Characterisation Studies of an Iron Age Crucible from Partney, Lincolnshire

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An Iron Age crucible from an excavation at Partney, Lincolnshire, was submitted for thin section and chemical analysis.

Thin Section Analysis

Description

The thin section was prepared by Steve Caldwell, University of Manchester, and stained using Dickson's method (Dickson 1965). The following inclusions were noted:

- Rounded and subangular quartz. Abundant grains, ranging from c.0.1mm to 1.5mm across. The larger grains are rounded and the smaller subangular. All the grains are monocrystalline and unstrained.
- Wood charcoal. Moderate fragments of wood charcoal, identifiable through their pore structure, c.0.5mm across.

The groundmass consists of black, opaque material in which small fragments of wood charcoal are tentatively identified. The outer 2.0mm of the vessel is completely vitrified and a vesicular colourless glass replaces the opaque groundmass. A small patch of amber coloured slag survives on the inner surface, c.1.0mm wide and 0.3mm thick at its maximum. The slag fills vesicles in the opaque matrix and each slag sphere has radial interference pattern, suggesting a cryptocrystalline radial structure. Brown phosphate fills some of the laminae and vesicles in the clay.

The quartz sand compares well with that found in the Spilsby Sandstone, which outcrops in the Partney area. The fine angular quartz sand which characterises the Kellaways Sands formation of the Upper Jurassic clay which also outcrops locally is absent. This suggests that the vessel was produced from local resources but perhaps not using Upper Jurassic clay. There are no cemented sandstone fragments in the section and it is most likely that a quartz sand formed from weathered sandstone was used as tempering. The opaque black colour suggests the presence of a high carbon content in the groundmass and this may have been achieved by mixing charcoal and quartz with a small amount of clay.

The outer glassy layer seems to have formed by vitrification of the body, in the presence of oxygen and alkalis such as sodium and potassium.

Chemical Analysis

A sample of the crucible omitting the margins and broken edges was prepared and submitted to Dr J N Walsh, Royal Holloway College, London, for analysis using Inductively-Coupled Plasma Spectroscopy (ICP-AES). A range of major elements was measured as percent oxides (App 1) and a range of minor elements was measured as parts per million (App 2).

It is standard practice at AVAC to estimate the silica content of the sample by subtracting the total measured major elements from 100%. However, since carbon is also not measured by ICPS this estimated value, 13.61% will include a mixture of silica and carbon. When compared with a number of other ICPS analyses from the Lincolnshire Wolds area, this estimate is towards the high end of pottery samples but is not as high as the estimates for fired clay used in kiln structures at Toynton All Saints or a clay sample from Market Rasen. The aluminium content of the sample, a good guide to the clay mineral content is at the lower end of values found in local pottery but higher than the two clays previous mentioned.

The chemical data were normalised to aluminium to take account of the dilution effect of added quartz sand. The data were then compared the same local comparanda. Compared with other vessels the crucible has higher values for iron, copper, vanadium, zirconium, cobalt and lead and lower values for potassium, barium, nickel, scandium, neodymium, samarium, zinc. In the case of copper and lead the discrepancy is such as to suggest that the metals were present as contamination from the contents of the crucible.

Factor analysis was then carried out on the data, excluding calcium and related elements (magnesium and strontium) and excluding the rare earth elements. This analysis found two factors and a bi-plot of the two factor scores places the crucible in the same area of the plot at samples from Toynton All Saints and Partney. Within these two sites, the similarities are strongest with medieval Toynton ware and medieval roof tile from Partney. Both of these groups were made using Upper Jurassic clay with Kellaways sand either naturally present or added as tempering.

Conclusions

The thin section analysis suggests that the crucible was made from a clay which was tempered with charcoal and quartz sand and that this quartz sand was obtained from the Spilsby Sandstone, either directly or more likely through the use of weathered sandstone, either *in situ* or redeposited.

The chemical analysis suggests that the parent clay is derived from the local Upper Jurassic clay and that the sample is contaminated with copper and lead from the use of the vessel. The high iron, vanadium and cobalt values are not greatly enhanced compared with other local samples and may indicate minor differences in the composition of the clay used for the crucible compared with the other samples. Of the elements which are relatively depleted in

the crucible, potassium, nickel, scandium and zinc are substantially below the levels found in the Toynton vessels and Partney medieval tiles. The reason for their depletion is not known.

Appendix 1

TSNO	Al2O3	Fe2O3	MgO	CaO	Na2O	K2O	TiO2	P2O5	MnO
V3528	13.61	7.67	0.6	0.6	0.3	1.64	0.58	1.17	0.027

Appendix 2

TSNO	Ba	Cr	Cu	Li	Ni	Sc	Sr	V	Y	Zr*	La	Ce	Nd	Sm	Eu	Dy	Yb	Pb	Zn	Co
V3528	257	94	221	45	17	10	66	177	12	107	27	56	28	3	1	2	2	172	42	22

Bibliography

Dickson, J. A. D. (1965) "A modified staining technique for carbonates in thin section." *Nature*, 205, 587.