

Characterisation of Medieval Pottery Fabrics from Evercreech, Somerset (AC1084)

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Samples of medieval pottery dating between the late 11th and the 14th or 15th centuries from excavations at Evercreech, Somerset, carried out by AC Archaeology Ltd were submitted for study. Two techniques were employed, thin section analysis and chemical compositional analysis. The aims of the project were i) to test and refine the visual classification of the pottery fabrics established by eye using a x20 magnification binocular microscope and ii) to determine whether the fabric analysis could refine or modify suggestions made as to the source of the pottery made on the basis of the visual study.

Amongst the types recognised by eye were vessels from the Ham Green kilns, near Pill, on the Bristol Avon (Fabrics 8 and 12); Nash Hill, Lacock (Fabrics 5 and 9); and various wares from south-east Wiltshire (Fabric 3, Fabric 16 and Fabric 19). These sources are all between 25 and 40 miles from Evercreech, close to the maximum for overland transport of pottery in the Severn Valley (Vince 1984) which was probably typical of medieval England, where coastal transport was not available. However, several wares found at the site either belong to groups which are only broadly classified (i.e. they should be thought of as regional types rather than the products of specific localities) and efforts were therefore concentrated on them, to establish the validity of the various visual groups and their sources. Examples of the well-known types were included for completeness and for comparison with the other fabrics.

Fabric 1

Fabric 1 belongs to a widespread group, known as Bath Fabric A. Examples have been found as far north as Gloucester, and as far west as south Wales, the latter undoubtedly the result of trade through Bristol. Attempts have been made to establish whether regional groups can be identified, on the assumption that a ware distributed over such a large area must be the product of several localities, but all such attempts have failed. Here, at least, the chemical analysis (see below) confirms that Fabrics 1 and 7 are chemically different, though very similar.

By eye, the distinctive features of Fabric 1 are the presence of sparse to moderate fragments of polished well-rounded quartz and chert. One sample was chosen for thin section (V5107) and six (including that one) were analysed using Inductively-Coupled Plasma Spectroscopy.

V5107

The following inclusion types were noted in thin section:

Quartz. Moderate well-rounded grains up to 1.0mm across. A few grains are coated with glauconite.

Glauconite. Moderate glauconite (light green isotropic) and altered glauconite (brown isotropic) up to 0.3mm across.

Organics. Sparse voids up to 1.0mm long surrounded by a dark carbon-rich halo.

Clay pellets. Rounded pellets of similar texture and colour to the groundmass, up to 1.5mm across, including sparse glauconite inclusions and quartz/muscovite silt.

Opaques. Well-rounded grains up to 0.2mm across.

The groundmass consists of light grey optically anisotropic baked clay with abundant angular quartz grains up to 0.15mm across and moderate muscovite laths of similar size.

The inclusions present all point to the use of Lower Cretaceous clays and sands and the silty nature of the fabric suggests that the parent clay was Gault clay, to which quartzose sand derived from Lower Cretaceous sands, was added as a temper (given that the quartz grains are absent from the clay pellets). Neither chert nor flint were present in the thin section, nor are they a significant feature of the fabric in the hand.



Figure 1

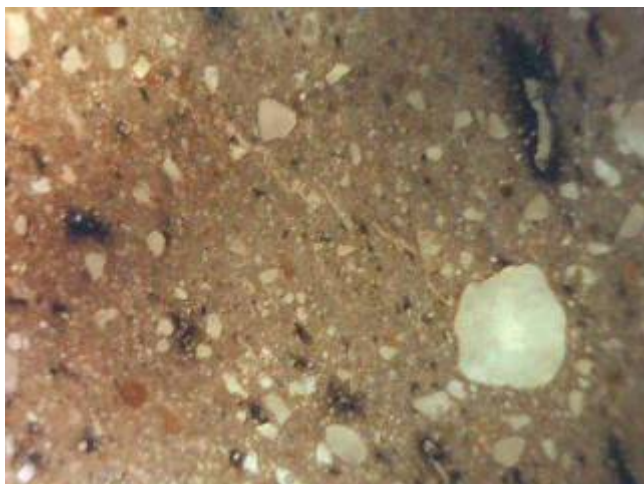


Figure 2 reflected light photograph of thin section, showing quartz, altered glauconite and organic inclusions

V5108



Figure 3

V5109



Figure 4

V5110



Figure 5

V5111



Figure 6

V5112

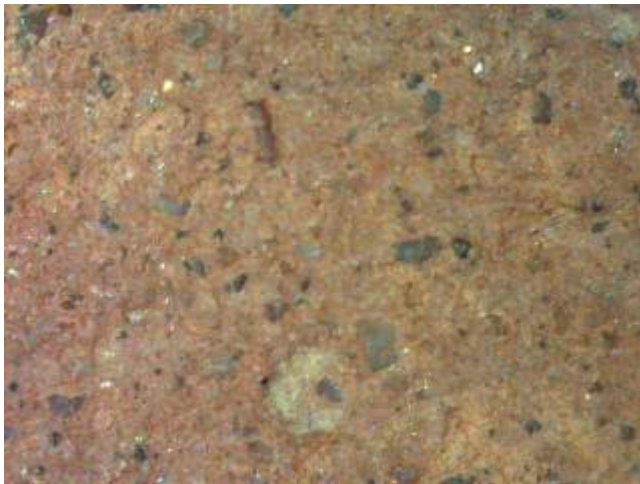


Figure 7

Finer texture with muscovite more common in groundmass

Fabric 2

Fabric 2 contains either rounded limestone inclusions or voids where these inclusions have weathered out. In the author's PhD thesis, this ware was described as Great Somerford-type ware (Vince 1984 #103). However, there is no suggestion that Great Somerford was its source.

One section of this fabric was made (V5117). The following inclusion types were noted in this section:

Limestone fragments. these vary considerably in appearance but in some cases fragments containing two or more lithologies occur, suggesting that all originate in a similar deposit. The most common lithology is calcareous sandstone with a well-sorted angular quartz sand (grains c.0.1mm). Others include peloidal limestones in which the pellets have a biological core, including fragments of punctate brachiopod shell and echinoid shell, coated in a light brown micrite, all cemented by ferroan calcite. Fragments of non-ferroan calcite bivalve shell also occur, sometimes loose and other times in a ferroan calcite cement. Some of the sandstone has iron-rich cement, which preceded the calcareous cement and some of the fragments have iron-rich staining indicating that the grains come from a detrital sand.

Organics. Sparse voids up to 1.5mm long surrounded by a dark halo.

The groundmass consists of light grey and light brown optically anisotropic baked clay, abundant angular quartz c.0.1mm across and rare accessory minerals of similar size. Muscovite and glauconite are absent from the fabric.

The lack of rounded quartz, glauconite and muscovite in this fabric indicates a very different source from Fabric 1. Similar, but much finer-textured, limestone sand occurs in Minety ware and it is likely that Fabric 2 originated in a similar environment, on the dip slope of the Jurassic ridge, with a sand derived in the main from a middle or upper Jurassic limestone. The source of the limestone should be sought in the Forest Marble or Cornbrash.

