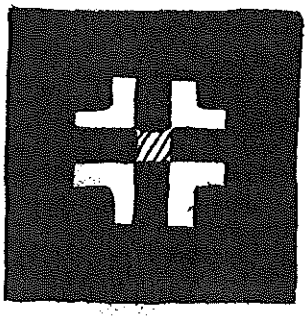


C



D

■ = blue ▨ = red □ = white