# Lanton Quarry, Northumberland

# Specialist reporting on artefacts and ecofacts

Anglo-Saxon industrial settlement at Lanton Quarry, looking towards the Cheviot Hills

**ARS Ltd Jan 2009**

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# The Anglo-Saxon Pottery from Lanton Quarry (LAN 06)

***Alan Vince and Kate Steane***

The excavations at Lanton Quarry, Northumberland, carried out by Archaeological Research Services Ltd, revealed an Anglo-Saxon settlement consisting of ground-level post-built structures, sunken-featured buildings, and other features. A small quantity of pottery was associated with this settlement (63 sherds, representing no more than 40 vessels and weighing in total 791 gm) and all of this material could be paralleled in the Anglo-Saxon period in Yorkshire or eastern England south of the Humber.

This pottery is remarkable for two main reasons. Firstly, pottery of this period is mainly extremely rare in the north-east of England and southeast Scotland and, secondly, where it has been found, as at Arbeia fort (Tipper forthcoming) or Ratho, just to the south of Edinburgh (Smith 1995) it is found as single sherds, implying that pottery was not in everyday use and that these vessels are unusual imports from further south. Thin section and chemical analysis of the Arbeia and Ratho sherds is consistent with their being made in the Vale of York (although it does not discount a local source). The only exception to this rule has been Yeavering, the site of a late $6^{th}$ to $7^{th}$-century royal palace (Hope-Taylor 1977). At Yeavering, however, pottery of Anglo-Saxon character is rare and most of the finds consist of rock-tempered vessels whose shape and method of manufacture suggest that they were made in a continuation of the pre-Roman Iron Age pottery tradition of northern England, although their dating to the late $6^{th}$ and $7^{th}$ centuries seems absolutely secure. This difference in ceramics between Lanton Quarry and Yeavering is all the more remarkable considering that the Lanton Quarry settlement seems to have been occupied whilst Yeavering was occupied (although the latter site was probably longer-lived, starting earlier and continuing later) and that it is possible to see one site from the other.

## Archaeological Context

Most of the pottery comes from the fills of sunken-featured buildings, with similar quantities coming from each fill (Table 1). In addition, one sherd comes from post-built building 1 (no context  number, SF <104>) and one from a pit (context 051, <175>).

*Table 1*

| context group | Contexts | Sherds | Vessels | Weight (gm) |
|---|---|---|---|---|
| Pit 51 | (051) | 1 | 1 | 6 |
| Post-Built Building 1 | None | 1 | 1 | 3 |
| Sunken Featured building 1 | (015) | 6 | 5 | 96 |
| Sunken Featured building 2 | (017) | 5 | 3 | 27 |
| Sunken Featured building 3 | (019), (1021) | 24 | 5 | 438 |
| Sunken Featured building 4 | (063) | 9 | 8 | 82 |
| Sunken Featured building 5 | (167) | 4 | 4 | 54 |

| | | | | |
|---|---|---|---|---|
| Sunken Featured building 6 | (281) | 13 | 13 | 85 |
| Grand Total | | 63 | 40 | 791 |

## Fabric

The pottery in the main is soft fired and has therefore not been heavily cleaned. However, from fresh breaks and from two thin sections and chemical analyses, it is clear that most has a very similar fabric to that of one of the two loomweight fabrics, with moderate angular sand up to 0.2mm across and a few larger angular rock fragments. Thin section analysis of two samples, however, indicates that they come from different sources. One fabric contains sparse altered volcanic rock fragments, consistent with a local origin (Fig 2), whilst the other is black throughout, with some obvious organic inclusions, and sparse to moderate angular rock fragments (Fig 1). The rock fragments in that thin section were shown to be coarse-grained quartz sandstone with overgrown grains. This fabric is typical of the pottery used and produced in the Vale of York, from the 5$^{th}$ to the 9$^{th}$ centuries and of the samples from Ratho and Arbeia. Thus, at least two quite different fabrics are present but without destructive analysis it is not possible to assign the sherds to either fabric group, nor to tell whether there are further fabrics present.

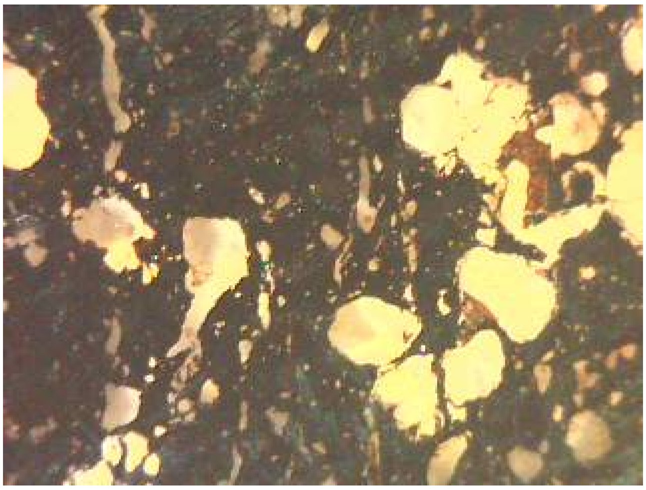

*Figure 1 SBF4, (063) <10>*

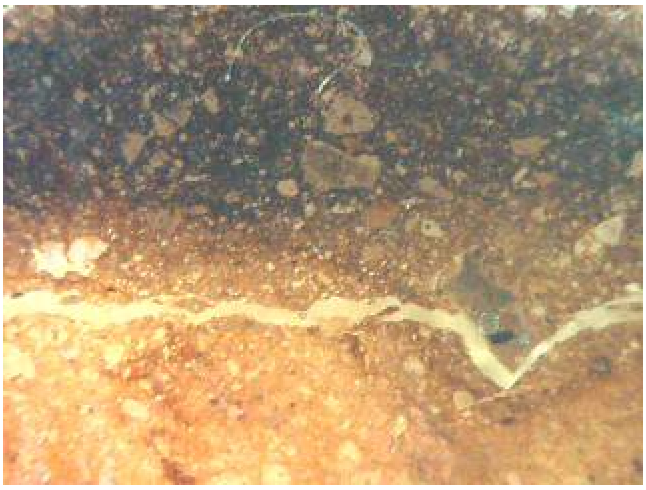

*Figure 2 SFB3 (1021) <152B>*

What can be said, with certainty, is that none of the sherds have the coarse rock-tempered fabric of the “Brittonic” sherds from Yeavering, nor are there any with purely organic temper, a fabric apparently present at Yeavering although those sherds cannot be identified in the surviving archive.

## Form

Most of the sherds are too undiagnostic to be assigned to a specific form and could be from either jars or bowls (Table 2). However, at least nine different vessels were bowls, crude vessels with a hemispherical base, straight vertical walls and a rounded rim (Figs 3, 4, 5 and 6). These vessels vary considerably in size but probably all were used in food preparation. For example both the largest and smallest examples have external sooting (Figs 4 and 5). A similar number of vessels definitely had a rim and neck narrower than the girth and are classed as jars (Figs 7, 8, 9, 10 and 11). Two of these vessels have external sooting, and as with the bowls the examples span the range of sizes found (Figs 7 and 8). One example (not illustrated) comes from a vessel which is appreciably bigger than the remainder and is classed as a large jar. Examples from other sites appear to have been used for storage. A single decorated vessel, a jar was present, represented by two stamped sherds and one with horizontal grooves (Fig 11). The stamp, a cross on a circular stamp, is one of the commonest types and therefore impossible to match with others in the Archive of Anglo-Saxon Pottery Stamps maintained by D Briscoe. There is no sign of the use of this vessel, which may have been used for display and/or storage.

*Table 2*

| Form | Sherds | Vessels | Weight (gm) |
|---|---|---|---|
| BOWL | 28 | 9 | 480 |
| JAR | 13 | 9 | 115 |
| JAR/BOWL | 21 | 21 | 158 |
| LARGE JAR | 1 | 1 | 38 |
| Grand Total | 63 | 40 | 791 |

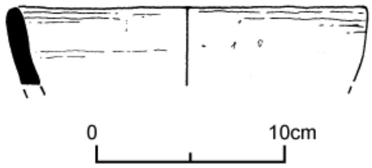


*Figure 3 dn2*

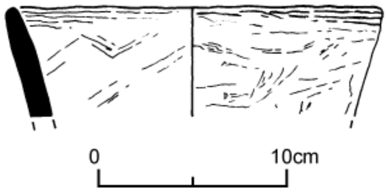


*Figure 4 dn11*

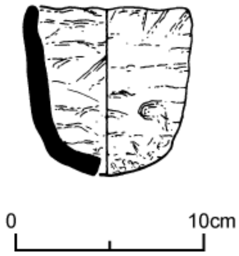


*Figure 5 dn12*

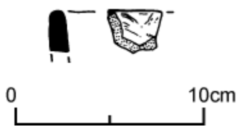


*Figure 6 dn6*

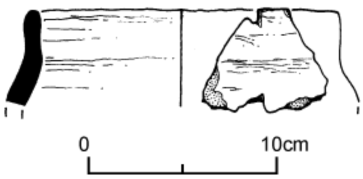


*Figure 7 dn1*

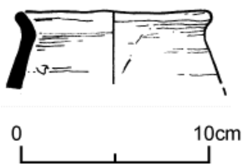


*Figure 8 dn3 and 4*

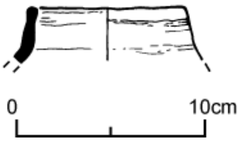


*Figure 9 dn5*

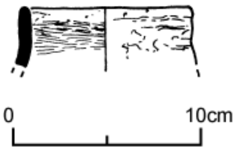


*Figure 10 dn7*

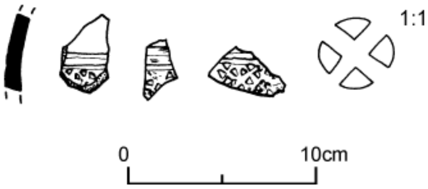


*Figure 11 dn8, 9, and 10*

## Condition

Most of the sherds are in fresh condition, although encrusted with soil and, in some cases, soot. Despite an attempt to reconstruct vessels, few joining sherds were found, and those which did occur were between sherds in the same feature. Joining sherds were found in the fills of four different features (SFB1, SFB2, SFB4 and SFB6) but in only one case was the substantial part of the vessel present, indicating that some form of rubbish disposal was in operation, assuming that the vessels were used in the structures where they were found.

*Table 3*

| vessel no | context group | REFNO | Total |
|---|---|---|---|
| 1 | Sunken Featured building 1 | <40> | 1 |
| | | <42> | 1 |
| 2 | Sunken Featured building 2 | <49> | 1 |
| | | <50> | 1 |
| | | <51> | 1 |
| 3 | Sunken Featured building 6 | <133> | 1 |
| | | <134> | 1 |
| | | <136> | 1 |
| | | <139> | 1 |
| 4 | Sunken Featured building 6 | <135> | 1 |
| | | <137> | 1 |
| | | <149> | 1 |
| 5 | Sunken Featured building 4 | <47> | 1 |
| | | <52> | 1 |

## Discussion

There is too little material present to make many inferences from the pottery but the following points can be made.

The two vessel types present are both found, together, in early Anglo-Saxon contexts further south, on both sides of the Humber. There is no evidence for a local “Britonnic” element in the pottery assemblage which therefore represents a foreign culture in north-eastern England. This unusual nature is also shown by the evidence for at least some local production. No such production can be demonstrated north of the Tees, although in no case is the evidence for non-local production cast iron, but is likely in several cases south of the Tees, where pottery is found in similar frequencies to that found at Lanton Quarry.

The bowl form seems not to have been subject to much chronological development from the 5$^{th}$ to the 7$^{th}$ centuries, and even later, since similar vessels have been found at Fishergate, York (Mainman 1993). The jar form too shows little development and the vertical neck with simple rounded rim seen on Figs 7, 9 and 10 is not only found in the 5$^{th}$ to 9$^{th}$ centuries but is also the basis for the Ipswich ware jars of the 8$^{th}$ centuries. However, the simple everted rim seen on Fig 8 is more common in 7$^{th}$ century contexts and later.

The stamped jar, Fig 11, probably consists of panels of stamping separated by incised lines. This tends to be a 6$^{th}$-century feature although it extends into the early 7$^{th}$ century.

In summary, therefore, if the settlement had a short period of use then it was probably occupied in the early 7$^{th}$ century. However, on the evidence of this pottery it could have had a much longer period of occupation.

A further point worth making is that the Lanton Quarry sherds do not support the model for backfilling of Anglo-Saxon sunken-featured buildings promoted by Jess Tipper. Based on his work at West Stow in Suffolk and West Heslerton in the Vale of Pickering, North Yorkshire, Tipper suggests that most of the finds from sunken featured buildings were initially disposed of elsewhere, on an above-ground midden, and that only later, when these buildings were abandoned and their raised floors decayed or removed, were they backfilled. This hypothesis explains well how it can be that unweathered, joining fragments of the same vessel can occur in the fills of features which on other grounds appear to be different in date (Tipper 2004). That this model does not apply to the Lanton Quarry site is also suggested by the discovery of features interpreted as the clay supports for the uprights of a warp-weighted loom, with the loomweights present ranged between these supports, in SFB4.

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Mainman, A J (1993) The pottery from 46-54 Fishergate. The Archaeology of York 16/6 London, Council British Archaeol

Smith, A. N. (1995) "The excavation of Neolithic, Bronze Age and Early Historic features near Ratho, Edinburgh." Proc Soc Antiq Scotland, 125, 69-138

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*Appendix 1*

| context group | phase | drawing no | REFNO | TSNO | Form | subfabric | Action | Drawing ID | vessel no | Description | Part | Nosh | NoV | Weight | ASW | Condition | Use |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Pit 51 | ND | 0 | <175> | | JAR | | | | | | BS | 1 | 1 | 6 | 6.00 | LOST EXT SURFACE | BLACK DEP INT |
| Post-Built Building 1 | ESAX | 0 | <104> | | JAR | | | | | | BS | 1 | 1 | 3 | 3.00 | LOST EXT SURFACE | BLACK DEP INT |
| Sunken Featured building 1 | ESAX | 1 | <42> | | JAR | | DR | 01 | 1 | | R | 1 | 1 | 18 | 18.00 | | SOOTED EXT |
| Sunken Featured building 1 | ESAX | 1 | <40> | | JAR | | DR | 01 | 1 | | BS | 1 | 0 | 17 | 17.00 | | |
| Sunken Featured building 1 | ESAX | 2 | <39> | | BOWL | | DR | 02 | | | R | 1 | 1 | 26 | 26.00 | | |
| Sunken Featured building 1 | ESAX | 0 | <37> | | JAR | | | | | | BS | 1 | 1 | 9 | 9.00 | | |
| Sunken Featured building 1 | ESAX | 0 | <38> | | BOWL | | | | | | BS | 1 | 1 | 25 | 25.00 | | |
| Sunken Featured building 1 | ESAX | 0 | <41> | | JAR/BOWL | | | | | | BS | 1 | 1 | 1 | 1.00 | | |
| Sunken Featured building 2 | ESAX | 0 | <9> | | JAR/BOWL | | | | | CLAY ADDED INT/EXT | BS | 1 | 1 | 7 | 7.00 | FRESH BREAK | |
| Sunken Featured building 2 | ESAX | 0 | <48> | | JAR/BOWL | | | | | | BS | 1 | 1 | 6 | 6.00 | | |
| Sunken Featured | ESAX | 0 | <49> | | JAR | | | | 2 | | BS | 1 | 1 | 4 | 4.00 | FRESH BREAK | SOOTED EXT |

| context group | phase | drawing no | REFNO | TSNO | Form | subfabric | Action | Drawing ID | vessel no | Description | Part | Nosh | NoV | Weight | ASW | Condition | Use |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| building 2 | | | | | | | | | | | | | | | | | |
| Sunken Featured building 2 | ESAX | 0 | <50> | | JAR | | | | 2 | | BS | 1 | 0 | 6 | 6.00 | FRESH BREAK | |
| Sunken Featured building 2 | ESAX | 0 | <51> | | JAR | | | | 2 | | BS | 1 | 0 | 4 | 4.00 | FRESH BREAK | |
| Sunken Featured building 3 | ESAX | 0 | <58> | | LARGE JAR | | | | | | BS | 1 | 1 | 38 | 38.00 | | |
| Sunken Featured building 3 | ESAX | 0 | <59> | | JAR/BOWL | | | | | | BS | 1 | 1 | 11 | 11.00 | | |
| Sunken Featured building 3 | ESAX | 11 | <152A> | | BOWL | M ORG;M ROCK | DR | 11 | | | R;BS | 3 | 1 | 56 | 18.67 | FRESH BREAKS | SOOTED EXT |
| Sunken Featured building 3 | ESAX | 12 | <152B> | V5104 | BOWL | INT CLAY: OXID WITH DECAYED ROCK;EXT CLAY BLACK M ROCK | DR;TS;ICPS | 12 | | CLAY ADDED INT/EXT | PROF | 18 | 1 | 323 | 17.94 | SOIL RETAINED WITHIN LARGE FRAG | SOOTED EXT |
| Sunken Featured building 3 | ESAX | 0 | <152C> | | BOWL | M ORG;M ROCK | | | | | BS | 1 | 1 | 10 | 10.00 | LOST EXT SURFACE | |
| Sunken Featured building 4 | ESAX | 0 | <10> | | JAR/BOWL | BLACK;M ORG;M ROCK | | | | | BS | 1 | 1 | 13 | 13.00 | LOST SURFACE INT | |
| Sunken Featured building 4 | ESAX | 3 | <47> | V5103 | JAR | BLACK;M ORG;M ROCK | DR;TS;ICPS | 03 | 5 | ROUNDED, BEADED RIM TO SHOULDER | R | 1 | 1 | 22 | 22.00 | | SOOTED EXT; BLACK DEP INT |

| context group | phase | drawing no | REFNO | TSNO | Form | subfabric | Action | Drawing ID | vessel no | Description | Part | Nosh | NoV | Weight | ASW | Condition | Use |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sunken Featured building 4 | ESAX | 4 | <52> | | JAR | BLACK;M ORG;M ROCK | DR | 04 | 5 | ROUNDED RIM | R | 1 | 1 | 3 | 3.00 | | |
| Sunken Featured building 4 | ESAX | 0 | <84> | | JAR/BOWL | BLACK;M ORG; S ROCK? | | | | | BS | 1 | 1 | 16 | 16.00 | | SOOTED EXT |
| Sunken Featured building 4 | ESAX | 5 | <60> | | JAR | | DR | 05 | | | R | 1 | 1 | 6 | 6.00 | | |
| Sunken Featured building 4 | ESAX | 0 | <61> | | JAR/BOWL | | | | | | BS | 1 | 1 | 1 | 1.00 | | |
| Sunken Featured building 4 | ESAX | 7 | <88> | | JAR | | DR | 07 | | | R | 1 | 0 | 8 | 8.00 | | |
| Sunken Featured building 4 | ESAX | 6 | <91> | | BOWL | | DR | 06 | | | R | 1 | 1 | 7 | 7.00 | | |
| Sunken Featured building 4 | ESAX | 0 | <90> | | JAR/BOWL | | | | | | BS | 1 | 1 | 6 | 6.00 | | |
| Sunken Featured building 5 | ESAX | 0 | <89> | | JAR | | | | | | BS | 1 | 1 | 9 | 9.00 | | SOOTED EXT |
| Sunken Featured building 5 | ESAX | 0 | <120> | | JAR/BOWL | | | | | | BS | 1 | 1 | 30 | 30.00 | LOST A SURFACE | |
| Sunken Featured building 5 | ESAX | 0 | <126> | | JAR/BOWL | | | | | | BS | 1 | 1 | 12 | 12.00 | FRESH BREAKS | |
| Sunken Featured building | ESAX | 0 | <771> | | BOWL | | | | | | BS | 1 | 1 | 3 | 3.00 | | |

| context group | phase | drawing no | REFNO | TSNO | Form | subfabric | Action | Drawing ID | vessel no | Description | Part | Nosh | NoV | Weight | ASW | Condition | Use |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 5 | | | | | | | | | | | | | | | | | |
| Sunken Featured building 6 | ESAX | 8 | <135> | | JAR/BOWL | | DR; PHOTO | 08 | 4 | HOT CROSS BUN STAMP; 2 HORIZ GROOVES | BS | 1 | 1 | 5 | 5.00 | | |
| Sunken Featured building 6 | ESAX | 0 | <140> | | JAR/BOWL | | | | | | BS | 1 | 1 | 3 | 3.00 | | |
| Sunken Featured building 6 | ESAX | 0 | <141> | | JAR/BOWL | | | | | | BS | 1 | 1 | 3 | 3.00 | | |
| Sunken Featured building 6 | ESAX | 0 | <143> | | JAR/BOWL | | | | | | BS | 1 | 1 | 5 | 5.00 | | |
| Sunken Featured building 6 | ESAX | 9 | <149> | | JAR/BOWL | | DR; PHOTO | 09 | 4 | HOT CROSS BUN STAMP; 1 HORIZ GROOVE | BS | 1 | 1 | 8 | 8.00 | FRESH BREAK | |
| Sunken Featured building 6 | ESAX | 0 | <151> | | JAR/BOWL | | | | | | BS | 1 | 1 | 6 | 6.00 | FRESH BREAK | |
| Sunken Featured building 6 | ESAX | 0 | <133> | | BOWL | BLACK;M ORG;M ROCK | | | 3 | | BS | 1 | 1 | 25 | 25.00 | FRESH BREAK | |
| Sunken Featured building 6 | ESAX | 0 | <136> | | JAR/BOWL | BLACK;M ORG;M ROCK | | | 3 | | BS | 1 | 1 | 4 | 4.00 | FRESH BREAK | |
| Sunken Featured building 6 | ESAX | 10 | <137> | | JAR/BOWL | BLACK;M ORG;M ROCK | DR; PHOTO | 10 | 4 | HOT CROSS BUN STAMP; 1 HORIZ GROOVE | BS | 1 | 1 | 7 | 7.00 | FRESH BREAK | |
| Sunken Featured building 6 | ESAX | 0 | <134> | | BOWL | BLACK;M ORG;M ROCK | | | 3 | | BS | 1 | 1 | 5 | 5.00 | FRESH BREAK | |
| Sunken | ESAX | 0 | <138> | | JAR/BOWL | BLACK;M | | | | | BS | 1 | 1 | 7 | 7.00 | | |

| context group | phase | drawing no | REFNO | TSNO | Form | subfabric | Action | Drawing ID | vessel no | Description | Part | Nosh | NoV | Weight | ASW | Condition | Use |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Featured building 6 | | | | | | ORG;M ROCK | | | | | | | | | | | |
| Sunken Featured building 6 | ESAX | 0 | <139> | | JAR/BOWL | BLACK;M ORG;M ROCK | | | 3 | | BS | 1 | 1 | 2 | 2.00 | FRESH BREAK | |
| Sunken Featured building 6 | ESAX | 0 | <150> | | JAR/BOWL | BLACK;M ORG;M ROCK | | | | | BS | 1 | 1 | 5 | 5.00 | FRESH BREAK | |

# The Fired and Unfired Clay from Lanton Quarry, Northumberland (LAN06)

***Alan Vince and Kate Steane***

Six hundred and seventy-four fragments of fired and unfired clay of Early Anglo-Saxon date were collected during the Lanton Quarry excavations by Archaeological Research Services Ltd. These included a number of loomweights of annular form, typical of the 5th to 7th centuries. The remainder consisted of amorphous fired clay (Table 1, FCLAY); unfired clay (Table 1 GEO); a small fragment with two flat faces, meeting at a slightly obtuse angle (100 degrees, Table 1 FLOOR TILE?) and fragments with flat or curved faces which do not appear to come from loomweights and in some cases have a better-finished “front” surface and a poorer “back”. These are interpreted as daub, but it should be noted that none have wattle impressions and if wattle and daub had been used one might expect to find it in larger quantities (Table 1 DAUB and DAUB?). Very little more can be said about the material except for the loomweights and the following report therefore concentrates on these.

*Table 1*

| Cname | Form | Fragments | Objects | Weight (gm) |
|---|---|---|---|---|
| FCLAY | DAUB | 10 | 10 | 378 |
| | DAUB? | 5 | 5 | 37 |
| | FCLAY | 382 | 357 | 2898 |
| | FLOOR TILE? | 1 | 1 | 9 |
| | LOOMWEIGHT | 217 | 153 | 6772 |
| FCLAY Total | | 615 | 526 | 10094 |
| GEO | GEO | 59 | 57 | 1509 |
| GEO Total | | 59 | 57 | 1509 |
| Grand Total | | 674 | 583 | 11603 |

## Archaeological context

The majority of the finds come from the fills of sunken-featured buildings, in particular SFB 4, where the finds consist mainly of loom weights found in a line along the north wall and northwest corner of the building, between two clay pads interpreted as the supports for a warp weighted loom (Context 63). Loomweight fragments were recovered from the fills of SFB 1, 3 ,4 ,6 and 7 and from a post-hole fill from post-built structure 4.

*Table 2*

| context group | Fragments | Objects | Weight (gm) |
|---|---|---|---|
| Post-Built Building 1 | 1 | 1 | 3 |
| Post-Built Building 4 | 26 | 25 | 164 |
| Sunken Featured building 1 | 37 | 36 | 518 |
| Sunken Featured building 2 | 143 | 141 | 1121 |

| | | | |
|---|---|---|---|
| Sunken Featured building 3 | 42 | 22 | 795 |
| Sunken Featured building 4 | 297 | 226 | 6539 |
| Sunken Featured building 5 | 35 | 34 | 245 |
| Sunken Featured building 6 | 92 | 90 | 948 |
| Sunken Featured building 7 | 3 | 2 | 56 |
| Pit 51 | 1 | 1 | 6 |
| Pit 49 | 50 | 36 | 1450 |
| Pit 121 | 4 | 4 | 6 |
| Hearth 263 | 4 | 4 | 542 |
| Context 181 | 2 | 1 | 1 |
| Grand Total | 737 | 623 | 12394 |

### Fabric

Visually, most of the fired clay has a similar appearance, consisting of soft light grey clay with sparse large angular rock inclusions when unfired or low-fired and hard brown clay when fired, whether deliberately or accidentally (e.g. Fig 67). Thin sections were taken of three loom weights, a sample of unfired "clay" whose texture suggests it is mainly composed of subsoil and a sample of fired clay from a hearth.

*Table 3*

| Context | phase | group | TSNO | REFNO | context group |
|---|---|---|---|---|---|
| 063 | ESAX | loom1 | V5038 | <65> | Sunken Featured building 4 |
| 263 | ND | fclay | V5062 | <392> | Hearth 263 |
| 063 | ESAX | loom2 | V5029 | <100B> | Sunken Featured building 4 |
| 049 | ND | loam | V5061 | <170D> | Pit 49 |
| 015 | ESAX | loom1 | V5058 | <33B> | Sunken Featured building 1 |

Subsamples of these samples were also analysed using Inductively-coupled plasma spectroscopy (ICP-AES) together with a further 30 samples of loomweights (Table 4) .

Factor analysis of the chemical data indicates that the samples can be divided into two groups. The second group is distinguished by higher iron, chromium, nickel, vanadium, scandium, magnesium, copper, zinc and cobalt values than the first group (all relative to aluminium). The thin section analysis confirms that the first group has a lighter-coloured groundmass than the second as well as a higher silica and other rock and mineral inclusions content.

The fired clay from hearth 263 and the "loam" from pit 49 both have similar characteristics in thin section and chemical composition to those of the second group of loomweights.

Two samples of pottery were also analysis. One is clearly imported to the site whilst the other matches the first loomweight group.

This evidence suggests that the second group of loomweights was produced from locally available clay, as shown by the similarity of the fabric, in thin section and chemical composition, to the "loam" and fired clay sample from hearth 263. The first loomweight fabric, and the locally-made pottery, however, cannot be linked to the site itself, but since the rock fragments in this group are altered volcanic rocks, which form the majority of the material in the Lanton Quarry gravel this group too is presumably made in northeastern England, most likely also close to the site.

*Table 4*

| Context | phase | group | TSNO | REFNO | context group |
|---|---|---|---|---|---|
| 063 | ESAX | Loom 2 | V5028 | 100/A | Sunken Featured building 4 |
| 063 | ESAX | Loom 2 | V5030 | 100/C | Sunken Featured building 4 |
| 063 | ESAX | Loom 2 | V5031 | 100/D | Sunken Featured building 4 |
| 063 | ESAX | Loom 1 | V5032 | 100/F | Sunken Featured building 4 |
| 063 | ESAX | Loom 1 | V5033 | 100/G | Sunken Featured building 4 |
| 063 | ESAX | Loom 2 | V5034 | 100/H | Sunken Featured building 4 |
| 063 | ESAX | Loom 2 | V5035 | 100/I | Sunken Featured building 4 |
| 063 | ESAX | Loom 2 | V5036 | 62/A | Sunken Featured building 4 |
| 063 | ESAX | Loom 2 | V5037 | 62/B | Sunken Featured building 4 |
| 063 | ESAX | Loom 1 | V5039 | 66/A | Sunken Featured building 4 |
| 063 | ESAX | Loom 1 | V5040 | 68 | Sunken Featured building 4 |
| 063 | ESAX | Loom 2 | V5041 | 72/A | Sunken Featured building 4 |
| 063 | ESAX | Loom 2 | V5042 | 72/B | Sunken Featured building 4 |
| 063 | ESAX | Loom 2 | V5043 | 72/C | Sunken Featured building 4 |
| 063 | ESAX | Loom 1 | V5044 | 74 | Sunken Featured building 4 |
| 063 | ESAX | Loom 1 | V5045 | 76/A | Sunken Featured building 4 |
| 063 | ESAX | Loom 1 | V5046 | 76/B | Sunken Featured building 4 |
| 063 | ESAX | Loom 1 | V5047 | 79/A | Sunken Featured building 4 |
| 063 | ESAX | Loom 1 | V5048 | 79/C | Sunken Featured building 4 |
| 063 | ESAX | Loom 1 | V5049 | 98 | Sunken Featured building 4 |
| 063 | ESAX | Loom 1 | V5050 | 99/A | Sunken Featured building 4 |
| 063 | ESAX | Loom 1 | V5051 | 99/B | Sunken Featured building 4 |
| 063 | ESAX | Loom 1 | V5052 | 99/D | Sunken Featured building 4 |
| 281 | ESAX | Loom 1 | V5053 | 131/A | Sunken Featured building 6 |
| 281 | ESAX | Loom 1 | V5054 | 131/B | Sunken Featured building 6 |
| 281 | ESAX | Loom 1 | V5055 | 131/D | Sunken Featured building 6 |
| 1130 | ESAX | Loom 1 | V5056 | 250 | Post-Built Building 4 |
| 281 | ESAX | Loom 2 | V5057 | 132 | Sunken Featured building 6 |
| 015 | ESAX | Loom 1 | V5059 | 33/A | Sunken Featured building 1 |
| 1021 | ESAX | Loom 1 | V5060 | 152/D | Sunken Featured building 3 |

## Loomweights

All of the reconstructable loom weights were drawn and any metrical and non-metrical traits were recorded. All the weights could be classified as annual, in that they are broadly symmetrical around their girth with a wide central hole, whereas the bun-shaped weights which replaced them during the 7th century have narrower holes and are more clearly non-symmetrical. Having said that, most of the  better-preserved examples had clearly defined top and bottom faces.

Few examples had diameters which could be reliably reconstructed but in most cases the distance from the girth to the hole and from “top” to “bottom” were measurable. Fig 1 shows a bi-plot of thickness against breadth. Despite the existence of two group 1 loomweights which are thicker than any group 2 weight and two group 2 weights which are broader than any group 1 weight, the means for both groups are very similar and the standard deviations for all three groups show almost total overlap.

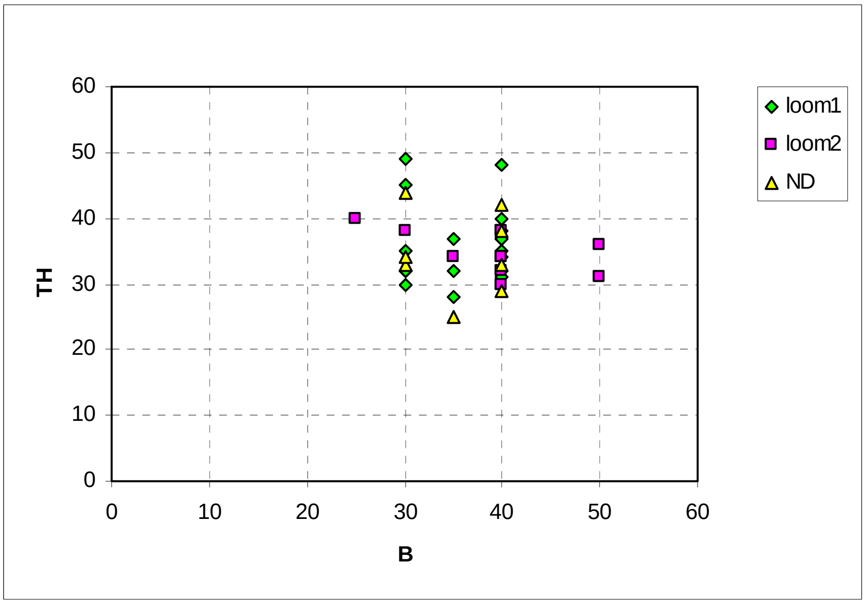


*Figure 1*

The only other variable of note is the presence of decoration. This consists of some incised lines, which might be deliberate but might not and a few weights with a single finger impression on the "top" surface. Three weights with possible deliberate indents and one with incised lines was present. None came from the main assemblage of weights from SFB4 but instead three came from SFB6 and one from SFB1.

## Catalogue

The best-preserved loomweights are catalogued here. The catalogue entry includes photographs (A Vince) and reconstruction drawings (C Bentley). Each weight is referred to by its unique register number.

<100G> SFB4 (063)

*Figure 2 <100G>*

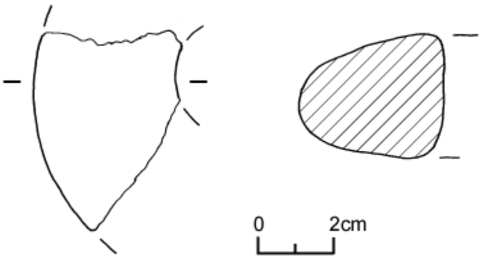


*Figure 3 <100G>*

<62A> SFB4 (063)

*Figure 4 <62A>*

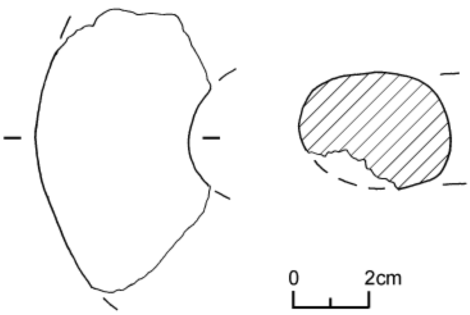


*Figure 5 <62A>*

<100B> SFB4 (063)

Thin section and ICPS analysis (V5029).

Loomweight fabric 2.

*Figure 6 <100B>*

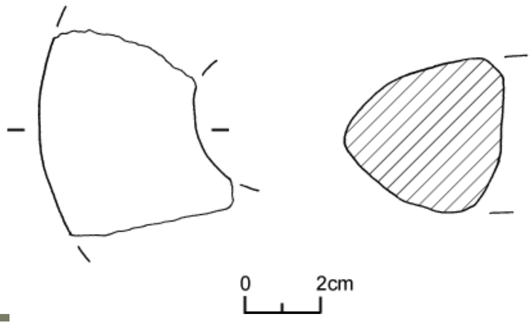


*Figure 7*

<100F> SFB4 (063)

*Figure 8 <100F>*

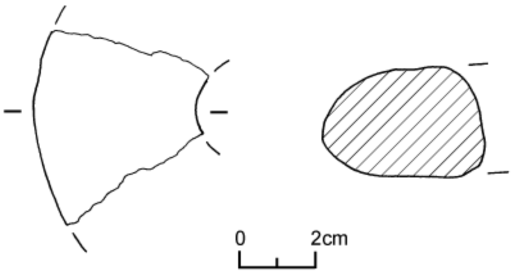


*Figure 9 <100F>*

<99A> SFB4 (063)

*Figure 10 <99A>*

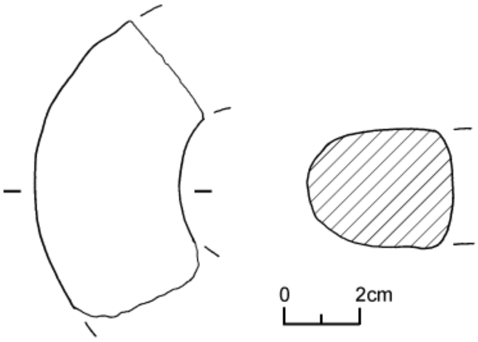


*Figure 11 <99A>*

<61A> SFB4 (063)

*Figure 12 <61A>*

<99B> SFB4 (063)

*Figure 13 <99B>*

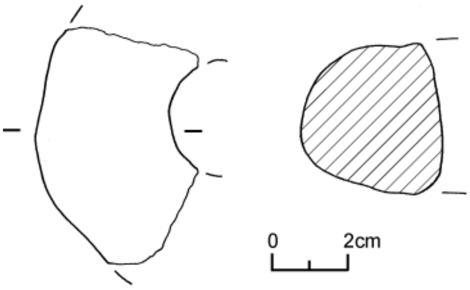


*Figure 14 <99B>*

<72C> SFB4 (063)

Figure 15 <72C>

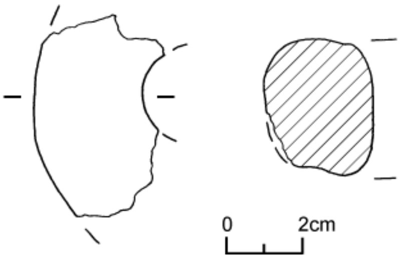


*Figure 16 <72C>*

<76A> SFB4 (063)

*Figure 17 <76A>*

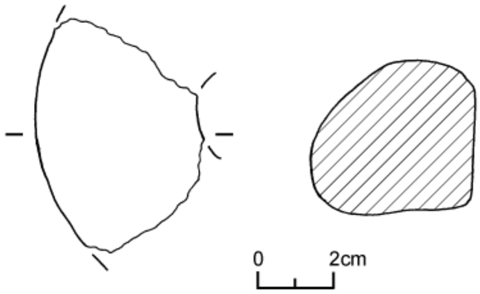


*Figure 18 <76A>*

<76B> SFB4 (063)

*Figure 19 <76B>*

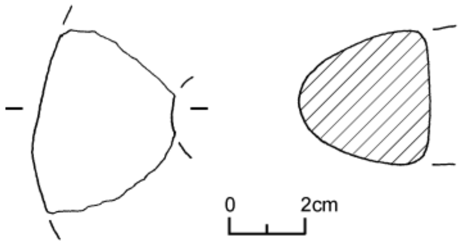


*Figure 20 <76B>*

<72A> SFB4 (063)

*Figure 21 <72A>*

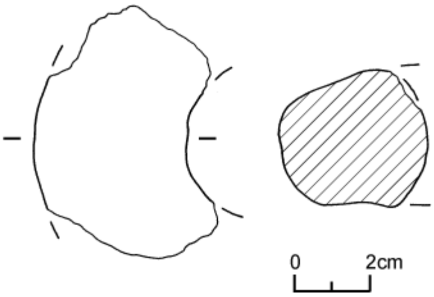


*Figure 22 <72A>*

<100H> SFB4 (063)

*Figure 23 <100H>*

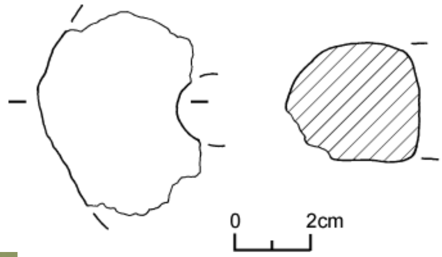


*Figure 24 <100H>*

<100D> SFB4 (063)

*Figure 25 <100D>*

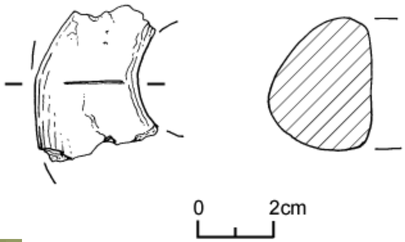


*Figure 26 <100D>*

<100C> SFB4 (063)

*Figure 27 <100C>*

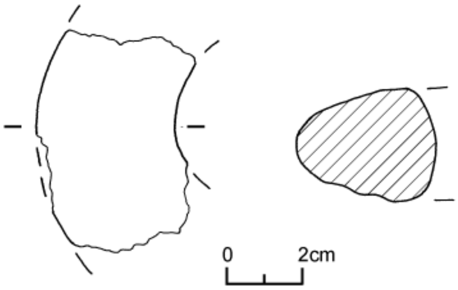


*Figure 28 <100C>*

<79C> SFB4 (063)

*Figure 29 <79C>*

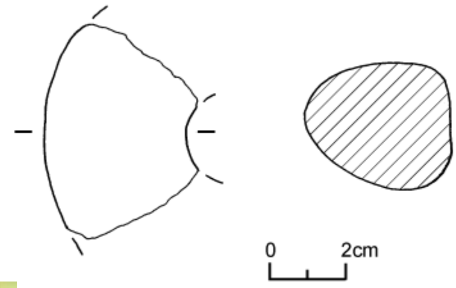


*Figure 30 <79C>*

<100I> SFB4 (063)

*Figure 31 <100I>*

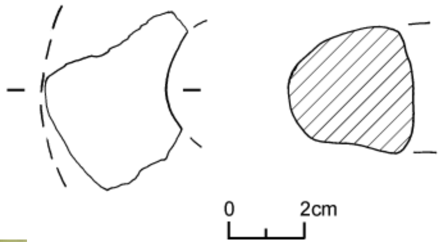


*Figure 32 <100I>*

<74> SFB4 (063)

*Figure 33 <74>*

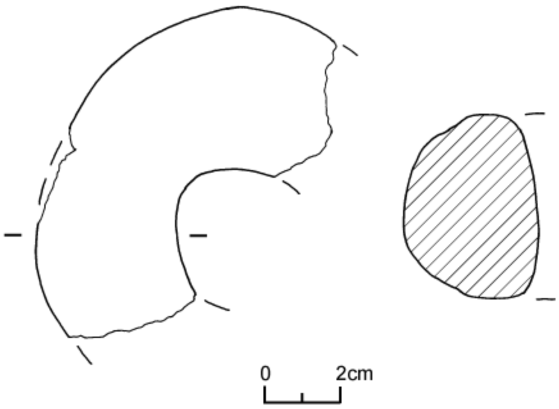


*Figure 34 <74>*

*Figure 35 <74>*

<99D> SFB4 (063)

*Figure 36 <99D>*

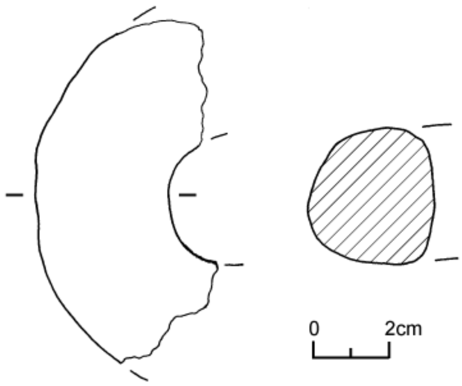


*Figure 37 <99D>*

<100A> SFB4 (063)

*Figure 38 <100A>*

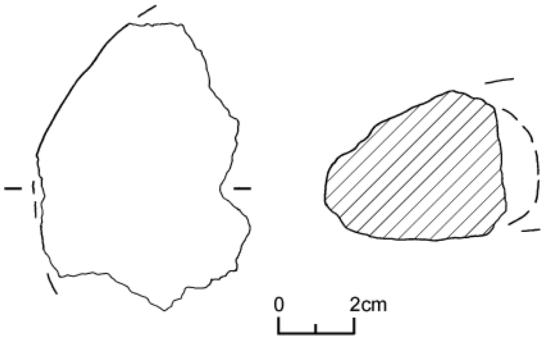


*Figure 39 <100A>*

<72B> SFB4 (063)

*Figure 40 <72B>*

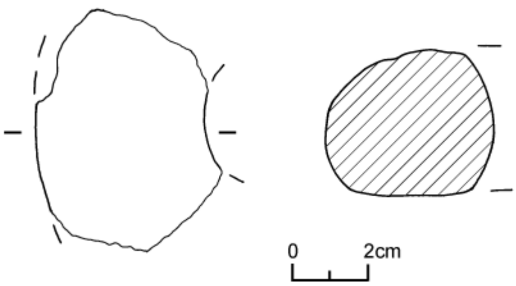


*Figure 41 <72B>*

<62B> SFB4 (063)

*Figure 42 <62B>*

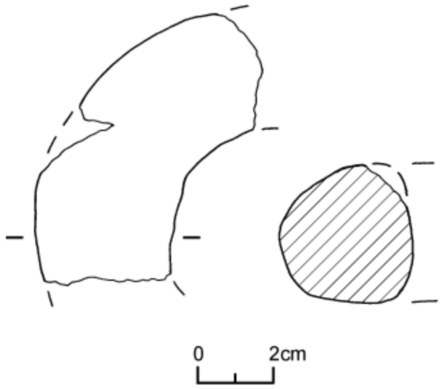


*Figure 43 <62B>*

<98> SFB4 (063)

*Figure 44 <98>*

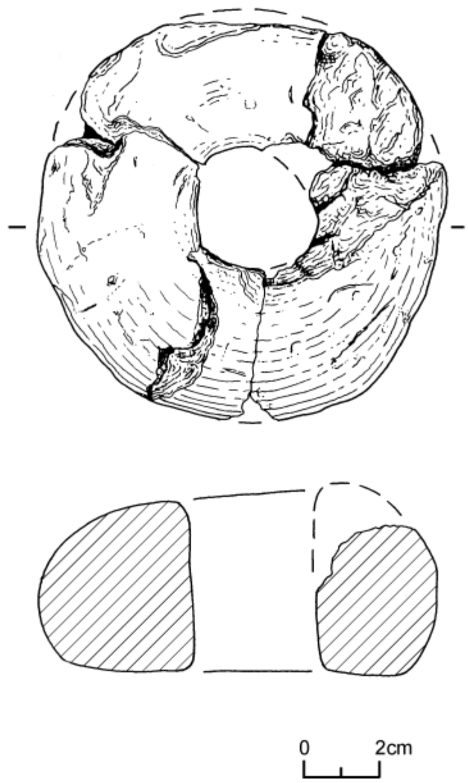


*Figure 45 <98>*

*Figure 47 <66A>*

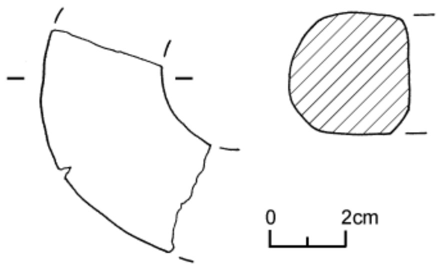


*Figure 48 <66A>*

*Figure 46 <98>*

<66A> SFB4 (063)

*Figure 49 <66A>*

<79A> SFB4 (063)

*Figure 50 <79A>*

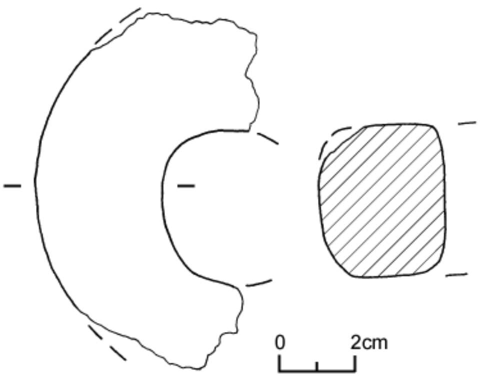


*Figure 51 <79A>*

*Figure 52 <79A>*

<65> SFB4 (063)

Thin section and ICPS analysis (V5038).

