

# ANALYTICAL ANALYSIS AND MANUFACTURING TECHNIQUES OF ANGLO-SAXON TILES

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## Summary

The method of manufacture of the tiles from York has been studied in detail and the results obtained compared with pre-Conquest tiles from other locations (Betts 1985, 285-314).

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## Method of Manufacture

Certain York tiles were clearly made in a mould as moulding sand survives on the bottom surface of the tiles. In other tiles any traces of moulding sand which may have been present have been removed when the bases of the tiles were scraped smooth. However, there is no evidence to suggest that these tiles were manufactured differently. The Canterbury and St Albans tiles both have examples of sanded and smoothed backs. The design was then impressed into the top surface presumably with a wooden die. In the case of the Bury St Edmunds tiles, Gem and Keen (1981, 25) suggest that the pattern was produced by pushing the clay into a mould with the design cut into the bottom surface. The evidence for this is the irregular backs of the Bury St Edmunds tiles. At Coventry yet another method of manufacture seems to have been employed (see Stokes, in this volume).

How York's flanged tiles were produced is uncertain. Either the clay was bent over to produce the flange, presumably after the decoration had been applied, or they were added separately. Flanged tiles are also known from St Albans. These flanged tiles were probably used to form a raised altar platform (Backhouse *et al* 1984, 136).

Certain of the smaller York tiles with the same die stamp can be split into two groups (Fig. 1). One set of tiles has one bevelled edge with no keying, whilst the second set of tiles has twin bevelled edges with keying. There are also certain tiles with one bevel and keying but these are rare. This suggests that at least two tilemakers were employed to make the York tiles, each with their own particular way of trimming the clay prior to glazing and firing. This same division into single and twin bevel sided tiles is seen on the tiles from St Albans, Canterbury, Bury St Edmunds, and Winchester.

At York, keying was carried out after the sides of the tile had been knife trimmed. This was done using a pointed stick, chisel or similar instrument. Some of the smallest tiles, however, have a single large semi-circular gouge in their bottom surface. The majority of the York examples are keyed, particularly the larger tiles, and the same is true of the Coventry tiles. A number of the St Albans tiles also have keyed backs. At Coventry, keying is produced by knife cut marks or with a stick or chisel. In addition, certain Coventry tiles are keyed with circular depressions, 12mm in diameter, the same method of keying used on certain plain tiles from Winchester. In contrast, the backs of the decorated tiles from Winchester are unkeyed, as are all the tiles from St Edmunds Abbey, Canterbury and the single example known from Westminster.

Three designs at York have additional small circular holes added by hand to the stamped decoration. Exactly the same technique was used on some of the Coventry tiles, although here the added decoration is more elaborate.

After keying the tiles were covered with glaze ready for firing. Despite their name, not all tiles are polychrome. Although most of the simple tile patterns do show two colours, some of the more complex designs at Coventry and York were covered in a single glaze. Presumably, the tiles must have been stacked horizontally in the kiln to prevent inter-mixing of the glaze on two colour tiles. A temperature of 950-1000°C has been suggested to fuse the glazes adequately (Gem and Keen 1981, 26), although Stokes (pers. comm.) believes that a figure of 1000-1050°C is more realistic.

### Analytical Results

Using a combination of petrological analysis and neutron activation analysis eight tiles from York were compared with Roman and medieval tiles which were almost certainly locally produced. In addition, they were also compared with a selection of brickearth samples obtained from the Coppergate area of the city.

The data obtained from neutron activation analysis was analysed using a combination of cluster analysis, discriminant analysis and principal components analysis. All revealed the same pattern. The York polychrome relief tiles grouped with all the Roman and medieval tiles are believed to have been locally produced, as well as all the brickearth samples. There is little doubt from the evidence of neutron activation analysis that the York pre-Conquest tiles are of local manufacture.

