Characterisation Studies of Iron Age and Medieval Pottery from Reighton Bypass, North Yorkshire (RBY06)

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A series of samples of Iron Age pottery from Reighton Bypass were selected by Chris Cumberpatch and submitted to the author for characterisation. In addition, a single sherd from a medieval storage jar found set in a pit was submitted.

The Iron Age samples were assigned to four fabric groups but the thin section results indicate that they should be assigned to at least six fabrics, and therefore a series of Petro-Fabric groups were created by the author and correlated with the Cumberpatch Fabrics in Table 1.

Table 1

TSNO	Context	cname	Action	locality	Cumberpatch Fabric	Petro-Fabric
V4044	1244	BLSF	TS;ICPS	Reighton	H2	FAB 3
V4045	1189	BLSF	TS;ICPS	Reighton	H1	FAB 3
V4046	1282	IAERR	TS;ICPS	Reighton	H2	FAB 5
V4047	1020	IARQ	TS;ICPS	Reighton	H2?	FAB 6
V4048	1141	IACALC	TS;ICPS	Reighton	H1	FAB 2
V4049	1075	IACALC	TS;ICPS	Reighton	H1	FAB 1
V4050	1324	IACALC	TS;ICPS	Reighton	H1	FAB 1
V4051	1336	IACALC	TS;ICPS	Reighton	H4	FAB 1
V4052	1159	IACALC	TS;ICPS	Reighton	H2	FAB 4
V4053		STAX	TS;ICPS	Reighton	BURIED IN PIT	FAB 8
V4054	1324	IAERR	TS;ICPS	Reighton	H2	FAB 7

Thin-Section Analysis

The thin sections were prepared by Steve Caldwell, University of Manchester, and stained using Dickson's method (Dickson 1965). The staining distinguishes between non-ferroan calcite (pink to red stain); ferroan calite (blue stain) and dolomite (unstained).

Fabric 1: Calcite Tempered

Three samples of this fabric were thin-sectioned (V4049, V4050 and V4051). They contain the following inclusion types:

- Calcite. Abundant angular fragments of sparry calcite. These have a slight pink stain.
- Mudstone. Moderate rounded fragments up to 1.0mm across, of similar colour and texture to the groundmass but with clear bedding laminae.
- Chalk. Sparse rounded fragments up to 1.5mm across with sparry calcite veins. The chalk has a slightly deeper stain than the sparry calcite.

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- Rounded Quartz. Sparse rounded grains up to 0.5mm across.
- Muscovite. Moderate laths c.0.2mm long.

The groundmass consists of optically anisotropic baked clay minerals with sparse to moderate dark brown grains up to 0.1mm across.

Fabric 2: Calcite and Fine Quartz

One sample of this fabric was thin-sectioned (V4048). The following inclusion types were noted:

- Calcite. As in Fabric 1.
- Quartz. Moderate subangular grains mainly up to 0.3mm across but ranging up to 1.0mm across.
- Plagioclase Feldspar. Sparse subangular grains up to 0.3mm across.
- Chalk. Sparse rounded, light brown stained grains up to 1.5mm across.

The groundmass is similar to that of Fabric 1.

Fabric 3: Quartz Sand and Sparse Calcite

Two samples of this fabric were thin-sectioned (V4044 and V4045). The following inclusion types were noted.

- Calcite. Sparse angular sparry calcite fragments up to 1.5mm across.
- Quartz. Abundant subangular and sparse rounded quartz grains up to 0.5mm across.
- Chert. A single rounded fragment of chert or altered rhyolite 0.7mm across.
- Muscovite. Moderate laths up to 0.2mm long.

The groundmass consists of dark brown, optically anisotropic, baked clay minerals and abundant subangular quartz grains and sparse muscovite laths up to 0.1mm long.

Fabric 4: Angular Quartz Sand and Sparse Calcite

A single sample of this fabric was thin-sectioned (V4052). The following inclusion types were noted.

- Quartz. Moderate very angular fragments of monocrystalline unstrained quartz between 0.5mm and 2.0mm across.
- Sandstone. A single angular fragment of sandstone with illsorted angular grains between 0.2mm and 0.5mm across and a dark brown to opaque cement.
- Calcite. Sparse angular fragments of sparry calcite, as in Fabrics 1, 2 and 3.

The groundmass is similar to that of Fabrics 1 and 2.