Loomweight fabric 1.

*Figure 53 <65>*

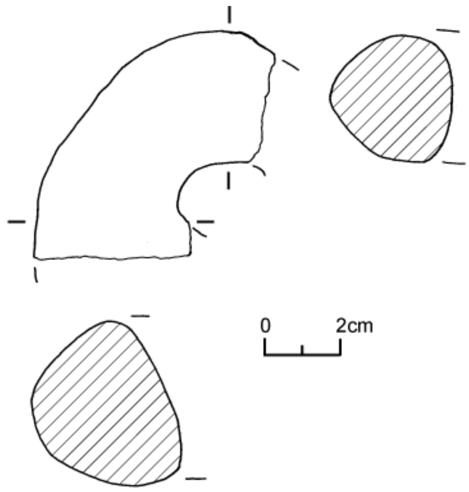


*Figure 54 <65>*

<68> SFB4 (063)

*Figure 55 <68>*

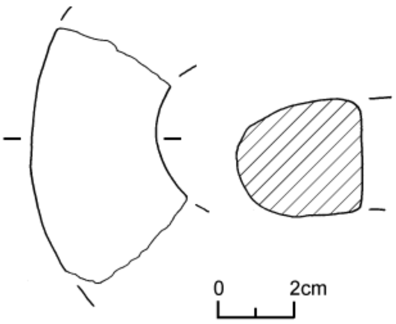

*Figure 56 <68>*

<131A> SFB6 (281)

*Figure 57 <131A>*

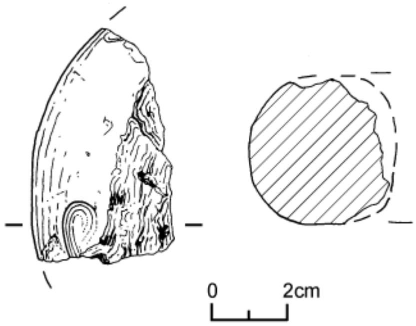

*Figure 58 <131A>*

*Figure 59 <131A> detail of possible deliberate indentation*

<131B> SFB6 (281)

*Figure 60 <131B>*

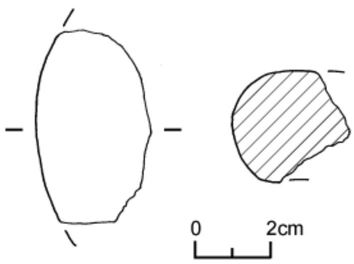

*Figure 61 <131B>*

<131D> SFB6 (281)

*Figure 62 <131D>*

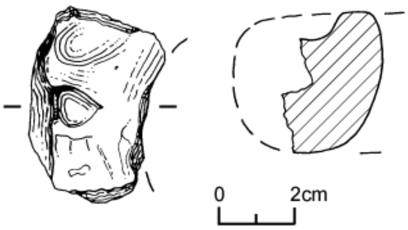


*Figure 63 <131D>*

*Figure 64 <131D> detail of possible deliberate indent*

*Figure 65 <131D> close-up of possible indent*

<250> Post-Built Structure 4 (1130)

Found in the fill of a subovoid triple post-hole.

*Figure 66 <250>*

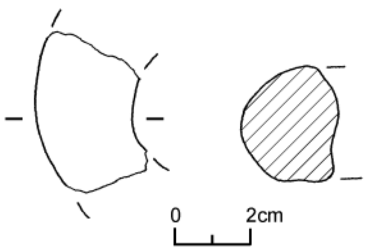


*Figure 67 <250>*

<132> SFB6 (281)


*Figure 68 <132>*

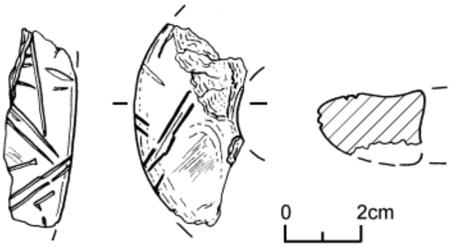


*Figure 69 <132>*

*Figure 70 <132> detail of possible decoration*

<33B> SFB1 (015)

Thin section and chemical analysis (V5058). Loomweight Fabric 1.

*Figure 71 <33B>*

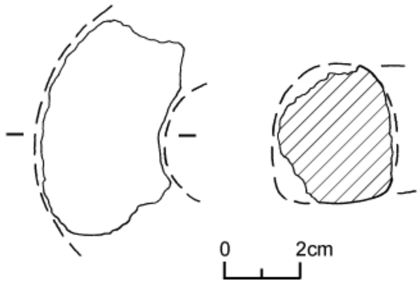


*Figure 72 <33B>*

<33A> SFB1 (015)

*Figure 73 <33A>*

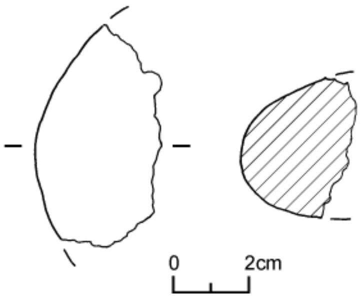


*Figure 74 <33A>*

<152D> SFB3 (1021)

*Figure 75 <152D>*

*Figure 76 <152D> detail of possible deliberate indent*

Lanton Quarry, Northumberland: Coarse stone assemblage

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July 2008

Introduction

Just eight stone artefacts were recovered from the excavation including four cobble tools, a rotary quern, a sharpening/ grinding slab, a quern rubber and a piece of flaked rock. Six unused cobbles were also collected as well as eight large boulders or slabs (table 1).

| | Neolithic | Bronze Age | Anglo-Saxon | Date Unknown |
|---|---|---|---|---|
| Quern rubber | 1 | | | |
| Cobble tools | 4 | | | |
| Unused cobbles | 5 | | | 1 |
| Rotary quern | | | 1 | |
| Sharpening slab | 1 | | | |
| Flaked slab | 1 | | | |
| Boulders | | 1 | 7 | |

*Table 1: Lanton Quarry, Northumberland: Stone artefacts by period*

*Neolithic*

The Neolithic pits produced a number of stone tools including a quern rubber, a sharpening/ grinding stone, a piece of flaked stone and some cobble tools. The most notable piece was a grinding or sharpening slab (472). This was made on an elongated boulder of coarse-grained rock and one face had been worn to a smooth, slightly concave surface as if from use as a sharpening stone or grinder. This tool is rather too narrow to be a quern and it was most likely used for grinding or sharpening stone axes. It was found at the base of the internal pit [255] of Building 8 overlain by hearth deposits.

The quern rubber (499), made on coarse-grained rock, is a fine example of the type: a smoothly worn grinding surface with a convex face and a domed upper face give the tool its classic D-shaped cross-section.

| | Building 8 Pit 255 | Building 8 Pit 117 | Building 10 pit 319 | Building 10 Pit 311 | Building 10 pit 313 | Pit 355 | Pit 533 | Pit cluster 595, 597 |
|---|---|---|---|---|---|---|---|---|
| Quern rubber | | | | | | 1 | | |
| Cobble tools | | | 2 | 1 | | | | 1 |
| Unused cobbles | | | 2 | | 1 | | 1 | 1 |
| Sharpening slab | 1 | | | | | | | |
| Flaked slab | | 1 | | | | | | |

*Table 2: Contexts of Neolithic stone objects*

The flaked slab (474) is a fragment of probably ?volcanic rock that has been roughly flaked along an edge as if in an attempt to shape it into a blank for further working. This may have been intended as a core tool, perhaps an axe. It was deposited in pit [117].

The four cobble tools were only lightly worn and all appeared to have been used as smoothers. They all had one face that had been lightly worn by smoothing and on two of the tools (459 and 433) there was additional light pecking around the surface of the cobble towards one end. A further five cobbles were retrieved from the Neolithic pits but none had any clear sign that they had been altered by wear traces. The cobble tools and unused cobbles came from pit fills within and outside the Neolithic buildings.

Cultural material appears to be deposited in Neolithic pits, particularly during the Early Neolithic in a highly structured manner. Whether we are getting a snapshot of the prehistoric mind because the deposits were ritually constructed, or whether the better survival of buried objects gives us selective object associations is open to question. But there is no doubt that particular artefacts such as broken axes, blades, pitchstone etc. are often found deliberately placed in pits (Clarke 1997, Clarke 2007, Clarke 2008, MacGregor 2007). It is of great interest then that the two artefacts at Lanton Quarry possibly associated with axe production were found in pits from the same Building 8. Here the grinding/ sharpening slab and the possible stone roughout for an axe blank may point to some specific use of the building either specifically for axe production or in remembrance of some similar activity or person.

*Anglo-Saxon*

The majority of the stones found during excavation of the Anglo-Saxon features were large natural blocks of rock such as boulders or slabs. There was no sign that these stones were ever used as there was no damage to the surface of the piece that could be ascribed to working. Just the large boulder found in two parts may have been deliberately split.

The boulders and slabs were found mainly in pits associated with the SFBs though one came from a pit in a PHB (table 2).

| | Boulders and Slabs | Rotary quern |
|---|---|---|
| SFB 2 | 2 | 1 refit to PHB 5 |
| SFB 3 | 3 | |
| SFB 4 | 1 | |
| PHB 5 | | 1 refit to SFB 2 |
| PHB 1 | 1 | |

*Table 2: Lanton Quarry: Stone from Anglo Saxon contexts*

It is not known precisely why these large, unused stones should have been deliberately deposited in these pits. They may have had some role in the construction of the *grubenhaus* or else they may have been part of the internal furniture. At New Bewick, Northumberland several large stones were described as lying around one of the fills of the *grubenhaus* but they appeared to have been placed in a random manner (www.bedesworld.co.uk). Large stones were also found at Bourton-on-the-Water and the excavator interpreted a group of these stones as a seat and foot-rest (Tipper 2004) but Tipper sees these as being a fortuitous arrangement as there were other stones that were not grouped (Tipper 2004, 169). It would seem then that large stones found in the fills of these SFBs are not uncommon but there is no pattern to their deposition; perhaps they fell in from above when the building decayed after abandonment and are in fact more closely associated with the structure above the pit than below.

The only stone artefact from Anglo-Saxon contexts was a lower stone of a rotary quern (394 and 554). This was made from a block of fine-grained micaceous sandstone and was heavily damaged on the base, around the edges and had been broken into at least three pieces across the perforation. The larger fragment was deposited in the pit from the SFB 2 and a smaller fragment was deposited in a post hole of the PHB 5. This smaller piece had clearly been further damaged before or during deposition in the posthole as the fractured edges did not have the clean break as on the larger piece. It also had black concretions adhering to it presumably from the matrix of the posthole fill.

References

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Clarke, A 2007 ‘The flaked lithic assemblage’ *in* WS Hanson *Elginhaugh: A Flavian Fort and its Annexe.* Britannia Monograph Series No. 23.

Clarke, A 2008 Girvan Reinforcement Pipeline GUARD 2465 and Maybole GUARD 2531. Coarse stone reports. Produced for GUARD

MacGregor, G 2007 ‘The Prehistoric Activity’ *in* WS Hanson *Elginhaugh: A Flavian Fort and its Annexe.* Britannia Monograph Series No. 23.

Tipper, J 2004 *The Grubenhaus in Anglo-Saxon England* Landscape Research Centre. Arch Monog Series Number 2: Volume 1

Lanton Quarry, Milfield

| | Context | Find no. | Artefact type | Description | ML | MW | MTh |
|---|---|---|---|---|---|---|---|
| AS pit in SFB 3 | 15 | 114 | Boulder fragment | Large fragment of a boulder of (orange coarse-grained rock). There are no clear wear traces on the surviving surface. | x244 | 218 | 170 |
| AS pit in grub | 15 | 112 | Boulder | Large round boulder of (orange coarse-grained rock). Large spall detached, breakage and cracking. No sign of any use wear. | 250 | 240 | x178 |
| AS SFB 3 | 15 | 113 | Boulder | Tabular boulder of (orange coarse-grained rock). There are no clear use-wear traces but one face does look as though it has been worn slightly smooth. | 222 | 186 | 83 |
| AS pit in SFB 2 | 17 | 115/116 | Split boulder | Large boulder of (orange coarse-grained rock). Found in two parts, this sub-angular boulder may have been deliberately split with a wedge as there are gaps along the broken edge on one face that may have been formed by a wedge/ chisel. Some flaking damage around the edge of the boulder on same face could have been incidental to the splitting of the rock. | 370 | 265 | 215 |
| AS pit in SFB 2 | 17 | 555 | Broken slab | Large tabular slab of (coarse-grained rock). Broken across width. Part of one face spalled from possible heat damage. No sign of use wear. | x310 | 310 | 84 |
| Neo pit Building 8 | 117 | 474 | Flaked stone fragment | Slabby fragment of a boulder of igneous rock. Sheared from natural plane then some attempt at flaking along natural edge. | x180 | x120 | x46 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Neo pit Building 8 | 255 | 472 | Grinding/ sharpening slab | Narrow elongated boulder of (coarse-grained rock). One face has been worn to a smooth, slightly concave surface as if from use as a whetstone or smoother. | 420 | 174 | 120 |
| Undated hearth | 265 | 473 | Unused cobble | Flat sub-oval cobble of fine-grained rock. Was covered in sooty deposit. There are no obvious signs of wear traces on the surface of this cobble. | 120 | 61 | 34 |
| Neo pit Building 10 | 311 | 443 | Hammerstone | Elongated oval cobble of fine-grained rock. There are localised spreads of pecking on one face and side towards the broad end. One face has also been worn flat and smooth. | 121 | 55 | 43 |
| Neo pit Building 10 | 313 | 538 | Unused cobble | Oval cobble of medium-grained sandstone. Heat-cracked and covered in sooty deposit. No clear signs of wear traces. | 79 | 58 | 39 |
| Neo pit Building 10 | 319 | 457 | Smoother? | Irregular oval-shaped cobble of fine-grained rock. Possible patch of smoothing in centre of natural concave face. | 103 | 50 | 40 |
| Neo pit Building 10 | 319 | 458 | Unused cobble | Irregular-shaped cobble of vesicular volcanic rock. Fragment missing. No sign of wear traces. | 123 | 76 | 50 |
| Neo pit Building 10 | 319 | 504 | Unused cobble | Sub-round cobble of coarse-grained rock. No sign of wear traces. | 73 | 67 | 49 |
| Neo pit Building 10 | 319 | 459 | Smoother? | Narrow elongated cobble of fine-grained rock. One naturally flat face appears to have been worn to a very smooth finish. Some light pecking towards narrower end. | 96 | 34 | 30 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Neo pit | 355 | 499 | Quern rubber | Large cobble of (orange coarse-grained rock). One face worn to smooth, slightly convex cross-section Classis D - shaped cross-section of a quern rubber. | 226 | 188 | 114 |
| Bronze Age Post hole | 467 | 547 | Boulder | Elongated boulder, fragment missing (orange coarse-grained rock). No sigr of wear traces. | 370 | 176 | 130 |
| Neo pit | 533 | 689 | Natural | Irregular lump of ?sandstone. The orange colour on one face is natural to the structure of the stone. | 40 | 37 | 33 |
| Neo pit cluster | 595 | 633 | Unused cobble | Irregular-shaped cobble of fine-grained rock. No clear signs of use wear. | 80 | 50 | 31 |
| Neo pit cluster | 597 | 569 | Smoother? | Irregular-shaped cobble of fine-grained rock. One flat face may have been worn to a smooth, slightly concave profile. | 66 | 45 | 34 |
| AS pit in PHB 1 | 1066 | 103 | Boulder fragment | Large blocky boulder of (orange coarse-grained rock). Fragment missing. No sign of any wear traces. | x270 | 210 | 120 |
| AS SFB 4 | ?1028/ 1030 | 393 | Broken block | Large tabular block of (coarse-grained orange rock). Fragment. No sign of any wear traces. | x210 | X200 | 113 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| AS Ph from PHB 5 and Pit in SFB 2 | 205 and 17 | 394 (smaller) and 554 (larger) | Rotary quern - lower stone | These two fragments were found in separate contexts. They refit to form three quarters of a roughly squared block with a central perforation. Tabular block of fine-grained bedded micaceous sandstone. A rough perforation has been pecked into the centre of the face. One face has been worn very smooth by grinding to leave a distinctive sinuous cross-section: raised around perforation then concave and raised around edge. Broken then deposited in different contexts. Smaller fragment has small black concretions adhering to it. | x340 | 330 | 110 |

# LANTON QUARRY LAN06

**Durham University**
**Conservation Services**
**Conservation Record**

**Date : 10/08**
**Conservator : JAJ**

| | | |
|---|---|---|
| **SF No : 92Δ** | **Context : 063** | **X-radiograph No : 5607/5729** |

| | | |
|---|---|---|
| **Object : Hook** | **Material : Fe** | **Photography : Digital pix bc&ac** |

**Description :**

Small iron hook, 32mm long. The X-radiograph suggests that it is complete, tapering to a point at one end and bent over at the other. Highly corroded and fragile, the surface is covered with discontinuous mineralised material, which appears to be traces of textile covered in places with wood, with the grain running almost parallel to the length of the hook. The presence of the mineralised material prevented removal of overlying corrosion, but the shape of the hook has been revealed by X-radiography.

**Condition :**

Highly corroded and fragile.

**Conservation Treatment :**

- Low pressure, powderless air abrasion was used to reveal and define the mineralised material.
- Surfaces consolidated with 8% Paraloid B72 (an ethyl methacrylate co-polymer ) in acetone.

**Analysis :**

Mineralised material examined under X16 magnification.

**<u>Storage</u> :**

**Should be stored in an airtight container at a stable temperature and below 20% RH, to inhibit further corrosion. The RH should be controlled by active silica gel, which is regularly monitored and regenerated as necessary.**

**Mineralised threads on point of hook (X16)**

**Mineralised wood on hook end X16**

# LANTON QUARRY LAN06

**Durham University**
**Conservation Services**
**Conservation Record**

**Date : 10/08**
**Conservator : JAJ**

| | | |
|---|---|---|
| **SF No : 93Δ** | **Context : 063 SFB4** | **X-radiograph No : 5607** |
| **Object :?Nail** | **Material : Fe** | **Photography : Digital pix bc&ac** |

**Description :**

Possible bent nail, c27mm long. The shank is rectangular in section, 5x2.5mm, with an expanded flat head 8.5x4.5mm. Totally corroded and incomplete.


**Condition :**

Very highly corroded and fragile, with surface blistering and spalling.

**HANDLE WITH CARE**

**Conservation Treatment :**

- Air abraded.
- Surfaces consolidated with 8% Paraloid B72 (an ethyl methacrylate co-polymer ) in acetone.
- Pieces re-adhered using Paraloid B72 adhesive.


**Analysis :**

None

**Storage :**

**Should be stored in an airtight container at a stable temperature and below 20% RH, to inhibit further corrosion. The RH should be controlled by active silica gel, which is regularly monitored and regenerated as necessary.**

# LANTON QUARRY LAN06

**Durham University**
**Conservation Services**
**Conservation Record**

**Date : 10/08**
**Conservator : JAJ**

| | | |
|---|---|---|
| **SF No : 94∆** | **Context : 063** | **X-radiograph No : 5608** |

| | | |
|---|---|---|
| **Object : Fragment** | **Material : Leather** | **Photography : Digital pix bc&ac** |

**Description :**

Curved irregularly shaped fragment of burnt leather, 29x28x2mm thick. The outer surface is grit encrusted. Traces of a pore structure characteristic of leather are visible on the inside surface.


**Condition :**

Stable but fragile.


**Conservation Treatment :**

- Selectively cleaned with low power, powderless air abrasion.
- Mechanically cleaned.

**Analysis :**

Examined under X16 magnification.

**Storage :**

**May be stored in conditions of ambient temperature and relative humidity, avoiding extremes of both.**

# LANTON QUARRY LAN06

**Durham University**
**Conservation Services**
**Conservation Record**

**Date : 10/08**
**Conservator : JAJ**

| | | |
|---|---|---|
| **SF No : 95Δ** | **Context : 063** | **X-radiograph No : 5608** |

| | | |
|---|---|---|
| **Object : Fragment** | **Material : Leather** | **Photography : Digital pix bc&ac** |

**Description :**

Curled fragment of burnt leather, irregularly shaped, 17x25x2mm thick. The outer surface is grit encrusted. Traces of a pore structure characteristic of leather are visible on the inside surface.



**Condition :**

Stable but fragile.

**Conservation Treatment :**

- Selectively cleaned with low power, powderless air abrasion.
- Mechanically cleaned.

**Analysis :**

Examined under X16 magnification.

**Storage :**

**May be stored in conditions of ambient temperature and relative humidity, avoiding extremes of both.**

# LANTON QUARRY LAN06

**Durham University**
**Conservation Services**
**Conservation Record**

**Date : 10/08**
**Conservator : JAJ**

| | | |
|---|---|---|
| **SF No : 96Δ** | **Context : 063 SFB4** | **X-radiograph No : none** |
| **Object : Bead** | **Material : Glass** | **Photography : Digital pix bc&ac** |

**Description :**

Large circular glass bead, 15mmlong, 18-19mm diameter, with a slightly off-centre tapering perforation 4.5mm max. X16 examination found that the bead has probably been made with a core of clear/green glass with strips of patterned glass made from tiny pieces of opaque red and yellow and clear/green glass rolled around it, the strips arranged to form a herringbone pattern. Patterned discs were also affixed to the bead ends.



**Condition :**

Stable. Edges of the bead are worn and chipped, and there is slight wear apparent around the perforations.

**Conservation Treatment :**

- Received with soil in the perforation. This was removed and examined, but no trace of a stringing thread was found.
- Surfaces cleaned with a water/industrial methylated spirits/non-ionic detergent mix.
- Air dried.

**Analysis :**

The side of the bead was analysed using EDXRF (energy dispersive X-ray fluorescence analysis). The close mix of colours on the bead surface made analysis of any particular colour impossible, but colourants detected included iron, manganese and lead (yellow).

**Storage :**

**May be stored in conditions of ambient temperature and relative humidity, avoiding extremes of both.**

# LANTON QUARRY LAN06

**Durham University**
**Conservation Services**
**Conservation Record**

**Date : 10/08**
**Conservator : JAJ**

| | | |
|---|---|---|
| **SF No : 97Δ** | **Context : 167** | **X-radiograph No : 5608/9/5629** |

| | | |
|---|---|---|
| **Object : Knife** | **Material : Fe** | **Photography : Digital pix bc&ac** |

**<u>Description</u> :**

Iron blade and part tang, received in three pieces, 90mm long together. Object is highly corroded and disfigured by sizeable corrosion warts and blisters and by cracking. Part of the tang had broken off during burial and become attached further up the tang by a corrosion blister. This was removed during conservation, but the two sections of tang can no longer be joined. Very slight traces of mineralised wood survive on one side of the tang. The X-radiograph shows the blade to be very highly corroded, with the cutting edge difficult to discern. The blade back is slightly curved, and the point is missing.

Towards the blade end is an area of mineralised vegetative material (not wood) , which appears to be wrapped around the blade. It was not clear whether this was intentional, so the mineralised material was left in place. A further fragment of this material had become detached from the blade surface. This was also retained.

**<u>Condition</u> :**

Very highly corroded and fragile. Corrosion blisters and mineralised material on the surface meant that little surface corrosion could be removed.

**<u>Conservation Treatment</u> :**

- Selectively air abraded, to define and reveal surface detail as far as possible.
- Surfaces consolidated with 8% Paraloid B72 (an ethyl methacrylate co-polymer ) in acetone.

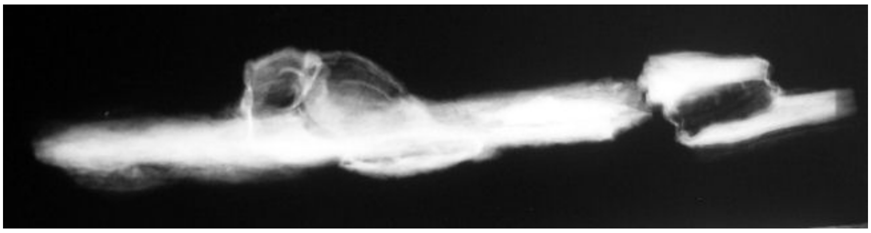
**<u>Analysis</u> :**

None

**XR5729**

**Storage** :

**Should be stored in an airtight container at a stable temperature and below 20% RH, to inhibit further corrosion. The RH should be controlled by active silica gel, which is regularly monitored and regenerated as necessary.**



**XR5729 showing displaced tang fragment, as received**

# LANTON QUARRY LAN06

**Durham University**
**Conservation Services**
**Conservation Record**

**Date : 10/08**
**Conservator : JAJ**

| | | |
|---|---|---|
| **SF No : 111Δ** | **Context : 121** | **X-radiograph No : 5607/5629** |

| | | |
|---|---|---|
| **Object : ?Nail shank** | **Material : Fe** | **Photography : Digital pix bc&ac** |

**Description :**

Probable iron nail shank, 33.5mm long, rectangular in section 8x3.5mm max, and tapered. Extreme point and nail head are missing. Traces of mineralised wood survive on the surface, but these are too ephemeral for species identification.

**Condition :**

Highly corroded but stable.

**Conservation Treatment :**

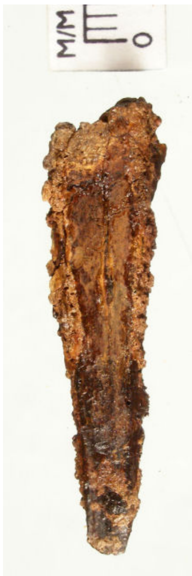
- Selectively air abraded to reveal and define mineralised material.
- Surfaces consolidated with 8% Paraloid B72 (an ethyl methacrylate co-polymer ) in acetone.

**Analysis :**

Mineralised material examined under X16 magnification.

**Storage :**

**Should be stored in an airtight container at a stable temperature and below 20% RH, to inhibit further corrosion. The RH should be controlled by active silica gel, which is regularly monitored and regenerated as necessary.**


# LANTON QUARRY LAN06

**Durham University**
**Conservation Services**
**Conservation Record**

**Date : 10/08**
**Conservator : JAJ**

| SF No : 127∆ | Context : 167 | X-radiograph No : 5609/5629 |
|---|---|---|

| Object : Knife | Material : Iron | Photography : Digital pix bc&ac |
|---|---|---|

**Description :**

Complete iron blade and tang, 82mm long, the blade 15mm wide max. The tang tapers to a point and the blade has a slightly curved back. Traces of mineralised wood – the remains of the handle – survive on the tang, with a clear delineation of the handle's top edge (see X-ray right). It is not possible to identify the mineralised wood, but it appears to be a fine-grained hardwood.

There are also possible traces of mineralised leather on one side of the blade, plus some disorganised mineralised vegetative material. The presence of leather suggests that the knife was deposited in a leather sheath.

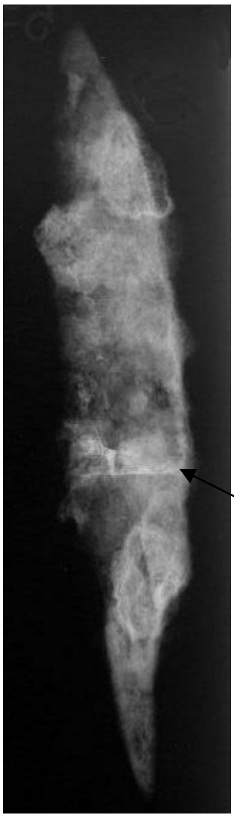
The X-radiograph shows the metal to be highly corroded and the revealed surface is disfigured by corrosion warts, blisters and cracks.

**Condition :**

Highly corroded and fragile. Owing to the presence of the mineralised material and the fragility of the knife, little surface corrosion could be removed. Its form is clearly visible on the X-radiograph.

**Conservation Treatment :**

- Selectively cleaned to reveal and define the mineralised material and to remove overlying soil, using low pressure, powderless air abrasion.
- Surfaces consolidated with 8% Paraloid B72 (an ethyl methacrylate co-polymer ) in acetone.



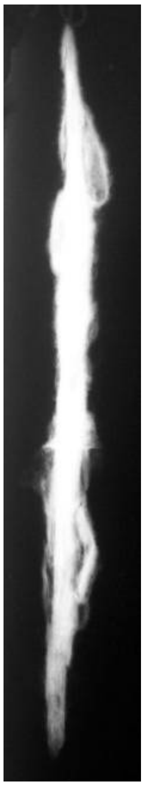
**Top edge of handle**
**XR5729**

**Analysis :**

Mineralised material examined under X16 magnification.

**<u>Storage</u> :**

**Should be stored in an airtight container at a stable temperature and below 20% RH, to inhibit further corrosion. The RH should be controlled by active silica gel, which is regularly monitored and regenerated as necessary.**

**XR5729 side view**

# LANTON QUARRY LAN06

**Durham University**
**Conservation Services**
**Conservation Record**

**Date : 10/08**
**Conservator : JAJ**

| | | |
|---|---|---|
| **SF No : 128Δ** | **Context : 167** | **X-radiograph No : 5607/5629** |
| **Object : ?Washer** | **Material : Iron** | **Photography : Digital pix bc&ac** |

**Description :**

Part of an iron ?washer, irregularly shaped, 24.5x20x2mm thick max. Part of the edge is curved and original, but the surviving straight edges are broken. There is a sub-circular perforation 4mm diameter, which has been roughly pushed through the metal, leaving a ragged edge. If the object was originally circular, then this perforation has been placed off centre.



**Condition :**

Highly corroded and fragile with lamination and corrosion blisters.

**Conservation Treatment :**

- Selectively air abraded.
- Surfaces consolidated with 8% Paraloid B72 (an ethyl methacrylate co-polymer ) in acetone.

**Analysis :**

None

**Storage :**

**Should be stored in an airtight container at a stable temperature and below 20% RH, to inhibit further corrosion. The RH should be controlled by active silica gel, which is regularly monitored and regenerated as necessary.**

# LANTON QUARRY LAN06

**Durham University**
**Conservation Services**
**Conservation Record**

**Date : 10/08**
**Conservator : JAJ**

| SF No : 153Δ | Context : 083 | X-radiograph No : none |
|---|---|---|
| **Object : Bead** | **Material : Glass** | **Photography : Digital pix bc&ac** |

**Description :**

Complete glass bead, 15.5mm long, 15.5mm diam max, with tapered ends. Slightly off-centre perforation, tapering to 3.5 from 5mm diam. Made from dark green translucent glass, with trailed white/cream opaque decorative lines.

**Condition :**

Stable.

**Conservation Treatment :**

- Received with soil in the perforation. This was removed and examined, but no trace of a stringing thread was found.
- Surfaces cleaned with a water/industrial methylated spirits/non-ionic detergent mix.
- Air dried.

**Analysis :**

The bead was analysed using EDXRF (energy dispersive X-ray fluorescence analysis) and found to be made from a soda lime glass, with iron and manganese present as green colourants. Traces of lead and tin were also detected, which may have been used as colourants and/or opacifiers in the opaque white trailing.

**Storage :**

**May be stored in conditions of ambient temperature and relative humidity, avoiding extremes of both.**


# LANTON QUARRY LAN06

**Durham University**
**Conservation Services**
**Conservation Record**

**Date : 10/08**
**Conservator : JAJ**

| **SF No : 218Δ** | **Context : 055** | **X-radiograph No : none** |
|---|---|---|

| **Object : Bead** | **Material : Glass** | **Photography : Digital pix bc&ac** |
|---|---|---|

**Description** :

Half a circular opaque white glass bead, 6mm long & c9.5mm diam. The ends are flattened and the perforation is 3mm diam.

**Condition** :

Stable.

**Conservation Treatment** :

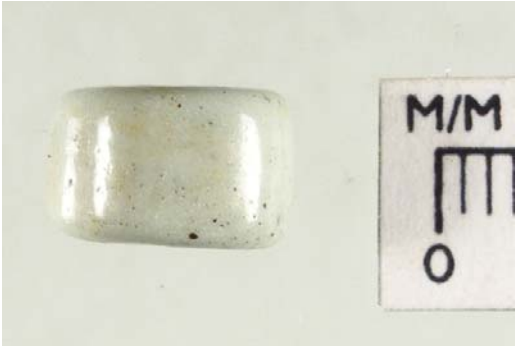
- Surfaces cleaned with a water/industrial methylated spirits/non-ionic detergent mix.
- Air dried.

**Analysis** :

Surface EDXRF (energy dispersive X-ray fluorescence analysis) found the bead to be made from a soda lime glass, with tin used as the opacifier to achieve the white colour.

**Storage** :

**May be stored in conditions of ambient temperature and relative humidity, avoiding extremes of both.**





# Lanton Quarry, Northumberland

# plant macrofossil analysis and radiocarbon dating assessment

*on behalf of*

**Archaeological Research Services Ltd**

**Report 1994**
August 2008

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# Lanton Quarry, Northumberland

## plant macrofossil analysis and radiocarbon dating assesssment

***Report 1994***
August 2008

***Archaeological Services Durham University***

on behalf of

***Archaeological Research Services Ltd***
*Suite 7 Angel House, Portland Square, Bakewell, Derbyshire, DE45 1HB*

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## Contents

# 1. Summary


***The project***

1.1 A multi-phase site has been excavated by Archaeological Research Services Ltd, at Lanton Quarry, Northumberland. This report presents the results of plant macrofossil analysis of 57 flots derived from bulk samples taken at the site and an assessment of the radiocarbon dating potential of 253 charcoal samples.

***Results***

*Mesolithic*

1.2 Two charred cereal grains were recorded which are likely to have come from wild-gathered grasses, or to be reworked material.

*Neolithic*

1.3 Charred plant remains consisted of cereal grains and/or hazel nutshell fragments, with fruitstones from hawthorn and cherry family, and a few weed seeds. Barley, wheat and oats were being used.

*Bronze Age*

1.4 Charred plant remains consisted of cereal grains and chaff, and a few weed seeds. Barley, spelt wheat and oats were being used.

*Iron Age*

1.5 The flot was dominated by charcoal and there were no charred food plant remains.

*Early Medieval*

1.6 Charred plant material consisted of cereal grains, hazel nutshell fragments and charred root tubers including a single tuber from false-oat grass, and a few weed seeds. Barley, wheat and oats were being used.

*Un-phased*

1.7 Charred plant material consisted of cereal grains and chaff, hazel nutshell fragments, charred root tubers and a few weed seeds. Barley and wheat were identified.

*Samples supplied but not on the environmental list*

1.8 Charred plant material was present in all the contexts except (1041), and consisted of a few cereal grains and hazel nutshell fragments. Barley was identified.

*Additional charcoal samples*

1.9 Most of the additional charcoal samples contained material that would be suitable for radiocarbon dating with suitable back-up material available if duplicate dates are required.

## 2. Project background

### *Location and background*

2.1 A multi-phase site has been excavated by Archaeological Research Services Ltd, at Lanton Quarry, Northumberland. This report presents the results of plant macrofossil analysis carried out on 57 flots from environmental samples selected from a range of contexts from all the archaeological periods potentially identified at the site. These comprise: pit and posthole fills; a hearth, context (399); and contexts from six sub-rectangular sunken floor buildings. In addition, an assessment of the radiocarbon dating potential of a further 253 charcoal samples is provided.

### *Objective*

2.2 The objective was to analyse the plant macrofossil evidence within the samples, in order to provide information about the diet and agricultural practices of former inhabitants, the palaeoenvironment of the site, and the presence of material that is potentially suitable for radiocarbon dating.

### *Dates*

2.3 Analysis and report writing were carried out between 9th June and 11th August 2008.

### *Personnel*

2.4 Plant macrofossil analysis and report preparation were conducted by Dr Helen Ranner.

### *Archive*

2.5 The site code is **LAN06.** The flots and charcoal samples are retained in the Environmental Laboratory at Archaeological Services Durham University, for collection.

## 3. Method

3.1 The bulk environmental samples were processed and assessed by Archaeological Research Services Ltd. The flots recommended for analysis were examined at ×40 magnification. The soil from this site is of a free-draining nature, therefore only carbonised plant material will have been preserved; any uncharred plant remains would be later intrusive material and have not been included in this analysis. The additional charcoal samples were examined at ×40 magnification. Identification of the charred plant remains was undertaken by comparison with modern reference material held in the Environmental Laboratory at Archaeological Services Durham University. Plant taxonomic nomenclature follows Stace (1997).

# 4. Results

### *Mesolithic*

4.1 The flots were relatively small and dominated by charcoal, with some modern root and seed material. Indeterminate fragments of unburnt bone, a single barley grain and an indeterminate grain were present in context (69). The results are presented in Appendix I.

### *Neolithic*

4.2 All the flots were dominated by charcoal, with some modern root and seed material, except context (181), where charcoal was absent. Clinker was present in the hearth context (399), and indeterminate fragments of calcined bone in context (181). Charred plant material consisted of cereal grains and /or hazel nutshell fragments which were recorded in all the contexts, fruitstones from hawthorn in context (1189), and fruitstones from the cherry family in context (399). Nutlets from the ruderal family of knotweeds were present in context (399), and grass caryopses in context (1189). The cereal grains were generally poorly preserved, with a majority being classified as indeterminate. Oats were identified in context (399), barley in contexts (1194), (399) and (1189), and wheat in contexts (311), (595), (977) and (1189). One of the barley grains in context (399) presented a twisted furrow characteristic of six-row barley, and wheat grains in contexts (311), (595), and (1189) showed the morphological characteristics associated with emmer wheat. Hazel nutshell fragments were particularly abundant in contexts (595) and (997) where they represent 9% of the flot material. The results are presented in Appendix I.

### *Bronze Age*

4.3 All the flots were dominated by charcoal, with occasional clinker; coal was present in context (513) and semi-vitrified fuel waste in context (479). Modern plant material including roots and seeds was present throughout, and insects were present in two contexts. Charred plant material consisted of cereal grains and chaff, and a few weed seeds. The cereal grains were generally poorly preserved with a majority of the grains being classified as indeterminate. Oats were identified in context (479), barley in all contexts except (465), and wheat in contexts (459) and (475). One of the barley grains in context (475) presented a twisted furrow characteristic of six-row barley, and hulled barley was identified in contexts (513) and (479). The wheat grains from this phase showed the morphological characteristics associated with emmer wheat, and a spelt wheat glume base was recorded in context (465). Nutlets from the ruderal family of knotweeds occurred in context (479) and grass caryopses in contexts (513) and (479). The results are presented in Appendix I.

### *Iron Age*

4.4 The flot was dominated by charcoal, with some modern roots and seeds, and a single indeterminate charred weed seed. The results are presented in Appendix I.

***Early Medieval***

4.5 All the flots were dominated by charcoal, with occasional clinker and semi-vitrified fuel waste. Modern plant material, including roots and seeds, was present throughout, and insects were recorded occasionally. Charred plant material consisted of cereal grains, hazel nutshell fragments, charred root tubers (including a tuber from false-oat grass), and a few weed seeds. The cereal grains were generally poorly preserved with a majority of the grains being classified as indeterminate. Oats were identified in contexts (167) and (281), barley in all contexts except (1095) and (281), and wheat in context (15). Some of the barley grains in contexts (17), (19) and (167) presented a twisted furrow, characteristic of six-row barley, and hulled barley was identified in contexts (1034), (63) and (281). Hazel nutshell fragments were recorded in contexts (15), (17), (19), (167), (281), (1039) and (1041). Indeterminate fragments of plant tubers were present in contexts (281) and (1039). Grass caryopses were present in contexts (19), (281) and (1039), and vetch seeds in context (17) and (1039). The results are presented in Appendix I.

***Un-phased***

4.6 All the flots were dominated by charcoal, with occasional records of semi-vitrified fuel waste. Modern plant material, including roots and seeds was present throughout, and insects were recorded occasionally. Charred plant material consisted of cereal grains and chaff, hazel nutshell fragments, charred root tubers and a few weed seeds. The cereal grains were generally poorly preserved with a majority of the grains being classified as indeterminate. Barley was present in contexts (11), (23), (25), (271), and (339) with a single basal rachis fragment in context (339), and wheat was present in contexts (11) and (439). Some of the barley grains in contexts (23) presented a twisted furrow, characteristic of six-row barley, and hulled barley was identified in contexts (11), (23) and (25). The wheat grain in context (439) showed the morphological characteristics associated with emmer wheat. Hazel nutshell fragments were recorded in contexts (187) and (381). Indeterminate fragments of plant tubers were present in contexts (23) and (271). Grass caryopses were present in contexts (11) and (23), and nutlets from pale persicaria and dock in contexts (439) and (23) respectively. The results are presented in Appendix I.

***Samples supplied but not on the environmental list***

4.7 All the flots were dominated by charcoal, with modern plant material, including roots and seeds present throughout. Charred plant material was present in all the contexts except (1041), and consisted of a few cereal grains and hazel nutshell fragments. Barley was present in contexts (1030) and (1039) sample ⟨68⟩, with one of the grains in context (1030) presenting a twisted furrow, characteristic of six-row barley. Hazel nutshell fragments were recorded in contexts (1030). The results are presented in Appendix I.

***Additional charcoal samples***

4.8 Most of the additional charcoal samples contained material that would be suitable for radiocarbon dating, together with suitable back-up material if duplicate dates are requied. This was generally non-oak charcoal with a few samples of hazel nutshell fragments, and a single piece of charred *Pyrus*/*Malus* species endocarp, in context (235). The results are presented in Appendix II; the samples that are particularly appropriate for dating purposes are indicated.

## 5. Discussion

***Food plants***

*Mesolithic*

5.1 Macrobotanical evidence for usage of plants is almost absent from Mesolithic deposits in the northern region, and the palaeoenvironmental evidence for human impact at this time has been obtained primarily from palynological studies (Huntley & Stallibrass 1995). These have provided evidence for episodes of woodland/forest disturbance (Simmons & Innes 1988; Turner & Hodgson 1979, 1981, 1991; Innes & Shennan 1991; Day & Mellars 1994), and the early appearance of cereal-type pollen, eg., at Soyland Moor, central Pennines (Williams 1985), thus suggesting openings in the forest canopy which would have allowed grasses to flourish. As there is little evidence for the cultivation of cereals at this time, the presence of charred barley in this phase may indicate the deliberate gathering of wild barley species that would have inhabited the coastal fringe. However, the possibility of these grains being later intrusive material must be considered.