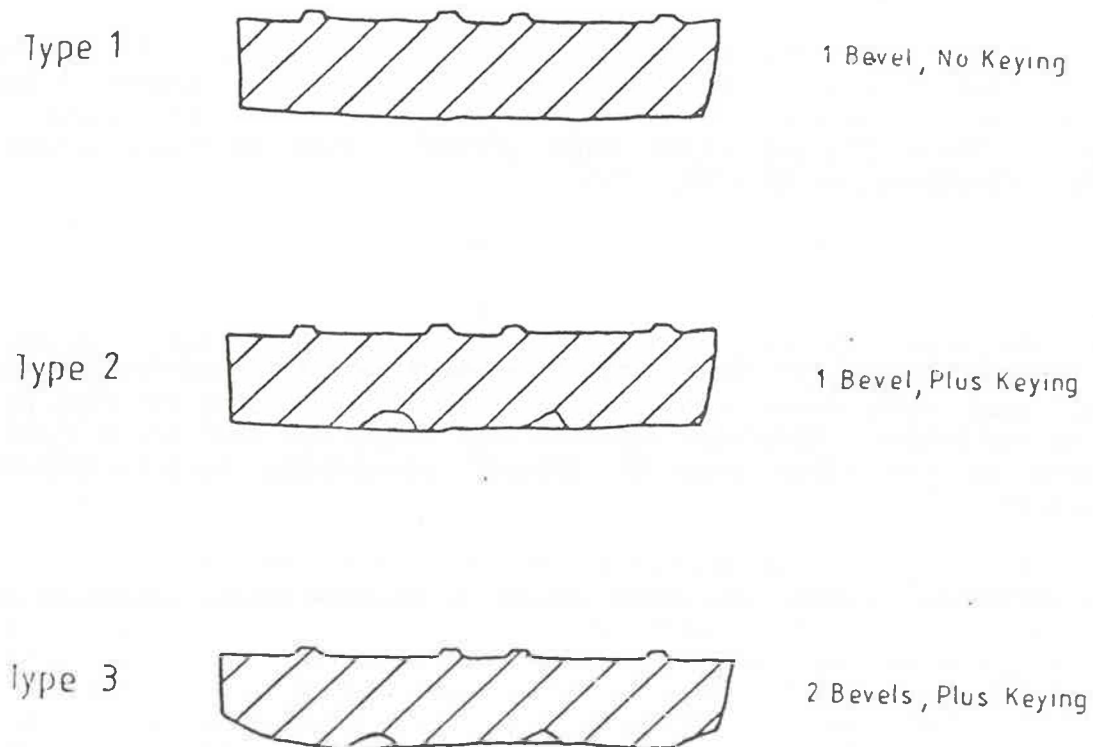


Fig. 1. Cross-sections through York tile showing three different bevel and keying combinations.

Thin section analysis was undertaken using the technique of textural analysis. This involved measurement of the long axis of 150 quartz grains in the clay matrix (Betts 1982). The results were then analysed by principal components analysis. This revealed that six out of seven samples thin sectioned fell into the same group as the locally produced medieval brick and tile (Fig. 2). Again this indicates that the York tiles were locally produced.

