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Site No 271

ANCIENT MONUMENTS LABORATORY REPORT NO. 4409

Examination of Technological Material from Bishopgate, Norwich

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Several samples of Medieval (12th - late 13th century) material of possible technological significance from the fill of gravel and sand pits were examined. The samples may have been associated with five features of similar date found close to the pits. These included two circular 'ovens' with shallow flues and three hearths. Two of the hearths were in one building and the third was in an adjacent building. One of the 'ovens' had a circular 'fire-pit' 1.20 m in diameter and 0.24 m deep. The other 'oven' was about 0.80 m in diameter. All the material examined, however, was from the gravel and sand pits and so could not be directly associated with any of the features.

Each of the samples is identified below, and the implications of the material for the likely metalworking activity on the site is then discussed. All elemental analyses were qualitative and were carried out using energy dispersive x-ray fluorescence.

BGN 72 (155)

A partially oxidised fired, unvitrified ceramic which has not been used as a crucible. Its appearance does not suggest that it was intended to be used as a crucible.

BGN 72 <97> (143)

A piece of iron smithing slag in three fragments. Iron smithing slag is the slag which collects in a blacksmiths hearth.

BGN 72 <118> (254)

A piece of hearth lining. High levels of copper and tin, and some lead, were detected in some areas. It was part of a hearth used in the melting of bronze (copper-tin alloy) which contained some lead.

BGN 72 (291)

Apart from one lump of iron stained limestone, sample consisted of fragments of coarse, porous, fired clay most, or all, of which was part of a mould (or moulds) used in the last wax casting of a large object. The larger fragments consisted of two layers, a black reduced fired layer and a red, oxidised fired, layer. In a few cases there was evidence of a relatively smooth original surface of fine clay on the reduced fired layer. Analysis of these fragments revealed significantly higher levels of copper, lead and tin on the original surface than on the oxidised fired back of the fragments. Zinc was detected at similar low levels on both surfaces. Although zinc may have been present in the metal being cast, it would only have been present at very low levels. The fragments were too small to enable the object being cast to be identified, but bells and cauldrons were the objects most commonly produced using moulds of this type. The analytical results would suggest that bell founding was more likely in this case.

The method used to cast bells or cauldrons is described in Tylecote, 1976 and in Hawthorne and Smith, 1979.

BGN 72 140 289

Several dribbles of waste metal containing high levels of copper, tin and lead. The remaining metal in one fragment appeared white and was hard and brittle. The sample was waste metal from casting high tin bronze containing some lead.

BGN 72 120 291

The bulk of this sample consisted of fragments of casting waste which included metal, charcoal and fuel ash slag (which is produced by a high tempertature reaction between ash and, for example, clay or sand). These fragments contained high levels of copper and tin and some lead, and were waste from (probably high tin) bronze casting. The bronze contained some lead.

The remaining material consisted of one lump of lightly fired soil of no technological significance and one mould fragment. The mould fragment contained numerous droplets of corroded metal which contained copper, lead and tin. It had been used in the casting of a fairly large bronze object, but it did not form part of the same mould as the fragments in sample BGN 72 291.

BGN 72 139 196

Most of the fragments in this sample were also waste from casting (probably high tin) bronze similar to samples BGN 72 140 289 and BGN 72 120 291. There was also one small spherical lump of corroded brass (copper-zinc alloy) which was probably an object originally, and several pieces of a blue material which contained barium, calcium and, at lower levels iron, sulphur and strontium. The only minerals detectable by x-ray diffraction (which has a detection limit at about 5%) were calcite ($Ca\ CO_3$) and barytes ($Ba\ SO_4$). However, neither of these minerals would be expected to produce the colour observed. It was suggested (R. Harding, Geological Museum, personnel communication) that the colour might be due to low levels of vivianite ($Fe_3\ (PO_4)_2\ 8H_2O$) but no phosphorus was detected by x-ray fluorescence. Altenatively the colour may be due to staining by an organic dye either deliberately or accidentally. The material would not have been of use in any technological process, and in particular it was not a copper ore. Its presence may have been accidental, and the only apparent use to which it could have been put was as a pigment.

Overall the material examined included remains from two metallurgical processes, blacksmithing and casting of bronze. There was no evidence for smelting of coper, iron or any other metal.

The evidence for blacksmithing consisted of a single piece of iron smithing slag. Since iron smithing slag is found in small quantities on most inhabited sites of the Iron Age or later nothing can be said about the likely scale of iron working (if there was any) on or near this site.

Substantial evidence for bronze casting was present, however, and it seems likely that most of the hearth lining, mould fragments and dribbles of metal were associated with bell founding using a lost wax casting process. Bell metal is a high tin bronze containing at most a few percent of lead, whereas cauldrons typically contain high levels of lead and less tin than bell metal (Tylecote 1976). The composition of the metal examined was consistent with its being bell metal. The major structures necessary for bell founding are a bell pit and a hearth in which the bell metal is melted. The bell mould is fired in the bell pit and remains there while the metal is cast into it. The bell pit and the hearth would therefore be expected to be built as close as possible to each other, and might even have been directly connected by a channel (See Hawthorne and Smith 1979 for a description of structures used in bell founding).

Although on the basis of the information available about the features found near the gravel and sand pits, there is no evidence that they were directly associated with the bell founding suggested by the samples examined, it is quite possible that some of them, at least, were either bell pits or hearths used to melt bell metal.

References

R. F. Tylecote "A History of Metallurgy", 1976 pp 71-75

J. G. Hawthorne and C. S. Smith "Theophilus : On Divers Arts", 1979 Dover edition, pp 167-176.