Fabric 5: Biotite Granite and Fine Quartz Sand

A single sample of this fabric was thin-sectioned (V4046). The following inclusion types were noted:

- Biotite Granite. Sparse fragments of igneous rock up to 2.0mm across composed of quartz, plagioclase feldspar and biotite together with fragments of these individual minerals. The biotite is mostly brown in plane polarised light but occasional blue-green patches are present.
- Quartz. Moderate fragments of angular quartz up to 1.5mm across. Most have at least one straight edge, indicating that they are probably overgrown detrital grains.
- Sandstone. Sparse fragments of coarse-grained sandstone containing quartz grains ranging from 0.3mm to 1.5mm across. Pores between grains are filled with brown clay.
- Muscovite. Moderate laths up to 0.2mm long.

The groundmass consists of optically anisotropic baked clay minerals, sparse angular quartz, moderate dark brown grains and sparse biotite laths up to 0.1mm across.

Fabric 6: Sparse Rounded Quartz sand and Fine Quartz Sand

A single sample of this fabric was thin-sectioned (V4047). The following inclusion types were noted.

- Quartz. Moderate subangular and rounded grains ranging from 0.3mm to 1.5mm across. The subangular fragments include some with at least one flat face and the rounded fragments include well-rounded grains of probable Lower Cretaceous origin.
- Microcline feldspar. A single rounded fragment c.1.0mm long.
- Chert? A single rounded brown-stained fragment 1.5mm across. The fragment contains sponge spicules and abundant amorphous brown inclusions c.0.05mm across.
- Clay/iron concretion. A single rounded dark brown clay/iron concretion containing sparse muscovite laths and quartz grains up to 0.2mm long.

The groundmass consists of optically anisotropic baked clay minerals, abundant angular quartz, moderate muscovite laths and sparse plagioclase quartz, all up to 0.1mm across.

Fabric 7: Basic Igneous Rock Fragments and Fine Quartz Sand

A single sample of this fabric was thin-sectioned (V4054). The following inclusion types were noted.

- Basic Igneous rock. Moderate angular fragments of rock up to 2.0mm across consisting of euhedral crystals of olivine, plagioclase feldspar and opaque grains up to 0.2mm across in a glassy groundmass.
- Quartz. Abundant subangular fragments, mostly up to 0.3mm across.
- Conglomerate. Moderate angular fragments of rock up to 4.0mm across consisting of rounded and angular quartz grains, biotite laths, plagioclase feldspar, chert, phyllite, and opaque grains with a dark brown clay cement.
- Clay/iron. Sparse rounded dark brown inclusionless grains up to 0.3mm across.
- Muscovite. Sparse laths up to 0.2mm long.

The groundmass consists of optically anisotropic baked clay minerals, sparse angular quartz, muscovite laths and dark brown grains up to 0.1mm across.

Fabric 8: Staxton ware

A single sample of this fabric was thin-sectioned (V4053). The following inclusion types were noted.

- Quartz. Abundant grains up to 0.3mm across. The grains include overgrown grains, well-rounded grains of probable Lower Cretaceous origin, some of which have dark brown to opaque veins.
- Mudstone. Sparse rounded pellets up to 2.0mm across, similar in texture and colour to the groundmass with clear bedding laminae.
- Clay/iron. Sparse rounded dark brown inclusionless grains up to 0.3mm across.
- Chert. Sparse rounded grains up to 0.3mm across.

The groundmass consists of brown, optically anisotropic baked clay minerals with sparse dark brown grains up to 0.1mm across.

Interpretation

The groundmass seen in Fabrics 1, 2, 4 and 8 is typical of Upper Jurassic clays from the Vale of Pickering, as is the presence of mudstone fragments (Fabrics 1 and 8). Similarly, the mixed quartzose sand (mostly quartz, chert and clay/iron grains) found in fabrics 3 and 8, and in smaller quantities in other fabrics, is matched by samples of blown sand from West Heslerton, and is derived from Upper Jurassic and Lower Cretaceous sands. The calcite and chalk fragments found in Fabrics 1, 2, 3, and 4 are also paralleled in superficial deposits in the Vale of Pickering, being derived from calcite veins occurring in the Chalk. No similar deposits occur to the east or south of the Wolds but similar geological conditions might be expected close to the base of the Chalk scarp on the west and south sides of the Wolds.

Fabrics 5 and 7 have similar groundmasses which are slightly more silty than those of the Upper Jurassic-derived clays, but are still much less silty that the Quaternary lacustrine and estuarine clays of East Yorkshire. They are probably boulder clays composed of material of Jurassic age (the lack of glauconite and flint might indicate a source north of the Wolds, but this is by no means certain). The principal inclusion types in both fabrics are likely to have been prepared by fire-cracking erratic rocks.

