Characterisation of Pipeclay from High Street, Much Wenlock, Shropshire

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Excavations in the High Street, Much Wenlock, Shropshire, by Archenfield Archaeology revealed waste from the manufacture of clay tobacco pipes together with parts of the pipe kiln. Samples of six pipes were submitted for chemical analysis, to establish whether the same clay was used for each (they were stamped with the marks of three makers, using four different stamps, Table 1) and whether the clay used was similar to that used at Broseley.

Table 1

TSNO	Context	Form	Action	Description	Subfabric
V4219	540	PIPE	ICPS	JOHN ROBERTS 2 LINE	A CLAY PELLETS
V4220	999	PIPE	ICPS	JOHN ROBERTS 2 LINE	A CLAY PELLETS
V4221	999	PIPE	ICPS	JOHN ROBERTS 3 LINE	A CLAY PELLETS
V4222	999	PIPE	ICPS	JOHN ROBERTS 3 LINE	M CLAY PELLETS;A SAQ <1.0MM
V4223	159	PIPE	ICPS	IOS HVGHES	A CLAY PELLETS
V4224	92	PIPE	ICPS	GEO HVGHES	A CLAY PELLETS

Each sample was examined at x20 magnification and two distinct fabrics were noted. The most common contained abundant rounded white clay pellets and few other visible inclusions whilst one sample, V4222, contained only moderate rounded white clay pellets together with abundant subangular quartz grains, ranging up to 1.0mm across. This sample was stamped with the same stamp as V4221, which had a standard fabric.

Each sample was prepared by taking an offcut from the pipe and mechanically removing all surface material which might have been contaminated after burial. The resulting block was crushed to a fine powder and analysed using Inductively-Coupled Plasma Spectroscopy at Royal Holloway College, London, under the supervision of Dr J N Walsh. A range of major elements was measured, as percent oxides (App 1) and a range of minor elements was measured in parts per million (App 2).

Silica content was estimated by subtracting the total oxides from 100% and the data were then normalised to aluminium. The silica content of V4222 is higher than the remaining samples, lying more than 1 SD from the mean (66.22% versus 62.44%).

The normalised data were examined using Winstat for Excel (Fitch 2001). First, a search was made for outlying values, i.e. those more than 4 SD from the mean. No outlying values were

present and the only aberrant value was for zinc (sample V4221). The data were then analysed using Factor Analysis, looking for the relationships between the measured elements. Five factors were found. The first factor scores depended mainly on differences in five rare earth elements (samarium, cerium and europium, neodymium, lanthanum), phosphorus and iron. The second factor scores were due to cobalt, nickel, titanium, lithium and lead. The third factor scores were due to manganese, zirconium, ytterbium and yttrium. The fourth factors scores were due to calcium, magnesium, barium and sodium. None of these factor scores showed any patterning within the six samples although V4222, the sandy fabric, did have the highest F1 score. The sample with the high zinc value had the highest F2 score and the strongest negative F4 score but this is almost certain just due to this single value.

The data was examined to see if there was any correlation between fabric and stamps or makers but the two John Roberts two-line stamped samples and the two John Roberts three-line stamped samples show no close similarity. Nor was there a close similarity between the two different Hughes stamps. It therefore seems that clay with a similar composition was used for all of the sampled pipes.

Next, the Much Wenlock pipes were compared with those found from Broseley, including production waste and pipes stamped with the marks of known Broseley makers. Elements with a high mobility (i.e. excluding calcium, strontium, phosphorus and the rare earth elements), zinc and zirconium (because it is only partially digested in the preparation method used at Royal Holloway College, London) were excluded. Four factors were found and a plot of the first two factor scores (Fig 1) shows no clear patterning, and certainly no evidence for a different composition to the Broseley and Much Wenlock pipeclays. The two Broseley pipes with initial marks (AB and ED) have negative F2 scores, but so does one of the full name marks (Much Wenlock maker, Edw Taylor). Similarly, a plot of the third and fourth factor scores showed that the F4 scores separated those three samples from the remainder whilst the F3 scores separated the Mich Brown sample (another Much Wenlock maker) and two of the late 17th century Broseley production waste samples. Interestingly, in this analysis two of the Much Wenlock pipes were so similar to each other that their scores were identical (hence only five symbols are shown for Much Wenlock on Fig 1). These were V4220 and V4223 (IOS HUGHES and JOHN ROBERTS two-line).