*Neolithic*

5.2 The charred food plant remains recorded in the Neolithic contexts, indicate a variety of cultivated and wild gathered material was being utilised at this site during the transition from hunter gatherer to farmer. Both barley (including six-row barley which is the common form of the earliest cultivated barley) and wheat were being used, as has been recorded on six other Neolithic sites in the north of England, with an additional seven sites recording barley only (Hall & Huntley 2007). The particular use of emmer wheat cannot be confirmed, due to the absence of any definitive chaff, however, this early type of wheat has previously been recorded at six other Neolithic sites in the north of England (Hall & Huntley 2007), and particularly at Millfield Basin ( Huntley 1999; Archaeological Services 2000) and Whitton Hill (van der Veen 1985) in Northumberland. Oats were a later introduction, and therefore the oat grain in context (399) is likely to have derived from wild oats, either gathered or growing amongst the cultivated crops. There is also evidence for the use of hazel nuts, hawthorn berries and cherry family fruits as additional food sources; evidence for the use of wild gathered fruits and nuts, particularly hazel nuts, has been recorded at the other Neolithic sites in the region (Hall and Huntley 2007).

*Bronze Age*

5.3 The charred food plant remains recorded in the Bronze Age contexts only derive from cultivated crops. There is no evidence for wild-gathered foods in this phase, however, the data set is very small and therefore interpretation cannot imply that this is a genuine trend. Nevertheless, the expansion of areas of occupation and clearing of land for cultivation would necessarily mean that wild resources were becoming less readily available. Both barley (including six-row barley) and wheat were being used, this is in common with other Bronze Age sites in northern England (Hall & Huntley 2007). The wheat types utilised appear to be spelt and emmer. The particular use of emmer wheat cannot be confirmed due to the absence of any definitive chaff, however, this early type of wheat has previously been recorded with spelt wheat at other Bronze Age sites in the north of England (Hall & Huntley 2007), and particularly at Hallshill in Northumberland (van der Veen 1992) where its use has been confirmed by the presence of the characteristic glume bases. The oat grain in context (479) is again likely to have derived from wild oats, either gathered or growing amongst the cultivated crops.

*Iron Age*

5.4 The only charred plant macrofossils from this phase were charcoal fragments.

*Early Medieval*

5.5 The charred food plant remains recorded in the medieval contexts, indicate that both cultivated and wild-gathered resources was being used. The evidence suggests that barley was the more common cereal grain, but that both wheat and oats were also being utilised, in common with other records of medieval sites in the north of England (Hall & Huntley 2007). Hulled barley was identified, with occasional grains presenting a twisted furrow suggesting the six-row variety (although not all the grains on a head of six-row barley develop this characteristic). Regional literature suggests that the earlier six-row barley was superseded by the two-row variety at some time during the medieval (Huntley & Stallibrass 1995). The presence of cultivated oats cannot be confirmed due to the absence of chaff, so that the oats recorded may have derived from wild oats growing amongst the cultivated cereals. The presence of a few hazel nutshell fragments suggests that nuts were still being used as an additional food source, but were probably becoming less important in the diet.

5.6 A single charred false oat-grass tuber was identified in context (281) sample ⟨70⟩. These plant structures are usually found in association with Neolithic and Bronze Age sites, and are believed to have been used as kindling for funeral pyres or more rarely as a food source (Robinson, 1988; Godwin, 1975). With evidence of prehistoric occupation at the site, it is likely that this tuber is re-worked material. The indeterminate fragments of charred tubers recorded in context (281) sample ⟨48⟩, and context (1039), could not be specifically identified and may have resulted from the casual burning of vegetation in association with domestic fires.

***The natural environment***

*Mesolithic*

5.7 Plant macrofossil remains are characteristically very sparse in the Mesolithic contexts. The barley grains recorded may have been gathered from wild varieties taking advantage of the increased light afforded in areas of cleared woodland/forest. The absence of any charred weed seeds may reflect the generally dense woodland cover at this time, providing little opportunity for the growth of an herbaceous ground flora.

*Neolithic*

5.8 The quantity and variety of plant macrofossil remains increases significantly in the Neolithic contexts. The abundance of hazel nutshell fragments, and the presence of small trees/shrubs of hawthorn and cherry family taxa, in this phase, indicates the presence of local woodland or scrub. These species would have proliferated and fruited well at woodland edges or in areas cleared for cultivation or habitation, where the availability of light was significantly increased.

*Bronze Age*

5.9 The suite of charred weed seeds is very limited with only a few seeds from ruderal and wide niche taxa, indicating some open and disturbed ground.

*Iron Age*

5.10 Little information can be provided about the local landscape during the Iron Age occupation of the site, due to the absence of charred plant remains other than charcoal

*Early Medieval*

5.11 The very limited suite of weed seeds is indicative of open and disturbed ground that would be associated with occupation and cultivation. Hazel would have been a constituent of local open woodland or may have grown as scrub in disturbed ground.

***The features***

5.12 The relatively low levels of domestic fire waste throughout are indicative of a background level associated with occupation and there are no compelling indications for specific functions that could be attributed to the features sampled.

***Un-phased samples***

5.13 The unphased samples all contained some of the elements found in the phased samples, i.e., barley and wheat grains and hazel nutshell fragments, and all were dominated by charcoal, but none presented a characteristic suite of plant macrofossils that would suggest a specific phase.

***Samples supplied but not on the environmental list***

5.14 Similarly, the four samples that were supplied but were not on the environmental list, were all dominated by charcoal, with occasional barley grains and hazel nutshell fragments.

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**Appendix I:** Data from plant macrofossil analysis (Mesolithic and Neolithic)

| Phase | | Mesolithic | | Neolithic | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Feature | | PBB3 | | PBB8 | | PBB10 | | PBB12 | Feature 18 | other features | | |
| Context | | 69 | 131 | 1182 | 1194 | 311 | 319 | 399 | 595 | 181 | 977 | 1189 |
| Description | | posthole | posthole | ovoid posthole | circular posthole | circular pit | sub-ovoid pit with internal posthole | sub-circular hearth | ovoid pit | sub-circular pit | sub-circular pit | sub-ovoid pit |
| Sample | | 54 | 64 | 126 | 164 | 194 | 177 | 192 | 261 | 52 | 268 | 108 |
| *Material available for radiocarbon dating* | | ✓ | - | - | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| *Volume of flot assessed (ml)* | | 20 | <5 | - | 10 | 400 | 50 | 50 | 50 | 50 | 50 | 475 |
| *Flot matrix (relative abundance)* | | | | | | | | | | | | |
| Bone (calcined) | indet. frags. | - | - | - | - | - | - | - | - | 1 | - | - |
| Bone (unburnt) | indet. frags. | 1 | - | - | - | - | - | - | - | - | - | - |
| Charcoal | | 2 | 2 | - | 2 | 4 | 3 | 3 | 4 | - | 4 | 4 |
| Clinker | | - | - | - | - | - | - | 1 | - | - | - | - |
| Coal | | - | - | - | - | - | - | - | - | - | - | - |
| Fruitstone (charred) | indet. frags. | - | - | - | - | - | - | - | - | - | - | 1 |
| Insecta | | - | - | - | - | - | 1 | - | - | - | - | 1 |
| Isopoda (Woodlice) | | - | - | - | - | - | - | - | - | 2 | - | - |
| Roots (modern) | | 1 | 1 | - | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 3 |
| Roots/rhizomes (charred) | | - | - | - | - | - | - | - | - | - | - | - |
| Seeds (uncharred) | | 1 | - | - | 2 | 1 | 1 | 1 | 2 | 2 | 2 | 3 |
| Semi-vitrified fuel waste | | - | - | - | - | - | - | - | - | - | - | - |
| Tubers (charred) | indet. frags. | - | - | - | - | 1 | - | - | - | - | - | - |
| Vegetative material | misc. | - | - | - | 1 | - | - | - | - | 1 | - | 3 |
| *Charred remains (total counts)* | | | | | | | | | | | | |
| (c) *Avena* spp (oat species) | grain | - | - | - | - | - | - | 1 | - | - | - | - |
| (c) *Hordeum* spp (Barley species) | grain | 1 | - | - | 1 | - | - | 6 | - | - | - | 2 |
| (c) *Hordeum* spp (Barley species) | grain (twisted furrow) | - | - | - | - | - | - | 1 | - | - | - | - |
| (c) *Hordeum* spp (Barley species) | basal rachis frag. | - | - | - | - | - | - | - | - | - | - | - |
| (c) *Hordeum* spp (Hulled Barley) | grain | - | - | - | - | - | - | - | - | - | - | - |
| (c) *Hordeum* spp (Naked Barley) | grain | - | - | - | - | - | - | - | - | - | - | - |
| (c) *Triticum* cf. *dicoccum* (Emmer Wheat) | grain | - | - | - | - | 1 | - | - | 1 | - | - | 1 |
| (c) *Triticum spelta* (Spelt Wheat) | glume base | - | - | - | - | - | - | - | - | - | - | - |
| (c) *Triticum* spp (Wheat species) | grain | - | - | - | - | - | - | - | - | - | 1 | 2 |
| (c) Cerealia indeterminate | grain | 1 | - | - | - | 9 | - | 7 | 1 | 1 | 3 | 10 |
| (g) *Arrhenatherum elatius* ssp *bulbosum* (False Oat-grass) | tuber | - | - | - | - | - | - | - | - | - | - | - |
| (r) Polygonaceae undiff. (Knotweed family) | nutlet | - | - | - | - | - | - | 1 | - | - | - | - |
| (t) *Corylus avellana* (Hazel) | nutshell frag. | - | - | - | - | 29 | 2 | - | 134 | 46 | 140 | - |
| (t) *Crataegus* spp (Hawthorn) | fruitstone | - | - | - | - | - | - | - | - | - | - | 4 |
| (t) *Crataegus* spp (Hawthorn) | fruitstone frag. | - | - | - | - | - | - | - | - | - | - | 3 |
| (t) Rosaceae (cf. Prunus sp) (Cherry) | fruitstone frag. | - | - | - | - | - | - | 1 | - | - | - | - |
| (w) *Persicaria lapathifolia* (Pale Persicaria) | nutlet | - | - | - | - | - | - | - | - | - | - | - |
| (x) Poaceae undiff. <4mm (Grass family) | caryopsis | - | - | - | - | - | - | - | - | - | - | 3 |
| (x) Poaceae undiff. >4mm (Grass family) | caryopsis | - | - | - | - | - | - | - | - | - | - | - |
| (x) Rumex spp (Dock) | nutlet | - | - | - | - | - | - | - | - | - | - | - |
| (x) *Vicia* spp (Vetch) | seed | - | - | - | - | - | - | - | - | - | - | - |
| Seed - indeterminate | | - | - | - | - | - | - | - | - | - | - | - |

[c-cultivated; g-grassland; r-ruderal; t-woodland; w-wetland; x-wide niche]. Relative abundance is based on a scale from 1 (lowest) to 5 (highest). (✓) there may be insufficient weight of carbon available for AMS radiocarbon dating

**Appendix I** (continued): Data from plant macrofossil analysis (Bronze Age and Iron Age)

| Phase | | Bronze Age | | | | | | Iron Age |
|---|---|---|---|---|---|---|---|---|
| Feature | | - | - | - | - | - | - | PBB6 |
| Context | | 459 | 465 | 513 | 477 | 479 | 475 | 111 |
| Description | | sub-circular posthole | sub-circular posthole | sub-ovoid posthole | sub-circular pit | sub-circular pit | sub-ovoid pit | irregular pit |
| Sample | | 231 | 222 | 220 | 235 | 218 | 233 | 174 |
| *Material available for radiocarbon dating* | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| *Volume of flot assessed (ml)* | | 7 | 20 | 5 | 5 | 20 | 25 | 5 |
| *Flot matrix (relative abundance)* | | | | | | | | |
| Bone (calcined) | indet. frags. | - | - | - | - | - | - | - |
| Bone (unburnt) | indet. frags. | - | - | - | - | - | - | - |
| Charcoal | | 2 | 3 | 2 | 2 | 2 | 4 | 3 |
| Clinker | | - | 1 | 1 | - | 1 | - | - |
| Coal | | - | - | 1 | - | - | - | - |
| Fruitstone (charred) | indet. frags. | - | - | - | - | - | - | - |
| Insecta | | - | 1 | - | - | 1 | - | - |
| Isopoda (Woodlice) | | - | - | - | - | - | - | - |
| Roots (modern) | | 1 | - | 2 | 1 | 2 | 1 | 1 |
| Roots/rhizomes (charred) | | - | - | - | - | - | - | - |
| Seeds (uncharred) | | 1 | 2 | 3 | 3 | 2 | 1 | 3 |
| Semi-vitrified fuel waste | | - | - | - | - | 1 | - | - |
| Tubers (charred) | indet. frags. | - | - | - | - | - | - | - |
| Vegetative material | misc. | 1 | - | 2 | 2 | 1 | 1 | - |
| *Charred remains (total counts)* | | | | | | | | |
| (c) *Avena* spp (oat species) | grain | - | - | - | - | 1 | - | - |
| (c) *Hordeum* spp (Barley species) | grain | 1 | - | - | 3 | 3 | 2 | - |
| (c) *Hordeum* spp (Barley species) | grain (twisted furrow) | - | - | - | - | - | 1 | - |
| (c) *Hordeum* spp (Barley species) | basal rachis frag. | - | - | - | - | - | - | - |
| (c) *Hordeum* spp (Hulled Barley) | grain | - | - | 1 | - | 1 | - | - |
| (c) *Hordeum* spp (Naked Barley) | grain | - | - | - | - | - | - | - |
| (c) *Triticum* cf. *dicoccum* (Emmer Wheat) | grain | 1 | - | - | - | - | 2 | - |
| (c) *Triticum spelta* (Spelt Wheat) | glume base | - | 1 | - | - | - | - | - |
| (c) *Triticum* spp (Wheat species) | grain | - | - | - | - | - | - | - |
| (c) Cerealia indeterminate | grain | 2 | 3 | 1 | 3 | 6 | 1 | - |
| (g) *Arrhenatherum elatius* ssp *bulbosum* (False Oat-grass) | tuber | - | - | - | - | - | - | - |
| (r) Polygonaceae undiff. (Knotweed family) | nutlet | 2 | - | - | - | 1 | - | - |
| (t) *Corylus avellana* (Hazel) | nutshell frag. | - | - | - | - | - | - | - |
| (t) *Crataegus* spp (Hawthorn) | fruitstone | - | - | - | - | - | - | - |
| (t) *Crataegus* spp (Hawthorn) | fruitstone frag. | - | - | - | - | - | - | - |
| (t) Rosaceae (cf. Prunus sp) (Cherry) | fruitstone frag. | - | - | - | - | - | - | - |
| (w) *Persicaria lapathifolia* (Pale Persicaria) | nutlet | - | - | - | - | - | - | - |
| (x) Poaceae undiff. <4mm (Grass family) | caryopsis | - | - | - | - | - | - | - |
| (x) Poaceae undiff. >4mm (Grass family) | caryopsis | - | - | 1 | - | 1 | - | - |
| (x) Rumex spp (Dock) | nutlet | - | - | - | - | - | - | - |
| (x) *Vicia* spp (Vetch) | seed | - | - | - | - | - | - | - |
| Seed - indeterminate | | - | - | - | - | - | - | 1 |

[c-cultivated; g-grassland; r-ruderal; t-woodland; w-wetland; x-wide niche]. Relative abundance is based on a scale from 1 (lowest) to 5 (highest). (✓) there may be insufficient weight of carbon available for AMS radiocarbon dating

## **Appendix I** (continued): Data from plant macrofossil analysis (Early Medieval)

| Phase | | Early Medieval | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Feature | | PBB2 | SFB1 | | SFB2 | | | SFB3 | | | |
| Context | | 1095 | 15 | 15 | 17 | 17 | 17 | 19 | 19 | 19 | 19 |
| Description | | sub-ovoid double posthole | sub-rectangular sunken floor building | | | | | | | | |
| Sample | | 9 | 25 | 26 | 34 | 30 | 32 | 38 | 41 | 35 | 36 |
| *Material available for radiocarbon dating* | | ✓ | ✓ | ✓ | ✓ | (✓) | (✓) | (✓) | (✓) | (✓) | ✓ |
| *Volume of flot assessed (ml)* | | 25 | 25 | 30 | 50 | 50 | 50 | 25 | 80 | 100 | 40 |
| *Flot matrix (relative abundance)* | | | | | | | | | | | |
| Bone (calcined) | indet. frags. | - | - | - | 1 | - | - | - | 1 | 1 | 1 |
| Bone (unburnt) | indet. frags. | - | - | - | - | - | - | 1 | 1 | - | - |
| Charcoal | | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| Clinker | | - | - | 1 | - | - | - | - | - | - | - |
| Coal | | - | - | - | - | - | - | - | - | - | - |
| Fruitstone (charred) | indet. frags. | - | - | - | - | - | - | - | - | - | - |
| Insecta | | - | 1 | - | - | - | - | - | - | - | - |
| Isopoda (Woodlice) | | - | - | - | - | - | - | - | - | - | - |
| Roots (modern) | | 1 | 1 | 2 | 2 | - | 1 | 1 | 1 | 1 | 1 |
| Roots/rhizomes (charred) | | - | - | - | - | - | - | - | - | - | - |
| Seeds (uncharred) | | 1 | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Semi-vitrified fuel waste | | - | 1 | 1 | 1 | 1 | - | - | 1 | 1 | 1 |
| Tubers (charred) | indet. frags. | - | - | - | - | - | - | - | - | - | - |
| Vegetative material | misc. | - | - | 1 | - | - | - | - | - | - | - |
| *Charred remains (total counts)* | | | | | | | | | | | |
| (c) *Avena* spp (oat species) | grain | - | - | - | - | - | - | - | - | - | - |
| (c) *Hordeum* spp (Barley species) | grain | - | 2 | 1 | 3 | 5 | 1 | 1 | 5 | 6 | 6 |
| (c) *Hordeum* spp (Barley species) | grain (twisted furrow) | - | - | - | 2 | - | - | 1 | 1 | - | 1 |
| (c) *Hordeum* spp (Barley species) | basal rachis frag. | - | - | - | - | - | - | - | - | - | - |
| (c) *Hordeum* spp (Hulled Barley) | grain | - | - | - | 1 | - | - | - | - | 1 | - |
| (c) *Hordeum* spp (Naked Barley) | grain | - | - | - | - | - | - | - | - | - | - |
| (c) *Triticum* cf. *dicoccum* (Emmer Wheat) | grain | - | - | - | - | - | - | - | - | - | - |
| (c) *Triticum spelta* (Spelt Wheat) | glume base | - | - | - | - | - | - | - | - | - | - |
| (c) *Triticum* spp (Wheat species) | grain | - | 2 | - | - | - | - | - | - | - | - |
| (c) Cerealia indeterminate | grain | 1 | 3 | 1 | 12 | 7 | 4 | - | 1 | 8 | 6 |
| (g) *Arrhenatherum elatius* ssp *bulbosum* (False Oat-grass) | tuber | - | - | - | - | - | - | - | - | - | - |
| (r) Polygonaceae undiff. (Knotweed family) | nutlet | - | - | - | - | - | - | - | - | - | - |
| (t) *Corylus avellana* (Hazel) | nutshell frag. | - | - | 1 | 1 | - | 1 | 1 | - | - | - |
| (t) *Crataegus* spp (Hawthorn) | fruitstone | - | - | - | - | - | - | - | - | - | - |
| (t) *Crataegus* spp (Hawthorn) | fruitstone frag. | - | - | - | - | - | - | - | - | - | - |
| (t) Rosaceae (cf. Prunus sp) (Cherry) | fruitstone frag. | - | - | - | - | - | - | - | - | - | - |
| (w) *Persicaria lapathifolia* (Pale Persicaria) | nutlet | - | - | - | - | - | - | - | - | - | - |
| (x) Poaceae undiff. <4mm (Grass family) | caryopsis | - | - | - | - | - | - | - | - | 1 | - |
| (x) Poaceae undiff. >4mm (Grass family) | caryopsis | - | - | - | - | - | - | - | - | 1 | - |
| (x) Rumex spp (Dock) | nutlet | - | - | - | - | - | - | - | - | - | - |
| (x) *Vicia* spp (Vetch) | seed | - | - | - | 1 | - | - | - | - | - | - |
| Seed - indeterminate | | - | - | - | - | - | - | - | - | - | - |

[c-cultivated; g-grassland; r-ruderal; t-woodland; w-wetland; x-wide niche]. Relative abundance is based on a scale from 1 (lowest) to 5 (highest). (✓) there may be insufficient weight of carbon available for AMS radiocarbon dating

## **Appendix I** (continued): Data from plant macrofossil analysis (Early Medieval, continued)

| Phase | | Early Medieval (continued) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Feature | | SFB3 | SFB4 | | | | | SFB5 | | | |
| Context | | 1034 | 63 | 63 | 63 | 63 | 1030 | 167 | 167 | 167 | 1036 |
| Description | | posthole | sub-rectangular sunken floor building | | | | circular posthole | secondary fill | NW quadrant | SE quadrant | ovoid posthole |
| Sample | | 43 | 14 | 13 | 16 | 15 | 11 | 46 | 47 | 44 | 45 |
| *Material available for radiocarbon dating* | | (✓) | ✓ | - | - | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| *Volume of flot assessed (ml)* | | 50 | 20 | - | - | 25 | 7 | 40 | 40 | 140 | 5 |
| *Flot matrix (relative abundance)* | | | | | | | | | | | |
| Bone (calcined) | indet. frags. | - | - | - | - | - | - | - | - | - | - |
| Bone (unburnt) | indet. frags. | - | - | - | - | - | - | 1 | - | - | - |
| Charcoal | | 2 | 3 | - | - | 3 | 3 | 3 | 3 | 3 | 1 |
| Clinker | | - | - | - | - | - | - | - | - | - | - |
| Coal | | - | - | - | - | - | - | - | - | - | - |
| Fruitstone (charred) | indet. frags. | - | - | - | - | - | - | - | - | - | - |
| Insecta | | 1 | - | - | - | - | - | - | - | - | - |
| Isopoda (Woodlice) | | - | - | - | - | - | - | - | - | - | - |
| Roots (modern) | | 1 | 1 | - | - | 1 | - | 1 | 1 | 1 | 1 |
| Roots/rhizomes (charred) | | - | - | - | - | - | - | - | - | - | - |
| Seeds (uncharred) | | 1 | 1 | - | - | 1 | - | 1 | 2 | - | 1 |
| Semi-vitrified fuel waste | | - | - | - | - | - | - | - | - | - | - |
| Tubers (charred) | indet. frags. | - | - | - | - | - | - | - | - | - | - |
| Vegetative material | misc. | 1 | - | - | - | - | - | 1 | - | 1 | 1 |
| *Charred remains (total counts)* | | | | | | | | | | | |
| (c) *Avena* spp (oat species) | grain | 1 | - | - | - | - | - | - | 1 | - | - |
| (c) *Hordeum* spp (Barley species) | grain | 4 | 1 | - | - | 1 | 1 | - | 3 | 2 | 4 |
| (c) *Hordeum* spp (Barley species) | grain (twisted furrow) | - | - | - | - | - | - | - | - | 1 | - |
| (c) *Hordeum* spp (Barley species) | basal rachis frag. | - | - | - | - | - | - | - | - | - | - |
| (c) *Hordeum* spp (Hulled Barley) | grain | 1 | 1 | - | - | - | - | - | - | - | - |
| (c) *Hordeum* spp (Naked Barley) | grain | - | - | - | - | 1 | - | 1 | - | - | - |
| (c) *Triticum* cf. *dicoccum* (Emmer Wheat) | grain | - | - | - | - | - | - | - | - | - | - |
| (c) *Triticum spelta* (Spelt Wheat) | glume base | - | - | - | - | - | - | - | - | - | - |
| (c) *Triticum* spp (Wheat species) | grain | - | - | - | - | - | - | - | - | - | - |
| (c) Cerealia indeterminate | grain | 1 | 2 | - | - | 1 | - | 2 | 2 | 1 | 1 |
| (g) *Arrhenatherum elatius* ssp *bulbosum* (False Oat-grass) | tuber | - | - | - | - | - | - | - | - | - | - |
| (r) Polygonaceae undiff. (Knotweed family) | nutlet | - | - | - | - | - | - | - | - | - | - |
| (t) *Corylus avellana* (Hazel) | nutshell frag. | - | - | - | - | - | - | - | - | 1 | - |
| (t) *Crataegus* spp (Hawthorn) | fruitstone | - | - | - | - | - | - | - | - | - | - |
| (t) *Crataegus* spp (Hawthorn) | fruitstone frag. | - | - | - | - | - | - | - | - | - | - |
| (t) Rosaceae (cf. Prunus sp) (Cherry) | fruitstone frag. | - | - | - | - | - | - | - | - | - | - |
| (w) *Persicaria lapathifolia* (Pale Persicaria) | nutlet | - | - | - | - | - | - | - | - | - | - |
| (x) Poaceae undiff. <4mm (Grass family) | caryopsis | - | - | - | - | - | - | - | - | - | - |
| (x) Poaceae undiff. >4mm (Grass family) | caryopsis | - | - | - | - | - | - | - | - | - | - |
| (x) Rumex spp (Dock) | nutlet | - | - | - | - | - | - | - | - | - | - |
| (x) *Vicia* spp (Vetch) | seed | - | - | - | - | - | - | - | - | - | - |
| Seed - indeterminate | | - | - | - | - | - | - | - | - | - | - |

[c-cultivated; g-grassland; r-ruderal; t-woodland; w-wetland; x-wide niche]. Relative abundance is based on a scale from 1 (lowest) to 5 (highest). (✓) there may be insufficient weight of carbon available for AMS radiocarbon dating

**Appendix I** (continued): Data from plant macrofossil analysis (Early Medieval, continued)

| Phase | | Early Medieval (continued) | | | | | |
|---|---|---|---|---|---|---|---|
| Feature | | SFB6 | | | | | |
| Context | | 281 | | | | 1039 | 1041 |
| Description | | sub-rectangular sunken floor building | | | | posthole | posthole |
| Sample | | 50 | 70 | 48 | 72 | 49 | 51 |
| *Material available for radiocarbon dating* | | ✓ | ✓ | - | ✓ | ✓ | ✓ |
| *Volume of flot assessed (ml)* | | 45 | 15 | 15 | 50 | 50 | 50 |
| *Flot matrix (relative abundance)* | | | | | | | |
| Bone (calcined) | indet. frags. | - | - | - | - | - | - |
| Bone (unburnt) | indet. frags. | - | - | - | - | - | - |
| Charcoal | | 3 | 2 | 2 | 3 | 4 | 3 |
| Clinker | | - | 1 | - | - | - | - |
| Coal | | - | - | - | - | - | - |
| Fruitstone (charred) | indet. frags. | - | - | - | - | - | - |
| Insecta | | - | - | - | - | - | - |
| Isopoda (Woodlice) | | - | - | - | - | - | - |
| Roots (modern) | | 1 | 1 | 2 | 1 | 1 | 2 |
| Roots/rhizomes (charred) | | - | - | - | - | - | - |
| Seeds (uncharred) | | 1 | 1 | 1 | 1 | 1 | 1 |
| Semi-vitrified fuel waste | | - | 1 | - | 1 | - | 1 |
| Tubers (charred) | indet. frags. | 2 | - | 2 | - | 1 | - |
| Vegetative material | misc. | - | - | 1 | 1 | - | - |
| *Charred remains (total counts)* | | | | | | | |
| (c) *Avena* spp (oat species) | grain | 1 | - | - | - | - | - |
| (c) *Hordeum* spp (Barley species) | grain | 4 | - | 1 | - | 3 | 1 |
| (c) *Hordeum* spp (Barley species) | grain (twisted furrow) | - | - | - | - | - | - |
| (c) *Hordeum* spp (Barley species) | basal rachis frag. | - | - | - | - | - | - |
| (c) *Hordeum* spp (Hulled Barley) | grain | 1 | - | - | 1 | - | - |
| (c) *Hordeum* spp (Naked Barley) | grain | - | - | - | - | - | - |
| (c) *Triticum* cf. *dicoccum* (Emmer Wheat) | grain | - | - | - | - | - | - |
| (c) *Triticum spelta* (Spelt Wheat) | glume base | - | - | - | - | - | - |
| (c) *Triticum* spp (Wheat species) | grain | - | - | - | - | - | - |
| (c) Cerealia indeterminate | grain | 2 | 1 | - | 4 | 3 | 1 |
| (g) *Arrhenatherum elatius* ssp *bulbosum* (False Oat-grass) | tuber | - | 1 | - | - | - | - |
| (r) Polygonaceae undiff. (Knotweed family) | nutlet | - | - | - | - | - | - |
| (t) *Corylus avellana* (Hazel) | nutshell frag. | 1 | - | - | - | 1 | 1 |
| (t) *Crataegus* spp (Hawthorn) | fruitstone | - | - | - | - | - | - |
| (t) *Crataegus* spp (Hawthorn) | fruitstone frag. | - | - | - | - | - | - |
| (t) Rosaceae (cf. Prunus sp) (Cherry) | fruitstone frag. | - | - | - | - | - | - |
| (w) *Persicaria lapathifolia* (Pale Persicaria) | nutlet | - | - | - | - | - | - |
| (x) Poaceae undiff. <4mm (Grass family) | caryopsis | 1 | - | - | - | 1 | - |
| (x) Poaceae undiff. >4mm (Grass family) | caryopsis | - | - | - | - | - | - |
| (x) Rumex spp (Dock) | nutlet | - | - | - | - | - | - |
| (x) *Vicia* spp (Vetch) | seed | - | - | - | - | 1 | - |
| Seed - indeterminate | | - | - | - | - | - | - |

[c-cultivated; g-grassland; r-ruderal; t-woodland; w-wetland; x-wide niche]. Relative abundance is based on a scale from 1 (lowest) to 5 (highest). (✓) there may be insufficient weight of carbon available for AMS radiocarbon dating

## **Appendix I** (continued): Data from plant macrofossil analysis (Phase unknown)

| Phase | | Unknown | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Feature | | | | | | | | | | |
| Context | | 11 | 23 | 25 | 37 | 187 | 271 | 339 | 381 | 439 |
| Description | | sub-circular posthole | ovoid pit | large ovoid pit | linear | sub-ovoid posthole | sub-ovoid pit | sub-circular pit | sub-ovoid pit | sub-rectangular pit |
| Sample | | 73 | 37 | 40 | 17 | 5 | 190 | 114 | 149 | 209 |
| *Material available for radiocarbon dating* | | ✓ | ✓ | (✓) | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| *Volume of flot assessed (ml)* | | 250 | 75 | 10 | 20 | 10 | 50 | 25 | 5 | 5 |
| *Flot matrix (relative abundance)* | | | | | | | | | | |
| Bone (calcined) | indet. frags. | - | - | - | - | - | - | - | - | - |
| Bone (unburnt) | indet. frags. | - | - | - | - | - | - | - | - | - |
| Charcoal | | 4 | 2 | 2 | 2 | 3 | 4 | 3 | 2 | 2 |
| Clinker | | - | - | - | - | - | - | - | - | - |
| Coal | | - | - | - | - | - | - | - | - | - |
| Fruitstone (charred) | indet. frags. | - | - | - | - | - | - | - | - | - |
| Insecta | | 1 | - | 1 | - | - | - | 1 | - | - |
| Isopoda (Woodlice) | | - | - | - | - | - | - | - | - | - |
| Roots (modern) | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 |
| Roots/rhizomes (charred) | | 1 | - | - | - | - | - | - | - | - |
| Seeds (uncharred) | | 1 | 2 | 2 | 1 | 1 | 2 | 1 | 1 | 2 |
| Semi-vitrified fuel waste | | 1 | 1 | - | - | 2 | - | - | - | 1 |
| Tubers (charred) | indet. frags. | - | 1 | - | - | - | 2 | - | - | - |
| Vegetative material | misc. | - | 1 | 1 | 1 | - | 2 | 2 | 1 | - |
| *Charred remains (total counts)* | | | | | | | | | | |
| (c) *Avena* spp (oat species) | grain | - | - | - | - | - | - | - | - | - |
| (c) *Hordeum* spp (Barley species) | grain | 6 | 4 | - | - | - | 1 | 11 | - | - |
| (c) *Hordeum* spp (Barley species) | grain (twisted furrow) | - | 1 | - | - | - | - | - | - | - |
| (c) *Hordeum* spp (Barley species) | basal rachis frag. | - | - | - | - | - | - | 1 | - | - |
| (c) *Hordeum* spp (Hulled Barley) | grain | 4 | 2 | 1 | - | - | - | - | - | - |
| (c) *Hordeum* spp (Naked Barley) | grain | - | - | - | - | - | - | - | - | - |
| (c) *Triticum* cf. *dicoccum* (Emmer Wheat) | grain | - | - | - | - | - | - | - | - | 1 |
| (c) *Triticum spelta* (Spelt Wheat) | glume base | - | - | - | - | - | - | - | - | - |
| (c) *Triticum* spp (Wheat species) | grain | 2 | - | - | - | - | - | - | - | - |
| (c) Cerealia indeterminate | grain | 6 | - | - | - | - | 2 | 23 | - | - |
| (g) *Arrhenatherum elatius* ssp *bulbosum* (False Oat-grass) | tuber | - | - | - | - | - | - | - | - | - |
| (r) Polygonaceae undiff. (Knotweed family) | nutlet | - | - | - | - | - | - | - | - | - |
| (t) *Corylus avellana* (Hazel) | nutshell frag. | - | - | - | - | 4 | - | - | 2 | - |
| (t) *Crataegus* spp (Hawthorn) | fruitstone | - | - | - | - | - | - | - | - | - |
| (t) *Crataegus* spp (Hawthorn) | fruitstone frag. | - | - | - | - | - | - | - | - | - |
| (t) Rosaceae (cf. Prunus sp) (Cherry) | fruitstone frag. | - | - | - | - | - | - | - | - | - |
| (w) *Persicaria lapathifolia* (Pale Persicaria) | nutlet | - | - | - | - | - | - | - | - | 1 |
| (x) Poaceae undiff. <4mm (Grass family) | caryopsis | - | 1 | - | - | - | - | - | - | - |
| (x) Poaceae undiff. >4mm (Grass family) | caryopsis | 1 | 1 | - | - | - | - | - | - | - |
| (x) Rumex spp (Dock) | nutlet | - | 11 | - | - | - | - | - | - | - |
| (x) *Vicia* spp (Vetch) | seed | - | - | - | - | - | - | - | - | - |
| Seed - indeterminate | | - | 1 | - | - | - | - | - | - | - |

[c-cultivated; g-grassland; r-ruderal; t-woodland; w-wetland; x-wide niche]. Relative abundance is based on a scale from 1 (lowest) to 5 (highest). (✓) there may be insufficient weight of carbon available for AMS radiocarbon dating

**Appendix I** (continued): Data from plant macrofossil analysis (samples not in environmental list)

| Phase | | samples not in environmental context list | | | |
|---|---|---|---|---|---|
| Feature | | - | - | - | - |
| Context | | 1041 | 1095 | 1030 | 1039? |
| Description | | - | - | - | - |
| Sample | | 69 | 2 | 8 | 68 |
| *Material available for radiocarbon dating* | | - | ✓ | ✓ | ✓ |
| *Volume of flot assessed (ml)* | | 20 | 12 | 15 | 50 |
| *Flot matrix (relative abundance)* | | | | | |
| Bone (calcined) | indet. frags. | - | - | - | - |
| Bone (unburnt) | indet. frags. | - | - | - | - |
| Charcoal | | 2 | 2 | 3 | 3 |
| Clinker | | - | - | - | - |
| Coal | | - | - | - | - |
| Fruitstone (charred) | indet. frags. | - | - | - | - |
| Insecta | | - | - | - | - |
| Isopoda (Woodlice) | | - | - | - | - |
| Roots (modern) | | 3 | 1 | 1 | 1 |
| Roots/rhizomes (charred) | | - | - | - | - |
| Seeds (uncharred) | | 1 | 1 | 1 | 1 |
| Semi-vitrified fuel waste | | - | - | - | - |
| Tubers (charred) | indet. frags. | - | - | - | - |
| Vegetative material | misc. | 1 | 1 | - | - |
| *Charred remains (total counts)* | | | | | |
| (c) *Avena* spp (oat species) | grain | - | - | - | - |
| (c) *Hordeum* spp (Barley species) | grain | - | - | 1 | 6 |
| (c) *Hordeum* spp (Barley species) | grain (twisted furrow) | - | - | 1 | - |
| (c) *Hordeum* spp (Barley species) | basal rachis frag. | - | - | - | - |
| (c) *Hordeum* spp (Hulled Barley) | grain | - | - | - | - |
| (c) *Hordeum* spp (Naked Barley) | grain | - | - | - | - |
| (c) *Triticum* cf. *dicoccum* (Emmer Wheat) | grain | - | - | - | - |
| (c) *Triticum spelta* (Spelt Wheat) | glume base | - | - | - | - |
| (c) *Triticum* spp (Wheat species) | grain | - | - | - | - |
| (c) Cerealia indeterminate | grain | - | 1 | - | 3 |
| (g) *Arrhenatherum elatius* ssp *bulbosum* (False Oat-grass) | tuber | - | - | - | - |
| (r) Polygonaceae undiff. (Knotweed family) | nutlet | - | - | - | - |
| (t) *Corylus avellana* (Hazel) | nutshell frag. | - | - | 1 | - |
| (t) *Crataegus* spp (Hawthorn) | fruitstone | - | - | - | - |
| (t) *Crataegus* spp (Hawthorn) | fruitstone frag. | - | - | - | - |
| (t) Rosaceae (cf. Prunus sp) (Cherry) | fruitstone frag. | - | - | - | - |
| (w) *Persicaria lapathifolia* (Pale Persicaria) | nutlet | - | - | - | - |
| (x) Poaceae undiff. <4mm (Grass family) | caryopsis | - | - | - | - |
| (x) Poaceae undiff. >4mm (Grass family) | caryopsis | - | - | - | - |
| (x) Rumex spp (Dock) | nutlet | - | - | - | - |
| (x) *Vicia* spp (Vetch) | seed | - | - | - | - |
| Seed - indeterminate | | - | - | - | 1 |

[c-cultivated; g-grassland; r-ruderal; t-woodland; w-wetland; x-wide niche]. Relative abundance is based on a scale from 1 (lowest) to 5 (highest). (✓) there may be insufficient weight of carbon available for AMS radiocarbon dating

**Appendix II:** Additional charcoal samples

| Environmental sample | Context | Provisional date | Material | Notes | Type of material suitable for 14C dating | Back-up sample available | Recommended | Notes |
|---|---|---|---|---|---|---|---|---|
| 1 | 657 | A-S | Charcoal | | non-oak charcoal | ✓ | | |
| 2 | 649 | A-S | Charcoal | PBB2 | x | | | oak |
| 3 | 655 | A-S | Charcoal | | non-oak charcoal | | | |
| 4 | 097 | A-S | Charcoal | | non-oak charcoal | ✓ | | |
| 5 | 671 | A-S | Charcoal | PBB1 | non-oak charcoal (very small) | ✓ | | |
| 6 | 665 | A-S | Charcoal | PBB1 | x | | | not suitable |
| 7 | 675 | A-S | Charcoal | PBB1 | x | | | not suitable |
| 8 | 669 | A-S | Charcoal | PBB1 | non-oak charcoal | ✓ | | |
| 9 | 121 | A-S | Charcoal | From pit | non-oak charcoal | ✓ | | |
| 10 | 643 | A-S | Charcoal | PBB2 | non-oak charcoal (very small) | ✓ | | |
| 11 | 641 | A-S | Charcoal | PBB2 | non-oak charcoal | ✓ | | |
| 12 | 645 | A-S | Charcoal | PBB2 | x | | | not suitable |
| 13 | 667 | A-S | Charcoal | PBB1 | non-oak charcoal (very small) | ✓ | | |
| 14 | 081 | A-S | Charcoal | SFB7 | non-oak charcoal | | | |
| 15 | 085 | A-S | Charcoal | SFB7 | non-oak charcoal | | | |
| 16 | 1091 | A-S | Charcoal | PBB2 | non-oak charcoal | | | |
| 17 | 1081 | A-S | Charcoal | PBB2 | x | | | oak |
| 18 | 653 | A-S | Charcoal | PBB2 | non-oak charcoal (very small) | ✓ | | |
| 19 | 245 | A-S | Charcoal | PBB2 | non-oak charcoal | ✓ | | |
| 20 | 1095 | A-S | Charcoal | PBB2 | non-oak charcoal (very small) | | | |
| 21 | 1093 | A-S | Charcoal | PBB2 | non-oak charcoal | ✓ | | |
| 22 | 041 | A-S | Charcoal | PBB2 | x | | | not suitable |
| 23 | 089 | | Charcoal | Pit | non-oak charcoal | | | |
| 24 | 089 | | Charcoal | Pit | non-oak charcoal | ✓ | | |
| 25 | 043 | A-S | Charcoal | | x | | | not suitable |
| 26 | 183 | A-S | Charcoal | | non-oak charcoal | | | |
| 27 | 653 | A-S | Charcoal | | x | | | not suitable |
| 28 | 097 | A-S | Charcoal | | non-oak charcoal | | | |
| 29 | 655 | A-S | Charcoal | | non-oak charcoal (very small) | ✓ | | |
| 30 | 657 | A-S | Charcoal | | non-oak charcoal | ✓ | | |
| 31 | 083 | A-S | Charcoal | | non-oak charcoal | ✓ | | |
| 32 | 085 | A-S | Charcoal | | x | | | not suitable |
| 33 | 679 | A-S | Charcoal | | x | | | oak |
| 34 | 1058 | A-S | Charcoal | | x | | | oak |
| 35 | 1054 | A-S | Charcoal | | x | | | not suitable |
| 36 | 039 | A-S | Charcoal | | x | | | oak |
| 37 | 1066 | A-S | Charcoal | | non-oak charcoal | ✓ | | |
| 38 | 677 | A-S | Charcoal | | x | | | oak |
| 39 | 661 | A-S | Charcoal | | non-oak charcoal | | | |
| 40 | 1093 | A-S | Charcoal | | non-oak charcoal | ✓ | | |
| 41 | 049 | A-S | Charcoal | | non-oak charcoal | ✓ | | |
| 42 | 183 | A-S | Charcoal | | non-oak charcoal | ✓ | | |
| 43 | 1027 | A-S | Charcoal | SFB4 'loom stand' (NE) | non-oak charcoal | ✓ | | |

**Appendix II** (continued)**:** Additional charcoal samples

| Environmental sample | Context | Provisional date | Material | Notes | Type of material suitable for 14C dating | Back-up sample available | Recommended | Notes |
|---|---|---|---|---|---|---|---|---|
| 44 | 051 | A-S | Charcoal | | non-oak charcoal | ✓ | | |
| 45 | 057 | A-S | Charcoal | | non-oak charcoal | | | |
| 46 | 131 | A-S | Charcoal | | non-oak charcoal | | | |
| 47 | 053 | A-S | Charcoal | | non-oak charcoal | ✓ | | |
| 48 | 135 | A-S | Charcoal | | | | | missing |
| 49 | 069 | A-S | Charcoal | | non-oak charcoal | ✓ | | |
| 50 | 147 | A-S | Charcoal | | non-oak charcoal | | | |
| 51 | 013 | A-S | Charcoal | | non-oak charcoal | | | |
| 52 | 061 | A-S | Charcoal | | non-oak charcoal | | | |
| 53 | 055 | A-S | Charcoal | | non-oak charcoal | | | |
| 54 | 011 | A-S | Charcoal | | non-oak charcoal | | | |
| 55 | 091 | A-S | Charcoal | | non-oak charcoal | | | |
| 56 | 1099 | A-S | Charcoal | | x | | | not suitable |
| 57 | 009 | A-S | Charcoal | | non-oak charcoal | ✓ | | |
| 58 | 075 | A-S | Charcoal | | non-oak charcoal | ✓ | | |
| 59 | 181 | A-S | Charcoal | Assoc. with pottery | non-oak charcoal | ✓ | | |
| 60 | 057 | A-S | Charcoal | | non-oak charcoal | ✓ | | |
| 61 | 159 | A-S | Charcoal | | non-oak charcoal | ✓ | | |
| 62 | 011 | A-S | Charcoal | | non-oak charcoal | ✓ | | |
| 63 | 065 | A-S | Charcoal | | non-oak charcoal | ✓ | | |
| 64 | 1114 | A-S | Charcoal | PBB4 | x | | | oak |
| 65 | 075 | A-S | Charcoal | | non-oak charcoal | ✓ | | |
| 66 | 233 | A-S | Charcoal | | non-oak charcoal | ✓ | | |
| 67 | 1128 | A-S | Charcoal | PBB4 | non-oak charcoal | ✓ | | |
| 68 | 1126 | A-S | Charcoal | PBB4 | non-oak charcoal | | | |
| 69 | 1118 | A-S | Charcoal | PBB4 | non-oak charcoal | | | |
| 70 | 1116 | A-S | Charcoal | PBB4 | non-oak charcoal | ✓ | | |
| 71 | 045 | A-S | Charcoal | | non-oak charcoal | ✓ | | |
| 72 | 1/381 | | Soil | Residue analysis | hazel nutshell / non-oak charcoal | ✓ | | |
| 73 | 335 | Neo. | Soil | | | | | missing |
| 74 | 263 | | Charcoal | | non-oak charcoal (fragile) | ✓ | | |
| 75 | 127 | | Charcoal | | non-oak charcoal | | | |
| 76 | 295 | | Seed | | | | | missing |
| 77 | 255 | | Charcoal | | non-oak charcoal | | | |
| 78 | 295 | | Charcoal | | non-oak charcoal | ✓ | | |
| 79 | 125 | | Charcoal | | non-oak charcoal | | | |
| 80 | 301 | | Charcoal | | non-oak charcoal | | | |
| 81 | 297 | Neo. | Charcoal | | non-oak charcoal | ✓ | ✓ | |
| 82 | 293 | | Charcoal | | x | | | oak |
| 83 | 255 | | Hazelnuts | | hazel nutshell | ✓ | ✓ | |
| 84 | 1130 | | Charcoal | | non-oak charcoal | ✓ | | |
| (Missed number) | | | | | | | | |
| 86 | 255 | | Charcoal | | non-oak charcoal | ✓ | | |