Fabric 3 has a distinctive groundmass, which might be a lacustrine or estuarine clay of Quaternary origin, and of local East Yorkshire origin, but could also be of Tertiary origin and non-local, for example East Anglia or the Thames basin. The quartzose sand is probably derived from lower Cretaceous or later rocks.

Chemical Analysis

Subsamples of each sample were taken for chemical analysis. The surfaces of the subsample were mechanically removed and the resulting block was crushed to a fine powder and submitted to Royal Holloway College, London, where it was analysed using Inductively-Coupled Plasma Spectroscopy (ICP-AES). A range of major elements was measured (expressed as percent oxides, App 1) together with a range of trace elements, expressed as parts per million (App 2). Silica was not measured directly but estimated by subtracting the total measured oxides from 100%. Thus, the estimate will also include organic matter and any other unmeasured elements.

Iron Age

Variation within the Reighton Data

The ICPS data were normalised to aluminium to take account of the diluting effect of quartz and calcite. The transformed data were then examined using Factor Analysis. Five significant factors were found. In the first, the main contributory elements were the Rare Earth elements (dysprosium, europium, samarium, yttrium, neodymium, lanthanum, ytterbium, and cerium), together with zinc, manganese, strontium and scandium. The second factor scores mainly depend on cobalt, copper, nickel and calcium values. The third factor scores mainly depend on chromium, scandium, magnesium, and lead together with a negative contribution from iron. Factor 4 scores depend mainly on titanium and iron values and a negative contribution from phosphorous and Factor 5 scores depend on potassium, sodium and barium scores and a negative contribution from vanadium.

Since Factors 1, 2 and 4 depend to some extent on mobile elements (strontium, calcite and phosphorous) the analysis was repeated excluding these elements. The rare earth elements were also omitted. In this second analysis, four factors were found. Factor 1 scores depend on copper, nickel, zinc, cobalt and manganese. Factor 2 scores depend on scandium, chromium, magnesium and a negative contribution from iron. Factor 3 scores depend on sodium, barium and a negative contribution from vanadium, whilst Factor 4 scores depend on titanium and iron.

Factor 1 scores do not distinguish any of the fabrics whilst all the Iron Age samples have similar Factor 2 scores with Fabric 8 having a lower (negative) score. Factor 3 distinguishes Fabric 4 (a stronger negative score) whilst Factor 4 distinguishes Fabrics 6 and 7 from the remainder (higher scores). None of the samples show much stronger similarity to their neighbours than others.

Comparison with other Calcite-tempered wares

The Reighton calcite-tempered wares were then compared with analyses from a range of calcite-tempered wares from other sites in Yorkshire. These samples differ in date, in post-burial alteration and, in some cases, in their petrological characteristics (Table 2). Factor analysis of this dataset revealed four factors of which the first and second did not distinguish any of the sample groups although within the single large cluster those samples with a quartz sand temper and sparse calcite have lower F2 scores than the remainder (West Heslerton and West Lilling BLSF) whilst the equivalent fabric from Reighton does not (Fabric 3).

Table 2

locality	Description	Grand Total
Elloughton	Late Roman	3
Ferrybridge	Probably Iron Age	2
Melton	Probably Iron Age	8
Scorton	Late Roman or Anglo-Saxon	2
West Heslerton	Bronze Age (6 samples); Late Roman (50 samples with abundant calcite and 11 with sparse calcite); early Anglo-Saxon (9 samples)	76
West Lilling	Late Roman (6 with abundant calcite, 6 with sparse calcite)	12
Grand Total		103

