Characterisation Studies of Ceramic Building Material from Skellingthorpe, Lincolnshire (SKFL05)

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An archaeological assessment of the ceramic building material recovered from land fronting Ferry Lane and Lower Church Road, Skellingthorpe, Lincolnshire, by Lindsey Archaeological Services recommended that samples of the four fabrics identified in the collection were analysed using thin section and chemical analysis to document the fabrics. This work was recommended because the nature of the tile suggested that it was production waste. The nib types suggest a later 16th or 17th-century date whilst ceramics found on the site suggested activity in the 18th and 19th centuries, with potentially earlier activity represented by glazed red earthenware vessels.

Thin Section Analysis

Four fabrics were recognised in the hand. However, in thin section two of these, SK1 and SK3, are indistinguishable.

Fabrics SK1 and SK3

By eye, Young recognised the following inclusions in these fabrics: common to abundant medium-sized subrounded to rounded quartz (0.3-0.6mm); moderate iron-rich grains; sparse to moderate white clay streaks. Clean clay pellets were noted in SK3 but not in SK1 and are the only distinguishing feature.

In thin section, the following inclusion types were noted:

- Rounded quartz. Sparse mainly monocrystalline, well-rounded grains c.0.3mm to 0.5mm across. Some polycrystalline, strained grains occur.
- Subangular quartz. Moderate to abundant monocrystalline grains c.0.2mm to c.0.8mm across (mostly less than 0.4mm).
- Chert. Sparse subangular grains up to 0.3mm across.
- Fine-grained Sandstone/Coarse siltstone. Sparse subangular and rounded grains composed of monocrystalline unstrained quartz grains up to 0.2mm across with a cement of silicious and brown amorphous material.
- Opaques. Rare tabular grains up to 0.4mm long and rounded grains up to 0.2mm across.
- Mudstone. Moderate angular fragments of dark brown, light brown and mixed laminated mudstone up to 2.0mm long.

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The groundmass consists of optically anisotropic baked clay minerals with thin laminae of light brown clay with a higher birefringence. The main groundmass contains moderate rounded dark brown grains up to 0.05mm across. Rare angular quartz and muscovite laths up to 0.1mm long were present.

Fabric SK2

By eye, Young recognised the following inclusions in these fabrics: common to abundant medium-sized subrounded to rounded quartz (0.3-0.6mm); moderate iron-rich grains; sparse to moderate white clay streaks and sparse to moderate clean clay pellets and sparse calcareous grains. The latter two types were noted for SK2 only and are the distinguishing feature of this fabric.

In thin section, the following inclusion types were noted:

- Rounded quartz. Sparse grains up to 1.5mm across, including polycrystalline, strained examples.
- Subangular quartz. Moderate grains up to 0.3mm across
- Fine-grained Sandstone/Coarse siltstone. Sparse subangular and rounded grains composed of monocrystalline unstrained quartz grains up to 0.2mm across with a cement of silicious and brown amorphous material.
- Calcareous inclusions. Moderate heat-altered rounded grains up to 0.5mm across.
- Opaques. Sparse subangular grains up to 0.3mm across.
- Mudstone. Sparse light-coloured and dark brown highly laminated fragments up to 2.0mm long.

The groundmass consists of optically isotropic baked clay minerals, probably once calcareous, sparse angular quartz and muscovite laths up to 0.1mm long.

Fabric SK4

Young noted the following inclusions by eye in this fabric: subround to round quartz, iron-rich grains; calcareous grains; clean clay pellets and white clay streaks.

In thin section, the following inclusion types were noted:

- Rounded quartz. Sparse grains up to 1.5mm across, including polycrystalline, strained examples.
- Subangular quartz. Moderate grains up to 0.3mm across
- Fine-grained Sandstone/Coarse siltstone. Sparse subangular and rounded grains composed of monocrystalline unstrained quartz grains up to 0.2mm across with a cement of silicious and brown amorphous material.

- Opaques. Sparse subangular grains up to 0.3mm across.

The groundmass consists of optically isotropic light brown baked clay minerals, probably once calcareous, abundant dark brown spherical grains up to 0.05mm across, sparse angular quartz and muscovite laths up to 0.1mm long.

Interpretation and Discussion of Thin Sections

There are three rather different clays used for these tiles. Fabric SK1/SK3 is composed of weathered mudstone/shale whose occasional light-bodied lenses indicate that it was deposited in sub-tropical deltaic conditions, similar to those which appertained in the Upper Carboniferous era. Such strata occur in the Middle Jurassic and outcrop along the Lincoln Edge. They could be present in the Trent valley either as a result of slumping of Jurassic deposits or redeposition in boulder clay. Very similar clays were used at North Hykeham, where large unglazed tiles similar to the Skellingthorpe example were being made.