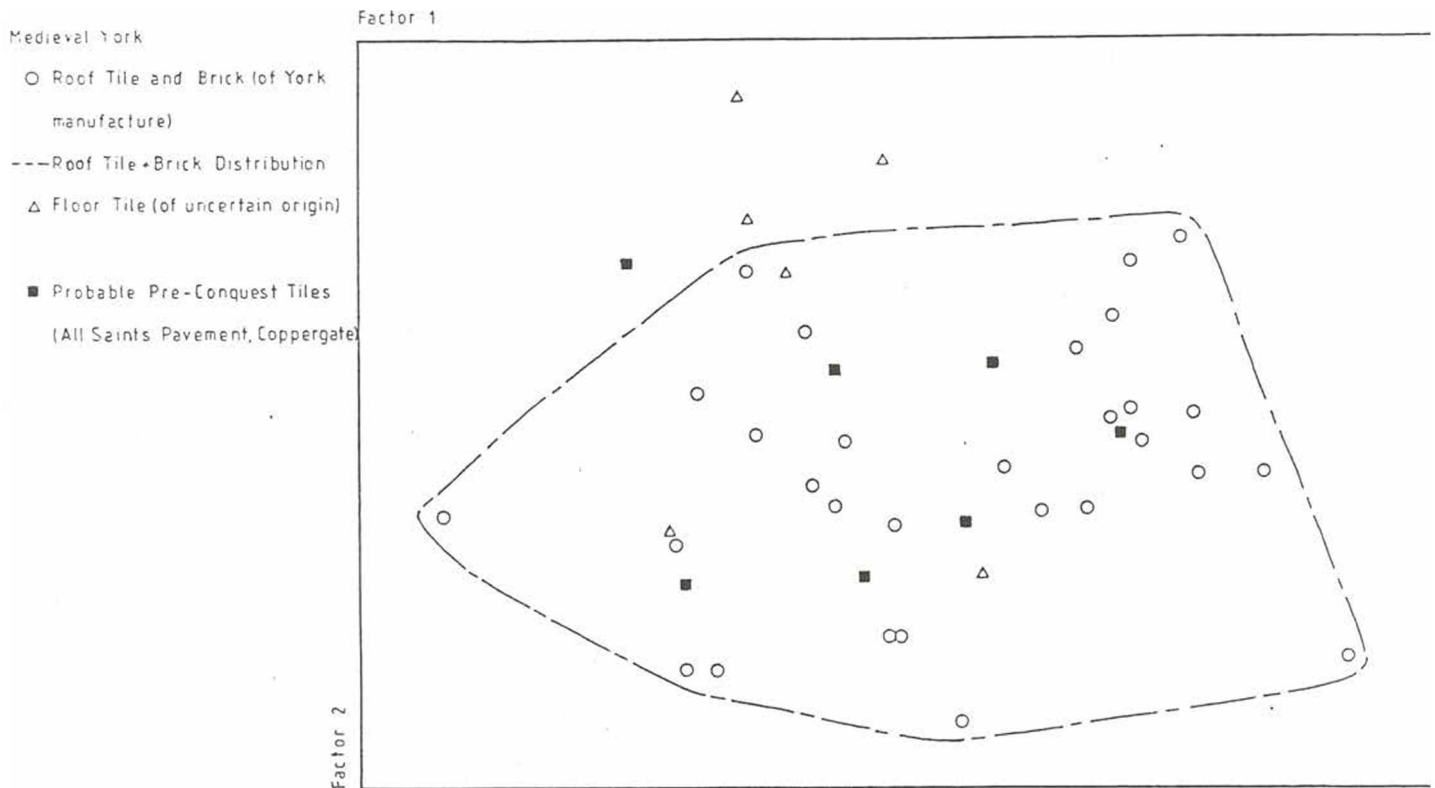


Fig. 2. Principal components analysis of probable pre-Conquest and Medieval tile from York thin-sectioned.

Three tiles from Coventry were also thin sectioned. The data obtained from textural analysis was compared with that obtained from the York tiles. Cluster analysis revealed two groups, one comprising two of the Coventry tiles, the other the York tiles plus the third Coventry tile. However, the principal component plot showed that this third Coventry tile was on the very edge of the York distribution (Fig. 3). There is little doubt that the Coventry tiles are from a different source to those manufactured at York,

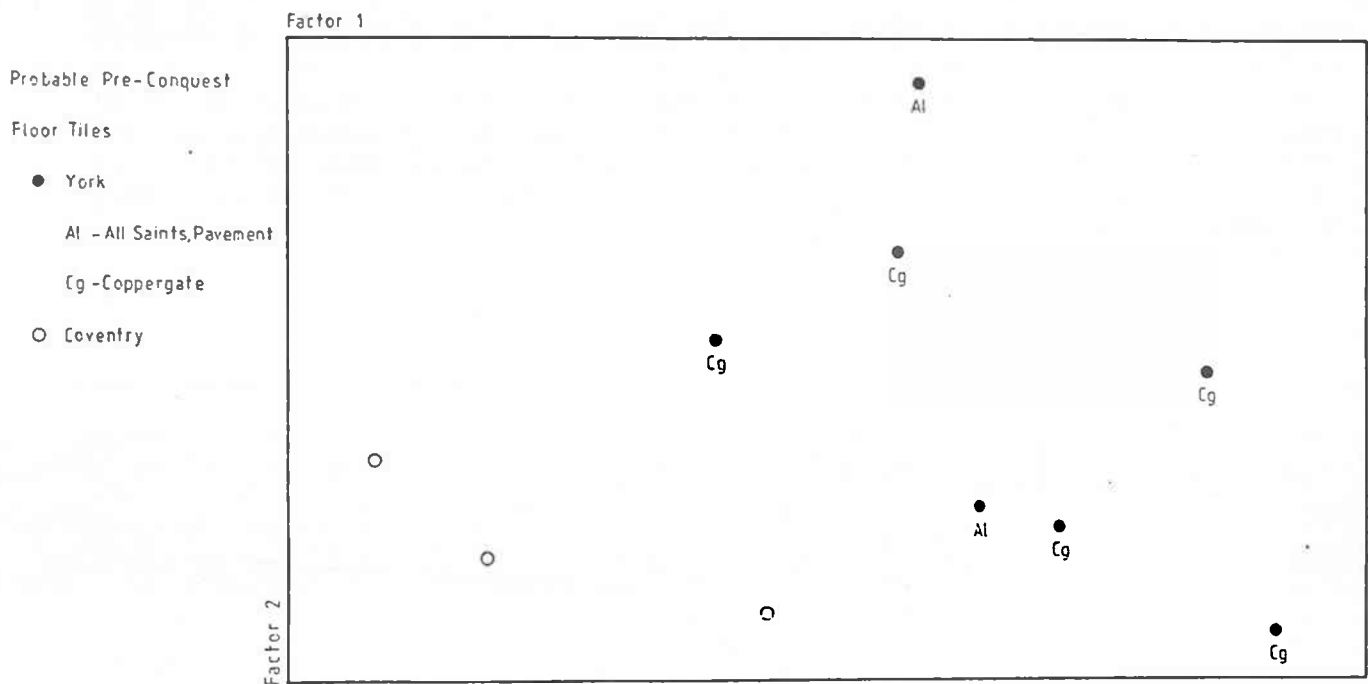


Fig. 3. Principal components analysis of York and Coventry tile thin-sectioned.

despite the presence of overlapping groups encountered in the statistical analysis of the grain size data. This is supported by the differences in manufacturing technique and the presence of the decorative patterns unique to each site.

