

Normandy whitewares from Ronaldson's Wharf, Leith, Scotland

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Samples of two whitewares from Ronaldson's Wharf, Leith, both putative Normandy products, (Haggarty, G 2006 word file 42), were selected by George Haggarty, courtesy of John Lawson the City of Edinburgh Archaeologist. These were studied using Inductively Coupled Plasma Emission Spectroscopy (ICP-ES) following on from the recent study of Scottish White Gritty ware (Jones *et al* 2002–3). The first group consists of samples identified as Normandy Gritty ware (NORG) and the second of two samples of a fine whiteware not previously recognised on sites in the British Isles but identified by Duncan Brown as probably a Normandy product, and here given the ware name Normandy White ware (code: NORW). A range of major, minor and trace elements were measured, the first as percent oxides and the remainder as parts per million (Appendix 1).

The data were compared with various datasets, some of which were obtained at the Centre for Ceramic Research at the University of Caen where only major elements are measured (Deroeux *et al* 1994). Furthermore, it was subsequently realised that the CaO and P₂O₅ values for some samples were enhanced (for example, the base level for calcium oxide was c. 0.3% and the enhanced samples ranged up to 3.3%), probably after burial, and therefore the element set was reduced further to exclude these elements. All the data was normalised by dividing the measured values by that for Al₂O₃ to try and remove the dilution effect brought about by variations in quartz sand temper.

The comparative data include samples of Rouen glazed wares, Rouen early glazed wares (10th/11th century), York Early Glazed Ware (which is probably a Lower Seine product) and La Londe ware from the kiln site (immediately south of Rouen on the south side of the Seine), La Londe ware from consumer sites in the British Isles (Vince 2006), Normandy Gritty ware from sites in Exeter (Hughes forthcoming), various other French and putative French whitewares, as described in Table 1.

An estimate of silica content was obtained by subtracting the sum of the major elements from 100%. This indicated that the two Normandy white samples at Leith contain substantially less silica than any of the comparative material, whilst the Leith Normandy Gritty fabric had a similar silica content to the Exeter Normandy Gritty ware samples but less than the remainder of the comparative material (Figure 1). This is consistent with the appearance of these fabrics at x20 magnification, where the Lower Seine types can be seen to contain abundant silt-sized quartz.

Factor analysis was carried out on this dataset using the WinStat for Excel program (Fitch 2001). This indicated only one factor with an eigenvalue over 1 (Table 2). The variation in this dataset was therefore the result, primarily, of fluctuations in the contents of MgO and K₂O, which are highly correlated, and TiO₂.

A plot of the F1 scores (dominated by the potassium, magnesium and iron oxide contents) for this dataset against those of F2 (eigenvalue 0.6; dominated by the cerium and lanthanum contents) was produced (Figure 2). This shows that the Leith samples can be distinguished from much of the comparanda using a combination of these two factors. All of the Lower Seine samples (La Londe ware – ROUEN UGW; Early

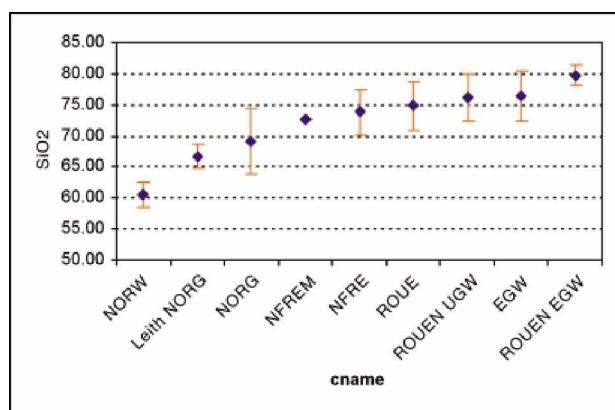


Figure 1

The silica ranges in the pottery groups from Normandy, Northern France, Rouen and the test samples from Leith (see Table 1)

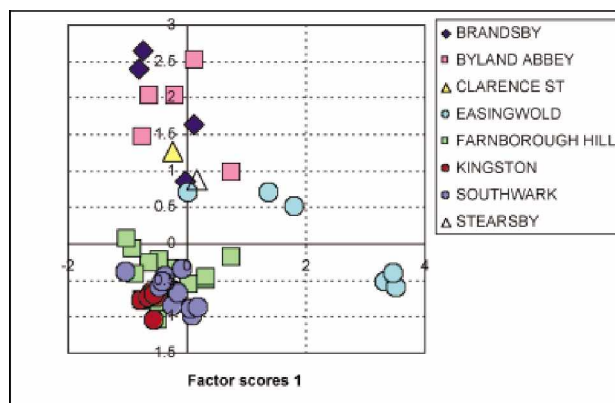


Figure 2

Plot of the first two factor scores resulting from factor analysis for the pottery samples in the nine groups shown

Lower Seine Glazed ware (ROUEN EGW); and medieval Rouen ware (ROUE) had higher F2 scores, as did the samples of Early Glazed Ware from York (EGW). It is therefore clear that neither the Leith Normandy Gritty ware nor Normandy White ware were lower Seine products.