Fabrics SK2 and SK4 appear to have been made from calcareous clays or marls. The calcareous inclusions in SK2 were probably present in the clay as dug since no examples of calcareous sands or gravels have been observed in the Trent valley by the author, even though limestone and fossil fragments must originally have been present in these gravels, given the nature of the terrain in the Trent catchment. The abundant dark brown spherical grains in SK4 are also a feature of some clays used in the Lincoln Anglo-Scandinavian pottery industry which utilised Upper Lias clays dug from the hillside in the Lower City and Butwerk Suburbs. However, those clays were never calcareous.

If all four fabrics were used in the same production site then mixed clays of Lower Jurassic and Middle Jurassic origin seem to have been utilised. These are more likely to have been quarried from the scarp slope of the Lincoln edge rather than in Skellingthorpe, unless a deposit of boulder clay was being utilised. No such boulder clay outcrop is marked on the Geological Map of the Skellingthorpe area, although it is quite possible that a small outcrop, too minor to be mapped, was utilised. However, the petrological evidence does suggest that brickworks to the east of Skellingthorpe, such as those at Long Leas Road or the south common, are a more likely source for these tiles.

Chemical Analysis

Samples were prepared for chemical analysis by taking an offcut and removing all potentially contaminated material then crushing the sample to a fine powder. This powder was analysed at Royal Holloway College, London, under the supervision of Dr J N Walsh using Inductively-Coupled Plasma Spectroscopy. A series of major elements were measured as percent oxides (App 1) and a series of minor and trace elements were measured and expressed as parts per million (App 2).

The data were normalised to aluminium to take account of the probability that quartzose sand had been added to the clay, thus diluting the original content of most of the measured elements, which are likely to have been present in the clay fraction of the parent clay.

Factor analysis of the normalised data indicates that four of the samples have similar chemical compositions but that two, both fabric SK1/SK3, had differences. V4848 has a higher F2 score than the main group and V4852 has a lower F2 score. Both have higher F1 scores than the main group. The high F2 score of V4848 is likely to be due to iron and chromium values whilst the low F2 score of V4852 is probably due to a low iron value. Both of the outliers have high sodium and potassium values. These may indicate the presence of sodium- and potassium-rich feldspars in the quartzose sand in these samples.

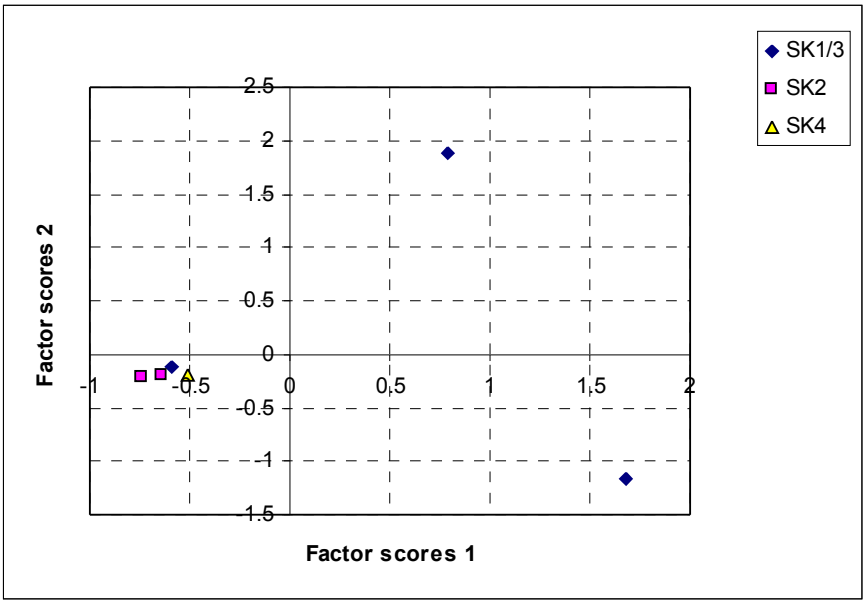

Figure 1

The chemical analysis, therefore, indicates that despite the differences between fabrics SK1/3, SK2 and SK4 in the hand, and in thin section, the chemical composition of these fabrics is generally similar.

The Skellingthorpe data was then compare with that from samples from Roman tileries at Heckington and Washingborough, both of which utilised Upper Estuarine Beds clays, and with brick and tile from a post-medieval brickyard at North Hykeham, which utilised a clay which was derived at least in part from the Lower Estuarine Beds, either through quarrying and transport of the clay from the cliff edge immediately east of the site or through the use of colluvium or boulder clay ultimately derived from this outcrop but outcropping closer to the North Hykeham site.