V5113

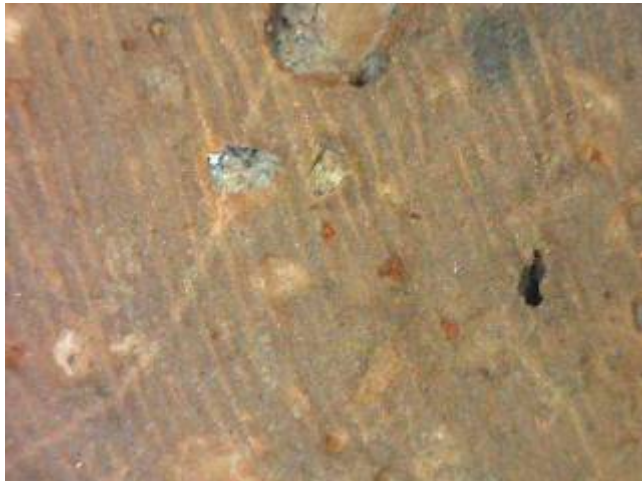


Figure 8

V5114



Figure 9

V5115



Figure 10

V5116



Figure 11

V5117



Figure 12



Figure 13 Reflected light photograph of thin section, showing rounded fragments of limestone containing well-sorted angular quartz and shell in a matrix of ferroan calcite.

V5118



Figure 14

Fabric 3

This group is identified as a SE Wiltshire glazed ware but the three submitted samples indicate that there are at least two textures, coarse and medium, and two colours, light-firing and red-firing. These are distinguished here as Sub-fabric 3.1 and 3.2.

Three samples were submitted from which to choose one for thin section. However, these samples can be divided into two groups, both of which might be of SE Wiltshire origin. Subfabric 1 has a white-firing body and coarse quartzose sand (V5119). Subfabric 2 is finer in texture with a red-firing groundmass (V5120 and V5121).

Subfabric 1

The following inclusion types were noted in thin section:

Quartz. Abundant, subangular grains up to 0.4mm across and sparse well-rounded grains (possibly of Triassic origin) of similar size.

Flint. Sparse angular, unstained grains up to 1.5mm across.

“Lydite”. Rare, almost opaque, grains up to 1.0mm across, cut by veins of quartz up to 0.2mm wide.

Opaques. Moderate subangular grains up to 0.3mm across.

The groundmass consists of optically anisotropic baked clay minerals with little quartz or mica but moderate subangular opaque grains up to 0.1mm across.

V5119



Figure 15

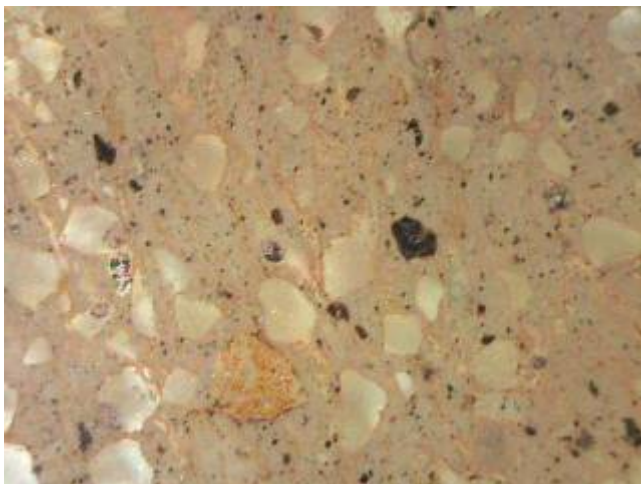


Figure 16 Reflected light photograph of thin section

Subfabric 3.2

One thin section of this group was made (V5120). The following inclusion types were noted:

Quartz. Abundant subangular fragments up to 0.5mm long. Some are cracked examples of well-rounded grains.

Chert. Sparse rounded grains up to 1.0mm across, probably of Carboniferous origin.

Flint. Sparse angular fragments up to 0.4mm long.

Opagues. Moderate rounded grains up to 0.3mm across.

Organics. Sparse voids up to 0.5mm long surrounded by a dark halo.

Ferruginous sandstone. Rare rounded, tabular fragments up to 1.5mm long and 0.4mm wide. They contain moderate quartz inclusions up to 0.2mm across.

V5120



Figure 17

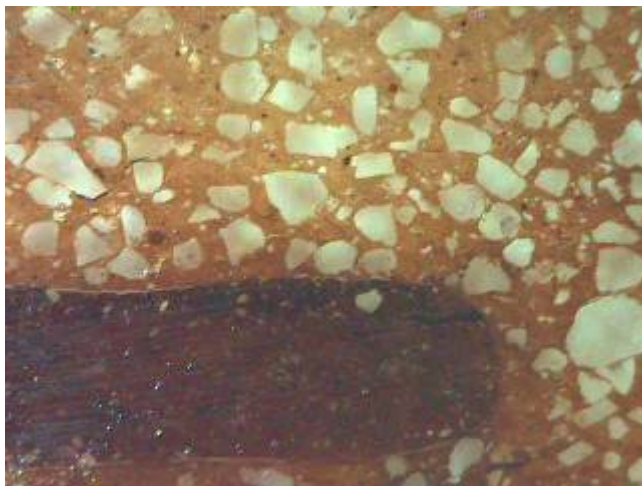


Figure 18 Reflected light photograph of thin section

V5121

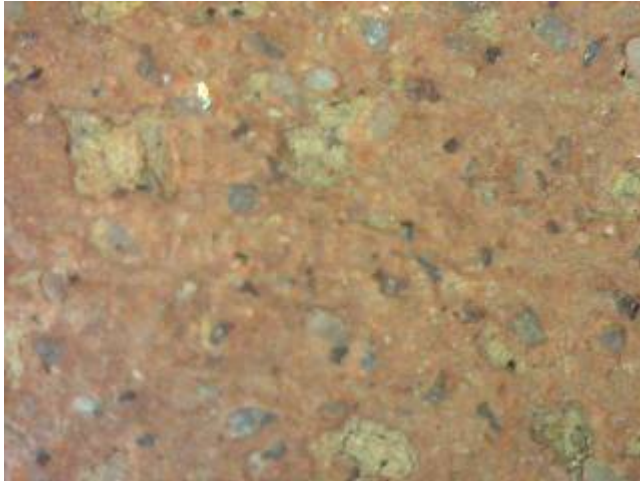


Figure 19

NOT SECTIONED

Fabric 4

Fabric 1 is another Bath A fabric.

Fabric 4 was defined by its similarity to Fabric 1 but with the addition of calcareous inclusions (a void from one such is shown in Fig 20). A single example of Fabric 4 was thin sectioned.

The following inclusion types were noted in thin section:

- Quartz. Abundant well-rounded grains up to 1.5mm across.
- Chert. Moderate rounded fragments of chert, consisting of a well-sorted medium-grained quartz sand with silica cement. The quartz sand averages c.0.2mm across. Some grains have a a high proportion of dark brown inclusions.
- Shell? Sparse fragments which appear to be silica-replaced nacreous bivalve shell 1.0mm long.
- Rounded clay pellets. These grains are similar in colour and texture to the groundmass. They do not contain any quartz, chert, shell or glauconite grains suggesting that in this case all of these inclusions were added as temper.
- Organics. Rare irregular outlined voids up to 1.0mm across (perhaps partially rotted roots) surrounded by darkened halo.
- The groundmass consists of anisotropic baked clay minerals, abundant angular quartz up to 0.1mm across and sparse muscovite laths up to 0.2mm long.