The Leith data were then compared with a set of analyses carried out for Phillippe Husi's study of Western French glazed wares. These analyses, which were carried out using XRF, did not include lithium, scandium, neodymium, samarium, europium, dysprosium, ytterbium, and cobalt. The Exeter Normandy Gritty ware samples and the La Londe kiln waste samples were included in this analysis. Factor analysis revealed 3 factors with eigenvalues over 1 (Table 3).

A plot of the first two factors (Figure 3) shows that the Leith samples and the Exeter Normandy Gritty ware samples tend to have higher F1 scores than the western French whitewares and La Londe ware (with a few exceptions). A plot of the first against the third factor (Figure 4) separates the La Londe samples from the remainder. This analysis confirms that the Leith samples are not western French products.

Finally, the Leith data were compared with samples of French whitewares from Dublin, Exeter, Southampton and Boston, all of which were analysed using ICPS and include data for the same range of elements as the Leith samples. Four factors with eigenvalues over 1 were found (Table 4).

A plot of F1 against F2 for this data (Figure 5) shows that the Exeter Normandy Gritty ware samples have higher F2 scores, whilst the Southampton whiteware samples and those from Dublin have similar F1 and F2 scores. However, a plot of the F3 against F4 scores (Figure 6) separates the Leith samples from the remainder except for five of the Dublin samples. However, when the F1 and F2 values for these five samples is examined, it is evident that they too can be separated from the Leith samples, having lower F1 and F2 scores. These Dublin samples consist of whitewares of unknown origin identified as French by their general method of manufacture and fabric characteristics (pers comm C McCutcheon).

In conclusion, although there are differences in chemical composition between the two groups of whiteware from Leith, as can be seen from their compositions in (Appendix 1), when compared with a range of French whitewares these two groups are consistently more similar to each other than to other samples. However, the closest match is with the four samples of Normandy Gritty ware from Exeter, although even these samples can be distinguished from the Leith ones. The most likely interpretation of this data is therefore that the two Leith fabric groups are indeed of Normandy origin but not from the Lower Seine valley, nor, probably, from the same production site as those found at Exeter.

Table 3

element	Factor 1	Factor 2	Factor 3
K ₂ O	0.841	0.187	-0.132
MgO	0.829	0.120	-0.283
Fe ₂ O ₃	0.814	0.074	0.185
V	0.639	0.231	0.415
Ni	0.635	0.149	0.135
Ba	0.591	0.510	-0.072
Zn	0.581	-0.077	0.258
Zr	-0.447	0.421	-0.241
MnO	0.325	-0.073	0.157
Ce	0.009	0.956	-0.065
La	0.048	0.903	-0.031
Na ₂ O	0.185	0.763	-0.226
Y	0.095	0.540	0.220
Cr	0.227	-0.012	0.887
TiO ₂	0.026	-0.093	0.856
sum of squares	3.96	3.192	2.101
percent of variance	26.4	21.3	14.0

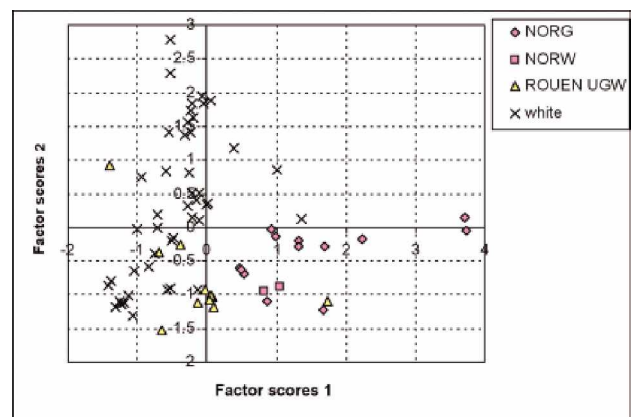


Figure 3

Plot of the first two factor scores resulting from factor analysis for the samples in the Normandy Gritty ware, Normandy White ware, Rouen La Londe ware and the Western French White wares