**Appendix II** (continued)**:** Additional charcoal samples

| Environmental sample | Context | Provisional date | Material | Notes | Type of material suitable for 14C dating | Back-up sample available | Recommended | Notes |
|---|---|---|---|---|---|---|---|---|
| 87 | 1144 | | Charcoal | | non-oak charcoal | ✓ | | |
| 88 | 113 | | Charcoal | | non-oak charcoal | ✓ | | |
| 89 | 109 | | Charcoal | | non-oak charcoal | ✓ | | |
| 90 | 115 | | Charcoal | | non-oak charcoal | ✓ | | |
| 91 | 263 | | Charcoal | | non-oak charcoal | ✓ | | |
| 92 | 107 | | Charcoal | | non-oak charcoal | ✓ | | |
| 93 | 267 | Neo. | Charcoal | | non-oak charcoal | ✓ | | |
| 94 | 297 | Neo. | Charcoal | | non-oak charcoal | | | |
| 95 | 237 | | Charcoal | | x | | | not suitable |
| 96 | 113 | | Charcoal | | non-oak charcoal (very small) | | | |
| 97 | 1161 | | Charcoal | | non-oak charcoal | ✓ | | |
| 98 | 291 | Neo. | Charcoal | | non-oak charcoal | ✓ | ✓ | |
| 99 | 233 | A-S | Charcoal | PBB5 | non-oak charcoal | ✓ | | |
| 100 | 239 | A-S | Charcoal | PBB6 | x | | | not suitable |
| 101 | 1124 | | Charcoal | | non-oak charcoal (very small) | ✓ | | |
| 102 | 1145 | | Charcoal | | non-oak charcoal | | | |
| 103 | 293 | | Charcoal | | non-oak charcoal | | | |
| 104 | 301 | | Charcoal | | non-oak charcoal | ✓ | | |
| 105 | 235 | | Charcoal | | non-oak charcoal (very small) | ✓ | | |
| 106 | 021 | Neo. | Charcoal | | non-oak charcoal | ✓ | | |
| 107 | 263 | | Charcoal | | non-oak charcoal | ✓ | ✓ | |
| 108 | 275 | Neo. | Charcoal | | non-oak charcoal | ✓ | | |
| 109 | 361 | Neo. | Charcoal | | non-oak charcoal | ✓ | | |
| 110 | 285 | Neo. | Charcoal | | non-oak charcoal | ✓ | | |
| 111 | 265 | | Charcoal | | non-oak charcoal | ✓ | ✓ | |
| 112 | 371 | | Charcoal | | non-oak charcoal | ✓ | | |
| 113 | 331 | | Charcoal | | non-oak charcoal | ✓ | | |
| 114 | 349 | | Charcoal | | non-oak charcoal | ✓ | | |
| 115 | 343 | | Charcoal | | non-oak charcoal | ✓ | | |
| 116 | 339 | | Charcoal | | non-oak charcoal | ✓ | ✓ | incl. twig |
| 117 | 113 | | Charcoal | | non-oak charcoal (very small) | ✓ | | |
| 118 | 307 | | Charcoal | | x | | | oak |
| 119 | 305 | | Charcoal | | x | | | oak |
| 120 | 355 | Neo. | Charcoal | | non-oak charcoal | ✓ | | |
| 121 | 311 | | Charcoal | | x | | | oak |
| 122 | 323 | | Charcoal | | non-oak charcoal | ✓ | | |
| 123 | 361 | Neo. | Charcoal | | non-oak charcoal | ✓ | | |
| 124 | 317 | | Charcoal | | non-oak charcoal | | | |
| 125 | 287 | Neo. | Hazelnuts | | hazel nutshell | | ✓ | |
| 126 | 347 | | Charcoal | | x | | | oak |
| 127 | 335 | Neo. | Charcoal | | non-oak charcoal | ✓ | | |
| 128 | 251 | Neo. | Charcoal | | non-oak charcoal (very small) | ✓ | | |
| 129 | 313 | | Charcoal | | non-oak charcoal | | | |
| 130 | 399 | | Charcoal | | non-oak charcoal | ✓ | | |
| 131 | 309 | | Charcoal | | x | | | oak |
| 132 | 319 | Neo. | Hazelnuts | | hazel nutshell | ✓ | ✓ | |

**Appendix II** (continued)**:** Additional charcoal samples

| Environmental sample | Context | Provisional date | Material | Notes | Type of material suitable for 14C dating | Back-up sample available | Recommended | Notes |
|---|---|---|---|---|---|---|---|---|
| 133 | 317 | | Charcoal | | non-oak charcoal | ✓ | | |
| 134 | 287 | Neo. | Charcoal | | non-oak charcoal | ✓ | | |
| 135 | 375 | | Charcoal | | non-oak charcoal | ✓ | | |
| 136 | 123 | | Charcoal | | non-oak charcoal | ✓ | | |
| 137 | 347 | | Charcoal | | x | | | oak |
| 138 | 283 | | Charcoal | | x | | | oak |
| 139 | 319 | Neo. | Charcoal | | non-oak charcoal | ✓ | | |
| 140 | 113 | | Charcoal | | x | | | not suitable |
| 141 | 1196 | | Charcoal | | non-oak charcoal | ✓ | | |
| 142 | 271 | | Charcoal | | non-oak charcoal | ✓ | | |
| 143 | 265 | | Charcoal | | non-oak charcoal | ✓ | ✓ | |
| 144 | 369 | Neo. | Soil | Residue analysis | | | | missing |
| 145 | 1203 | | Soil | Residue analysis | | | | missing |
| 146 | 477 | | Charcoal | | non-oak charcoal | ✓ | | |
| 147 | 535 | Neo. | Hazelnuts | | hazel nutshell | ✓ | ✓ | |
| 148 | 467 | | Charcoal | | non-oak charcoal | ✓ | | |
| 149 | 535 | Neo. | Charcoal | | x | | | oak |
| 150 | 561 | Neo. | Charcoal | | non-oak charcoal | ✓ | | |
| 151 | 487 | | Charcoal | | x | | | not suitable |
| 152 | 515 | | Charcoal | | non-oak charcoal (roundwood) | ✓ | ✓ | |
| 153 | 513 | | Charcoal | Posthole of PBB14 | x | | | oak |
| 154 | 531 | | Charcoal | | x | | | oak |
| 155 | 359 | | Charcoal | | non-oak charcoal | ✓ | | |
| 156 | 431 | Neo. | Charcoal | | non-oak charcoal (fragile) | ✓ | | |
| 157 | 521 | Neo. | Charcoal | PBB13 | x | | | oak |
| 158 | 419 | | Charcoal | PBB11 | x | | | oak |
| 159 | 997 | | Charcoal | | x | | | oak |
| 160 | 539 | | Charcoal | | x | | | oak |
| 161 | 489 | | Charcoal | | x | | | oak |
| 162 | 603 | | Charcoal | | x | | | oak |
| 163 | 533 | Neo. | Charcoal | | non-oak charcoal | ✓ | | |
| 164 | 493 | | Charcoal | | non-oak charcoal | | | |
| 165 | 527 | | Charcoal | | non-oak charcoal | | | |
| 166 | 413 | | Charcoal | | x | | | oak |
| 167 | 517 | | Charcoal | PBB14 | non-oak charcoal (very small) | | | |
| 168 | 437 | | Charcoal | | non-oak charcoal | ✓ | | |
| 169 | 447 | | Charcoal | PBB14 | non-oak charcoal | ✓ | | |
| 170 | 499 | | Charcoal | | x | | | oak |
| 171 | 455 | | Charcoal | Posthole | non-oak charcoal | | | |
| 172 | 571 | | Charcoal | | x | | | oak |
| 173 | 491 | | Charcoal | | x | | | oak |
| 174 | 469 | | Charcoal | | non-oak charcoal | | | |

## **Appendix II** (continued)**:** Additional charcoal samples

| Environmental sample | Context | Provisional date | Material | Notes | Type of material suitable for 14C dating | Back-up sample available | Recommended | Notes |
|---|---|---|---|---|---|---|---|---|
| 175 | 1207 | | Charcoal | | x | | | oak |
| 176 | 461 | | Charcoal | | x | | | oak |
| 177 | 351 | | Charcoal | | non-oak charcoal | ✓ | | |
| 178 | 475 | Neo. | Charcoal | | non-oak charcoal | ✓ | | |
| 179 | 203 | | Charcoal | PBB5 | non-oak charcoal | | | |
| 180 | 465 | | Charcoal | PBB14 | non-oak charcoal | ✓ | | |
| 181 | 423 | | Charcoal | PBB11 | x | | | oak |
| 182 | 385 | | Charcoal | | non-oak charcoal | ✓ | | |
| 183 | 421 | | Charcoal | PBB11 | x | | | oak |
| 184 | 717 | | Charcoal | | x | | | oak |
| 185 | 975 | | Charcoal | | x | | | oak |
| 186 | 707 | | Charcoal | | x | | | oak |
| 187 | 705 | | Charcoal | | x | | | oak |
| 188 | 589 | Neo. | Hazelnuts | | hazel nutshell | ✓ | ✓ | |
| 189 | 597 | Neo. | Charcoal | | non-oak charcoal | ✓ | | |
| 190 | 625 | | Charcoal | | x | | | oak |
| 191 | 541 | | Charcoal | | non-oak charcoal | ✓ | | |
| 192 | 627 | | Charcoal | | x | | | oak |
| 193 | 941 | | Charcoal | | x | | | oak |
| 194 | 591 | Neo. | Hazelnuts | | hazel nutshell | ✓ | ✓ | |
| 195 | 695 | | Charcoal | | non-oak charcoal | ✓ | | |
| 196 | 595 | Neo. | Hazelnuts | | hazel nutshell | ✓ | ✓ | |
| 197 | 977 | Neo. | Charcoal | | non-oak charcoal | ✓ | | |
| 198 | 921 | | Charcoal | | non-oak charcoal | ✓ | | |
| 199 | 591 | Neo. | Hazelnuts | | hazel nutshell | | ✓ | |
| 200 | 1009 | Neo. | Charcoal | | non-oak charcoal | ✓ | ✓ | |
| 201 | 595 | Neo. | Charcoal | | non-oak charcoal | ✓ | | |
| 202 | 945 | | Charcoal | | non-oak charcoal | ✓ | | |
| 203 | 593 | Neo. | Hazelnuts | | non-oak charcoal | ✓ | ✓ | |
| 204 | 937 | | Charcoal | | non-oak charcoal (roundwood) | | ✓ | |
| 205 | 595 | Neo. | Hazelnuts | | hazel nutshell | ✓ | ✓ | |
| 206 | 907 | | Charcoal | | non-oak charcoal | ✓ | | |
| 207 | 589 | Neo. | Hazelnuts | | hazel nutshell | ✓ | ✓ | |
| 208 | 925 | | Charcoal | | x | | | oak |
| 209 | 949 | Neo. | Charcoal | | non-oak charcoal | ✓ | | |
| 210 | 723 | | Charcoal | | x | | | oak |
| 211 | 943 | | Charcoal | | x | | | oak |
| 212 | 927 | | Charcoal | | x | | | oak |
| 213 | 597 | Neo. | Hazelnuts | | hazel nutshell | ✓ | ✓ | |
| 214 | 533 | Neo. | Charcoal | | non-oak charcoal | ✓ | | |
| 215 | 977 | Neo. | Hazelnuts | | hazel nutshell | ✓ | ✓ | |
| 216 | 975 | | Hazelnuts | | hazel nutshell | | ✓ | |
| 217 | 591 | Neo. | Charcoal | | non-oak charcoal | ✓ | | |
| 218 | 589 | Neo. | Charcoal | | x | | | not suitable |
| 219 | 593 | Neo. | Charcoal | | non-oak charcoal | ✓ | | |
| 220 | 587 | | Charcoal | | non-oak charcoal | ✓ | | |

**Appendix II** (continued)**:** Additional charcoal samples

| Environmental sample | Context | Provisional date | Material | Notes | Type of material suitable for 14C dating | Back-up sample available | Recommended | Notes |
|---|---|---|---|---|---|---|---|---|
| 221 | 973 | Neo. | Charcoal | | non-oak charcoal | ✓ | | |
| 222 | 595 | Neo. | Charcoal | | non-oak charcoal | ✓ | | |
| 223 | 1013 | Neo. | Charcoal | | non-oak charcoal (small) | ✓ | | |
| 224 | 721 | | Charcoal | | x | | | oak |
| 225 | 967 | | Charcoal | | x | | | oak |
| 226 | 955 | | Charcoal | | x | | | oak |
| 227 | 535 | Neo. | Charcoal | | non-oak charcoal | | | |
| 228 | 535 | Neo. | Hazelnuts | | hazel nutshell | | ✓ | |
| 229 | 941 | | Charcoal | | x | | | oak |
| 230 | 695 | | Charcoal | In-situ burning | non-oak charcoal | ✓ | ✓ | |
| 231 | 607 | | Charcoal | | x | | | oak |
| 232 | 599 | | Charcoal | | x | | | not suitable |
| 233 | 743 | | Charcoal | | x | | | oak |
| 234 | 783 | Neo. | Charcoal | | hazel nutshell / non-oak charcoal | ✓ | ✓ | |
| 235 | 899 | Neo. | Fruit/Seed | | Pyrus/Malus sp (fruit) | | ✓ | |
| 236 | 973 | Neo. | Charcoal | | non-oak charcoal | ✓ | | |
| 237 | 863 | | Charcoal | | x | | | oak |
| 238 | 799 | Neo. | Charcoal | | x | | | oak |
| 239 | 853 | | Charcoal | | non-oak charcoal | | | |
| 240 | 779 | | Charcoal | | hazel nutshell | ✓ | ✓ | |
| 241 | 785 | | Charcoal | | non-oak charcoal | ✓ | ✓ | |
| 242 | 853 | | Hazelnuts | | hazel nutshell | ✓ | ✓ | |
| 243 | 817 | | Charcoal | | x | | | oak |
| 244 | 861 | | Charcoal | | non-oak charcoal | | | |
| 245 | 779 | | Hazelnuts | | hazel nutshell | ✓ | ✓ | |
| 246 | 959 | | Charcoal | | x | | | oak |
| 247 | 957 | | Charcoal | | x | | | oak |
| 248 | 953 | | Charcoal | | x | | | oak |
| 249 | 737 | | Charcoal | | x | | | oak |
| 250 | 961 | | Charcoal | | x | | | oak |
| 251 | 763 | | Charcoal | | non-oak charcoal | | | |
| 252 | 791 | | Charcoal | | x | | | oak |
| (Missed number) | | | | | | | | |
| 253 | 777 | | | | x | | | oak |
| 254 | 777 | | Charcoal | | | | | missing |
| 255 | 801 | | Hazelnuts | | hazel nutshell | ✓ | ✓ | |
| 256 | 975 | | Charcoal | | x | | | oak |
| 257 | 749 | Neo. | Charcoal | | non-oak charcoal | ✓ | | |
| 258 | 799 | Neo. | Hazelnuts | | hazel nutshell | ✓ | ✓ | |
| 444 | 319 | | | | non-oak charcoal | ✓ | ✓ | extra sample |

**Lanton Cremated Bone Samples Assessment**

**Alex Thornton**
**ARS Ltd**

The section headings in the following assessment report refer to those in the 'Management of Archaeological Projects' (HBMC 1991), Appendix 4.

## 1. FACTUAL DATA

### 1.1 *Quantity*

A total of thirty cremated bone samples were recovered from the Lanton excavations and were identified as being of prehistoric and early medieval date.

### 1.2 *Provenance*

Table 1 below lists the contexts from which the material was recovered. These comprised isolated postholes, pits and hearths, as well as post-built buildings and structures, and sunken-featured buildings.

### 1.3 *Dating*

Provisional dating has been supplied by material culture found with each sample (primarily lithics and ceramics of various periods) and is included in Table 1.

### 1.4 *Range and variety*

Within the cremated bone assemblage were fragments of lower limb, upper limb, skull and axial skeleton. Specifically identified fragments were two metacarpals (Table 1).

Table 1 Environmental samples from Lanton Quarry

| Context no. | Description | Assigned date | Total weight (g) | Weight Sieve fraction of 10mm (g) | Weight Sieve fraction of 5mm (g) | Weight Sieve fraction of 2mm (g) | Specifically identifiable fragments |
|---|---|---|---|---|---|---|---|
| 255 | Circular pit | Neolithic | <0.01 | 0 | <0.01 | <0.01 | |
| 257 | Circular hearth | Neolithic | <0.01 | 0 | 0 | <0.01 | |
| 1182 | Ovoid pit PPB8 | Neolithic | <0.01 | 0 | 0 | <0.01 | |
| 319 | Sub-ovoid pit with internal posthole PBB10 | Neolithic | <0.01 | 0 | 0 | <0.01 | |
| 323 | Circular hearth PBB10 | Neolithic | <0.01 | 0 | 0 | <0.01 | |

| Context no. | Description | Assigned date | Total weight (g) | Weight Sieve fraction of 10mm (g) | Weight Sieve fraction of 5mm (g) | Weight Sieve fraction of 2mm (g) | Specifically identifiable fragments |
|---|---|---|---|---|---|---|---|
| 399 | Sub-circular hearth PBBB12 | Neolithic | 5.52 | 4.68 | 0.84 | <0.01 | Lower limb (x3), Upper limb (x2), skull (x1) |
| 799 | Circular hearth PBB15 | Neolithic | <0.01 | 0 | 0 | <0.01 | |
| 597 | Ovoid pit Feature 15 | Neolithic | 1.94 | 0.74 | 0.13 | 2.81 | Skull (x2) |
| 533 | Circular pit | Neolithic | 50.3 | 27.41 | 18.15 | 4.74 | Lower limb (x3), Upper limb (x3), skull (x7) |
| 1013 | Circular pit | Neolithic | <0.01 | 0 | <0.01 | 0 | |
| 181 | Sub-circular pit | Neolithic | 2.06 | 0.9 | 0.86 | 0.3 | Lower limb (x1) |
| 571 | Sub-circular pit | Neolithic | 7.47 | 4.91 | 2.09 | 0.47 | |
| 1189 | Sub-ovoid pit | Neolithic | 1.09 | 0 | 0.88 | 0.21 | |
| 465 | Sub-circular posthole | Bronze Age | 8.16 | 4.67 | 2.76 | 0.73 | Lower limb (x4), metacarpal (x1) |
| 467 | Sub-circular western posthole of a double posthole | Bronze Age | <0.01 | 0 | 0 | <0.01 | |
| 469 | Sub-circular eastern posthole of a double posthole | Bronze Age | <0.01 | 0 | 0 | <0.01 | Upper limb (x1) |
| 477 | Sub-circular pit | Bronze Age | 5.69 | 2.77 | 2.05 | 0.87 | Lower limb (x1), metacarpal (x1) |
| 479 | Sub-circular pit | Bronze Age | 3.91 | 3.21 | 0.7 | 0 | Lower limb (x5) |
| 475 | Sub-ovoid pit | Bronze Age | 3.6 | 2.04 | 0.99 | 0.57 | |
| 015 SFB1 | Sub-rectangular sunken floor building | Early medieval | <0.01 | 0 | 0 | <0.01 | |

| Context no. | Description | Assigned date | Total weight (g) | Weight Sieve fraction of 10mm (g) | Weight Sieve fraction of 5mm (g) | Weight Sieve fraction of 2mm (g) | Specifically identifiable fragments |
|---|---|---|---|---|---|---|---|
| 281 SFB6 | Sub-rectangular sunken floor building | Early medieval | 6.31 | 4.66 | 1.65 | 0 | Lower limb (x2) |
| 377 | Hearth | Unknown | 0.63 | 0 | 0.63 | 0 | |
| 439 | Sub-rectangular pit | Unknown | 4.92 | 4.07 | 0.85 | <0.01 | Lower limb (x1) |
| 599 | Circular pit | Unknown | 9.74 | 6.27 | 2.01 | 1.46 | Lower limb (x4), upper limb (x4), skull (x1) |
| 943 | Ovoid pit | Unknown | 0.49 | 0 | 0.44 | 0.05 | |

## 1.5 *Contamination*

There is little possibility that any of the assemblage was contaminated, as the site lies wholly with an agricultural landscape.

## 1.6 *Condition*

Although 68% of the cremated bone fragments are over 10mm and some of the bone was able to be placed into one of four categories (skull, axial skeleton, lower limb and upper limb), the fragments were generally difficult to identify more precisely than by category. This is because of the poor preservation of the bone, possibly due to post depositional disturbance on site.

## 1.7 *Primary sources and documentation*

N/A

## 1.8 *Methodology*

All features were excavated by hand and all cremated bone excavated was bagged via context separately, in sealed plastic bags. Each bag was assigned a unique finds number, which was written on each sample bag, along with context information. A sample register, context register and context sheets were supplied with the samples. The methods which were applied for analysis of the cremated bones occur within Brickley and McKinley's *'Guidelines to the Standards for Recording Human Remains'* (2004). The total weight of the bone for each context was obtained using a BB Adam electronic scale and the bone from each context was passed through three sieve fractions of 10mm, 5mm and 2mm. The fragment size of the largest piece of cremated bone within each context was also recorded. Every fragment was examined in order to determine any identifiable material and these were separated into four skeletal areas; the skull, the axial skeleton, the upper limb and the lower limb.

Using the weights of the sieve fractions and maximum bone fragment size an evaluation of the bone fragmentation for the assemblage was complied. The identifiable bone fragments were examined for any duplications.

## 2. STATEMENT OF POTENTIAL

### 2.1 *Value of the Data*

The cremated bone material has a low potential for assisting with answering questions posed by the Lanton Project Design. Furthermore, the fragmentary and incomplete nature of a cremated assemblage renders it difficult to determine if the assemblage is human or animal.

2.2 Contextual data relative to the recovery of the bone may be utilised to inform upon the placement of cremated bone during the Neolithic, Bronze Age and early medieval. However, these site specific questions must be approached with caution, due to the uncertainty of species identification.

## 3. ARCHIVE REQUIREMENTS

### 3.1 *Storage and Curation*

The cremated bone is presently contained in sealed, labelled plastic bags. Each context is individually bagged. These bags are stored in a plastic storage box.

## 4. REFERENCES

Brickley, M. and McKinley, J.I. (ed.) 2004. 'Guidelines to the Standards for Recording Human Remains' Institute of Field Archaeologists / British Association of Biological Anthropology and Osteoarchaeology: University of Reading.

HBMC 1991. *Management of Archaeological Reports*. English Heritage.

# Geochemical Survey at Lanton Quarry, Northumberland 2006

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AAC Report 805

December 2008

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# Geochemical Survey at Lanton Quarry, Northumberland 2006

## *AAC Report 805*

December 2008

***Archaeo-Analytic University of Durham***

## Contents

# 1 Geochemical Survey at Lanton Quarry, Northumberland.

## 1.1 Study Area

This report details the geochemical analysis of soil samples from Lanton Quarry, Northumberland with the aim of establishing the distribution patterns of potential anthropogenic indicators across selected areas of the site. The areas identified for analysis were the five features considered to be sunken floored buildings (SFB). A detailed elemental analysis was undertaken for the macro and micro nutrients within the soil in addition to the measurement of the soil's magnetic susceptibility. The results are presented as distribution plots of the variation in concentration of the measured parameters.

## 1.2 The Sample Set

A total of 784 samples were analysed from the areas of features SFB 2, 3, 4, 5 and 6. Each area was sampled at 0.5 metre interval over an area of approximately 45 squ metres. This would provide an indication as to any broad zones of activity in and around the features and establish whether any consistent patterns were apparent between the 5 features.

## 1.3 Analytical techniques

Analysis was undertaken using energy dispersive X-ray fluorescence (EDXRF) on the < 2 mm fraction. The samples were dried at 50 deg. C, ground to a fine powder and pelletised at a pressure of 15 tonnes. The elemental concentrations were measured using an Oxford Instruments ED2000 EDXRF spectrometer employing a silver anode X-ray tube running at 10 kV. The system was calibrated with a suit of 10 multi element soil standards. Measurements were taken for the elements sodium, magnesium, aluminium, silicon, phosphorus, sulphur, chlorine, potassium, calcium, titanium, manganese, and iron.

The magnetic susceptibility was measured on the < 1 mm fraction using a Bartington MS2 magnetic susceptibility meter and a MS2G sensor.

Full details of the analytical techniques and the methodology are reported in the appendices.

# 2 Survey Results

## 2.1 Display

Summary colour coded plots of the analytical data are produced for the elements magnesium, aluminium, silicon, phosphorus, sulphur, potassium, calcium, titanium, manganese and iron in addition to the results of the magnetic susceptibility measurements. The results for sodium and chlorine are not plotted as the concentrations were below the minimum detectable levels. Trend surface analysis ( see appendix) was not deemed appropriate as the sampled areas were not contiguous.

A colour scale accompanies each plot showing the maximum and minimum percentage element concentrations.

## 2.2 Discussion of Results

The full analytical results are shown in tables 1, 2, 3 and 4 and the distribution plots of the particular elements of interest and the magnetic susceptibility are presented in figures 1 to 10. The plots are arranged by element to facilitate the comparison of the five areas and the discussion will be structured in a similar manner. The discussion is based very much on the empirical observation of the element distribution both within and between the sampled areas as whilst anthropogenic activities will effect the nature of the archaeological deposits, the local geology, soil type, topography and history of land use will all have an major influence on the way the anthropogenic signals are preserved within the deposits. During the discussion it is assumed that there could also be an alternative explanation for the observed variations based on differences in preservation of the anthropogenic signal.

### *2.2.1 **Phosphorus** (figure 1)*

Phosphorus is considered to be the most reliable elemental indicator of anthropogenic activity and as such one could assume that similarities would be observed in the distribution of phosphorus across the areas. This clearly not the case. The plot across SFB4 shows a very marked delineation of high phosphorus values within the confines of the structure with some zoning of the higher values across the middle and to the eastern end of the structure. This distribution pattern is what could be expected from structures that have been occupied for a reasonable length of time with specific tasks being undertaken in specific areas. Particularly if there is no regular cleaning regime. Conversely the negative pattern to this may be expected if the structure was continually cleaned and the debris/waste deposited away from the living area and there is some suggestion of this in the plot for SFB5. The plot across SFB6 shows some similarity with SFB4 although not as clearly defined however the presence of elevated concentrations along the south east side should be noted. A further difference is apparent in SFB 2 and SFB3 which show reduced levels in the centre of the structures increasing towards the outer limits.

It is possible that these observed differences are due to the use of the structures for different purposes, perhaps SFB4 and possibly SFB6 as a workshop or even an animal shelter due to the high levels of phosphorus where as SFB5 would be living quarters.

### ***2.2.2 Magnetic Susceptibility** (figure 2)*

All areas show a remarkably similar distribution with the SFB structures clearly delineated with all low values inside the features and high values around the outside. High magnetic susceptibility values are often associated with hearths and the build up and decomposition of organic waste and whilst the high values outside the structures could be explained by the discard of organic material one would perhaps have expected some evidence of hearths within the structures themselves.

### ***2.2.3 Manganese** (figure 3)*

All distribution plots show remarkably similar patterns with high values across the features and clearly defined areas of very high manganese concentrations around the inner perimeter of the structures. The measured concentration range for the element is wide with the highest concentrations over twice the value of what could be considered 'normal background' levels. Build up of manganese across archaeological areas has been associated with compaction leading to 'gleying' within deposits and there could provide some explanation in this instance with the sunken edges of the features being compacted and supported by some form of wooden structure.

#### *2.2.4 Sulphur (figure 4)*

These plots are included for completeness and to record that discrete areas of high values are confined to the inside of the structures.

#### *2.2.5 Aluminium, iron and titanium (figures 5, 6 and 7)*

The distribution patterns for these elements are generally similar in relatively undisturbed soil and can give an insight into the general nature of the soil and any changes across the sampled area. They can therefore highlight areas of erosion, removal of soil horizon, provide evidence as to the extent of disturbance within deposits and identify any changes in the underlying geology. Considering the distribution of these elements is also particularly useful in assessing and interpreting the distribution of the more well defined anthropogenic indicators e.g. phosphorus.

The distribution plots show a fairly homogeneous distribution across all areas with typical concentration ranges indicating little change in the general characteristics of the soil.. There are however a number of discrete areas of enhancement or depletion which should be noted.

The SFB 2 and 3 area shows a pronounced change in deposit type along the northern edge. This is defined by low concentrations of both iron and titanium and to some extent aluminium.

Within the areas of SFB 4 and 5 there are consistent discrete areas of enhancement values and a correlation between the three elements particularly along the southern perimeter indicating mineral rich deposits.

In the case of the area of SFB 6 there is however a noticeable difference in the general patterns. Whilst iron and aluminium show a strong positive correlation across the area particularly in the identification of mineral rich deposits towards the north and west, titanium shows a negative correlation with enhancement centred within the structure. There is no clear explanation of this phenomenon.

#### *2.2.6 Silicon (figure 8)*

As with the aluminium iron and titanium this shows a reasonably homogeneous distribution across the site with a typical concentration range. This supports the evidence that the general soil characteristics within the four areas are similar. Discrete areas showing lower concentrations generally correlate with more mineral rich deposits.

#### *2.2.7 Potassium and magnesium (figures 9 and 10)*

The distribution of these elements is difficult to interpret in terms of the archaeology. It is probable that the general variations are due to factors such as drainage and soil coverage across the areas. There are however a number of anomalies which may be associated with archaeological features.

Both these elements are often associated with hearths or areas of burning due to their relatively high concentrations in wood ash. From the distribution plots there appears to be some correlation between the two elements however this is not consistent across all areas. The internal area of SFBs 2, 3 and 6 show noticeable depletion of both elements with very similar distribution patterns however SFBs 4 and 5 show little similarity although there is a suggestion of a negative correlation across the internal area of SFB 5. . The concentration level and range for magnesium is however low and narrow and most probably reflects the variation in the natural soil matrix.

### *2.2.8 Calcium (figure 11)*

The range of calcium values across all areas is generally low. In areas of SFBs 2, 3, and 4 the distribution is homogenous with little evidence of any discrete deposits of calcium rich material such as bone or shell. The areas covering SFBs 5 and 6 show much lower overall levels however attention is drawn to what could be discrete calcium rich deposits inside SFB 5 stretching from the north west corner to the centre of the structure and within the south east corner of SFB 6. It should be noted that these correlate well with the distribution of sulphur in these areas suggesting that they are anthropogenic in origin.

# 3 Conclusion

The survey has detected a number of areas of potential archaeological activity and within these areas a variety of levels and types of activity. Although the survey has identified some consistent patterns across the areas in general, highlighting particularly the existence of the SFB structures, there is little that is immediately identifiable within the structures themselves. The main indicators for suggested areas of anthropogenic activity are considered to be phosphorus and magnetic susceptibility however there are some inconsistencies in the observed distribution patterns for these indicators which cannot immediately be explained. Manganese and sulphur have also provided some supporting evidence for identification of the structures. Aluminium, titanium and iron have shown the nature and variation in the soil coverage across the area.

It is clear that the existence of the SFB structures and the past activity associated with these has produced indicators preserved within the soil matrix. The observed phenomenon however appears particularly complex and are not as one would have initially expected. Whilst there is some correlation of the distribution patterns between the different areas this is not consistent suggesting that either the various structures may have had different functions or that they have been in use for different lengths of time.

The initial analysis of the data has produced some intriguing information however the volume of data and the level of detail within the data are such that it would provide a good opportunity for further analysis and research in order to expand the understanding of the impact of anthropogenic activity on sediments and the level of preservation within deposits.

# 4 Appendix

## 4.1 Multi-Element Soil Analysis: the technique

Multi-element geochemical survey relies upon the assumption that changes occur within the soil chemistry of an area as a result of human intervention and that the function of various structures in and around archaeological sites is reflected in the elemental composition of the associated deposits. Thus, where as geophysical surveys can inform on the type of structures present on sites, geochemical analysis has the potential for more specific archaeological interpretations for the use of space in and around archaeological settlements.

The method utilises energy dispersive X-ray fluorescence (EDXRF) to provide a rapid quantitative multi-element analysis of soils from archaeological deposits/sites. The technique allows for the simultaneous accurate analysis of all the major and minor elements present within the sample thus providing a detailed characterisation of the soil. The elements under investigation are sodium (Na), magnesium (Mg), aluminium (Al), silicon (Si), phosphorus (P), sulphur (S), potassium (K), calcium (Ca), titanium (Ti), manganese (Mn) and iron (Fe) The group was chosen as it includes 11 of the 16 most abundant geological elements, five of which are soil macronutrients (Ca, Mg, K, P & S) and two micronutrients (Mn & Fe).

## 4.2 Analytical Method

### *4.2.1 Sample preparation*

The samples are dried and sieved to collect the < 2mm fraction. This is ground to a fine powder and 0.5 grams of this are pressed into a 13mm diameter pellet ready for analysis.

### *4.2.2 Analysis*

The analysis is undertaken using an Oxford Instruments ED2000 energy dispersive X-ray fluorescence spectrometer (EDXRF) employing a silver anode X-ray tube running at 10kV. All analyses are carried out under vacuum to allow detection of the low atomic number elements and the spectra are collected for a live time of 100 seconds.

Simultaneous analysis is undertaken for the elements sodium (Na), magnesium (Mg), aluminium (Al), silicon (Si), sulphur (S), potassium (K), calcium (Ca), titanium (Ti), manganese (Mn) and iron (Fe)). The results being calibrated using an intensity based correction model (LaChance and Traill 1967; Lucas-Tooth and Price 1961; Lucas-Tooth and Pyne 1964) derived from the analysis of a suit of eight international soil standards.

The results as weight percent of element are then transferred to appropriate software for statistical analysis and mapping.

## 4.3 Presentation

The raw data for each element are mapped as separate two dimensional colour coded images using a scaling based on the rainbow sequence of colours. This offers a smooth transition from indigo and blue that represent low values, through yellow, to orange and red that represent the high values, and provides a very intuitive means of visually interpreting the data. This empirical observation also takes into account such factors as the topography of the area, the geology and, for example, the history of land use. When appropriate, interpolation of the raw data, using a spherical kriging model (Isaaks and Srivastava 1989), is undertaken to further aid visualisation and facilitate comparison between data sets.

Further interrogation of the data may be undertaken using Trend Surface analysis (Davis 1986). The data are separated into two components. The widespread or regional variations across the area, and the local deviations from this trend, thus producing a simulation of the broad features, which may be seen as background variation, and, through observation of the residuals, highlighting any local anomalies (Clogg and Ferrell 1993). The results are again presented as colour coded maps as above.

### 4.4 References

Clogg P. & Ferrell G. 1993 'Geochemical survey in Northumberland' Northern Archaeology 11, 43-50

Davis J. C. 1986 Statistics and data analysis in Geology - 2nd edition. New York, J. Wiley & Sons

Isaaks E.H. & Srivastava R.M. 1989 An Introduction to Applied Geostatistics. Oxford, Oxford University Press.

LaChance, G.R. & Traill, R.J. 1967 "A new approach to X-ray Spectrochemical analysis", Geological Survey of Canada, 64-57 Ottawa Canada.

Lucas-Tooth, H.J. & Price, B.J., 1961 "A mathematical method for investigation of inter-element effects in X-ray fluorescent analysis", Metallurgia, Vol 64 No 383 p149

Lucas-Tooth, H.J. Pyne, C., 1964 "The accurate determination of major constituents by X-ray fluorescence analysis in the presence of large interelement effects", Advances in X-ray Analysis, Vol 7, Plenum Press 523, New York.

## 5 Magnetic Susceptibility

### 5.1 Introduction

Magnetic susceptibility is a measure of how magnetic a sample is. This can provide information on the minerals found in soils and sediments and hence the processes of their formation. Enhancement of magnetic susceptibility of soils can be attributed to heating or burning and to a lesser extent by fermentation caused by bacterial action on organic deposits and can therefore indicate anthropogenic activity.

### 5.2 Sample preparation

The samples are dried and sieved to collect the < 1mm fraction.

### 5.3 Analysis

The measurements were undertaken on a known volume of sample using a Bartington MS2 magnetic susceptibility meter and a MS2G single frequency sensor for 1cc samples.

### 5.4 Presentation

The magnetic susceptibility results were plotted as colour coded images as with the elemental data (Appendix section 1.3)

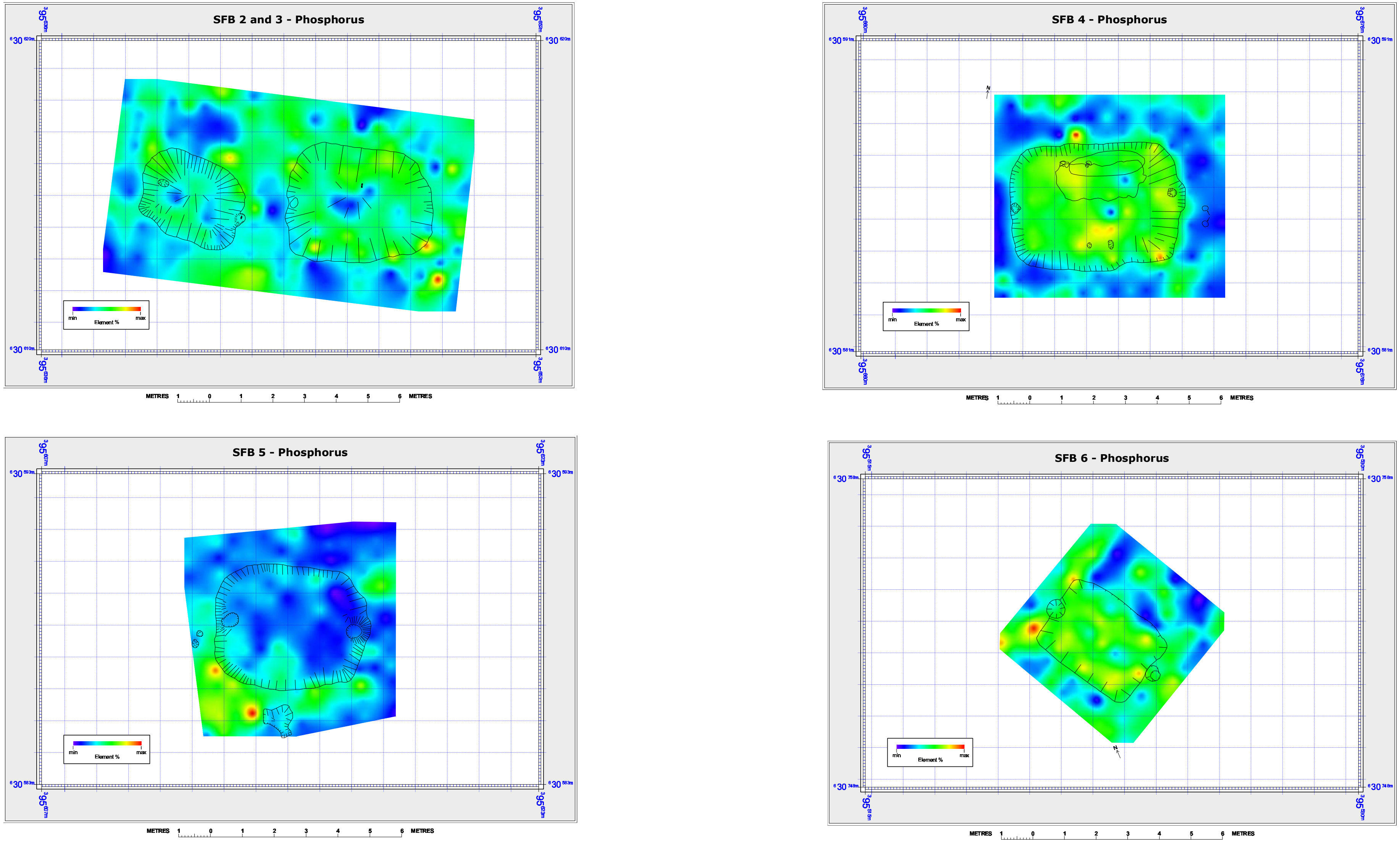



*Figure 1. Distribution plots for phosphorus across the SFB areas. Concentration range min = 0.08%, max = 0.5%.*

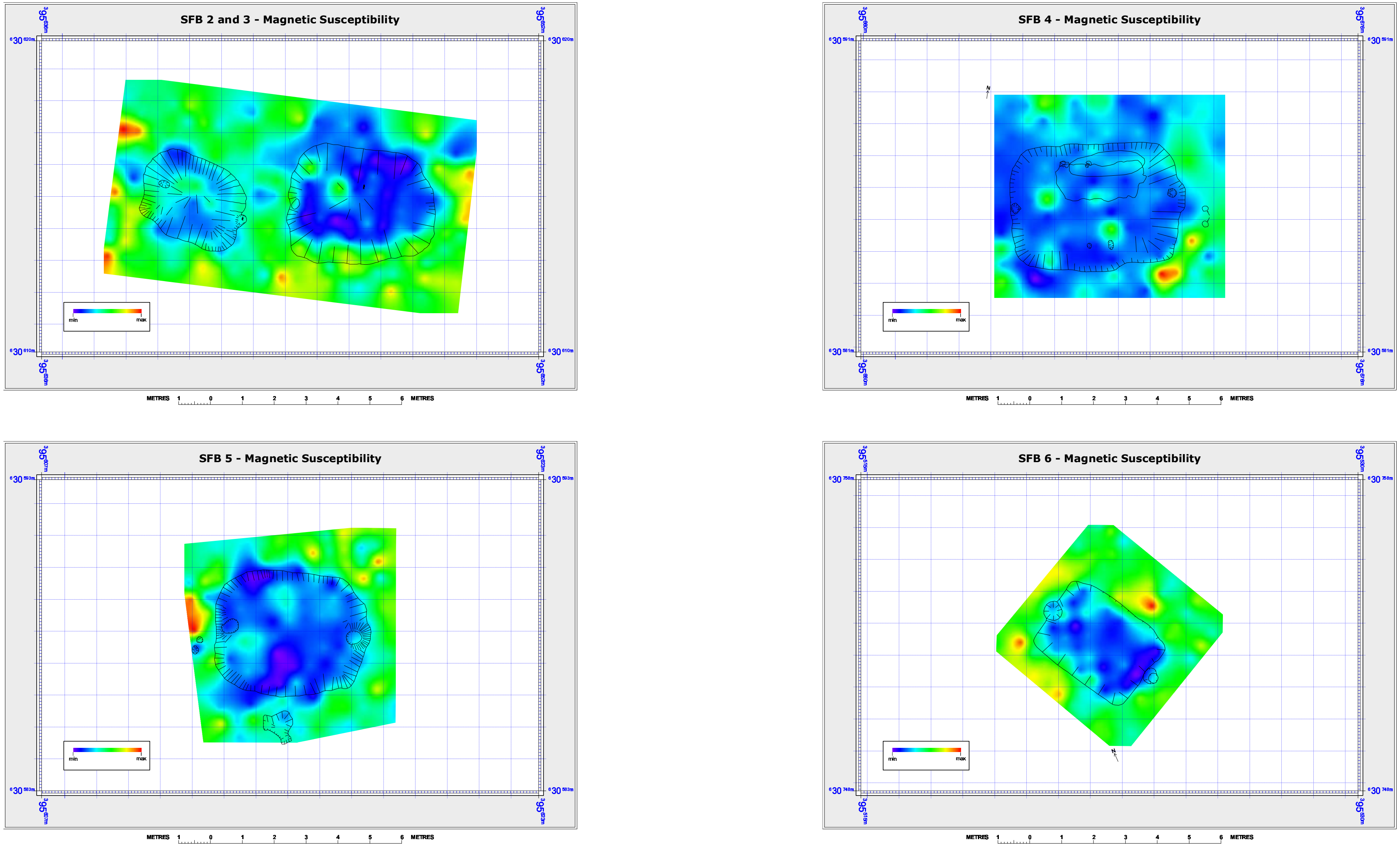



*Figure 2. Distribution plots for magnetic susceptibility across the SFB areas. Measurement range min = 30, max = 150.*