V5122



Figure 20

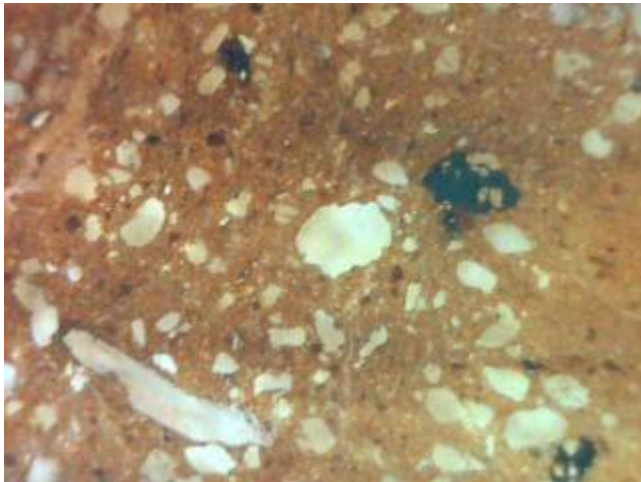


Figure 21 Reflected light photograph of thin section.

Fabric 5

Although clearly related to Fabrics 1 and 4, Fabric 5 contains little or no chert or flint and the abundant quartz grains are mainly coated with haematite. It is suggested here that it is a coarser, handmade version of Fabric 9 and both fabrics contain red clay pellets which, it is suggested, are altered glauconite.

A single thin section was produced (V5123) and thin same and five others were analysed using ICPS.

The following inclusion types were noted in thin section:

Quartz. Abundant well-rounded grains, up to 0.5mm across, most with dark brown veins and some with a thin dark brown coating.

Flint. Rare angular fragments up to 0.5mm across.

Chert. Rare fragments up to 0.3mm across, containing sponge spicules.

Opaques. Sparse rounded grains, up to 1.0 mm across.

Clay pellets. Sparse rounded pellets up to 1.5mm across, similar in texture to the groundmass but some with dark brown staining.

Altered glauconite. Rare rounded grains up to 0.3mm across.

The groundmass consists of optically anisotropic baked clay minerals and abundant angular quartz.

V5123



Figure 22

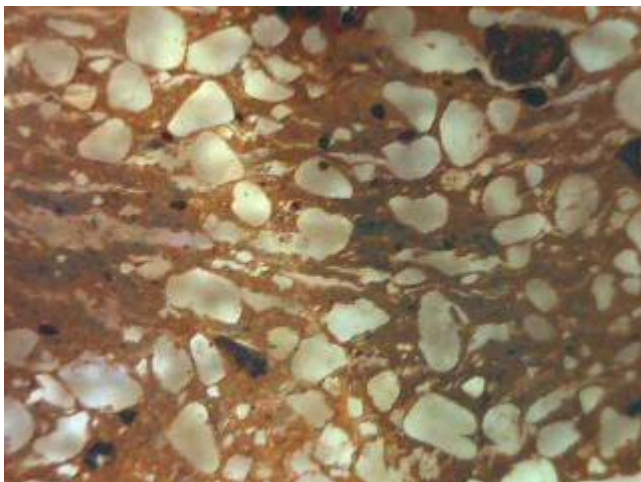


Figure 23

V5137



Figure 24

V5138



Figure 25

V5139



Figure 26

V5140



Figure 27

Fabric 6

A single thin section of this fabric was made (V5124). The following inclusion types were noted:

- Quartz. Abundant, angular, subangular and rounded grains c.0.2mm across. Some grains appear to have been cracked and have one straight or conchoidal face with the remainder well-rounded.
- Altered glauconite? Abundant rounded brown grains, c.0.2mm across, slightly lighter in colour than the groundmass. Unlike glauconite or altered glauconite, these grains are anisotropic, although their colour makes their birefringence somewhat.

- Opaques. Sparse rounded grains c.0.2mm across.
- The groundmass consists of anisotropic baked clay minerals with no visible inclusions.

V5124

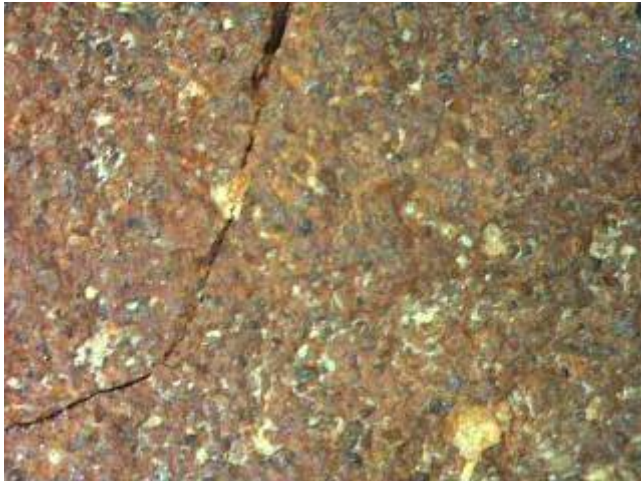


Figure 28

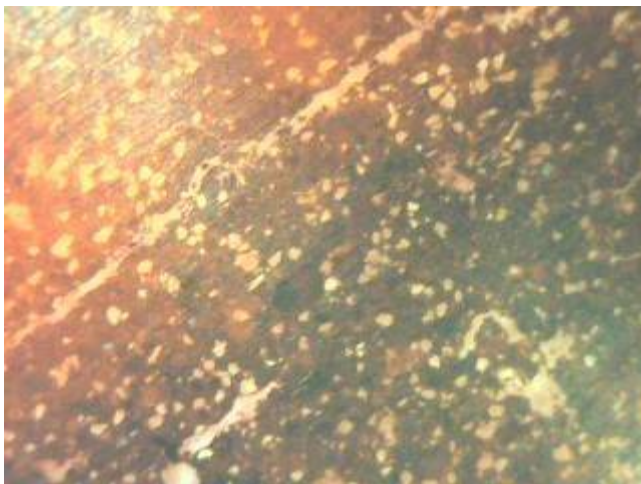


Figure 29 Reflected light photograph of thin section

Fabric 7

Fabric 7 is a finer variant of Fabric 1, and is classed as a Bath A ware.

Fabric 7 is very similar to Fabric 1 but contains fewer inclusions over 0.1mm across.

A single thin section of this fabric was made (V5125). The following inclusion types were noted in thin section:

Quartz. Moderate well-rounded grains up to 1.5mm across.

Altered glauconite. Moderate grains up to 0.3mm across.

Organics. Sparse voids with darkened haloes, up to 0.5mm long.

Chert, Sparse fragments up to 0.5mm across containing rounded and subangular quartz grains in a silica matrix.

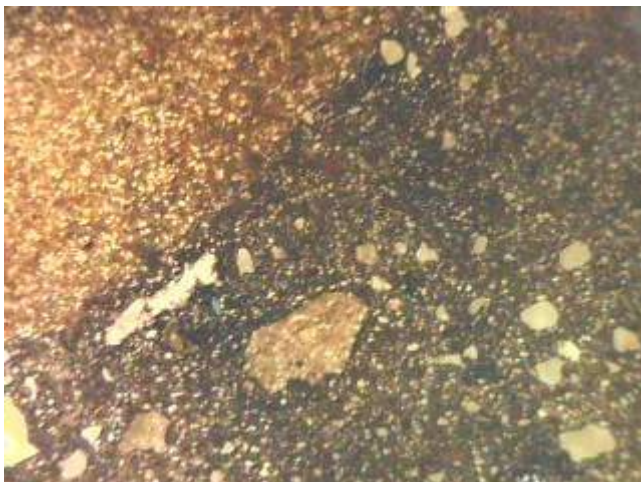
Clay pellets. Rounded pellets of similar texture to the groundmass but lighter in colour.