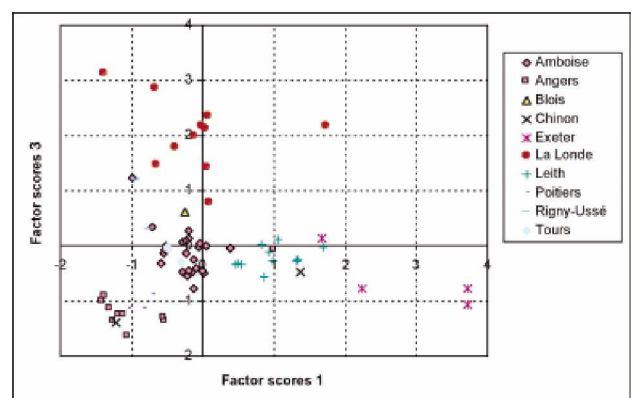


Figure 4

Plot of the scores on Factors 1 and 3 resulting from factor analysis for White ware from Amboise, Angers, Blois, Chinon, Exeter, La Londe, Leith, Poitiers, Rigny Ussé and Tours. Factor 3 is dominated by the chromium and titanium contents

Table 4

element	Factor 1	Factor 2	Factor 3	Factor 4
Sm	0.964	0.002	-0.025	0.043
Ce	0.938	0.134	0.152	0.111
La	0.905	0.146	0.276	0.090
Nd	0.898	0.167	0.284	-0.105
Dy	0.861	0.267	0.327	-0.154
Y	0.842	0.309	0.262	-0.198
Eu	0.820	0.396	-0.079	-0.0214
Ni	0.651	0.412	-0.085	-0.199
Yb	0.634	0.4249	0.553	-0.258
Sr	0.629	-0.049	0.091	0.289
K ₂ O	0.110	0.928	0.002	0.215
MgO	0.153	0.919	-0.068	0.0396
V	0.226	0.810	0.140	0.247
Co	-0.007	0.680	0.455	-0.166
Fe ₂ O ₃	0.388	0.610	0.202	0.008
Li	0.334	0.575	-0.137	-0.353
Zr	0.221	0.130	0.942	-0.122
TiO ₂	0.1488	-0.090	0.813	0.174
Zn	0.349	-0.040	0.609	0.436
Cu	0.024	0.107	0.437	0.209
Na ₂ O	-0.225	0.245	0.251	0.654
MnO	-0.152	-0.185	-0.115	0.647
Ba	0.185	0.499	0.162	0.638
Cr	0.315	0.113	0.310	0.561
sum of squares	7.528	4.665	3.282	2.394
% variance	31.4	19.4	13.7	10.0

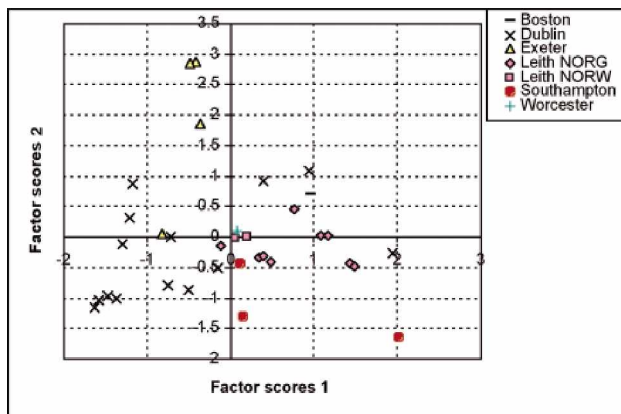


Figure 5

Plot of the first two factor scores resulting from factor analysis for the pottery samples from Boston, Dublin, Exeter, Normandy White and Gritty found at Leith, Southampton and Worcester

Acknowledgements

We are grateful to Clare McCutcheon and Michael Hughes for supplying copies of their data in digital form and for permission to use it in this study. George Haggarty suggested the analysis as part a survey of French pottery in Scotland.

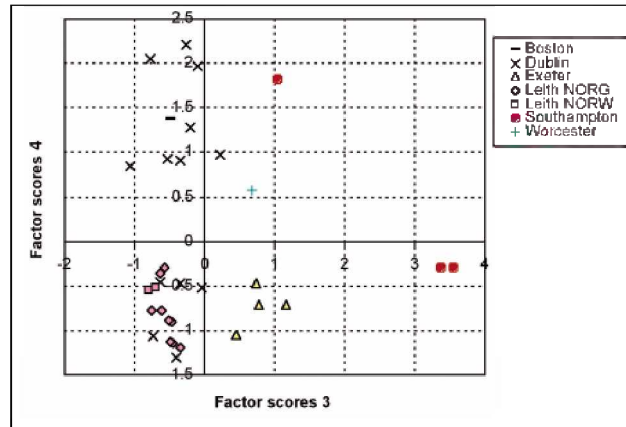


Figure 6

Plot of the scores on Factors 3 and 4 resulting from factor analysis for the pottery samples from Boston, Dublin, Exeter, Normandy White and Gritty found at Leith, Southampton and Worcester