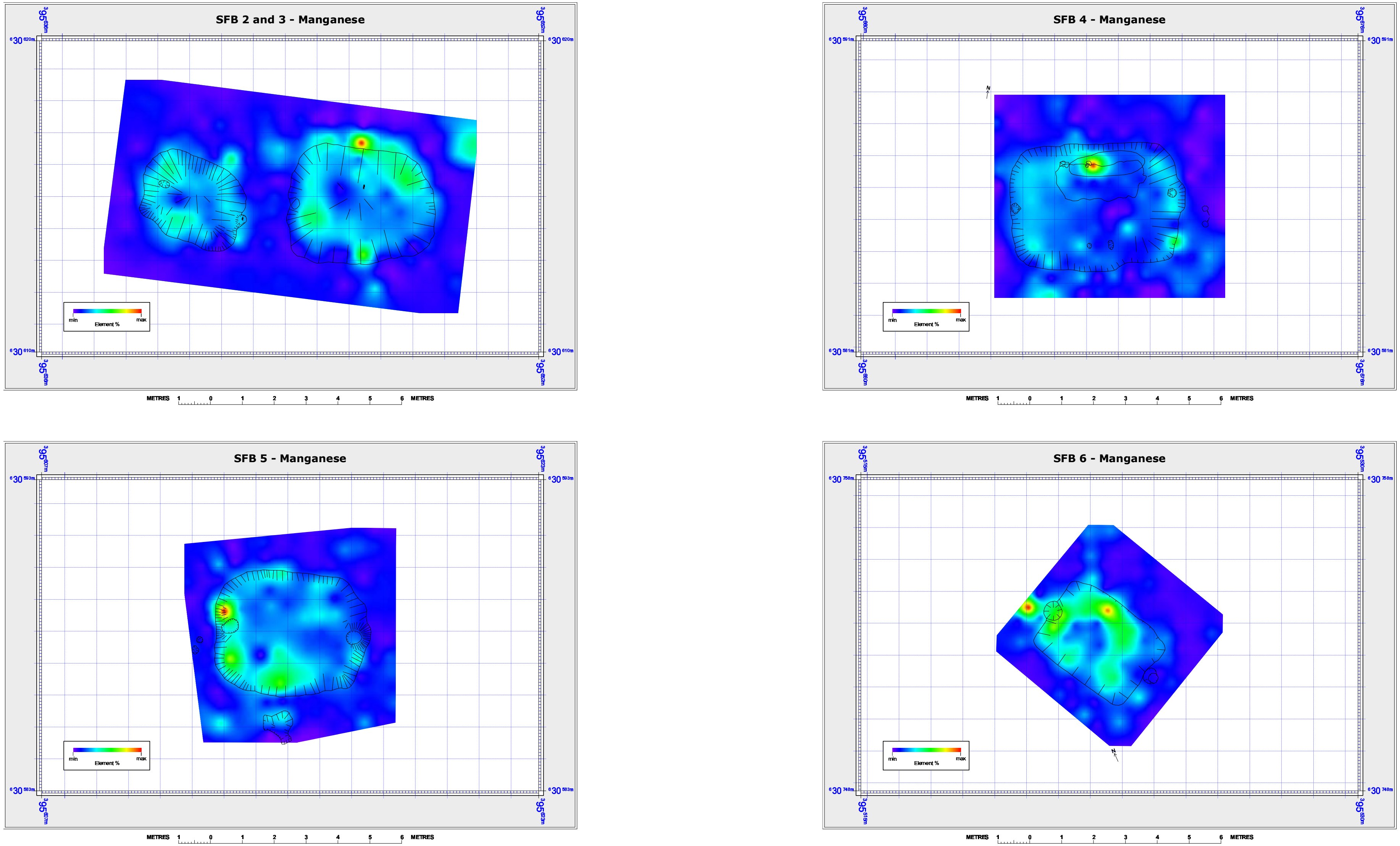



*Figure 3. Distribution plots for manganese across the SFB areas. Concentration range min = 0.01%, max = 0.5%.*

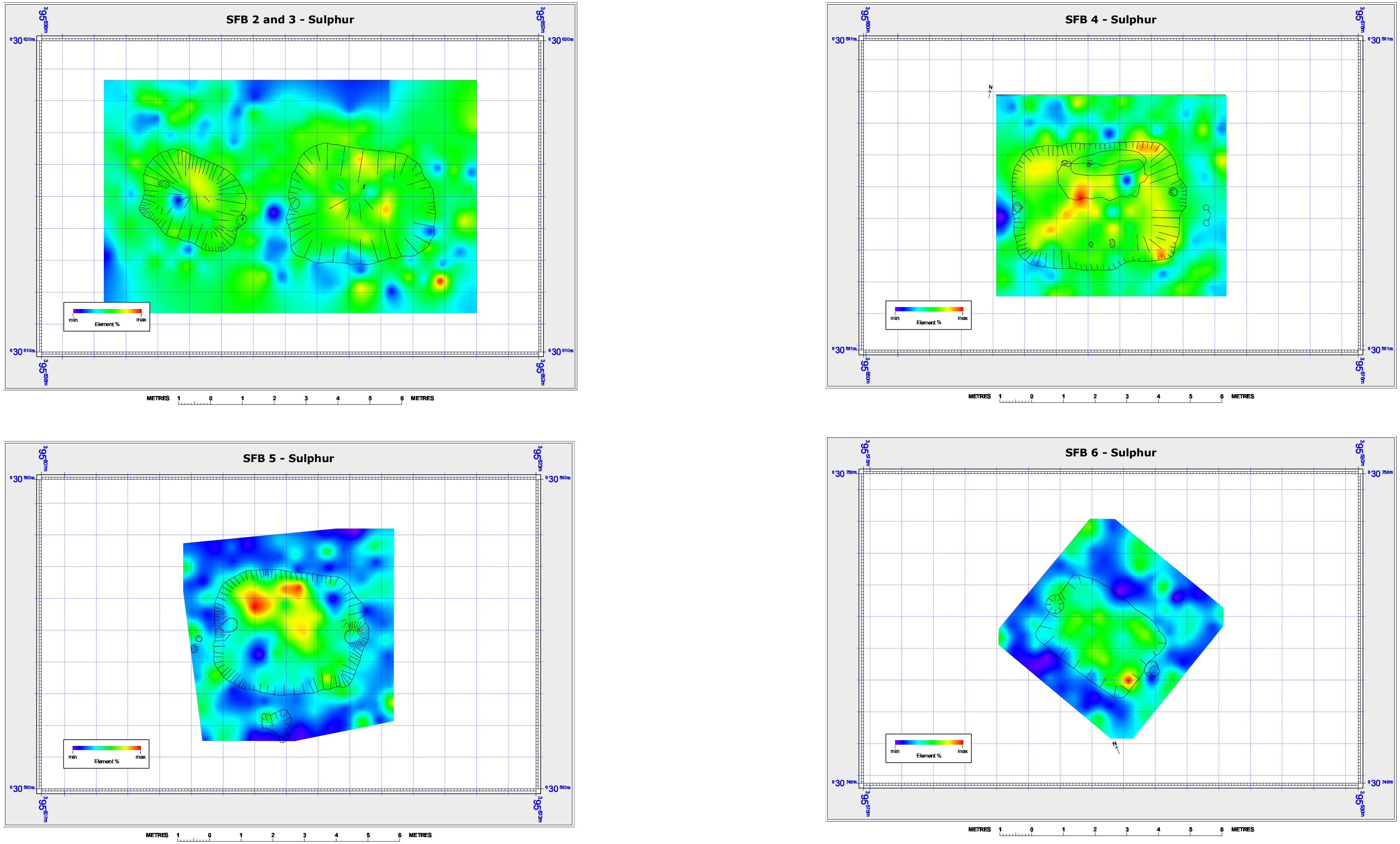



*Figure 4. Distribution plots for sulphur across the SFB areas. Concentration range min = 0.01%, max = 0.05%.*

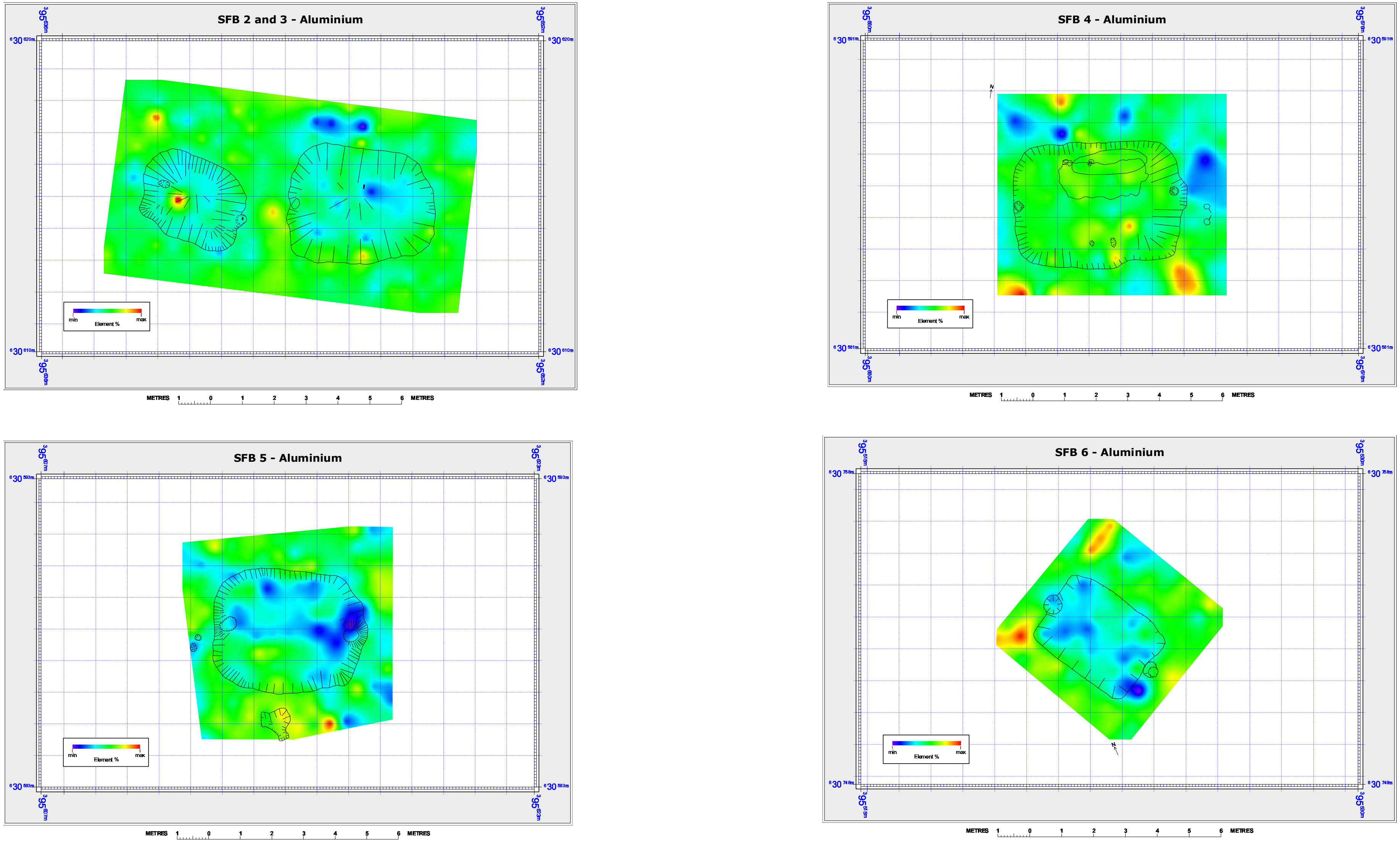



*Figure 5. Distribution plots for aluminium across the SFB areas. Concentration range min = 2%, max = 6.0%.*

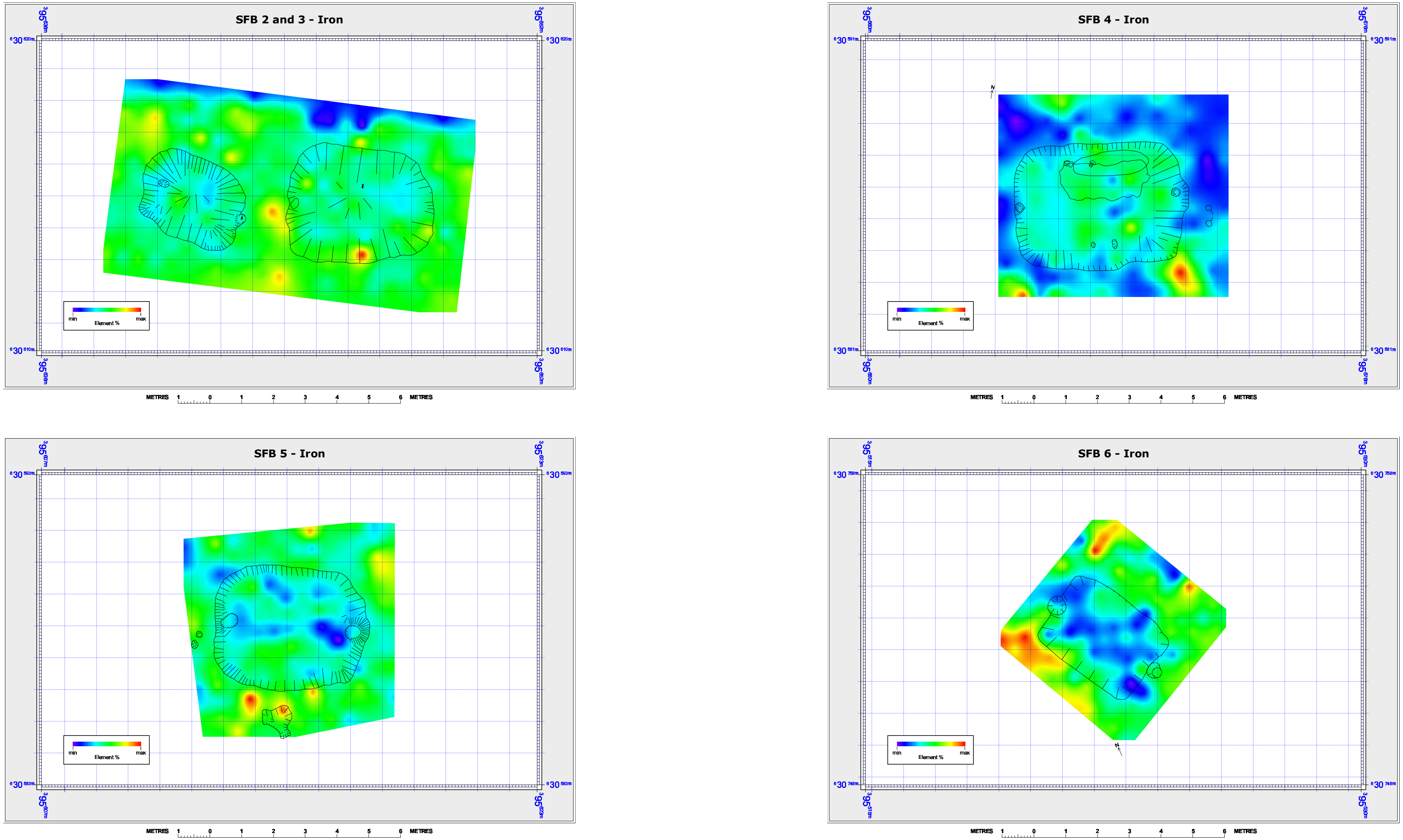



*Figure 6. Distribution plots for iron across the SFB areas. Concentration range min = 2%, max = 4.5%.*

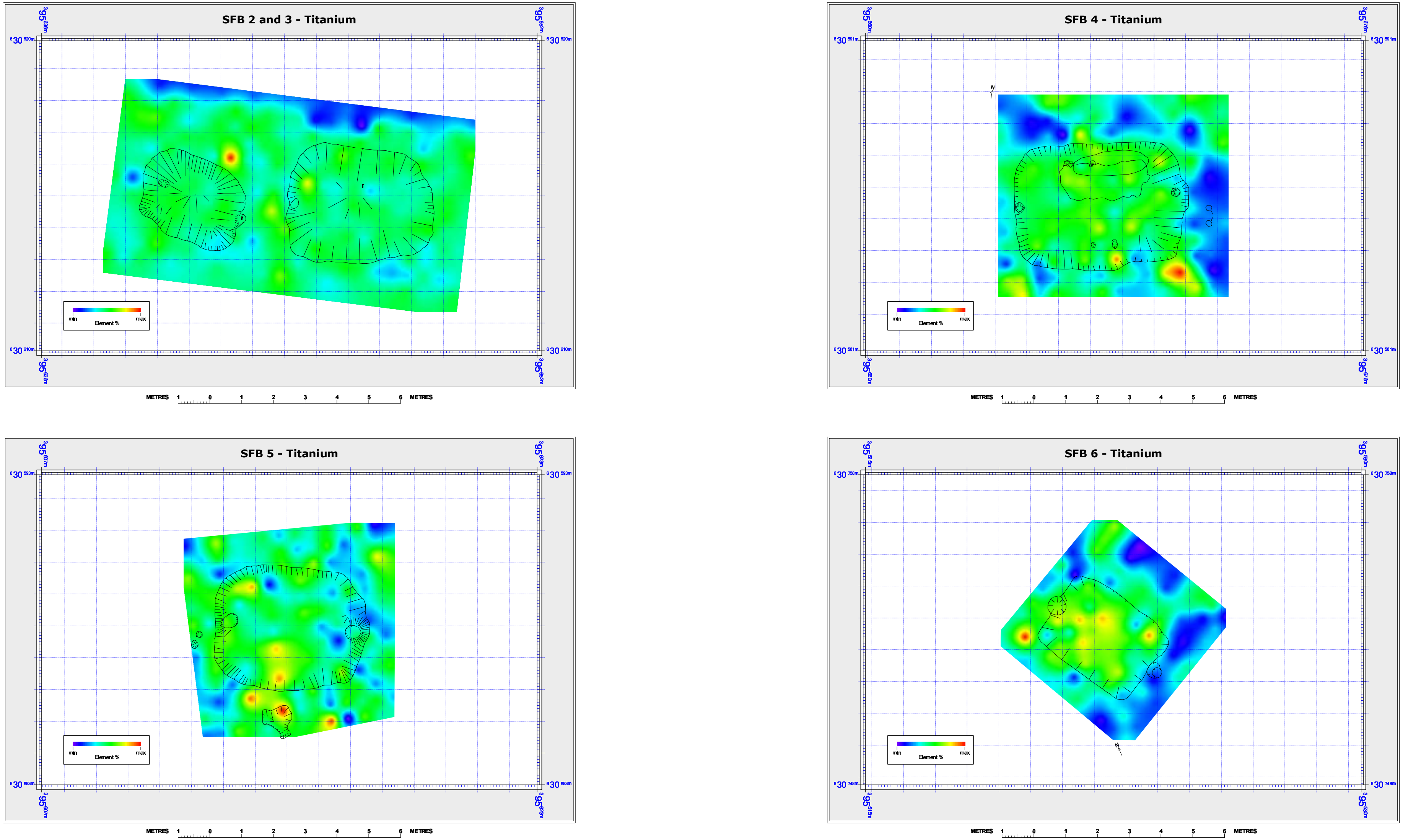



*Figure 7. Distribution plots for titanium across the SFB areas. Concentration range min = 0.25%, max = 1.0%.*

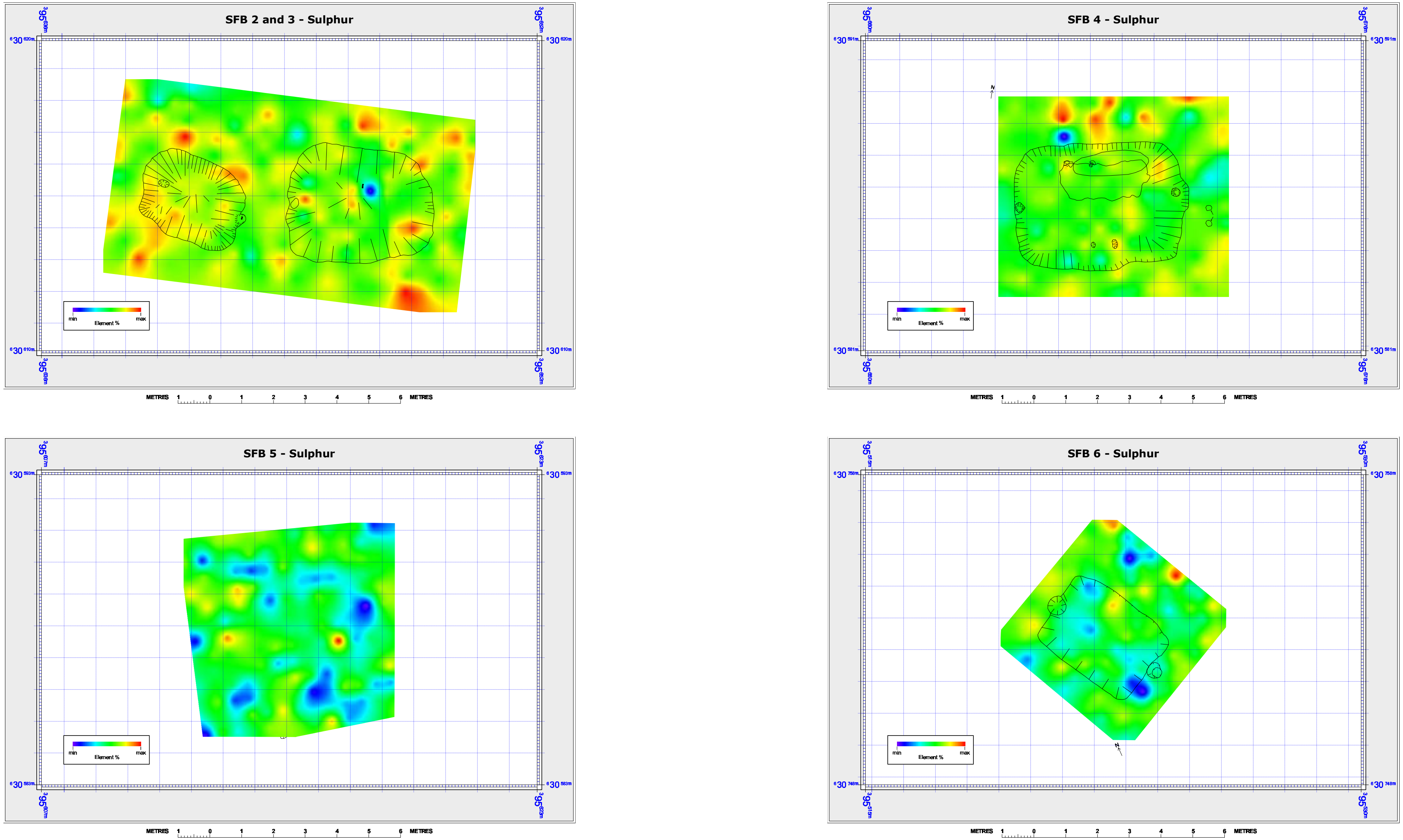
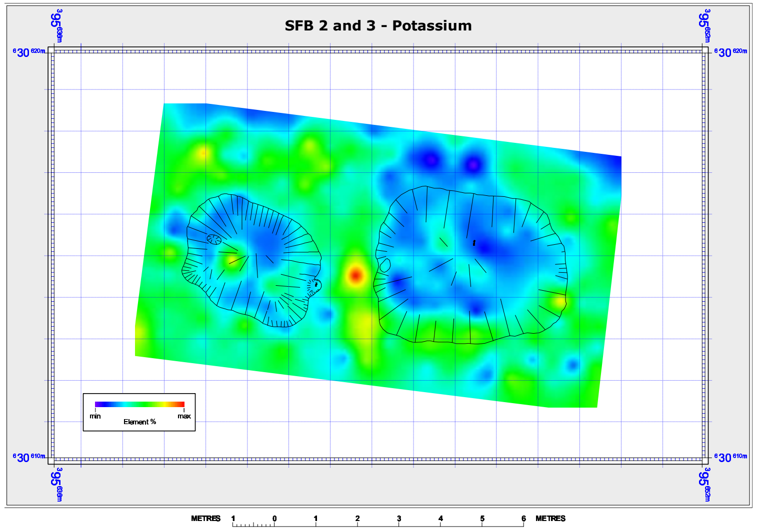
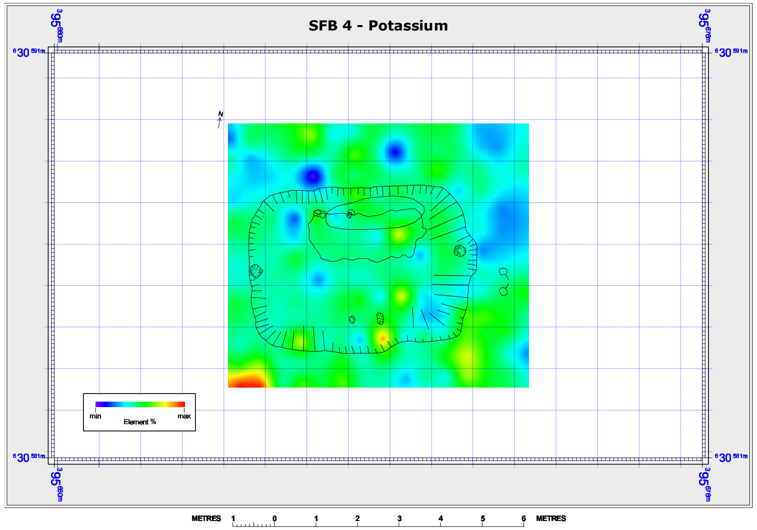
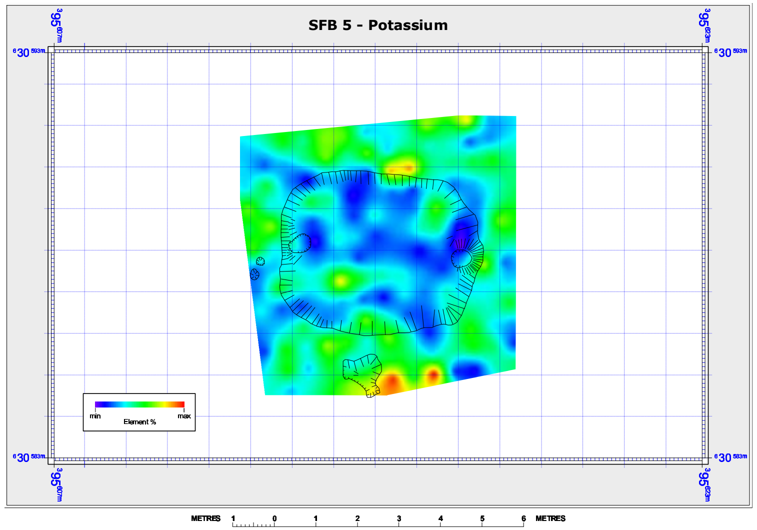



*Figure 8. Distribution plots for silicon across the SFB areas. Concentration range min = 16%, max = 28%.*



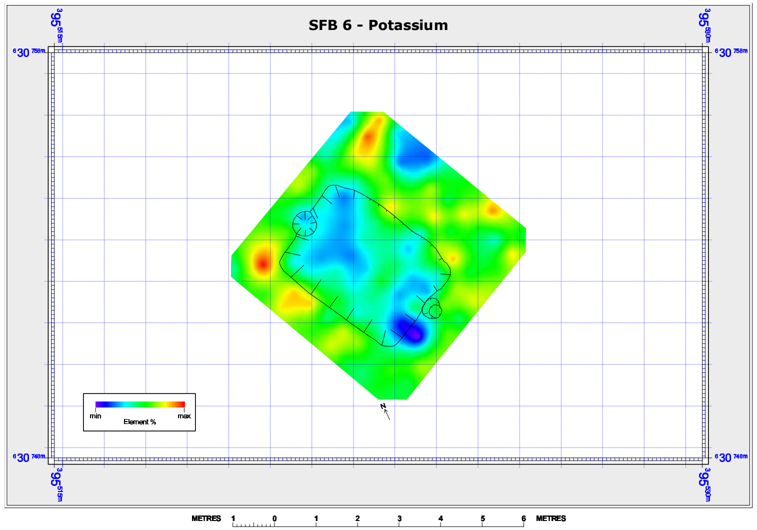




*Figure 9. Distribution plots for potassium across the SFB areas. Concentration range min = 2.3%, max = 6.0%.*

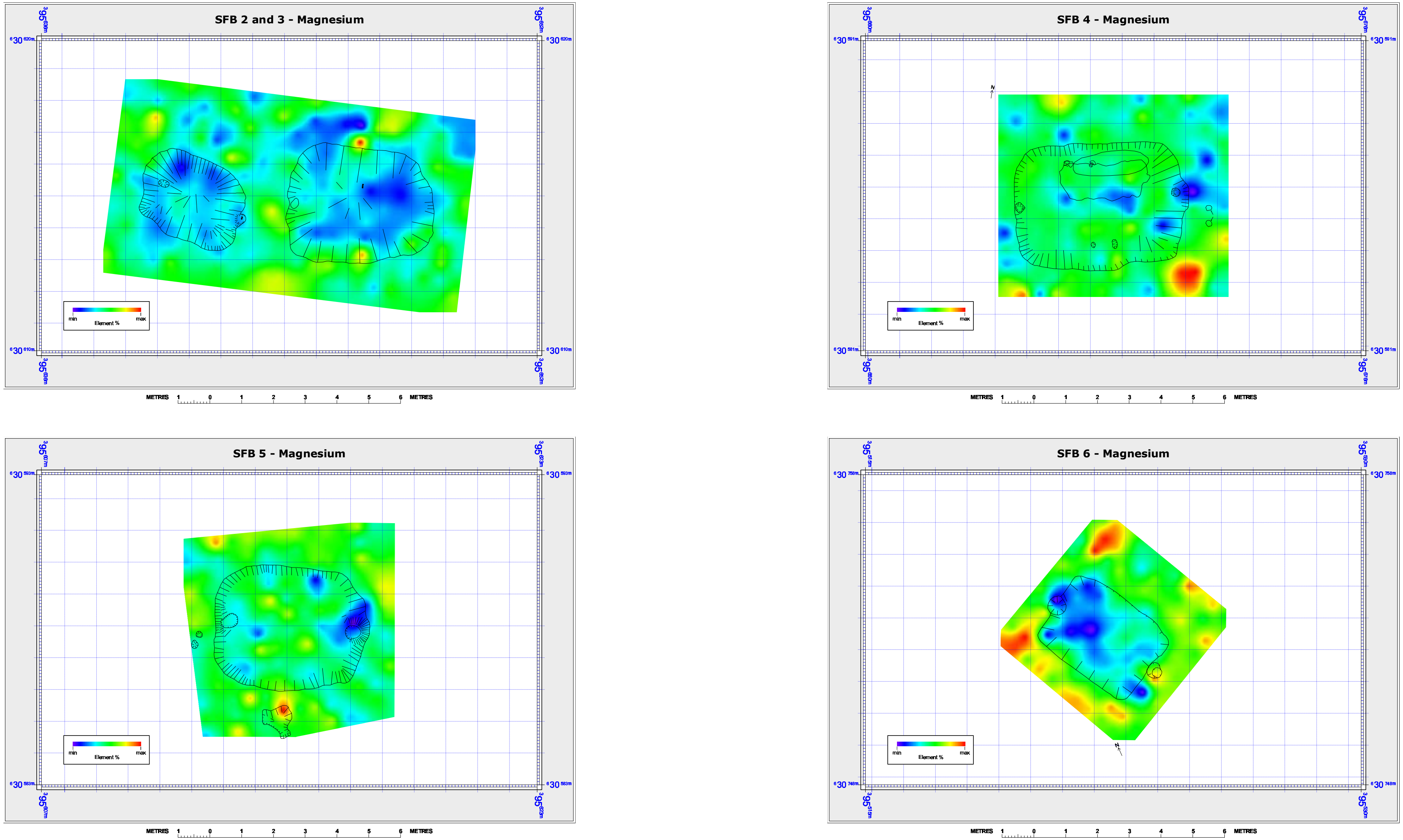



*Figure 10. Distribution plots for magnesium across the SFB areas. Concentration range min = 0.15%, max = 0.6%.*

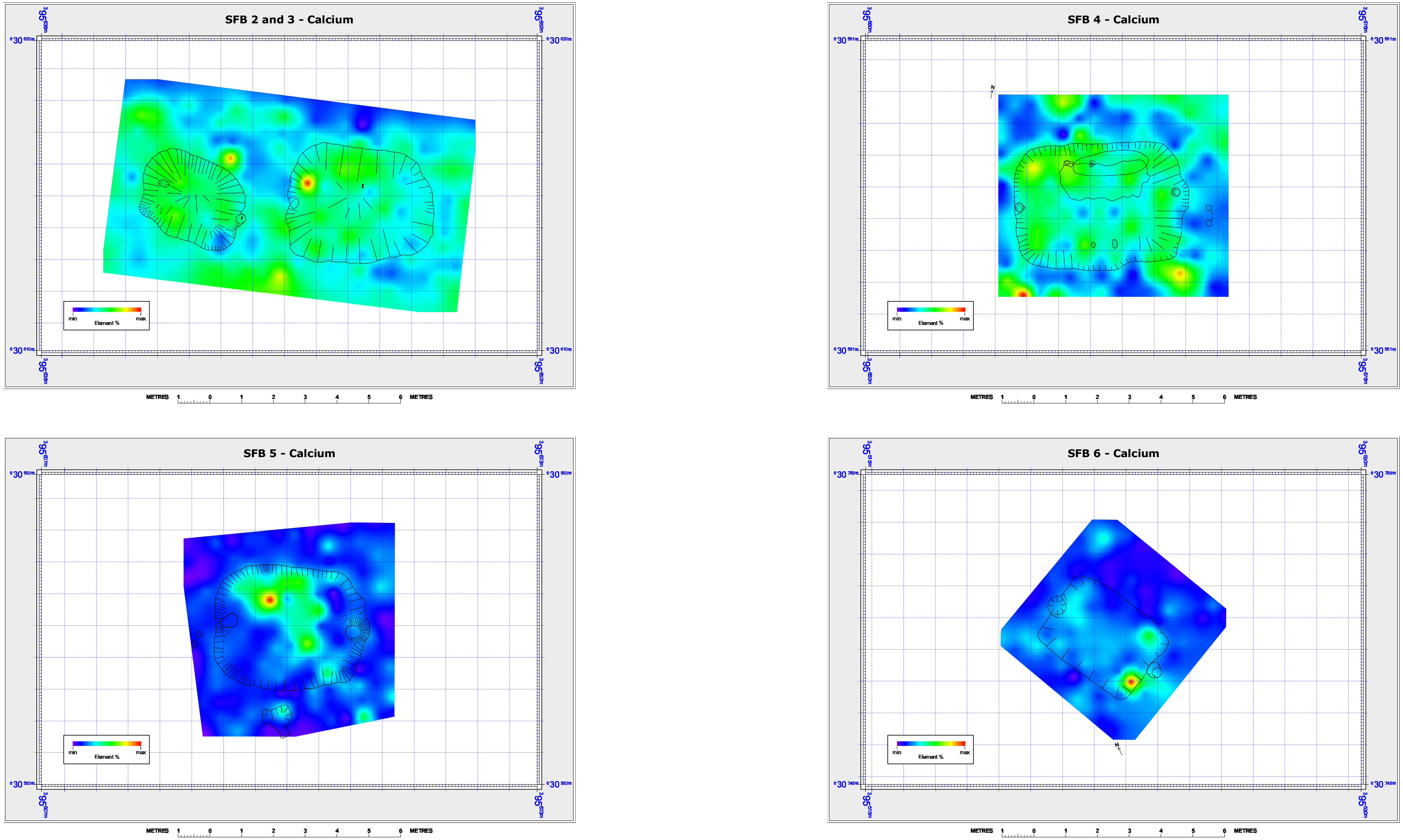



*Figure 1. Distribution plots for calcium across the SFB areas. Concentration range min = 0%2, max = 1.1%.*