The groundmass consists of anisotropic baked clay minerals, abundant angular quartz grains up to 0.1mm across and moderate muscovite laths up to 0.1mm long.

V5125



Figure 30



V5141



Figure 31

V4152



Figure 32

V5143



Figure 33

V5144



Figure 34

V5145



Figure 35

Fabric 8

Fabric 8 was identified using a stereomicroscope as Ham Green glazed ware. This is a carbon-rich Coal Measures Whiteware (so appears dark grey with usually light coloured surfaces). The characterisation is consistent with this identification. The fabric is tempered with a mixed calcium carbonate/quartz sand temper.

A single sample of this fabric was thin-sectioned (V5126). The following inclusion types were noted:

Quartz. Abundant, subangular, subrounded and rounded grains up to 0.3mm across.

Mudstone. Moderate rounded pellets of light-coloured mudstone up to 1.0mm across, usually with fine-textured organic lenses.

Opaques. Sparse rounded grains.

Calcareous inclusions. Sparse heat-altered grains up to 0.2mm across.

The groundmass consists of light-coloured anisotropic baked clay with few visible inclusions, similar in colour to the mudstone fragments (or slightly darker, towards the core of the sample).

V5126



Figure 36

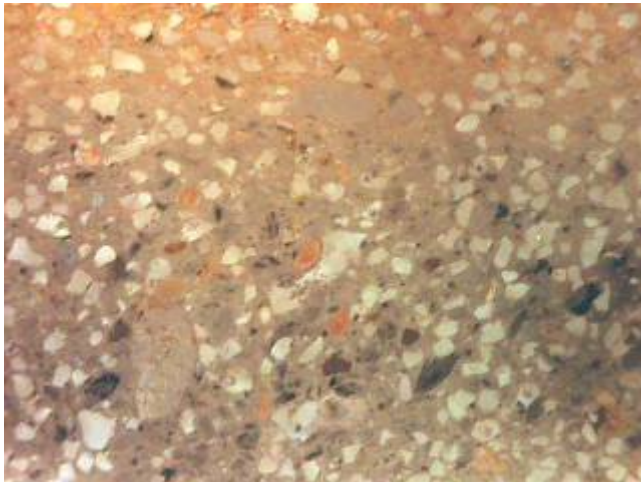


Figure 37 Reflected light photograph of thin section

Fabric 9

Fabric 9 was identified using a stereomicroscope as Nash Hill glazed ware.

A single sample of Fabric 9 was thin-sectioned (V5127). The following inclusion types were noted:

- Quartz. Abundant, mostly well-rounded grains up to 0.3mm across. A few subangular grains occur.
- Opaques and altered glauconite? Abundant well-rounded grains up to 0.3mm across ranging from a dark brown, birefringent mineral (similar to that in Fabric 6) to completely opaque grains. The latter predominate.

- The groundmass consists of optically anisotropic baked clay with moderate angular quartz inclusions up to 0.1mm across.

V5127



Figure 38

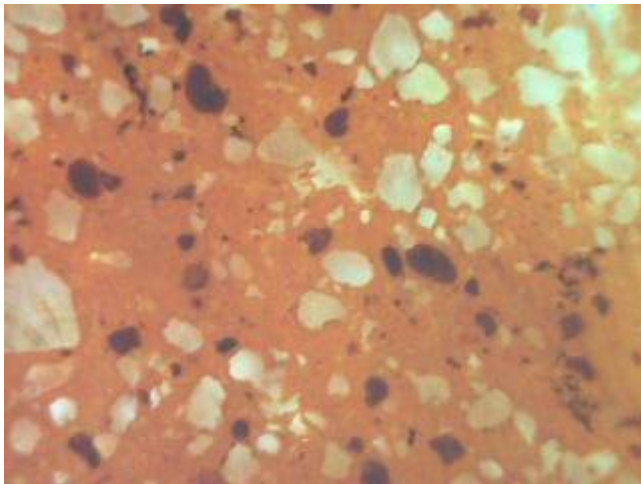


Figure 39 Reflected light photograph showing quartz grains and opaques

Fabric 10

Fabric 10 was identified in thin section as Crockerton Glazed ware

A single example of Fabric 10 was thin-sectioned (V5128). The following inclusion types were noted:

- Quartz. Moderate subangular grains up to 0.3mm across.
- Altered glauconite. Moderate well-rounded grains up to 0.3mm across.
- The groundmass consists of optically anisotropic baked clay, abundant angular quartz and moderate muscovite.

V5128



Figure 40



Figure 41 Reflected light photograph of thin section

Fabric 11

Although identified using a stereomicroscope as a Somerset Levels ware, the thin section suggests that it was another local variant of Bath A.

A single thin section was produced (V5129). The following inclusion types were noted:

- Quartz. Moderate rounded grains up to 0.2mm across.
- Altered Glauconite. Moderate rounded grains up to 0.2mm across.
- Opaques. Sparse rounded grains up to 0.2mm across.
- The groundmass consists of optically anisotropic baked clay minerals, abundant angular quartz grains up to 0.1mm across and moderate muscovite laths up to 0.1mm long.

V5129



Figure 42

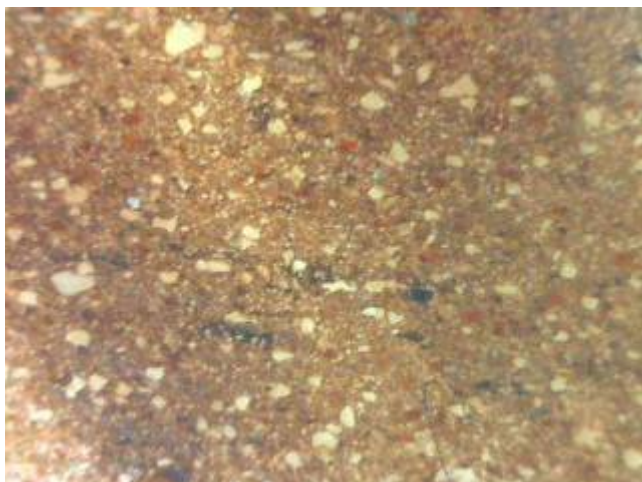


Figure 43 Reflected light photograph of thin section

Fabric 12

Identified using a stereomicroscope as Ham Green redware. This coarseware is usually a lot less common on inland sites than the glazed ware (Fabric 8). However, the thin section analysis confirms the identification.

A single thin section was produced (V5130). The following inclusion types were noted:

- Quartz. Well-sorted subangular, subrounded and rounded quartz grains c.0.25mm across.
- Chert. Sparse grains of similar size and character to the quartz.
- Mudstone. Rounded grains up to 1.5mm across with slight signs of lamination. The colour and texture of the pellets is almost identical to the groundmass.
- Altered calcareous inclusions. Sparse grains up to 0.3mm across.
- The groundmass consists of optically anisotropic baked clay minerals with sparse angular quartz inclusions.