Table 2

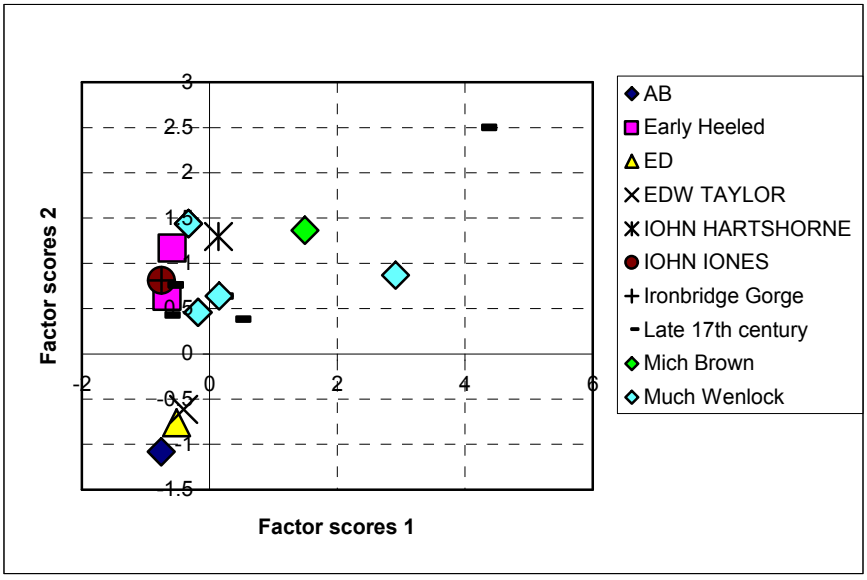

Figure 1

Factor analysis of the full range of elements does show clustering, but this could be due to post-burial alteration of the samples. However, even in this analysis there is no great separation between the Broseley and Much Wenlock pipes (Fig 2).

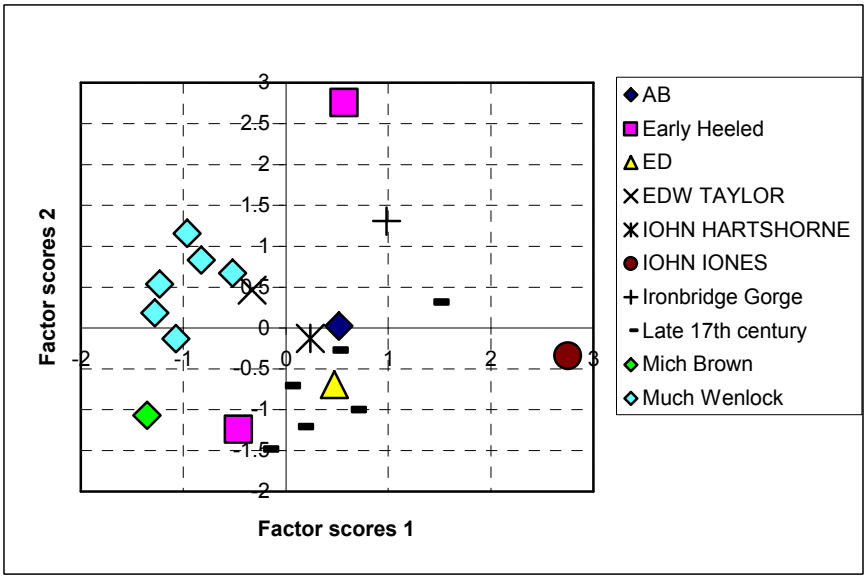

Figure 2

Finally, to demonstrate the similarity of the Much Wenlock and Broseley compositions, the two datasets were analysed alongside a series of samples of late 17th-century Ludlow pipes. Factor analysis of this data did indeed show that the Ludlow pipes were made in a distinctly difference clay, but unexpectedly also revealed a difference between the Much Wenlock pipes and all but two of the Broseley samples. Those two, Mich Brown and Edw Taylor were

made by Much Wenlock makers, which suggests that the separation is quite possibly significant. Examination of the data indicates that this separation is due mainly to titanium and magnesium values, which this analysis emphasised. Despite their similarity to the High Street samples, these two samples do differ in composition, indicating that it should be possible to distinguish the products of different pipemaking sites in Much Wenlock.