| Sample No | Na | Mg | Al | Si | P | S | Cl | K | Ca | Ti | Mn | Fe | Mag Sus |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | *Sample too friable to for pellet for analysis* | | | | | | | | | | | | |
| 2 | 0.2864 | 0.2784 | 4.2591 | 27.2117 | 0.1970 | 0.0049 | 0.0011 | 4.0725 | 0.4184 | 0.6579 | 0.0504 | 2.9977 | 65.30 |
| 3 | 0.2355 | 0.4063 | 4.6703 | 24.0115 | 0.2790 | 0.0056 | 0.0010 | 4.2871 | 0.6146 | 0.6062 | 0.0435 | 3.9624 | 82.45 |
| 4 | 0.2048 | 0.4127 | 4.6522 | 25.1394 | 0.2848 | 0.0054 | 0.0017 | 4.2146 | 0.6068 | 0.5915 | 0.0448 | 3.7867 | 125.55 |
| 5 | 0.1096 | 0.3883 | 4.6739 | 26.3861 | 0.2818 | 0.0072 | 0.0020 | 4.1259 | 0.5396 | 0.5563 | 0.0477 | 3.9190 | 91.15 |
| 6 | 0.1744 | 0.3142 | 4.6745 | 26.2989 | 0.2793 | 0.0062 | 0.0015 | 4.5063 | 0.5055 | 0.5717 | 0.0337 | 3.6172 | 58.70 |
| 7 | 0.1292 | 0.4224 | 4.0832 | 21.7890 | 0.2192 | 0.0055 | 0.0024 | 3.8947 | 0.5762 | 0.6043 | 0.0161 | 3.7525 | 84.45 |
| 8 | 0.1630 | 0.3251 | 4.2123 | 24.8943 | 0.2455 | 0.0068 | 0.0019 | 4.3308 | 0.5852 | 0.5426 | 0.0126 | 3.3219 | 117.40 |
| 9 | 0.2591 | 0.3038 | 4.2521 | 25.6370 | 0.2921 | 0.0063 | 0.0015 | 3.8790 | 0.4922 | 0.5337 | 0.0274 | 3.0725 | 75.40 |
| 10 | 0.1966 | 0.3306 | 3.9437 | 27.1149 | 0.2289 | 0.0056 | 0.0016 | 4.1918 | 0.4784 | 0.5119 | 0.0247 | 3.0441 | 67.45 |
| 11 | *Sample too friable to for pellet for analysis* | | | | | | | | | | | | 63.50 |
| 12 | 0.3070 | 0.4335 | 4.8757 | 24.5817 | 0.1437 | 0.0030 | 0.0013 | 5.1843 | 0.5861 | 0.6389 | 0.0100 | 3.8096 | 121.50 |
| 13 | *Sample too friable to for pellet for analysis* | | | | | | | | | | | | |
| 14 | *Sample too friable to for pellet for analysis* | | | | | | | | | | | | |
| 15 | 0.1328 | 0.3129 | 3.9061 | 24.4763 | 0.2946 | 0.0080 | 0.0012 | 3.5407 | 0.5166 | 0.5766 | 0.0613 | 3.2129 | 75.20 |
| 16 | 0.1405 | 0.3690 | 4.3477 | 23.8408 | 0.2211 | 0.0043 | 0.0013 | 4.2689 | 0.7444 | 0.6671 | 0.0442 | 3.6551 | 72.20 |
| 17 | 0.2379 | 0.3873 | 4.5176 | 25.3853 | 0.2266 | 0.0046 | 0.0018 | 4.6121 | 0.5120 | 0.6088 | 0.0397 | 3.9081 | 116.80 |
| 18 | 0.2833 | 0.4134 | 4.9112 | 24.1725 | 0.2118 | 0.0055 | 0.0017 | 4.7322 | 0.5611 | 0.5334 | 0.0104 | 3.6709 | 74.75 |
| 19 | 0.1987 | 0.3404 | 3.7415 | 23.7262 | 0.2412 | 0.0084 | 0.0019 | 3.3904 | 0.5415 | 0.5505 | 0.0582 | 3.1614 | 61.00 |
| 20 | 0.1552 | 0.2775 | 3.2749 | 23.4989 | 0.2089 | 0.0061 | 0.0016 | 2.9829 | 0.4021 | 0.3636 | 0.0539 | 3.1471 | 45.80 |
| 21 | 0.2784 | 0.3499 | 4.3962 | 24.5804 | 0.1854 | 0.0045 | 0.0020 | 5.0383 | 0.5412 | 0.5856 | 0.0085 | 3.1907 | 76.55 |
| 22 | 0.2220 | 0.3271 | 3.8917 | 25.9838 | 0.2741 | 0.0061 | 0.0016 | 3.7522 | 0.5009 | 0.5371 | 0.0237 | 3.1938 | 99.80 |
| 23 | 0.1456 | 0.3795 | 4.1550 | 25.1074 | 0.2747 | 0.0074 | 0.0017 | 4.3117 | 0.4590 | 0.5175 | 0.0067 | 3.2644 | 102.00 |
| 24 | 0.0393 | 0.3280 | 4.1163 | 23.2879 | 0.2559 | 0.0064 | 0.0016 | 3.9973 | 0.5148 | 0.5022 | 0.0435 | 3.5812 | 104.45 |
| 25 | 0.2251 | 0.3298 | 3.9348 | 24.1308 | 0.2286 | 0.0059 | 0.0016 | 3.9965 | 0.5015 | 0.4933 | 0.0197 | 3.0544 | 78.40 |
| 26 | *Sample too friable to for pellet for analysis* | | | | | | | | | | | | |
| 27 | 0.3770 | 0.3804 | 4.3134 | 21.8604 | 0.2522 | 0.0052 | 0.0015 | 3.2621 | 0.3637 | 0.3529 | 0.0253 | 2.1540 | |
| 28 | 0.1792 | 0.2684 | 3.6570 | 20.0960 | 0.3086 | 0.0083 | 0.0015 | 3.7268 | 0.5326 | 0.5138 | 0.0577 | 3.3845 | 75.20 |
| 29 | 0.4637 | 0.5164 | 5.8928 | 26.7106 | 0.2634 | 0.0038 | 0.0010 | 5.5375 | 0.7022 | 0.6840 | 0.0565 | 4.3330 | 73.75 |
| 30 | 0.2586 | 0.4581 | 4.8949 | 25.0428 | 0.3224 | 0.0060 | 0.0013 | 4.4582 | 0.6306 | 0.6043 | 0.0463 | 4.1207 | 75.60 |
| 31 | 0.1557 | 0.3588 | 4.2895 | 23.2708 | 0.3724 | 0.0076 | 0.0018 | 3.9850 | 0.5468 | 0.4826 | 0.0486 | 3.8943 | 84.40 |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 32 | 0.2478 | 0.4130 | 4.4653 | 25.2979 | 0.3318 | 0.0065 | 0.0013 | 4.1173 | 0.6079 | 0.5974 | 0.0668 | 3.7835 | 65.95 |
| 33 | 0.1563 | 0.2472 | 3.4713 | 26.2712 | 0.2691 | 0.0080 | 0.0019 | 3.1698 | 0.6245 | 0.5349 | 0.1664 | 2.7554 | 70.00 |
| 34 | 0.0000 | 0.2904 | 4.0383 | 26.5777 | 0.2875 | 0.0070 | 0.0018 | 3.8512 | 0.6257 | 0.6285 | 0.1796 | 3.3403 | 83.25 |
| 35 | 0.2726 | 0.2930 | 3.9151 | 26.1894 | 0.2803 | 0.0063 | 0.0011 | 3.8897 | 0.4702 | 0.5958 | 0.0737 | 2.7761 | 97.15 |
| 36 | 0.2254 | 0.2876 | 4.0599 | 25.9151 | 0.2031 | 0.0062 | 0.0019 | 4.2600 | 0.4781 | 0.5742 | 0.0538 | 3.1070 | 73.90 |
| 37 | 0.1717 | 0.2935 | 4.1132 | 25.4310 | 0.2238 | 0.0063 | 0.0015 | 4.1061 | 0.4621 | 0.5328 | 0.0410 | 3.1778 | 84.50 |
| 38 | 0.2493 | 0.3360 | 4.4963 | 28.2352 | 0.1865 | 0.0052 | 0.0017 | 4.1069 | 0.4305 | 0.5945 | 0.0319 | 3.7178 | 79.10 |
| 39 | *Sample too friable to for pellet for analysis* | | | | | | | | | | | | |
| 40 | *Sample too friable to for pellet for analysis* | | | | | | | | | | | | |
| 41 | 0.1111 | 0.3486 | 4.2557 | 24.8551 | 0.2017 | 0.0061 | 0.0021 | 4.4747 | 0.4523 | 0.6076 | 0.0358 | 3.2761 | 70.30 |
| 42 | 0.2264 | 0.3404 | 3.7812 | 24.2963 | 0.2225 | 0.0081 | 0.0012 | 3.6929 | 0.5030 | 0.5894 | 0.0278 | 3.1928 | 81.45 |
| 43 | 0.2385 | 0.3294 | 4.5273 | 25.8247 | 0.1975 | 0.0046 | 0.0017 | 4.8123 | 0.5628 | 0.5677 | 0.0492 | 3.6049 | 78.65 |
| 44 | 0.0912 | 0.3365 | 4.2560 | 25.5188 | 0.2561 | 0.0067 | 0.0017 | 3.6784 | 0.6557 | 0.6218 | 0.1598 | 3.5396 | 46.45 |
| 45 | 0.1674 | 0.2847 | 3.6300 | 24.6294 | 0.3406 | 0.0076 | 0.0012 | 3.1205 | 0.7100 | 0.5500 | 0.2201 | 2.9015 | 56.65 |
| 46 | 0.2024 | 0.2891 | 3.5678 | 24.8975 | 0.2808 | 0.0073 | 0.0017 | 3.2686 | 0.6213 | 0.5784 | 0.1724 | 2.7570 | 59.90 |
| 47 | 0.1843 | 0.2733 | 3.6591 | 26.2131 | 0.2529 | 0.0072 | 0.0014 | 3.2734 | 0.6207 | 0.6077 | 0.1289 | 2.8182 | 66.95 |
| 48 | 0.1008 | 0.2518 | 3.6848 | 25.6041 | 0.2972 | 0.0075 | 0.0014 | 3.4839 | 0.6617 | 0.5833 | 0.1722 | 2.7938 | 63.60 |
| 49 | 0.1360 | 0.2407 | 3.8670 | 26.7604 | 0.2376 | 0.0067 | 0.0015 | 3.7819 | 0.5257 | 0.6391 | 0.1196 | 3.1731 | 49.35 |
| 50 | 0.1720 | 0.2877 | 4.6336 | 26.6797 | 0.2495 | 0.0050 | 0.0011 | 4.3961 | 0.5353 | 0.6727 | 0.0645 | 3.2773 | 73.10 |
| 51 | 0.1108 | 0.2757 | 3.9816 | 25.0345 | 0.2506 | 0.0073 | 0.0013 | 3.6747 | 0.4987 | 0.5578 | 0.0232 | 3.0205 | 83.20 |
| 52 | *Sample too friable to for pellet for analysis* | | | | | | | | | | | | |
| 53 | 0.3099 | 0.4112 | 4.2610 | 20.3926 | 0.2789 | 0.0049 | 0.0009 | 3.0601 | 0.4062 | 0.3890 | 0.0171 | 2.4424 | |
| 54 | 0.1681 | 0.3146 | 4.1097 | 24.8554 | 0.3323 | 0.0083 | 0.0018 | 3.8159 | 0.5437 | 0.5595 | 0.0143 | 3.7402 | 95.00 |
| 55 | 0.1769 | 0.2510 | 3.3768 | 23.1547 | 0.2047 | 0.0070 | 0.0017 | 3.3983 | 0.4217 | 0.4733 | 0.0355 | 2.8820 | 64.85 |
| 56 | 0.1080 | 0.3028 | 4.3961 | 28.9175 | 0.2400 | 0.0054 | 0.0022 | 4.6008 | 0.4977 | 0.6147 | 0.0754 | 3.5150 | 74.85 |
| 57 | 0.1523 | 0.2537 | 3.4118 | 25.6101 | 0.2547 | 0.0085 | 0.0018 | 3.0779 | 0.5532 | 0.5334 | 0.1080 | 2.7022 | 43.55 |
| 58 | 0.1133 | 0.1796 | 3.4861 | 24.2519 | 0.2730 | 0.0081 | 0.0014 | 3.4618 | 0.6572 | 0.5791 | 0.1602 | 2.9665 | 55.20 |
| 59 | 0.1590 | 0.2581 | 3.5798 | 25.6050 | 0.2552 | 0.0075 | 0.0014 | 3.4602 | 0.7257 | 0.5828 | 0.1619 | 2.9536 | 76.75 |
| 60 | 0.1655 | 0.3336 | 6.2823 | 24.1625 | 0.1818 | 0.0029 | 0.0014 | 5.4154 | 0.5473 | 0.6308 | 0.0230 | 3.8084 | 61.35 |
| 61 | 0.0807 | 0.3231 | 4.0347 | 27.0133 | 0.3042 | 0.0056 | 0.0010 | 3.7142 | 0.7431 | 0.6297 | 0.2023 | 3.3299 | 59.15 |
| 62 | 0.1941 | 0.2676 | 3.6834 | 25.6216 | 0.2646 | 0.0082 | 0.0014 | 3.3381 | 0.6413 | 0.5740 | 0.1780 | 3.1522 | 52.65 |
| 63 | 0.1735 | 0.2894 | 3.7906 | 25.3906 | 0.2225 | 0.0066 | 0.0021 | 3.6689 | 0.5243 | 0.5757 | 0.0951 | 3.0175 | 65.05 |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 64 | 0.1769 | 0.4194 | 4.1703 | 24.2353 | 0.2239 | 0.0053 | 0.0018 | 4.0527 | 0.4943 | 0.5021 | 0.0232 | 3.4403 | 68.55 |
| 65 | *Sample too friable to for pellet for analysis* | | | | | | | | | | | | |
| 66 | *Sample too friable to for pellet for analysis* | | | | | | | | | | | | |
| 67 | 0.1547 | 0.2574 | 3.7545 | 23.1834 | 0.1985 | 0.0061 | 0.0015 | 3.9866 | 0.4276 | 0.5060 | 0.0382 | 2.9039 | 82.00 |
| 68 | 0.2674 | 0.3540 | 4.2509 | 24.6372 | 0.1900 | 0.0044 | 0.0014 | 4.6833 | 0.4451 | 0.5376 | 0.0091 | 3.0851 | 90.30 |
| 69 | 0.2269 | 0.3949 | 4.6877 | 25.3420 | 0.1924 | 0.0049 | 0.0022 | 4.2932 | 0.5163 | 0.6038 | 0.0394 | 4.2221 | 76.40 |
| 70 | 0.1874 | 0.2975 | 3.8527 | 24.3905 | 0.2061 | 0.0061 | 0.0018 | 3.7917 | 0.5753 | 0.5694 | 0.1103 | 3.2228 | 67.35 |
| 71 | 0.1892 | 0.2844 | 3.7243 | 24.7775 | 0.2404 | 0.0089 | 0.0030 | 3.3550 | 0.5496 | 0.5765 | 0.0978 | 3.3227 | 53.05 |
| 72 | 0.1349 | 0.2923 | 3.6254 | 25.4226 | 0.2863 | 0.0091 | 0.0018 | 3.1474 | 0.6265 | 0.6001 | 0.1422 | 2.9348 | 80.60 |
| 73 | 0.1396 | 0.2927 | 3.8609 | 26.0807 | 0.3008 | 0.0079 | 0.0013 | 3.4180 | 0.5653 | 0.5654 | 0.1176 | 3.1045 | 49.75 |
| 74 | 0.1942 | 0.2854 | 3.5312 | 24.8389 | 0.2946 | 0.0065 | 0.0013 | 3.2940 | 0.5987 | 0.5706 | 0.1945 | 2.8796 | 50.65 |
| 75 | 0.2881 | 0.3173 | 3.6475 | 26.1300 | 0.2743 | 0.0075 | 0.0009 | 3.3020 | 0.5627 | 0.5233 | 0.1255 | 2.9916 | 56.75 |
| 76 | 0.2410 | 0.3287 | 4.4863 | 24.4253 | 0.2232 | 0.0036 | 0.0013 | 4.7494 | 0.5085 | 0.5791 | 0.0268 | 3.4111 | 77.25 |
| 77 | 0.1893 | 0.3434 | 3.9237 | 24.4648 | 0.2746 | 0.0080 | 0.0013 | 3.7782 | 0.5263 | 0.5294 | 0.0472 | 3.3211 | 76.95 |
| 78 | *Sample too friable to for pellet for analysis* | | | | | | | | | | | | |
| 79 | 0.3330 | 0.3905 | 4.7230 | 22.7544 | 0.3760 | 0.0069 | 0.0012 | 3.2145 | 0.4356 | 0.3980 | 0.0112 | 2.6413 | |
| 80 | 0.1741 | 0.3583 | 3.8324 | 23.2801 | 0.2490 | 0.0060 | 0.0015 | 3.7142 | 0.4438 | 0.5592 | 0.0241 | 3.3934 | 71.15 |
| 81 | 0.1359 | 0.2775 | 4.2148 | 24.8048 | 0.1721 | 0.0056 | 0.0023 | 4.5272 | 0.5471 | 0.6220 | 0.0739 | 3.4587 | 63.30 |
| 82 | 0.1914 | 0.2212 | 3.7446 | 26.6674 | 0.2022 | 0.0068 | 0.0019 | 3.7282 | 0.3710 | 0.6121 | 0.0335 | 2.8009 | 81.35 |
| 83 | 0.1713 | 0.3165 | 4.0737 | 22.6234 | 0.3268 | 0.0076 | 0.0020 | 4.0733 | 0.4871 | 0.5003 | 0.0261 | 3.1326 | 85.65 |
| 84 | 0.0377 | 0.2199 | 3.4570 | 26.4302 | 0.2616 | 0.0072 | 0.0014 | 3.1911 | 0.5562 | 0.5659 | 0.1636 | 2.8002 | 56.00 |
| 85 | 0.1656 | 0.2391 | 3.5275 | 24.4650 | 0.2617 | 0.0084 | 0.0015 | 3.1245 | 0.5793 | 0.5270 | 0.1217 | 2.7324 | 55.80 |
| 86 | 0.1534 | 0.2756 | 3.4367 | 24.1382 | 0.2286 | 0.0087 | 0.0017 | 3.2199 | 0.5966 | 0.5424 | 0.0890 | 2.6856 | 72.15 |
| 87 | 0.2741 | 0.2798 | 3.9904 | 24.5630 | 0.1997 | 0.0062 | 0.0033 | 4.2480 | 0.4774 | 0.6148 | 0.0909 | 3.4675 | 53.00 |
| 88 | 0.0894 | 0.2473 | 3.5642 | 26.1998 | 0.3049 | 0.0073 | 0.0015 | 3.1987 | 0.5946 | 0.5484 | 0.1663 | 2.8398 | 52.95 |
| 89 | 0.0950 | 0.3044 | 3.6917 | 23.8051 | 0.2572 | 0.0074 | 0.0018 | 3.5939 | 0.5207 | 0.4954 | 0.0443 | 2.9832 | 85.70 |
| 90 | 0.1804 | 0.3430 | 4.1466 | 24.3638 | 0.2985 | 0.0054 | 0.0015 | 4.0703 | 0.6058 | 0.5229 | 0.0416 | 3.4189 | 105.90 |
| 91 | *Sample too friable to for pellet for analysis* | | | | | | | | | | | | |
| 92 | *Sample too friable to for pellet for analysis* | | | | | | | | | | | | |
| 93 | 0.2267 | 0.4279 | 5.0118 | 24.1479 | 0.2520 | 0.0038 | 0.0011 | 5.1566 | 0.5926 | 0.6454 | 0.0286 | 3.9478 | 63.90 |
| 94 | 0.2078 | 0.3007 | 4.0854 | 21.7746 | 0.2076 | 0.0048 | 0.0014 | 4.3718 | 0.4995 | 0.5443 | 0.0232 | 3.6977 | 74.80 |
| 95 | 0.2536 | 0.2907 | 4.3292 | 26.1389 | 0.2050 | 0.0042 | 0.0009 | 4.8472 | 0.3642 | 0.6559 | 0.0535 | 3.2357 | 76.70 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 96 | 0.2493 | 0.4809 | 4.8244 | 25.0798 | 0.4183 | 0.0074 | 0.0015 | 3.8163 | 0.9721 | 0.9372 | 0.2380 | 4.3327 | 67.90 |
| 97 | 0.2368 | 0.2748 | 3.9831 | 27.4632 | 0.2803 | 0.0081 | 0.0013 | 3.7040 | 0.6004 | 0.6163 | 0.1494 | 3.0051 | 69.10 |
| 98 | 0.2622 | 0.2644 | 3.6634 | 23.5241 | 0.2406 | 0.0064 | 0.0012 | 3.5132 | 0.5378 | 0.5737 | 0.1588 | 3.2062 | 57.15 |
| 99 | 0.2017 | 0.3170 | 4.0950 | 26.5199 | 0.2757 | 0.0074 | 0.0017 | 3.9682 | 0.6555 | 0.6461 | 0.1657 | 3.2498 | 59.30 |
| 100 | 0.2072 | 0.2996 | 3.8446 | 25.8297 | 0.2628 | 0.0079 | 0.0011 | 3.8280 | 0.6390 | 0.6209 | 0.1193 | 3.0432 | 58.00 |
| 101 | 0.0684 | 0.3119 | 3.8467 | 23.2608 | 0.2138 | 0.0078 | 0.0030 | 3.8968 | 0.3530 | 0.4769 | 0.0106 | 3.1462 | 62.70 |
| 102 | 0.0522 | 0.2638 | 3.2469 | 24.3215 | 0.2531 | 0.0065 | 0.0013 | 3.3110 | 0.4108 | 0.4807 | 0.0103 | 2.8093 | 56.10 |
| 103 | 0.1407 | 0.3718 | 4.5611 | 25.9563 | 0.2925 | 0.0062 | 0.0016 | 4.6014 | 0.6440 | 0.5789 | 0.0292 | 3.7006 | 92.10 |
| 104 | *Sample too friable to for pellet for analysis* | | | | | | | | | | | | |
| 105 | 0.6437 | 0.2368 | 4.6305 | 23.2608 | 0.2034 | 0.0033 | 0.0011 | 3.8334 | 0.4022 | 0.4109 | 0.0382 | 2.1955 | |
| 106 | 0.1644 | 0.3183 | 4.1913 | 24.0884 | 0.3289 | 0.0074 | 0.0016 | 4.0168 | 0.5008 | 0.5449 | 0.0517 | 3.6676 | 55.80 |
| 107 | 0.1759 | 0.4314 | 4.7970 | 25.5161 | 0.2856 | 0.0058 | 0.0014 | 4.9727 | 0.5160 | 0.6461 | 0.0417 | 4.0442 | 82.50 |
| 108 | 0.2164 | 0.3328 | 3.9474 | 23.6250 | 0.2830 | 0.0065 | 0.0013 | 3.8376 | 0.4068 | 0.5126 | 0.0220 | 3.4898 | 80.55 |
| 109 | 0.2069 | 0.4061 | 4.5925 | 24.8585 | 0.2948 | 0.0068 | 0.0015 | 4.2272 | 0.4345 | 0.5299 | 0.0298 | 3.5099 | 68.00 |
| 110 | 0.1339 | 0.2754 | 4.2038 | 27.4531 | 0.3036 | 0.0055 | 0.0011 | 4.1104 | 0.4223 | 0.6023 | 0.0602 | 3.0156 | 63.15 |
| 111 | 0.1659 | 0.3647 | 4.3465 | 25.8823 | 0.3559 | 0.0076 | 0.0015 | 4.0870 | 0.5522 | 0.5707 | 0.0359 | 3.4905 | 71.05 |
| 112 | 0.0709 | 0.2624 | 3.5199 | 23.4413 | 0.2429 | 0.0078 | 0.0018 | 3.2755 | 0.4966 | 0.5387 | 0.1328 | 2.9502 | 73.05 |
| 113 | 0.0822 | 0.2523 | 3.6412 | 23.6429 | 0.2575 | 0.0070 | 0.0016 | 3.4701 | 0.5948 | 0.5689 | 0.1500 | 2.9679 | 62.35 |
| 114 | 0.1482 | 0.3430 | 4.0180 | 23.1993 | 0.2513 | 0.0073 | 0.0014 | 3.7135 | 0.5186 | 0.6072 | 0.1802 | 3.6379 | 57.00 |
| 115 | 0.1369 | 0.3172 | 4.0090 | 25.6090 | 0.2485 | 0.0059 | 0.0013 | 3.9751 | 0.5284 | 0.4905 | 0.0266 | 3.0614 | 72.95 |
| 116 | 0.1509 | 0.3292 | 4.3033 | 25.0520 | 0.3204 | 0.0070 | 0.0015 | 3.7474 | 0.5810 | 0.5412 | 0.0512 | 3.5004 | 69.65 |
| 117 | *Sample too friable to for pellet for analysis* | | | | | | | | | | | | |
| 118 | *Sample too friable to for pellet for analysis* | | | | | | | | | | | | |
| 119 | 0.1900 | 0.3528 | 4.5584 | 27.0469 | 0.2761 | 0.0057 | 0.0018 | 4.4487 | 0.5251 | 0.6015 | 0.0616 | 3.6256 | 82.50 |
| 120 | 0.2750 | 0.3022 | 4.2234 | 24.2106 | 0.2534 | 0.0064 | 0.0015 | 3.6905 | 0.4650 | 0.6080 | 0.0819 | 3.2641 | 73.85 |
| 121 | 0.2681 | 0.3040 | 4.2038 | 24.9042 | 0.2964 | 0.0072 | 0.0014 | 3.8193 | 0.4581 | 0.6064 | 0.1162 | 3.3108 | 61.75 |
| 122 | 0.2150 | 0.2722 | 3.8671 | 22.8471 | 0.2826 | 0.0061 | 0.0013 | 3.7898 | 0.4092 | 0.4950 | 0.0751 | 3.1002 | 60.60 |
| 123 | 0.2923 | 0.2921 | 3.8882 | 24.4799 | 0.2478 | 0.0072 | 0.0015 | 4.1931 | 0.4452 | 0.5340 | 0.0493 | 3.3671 | 77.15 |
| 124 | 0.0955 | 0.3486 | 3.8866 | 24.9632 | 0.2272 | 0.0072 | 0.0017 | 3.9512 | 0.4632 | 0.4868 | 0.0274 | 3.1417 | 51.30 |
| 125 | 0.0739 | 0.3732 | 4.3652 | 24.5845 | 0.3683 | 0.0078 | 0.0020 | 3.8806 | 0.5666 | 0.5746 | 0.0662 | 3.5849 | 65.60 |
| 126 | 0.3178 | 0.3283 | 4.2303 | 24.0993 | 0.2272 | 0.0057 | 0.0016 | 4.3996 | 0.4751 | 0.5749 | 0.0521 | 3.4648 | 82.10 |
| 127 | 0.1484 | 0.3168 | 3.6897 | 23.2006 | 0.2703 | 0.0080 | 0.0014 | 3.1547 | 0.4229 | 0.4438 | 0.0338 | 3.4361 | 76.00 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 128 | 0.1288 | 0.2919 | 3.5341 | 20.8774 | 0.2307 | 0.0060 | 0.0014 | 3.8044 | 0.4720 | 0.5131 | 0.0265 | 3.1606 | 68.10 |
| 129 | 0.1940 | 0.3852 | 4.2838 | 23.7826 | 0.3706 | 0.0080 | 0.0017 | 3.6893 | 0.6695 | 0.5347 | 0.0556 | 3.7945 | 80.50 |
| 130 | *Sample too friable to for pellet for analysis* | | | | | | | | | | | | |
| 131 | 0.3056 | 0.3531 | 4.9210 | 22.9626 | 0.3051 | 0.0057 | 0.0008 | 3.1242 | 0.3690 | 0.4383 | 0.0217 | 2.6649 | |
| 132 | 0.2583 | 0.4542 | 4.3920 | 24.2559 | 0.3251 | 0.0056 | 0.0016 | 4.0980 | 0.6538 | 0.5552 | 0.0189 | 3.6320 | 82.95 |
| 133 | 0.1983 | 0.3157 | 3.9005 | 24.2913 | 0.2738 | 0.0067 | 0.0015 | 3.8412 | 0.4285 | 0.5170 | 0.0390 | 3.2025 | 72.65 |
| 134 | 0.1517 | 0.2887 | 4.1112 | 23.1754 | 0.2752 | 0.0065 | 0.0009 | 3.9808 | 0.5500 | 0.6078 | 0.1543 | 3.3073 | 60.10 |
| 135 | 0.1864 | 0.3388 | 4.3616 | 25.8500 | 0.2729 | 0.0074 | 0.0015 | 4.3229 | 0.4743 | 0.6259 | 0.1132 | 3.4427 | 57.40 |
| 136 | 0.1426 | 0.3202 | 4.1454 | 25.6858 | 0.2353 | 0.0076 | 0.0017 | 4.2848 | 0.4480 | 0.5449 | 0.0081 | 3.2157 | 82.50 |
| 137 | 0.1432 | 0.3505 | 4.3438 | 23.8183 | 0.2315 | 0.0061 | 0.0015 | 4.8872 | 0.4725 | 0.6577 | 0.0706 | 3.6314 | 57.65 |
| 138 | 0.4064 | 0.4852 | 5.5418 | 25.3579 | 0.1449 | 0.0019 | 0.0013 | 6.2524 | 0.6190 | 0.7609 | 0.0725 | 4.5338 | 74.70 |
| 139 | 0.2797 | 0.3953 | 4.6242 | 25.5159 | 0.2491 | 0.0053 | 0.0016 | 4.5611 | 0.5865 | 0.6033 | 0.0287 | 3.7697 | 87.85 |
| 140 | 0.1743 | 0.3292 | 4.6742 | 24.9850 | 0.2667 | 0.0042 | 0.0011 | 4.8752 | 0.5333 | 0.5838 | 0.0730 | 3.5085 | 82.25 |
| 141 | 0.2525 | 0.3357 | 4.4000 | 25.2233 | 0.2614 | 0.0044 | 0.0009 | 4.6586 | 0.5517 | 0.5487 | 0.0381 | 3.7026 | 88.70 |
| 142 | 0.1961 | 0.4503 | 4.7118 | 23.4188 | 0.3536 | 0.0083 | 0.0019 | 3.3522 | 0.6051 | 0.5356 | 0.0411 | 3.7439 | 60.60 |
| 143 | *Sample too friable to for pellet for analysis* | | | | | | | | | | | | |
| 144 | *Sample too friable to for pellet for analysis* | | | | | | | | | | | | |
| 145 | 0.1322 | 0.3556 | 4.1193 | 23.4057 | 0.3064 | 0.0058 | 0.0010 | 3.9495 | 0.4998 | 0.5472 | 0.0629 | 3.3598 | 98.65 |
| 146 | 0.0561 | 0.2350 | 3.4663 | 19.7891 | 0.3409 | 0.0079 | 0.0023 | 3.0340 | 0.4314 | 0.5174 | 0.0393 | 3.2380 | 64.55 |
| 147 | 0.2029 | 0.2680 | 3.4822 | 23.3655 | 0.2312 | 0.0074 | 0.0028 | 3.2779 | 0.4499 | 0.5494 | 0.0905 | 3.0483 | 53.85 |
| 148 | 0.1603 | 0.3952 | 4.3248 | 26.0173 | 0.3841 | 0.0074 | 0.0014 | 4.0052 | 0.5267 | 0.5388 | 0.0710 | 3.3566 | 53.80 |
| 149 | 0.1852 | 0.3131 | 3.6858 | 24.9586 | 0.3077 | 0.0065 | 0.0018 | 3.4805 | 0.4114 | 0.4912 | 0.0318 | 2.9359 | 65.20 |
| 150 | 0.0887 | 0.3071 | 3.7554 | 24.6580 | 0.2447 | 0.0070 | 0.0016 | 3.4814 | 0.4274 | 0.4803 | 0.0469 | 3.4088 | 89.15 |
| 151 | 0.2864 | 0.3706 | 4.4171 | 25.8909 | 0.2436 | 0.0056 | 0.0015 | 4.3938 | 0.5529 | 0.5428 | 0.0403 | 3.7992 | 69.75 |
| 152 | 0.2562 | 0.4370 | 5.0036 | 24.5850 | 0.2326 | 0.0060 | 0.0014 | 4.3123 | 0.7168 | 0.6937 | 0.0287 | 4.2361 | 63.45 |
| 153 | 0.2498 | 0.3546 | 4.6927 | 23.4906 | 0.2393 | 0.0042 | 0.0014 | 5.2449 | 0.5341 | 0.6131 | 0.0165 | 3.7897 | 79.05 |
| 154 | 0.3410 | 0.3611 | 4.8192 | 26.8612 | 0.2206 | 0.0051 | 0.0012 | 5.1727 | 0.6243 | 0.6173 | 0.0317 | 3.6985 | 81.80 |
| 155 | 0.2563 | 0.4638 | 4.8710 | 25.9185 | 0.2239 | 0.0038 | 0.0012 | 4.9684 | 0.8526 | 0.7087 | 0.0602 | 4.3879 | 114.45 |
| 156 | *Sample too friable to for pellet for analysis* | | | | | | | | | | | | |
| 157 | 0.4024 | 0.4235 | 4.7566 | 23.8817 | 0.2716 | 0.0052 | 0.0011 | 3.6369 | 0.3311 | 0.3957 | 0.0377 | 2.3676 | |
| 158 | 0.1083 | 0.2179 | 2.7505 | 25.3440 | 0.1932 | 0.0076 | 0.0016 | 3.0164 | 0.3280 | 0.3231 | 0.0062 | 2.0485 | 48.25 |
| 159 | 0.1986 | 0.2694 | 3.9078 | 24.1977 | 0.2958 | 0.0077 | 0.0013 | 3.5472 | 0.5087 | 0.6146 | 0.1561 | 3.0504 | 49.65 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 160 | 0.1765 | 0.2842 | 3.6545 | 24.4633 | 0.2881 | 0.0073 | 0.0019 | 3.3079 | 0.5053 | 0.5370 | 0.1695 | 2.9372 | 52.55 |
| 161 | 0.1753 | 0.2640 | 3.5853 | 25.3214 | 0.2961 | 0.0089 | 0.0013 | 3.0824 | 0.5740 | 0.5306 | 0.1694 | 2.8093 | 95.15 |
| 162 | 0.2004 | 0.3236 | 3.7748 | 20.5722 | 0.3136 | 0.0073 | 0.0019 | 3.1519 | 1.0536 | 0.7961 | 0.1819 | 4.1394 | 42.10 |
| 163 | 0.1762 | 0.2807 | 4.3185 | 28.0088 | 0.2641 | 0.0056 | 0.0014 | 3.7338 | 0.5869 | 0.6335 | 0.1647 | 2.9868 | 41.35 |
| 164 | 0.1541 | 0.3826 | 3.6208 | 21.2432 | 0.2931 | 0.0073 | 0.0018 | 2.7493 | 0.5721 | 0.5571 | 0.2249 | 3.3235 | 35.15 |
| 165 | 0.2097 | 0.2599 | 3.5839 | 24.9561 | 0.2644 | 0.0071 | 0.0012 | 3.4481 | 0.5634 | 0.5710 | 0.1554 | 3.1006 | 50.10 |
| 166 | 0.1816 | 0.3317 | 4.3763 | 25.5633 | 0.2228 | 0.0068 | 0.0010 | 4.3377 | 0.5244 | 0.5533 | 0.0316 | 3.5370 | 96.95 |
| 167 | 0.0919 | 0.3263 | 4.0366 | 24.6199 | 0.2879 | 0.0072 | 0.0014 | 3.8227 | 0.4634 | 0.5060 | 0.0241 | 3.5537 | 89.80 |
| 168 | 0.2522 | 0.4298 | 4.4959 | 23.2809 | 0.2677 | 0.0060 | 0.0015 | 4.3567 | 0.6091 | 0.5857 | 0.0510 | 3.7409 | 92.95 |
| 169 | *Sample too friable to for pellet for analysis* | | | | | | | | | | | | |
| 170 | *Sample too friable to for pellet for analysis* | | | | | | | | | | | | |
| 171 | 0.1755 | 0.2478 | 2.6074 | 25.6264 | 0.2645 | 0.0074 | 0.0014 | 2.4693 | 0.3800 | 0.3756 | 0.0000 | 2.0013 | 50.40 |
| 172 | 0.0828 | 0.2385 | 3.5600 | 25.8003 | 0.2724 | 0.0078 | 0.0017 | 3.3874 | 0.4873 | 0.5497 | 0.2169 | 3.0862 | 53.00 |
| 173 | 0.0800 | 0.2389 | 3.5392 | 24.9867 | 0.2904 | 0.0078 | 0.0012 | 3.2358 | 0.5800 | 0.5372 | 0.1402 | 2.8473 | 57.00 |
| 174 | 0.1956 | 0.2625 | 3.6817 | 25.1080 | 0.2634 | 0.0076 | 0.0019 | 3.5393 | 0.5811 | 0.5882 | 0.1406 | 3.2889 | 53.50 |
| 175 | 0.1919 | 0.2666 | 3.3386 | 23.7908 | 0.2582 | 0.0077 | 0.0017 | 3.1897 | 0.4798 | 0.5150 | 0.1246 | 2.7522 | 53.20 |
| 176 | 0.1115 | 0.3215 | 4.0088 | 24.8907 | 0.2919 | 0.0074 | 0.0013 | 3.5915 | 0.5435 | 0.5891 | 0.1637 | 3.3364 | 50.50 |
| 177 | 0.1784 | 0.3189 | 3.9427 | 26.1988 | 0.3240 | 0.0071 | 0.0014 | 3.5269 | 0.6769 | 0.5997 | 0.2278 | 3.2082 | 49.55 |
| 178 | 0.1571 | 0.2269 | 3.2266 | 23.2678 | 0.2278 | 0.0071 | 0.0026 | 3.0781 | 0.5410 | 0.5290 | 0.1596 | 2.8622 | 40.50 |
| 179 | 0.1150 | 0.3468 | 4.4990 | 24.1733 | 0.4175 | 0.0069 | 0.0023 | 4.1131 | 0.7086 | 0.6457 | 0.1126 | 3.5026 | 66.85 |
| 180 | 0.3353 | 0.4344 | 4.5880 | 23.5062 | 0.1555 | 0.0043 | 0.0013 | 4.5431 | 0.5316 | 0.5814 | 0.0218 | 3.5733 | 99.60 |
| 181 | *Sample too friable to for pellet for analysis* | | | | | | | | | | | | 97.45 |
| 182 | *Sample too friable to for pellet for analysis* | | | | | | | | | | | | |
| 183 | 0.5772 | 0.3311 | 4.9650 | 25.2097 | 0.2492 | 0.0039 | 0.0011 | 3.9785 | 0.3781 | 0.4124 | 0.0391 | 2.3722 | |
| 184 | 0.0541 | 0.1873 | 3.3657 | 22.1378 | 0.3386 | 0.0073 | 0.0012 | 3.5122 | 0.4373 | 0.4586 | 0.0594 | 3.0447 | 58.80 |
| 185 | 0.1410 | 0.2950 | 3.5980 | 24.0223 | 0.2832 | 0.0083 | 0.0013 | 3.1796 | 0.4563 | 0.5604 | 0.1273 | 2.7915 | 52.45 |
| 186 | 0.1839 | 0.3096 | 4.0600 | 26.0925 | 0.3020 | 0.0065 | 0.0015 | 3.5262 | 0.6457 | 0.6970 | 0.1350 | 3.4198 | 43.60 |
| 187 | 0.2144 | 0.3286 | 4.2236 | 23.4770 | 0.3427 | 0.0080 | 0.0019 | 3.6829 | 0.7395 | 0.6115 | 0.1111 | 3.2821 | 52.10 |
| 188 | 0.1628 | 0.3332 | 4.1489 | 24.6632 | 0.2897 | 0.0059 | 0.0016 | 4.0953 | 0.5586 | 0.5001 | 0.0259 | 3.4925 | 92.65 |
| 189 | 0.0784 | 0.2545 | 3.2584 | 23.8724 | 0.1834 | 0.0096 | 0.0019 | 3.0931 | 0.5785 | 0.5253 | 0.0707 | 2.8535 | 63.20 |
| 190 | 0.2693 | 0.2667 | 3.7975 | 23.6057 | 0.2855 | 0.0078 | 0.0018 | 3.5631 | 0.5732 | 0.5292 | 0.1311 | 3.3845 | 32.55 |
| 191 | 0.1528 | 0.2438 | 3.6255 | 25.3023 | 0.3034 | 0.0076 | 0.0016 | 3.2673 | 0.5157 | 0.5763 | 0.1453 | 2.9952 | 55.85 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 192 | 0.2259 | 0.3581 | 4.5286 | 25.3639 | 0.2923 | 0.0063 | 0.0021 | 4.5948 | 0.5441 | 0.5955 | 0.0392 | 3.6403 | 90.05 |
| 193 | 0.3806 | 0.4456 | 4.7864 | 24.9694 | 0.2120 | 0.0050 | 0.0016 | 4.7017 | 0.4741 | 0.5903 | 0.0423 | 3.7317 | 66.60 |
| 194 | 0.1315 | 0.3405 | 3.9031 | 26.0305 | 0.1819 | 0.0044 | 0.0012 | 3.5766 | 0.4921 | 0.4840 | 0.0588 | 3.1318 | 94.70 |
| 195 | *Sample too friable to for pellet for analysis* | | | | | | | | | | | | |
| 196 | *Sample too friable to for pellet for analysis* | | | | | | | | | | | | |
| 197 | 0.0211 | 0.1486 | 2.1493 | 28.3539 | 0.1306 | 0.0080 | 0.0015 | 2.3133 | 0.2032 | 0.2671 | 0.0000 | 1.8091 | 37.65 |
| 198 | 0.2362 | 0.5936 | 5.0931 | 22.9776 | 0.3160 | 0.0067 | 0.0020 | 3.6206 | 0.6132 | 0.6290 | 0.5162 | 4.3661 | 56.75 |
| 199 | 0.2281 | 0.3407 | 3.8223 | 23.7092 | 0.2668 | 0.0098 | 0.0018 | 3.2143 | 0.6550 | 0.5792 | 0.0994 | 3.0035 | 53.60 |
| 200 | 0.1071 | 0.2920 | 3.6683 | 22.1639 | 0.3425 | 0.0082 | 0.0022 | 3.0616 | 0.6974 | 0.5767 | 0.1885 | 3.0836 | 33.65 |
| 201 | 0.0769 | 0.2850 | 3.7897 | 26.3837 | 0.3240 | 0.0082 | 0.0016 | 3.2960 | 0.5963 | 0.5919 | 0.0935 | 3.0524 | 42.90 |
| 202 | 0.2638 | 0.2899 | 3.9640 | 27.0837 | 0.1689 | 0.0064 | 0.0012 | 3.7887 | 0.5168 | 0.6298 | 0.0964 | 3.5776 | 54.40 |
| 203 | 0.1935 | 0.2550 | 3.6850 | 23.4425 | 0.2487 | 0.0082 | 0.0021 | 3.1455 | 0.5509 | 0.5481 | 0.1485 | 3.0480 | 39.10 |
| 204 | 0.2135 | 0.2838 | 4.1182 | 25.9226 | 0.3599 | 0.0079 | 0.0018 | 3.5476 | 0.7011 | 0.6163 | 0.1634 | 3.3344 | 39.60 |
| 205 | 0.2147 | 0.3306 | 4.1605 | 22.0619 | 0.2673 | 0.0046 | 0.0012 | 4.3651 | 0.5252 | 0.5730 | 0.0315 | 3.6240 | 97.05 |
| 206 | 0.2516 | 0.3700 | 4.3587 | 23.9523 | 0.2513 | 0.0054 | 0.0015 | 4.4454 | 0.4905 | 0.6369 | 0.0510 | 3.5386 | 100.60 |
| 207 | 0.1178 | 0.3138 | 4.2380 | 24.9292 | 0.2145 | 0.0052 | 0.0013 | 4.1954 | 0.5086 | 0.5287 | 0.0103 | 3.5286 | 69.50 |
| 208 | *Sample too friable to for pellet for analysis* | | | | | | | | | | | | |
| 209 | 0.3139 | 0.4079 | 4.7525 | 25.2866 | 0.1630 | 0.0050 | 0.0014 | 3.7380 | 0.3463 | 0.3954 | 0.0131 | 2.3763 | |
| 210 | 0.2251 | 0.4549 | 4.6702 | 26.6898 | 0.3330 | 0.0064 | 0.0013 | 3.7040 | 0.4395 | 0.6483 | 0.0584 | 3.7397 | 59.45 |
| 211 | 0.1264 | 0.2786 | 3.6256 | 22.7959 | 0.2768 | 0.0064 | 0.0022 | 3.3684 | 0.4233 | 0.5605 | 0.1823 | 3.2550 | 47.70 |
| 212 | 0.1712 | 0.3104 | 3.7639 | 22.4676 | 0.3407 | 0.0082 | 0.0020 | 3.2903 | 0.6445 | 0.5774 | 0.1824 | 3.0802 | 34.25 |
| 213 | 0.2619 | 0.3113 | 3.7635 | 22.7711 | 0.3190 | 0.0086 | 0.0022 | 3.2114 | 0.6607 | 0.5789 | 0.1430 | 3.2700 | 52.75 |
| 214 | 0.1279 | 0.1937 | 2.6095 | 16.0762 | 0.1903 | 0.0050 | 0.0021 | 2.7003 | 0.4408 | 0.4552 | 0.1522 | 2.8687 | 51.70 |
| 215 | 0.1963 | 0.2683 | 3.8020 | 23.9787 | 0.2619 | 0.0078 | 0.0012 | 3.7491 | 0.5203 | 0.6045 | 0.1027 | 3.1556 | 48.10 |
| 216 | 0.1175 | 0.2982 | 3.7977 | 24.2954 | 0.2844 | 0.0072 | 0.0015 | 3.4173 | 0.5856 | 0.5644 | 0.1162 | 3.0830 | 58.60 |
| 217 | 0.1138 | 0.2299 | 3.1285 | 23.0649 | 0.2706 | 0.0089 | 0.0017 | 2.7680 | 0.5591 | 0.5036 | 0.1275 | 2.7695 | 46.75 |
| 218 | 0.2512 | 0.5304 | 5.4951 | 24.8002 | 0.3516 | 0.0054 | 0.0013 | 4.7924 | 0.4259 | 0.5892 | 0.3412 | 4.9269 | 78.35 |
| 219 | 0.3225 | 0.4196 | 4.5908 | 24.3217 | 0.2324 | 0.0036 | 0.0012 | 4.5710 | 0.5764 | 0.5993 | 0.0889 | 3.7300 | 92.50 |
| 220 | 0.3124 | 0.3649 | 4.2353 | 23.4491 | 0.2700 | 0.0095 | 0.0015 | 3.6912 | 0.4631 | 0.5671 | 0.0493 | 3.6087 | 62.30 |
| 221 | *Sample too friable to for pellet for analysis* | | | | | | | | | | | | |
| 222 | *Sample too friable to for pellet for analysis* | | | | | | | | | | | | |
| 223 | 0.2594 | 0.4711 | 4.4035 | 25.5330 | 0.2337 | 0.0061 | 0.0022 | 4.2579 | 0.4958 | 0.5354 | 0.0301 | 3.5357 | 72.90 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 224 | 0.1820 | 0.2840 | 3.9617 | 26.9460 | 0.3416 | 0.0065 | 0.0018 | 3.8313 | 0.5293 | 0.5623 | 0.2085 | 3.1995 | 63.85 |
| 225 | 0.0313 | 0.3066 | 3.8134 | 23.0855 | 0.3701 | 0.0087 | 0.0033 | 3.1562 | 0.5539 | 0.6263 | 0.1986 | 3.1919 | 38.15 |
| 226 | 0.0497 | 0.2521 | 3.8219 | 25.5199 | 0.3017 | 0.0064 | 0.0016 | 3.6363 | 0.5759 | 0.5847 | 0.1740 | 3.2859 | 41.80 |
| 227 | 0.0006 | 0.2208 | 3.2543 | 24.7301 | 0.2932 | 0.0085 | 0.0014 | 2.9673 | 0.5720 | 0.5253 | 0.0727 | 2.8471 | 38.20 |
| 228 | 0.1747 | 0.2713 | 3.5963 | 22.8914 | 0.2905 | 0.0099 | 0.0016 | 3.2756 | 0.6550 | 0.5951 | 0.1250 | 3.0920 | 40.90 |
| 229 | 0.1842 | 0.2515 | 3.7012 | 23.1315 | 0.2984 | 0.0073 | 0.0012 | 3.4678 | 0.4909 | 0.5920 | 0.1100 | 3.1891 | 37.30 |
| 230 | 0.0777 | 0.2511 | 3.6640 | 24.6622 | 0.2964 | 0.0075 | 0.0021 | 3.5175 | 0.5277 | 0.6121 | 0.1462 | 3.2501 | 47.35 |
| 231 | 0.0900 | 0.2940 | 4.2749 | 23.6951 | 0.2522 | 0.0066 | 0.0016 | 4.5655 | 0.5693 | 0.5745 | 0.0431 | 3.3890 | 99.20 |
| 232 | 0.1533 | 0.3179 | 3.7206 | 25.1028 | 0.2530 | 0.0065 | 0.0017 | 3.5819 | 0.3786 | 0.4675 | 0.0248 | 3.0700 | 66.90 |
| 233 | 0.1477 | 0.2701 | 3.4429 | 23.5295 | 0.2368 | 0.0078 | 0.0021 | 3.1739 | 0.5091 | 0.5652 | 0.1701 | 3.0575 | 74.55 |
| 234 | *Sample too friable to for pellet for analysis* | | | | | | | | | | | | |
| 235 | 0.3165 | 0.4320 | 4.8524 | 24.0287 | 0.2521 | 0.0066 | 0.0026 | 3.6671 | 0.3593 | 0.3671 | 0.0050 | 2.4681 | |
| 236 | 0.0905 | 0.3661 | 4.3575 | 26.8568 | 0.3041 | 0.0065 | 0.0013 | 4.0511 | 0.4707 | 0.5735 | 0.0466 | 3.3489 | 80.65 |
| 237 | 0.2152 | 0.2733 | 3.6727 | 22.8619 | 0.2351 | 0.0079 | 0.0014 | 4.1071 | 0.5807 | 0.5677 | 0.1253 | 2.8975 | 56.65 |
| 238 | 0.1215 | 0.2509 | 4.0164 | 25.9106 | 0.3221 | 0.0074 | 0.0017 | 3.7800 | 0.5406 | 0.5790 | 0.2115 | 3.2341 | 32.15 |
| 239 | 0.1060 | 0.2303 | 3.3958 | 24.2557 | 0.3254 | 0.0071 | 0.0015 | 3.1454 | 0.4498 | 0.5197 | 0.2617 | 2.8264 | 45.15 |
| 240 | 0.1489 | 0.1914 | 3.3977 | 22.8035 | 0.3050 | 0.0070 | 0.0009 | 3.2344 | 0.5402 | 0.5480 | 0.1652 | 2.8239 | 49.05 |
| 241 | 0.1049 | 0.2506 | 3.3931 | 23.6762 | 0.2305 | 0.0066 | 0.0026 | 3.3751 | 0.4291 | 0.5310 | 0.0847 | 2.8366 | 51.75 |
| 242 | 0.2630 | 0.2569 | 3.8261 | 26.4598 | 0.2488 | 0.0071 | 0.0019 | 3.5343 | 0.4971 | 0.5797 | 0.1115 | 3.7227 | 55.40 |
| 243 | 0.2816 | 0.2799 | 3.8753 | 25.4487 | 0.3010 | 0.0073 | 0.0015 | 3.7038 | 0.5079 | 0.5622 | 0.1254 | 3.0439 | 68.55 |
| 244 | 0.0615 | 0.3212 | 4.1759 | 26.1001 | 0.4010 | 0.0076 | 0.0018 | 3.9499 | 0.4442 | 0.4947 | 0.0359 | 3.2394 | 76.70 |
| 245 | 0.1934 | 0.3508 | 3.7935 | 26.3100 | 0.1643 | 0.0061 | 0.0032 | 3.9803 | 0.3558 | 0.4423 | 0.0034 | 3.0827 | 66.60 |
| 246 | 0.3117 | 0.4072 | 4.5762 | 25.1208 | 0.2110 | 0.0030 | 0.0012 | 4.7901 | 0.5316 | 0.5659 | 0.0314 | 3.5743 | 108.85 |
| 247 | *Sample too friable to for pellet for analysis* | | | | | | | | | | | | |
| 248 | *Sample too friable to for pellet for analysis* | | | | | | | | | | | | |
| 249 | 0.1549 | 0.2907 | 3.9094 | 24.4272 | 0.2289 | 0.0068 | 0.0020 | 4.1297 | 0.4515 | 0.4819 | 0.0221 | 3.1686 | 103.35 |
| 250 | 0.2099 | 0.3113 | 3.7349 | 25.5862 | 0.2179 | 0.0060 | 0.0018 | 4.0762 | 0.4255 | 0.4528 | 0.0027 | 2.9427 | 62.05 |
| 251 | 0.1513 | 0.3037 | 4.2159 | 27.8353 | 0.3244 | 0.0065 | 0.0014 | 3.9673 | 0.5350 | 0.6542 | 0.1270 | 3.1389 | 54.75 |
| 252 | 0.2097 | 0.3040 | 3.8136 | 23.4798 | 0.3010 | 0.0076 | 0.0019 | 3.7320 | 0.5051 | 0.5456 | 0.2163 | 3.0617 | 54.85 |
| 253 | 0.1084 | 0.2585 | 3.5543 | 23.5445 | 0.2884 | 0.0068 | 0.0018 | 3.3423 | 0.4795 | 0.5417 | 0.1431 | 2.9841 | 45.40 |
| 254 | 0.2236 | 0.2555 | 3.6730 | 24.5153 | 0.3015 | 0.0070 | 0.0057 | 3.6903 | 0.5216 | 0.5574 | 0.1255 | 2.9805 | 47.95 |
| 255 | 0.1398 | 0.2936 | 4.0268 | 28.1958 | 0.2556 | 0.0055 | 0.0012 | 3.9821 | 0.5004 | 0.6264 | 0.1306 | 3.3764 | 47.95 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 256 | 0.0357 | 0.4381 | 4.5640 | 24.0849 | 0.2738 | 0.0058 | 0.0040 | 4.1531 | 0.4162 | 0.5554 | 0.0157 | 3.7072 | 94.85 |
| 257 | 0.2002 | 0.2936 | 4.3197 | 25.4196 | 0.2734 | 0.0046 | 0.0018 | 4.5471 | 0.5492 | 0.6014 | 0.0659 | 3.2107 | 92.15 |
| 258 | 0.1489 | 0.2962 | 3.6749 | 23.8647 | 0.2701 | 0.0085 | 0.0018 | 3.3248 | 0.4290 | 0.4651 | 0.0246 | 3.0359 | 81.85 |
| 259 | 0.1416 | 0.3547 | 4.6550 | 28.7447 | 0.1997 | 0.0057 | 0.0015 | 4.5881 | 0.4673 | 0.6109 | 0.0282 | 3.3934 | 79.90 |
| 260 | *Sample too friable to for pellet for analysis* | | | | | | | | | | | | |
| 261 | 0.2735 | 0.2591 | 4.2317 | 24.1721 | 0.2644 | 0.0066 | 0.0023 | 3.2032 | 0.3878 | 0.4300 | 0.0960 | 2.1126 | |
| 262 | 0.2427 | 0.3668 | 4.4448 | 26.2245 | 0.2480 | 0.0068 | 0.0020 | 4.1892 | 0.4788 | 0.5008 | 0.0305 | 3.4844 | 69.60 |
| 263 | 0.1695 | 0.3604 | 4.3986 | 25.6296 | 0.2901 | 0.0070 | 0.0017 | 4.0709 | 0.4612 | 0.5570 | 0.0326 | 3.6587 | 60.45 |
| 264 | 0.3908 | 0.4256 | 4.7661 | 24.7050 | 0.1643 | 0.0039 | 0.0026 | 4.7729 | 0.5871 | 0.5893 | 0.0188 | 3.8145 | 100.20 |
| 265 | 0.0614 | 0.3088 | 3.6550 | 23.9701 | 0.2705 | 0.0069 | 0.0016 | 3.4005 | 0.4877 | 0.5175 | 0.0339 | 2.9859 | 73.60 |
| 266 | 0.1317 | 0.2591 | 3.7975 | 24.6538 | 0.2739 | 0.0069 | 0.0014 | 3.6742 | 0.5146 | 0.5850 | 0.1538 | 3.3385 | 45.95 |
| 267 | 0.1856 | 0.2807 | 3.6419 | 24.4890 | 0.2693 | 0.0077 | 0.0021 | 3.4038 | 0.5039 | 0.5768 | 0.1208 | 3.2949 | 61.40 |
| 268 | 0.2630 | 0.4002 | 4.9672 | 25.5992 | 0.2185 | 0.0033 | 0.0011 | 5.5137 | 0.5741 | 0.6511 | 0.0657 | 4.2017 | 73.60 |
| 269 | 0.1767 | 0.3194 | 4.0182 | 22.0628 | 0.4505 | 0.0083 | 0.0019 | 3.5369 | 0.4831 | 0.4746 | 0.0731 | 3.4492 | 90.20 |
| 270 | 0.2102 | 0.3127 | 4.2672 | 23.9750 | 0.2609 | 0.0066 | 0.0016 | 4.0955 | 0.4816 | 0.4858 | 0.0140 | 3.3998 | 67.90 |
| 271 | 0.1968 | 0.3934 | 4.4358 | 24.5555 | 0.2012 | 0.0049 | 0.0010 | 4.1873 | 0.4257 | 0.5670 | 0.0325 | 3.7610 | 103.85 |
| 272 | 0.1713 | 0.3552 | 4.0470 | 27.3592 | 0.3348 | 0.0068 | 0.0013 | 3.8223 | 0.4875 | 0.5268 | 0.0341 | 3.3552 | 74.15 |
| 273 | *Sample too friable to for pellet for analysis* | | | | | | | | | | | | |
| 274 | *Sample too friable to for pellet for analysis* | | | | | | | | | | | | |
| 275 | 0.2267 | 0.2677 | 3.8099 | 27.7119 | 0.2663 | 0.0067 | 0.0016 | 3.6003 | 0.5148 | 0.5971 | 0.1477 | 3.0446 | 52.95 |
| 276 | 0.2189 | 0.2661 | 3.7795 | 24.7237 | 0.2662 | 0.0074 | 0.0012 | 3.5551 | 0.5334 | 0.5751 | 0.1493 | 3.1554 | 45.75 |
| 277 | 0.1003 | 0.3989 | 4.5908 | 23.2126 | 0.3974 | 0.0082 | 0.0019 | 4.0393 | 0.6454 | 0.5452 | 0.0309 | 3.6316 | 88.15 |
| 278 | *Sample too friable to for pellet for analysis* | | | | | | | | | | | | 95.80 |
| 279 | 0.2186 | 0.2947 | 4.0577 | 23.7188 | 0.2461 | 0.0060 | 0.0031 | 3.7187 | 0.4361 | 0.6190 | 0.0374 | 3.3051 | 67.55 |
| 280 | 0.2140 | 0.3391 | 4.6711 | 26.6324 | 0.3258 | 0.0059 | 0.0015 | 4.2394 | 0.4463 | 0.6312 | 0.0405 | 3.4727 | 72.45 |
| 281 | 0.2930 | 0.2777 | 3.9479 | 24.4197 | 0.2311 | 0.0061 | 0.0014 | 3.7510 | 0.4412 | 0.5527 | 0.0360 | 2.8369 | 90.75 |
| 282 | 0.1531 | 0.4173 | 4.7323 | 26.0495 | 0.3324 | 0.0063 | 0.0012 | 4.5264 | 0.5545 | 0.5754 | 0.0291 | 3.7489 | 70.55 |
| 283 | 0.3079 | 0.4323 | 4.4192 | 25.2499 | 0.1910 | 0.0042 | 0.0018 | 4.2575 | 0.4405 | 0.5563 | 0.0467 | 3.5428 | 85.35 |
| 284 | 0.0100 | 0.3085 | 3.9566 | 23.2519 | 0.4807 | 0.0115 | 0.0017 | 3.0372 | 0.5449 | 0.4686 | 0.0368 | 3.4453 | 98.95 |
| 285 | 0.2157 | 0.3660 | 4.4487 | 25.3314 | 0.3008 | 0.0068 | 0.0014 | 4.1081 | 0.4894 | 0.5481 | 0.0322 | 3.7614 | 86.00 |
| 286 | *Sample too friable to for pellet for analysis* | | | | | | | | | | | | |
| 287 | 0.2913 | 0.2524 | 3.9745 | 24.9377 | 0.3029 | 0.0087 | 0.0021 | 2.7966 | 0.3720 | 0.4139 | 0.1435 | | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 288 | 0.1786 | 0.2639 | 3.4202 | 23.7395 | 0.2711 | 0.0066 | 0.0016 | 3.2461 | 0.5201 | 0.5789 | 0.2172 | 3.1438 | 52.55 |
| 289 | 0.1686 | 0.2515 | 3.7755 | 26.8914 | 0.2636 | 0.0065 | 0.0021 | 3.8418 | 0.4974 | 0.6727 | 0.1974 | 2.9595 | 58.60 |
| 290 | 0.2016 | 0.3948 | 4.9575 | 26.2114 | 0.2514 | 0.0039 | 0.0012 | 4.7705 | 0.5955 | 0.6116 | 0.0402 | 4.0236 | 112.25 |
| 291 | 0.1409 | 0.3779 | 4.4714 | 26.3448 | 0.2139 | 0.0070 | 0.0020 | 4.3772 | 0.4832 | 0.5971 | 0.0252 | 3.7612 | 97.95 |
| 292 | 0.1111 | 0.4245 | 4.5785 | 25.5022 | 0.2357 | 0.0062 | 0.0016 | 4.3460 | 0.6096 | 0.5615 | 0.0274 | 3.8013 | 105.80 |
| 293 | 0.2221 | 0.3963 | 4.4980 | 24.0227 | 0.3320 | 0.0093 | 0.0023 | 4.1203 | 0.5773 | 0.5548 | 0.0254 | 3.7032 | 108.50 |
| 294 | 0.2219 | 0.3095 | 4.0549 | 22.3350 | 0.3584 | 0.0070 | 0.0016 | 3.8172 | 0.5558 | 0.5517 | 0.0315 | 3.5382 | 70.55 |
| 295 | 0.2086 | 0.3196 | 4.1727 | 23.9688 | 0.2040 | 0.0041 | 0.0020 | 4.4349 | 0.5010 | 0.5263 | 0.0139 | 3.2759 | 85.75 |
| 296 | 0.1283 | 0.3144 | 4.1999 | 25.5124 | 0.2941 | 0.0064 | 0.0013 | 3.6155 | 0.4171 | 0.5422 | 0.0294 | 3.4683 | 85.40 |
| 297 | *Sample too friable to for pellet for analysis* | | | | | | | | | | | | 98.60 |
| 298 | 0.2576 | 0.4371 | 4.7664 | 25.5951 | 0.2179 | 0.0053 | 0.0012 | 4.5887 | 0.6155 | 0.6020 | 0.0469 | 3.8511 | 93.40 |
| 299 | 0.1748 | 0.3757 | 4.3014 | 24.5828 | 0.2256 | 0.0056 | 0.0019 | 4.5813 | 0.5605 | 0.5107 | 0.0748 | 3.4710 | 112.75 |