V5130



Figure 44

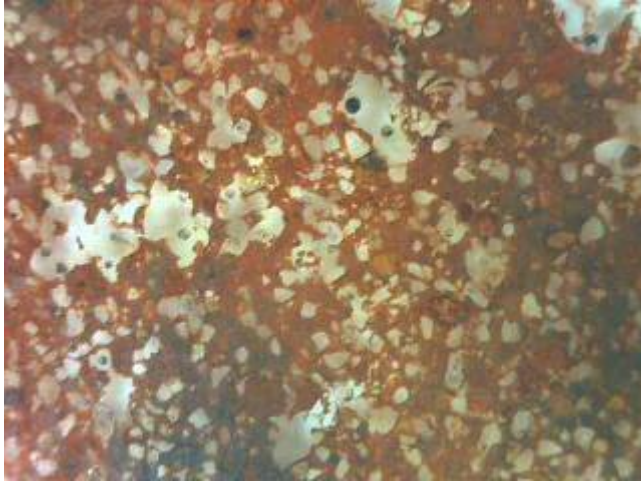


Figure 45 Reflected light photograph of thin section

Fabric 15

A single thin section of Fabric 15 was produced (V5131). The following inclusion types were noted:

- Quartz. Abundant, rounded quartz grains, some cracked, up to 1.5mm across.
- Chert. Moderate rounded grains up to 1.5mm across. None contain quartz sand but are probably all of Cretaceous origin.
- Flint. Sparse angular grains up to 1.0mm across. Most grains are brown-stained and the staining emphasises the various microfossils in the groundmass.
- Opaques. Sparse rounded grains up to 0.5mm across.
- The groundmass consists of optically anisotropic baked clay.

V5131



Figure 46

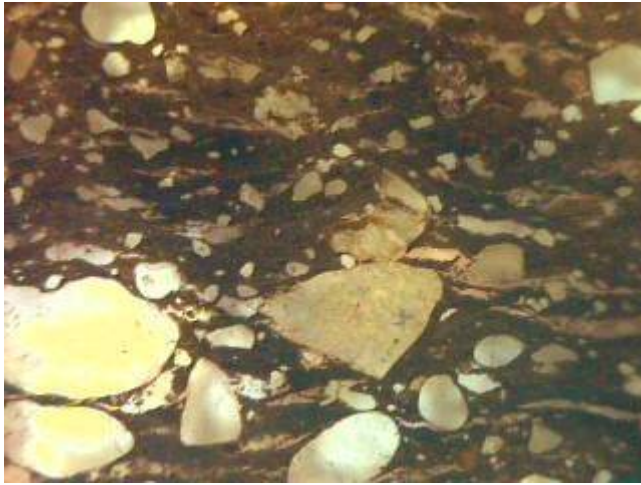


Figure 47 Reflected light photograph of thin section

V5146



Figure 48

V5147



Figure 49

V5148



Figure 50

V5149



Figure 51

V5150



Figure 52

Fabric 16

A single thin section of this fabric was produced (V5126). The following inclusion types were noted:

- Quartz. Subangular, subrounded, rounded and well-rounded grains up to 0.4mm across.
- Chert. Sparse. This is coarser than flint but does not have the staining or internal structure of the Lower Cretaceous examples.
- Clay pellets. Rare, up to 1.5mm across.

- Organics. Rare voids surrounded by a dark halo.
- The groundmass consists of optically anisotropic baked clay with few visible inclusions. The core is opaque and dark grey in reflected light.

V5132

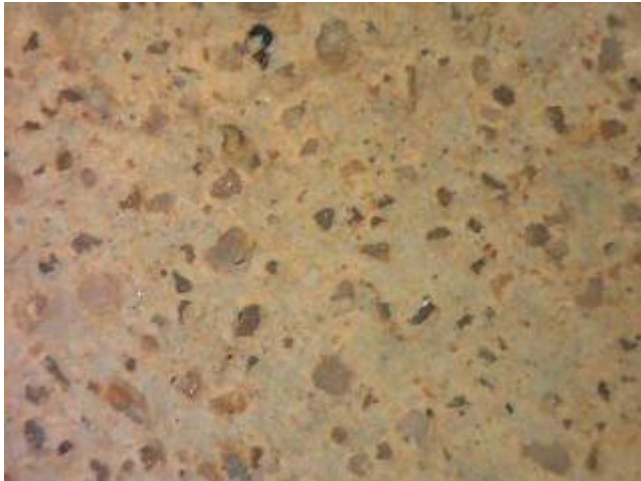


Figure 53

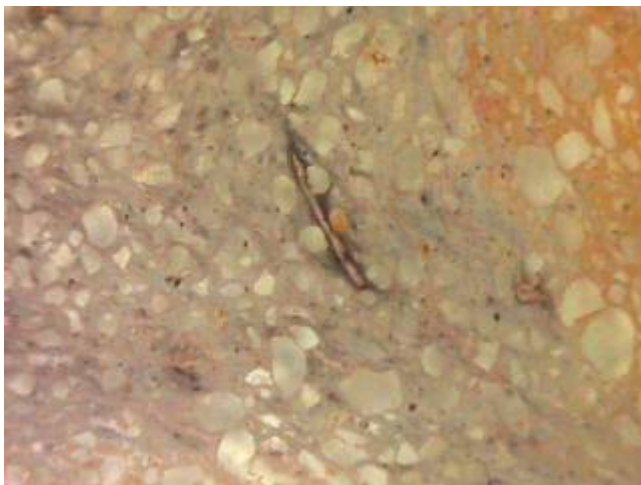


Figure 54 Reflected light photo of thin section V5132

Fabric 19

Fabric 19 was identified using a stereomicroscope as a SE Wiltshire glazed ware. This is consistent with the thin section.

A single thin section of this fabric was produced (V5133). The following inclusion types were noted:

- Quartz. Abundant subangular grains up to 0.4mm across.

- Tourmaline. Rare grains up to 0.3mm across.
- The groundmass consists of optically isotropic baked clay minerals with no visible inclusions under 0.1mm across.

V5133



Figure 55

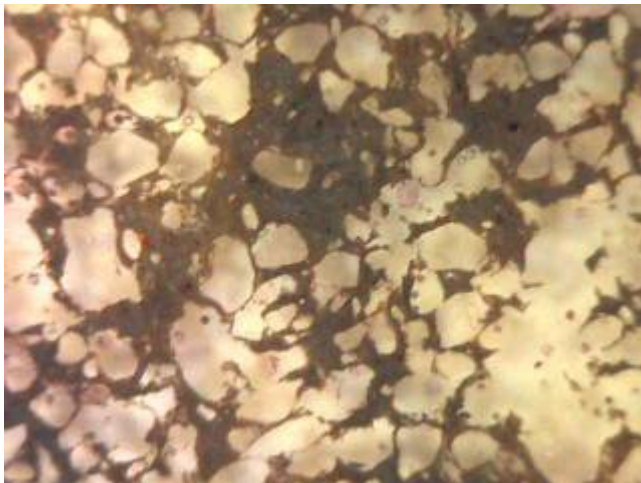


Figure 56

Fabric 23

Fabric 23 has been re-identified in thin section as Fabric 2, having been originally identified as being tempered with chert gravel. A single thin section was produced (V5134). The following inclusion types were seen:

- Limestone. Moderate, subangular fragments of limestone up to 2.0mm across. These contain abundant angular quartz sand, some grains of which are coated with

brown micrite. Some thin-walled ferroan calcite bivalve shell, up to 0.5mm long, and rounded ferroan calcite echinoid shell fragments up to 0.5mm across were also present. The groundmass consists of ferroan calcite.

- Opaques. Rare rounded grains up to 0.3mm across.
- The groundmass consists of optically anisotropic baked clay minerals with no inclusions under 0.1mm across.

