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Ancient Monuments Lab. Report No 4103

The Examination and analysis of glazed tiles etc from York Minster

The finds submitted were all examined under a low power microscope and their surfaces qualitatively analysed by x-ray fluorescence (XRF).

There were two irregular pieces of stone which were completely covered in a thin, pale greenish glassy layer (M2211, M2220). This glassy surface was the accidential product of heating the stones in a fire where the silica of the stone reacted with the (alkaline) ash. Fuel ash glazes of this sort can form when any silicate material (eg sand, clay, stone) is heated for long enough at a high enough temperature in contact with alkalis such as the ash in a fire.

Further examples of fuel ash glazes are to be found among the tiles with glassy surfaces ie PG 177/4, MT 2 tile 22, XB 244/1, EN/4, XB 30/14 and PK 210/30. These 'glazes' can have a number of different origins; the tile may be a waster, accidentally spoiled in the kiln where it was fired; the 'glaze' may have been produced by deliberate contact with heat (eg in the fire-box of a hypocaust system) or it may be an accidental vitrification produced when the structure the tile was part of burnt down.

The other tile samples (AH 23/18, XK 97/20, XB 24/15 and PK 210/10) all had considerable quantities of lead in the glazed areas. In a similar way to alkalis fluxing silicates to produce glass, lead oxides also react with silicate materials producing lead glasses or, where there is only a thin surface layer, lead glazes. This clear yellowish glaze is common on medieval pottery and floor tiles. This sort of glazing can, like fuel ash glazing, also happen accidentally if lead is

heated in oxidising conditions in contact with a clay ceramic. Lead dribbling into a fire on a tile hearth might be enough to produce local lead glazing of the tiles while on a larger scale the destruction by fire of a house with quantities of lead plumbing can result in massive deposits of brick and tile, cemented together by the accidentally formed lead glass. The lead glaze on XB 24/15 and AH 23/18 definitely look accidental as the glassy layers are thick, localised and have pitted the underlying clay. The deposits on XK 97/20 and PK 210/10 are thinner and more even and so may be the remains of a deliberately applied glaze.

The lead glazes on the potsherds ST/170 and ST/351 are just the same as those on the tiles. The real question is whether they are deliberate or accidental. I do not think the glazing is deliberate as i) it is on the inside of the vessel rather than the outside which is where both Roman and later Saxon pots tend to be glazed, ii) it is patchy, neither 'splashed' nor continuous, iii) it has been soft when in contract with a lot of sand etc which has stuck to it and iv) it also has embedded in it droplets of metallic lead. Most of these points could be argued against if the sherds were kiln wasters but I am still not happy with them as deliberately glazed pottery. A further possibility which should be considered is that the glaze was accidentally produced in the course of a lead working operation of some sort. The possibilities would seem to be lead melting, the production of lead oxide or the melting or manufacture of high lead glass. As it is lead oxide rather than the metal itself which reacts with silicates to produce glazes, metal melting is unlikely to produce widespread glazing as found here (the temperature is unlikely to have been high enough anyway). In making lead oxide again the temperature would probably not be high enough to produce glazing. The main use for the resulting oxide would be in the intentional glazing and pottery or tiles and so the process is unlikely to have been carried out unless ceramics were to be glazed on a reasonable scale. Finally, pots containing deliberately made lead glass are known in 10th century contexts but the deposits in them are far thicker than those seen here so these sherds are not likely to have been used in this

way. I would suggest that the glaze on the potsherds, like that on XB 24/15 and AH 23/18, is of accidental origin.

The final group of finds are those probably from a 13th century bell pit. M 2166 comprises two lumps which are mainly metal. XRF analysis showed them to be high tin bronzes containing minor amounts of lead. Where clean metal was exposed it was seen to have a white colour. These results are consistent with the metal being bell-metal. The lump in M 2185 was of similar composition though it also contained a little zinc which is not normally found in bell metal. The metal spilt on the clay (in M2093) appeared to be a lower tin bronze while the metal corrosion on the large stone in the same sample was indicative of a brass and as such was unlikely to have had anything to do with bell-casting.

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