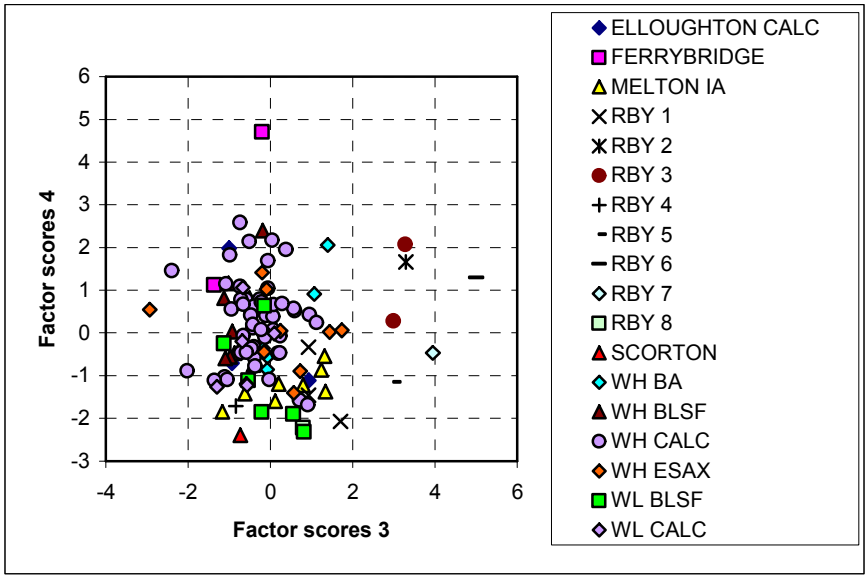

Figure 1

A plot of the third against the fourth factors (Fig 1 distinguishes several of the Reighton samples from the remainder (Fabrics 2, 3, 5, 6, 7) whilst within the single large cluster the Reighton Fabric 1 and 4 samples have similar F4 scores to the Melton Iron Age samples. The Fabric 8 (Staxton ware) sample plots with the calcite-tempered vessels, having a similar composition to one of the West Lilling BLSF samples.

Comparison with Silty Micaceous Fabrics

Fabric 6 contains rounded quartz sand of a type which occurs throughout eastern England, from the Yorkshire Wolds southwards, and has a silty, micaceous groundmass which is also widely paralleled. To establish the likely source the Reighton sample was compared with material with similar groundmasses from East Anglia and Yorkshire (Table 3). Factor analysis of this data found two significant factors. Factor 1 distinguishes East Anglian from Yorkshire wares whilst Factor 2 distinguishes wares from the Vale of York and Humber wetlands west of the Wolds from those made in Beverley and the Vale of Pickering (Staxton and Reighton Fabric 8).. Fabric 6 plots within the Beverley group, and this supports an East Yorkshire clayland origin for the fabric.

Table 3

locality	Beverley	GSS	IPS	Melton 1	Melton FCLAY	RBY 6	RBY 8	Staxton	West Cowick HUM	York HUM	Grand Total
Barton-upon-Humber			1								1
Doncaster		1									1
Hart		12									12
Melton				3	12						15
Newcastle-upon-Tyne		2									2
Orby		3									3
Reighton						1	1				2
Staxton								6			6
Wawne	9										9
West Cowick									8		8
York			1							10	11
Grand Total	9	18	2	3	12	1	1	6	8	10	70

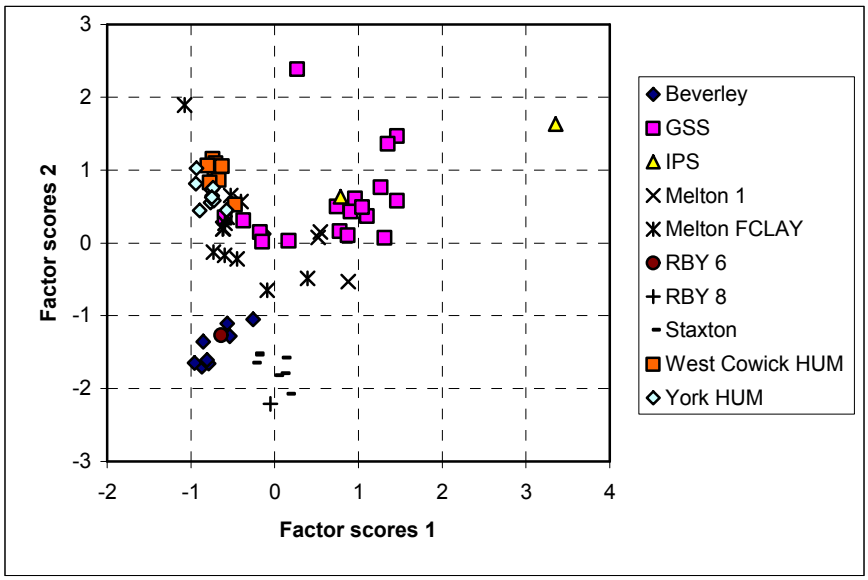

Figure 2

Staxton ware

The ICPS data from Fabric 8, Staxton ware, was compared with various Late Saxon and medieval handmade wares from Yorkshire, Lincolnshire and East Anglia (Table 4). Factor analysis of the ICPS data (excluding the same elements as above) revealed two factors and a plot of F1 against F2 (Fig 2) indicates that the F1 scores distinguish the two East Anglian wares from the remainder whilst the F2 scores separate the various Staxton-type groups. Samples from a waster dump at Staxton, excavated in 1998 by On-Site Archaeology Ltd are distinguished by a high F2 score whilst samples from Wawne, have an identical chemical signature and petrological composition to wares known to have been made at Beverley. The samples from the consumer sites at Hartlepool and Scarborough and the Reighton sample all have intermediate F2 scores.