V5134



Figure 57

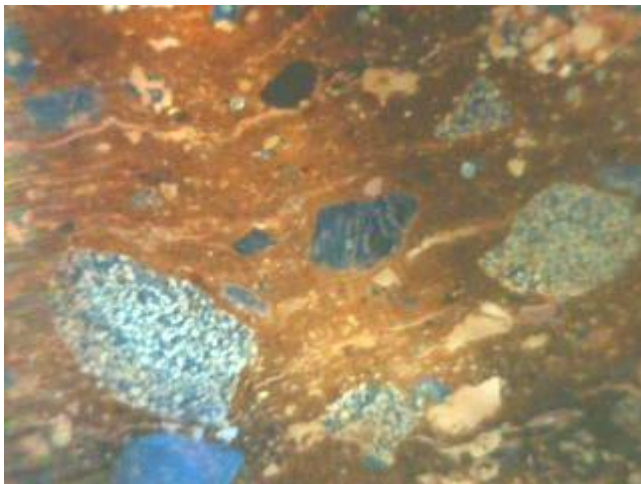


Figure 58 Reflected light photograph of thin section V5134

Fabric 24

Fabric 24 was identified as a variant of Fabric 2, having a quartz sand temp missing in Fabric 2. The thin section, V5135, indicates that the sample is completely leached. The following inclusion types were noted:

- Limestone. Leached grains, probably originally similar to those in Fabrics 2 and 23.
- Quartz. Moderate angular quartz grains up to 0.2mm across.
- Opaques. Sparse rounded grains up to 0.3mm across.
- The groundmass consists of optically anisotropic baked clay minerals with few visible inclusions.

V5135



Figure 59



Figure 60 Reflected light photograph of thin section V5135

Fabric 25

A single thin section of crucible Fabric 25 was produced (V5136). The following inclusion types were noted:

- Quartz. Moderate angular quartz grains up to 0.3mm across.
- Chert. Sparse angular grains up to 0.3mm across.
- The groundmass consists of optically isotropic baked clay with few visible inclusions under 0.1mm across.

V5136



Figure 61

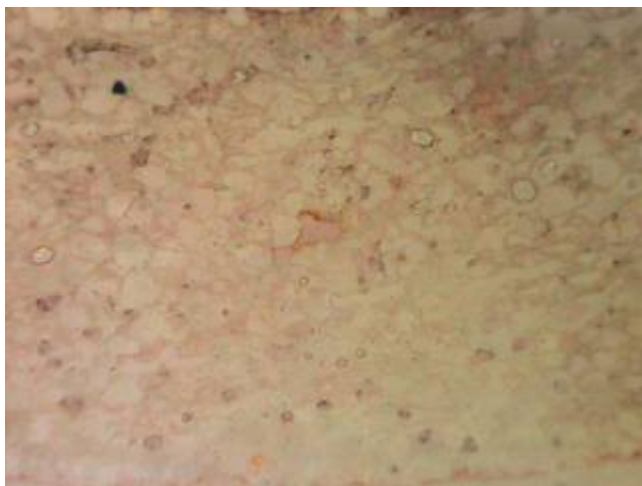


Figure 62 Reflect light photograph of thin section V5136

Chemical composition

Fabrics 1, 5, 7 and 15

Fabrics 1, 5 and 7 all have a similar range of inclusions, differing mainly in their relative frequencies and in the fact that the altered glauconite in Fabric 7 has been changed to a clay whilst in Fabric 1 and 7 it is an isotropic mineral.

Analysis using Inductively-Coupled Plasma Spectroscopy shows that there are few clear differences between Fabric 1 and Fabric 7 in chemical composition. Fabric 5, however has lower mean Function 3 scores and fabric 12 has higher Factor 1 scores than fabrics 1, 5 and 7.

Factor 4 separates the Bath A samples from Dursley from those from Evercreech, but whether this is due to the different in soil chemistry in which they were buried or a difference in composition is not certain.

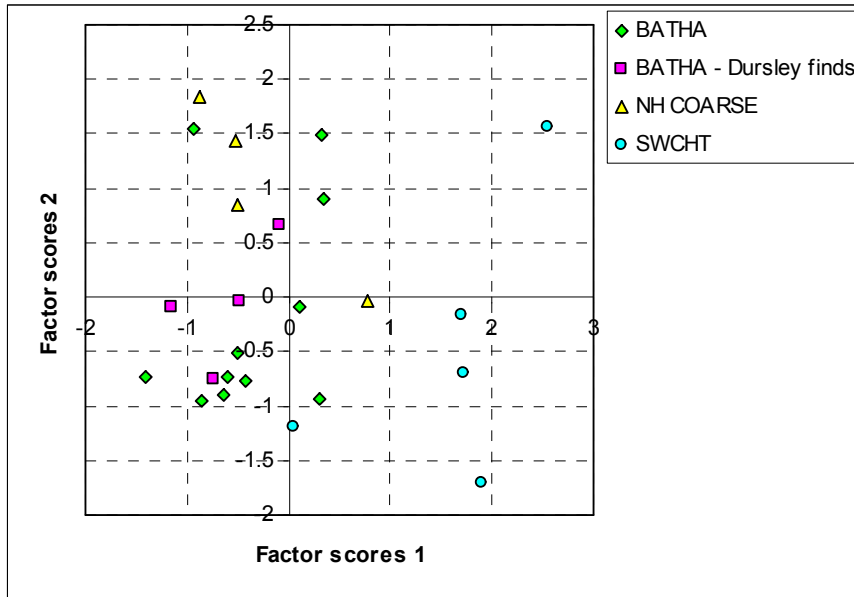


Figure 63 Bath A = Fabrics 1 and 7 from Evercreech, NH Coarse = Fabric 5, SWCHT = Chert and quartz gravel tempered, Fabric 15, from Evercreech

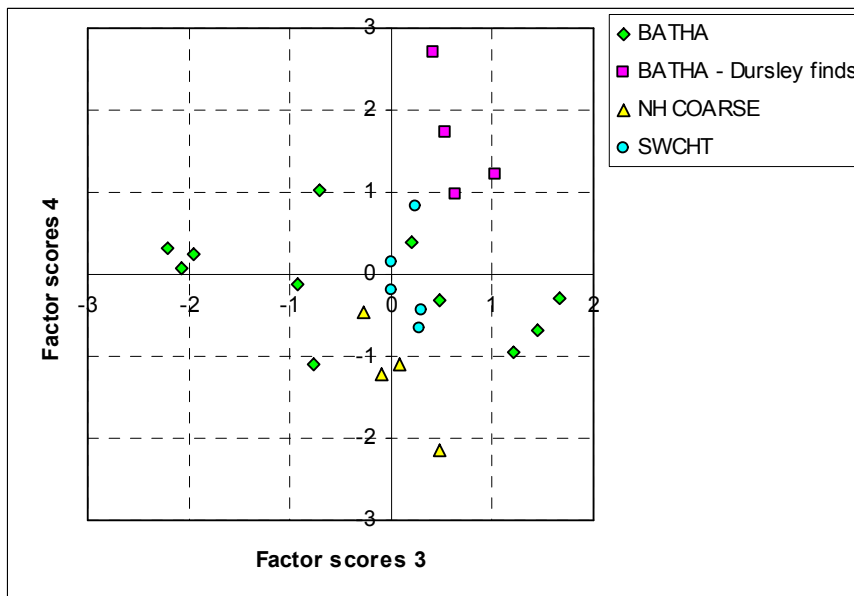


Figure 64 key as Fig 63

The composition of Fabric 15 (SWCHT) was compared with a series of samples from West Lear's Farm, Chard, Dorset (Anthony 2007). The function 1 scores differ (F1 is the most common function and usually a difference at this level indicates a different source) whilst the F3 and F4 scores show no clear separation (Fig 66). It is likely, therefore, that the Evercreech Fabric 15 samples are from a different source from the West Lear's Farm samples. It is very likely that they not only differ in findspot but also in date, with the West Lear's Farm samples being pre-Conquest.