*Table 1. Analytical results from SFB 2 and 3. Figures in weight percent.*

| Sample No | Na | Mg | Al | Si | P | S | Cl | K | Ca | Ti | Mn | Fe | Mag Sus |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 300 | 0.1296 | 0.2243 | 2.5898 | 23.4133 | 0.1619 | 0.0049 | 0.0015 | 2.7328 | 0.3184 | 0.3706 | 0.0000 | 1.9018 | 67.45 |
| 301 | 0.0665 | 0.2365 | 2.9111 | 25.0939 | 0.1318 | 0.0052 | 0.0015 | 3.3089 | 0.3793 | 0.4366 | 0.0302 | 2.1689 | 60.25 |
| 302 | 0.1159 | 0.2801 | 3.0119 | 23.9286 | 0.1297 | 0.0058 | 0.0012 | 3.1165 | 0.3890 | 0.4499 | 0.0085 | 2.2155 | 62.70 |
| 303 | 0.0738 | 0.2394 | 2.7823 | 24.0486 | 0.1341 | 0.0062 | 0.0008 | 2.9989 | 0.3209 | 0.4178 | 0.0166 | 2.0416 | 56.35 |
| 304 | 0.0916 | 0.2700 | 3.3363 | 25.4257 | 0.1602 | 0.0062 | 0.0012 | 3.5180 | 0.4352 | 0.4765 | 0.0386 | 2.3704 | 55.85 |
| 305 | 0.1006 | 0.2468 | 3.0602 | 22.3471 | 0.1079 | 0.0055 | 0.0023 | 3.3418 | 0.2970 | 0.4517 | 0.0000 | 2.4757 | 59.00 |
| 306 | 0.0860 | 0.2540 | 2.7763 | 22.0269 | 0.0968 | 0.0045 | 0.0011 | 3.1680 | 0.3210 | 0.4085 | 0.0150 | 1.9777 | 57.20 |
| 307 | 0.0581 | 0.2557 | 2.7851 | 21.3761 | 0.1058 | 0.0026 | 0.0011 | 3.1967 | 0.3774 | 0.4307 | 0.0220 | 2.0385 | 51.15 |
| 308 | 0.0582 | 0.1486 | 2.6785 | 23.0340 | 0.0998 | 0.0042 | 0.0012 | 3.5398 | 0.3750 | 0.4033 | 0.0169 | 2.2312 | 51.80 |
| 309 | 0.0602 | 0.2454 | 2.8027 | 22.8540 | 0.0991 | 0.0066 | 0.0022 | 3.4079 | 0.3530 | 0.4602 | 0.0028 | 2.2428 | 89.70 |
| 310 | 0.0886 | 0.1865 | 2.6438 | 23.4764 | 0.1048 | 0.0058 | 0.0011 | 3.2066 | 0.3238 | 0.3560 | 0.0033 | 2.0466 | 64.10 |
| 311 | 0.1419 | 0.3025 | 3.6331 | 24.5244 | 0.1995 | 0.0070 | 0.0018 | 3.6602 | 0.5010 | 0.5317 | 0.0118 | 2.9792 | 96.10 |
| 312 | 0.1748 | 0.3208 | 3.8457 | 22.1906 | 0.1014 | 0.0053 | 0.0013 | 4.7476 | 0.4344 | 0.4921 | 0.0109 | 2.9507 | 84.95 |
| 313 | 0.0541 | 0.2413 | 2.8500 | 24.7451 | 0.1001 | 0.0041 | 0.0011 | 3.5024 | 0.3630 | 0.3907 | 0.0101 | 2.1804 | 61.25 |
| 314 | 0.0175 | 0.1795 | 2.2080 | 24.1924 | 0.1079 | 0.0056 | 0.0009 | 2.9160 | 0.3222 | 0.3858 | 0.0000 | 1.8018 | 63.35 |
| 315 | 0.1438 | 0.2484 | 2.6368 | 23.1454 | 0.1122 | 0.0057 | 0.0012 | 2.9876 | 0.3280 | 0.3904 | 0.0167 | 2.0220 | 57.50 |
| 316 | *Sample too friable to for pellet for analysis* | | | | | | | | | | | | 58.55 |
| 317 | *Sample too friable to for pellet for analysis* | | | | | | | | | | | | |
| 318 | 0.0810 | 0.2830 | 3.3703 | 23.9611 | 0.1701 | 0.0070 | 0.0014 | 3.3651 | 0.4333 | 0.4988 | 0.0458 | 2.4434 | 55.15 |
| 319 | *Sample too friable to for pellet for analysis* | | | | | | | | | | | | |
| 320 | *Sample too friable to for pellet for analysis* | | | | | | | | | | | | |
| 321 | 0.0993 | 0.2547 | 3.2157 | 24.2086 | 0.1811 | 0.0065 | 0.0012 | 3.3613 | 0.3976 | 0.4672 | 0.0447 | 2.6450 | 66.20 |
| 322 | *Sample too friable to for pellet for analysis* | | | | | | | | | | | | |
| 323 | 0.0515 | 0.2074 | 3.0103 | 22.7439 | 0.1408 | 0.0050 | 0.0009 | 3.3778 | 0.4174 | 0.4540 | 0.0186 | 2.3025 | 54.25 |
| 324 | 0.1727 | 0.2649 | 3.3264 | 25.4563 | 0.1151 | 0.0049 | 0.0017 | 3.9580 | 0.3801 | 0.5304 | 0.0121 | 2.6545 | 68.50 |
| 325 | 0.1864 | 0.3830 | 4.3452 | 23.3214 | 0.1825 | 0.0050 | 0.0015 | 4.6521 | 0.6170 | 0.5650 | 0.0290 | 3.5936 | |
| 326 | 0.1144 | 0.2343 | 3.1425 | 23.4901 | 0.2001 | 0.0070 | 0.0011 | 3.3713 | 0.3238 | 0.4036 | 0.0080 | 2.4027 | 64.10 |
| 327 | 0.1002 | 0.2336 | 2.5958 | 24.3573 | 0.1097 | 0.0043 | 0.0015 | 3.1474 | 0.3327 | 0.3439 | 0.0076 | 2.0473 | 76.10 |
| 328 | 0.0853 | 0.2474 | 2.6662 | 22.9489 | 0.1165 | 0.0054 | 0.0011 | 3.0250 | 0.3359 | 0.3590 | 0.0094 | 2.1343 | 61.50 |
| 329 | *Sample too friable to for pellet for analysis* | | | | | | | | | | | | |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 330 | 0.0898 | 0.2890 | 3.3634 | 24.2941 | 0.2190 | 0.0082 | 0.0019 | 3.3867 | 0.5405 | 0.5077 | 0.0544 | 2.7013 | 58.00 |
| 331 | *Sample too friable to for pellet for analysis* | | | | | | | | | | | | |
| 332 | 0.1161 | 0.2503 | 3.2779 | 24.5088 | 0.2221 | 0.0069 | 0.0011 | 3.2676 | 0.4304 | 0.4728 | 0.0546 | 2.6239 | 59.20 |
| 333 | *Sample too friable to for pellet for analysis* | | | | | | | | | | | | |
| 334 | 0.0200 | 0.2455 | 3.2180 | 21.4151 | 0.2211 | 0.0075 | 0.0017 | 3.2337 | 0.4708 | 0.4771 | 0.0490 | 2.5205 | 55.95 |
| 335 | 0.1336 | 0.2500 | 3.3757 | 24.6650 | 0.2243 | 0.0078 | 0.0012 | 3.2141 | 0.4731 | 0.5220 | 0.0662 | 2.5873 | 60.60 |
| 336 | 0.0938 | 0.2530 | 2.8658 | 23.6813 | 0.1098 | 0.0042 | 0.0011 | 3.2978 | 0.3632 | 0.3749 | 0.0144 | 2.0556 | 55.65 |
| 337 | 0.0680 | 0.2548 | 3.0241 | 23.1192 | 0.1071 | 0.0055 | 0.0015 | 3.2641 | 0.3352 | 0.3687 | 0.0436 | 2.0903 | 42.10 |
| 338 | 0.1129 | 0.1725 | 2.8484 | 23.9645 | 0.1430 | 0.0051 | 0.0008 | 3.2825 | 0.3575 | 0.4068 | 0.0545 | 2.2519 | 65.15 |
| 339 | 0.1643 | 0.3142 | 3.2426 | 24.3287 | 0.1574 | 0.0048 | 0.0008 | 3.5590 | 0.4181 | 0.5147 | 0.0203 | 2.7532 | 98.90 |
| 340 | 0.0489 | 0.2461 | 2.7962 | 25.0531 | 0.1261 | 0.0049 | 0.0012 | 3.4349 | 0.3624 | 0.3502 | 0.0178 | 2.0973 | 60.40 |
| 341 | 0.0594 | 0.2696 | 2.8053 | 23.6288 | 0.1345 | 0.0077 | 0.0016 | 3.0802 | 0.3797 | 0.4080 | 0.0159 | 2.2545 | 68.15 |
| 342 | 0.1747 | 0.2507 | 3.2129 | 23.9591 | 0.2250 | 0.0073 | 0.0024 | 3.3438 | 0.4470 | 0.4437 | 0.0277 | 2.3121 | 60.40 |
| 343 | 0.0806 | 0.2522 | 2.9931 | 21.6239 | 0.2290 | 0.0082 | 0.0020 | 2.6732 | 0.4526 | 0.4748 | 0.0502 | 2.3594 | 66.70 |
| 344 | 0.0738 | 0.2183 | 3.0635 | 24.1322 | 0.2101 | 0.0071 | 0.0016 | 3.0058 | 0.3891 | 0.4585 | 0.0427 | 2.4298 | 63.45 |
| 345 | 0.1318 | 0.2285 | 3.3411 | 25.0109 | 0.2148 | 0.0064 | 0.0013 | 3.5781 | 0.4282 | 0.4558 | 0.0378 | 2.4522 | 97.85 |
| 346 | 0.1366 | 0.2631 | 3.0789 | 23.2908 | 0.1862 | 0.0066 | 0.0014 | 3.2336 | 0.3984 | 0.4913 | 0.0444 | 2.4334 | 53.75 |
| 347 | 0.2341 | 0.2610 | 3.1952 | 24.5644 | 0.1885 | 0.0087 | 0.0019 | 3.3712 | 0.4277 | 0.5040 | 0.0365 | 2.4721 | 60.10 |
| 348 | 0.0988 | 0.2527 | 3.0784 | 24.3154 | 0.1971 | 0.0057 | 0.0009 | 3.2806 | 0.3740 | 0.4344 | 0.0378 | 2.4969 | 72.30 |
| 349 | 0.1292 | 0.2638 | 3.5788 | 23.2632 | 0.1545 | 0.0055 | 0.0013 | 4.1683 | 0.4059 | 0.5038 | 0.0652 | 2.7105 | 82.40 |
| 350 | 0.0099 | 0.2358 | 2.9039 | 23.9821 | 0.1124 | 0.0044 | 0.0013 | 3.2829 | 0.3356 | 0.4043 | 0.0087 | 2.0695 | 51.35 |
| 351 | 0.0473 | 0.3271 | 3.7923 | 25.5716 | 0.1691 | 0.0073 | 0.0011 | 3.7977 | 0.4717 | 0.5034 | 0.0704 | 2.9406 | 61.15 |
| 352 | 0.1615 | 0.3531 | 4.1208 | 26.8864 | 0.2298 | 0.0043 | 0.0012 | 4.0001 | 0.5169 | 0.5113 | 0.0356 | 3.1050 | 87.70 |
| 353 | 0.0332 | 0.2607 | 3.0802 | 28.8864 | 0.1501 | 0.0044 | 0.0011 | 3.4140 | 0.3966 | 0.4249 | 0.0269 | 2.4326 | 78.80 |
| 354 | 0.0000 | 0.1503 | 1.8856 | 15.8335 | 0.0820 | 0.0049 | 0.0020 | 2.2634 | 0.2683 | 0.3175 | 0.0164 | 1.9273 | 71.50 |
| 355 | 0.0000 | 0.2471 | 3.2356 | 24.1680 | 0.2146 | 0.0074 | 0.0014 | 3.2465 | 0.4793 | 0.4474 | 0.0442 | 2.4465 | 66.65 |
| 356 | 0.1691 | 0.2731 | 3.6020 | 26.5863 | 0.2447 | 0.0075 | 0.0015 | 3.7303 | 0.5007 | 0.5206 | 0.0589 | 2.6397 | 55.40 |
| 357 | 0.1544 | 0.2762 | 3.4583 | 24.3570 | 0.2389 | 0.0069 | 0.0014 | 3.4649 | 0.4781 | 0.5283 | 0.0528 | 2.6565 | 64.45 |
| 358 | 0.0964 | 0.1591 | 2.9242 | 23.0610 | 0.1861 | 0.0067 | 0.0014 | 3.2457 | 0.3726 | 0.4326 | 0.0333 | 2.4783 | 63.45 |
| 359 | 0.0891 | 0.2403 | 2.9822 | 23.0031 | 0.2139 | 0.0086 | 0.0017 | 2.8561 | 0.4161 | 0.4946 | 0.0391 | 2.4952 | 57.10 |
| 360 | 0.1503 | 0.2358 | 3.2225 | 23.7890 | 0.1977 | 0.0075 | 0.0021 | 3.2458 | 0.3989 | 0.4821 | 0.0338 | 2.4760 | 64.90 |
| 361 | 0.0611 | 0.2186 | 3.1174 | 23.4939 | 0.1967 | 0.0071 | 0.0012 | 3.2892 | 0.3541 | 0.4559 | 0.0340 | 2.4520 | 53.20 |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 362 | 0.2039 | 0.2505 | 2.9230 | 20.4265 | 0.1619 | 0.0065 | 0.0028 | 3.1523 | 0.3947 | 0.4326 | 0.0185 | 2.4363 | 55.10 |
| 363 | 0.0747 | 0.2854 | 3.2898 | 25.0743 | 0.1363 | 0.0062 | 0.0020 | 3.3652 | 0.3181 | 0.4631 | 0.0308 | 2.2413 | 59.35 |
| 364 | 0.2376 | 0.2841 | 3.5210 | 26.0780 | 0.1892 | 0.0069 | 0.0015 | 3.4761 | 0.3756 | 0.4738 | 0.0324 | 2.4947 | 61.55 |
| 365 | 0.0000 | 0.2746 | 3.1129 | 23.7452 | 0.1872 | 0.0081 | 0.0016 | 3.0475 | 0.4572 | 0.4717 | 0.0151 | 2.5179 | 63.25 |
| 366 | 0.0028 | 0.2189 | 2.7293 | 24.6877 | 0.0909 | 0.0050 | 0.0016 | 3.2870 | 0.3190 | 0.4140 | 0.0000 | 2.0813 | 63.35 |
| 367 | 0.0768 | 0.2686 | 3.7063 | 23.4344 | 0.3032 | 0.0075 | 0.0020 | 3.4773 | 0.5017 | 0.5701 | 0.0472 | 2.8166 | 69.80 |
| 368 | 0.0735 | 0.2269 | 3.1024 | 23.7016 | 0.2061 | 0.0071 | 0.0016 | 3.2015 | 0.4116 | 0.4839 | 0.0556 | 2.4110 | 56.30 |
| 369 | 0.1066 | 0.2310 | 3.1147 | 23.3894 | 0.2435 | 0.0071 | 0.0016 | 2.9789 | 0.4615 | 0.4399 | 0.0452 | 2.4125 | 68.60 |
| 370 | 0.0589 | 0.2527 | 3.4631 | 23.7280 | 0.2531 | 0.0082 | 0.0016 | 3.3380 | 0.4494 | 0.5328 | 0.0192 | 2.7253 | 58.10 |
| 371 | 0.1578 | 0.2655 | 3.5964 | 23.5203 | 0.2419 | 0.0097 | 0.0017 | 3.4015 | 0.4025 | 0.4948 | 0.0435 | 2.8492 | 54.40 |
| 372 | 0.0000 | 0.2191 | 3.1761 | 24.7732 | 0.2237 | 0.0076 | 0.0012 | 3.2682 | 0.3431 | 0.5118 | 0.0285 | 2.5883 | 56.70 |
| 373 | 0.1394 | 0.2956 | 3.5191 | 22.3502 | 0.2128 | 0.0071 | 0.0029 | 3.5036 | 0.4151 | 0.4803 | 0.0251 | 2.8903 | 62.35 |
| 374 | 0.1220 | 0.2615 | 3.6027 | 25.5666 | 0.2600 | 0.0064 | 0.0012 | 3.4606 | 0.4896 | 0.5051 | 0.0593 | 2.7922 | 56.90 |
| 375 | 0.2120 | 0.2607 | 3.1887 | 23.9288 | 0.1880 | 0.0069 | 0.0017 | 3.3592 | 0.4126 | 0.5233 | 0.0262 | 2.4560 | 54.80 |
| 376 | 0.0824 | 0.2657 | 3.2812 | 24.2433 | 0.1664 | 0.0057 | 0.0008 | 3.6427 | 0.3719 | 0.4161 | 0.0521 | 2.4523 | 66.00 |
| 377 | 0.0942 | 0.2661 | 3.3011 | 24.5949 | 0.1189 | 0.0056 | 0.0019 | 3.8265 | 0.3661 | 0.4419 | 0.0011 | 2.4322 | 76.30 |
| 378 | 0.1167 | 0.2296 | 3.0321 | 23.3872 | 0.1326 | 0.0063 | 0.0017 | 3.1583 | 0.2931 | 0.4460 | 0.0000 | 2.4442 | 80.35 |
| 379 | 0.0485 | 0.2361 | 3.0986 | 28.0294 | 0.1008 | 0.0047 | 0.0010 | 3.8502 | 0.3674 | 0.4783 | 0.0152 | 2.3315 | 66.30 |
| 380 | 0.1784 | 0.2870 | 3.1689 | 26.4334 | 0.1446 | 0.0067 | 0.0016 | 3.3850 | 0.3637 | 0.4178 | 0.0055 | 2.3034 | 63.40 |
| 381 | 0.1166 | 0.2699 | 3.7107 | 25.9735 | 0.1773 | 0.0060 | 0.0016 | 3.8013 | 0.4812 | 0.5370 | 0.0363 | 2.9789 | 72.70 |
| 382 | 0.0834 | 0.2486 | 3.4202 | 22.3833 | 0.2275 | 0.0061 | 0.0007 | 3.5058 | 0.3853 | 0.5217 | 0.1763 | 2.7185 | 62.00 |
| 383 | 0.1072 | 0.2602 | 3.2666 | 24.6469 | 0.2068 | 0.0079 | 0.0014 | 3.3182 | 0.4131 | 0.4862 | 0.0153 | 2.6280 | 50.25 |
| 384 | 0.0931 | 0.1970 | 3.1647 | 23.4803 | 0.1933 | 0.0068 | 0.0017 | 3.3703 | 0.3928 | 0.5038 | 0.0354 | 2.7237 | 80.75 |
| 385 | 0.1022 | 0.2432 | 3.0656 | 22.7663 | 0.2125 | 0.0082 | 0.0016 | 3.1474 | 0.4164 | 0.4905 | 0.0242 | 2.4867 | 57.95 |
| 386 | 0.0752 | 0.2853 | 3.5870 | 25.4078 | 0.2614 | 0.0061 | 0.0011 | 3.6309 | 0.4051 | 0.5474 | 0.0307 | 2.7073 | 64.70 |
| 387 | 0.0543 | 0.2433 | 3.2050 | 23.8935 | 0.2311 | 0.0067 | 0.0014 | 3.3606 | 0.3910 | 0.4458 | 0.0151 | 2.4088 | 54.05 |
| 388 | 0.0784 | 0.2014 | 2.7171 | 20.7224 | 0.1661 | 0.0070 | 0.0022 | 2.9419 | 0.3600 | 0.4316 | 0.0379 | 2.2447 | 53.45 |
| 389 | 0.1137 | 0.2530 | 2.8516 | 24.0881 | 0.1289 | 0.0066 | 0.0017 | 3.1900 | 0.3157 | 0.4011 | 0.0041 | 2.2458 | 63.85 |
| 390 | 0.0646 | 0.2895 | 3.3853 | 23.3601 | 0.1598 | 0.0064 | 0.0013 | 3.2516 | 0.3990 | 0.5094 | 0.0260 | 2.5982 | 67.10 |
| 391 | 0.1094 | 0.2609 | 3.1347 | 28.3724 | 0.1268 | 0.0058 | 0.0016 | 3.5592 | 0.3997 | 0.4223 | 0.0148 | 2.3730 | 79.90 |
| 392 | 0.1217 | 0.2261 | 3.1158 | 24.9021 | 0.1608 | 0.0065 | 0.0013 | 3.4040 | 0.3356 | 0.4296 | 0.0080 | 2.3656 | 68.40 |
| 393 | 0.0249 | 0.2498 | 2.8516 | 25.6458 | 0.1335 | 0.0033 | 0.0010 | 3.5106 | 0.3630 | 0.3754 | 0.0213 | 2.2330 | 70.45 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 394 | 0.0746 | 0.2578 | 3.0951 | 24.8454 | 0.1816 | 0.0062 | 0.0012 | 3.2117 | 0.3863 | 0.4881 | 0.0271 | 2.5168 | 58.40 |
| 395 | 0.1400 | 0.2216 | 3.4172 | 25.7344 | 0.1942 | 0.0072 | 0.0013 | 3.5520 | 0.4000 | 0.4873 | 0.0604 | 2.6898 | 68.75 |
| 396 | 0.1220 | 0.2239 | 2.9701 | 23.3752 | 0.1907 | 0.0080 | 0.0012 | 3.0492 | 0.3681 | 0.4502 | 0.0215 | 2.2224 | 60.50 |
| 397 | 0.0088 | 0.1684 | 3.2161 | 22.9990 | 0.2274 | 0.0078 | 0.0017 | 3.3746 | 0.4117 | 0.4999 | 0.0229 | 2.7067 | 69.30 |
| 398 | 0.0884 | 0.2401 | 2.7421 | 24.8879 | 0.1066 | 0.0045 | 0.0012 | 3.3412 | 0.3433 | 0.4221 | 0.0000 | 2.1162 | 48.50 |
| 399 | 0.1556 | 0.2683 | 3.2216 | 22.1618 | 0.2681 | 0.0084 | 0.0019 | 3.0402 | 0.3924 | 0.4607 | 0.0135 | 2.5856 | 98.75 |
| 400 | 0.0000 | 0.2671 | 3.4961 | 26.9628 | 0.2243 | 0.0071 | 0.0015 | 3.6220 | 0.4097 | 0.4741 | 0.0266 | 2.4967 | 69.35 |
| 401 | 0.1329 | 0.3203 | 3.9411 | 25.2989 | 0.2478 | 0.0053 | 0.0015 | 4.4715 | 0.4265 | 0.6039 | 0.0350 | 2.7579 | 52.30 |
| 402 | 0.1505 | 0.3054 | 3.3191 | 26.3887 | 0.1381 | 0.0053 | 0.0018 | 3.5909 | 0.3888 | 0.4700 | 0.0426 | 2.3710 | 78.50 |
| 403 | 0.0691 | 0.2258 | 2.9353 | 22.3165 | 0.1118 | 0.0054 | 0.0015 | 3.2880 | 0.3124 | 0.4013 | 0.0118 | 2.3074 | 60.80 |
| 404 | 0.1535 | 0.2394 | 2.8284 | 23.0458 | 0.1584 | 0.0072 | 0.0017 | 3.2583 | 0.4149 | 0.3952 | 0.0235 | 2.3216 | 55.30 |
| 405 | 0.0131 | 0.2109 | 2.2147 | 19.6836 | 0.1130 | 0.0055 | 0.0018 | 2.4565 | 0.3196 | 0.3427 | 0.0140 | 1.9782 | 63.00 |
| 406 | 0.0000 | 0.2336 | 2.7828 | 24.5140 | 0.1321 | 0.0060 | 0.0012 | 3.2459 | 0.3637 | 0.4156 | 0.0046 | 2.2763 | 63.05 |
| 407 | 0.0615 | 0.2630 | 3.3727 | 23.5659 | 0.2052 | 0.0073 | 0.0014 | 3.5394 | 0.3680 | 0.5021 | 0.0299 | 2.6496 | 56.55 |
| 408 | 0.1432 | 0.2681 | 3.3480 | 24.6686 | 0.2159 | 0.0069 | 0.0012 | 3.2618 | 0.4277 | 0.5122 | 0.0231 | 2.6366 | 70.10 |
| 409 | 0.2055 | 0.3101 | 3.6378 | 24.0035 | 0.1217 | 0.0030 | 0.0012 | 4.1970 | 0.4799 | 0.5367 | 0.0346 | 2.9922 | 53.15 |
| 410 | 0.1128 | 0.1651 | 2.9258 | 25.6648 | 0.2095 | 0.0062 | 0.0013 | 3.3341 | 0.3982 | 0.4361 | 0.0198 | 2.3437 | 58.95 |
| 411 | 0.0443 | 0.1740 | 3.0815 | 26.1388 | 0.2466 | 0.0080 | 0.0015 | 3.4075 | 0.4132 | 0.4975 | 0.0047 | 2.3634 | 58.10 |
| 412 | 0.1023 | 0.3229 | 4.0553 | 25.6985 | 0.2188 | 0.0059 | 0.0013 | 4.1979 | 0.4707 | 0.5517 | 0.0641 | 3.2663 | 55.90 |
| 413 | 0.1422 | 0.2425 | 3.1352 | 22.4965 | 0.1788 | 0.0062 | 0.0017 | 3.3942 | 0.3864 | 0.4508 | 0.0220 | 2.5167 | 60.50 |
| 414 | 0.1319 | 0.2301 | 2.9239 | 24.8012 | 0.1510 | 0.0068 | 0.0016 | 3.0552 | 0.3381 | 0.3894 | 0.0157 | 2.3565 | 62.30 |
| 415 | 0.1081 | 0.2417 | 2.8786 | 23.9543 | 0.1386 | 0.0057 | 0.0023 | 3.2593 | 0.2877 | 0.4447 | 0.0000 | 2.1334 | 62.25 |
| 416 | 0.1470 | 0.2340 | 2.6445 | 22.5692 | 0.1435 | 0.0060 | 0.0016 | 2.9437 | 0.3270 | 0.4042 | 0.0192 | 2.1124 | 64.10 |
| 417 | 0.0000 | 0.1827 | 2.8003 | 23.7541 | 0.1646 | 0.0055 | 0.0011 | 3.4107 | 0.3980 | 0.4174 | 0.0196 | 2.2780 | 58.95 |
| 418 | 0.1320 | 0.3098 | 3.2041 | 27.6303 | 0.1552 | 0.0053 | 0.0011 | 3.3951 | 0.3881 | 0.3868 | 0.0112 | 2.2478 | 59.90 |
| 419 | 0.1335 | 0.2645 | 3.0932 | 25.1020 | 0.1776 | 0.0075 | 0.0017 | 3.3042 | 0.3964 | 0.4140 | 0.0189 | 2.4167 | 67.75 |
| 420 | 0.1726 | 0.2485 | 3.1764 | 24.7644 | 0.1972 | 0.0088 | 0.0019 | 3.3358 | 0.3899 | 0.4690 | 0.0357 | 2.5520 | 63.95 |
| 421 | 0.2029 | 0.2722 | 3.2964 | 24.0827 | 0.2150 | 0.0064 | 0.0011 | 3.3054 | 0.4522 | 0.4669 | 0.0346 | 2.6593 | 73.10 |
| 422 | 0.1417 | 0.2540 | 3.3453 | 25.5526 | 0.2219 | 0.0085 | 0.0021 | 3.4368 | 0.3762 | 0.4651 | 0.0197 | 2.5914 | 64.00 |
| 423 | 0.1374 | 0.2484 | 2.9466 | 21.8643 | 0.1773 | 0.0077 | 0.0020 | 2.9137 | 0.3717 | 0.4724 | 0.0399 | 2.6589 | 64.80 |
| 424 | 0.1528 | 0.2777 | 3.1807 | 23.6476 | 0.1960 | 0.0071 | 0.0011 | 3.2726 | 0.3775 | 0.5122 | 0.0307 | 2.6231 | 63.50 |
| 425 | 0.1421 | 0.2238 | 2.8769 | 23.5358 | 0.1783 | 0.0073 | 0.0016 | 3.0374 | 0.3894 | 0.4510 | 0.0254 | 2.4619 | 56.30 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 426 | 0.1094 | 0.2420 | 2.9992 | 22.6998 | 0.2364 | 0.0078 | 0.0016 | 2.9516 | 0.3798 | 0.4308 | 0.0181 | 2.3173 | 62.00 |
| 427 | 0.0871 | 0.2658 | 3.2691 | 25.0474 | 0.1855 | 0.0064 | 0.0011 | 3.4166 | 0.4281 | 0.4207 | 0.0222 | 2.4779 | 62.85 |
| 428 | 0.1006 | 0.2463 | 2.9048 | 24.1340 | 0.1542 | 0.0060 | 0.0015 | 3.2948 | 0.4300 | 0.4050 | 0.0318 | 2.5232 | 73.45 |
| 429 | 0.0685 | 0.1878 | 2.7303 | 25.3104 | 0.1096 | 0.0051 | 0.0016 | 3.3280 | 0.3346 | 0.4148 | 0.0000 | 2.1507 | 54.95 |
| 430 | 0.0653 | 0.2839 | 3.3201 | 23.9958 | 0.1758 | 0.0054 | 0.0012 | 3.5610 | 0.4206 | 0.4586 | 0.0212 | 2.5647 | 69.85 |
| 431 | 0.0195 | 0.2404 | 2.9014 | 24.9189 | 0.1200 | 0.0065 | 0.0014 | 3.3731 | 0.3384 | 0.4200 | 0.0070 | 2.1162 | 49.50 |
| 432 | 0.0000 | 0.2575 | 3.1350 | 25.8864 | 0.1285 | 0.0045 | 0.0013 | 3.8090 | 0.3511 | 0.3946 | 0.0113 | 2.2527 | 58.60 |
| 433 | 0.1898 | 0.2647 | 3.3138 | 22.6784 | 0.2550 | 0.0088 | 0.0014 | 3.2459 | 0.4003 | 0.4561 | 0.0056 | 2.5486 | 61.40 |
| 434 | 0.0506 | 0.2794 | 3.5213 | 26.7161 | 0.2323 | 0.0067 | 0.0013 | 3.5194 | 0.4459 | 0.5591 | 0.0643 | 2.7810 | 69.40 |
| 435 | 0.1401 | 0.2602 | 3.3804 | 26.2553 | 0.2078 | 0.0068 | 0.0016 | 3.5762 | 0.3771 | 0.4223 | 0.0451 | 2.4983 | 55.85 |
| 436 | 0.0838 | 0.2832 | 3.4434 | 22.3675 | 0.2492 | 0.0077 | 0.0013 | 3.5244 | 0.4775 | 0.5282 | 0.0234 | 2.9081 | 65.25 |
| 437 | 0.0544 | 0.2538 | 3.2576 | 22.8803 | 0.2124 | 0.0081 | 0.0015 | 3.4313 | 0.4461 | 0.4769 | 0.0383 | 2.6389 | 54.55 |
| 438 | 0.0209 | 0.1334 | 2.8867 | 22.6794 | 0.2068 | 0.0078 | 0.0016 | 3.1995 | 0.4331 | 0.4784 | 0.0319 | 2.4823 | 61.35 |
| 439 | 0.1907 | 0.2833 | 3.1141 | 22.9049 | 0.2220 | 0.0076 | 0.0020 | 3.0362 | 0.4389 | 0.4871 | 0.0304 | 2.6416 | 58.40 |
| 440 | 0.0727 | 0.2635 | 3.2921 | 23.8359 | 0.2857 | 0.0093 | 0.0017 | 3.1726 | 0.4444 | 0.4719 | 0.0442 | 2.4862 | 58.70 |
| 441 | 0.0672 | 0.3117 | 3.3329 | 25.6385 | 0.1312 | 0.0041 | 0.0016 | 3.6620 | 0.4846 | 0.5693 | 0.0249 | 2.9996 | 128.25 |
| 442 | 0.0748 | 0.2982 | 3.0167 | 25.9763 | 0.1444 | 0.0058 | 0.0013 | 3.1033 | 0.3873 | 0.4416 | 0.0000 | 2.4519 | 95.90 |
| 443 | 0.0732 | 0.2352 | 3.1028 | 26.2625 | 0.1564 | 0.0063 | 0.0017 | 3.4543 | 0.4497 | 0.4397 | 0.0271 | 2.3756 | 64.60 |
| 444 | 0.0555 | 0.2583 | 3.0774 | 23.9057 | 0.1435 | 0.0058 | 0.0011 | 3.4025 | 0.3698 | 0.4751 | 0.0190 | 2.3167 | 70.55 |
| 445 | 0.1014 | 0.2430 | 2.8909 | 22.8413 | 0.1400 | 0.0068 | 0.0015 | 3.3047 | 0.3501 | 0.4236 | 0.0171 | 2.2754 | 72.00 |
| 446 | 0.1376 | 0.2408 | 2.6034 | 22.6877 | 0.1182 | 0.0063 | 0.0017 | 2.9921 | 0.3130 | 0.4486 | 0.0221 | 2.1856 | 76.20 |
| 447 | 0.1112 | 0.2827 | 3.2919 | 23.7089 | 0.2141 | 0.0072 | 0.0016 | 3.2965 | 0.4421 | 0.4683 | 0.0308 | 2.6894 | 80.55 |
| 448 | 0.0000 | 0.2146 | 2.9923 | 23.1611 | 0.2158 | 0.0074 | 0.0018 | 3.0848 | 0.3938 | 0.4029 | 0.0535 | 2.4195 | 62.90 |
| 449 | 0.1105 | 0.1674 | 2.9727 | 24.3792 | 0.2305 | 0.0062 | 0.0012 | 3.4091 | 0.3938 | 0.4558 | 0.0578 | 2.4054 | 58.95 |
| 450 | 0.1599 | 0.2257 | 3.1050 | 22.9341 | 0.2402 | 0.0067 | 0.0014 | 3.2407 | 0.3601 | 0.4689 | 0.0642 | 2.4618 | 53.20 |
| 451 | 0.1024 | 0.2053 | 2.9465 | 23.7421 | 0.2141 | 0.0074 | 0.0019 | 3.0298 | 0.3603 | 0.4050 | 0.0113 | 2.1570 | 69.60 |
| 452 | 0.0839 | 0.2479 | 3.4527 | 24.4026 | 0.2174 | 0.0080 | 0.0014 | 3.7936 | 0.4347 | 0.4958 | 0.1015 | 2.6783 | 59.10 |
| 453 | 0.0958 | 0.3059 | 3.5732 | 23.7837 | 0.1464 | 0.0053 | 0.0016 | 3.7855 | 0.3545 | 0.5044 | 0.0181 | 3.1832 | 92.35 |
| 454 | 0.2242 | 0.3977 | 4.0708 | 23.8633 | 0.1899 | 0.0050 | 0.0009 | 4.1722 | 0.5610 | 0.6298 | 0.0367 | 3.6881 | 117.35 |
| 455 | 0.1381 | 0.3662 | 3.9605 | 25.1959 | 0.2220 | 0.0072 | 0.0011 | 4.0284 | 0.4825 | 0.5014 | 0.0361 | 3.2503 | 76.10 |
| 456 | 0.1958 | 0.3034 | 3.0167 | 27.9713 | 0.1845 | 0.0050 | 0.0011 | 2.9299 | 0.4076 | 0.5139 | 0.0332 | 2.1066 | 67.95 |
| 457 | 0.0491 | 0.1951 | 2.7294 | 20.3635 | 0.1421 | 0.0045 | 0.0008 | 3.0213 | 0.4423 | 0.4316 | 0.0265 | 2.3243 | 66.80 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 458 | 0.0837 | 0.2297 | 2.7273 | 23.4221 | 0.1039 | 0.0054 | 0.0012 | 3.3885 | 0.3524 | 0.3191 | 0.0148 | 2.0498 | 76.70 |
| 459 | 0.0330 | 0.2108 | 2.8544 | 24.1646 | 0.1396 | 0.0058 | 0.0014 | 3.3892 | 0.4174 | 0.3885 | 0.0016 | 2.2264 | 81.65 |
| 460 | 0.1119 | 0.2537 | 2.7221 | 25.3250 | 0.1131 | 0.0052 | 0.0013 | 3.1310 | 0.4008 | 0.5028 | 0.0138 | 2.3822 | 90.75 |
| 461 | 0.0865 | 0.1951 | 2.5130 | 23.7234 | 0.1164 | 0.0058 | 0.0013 | 3.1721 | 0.3374 | 0.4313 | 0.0000 | 2.2043 | 74.70 |
| 462 | 0.0000 | 0.1103 | 2.4143 | 21.5374 | 0.1396 | 0.0058 | 0.0009 | 2.8346 | 0.3883 | 0.3733 | 0.0162 | 2.1393 | 68.65 |
| 463 | 0.0457 | 0.2607 | 3.0719 | 24.8037 | 0.1734 | 0.0062 | 0.0012 | 3.2308 | 0.3806 | 0.4248 | 0.0221 | 2.3789 | 57.55 |
| 464 | 0.1156 | 0.2580 | 2.7414 | 24.1124 | 0.1175 | 0.0056 | 0.0017 | 3.1738 | 0.3151 | 0.3631 | 0.0289 | 2.0865 | 72.70 |
| 465 | 0.1096 | 0.2714 | 3.2677 | 24.0589 | 0.1297 | 0.0046 | 0.0013 | 3.7679 | 0.3885 | 0.4679 | 0.0329 | 2.6631 | 119.70 |
| 466 | 0.2300 | 0.2971 | 3.0564 | 23.0581 | 0.1051 | 0.0050 | 0.0019 | 3.5527 | 0.3267 | 0.3714 | 0.0142 | 2.4697 | 88.60 |
| 467 | 0.1825 | 0.4048 | 3.7033 | 25.4980 | 0.1911 | 0.0069 | 0.0016 | 3.6160 | 0.4379 | 0.4693 | 0.0317 | 2.8823 | 68.60 |
| 468 | 0.2199 | 0.3618 | 3.9104 | 23.9321 | 0.1505 | 0.0066 | 0.0012 | 3.5676 | 0.4296 | 0.5541 | 0.0381 | 3.2007 | 71.00 |
| 469 | *Sample too friable to for pellet for analysis* | | | | | | | | | | | | |
| 470 | 0.0656 | 0.2098 | 2.8488 | 24.7629 | 0.1974 | 0.0064 | 0.0017 | 2.8710 | 0.4044 | 0.4741 | 0.0000 | 2.1103 | 73.50 |
| 471 | 0.0863 | 0.2516 | 3.0173 | 24.6360 | 0.1417 | 0.0078 | 0.0018 | 3.0882 | 0.4027 | 0.4507 | 0.0056 | 2.0851 | 70.30 |
| 472 | *Sample too friable to for pellet for analysis* | | | | | | | | | | | | |
| 473 | 0.0000 | 0.1336 | 2.0263 | 23.4010 | 0.0922 | 0.0050 | 0.0010 | 2.8281 | 0.3205 | 0.3861 | 0.0000 | 1.8517 | 75.90 |
| 474 | 0.0764 | 0.2316 | 2.4702 | 20.1876 | 0.1274 | 0.0046 | 0.0012 | 2.8622 | 0.3652 | 0.3397 | 0.0143 | 1.9493 | 75.65 |
| 475 | *Sample too friable to for pellet for analysis* | | | | | | | | | | | | |
| 476 | *Sample too friable to for pellet for analysis* | | | | | | | | | | | | |
| 477 | *Sample too friable to for pellet for analysis* | | | | | | | | | | | | |
| 478 | *Sample too friable to for pellet for analysis* | | | | | | | | | | | | |
| 479 | 0.0240 | 0.3034 | 3.2125 | 25.6778 | 0.1688 | 0.0059 | 0.0015 | 3.6196 | 0.3950 | 0.3863 | 0.0464 | 2.5115 | 58.75 |
| 480 | 0.0178 | 0.2775 | 2.7971 | 25.9269 | 0.1408 | 0.0070 | 0.0017 | 3.1692 | 0.3633 | 0.3311 | 0.0360 | 2.2053 | 87.45 |
| 481 | 0.1076 | 0.2229 | 3.0340 | 24.9136 | 0.1094 | 0.0047 | 0.0010 | 3.4587 | 0.3036 | 0.3964 | 0.0099 | 2.4196 | 75.95 |
| 482 | *Sample too friable to for pellet for analysis* | | | | | | | | | | | | |
| 483 | 0.1127 | 0.1775 | 2.7094 | 24.8086 | 0.1434 | 0.0052 | 0.0012 | 3.1534 | 0.3774 | 0.4441 | 0.0107 | 2.0490 | 67.95 |
| 484 | 0.0096 | 0.2095 | 2.7821 | 26.2335 | 0.1234 | 0.0041 | 0.0011 | 3.2616 | 0.4127 | 0.4746 | 0.0072 | 2.1464 | 67.30 |
| 485 | 0.0270 | 0.2623 | 3.1255 | 25.7979 | 0.1700 | 0.0055 | 0.0013 | 3.0552 | 0.4397 | 0.5134 | 0.0165 | 2.2469 | 62.15 |
| 486 | 0.0487 | 0.2512 | 2.7137 | 21.1677 | 0.1422 | 0.0083 | 0.0019 | 2.9369 | 0.3961 | 0.4117 | 0.0163 | 2.2945 | 67.85 |
| 487 | *Sample too friable to for pellet for analysis* | | | | | | | | | | | | |
| 488 | *Sample too friable to for pellet for analysis* | | | | | | | | | | | | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 489 | 0.0498 | 0.1917 | 2.5939 | 24.5773 | 0.1183 | 0.0053 | 0.0013 | 3.2377 | 0.3304 | 0.3755 | 0.0000 | 2.1093 | 80.80 |
| 490 | 0.1183 | 0.2749 | 2.9689 | 22.0613 | 0.0879 | 0.0048 | 0.0012 | 3.6636 | 0.3428 | 0.4095 | 0.0019 | 2.5292 | 87.30 |
| 491 | 0.1041 | 0.3548 | 3.2246 | 26.0590 | 0.1335 | 0.0046 | 0.0013 | 3.3585 | 0.3488 | 0.3721 | 0.0291 | 2.5028 | 80.95 |
| 492 | *Sample too friable to for pellet for analysis* | | | | | | | | | | | | |
| 493 | 0.0796 | 0.2516 | 2.6755 | 24.9882 | 0.1274 | 0.0050 | 0.0012 | 2.8352 | 0.3593 | 0.3715 | 0.0130 | 2.2324 | 83.70 |
| 494 | *Sample too friable to for pellet for analysis* | | | | | | | | | | | | |