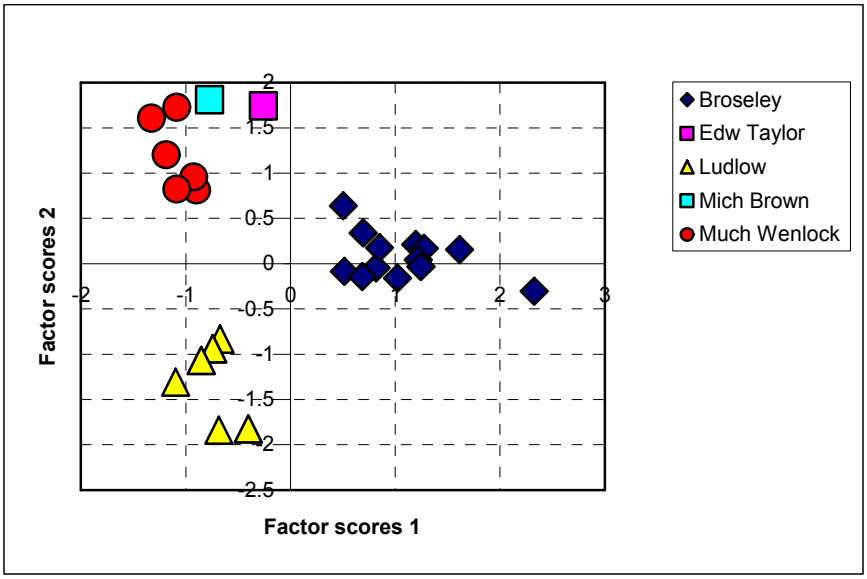

Figure 3

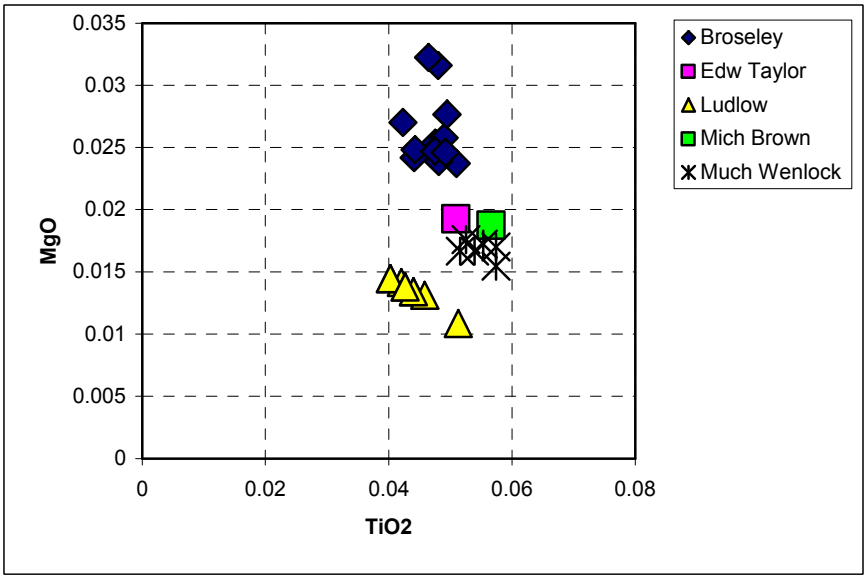

Figure 4

Discussion and Conclusion

The abundant clay pellets seem at x20 magnification is typical of Coal Measure seatearth clays. These occur immediately below coal seams and are paleosols. Several coal seams are present in the Much Wenlock/Ironbridge Gorge area but all are of similar geological age

and it is not clear that pipeclay from Much Wenlock would be different in composition to that from Ironbridge Gorge. All that can be said is that a local Coal Measures clay was being used. Differences in the titanium and magnesium compositions do, however, suggest that the High Street, Much Wenlock samples, together with samples stamped by two other Much Wenlock makers, Mich Brown and Edw Taylor, might be produced from a different clay from the Broseley pipes.

One of the samples contains abundant quartz sand. This concentration of coarse material is often the result of levigation, in which the pipeclay is worked to a slip and allowed to settle. The quartz sinks to the bottom of the settling tank and is usually discarded. However, in this instance some of the coarse fraction was used. It is worth noting that this difference in texture resulted in only minor differences in chemical composition. These differences are best interpreted as being due to grains of minerals other than quartz being present in the sand: a titanium rich mineral (rutile?); a phosphorus-rich mineral containing rare earths (monazite?) and a mineral rich in sodium (a sodic feldspar?).

The chemical analysis suggests that all the pipes were produced using similar clay, with no evidence for either the three different makers or the four different stamps being produced from separate batches of pipeclay.

Acknowledgments

The comparative samples were collected by Allan Peacey and David Higgins and were analysed with the aid of grants from Bristol and Gloucester Archaeological Society and the Pipe Aston Project.

Appendix 1

TSNO	Al2O3	Fe2O3	MgO	CaO	Na2O	K2O	TiO2	P2O5	MnO
V4219	32.37	1.65	0.54	0.24	0.14	1.35	1.67	0.04	0.009
V4220	30.17	1.66	0.52	0.26	0.14	1.23	1.67	0.02	0.009
V4221	29.10	1.67	0.45	0.19	0.12	0.92	1.67	0.03	0.006
V4222	28.21	1.89	0.48	0.25	0.16	1.07	1.62	0.11	0.007
V4223	33.58	2.47	0.56	0.24	0.17	1.29	1.81	0.07	0.008
V4224	33.50	1.98	0.59	0.30	0.17	1.40	1.76	0.03	0.007
mean	31.16	1.89	0.52	0.25	0.15	1.21	1.70	0.05	0.008
SD	2.31	0.32	0.05	0.04	0.02	0.18	0.07	0.03	0.001

Appendix 2

TSNO	Ba	Cr	Cu	Li	Ni	Sc	Sr	V	Y	Zr*	La	Ce	Nd	Sm	Eu	Dy	Yb	Pb	Zn	Co
V4219	352	93	41	243	44	35	48	163	39	196	31	52	34	5	1	5	4	40	62	20
V4220	330	97	45	237	45	33	47	140	41	189	30	54	33	5	1	5	4	70	50	21
V4221	257	106	38	267	49	28	40	205	31	152	29	50	31	4	1	4	3	72	397	21

V4222	311	95	46	232	45	28	53	172	35	159	33	59	35	6	1	5	4	110	83	19
V4223	350	118	42	260	45	35	47	169	43	196	35	69	38	8	2	6	4	55	60	21
V4224	396	109	44	271	48	35	50	167	40	187	29	46	32	4	1	5	4	36	60	22