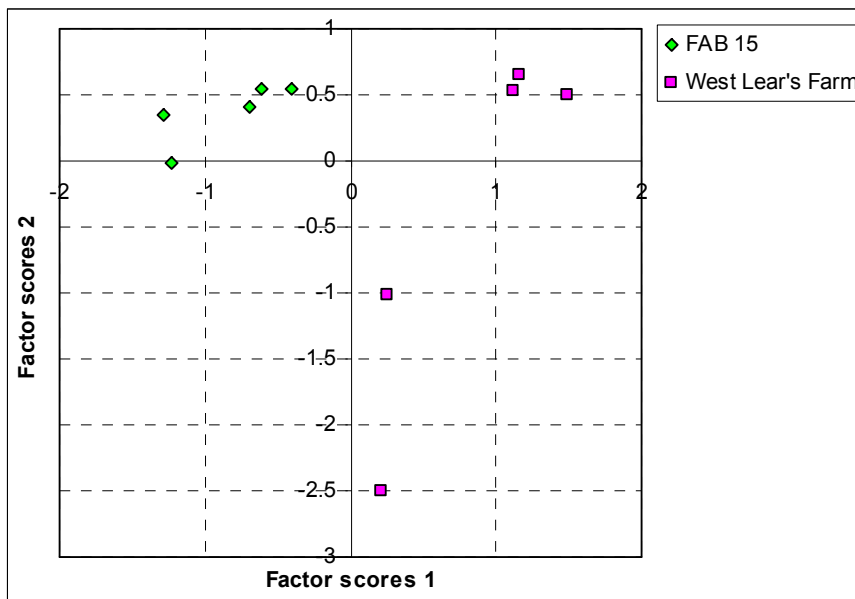


Figure 65

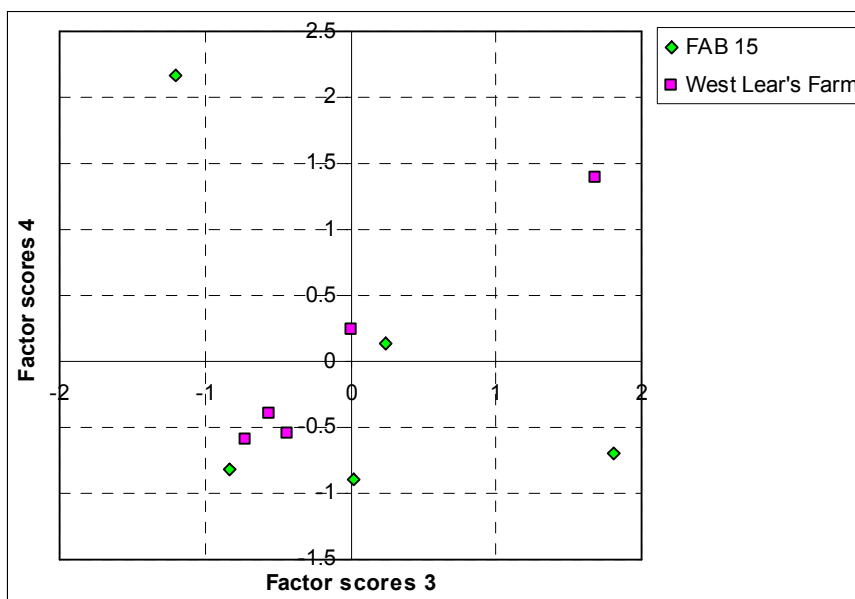


Figure 66

Fabric 2

Six samples of Fabric 2 were examined using ICPS. Results were compared with other Evercreech fabrics using factor analysis and Factor 2 scores were seen to separate the Fabric 2 samples from the remaining samples.

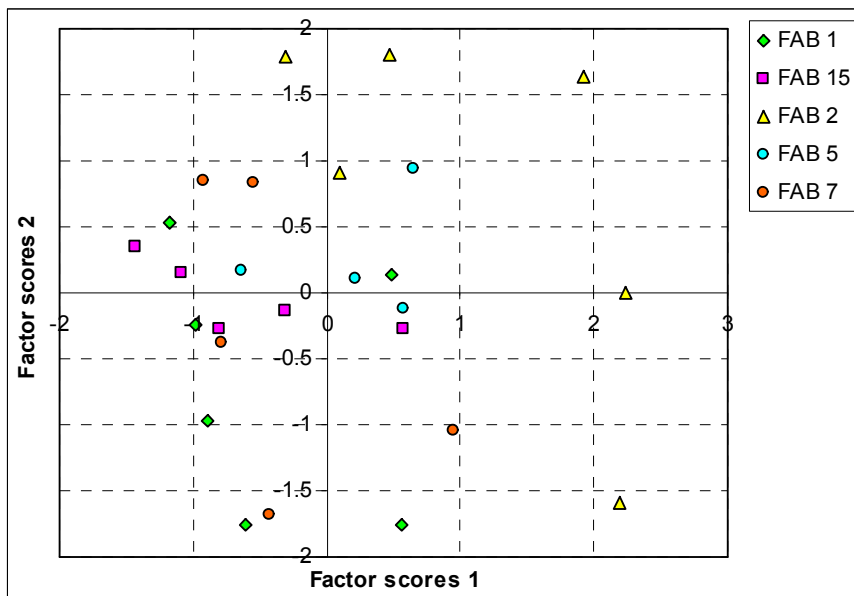


Figure 67 Evercreech Samples

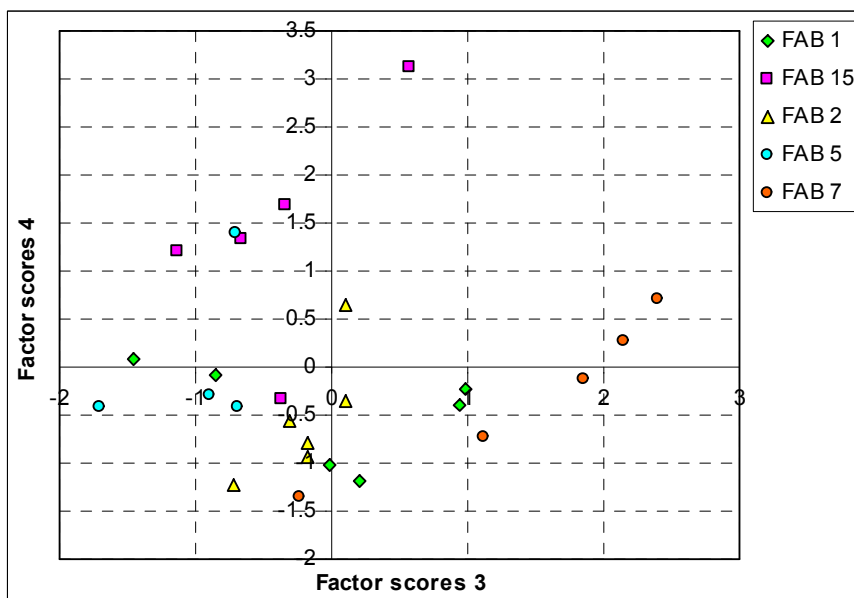


Figure 68 Evercreech Samples

Crucible

A sample was taken from the small crucible in Fabric 25. Unfortunately we could not afford to sample with Bristol area or Salisbury area whitewares and therefore have no comparanda for its source.