Table 4

locality	BEVERLEY STAXT	STAX	STAXT	THET	THETG	THETT	Grand Total
Barton-upon-Humber						1	1
Doncaster						1	1
Grimston					4		4
Hartlepool			6				6
Scarborough			1				1
Selby					1		1
Staxton		6					6
Thetford				2			2
Wawne	5						5
Grand Total	5	6	7	2	5	2	54

Key: STAX = Staxton ware; STAXT = Staxton-type ware; THET = Thetford ware from Thetford; THETG = Grimston Thetford-type ware; THETT = Thetford-type wares.

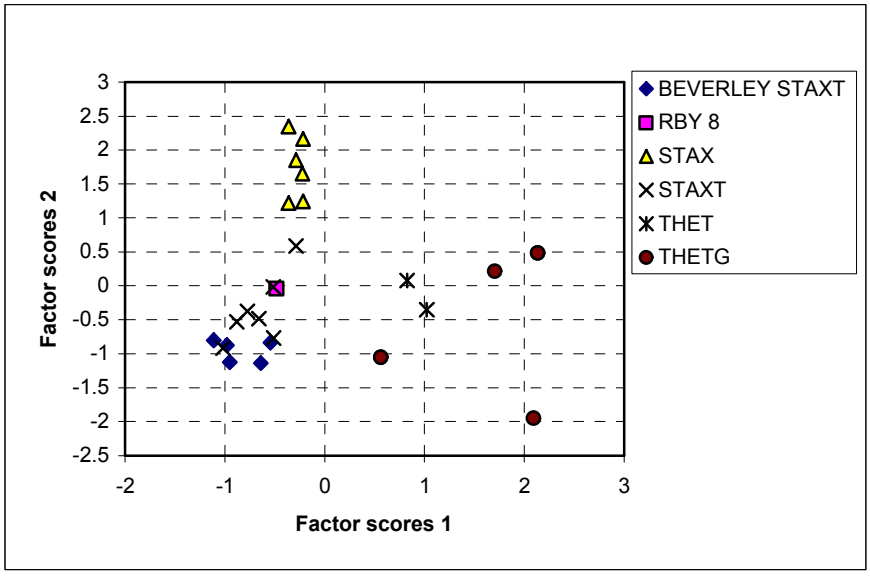

Figure 3

Conclusions

The Iron Age samples can be grouped into three groups on the basis of their groundmass characteristics and inclusions. Fabrics 1, 2 and 4 are almost certainly from the Vale of Pickering, as probably is Fabric 3, and the lack of glauconite suggests that they were not made from the Speeton Clay, which outcrops mainly at the south-eastern corner of the vale, and points towards a source along the foot of the chalk scarp from the middle of the vale westwards.

Fabrics of this source were produced in the Vale of Pickering from the Bronze Age onwards and continued to be made through the Iron Age and Roman periods and into the early Anglo-Saxon period (2004; Freestone and Humphrey 1992;Freestone and Middleton 1991; Wardle 1991). Fabric 4 is paralleled at the Roman fort at Lease Rigg, North Yorkshire, where it was either used in the late 1st/early 2nd century or may be residual from an earlier Iron Age settlement (Vince forthcoming). Fabric 3 is similar to a late Roman fabric found at West Heslerton and York which appears to have been produced alongside the standard Calcite tempered ware (West Heslerton BLSF, Vince in Darling and Precious forthcoming). However, since the raw materials occur widely in the Vale there is no reason why the fabric should not have also been produced earlier. The similarity of the chemical composition of Reighton Fabric 1 to Iron Age samples from Melton, East Yorkshire, indicates the likelihood that a single centre produced both wares whilst the lack of glauconite probably indicates a source towards the centre to western end of the Vale of Pickering. The chemical and petrological differences between the other Reighton calcite-tempered wares (Fabrics 2 and 3) and the remainder suggests that they may be from different centres.