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Appendix I

Normandy White ware found at Leith: major elements (percent oxides)

sample	Al ₂ O ₃	Fe ₂ O ₃	MgO	CaO	Na ₂ O	K ₂ O	TiO ₂	P ₂ O ₅	MnO
N1	32.61	3.34	0.79	0.27	0.14	2.31	1.25	0.12	0.06
N2	30.85	2.61	0.75	0.17	0.14	2.17	1.19	0.05	0.02
mean	31.73	2.98	0.77	0.22	0.14	2.24	1.22	0.09	0.04

Normandy Gritty Ware found at Leith: major elements (percent oxides)

SD standard deviation

sample	Al ₂ O ₃	Fe ₂ O ₃	MgO	CaO	Na ₂ O	K ₂ O	TiO ₂	P ₂ O ₅	MnO
LRW1	29.71	3.35	0.73	0.13	0.09	1.56	1.06	0.04	0.019
LRW2	26.57	2.44	0.56	0.14	0.12	2.05	1.19	0.07	0.010
LRW3	23.63	3.34	0.58	0.13	0.13	1.96	1.12	0.07	0.013
LRW4	23.28	3.19	0.56	0.14	0.13	1.91	1.09	0.08	0.012
LRW5	26.79	2.51	0.56	0.15	0.12	2.04	1.16	0.10	0.011
LRW6	26.46	2.48	0.56	0.13	0.13	2.04	1.17	0.09	0.010
LRW7	27.70	3.11	0.77	0.32	0.22	1.80	1.09	0.06	0.090
LRW8	25.75	3.76	0.73	0.44	0.20	1.60	1.10	0.05	0.023
LRW9	25.70	3.78	0.70	0.44	0.19	1.59	1.10	0.05	0.021
mean	26.18	3.11	0.64	0.22	0.15	1.84	1.12	0.07	0.023
SD	1.96	0.52	0.09	0.14	0.04	0.21	0.04	0.02	0.026

Normandy White ware found at Leith: trace elements (ppm)

sample	Ba	Cr	Cu	Li	Ni	Sc	Sr	V	Y	Zr*	La	Ce	Nd	Sm	Eu	Dy	Yb	Pb	Zn	Co
N1	458	173	36	308	70	20	167	126	27	81	81	143	81	9	2	5	3	49	51	20
N2	396	162	35	317	61	19	154	125	23	66	70	127	70	9	2	5	2	211	48	7

Résumé

Des échantillons de deux types de céramique blanche provenant de fouilles à Ronaldson's Wharf, Leith, toutes deux provenant peut-être de Normandie ont été sélectionnés par George Haggarty avec la permission de John Lawson Archéologue en charge de la Cité d'Edinburgh.

Les données recueillies sur la composition ont été comparées à des échantillons de céramique vernie de Rouen, de céramique vernie précoce de Rouen (10/11ème siècles), de céramique vernie précoce de York (probablement un produit de Basse Seine), de céramique du centre de production de La Londe (au sud de Rouen sur la rive sud de la Seine), de céramique de La Londe trouvée sur des sites de consommation au Royaume Uni (Vince 2006), de céramique type Normandy Gritty ware découverte à Exeter (Hughes à paraître) et diverses autres céramiques blanches de France ou supposées de France.

Zusammenfassung

Proben zweier Weißwaren aus der Ausgrabung in der Ronaldson-Werft, Leith, beide vermeintliche Erzeugnisse aus der Normandie, wurden auf Empfehlung John Lawsons, dem City of Edinburgh-Archäologen, von George Haggarty für diese Untersuchung ausgewählt. In Verfolg einer kürzlichen Untersuchung schottischer Weiß-Sandware wurden diese Gefäße mit Hilfe der ICPEs-Methode (Inductively Coupled Plasma Emission Spectroscopy) untersucht. Die Daten über die Zusammensetzung wurden dann mit verschiedenen anderen Waren verglichen: mit glasierter Rouen-Ware, mit früher glasierter Rouen-Ware (10. und 11. Jahrhundert), mit früher glasierter York-Ware (die wahrscheinlich ein Erzeugnis vom unteren Seine-Lauf ist) und auch mit La Lande-Ware von einer Töpferei unmittelbar südlich von Rouen auf der Südseite der Seine, sowie mit La Lande-Ware, wie sie an Stätten auf den Britischen Inseln gefunden wurden (Vince 2006), sowie mit normannischer Sandware von Ausgrabungen in Exeter (Hughes in Vorbereitung) wie auch mit anderer französischer und vermutlich französischer Weißware.