The Coventry and York tiles not only differ from each other, they have a distinctly finer fabric than most of the southern England tiles so far examined. Using a low powered binocular microscope or hand lens the fabric of a selection of tiles from St Albans, Canterbury, Westminster and Winchester has been examined. Both the Winchester and St Albans tiles show slight differences in fabric between individual tiles, but this is no more than would be expected at a single production site. The London tile is similar to many of the Winchester tiles, one of the plain Winchester tiles is an almost exact match. A selection of decorated St Albans and Winchester tiles were compared

under the microscope and were found to have an almost identical fabric. These southern England tiles have a distinctive granular texture to their fabric caused by the presence of frequent quartz grains in the clay matrix together with occasional iron oxide. The majority of quartz grains range in size from 0.1mm - 0.7mm. In contrast, few quartz grains in the York tiles are over 0.08mm, and in the Coventry tiles this figure is smaller still (0.04mm). The majority of the tiles in the southern England group are white, cream or pale red in colour.

At Bury St Edmunds there are two distinct fabrics. Presumably both are contemporary as one design seems to occur on tiles in both fabric types. One fabric is described as sandy with a granular appearance suggesting a link with the St Albans-Westminster-Winchester group. The other fabric is less sandy in appearance (Gem and Keen 1981, 20).

Three pre-Conquest tiles are known from Canterbury. These tiles lack the granular fabric characteristic of the St Albans, Westminster and Winchester examples and are also different in fabric from locally produced pottery and tile. It is uncertain at present whether these tiles match the second, finer fabric found at Bury St Edmunds. Despite their different fabric, the Canterbury tiles are probably from the same source as the other southern England tiles as one of the designs is also found at St Albans (Horton, forthcoming). One Canterbury tile is unique in that it is triangular in shape. This is probably an edge tile used in conjunction with square tiles rather than a fragment from a mosaic floor.

The evidence from the southern England tiles so far examined points to a common source for these tiles. It is known from Bury St Edmunds that two different clays were used. Whether this represents two different clay sources, or the addition of sand temper to some clay but not others, is uncertain. Certainly, the uniform size of much of the quartz in the tiles with a granular fabric suggests that quartzsand may have been deliberately added.

There is one possible source for these tiles. Biddle and Barclay (1974, 152) have already pointed out the close similarity in fabric between Winchester Ware pottery and the pre-Conquest tiles found in the city. Winchester Ware was around by the 10th century, but its main period of use was in the 11th century. As the pottery seems to have been locally produced there is a strong possibility, on fabric evidence, that polychrome relief tiles were manufactured in the Winchester area as well.

It is hoped that a future programme of scientific analysis will confirm whether a single origin for all the southern England tile group is correct.

## Conclusions

The cost of polychrome relief tiles is unknown but the considerable time and care taken in their manufacture must have put their price beyond the reach of all but the most wealthy. This may explain the apparent restriction of such tiles to religious buildings in widely separate locations.

Many of the tiles seem to have been custom made for the building in which they were used. This would account for the presence of designs unique to each area. At York certain flanged tiles have been especially cut, prior to firing, to allow them to be correctly fitted in their allocated position.

The similarities in the methods of manufacture used to produce these tiles suggest that all were produced within a relatively short time span. A second reason for believing that the tiles may have been manufactured around the same date is the presence of designs of the same type in different areas. The tilemakers seem to have had a settled area of production somewhere in southern England, possibly Winchester. In contrast, the Coventry and York tiles may well have been made by itinerant tilemakers. It is unlikely that either place would have had sufficient tiling work during this period to support a settled community of tilemakers. As both have tiles characterised by additional decoration to their top surface it is not unreasonable to suggest that the same workmen may have been employed at both Coventry and York. Indeed, there is a definite possibility that all the polychrome tiles found in Britain are the product of a single group of tilemakers.

#### Acknowledgements

I would like to thank Peter Addyman for allowing me to study the York Archaeological Trust material and Elizabeth Hartley for allowing access to the Yorkshire Museum collection. Professor Biddle kindly allowed me to study the St Albans and Winchester material. The Department of Greater London Archaeology gave me access to the Westminster material. I would also like to thank Jane Elder for her help with the Canterbury Archaeological Trust tiles and also Michael Stokes for his comments on the Coventry material.

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