Factor analysis of this data indicates that five of the Skellingthorpe samples are distinguished from the remainder by higher F1 scores (Fig 2) whilst the sixth (one of the fabric SK1/3 samples) has a similar F1 score to the Heckington and Washingborough tiles, but a lower F2

score. Here too, it appears to be the higher potassium and sodium values which distinguish the sample.

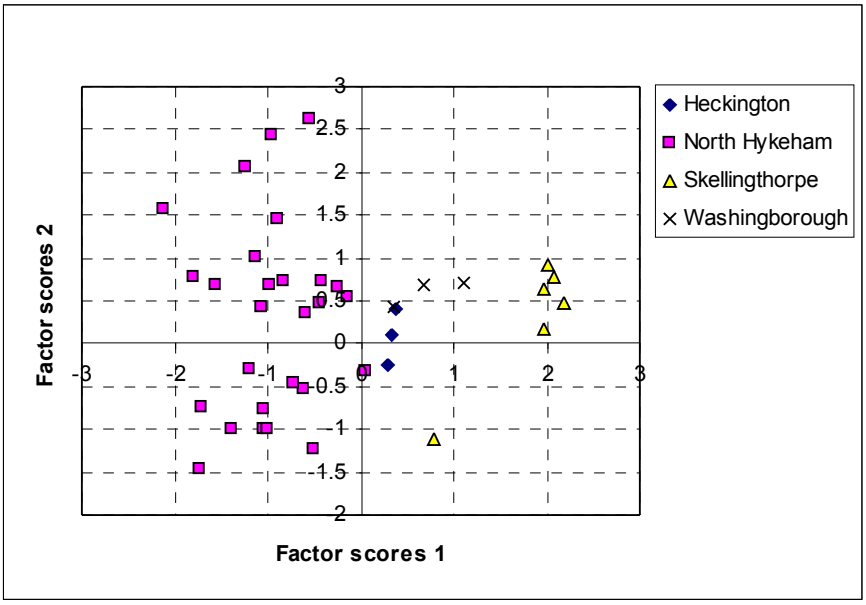

Figure 2

Conclusions

Thin section analysis suggests that the Skellingthorpe ceramic building material was made from similar raw materials to those used at North Hykeham in the post-medieval period and Washingborough and Heckington in the Roman period in which lenses of light-firing clay were present alongside the more common red-firing clays. These clays probably do not occur naturally in the Skellingthorpe area, unless there is a small deposit of boulder clay derived from the Lower Estuarine Beds in the area. No such clay is marked on the geological map of the area.

Chemical analysis, however, confirms that the Skellingthorpe material was made from different raw materials to those used at North Hykeham, Washingborough and Heckington. However, the most useful comparison would be with brick and tile produced in the various brickyards which clustered around Lincoln from the later 17th century onwards. No material from these sites has been analysed using ICPS.

Appendix 1

TSNO	Al2O3	Fe2O3	MgO	CaO	Na2O	K2O	TiO2	P2O5	MnO
V4848	18.74	9.32	1.31	0.93	0.27	2.83	0.79	0.14	0.029
V4849	21.77	8.50	1.61	5.22	0.26	3.00	0.85	0.31	0.051
V4850	22.33	9.05	1.59	4.47	0.26	3.07	0.89	0.33	0.049
V4851	22.03	8.86	1.61	4.47	0.25	3.02	0.86	0.37	0.049
V4852	17.90	7.85	1.94	0.46	0.32	2.86	0.78	0.07	0.066
V4853	21.19	8.72	1.54	4.98	0.25	2.93	0.82	0.31	0.049

Appendix 2

TSNO	Ba	Cr	Cu	Li	Ni	Sc	Sr	V	Y	Zr*	La	Ce	Nd	Sm	Eu	Dy	Yb	Pb	Zn	Co
V4848	366	99	51	72	43	18	103	177	14	58	50	81	49	8	1	2	2	29	74	13
V4849	367	112	41	174	73	22	203	123	35	101	52	104	54	12	2	5	3	17	125	19
V4850	384	114	42	179	71	22	209	123	32	92	53	105	54	13	2	5	4	17	125	20
V4851	383	111	43	177	73	22	211	127	30	57	54	108	55	12	2	5	3	16	127	20
V4852	400	88	30	103	59	17	79	139	24	56	48	86	49	11	2	4	2	20	77	19
V4853	361	112	41	169	74	21	194	123	31	67	50	102	52	12	2	5	3	21	124	20