The sample was examined using ICP-MS to see if elements associated with metalworking were present in unusually high quantities (App 1). Lead and copper are only slightly higher than in unglazed redwares (Fabrics 1, 5 and 7) but silver (Ag) is at least five times higher than in such wares (although it was not measured in the Evercreech examples). It is likely, therefore, that the vessel was used for melting silver or a silver-rich compound. Gold, however, was not measured and gold with a high silver admixture cannot therefore be excluded as the contents of the crucible.

Conclusions

The sampled sherds in the main confirm that there are differences between the various groups. In one case, the suggested identification of the fabric, 23, proved to be wrong and the sherds have been amalgamated with those of Fabric 2. Only two comparative groups were available, Bath A ware from Dursley and chert-tempered ware from Dorset. Both could be distinguished from the Evercreech samples.

Bibliography

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Appendix 1

TSNO	As	Rb	Nb	Mo	Ag	Cd	Sn	Sb	Cs	Tl	Bi	Th	U
V5136	4.9	69.0	12.7	0.6	5.5	0.0	2.4	0.6	6.6	0.4	0.1	8.86	1.64

Appendix 2

TSNO	Al2O3	Fe2O3	MgO	CaO	Na2O	K2O	TiO2	P2O5	MnO
V5107	13.89	5.2	0.87	0.52	0.13	1.85	0.7	0.09	0.012
V5108	15.5	6.74	0.59	0.62	0.11	1.63	0.7	0.49	0.059
V5109	15.72	8.14	0.45	0.31	0.14	1.65	0.71	0.49	0.021
V5110	14.15	7.28	0.92	0.43	0.14	1.84	0.65	0.33	0.051
V5111	12.44	5.6	0.73	0.55	0.14	1.83	0.57	0.33	0.013
V5112	12.14	5.61	0.59	0.39	0.1	1.57	0.58	0.24	0.012
V5113	18.98	8.54	1.07	1.33	0.18	2.3	0.85	0.74	0.111
V5114	19.06	8.65	1.06	0.71	0.18	2.14	0.84	0.92	0.161
V5115	15.64	5.23	0.72	3.34	0.28	1.98	0.84	0.59	0.042
V5116	16.88	6.78	0.78	0.99	0.29	2.02	0.9	0.32	0.088
V5117	13.64	4.55	0.61	8.93	0.28	1.81	0.73	0.48	0.041
V5118	17.13	6.95	0.71	0.78	0.32	2.1	0.9	0.69	0.103
V5135	17.79	7.77	0.86	0.75	0.18	2.05	0.77	1.29	0.21
V5136	17.17	4.28	0.52	0.79	0.19	1.17	0.76	0.18	0.033
V5137	15.73	8.33	0.47	0.26	0.09	1.69	0.67	0.32	0.042
V5138	12.79	8.95	0.5	1.58	0.11	1.22	0.55	0.43	0.046
V5139	13.73	7.48	0.57	1.67	0.13	1.5	0.61	0.67	0.035
V5140	13.23	7.12	0.59	2.05	0.13	1.5	0.58	0.48	0.046
V5141	14.07	5.78	0.65	0.82	0.12	1.73	0.69	0.23	0.022
V5142	11.57	5.35	0.83	0.39	0.1	1.56	0.67	0.43	0.021

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V5143	13.51	4.71	0.86	0.46	0.14	2.08	0.7	0.33	0.014
V5144	12.89	5.93	0.93	0.98	0.13	2.06	0.71	0.28	0.014
V5145	12.83	6.57	0.81	0.61	0.11	1.84	0.68	0.34	0.016
V5146	13.31	3.82	0.37	0.41	0.13	1.39	0.61	0.93	0.015
V5147	14.62	5.4	0.49	0.27	0.1	1.78	0.67	0.55	0.073
V5148	15.19	4.54	0.57	0.22	0.17	1.9	0.68	0.58	0.017
V5149	14.2	4.32	0.41	0.64	0.11	1.58	0.69	0.31	0.025
V5150	14.65	5.37	0.45	0.5	0.12	1.86	0.66	0.47	0.03

Appendix 3

TSNO	Ba	Cr	Cu	Li	Ni	Sc	Sr	V	Y	Zr*	La	Ce	Nd	Sm	Eu	Dy	Yb	Pb	Zn	Co
V5107	269	92	17	44	28	13	59	140	16	90	37	83	37	6	1	3	2	79	52	12
V5108	349	127	28	56	57	15	43	138	19	84	29	61	30	5	1	3	2	22	93	16
V5109	324	150	31	42	39	15	41	133	16	84	35	62	35	6	1	3	2	21	89	11
V5110	324	125	24	57	46	13	42	173	17	94	34	82	35	7	1	3	2	23	79	16
V5111	274	110	18	48	30	10	67	139	10	69	28	58	28	4	1	2	2	20	56	10
V5112	307	121	14	61	27	11	45	124	9	79	25	50	25	4	1	2	2	18	50	9
V5113	500	156	31	133	83	18	136	162	27	98	45	75	46	8	1	4	3	23	149	25
V5114	498	158	37	95	87	20	61	173	34	105	49	95	52	9	2	6	3	53	150	23
V5115	446	128	28	74	42	14	135	125	22	111	44	73	45	8	1	4	3	18	89	13
V5116	455	137	32	86	92	15	78	136	29	124	44	95	47	10	2	6	3	19	120	21
V5117	327	114	23	51	35	12	205	110	18	94	40	61	40	7	1	3	3	17	77	11

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V5118	475	136	29	41	58	16	66	139	26	119	50	91	52	9	2	5	3	24	102	19
V5135	441	147	30	69	80	18	67	150	32	99	54	99	57	9	2	7	3	22	128	24
V5136	250	126	39	65	32	16	96	140	22	124	26	54	28	5	1	3	3	29	48	11
V5137	310	147	42	41	46	16	37	133	18	83	39	71	40	7	1	3	2	26	93	14
V5138	215	110	22	47	53	12	97	115	17	61	31	58	32	5	1	3	2	18	92	15
V5139	245	121	21	66	51	13	109	122	17	71	33	63	33	6	1	3	2	24	90	13
V5140	262	95	20	56	48	13	87	124	16	74	33	57	33	5	1	3	2	20	95	14
V5141	306	85	16	64	32	12	65	125	16	89	30	60	30	4	1	2	2	32	67	11
V5142	282	89	23	66	42	11	40	113	14	98	27	63	28	5	1	2	2	18	86	12
V5143	294	83	18	54	30	11	65	120	17	87	34	75	34	6	1	2	2	41	72	10
V5144	294	103	19	42	32	11	74	115	15	88	37	81	37	7	1	2	2	22	62	12
V5145	293	117	20	48	35	12	57	120	18	137	37	82	37	7	1	2	2	22	63	13
V5146	298	132	33	31	25	13	54	96	19	69	33	56	33	6	1	3	2	98	77	7
V5147	314	148	45	43	54	16	35	123	26	82	39	69	40	6	1	4	2	26	136	16
V5148	295	133	38	42	45	16	38	110	22	83	37	66	37	6	1	3	2	19	110	10
V5149	303	110	25	64	34	12	57	122	17	77	37	79	37	6	1	2	2	20	63	11
V5150	315	141	31	54	47	15	50	95	23	70	34	66	35	7	1	3	2	19	101	11