The two fabrics with coarse, extremely angular rock fragments (Fabrics 5 and 7) are examples of the Erratic-temper wares which occur in Yorkshire, and more widely in northern England, from the Bronze Age to the Iron Age (Wardle 1991; Freestone and Humphrey 1992;Freestone and Middleton 1991; 2004). This tradition, too, probably continued into the Roman period, although it probably did not survive past the end of the 1st century AD. In the two Reighton examples it is clear that the interpretation put forward by Wardle and others is correct, that the inclusions were produced from rocks which were deliberately selected for their crystalline, exotic, appearance which were then shattered, presumably by fire-cracking, and then used as temper. Some of the inclusions in both thin sections have extreme angularity with no sign at all of mechanical weathering. This angularity distinguishes them from erratics found naturally in the Yorkshire tills, as does the limited range of lithologies.

Fabric 6 is petrologically quite different from the remaining Iron Age samples. The rounded quartz sand is found in East Yorkshire, as could be the silty, micaceous groundmass. It is therefore likely that this vessel was produced using a lacustrine or estuarine clay from the East Yorkshire claylands. However, in much of those claylands

the main Iron Age pottery fabric used is Erratic Tempered ware and no close local parallels are known to the author of this report. Nevertheless, the chemical composition suggests an East Yorkshire claylands origin rather than a more exotic source.

Finally, Fabric 8 is identified from its petrology as being a Staxton ware but is more similar to samples of Staxton-type ware from Hartlepool and Scarborough than to waste from Staxton itself. However, only one waste dump, from an industry which spread over two adjoining villages (Potter Brompton and Staxton) has been sampled and it is possible that the lack of identity between the Reighton and Staxton ICPS analyses indicates that Potter Brompton was the source of the Reighton piece, and perhaps those from Hartlepool and Scarborough.

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Appendix 1

TSNO	Al2O3	Fe2O3	MgO	CaO	Na2O	K2O	TiO2	P2O5	MnO
V4044	11.91	3.33	0.71	3.87	0.55	1.7	0.45	1.25	0.024
V4045	11.7	2.47	0.98	15.94	0.46	1.37	0.5	0.27	0.03
V4046	16.11	4.2	0.84	1.31	0.67	1.7	0.6	1.19	0.047
V4047	12.8	4.32	0.86	1.22	0.87	1.64	0.62	0.4	0.022
V4048	13.79	3.13	1.01	6.04	0.55	1.94	0.42	1.58	0.028
V4049	16.63	4.78	1.16	10.83	0.3	1.66	0.7	0.55	0.023
V4050	12.74	2.68	1.05	20.9	0.27	1.09	0.44	0.74	0.069
V4051	12.72	3.3	0.94	22.79	0.2	1.43	0.5	0.54	0.071
V4052	16.07	3.98	0.97	1.65	0.19	1.66	0.6	1.32	0.01
V4053	15.23	4.99	0.69	0.64	0.24	1.61	0.63	0.11	0.015
V4054	18.92	5.14	1.64	2.11	0.94	1.72	1	0.57	0.041

Appendix 2

TSNO	Ba	Cr	Cu	Li	Ni	Sc	Sr	V	Y	Zr*	La	Ce	Nd	Sm	Eu	Dy	Yb	Pb	Zn	Co
V4044	585	64	21	59	35	9	329	77	12	35	29	62	29	5	1	2	2	16	71	8
V4045	396	91	19	70	33	11	730	68	23	53	36	75	38	7	1	4	2	20	64	9
V4046	395	77	26	56	48	13	174	104	17	61	33	78	34	5	1	3	2	21	80	13
V4047	469	72	20	68	40	11	126	71	25	70	40	70	42	7	1	4	3	20	77	11
V4048	587	71	18	41	31	12	343	78	24	56	41	65	42	8	1	4	2	20	50	9
V4049	374	85	32	99	64	13	412	109	14	63	30	74	31	5	1	3	2	19	96	14
V4050	457	97	31	80	42	13	950	72	46	49	57	115	61	14	3	8	4	17	119	9
V4051	300	80	42	75	71	11	778	73	24	88	38	88	39	7	1	4	3	18	104	20
V4052	441	120	30	83	39	15	205	176	15	64	34	63	35	6	1	3	2	23	72	12

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V4053	337	87	31	57	75	12	54	113	21	62	32	82	34	7	1	4	2	21	76	16
V4054	586	136	20	85	47	18	286	120	31	98	55	99	58	12	3	6	3	28	89	14