*Table 2. Analytical results from SFB 4. Figures in weight percent.*

| Sample No | Na | Mg | Al | Si | P | S | Cl | K | Ca | Ti | Mn | Fe | Mag Sus |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 495 | 0.1369 | 0.2726 | 3.4627 | 23.4579 | 0.2591 | 0.0066 | 0.0019 | 3.5999 | 0.5247 | 0.4492 | 0.0479 | 2.6640 | 94.10 |
| 496 | 0.1219 | 0.2479 | 3.5177 | 23.9015 | 0.2780 | 0.0101 | 0.0016 | 3.6129 | 0.6371 | 0.5355 | 0.0489 | 2.7910 | 91.70 |
| 497 | 0.1892 | 0.3431 | 3.9531 | 23.0181 | 0.2184 | 0.0058 | 0.0007 | 3.6147 | 0.4871 | 0.6052 | 0.0558 | 3.2203 | 70.20 |
| 498 | 0.1378 | 0.4267 | 4.2697 | 25.2563 | 0.2698 | 0.0067 | 0.0013 | 4.3625 | 0.6438 | 0.5660 | 0.0184 | 3.4365 | 142.95 |
| 499 | 0.2162 | 0.3837 | 4.1910 | 22.6714 | 0.2877 | 0.0064 | 0.0014 | 4.0446 | 0.7082 | 0.5400 | 0.0352 | 3.6769 | 137.45 |
| 500 | 0.2822 | 0.4118 | 4.3956 | 22.8325 | 0.2998 | 0.0111 | 0.0020 | 4.3010 | 0.6567 | 0.5927 | 0.0514 | 3.9327 | 152.50 |
| 501 | 0.0595 | 0.2800 | 3.2528 | 18.3720 | 0.2497 | 0.0067 | 0.0011 | 3.3513 | 0.6208 | 0.5465 | 0.0619 | 3.5146 | 52.25 |
| 502 | 0.1159 | 0.2901 | 3.5758 | 22.5101 | 0.3303 | 0.0072 | 0.0013 | 3.4278 | 0.5326 | 0.4860 | 0.0464 | 3.1457 | 91.35 |
| 503 | 0.1293 | 0.3012 | 3.8216 | 22.2987 | 0.3593 | 0.0069 | 0.0014 | 3.6957 | 0.5697 | 0.5025 | 0.0620 | 3.3182 | 96.05 |
| 504 | 0.0725 | 0.3064 | 3.5925 | 21.6463 | 0.3748 | 0.0090 | 0.0015 | 3.4691 | 0.6249 | 0.5057 | 0.0525 | 2.9236 | 77.45 |
| 505 | 0.1841 | 0.2685 | 3.5628 | 22.2493 | 0.4210 | 0.0099 | 0.0017 | 3.2782 | 0.6597 | 0.4994 | 0.0807 | 3.0334 | 92.35 |
| 506 | 0.1329 | 0.3570 | 4.0789 | 21.3687 | 0.4074 | 0.0077 | 0.0014 | 3.7240 | 0.6037 | 0.5567 | 0.0873 | 3.6346 | 102.00 |
| 507 | 0.1273 | 0.2436 | 3.4693 | 18.2254 | 0.2440 | 0.0059 | 0.0016 | 3.7733 | 0.4926 | 0.4783 | 0.0340 | 3.4754 | 104.30 |
| 508 | *Sample too friable to for pellet for analysis* | | | | | | | | | | | | 84.75 |
| 509 | 0.1180 | 0.2729 | 3.3486 | 18.8216 | 0.2421 | 0.0062 | 0.0019 | 3.3409 | 0.5267 | 0.4993 | 0.0278 | 3.2015 | 85.45 |
| 510 | 0.2733 | 0.3635 | 3.9234 | 23.9298 | 0.2427 | 0.0049 | 0.0019 | 4.1035 | 0.5175 | 0.5362 | 0.0277 | 3.0964 | 120.50 |
| 511 | 0.2209 | 0.3301 | 3.8529 | 23.8511 | 0.2516 | 0.0093 | 0.0015 | 3.6918 | 0.7333 | 0.5756 | 0.0472 | 3.1797 | 67.40 |
| 512 | 0.2753 | 0.3755 | 4.3309 | 25.1148 | 0.3227 | 0.0052 | 0.0011 | 4.4710 | 0.6617 | 0.5692 | 0.0598 | 3.4853 | 118.45 |
| 513 | 0.1694 | 0.3783 | 3.7745 | 22.8019 | 0.2963 | 0.0062 | 0.0018 | 3.6960 | 0.6363 | 0.5091 | 0.0232 | 3.2584 | 88.95 |
| 514 | 0.2180 | 0.3167 | 3.6473 | 22.7185 | 0.3438 | 0.0085 | 0.0020 | 3.5795 | 0.7215 | 0.5746 | 0.0406 | 3.3004 | 80.70 |
| 515 | 0.1281 | 0.3541 | 4.2611 | 23.6460 | 0.3418 | 0.0077 | 0.0018 | 4.1781 | 0.7422 | 0.5915 | 0.0523 | 3.5179 | 120.10 |
| 516 | 0.0000 | 0.3506 | 4.0838 | 22.2891 | 0.5125 | 0.0116 | 0.0016 | 3.3431 | 0.7420 | 0.5872 | 0.0503 | 3.7130 | 88.00 |
| 517 | 0.1618 | 0.3708 | 4.0914 | 22.8951 | 0.3621 | 0.0080 | 0.0020 | 3.6628 | 0.7345 | 0.5522 | 0.0198 | 3.7960 | 70.75 |
| 518 | 0.0661 | 0.3369 | 4.1524 | 23.8805 | 0.4223 | 0.0069 | 0.0016 | 4.2252 | 0.5755 | 0.4666 | 0.0403 | 3.1109 | 71.40 |
| 519 | 0.1790 | 0.3532 | 4.3473 | 22.8898 | 0.4367 | 0.0083 | 0.0013 | 4.2388 | 0.7006 | 0.5280 | 0.1523 | 3.7572 | 125.90 |
| 520 | 0.0574 | 0.3290 | 4.0013 | 23.4255 | 0.4067 | 0.0095 | 0.0020 | 3.5548 | 0.6951 | 0.4857 | 0.0587 | 3.5376 | 89.90 |
| 521 | 0.2990 | 0.4846 | 4.5625 | 24.0621 | 0.2985 | 0.0049 | 0.0011 | 4.2095 | 0.7088 | 0.6136 | 0.0603 | 3.9008 | 78.85 |
| 522 | 0.2543 | 0.2845 | 3.5813 | 22.6589 | 0.1978 | 0.0064 | 0.0009 | 3.5611 | 0.5997 | 0.5716 | 0.1163 | 3.2502 | 106.00 |
| 523 | 0.0590 | 0.2834 | 3.5147 | 22.2715 | 0.2918 | 0.0082 | 0.0018 | 3.4662 | 0.6313 | 0.4557 | 0.0350 | 2.6887 | 108.75 |
| 524 | 0.1790 | 0.3046 | 3.6855 | 23.3840 | 0.2635 | 0.0083 | 0.0012 | 3.6309 | 0.7000 | 0.5855 | 0.1086 | 3.1540 | 59.55 |
| 525 | 0.2076 | 0.2877 | 3.7315 | 23.1380 | 0.2617 | 0.0067 | 0.0013 | 3.6744 | 0.6764 | 0.5798 | 0.3984 | 3.2410 | 54.35 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 526 | 0.1690 | 0.2951 | 3.6316 | 20.6692 | 0.2516 | 0.0074 | 0.0020 | 3.8178 | 0.6561 | 0.5940 | 0.1468 | 3.1960 | 55.10 |
| 527 | 0.1291 | 0.2738 | 3.8780 | 26.2231 | 0.2956 | 0.0079 | 0.0013 | 3.6697 | 0.7041 | 0.5979 | 0.1522 | 3.0925 | 75.80 |
| 528 | 0.1536 | 0.3000 | 3.8566 | 23.0913 | 0.2830 | 0.0091 | 0.0013 | 3.8513 | 0.7188 | 0.5651 | 0.2776 | 3.2169 | 58.70 |
| 529 | 0.1719 | 0.2607 | 3.5403 | 22.8713 | 0.2952 | 0.0087 | 0.0017 | 3.2624 | 0.6429 | 0.5565 | 0.1623 | 2.9274 | 64.75 |
| 530 | 0.1081 | 0.3544 | 4.1039 | 22.3586 | 0.4480 | 0.0054 | 0.0029 | 4.0325 | 0.6767 | 0.4756 | 0.0679 | 3.3923 | 62.25 |
| 531 | 0.1374 | 0.3186 | 3.7540 | 19.1790 | 0.3767 | 0.0061 | 0.0018 | 3.6390 | 0.5930 | 0.5244 | 0.0453 | 3.3731 | 66.15 |
| 532 | 0.1377 | 0.3040 | 4.0038 | 20.9950 | 0.3494 | 0.0081 | 0.0019 | 3.5514 | 0.6418 | 0.5192 | 0.0663 | 3.5669 | 72.60 |
| 533 | 0.1750 | 0.4585 | 4.2891 | 20.8926 | 0.3258 | 0.0078 | 0.0020 | 3.8031 | 0.8043 | 0.5960 | 0.0707 | 4.1300 | 72.15 |
| 534 | 0.1948 | 0.3533 | 3.8353 | 24.1744 | 0.2170 | 0.0066 | 0.0016 | 3.8738 | 0.5307 | 0.5201 | 0.0107 | 2.9911 | 81.65 |
| 535 | 0.1656 | 0.3491 | 4.0105 | 21.5997 | 0.2589 | 0.0055 | 0.0017 | 3.8925 | 0.6866 | 0.5196 | 0.0154 | 3.4631 | 76.50 |
| 536 | 0.3594 | 0.3138 | 3.2663 | 20.1334 | 0.2190 | 0.0086 | 0.0022 | 3.0682 | 0.7268 | 0.5055 | 0.1115 | 2.8453 | 57.20 |
| 537 | 0.1725 | 0.3417 | 3.9695 | 25.5707 | 0.2688 | 0.0124 | 0.0018 | 4.1328 | 1.0069 | 0.6221 | 0.1009 | 3.4627 | 64.70 |
| 538 | 0.2043 | 0.2634 | 3.3479 | 24.9581 | 0.2286 | 0.0096 | 0.0014 | 3.2932 | 0.7231 | 0.5053 | 0.1023 | 2.9740 | 65.55 |
| 539 | 0.1670 | 0.2617 | 3.2037 | 22.1588 | 0.2593 | 0.0092 | 0.0023 | 3.0376 | 0.6743 | 0.5381 | 0.1193 | 2.8285 | 65.40 |
| 540 | 0.1712 | 0.2930 | 3.7417 | 24.3241 | 0.2771 | 0.0087 | 0.0018 | 3.5076 | 0.7125 | 0.5523 | 0.1116 | 2.9697 | 87.05 |
| 541 | 0.1620 | 0.3113 | 3.8905 | 23.7991 | 0.2971 | 0.0073 | 0.0017 | 3.7736 | 0.6696 | 0.5690 | 0.1311 | 3.2578 | 71.70 |
| 542 | 0.1831 | 0.2353 | 3.6238 | 23.1461 | 0.2376 | 0.0073 | 0.0012 | 3.5354 | 0.5944 | 0.5105 | 0.1213 | 3.4902 | 71.75 |
| 543 | 0.1431 | 0.2778 | 3.6747 | 20.5955 | 0.3377 | 0.0065 | 0.0018 | 3.4358 | 0.6494 | 0.5341 | 0.1070 | 3.2656 | 54.40 |
| 544 | 0.0746 | 0.4675 | 4.3118 | 19.5671 | 0.3791 | 0.0057 | 0.0013 | 4.4931 | 0.6562 | 0.6700 | 0.0902 | 4.6560 | 53.50 |
| 545 | 0.1068 | 0.3299 | 4.4503 | 23.8861 | 0.5613 | 0.0075 | 0.0020 | 4.1363 | 0.7507 | 0.5689 | 0.0840 | 4.1186 | 109.25 |
| 546 | 0.1801 | 0.3354 | 4.1608 | 22.4492 | 0.3015 | 0.0046 | 0.0012 | 4.1257 | 0.6568 | 0.5654 | 0.0523 | 3.4709 | 81.30 |
| 547 | 0.1863 | 0.4081 | 4.1575 | 23.7592 | 0.2499 | 0.0047 | 0.0011 | 4.4125 | 0.6785 | 0.5297 | 0.0528 | 3.3531 | 74.60 |
| 548 | 0.1682 | 0.3797 | 4.1174 | 23.8085 | 0.2596 | 0.0064 | 0.0013 | 4.3914 | 0.6299 | 0.5293 | 0.0563 | 3.4137 | 61.15 |
| 549 | 0.1681 | 0.3468 | 3.4809 | 19.1576 | 0.2421 | 0.0106 | 0.0018 | 3.5221 | 0.8936 | 0.5162 | 0.1215 | 3.0933 | 42.50 |
| 550 | 0.1220 | 0.3576 | 4.0706 | 24.0519 | 0.2750 | 0.0135 | 0.0015 | 3.8886 | 1.0369 | 0.6533 | 0.1069 | 3.7282 | 49.85 |
| 551 | 0.0667 | 0.3571 | 3.6470 | 22.0632 | 0.2657 | 0.0156 | 0.0015 | 3.7074 | 1.0610 | 0.5675 | 0.0738 | 3.1728 | 61.80 |
| 552 | 0.1788 | 0.3271 | 3.5954 | 22.5606 | 0.2120 | 0.0112 | 0.0017 | 3.7658 | 0.8395 | 0.5358 | 0.0806 | 3.2113 | 61.85 |
| 553 | 0.2326 | 0.1958 | 3.3226 | 23.1831 | 0.2029 | 0.0069 | 0.0017 | 3.5613 | 0.5965 | 0.5270 | 0.1066 | 2.9146 | 79.20 |
| 554 | 0.1895 | 0.4281 | 4.4626 | 23.0362 | 0.1999 | 0.0040 | 0.0016 | 4.7359 | 0.6406 | 0.5873 | 0.0132 | 3.6459 | 68.60 |
| 555 | 0.2096 | 0.2931 | 3.9742 | 23.5206 | 0.2904 | 0.0081 | 0.0013 | 3.5527 | 0.7484 | 0.5687 | 0.1405 | 3.4239 | 64.35 |
| 556 | 0.1559 | 0.3669 | 3.9876 | 22.4100 | 0.2797 | 0.0092 | 0.0022 | 3.5787 | 0.7078 | 0.5747 | 0.1739 | 3.1929 | 43.35 |
| 557 | 0.2228 | 0.3180 | 4.2642 | 22.7713 | 0.3467 | 0.0058 | 0.0015 | 4.2656 | 0.6274 | 0.6060 | 0.0404 | 3.6763 | 75.35 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 558 | 0.0402 | 0.3162 | 3.9059 | 21.7978 | 0.2618 | 0.0106 | 0.0020 | 3.6113 | 0.7217 | 0.5691 | 0.1290 | 3.5560 | 86.95 |
| 559 | 0.1512 | 0.3127 | 4.0465 | 24.0695 | 0.2402 | 0.0053 | 0.0015 | 4.4538 | 0.5143 | 0.5219 | 0.0083 | 3.4511 | 83.15 |
| 560 | 0.1913 | 0.3813 | 4.1940 | 23.9895 | 0.2209 | 0.0062 | 0.0012 | 4.3403 | 0.6698 | 0.5548 | 0.0594 | 3.5512 | 89.00 |
| 561 | 0.0819 | 0.2927 | 3.8148 | 21.6657 | 0.2438 | 0.0058 | 0.0009 | 3.8728 | 0.6670 | 0.5344 | 0.0241 | 3.3381 | 100.85 |
| 562 | 0.1719 | 0.2539 | 3.5755 | 20.1840 | 0.2639 | 0.0069 | 0.0017 | 3.4421 | 0.7209 | 0.5269 | 0.1508 | 3.0592 | 40.90 |
| 563 | 0.1380 | 0.2489 | 2.9926 | 21.2736 | 0.2301 | 0.0116 | 0.0012 | 3.1122 | 0.9375 | 0.4448 | 0.0557 | 2.6958 | 72.45 |
| 564 | 0.1673 | 0.4442 | 3.5101 | 19.4582 | 0.2735 | 0.0136 | 0.0017 | 3.2591 | 1.6791 | 0.5600 | 0.1092 | 3.3172 | 68.55 |
| 565 | 0.2070 | 0.3114 | 3.6296 | 21.4684 | 0.2388 | 0.0107 | 0.0012 | 3.6311 | 0.8557 | 0.5709 | 0.0918 | 3.2477 | 49.70 |
| 566 | 0.1173 | 0.3066 | 3.4345 | 22.6450 | 0.2371 | 0.0080 | 0.0016 | 3.2624 | 0.6524 | 0.5120 | 0.1047 | 2.7873 | 63.45 |
| 567 | 0.0884 | 0.3759 | 4.2572 | 24.1471 | 0.3273 | 0.0100 | 0.0002 | 4.1166 | 0.8183 | 0.6436 | 0.1686 | 3.5532 | 39.90 |
| 568 | 0.1313 | 0.2928 | 3.7563 | 20.1395 | 0.3033 | 0.0083 | 0.0018 | 3.3541 | 0.7367 | 0.6063 | 0.1663 | 3.5771 | 43.85 |
| 569 | 0.1900 | 0.3740 | 4.3887 | 23.5532 | 0.3422 | 0.0078 | 0.0016 | 4.4219 | 0.7735 | 0.6584 | 0.2474 | 3.5322 | 43.00 |
| 570 | 0.1031 | 0.4292 | 4.1805 | 23.7425 | 0.3198 | 0.0067 | 0.0010 | 3.6888 | 0.5320 | 0.5718 | 0.0273 | 3.8291 | 87.85 |
| 571 | 0.1816 | 0.5413 | 4.6451 | 25.3087 | 0.2828 | 0.0071 | 0.0015 | 3.7927 | 1.0412 | 0.6961 | 0.1553 | 4.4820 | 63.20 |
| 572 | 0.2328 | 0.3540 | 4.3539 | 24.2039 | 0.3105 | 0.0059 | 0.0012 | 4.4985 | 0.6233 | 0.5859 | 0.0440 | 3.5019 | 86.60 |
| 573 | 0.2267 | 0.4010 | 3.8767 | 23.4136 | 0.2786 | 0.0075 | 0.0016 | 3.5856 | 0.5798 | 0.4938 | 0.0269 | 3.2735 | 109.85 |
| 574 | 0.2590 | 0.3401 | 4.2557 | 23.3293 | 0.2027 | 0.0059 | 0.0016 | 4.3849 | 0.6951 | 0.5782 | 0.0382 | 3.4889 | 94.45 |
| 575 | 0.1943 | 0.3077 | 4.0359 | 23.9974 | 0.3029 | 0.0091 | 0.0017 | 3.2223 | 0.8450 | 0.5898 | 0.1684 | 3.4833 | 58.30 |
| 576 | 0.1646 | 0.3599 | 3.5291 | 21.8371 | 0.2812 | 0.0144 | 0.0020 | 3.3963 | 1.1975 | 0.5395 | 0.0948 | 3.0691 | 79.65 |
| 577 | 0.1964 | 0.2847 | 3.4998 | 22.9917 | 0.1902 | 0.0097 | 0.0013 | 3.8076 | 0.7705 | 0.5155 | 0.0608 | 2.7550 | 83.05 |
| 578 | 0.1568 | 0.4174 | 3.5575 | 22.6948 | 0.2260 | 0.0127 | 0.0018 | 3.2645 | 0.9474 | 0.5505 | 0.0977 | 3.3724 | 73.80 |
| 579 | 0.0888 | 0.3000 | 3.3844 | 22.0146 | 0.2371 | 0.0121 | 0.0010 | 3.4189 | 0.9160 | 0.5469 | 0.0893 | 2.9051 | 56.90 |
| 580 | 0.1514 | 0.3490 | 3.9831 | 23.4073 | 0.2553 | 0.0090 | 0.0014 | 3.8525 | 0.7646 | 0.5896 | 0.1151 | 3.7265 | 50.00 |
| 581 | 0.0455 | 0.3216 | 3.7909 | 20.9179 | 0.3060 | 0.0085 | 0.0023 | 3.1399 | 0.8549 | 0.5908 | 0.1480 | 3.1607 | 43.95 |
| 582 | 0.2512 | 0.2941 | 3.8850 | 24.8643 | 0.2804 | 0.0087 | 0.0013 | 3.7960 | 0.6428 | 0.5810 | 0.1527 | 3.2298 | 76.30 |
| 583 | 0.1973 | 0.3804 | 4.1171 | 22.7073 | 0.2718 | 0.0062 | 0.0018 | 4.4198 | 0.5621 | 0.5039 | 0.0443 | 3.3352 | 63.60 |
| 584 | 0.1772 | 0.3277 | 4.1244 | 21.4632 | 0.3509 | 0.0067 | 0.0021 | 4.0586 | 0.5905 | 0.5148 | 0.0509 | 3.4680 | 85.10 |
| 585 | 0.1347 | 0.3540 | 4.5380 | 23.5694 | 0.2262 | 0.0045 | 0.0016 | 5.1116 | 0.5332 | 0.5587 | 0.0210 | 3.6880 | 73.90 |
| 586 | 0.1733 | 0.4097 | 4.0135 | 21.7430 | 0.3208 | 0.0070 | 0.0013 | 3.6632 | 0.7181 | 0.5562 | 0.0417 | 3.4795 | 100.60 |
| 587 | 0.1144 | 0.3249 | 3.4684 | 22.9052 | 0.2578 | 0.0086 | 0.0013 | 3.5920 | 0.6645 | 0.4960 | 0.0359 | 3.0880 | 84.95 |
| 588 | 0.1278 | 0.3405 | 4.3305 | 21.3572 | 0.2117 | 0.0054 | 0.0012 | 4.8476 | 0.6992 | 0.5464 | 0.0554 | 3.6581 | 50.80 |
| 589 | 0.0981 | 0.3303 | 3.3970 | 20.5802 | 0.2595 | 0.0152 | 0.0019 | 3.4088 | 1.2040 | 0.5992 | 0.0788 | 3.2052 | 65.85 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 590 | 0.0856 | 0.3575 | 3.5270 | 21.1904 | 0.2417 | 0.0129 | 0.0017 | 3.4709 | 1.0462 | 0.5195 | 0.0867 | 3.2423 | 62.95 |
| 591 | 0.0414 | 0.3134 | 3.4116 | 22.2758 | 0.2380 | 0.0128 | 0.0013 | 3.4822 | 0.9857 | 0.5935 | 0.1246 | 3.1511 | 60.15 |
| 592 | 0.1475 | 0.3305 | 3.3712 | 21.7620 | 0.2452 | 0.0134 | 0.0013 | 3.3636 | 0.9558 | 0.5535 | 0.0738 | 3.0713 | 58.45 |
| 593 | 0.2726 | 0.4360 | 3.7722 | 22.5490 | 0.2155 | 0.0119 | 0.0012 | 3.7433 | 1.3347 | 0.5599 | 0.0802 | 3.3406 | 60.10 |
| 594 | 0.2464 | 0.3062 | 3.7360 | 22.1659 | 0.2082 | 0.0084 | 0.0017 | 3.6982 | 0.7463 | 0.5814 | 0.1251 | 3.2834 | 62.15 |
| 595 | 0.0769 | 0.2533 | 3.4117 | 23.1619 | 0.2390 | 0.0071 | 0.0011 | 3.3526 | 0.6040 | 0.5404 | 0.1373 | 2.8920 | 53.05 |
| 596 | 0.0189 | 0.3217 | 4.1585 | 18.4311 | 0.4131 | 0.0076 | 0.0018 | 3.8438 | 0.8248 | 0.5932 | 0.0451 | 4.3533 | 46.90 |
| 597 | 0.1692 | 0.4148 | 4.3909 | 20.4912 | 0.3578 | 0.0079 | 0.0014 | 3.9552 | 0.7430 | 0.5556 | 0.0536 | 3.8048 | 88.55 |
| 598 | 0.0751 | 0.3682 | 3.9564 | 22.2036 | 0.2537 | 0.0061 | 0.0017 | 3.9928 | 0.5857 | 0.5752 | 0.0201 | 3.3721 | 99.70 |
| 599 | 0.1206 | 0.3626 | 3.8657 | 24.0330 | 0.1962 | 0.0063 | 0.0014 | 3.8202 | 0.5308 | 0.5211 | 0.0227 | 4.3022 | 103.15 |
| 600 | 0.0981 | 0.3782 | 3.8291 | 25.2999 | 0.2236 | 0.0063 | 0.0015 | 3.9552 | 0.5859 | 0.5177 | 0.0267 | 2.9289 | 136.75 |
| 601 | 0.2023 | 0.3785 | 4.4280 | 22.7875 | 0.2073 | 0.0066 | 0.0015 | 4.9035 | 0.6712 | 0.6113 | 0.0363 | 3.6685 | 92.95 |
| 602 | 0.0000 | 0.1582 | 3.2331 | 20.0326 | 0.3328 | 0.0071 | 0.0012 | 3.2612 | 0.8277 | 0.5606 | 0.1380 | 3.0989 | 71.95 |
| 603 | 0.1874 | 0.2530 | 3.3866 | 23.6188 | 0.2499 | 0.0094 | 0.0013 | 3.4540 | 0.7465 | 0.5215 | 0.1108 | 2.8441 | 68.05 |
| 604 | 0.1911 | 0.3745 | 3.9021 | 22.8861 | 0.2875 | 0.0125 | 0.0013 | 3.7478 | 1.2059 | 0.5808 | 0.1353 | 3.5186 | 69.35 |
| 605 | 0.1644 | 0.2410 | 2.8869 | 23.4083 | 0.1957 | 0.0097 | 0.0018 | 3.1221 | 0.6545 | 0.4862 | 0.0621 | 2.3889 | 59.00 |
| 606 | 0.0120 | 0.3029 | 3.4748 | 21.6793 | 0.2133 | 0.0104 | 0.0012 | 3.4873 | 0.8274 | 0.5419 | 0.0717 | 3.0730 | 64.75 |
| 607 | 0.1584 | 0.3221 | 3.5498 | 21.3593 | 0.2262 | 0.0090 | 0.0020 | 3.4329 | 0.7800 | 0.5351 | 0.1045 | 3.2594 | 51.05 |
| 608 | 0.1752 | 0.3146 | 3.3290 | 19.4194 | 0.2374 | 0.0128 | 0.0016 | 3.3383 | 1.0722 | 0.5187 | 0.0733 | 3.0557 | 61.30 |
| 609 | 0.0323 | 0.2812 | 3.4736 | 19.8221 | 0.3599 | 0.0086 | 0.0017 | 3.2052 | 0.6420 | 0.4978 | 0.0664 | 3.2899 | 94.70 |
| 610 | 0.1393 | 0.2614 | 3.5521 | 20.7256 | 0.2877 | 0.0066 | 0.0014 | 3.6380 | 0.6176 | 0.4734 | 0.0333 | 3.3875 | 101.95 |
| 611 | 0.2804 | 0.4178 | 5.0862 | 25.6215 | 0.2729 | 0.0049 | 0.0010 | 5.2183 | 0.6930 | 0.6820 | 0.0427 | 3.7001 | 81.75 |
| 612 | 0.1820 | 0.3908 | 3.9265 | 22.1550 | 0.1606 | 0.0052 | 0.0016 | 4.4791 | 0.5997 | 0.5711 | 0.0394 | 3.4519 | 83.75 |
| 613 | 0.1451 | 0.3630 | 3.7947 | 23.2027 | 0.2388 | 0.0103 | 0.0014 | 3.7416 | 0.9177 | 0.5900 | 0.0473 | 3.3744 | 84.70 |
| 614 | 0.2871 | 0.3732 | 3.7436 | 22.1787 | 0.1717 | 0.0047 | 0.0012 | 3.9237 | 0.5634 | 0.4864 | 0.0288 | 3.1935 | 90.05 |
| 615 | 0.2362 | 0.3385 | 3.6054 | 20.2041 | 0.2650 | 0.0100 | 0.0015 | 3.6804 | 0.9673 | 0.5261 | 0.1276 | 3.2343 | 48.40 |
| 616 | 0.1972 | 0.3184 | 3.6809 | 22.7298 | 0.1593 | 0.0044 | 0.0018 | 4.3712 | 0.4963 | 0.4879 | 0.0336 | 3.0091 | 73.80 |
| 617 | 0.1660 | 0.3632 | 3.7519 | 22.0194 | 0.2062 | 0.0072 | 0.0016 | 3.9559 | 0.5702 | 0.5434 | 0.1232 | 3.2775 | 69.80 |
| 618 | 0.1457 | 0.2537 | 3.4011 | 20.7996 | 0.2314 | 0.0091 | 0.0019 | 3.4589 | 0.6911 | 0.5427 | 0.0847 | 2.9826 | 56.30 |
| 619 | 0.1446 | 0.2226 | 2.9518 | 27.4808 | 0.1975 | 0.0083 | 0.0009 | 3.2497 | 0.5773 | 0.4481 | 0.0605 | 2.2593 | 54.50 |
| 620 | 0.1316 | 0.2954 | 3.3787 | 22.4106 | 0.2085 | 0.0106 | 0.0013 | 3.7874 | 0.8213 | 0.5206 | 0.0659 | 3.3227 | 68.35 |
| 621 | 0.2849 | 0.3438 | 3.8879 | 22.5001 | 0.2773 | 0.0075 | 0.0012 | 3.8153 | 0.7131 | 0.6166 | 0.1262 | 3.3780 | 66.60 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 622 | 0.3024 | 0.3429 | 3.7960 | 24.0006 | 0.2976 | 0.0108 | 0.0016 | 3.7365 | 0.8343 | 0.5656 | 0.0728 | 3.3356 | 94.55 |
| 623 | 0.1646 | 0.2808 | 3.7681 | 20.2737 | 0.2802 | 0.0058 | 0.0014 | 3.9016 | 0.6907 | 0.5869 | 0.0609 | 3.6414 | 103.20 |
| 624 | 0.0294 | 0.2494 | 3.0912 | 20.1851 | 0.2214 | 0.0059 | 0.0019 | 3.2382 | 0.5133 | 0.4120 | 0.0318 | 2.9775 | 74.65 |
| 625 | 0.1109 | 0.3573 | 3.9917 | 23.0512 | 0.1899 | 0.0051 | 0.0009 | 4.1217 | 0.5338 | 0.5088 | 0.0342 | 3.5140 | 126.85 |
| 626 | 0.1522 | 0.3579 | 3.8923 | 24.1230 | 0.2338 | 0.0061 | 0.0015 | 3.7718 | 0.6914 | 0.4740 | 0.0928 | 3.2226 | 119.20 |
| 627 | 0.1360 | 0.3246 | 3.7565 | 23.5020 | 0.1984 | 0.0061 | 0.0014 | 3.9438 | 0.6262 | 0.5033 | 0.0437 | 3.1370 | 117.30 |
| 628 | 0.1402 | 0.2878 | 3.4028 | 21.3440 | 0.2815 | 0.0077 | 0.0016 | 3.3812 | 0.7888 | 0.5084 | 0.0488 | 3.2230 | 101.20 |
| 629 | 0.1354 | 0.3307 | 3.6113 | 20.7564 | 0.2107 | 0.0079 | 0.0014 | 3.7781 | 0.8191 | 0.5859 | 0.0743 | 3.3332 | 57.70 |
| 630 | 0.1856 | 0.2712 | 3.0877 | 20.8357 | 0.1918 | 0.0095 | 0.0020 | 3.1102 | 0.7051 | 0.4901 | 0.0677 | 2.9290 | 62.60 |
| 631 | 0.0026 | 0.1287 | 2.7323 | 20.5226 | 0.2051 | 0.0109 | 0.0014 | 2.9117 | 0.8421 | 0.5151 | 0.0674 | 3.0188 | 61.20 |
| 632 | 0.0612 | 0.2722 | 3.6086 | 20.2647 | 0.2559 | 0.0070 | 0.0015 | 3.6991 | 0.7346 | 0.5553 | 0.1085 | 3.2445 | 81.85 |
| 633 | 0.1059 | 0.2843 | 3.7466 | 20.9661 | 0.3212 | 0.0086 | 0.0014 | 3.5631 | 0.7560 | 0.5608 | 0.1645 | 3.2162 | 62.80 |
| 634 | 0.1283 | 0.2509 | 3.5492 | 21.6629 | 0.2060 | 0.0075 | 0.0017 | 3.8984 | 0.5205 | 0.4573 | 0.0257 | 2.8509 | 79.85 |
| 635 | 0.0695 | 0.3685 | 4.4795 | 23.6071 | 0.4433 | 0.0083 | 0.0017 | 4.2513 | 0.8485 | 0.5674 | 0.0626 | 3.8051 | 82.75 |
| 636 | 0.1221 | 0.3328 | 3.9050 | 20.1266 | 0.2663 | 0.0063 | 0.0015 | 4.1543 | 0.6817 | 0.5400 | 0.0380 | 3.6087 | 81.80 |
| 637 | 0.0000 | 0.2679 | 3.5099 | 20.9780 | 0.2668 | 0.0113 | 0.0013 | 3.1181 | 1.1024 | 0.5948 | 0.1081 | 3.3235 | 93.05 |
| 638 | 0.1659 | 0.4221 | 4.4387 | 23.1838 | 0.1753 | 0.0040 | 0.0015 | 4.7302 | 0.6259 | 0.5906 | 0.0458 | 3.5628 | 113.80 |
| 639 | 0.1255 | 0.2824 | 3.4798 | 21.1148 | 0.2306 | 0.0078 | 0.0013 | 3.3294 | 0.7285 | 0.5284 | 0.0763 | 3.1071 | 71.25 |
| 640 | 0.2083 | 0.4252 | 4.1427 | 23.7142 | 0.2635 | 0.0072 | 0.0017 | 4.0913 | 0.6479 | 0.5336 | 0.0352 | 3.3734 | 84.75 |
| 641 | 0.2196 | 0.3620 | 3.7275 | 21.9356 | 0.2587 | 0.0065 | 0.0016 | 3.5638 | 0.6188 | 0.4865 | 0.0184 | 3.2659 | 136.05 |
| 642 | 0.0755 | 0.3191 | 3.9247 | 22.6495 | 0.3629 | 0.0089 | 0.0019 | 3.4197 | 0.6988 | 0.4946 | 0.0541 | 3.5103 | 83.80 |
| 643 | 0.1015 | 0.1753 | 3.1059 | 17.7319 | 0.2520 | 0.0051 | 0.0010 | 3.4284 | 0.6680 | 0.5060 | 0.0458 | 3.2136 | 85.75 |
| 644 | 0.0174 | 0.2194 | 3.4578 | 19.9408 | 0.2553 | 0.0074 | 0.0015 | 3.7251 | 0.6589 | 0.4648 | 0.0282 | 3.0354 | 71.25 |
| 645 | 0.1084 | 0.3129 | 3.9034 | 22.2022 | 0.2008 | 0.0070 | 0.0014 | 4.5378 | 0.7832 | 0.5582 | 0.0383 | 3.3038 | 81.65 |
| 646 | 0.1967 | 0.3408 | 3.7576 | 21.7964 | 0.3207 | 0.0081 | 0.0020 | 3.6472 | 0.6580 | 0.5127 | 0.0265 | 3.2337 | 79.05 |
| 647 | 0.1206 | 0.3111 | 3.6131 | 23.0208 | 0.1979 | 0.0071 | 0.0014 | 3.7684 | 0.6371 | 0.5464 | 0.0564 | 3.4657 | 91.05 |
| 648 | 0.0911 | 0.2612 | 3.3334 | 20.2065 | 0.2702 | 0.0067 | 0.0015 | 3.6633 | 0.6373 | 0.4823 | 0.0591 | 3.2007 | 124.40 |
| 649 | 0.0918 | 0.3613 | 3.8616 | 22.0863 | 0.2686 | 0.0067 | 0.0013 | 3.9902 | 0.6895 | 0.5742 | 0.0469 | 3.5432 | 88.60 |
| 650 | 0.2124 | 0.3254 | 3.7732 | 22.2258 | 0.2348 | 0.0054 | 0.0012 | 3.8258 | 0.6325 | 0.5314 | 0.0298 | 3.3385 | 87.55 |
| 651 | 0.0795 | 0.2901 | 3.3210 | 18.9578 | 0.1584 | 0.0068 | 0.0023 | 3.5368 | 0.5762 | 0.4410 | 0.0183 | 2.9793 | 113.40 |
| 652 | 0.1942 | 0.3229 | 3.6362 | 21.6314 | 0.2414 | 0.0097 | 0.0015 | 3.4680 | 0.7035 | 0.5098 | 0.0574 | 3.0820 | 83.10 |
| 653 | 0.1320 | 0.3421 | 4.0268 | 23.1111 | 0.2345 | 0.0055 | 0.0013 | 4.1846 | 0.7828 | 0.6342 | 0.0380 | 4.1123 | 141.30 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 654 | 0.1971 | 0.4021 | 4.3879 | 22.6159 | 0.3260 | 0.0084 | 0.0014 | 3.7985 | 0.7295 | 0.5724 | 0.0511 | 4.0455 | 74.90 |
| 655 | 0.1644 | 0.4357 | 4.3746 | 24.3188 | 0.4125 | 0.0088 | 0.0015 | 3.8664 | 0.8826 | 0.5609 | 0.0525 | 3.7094 | 106.68 |
| 656 | 0.1439 | 0.4100 | 4.2737 | 23.8414 | 0.2636 | 0.0068 | 0.0012 | 4.4111 | 0.6817 | 0.5413 | 0.0496 | 3.7562 | 111.80 |
| 657 | 0.1912 | 0.3609 | 3.7007 | 22.6128 | 0.1791 | 0.0062 | 0.0018 | 3.9204 | 0.5000 | 0.5067 | 0.0357 | 3.3287 | 102.05 |
| 658 | 0.1812 | 0.2653 | 3.4773 | 22.0880 | 0.2492 | 0.0085 | 0.0016 | 3.3794 | 0.5722 | 0.4770 | 0.0169 | 3.1503 | 101.85 |
| 659 | 0.1210 | 0.2945 | 3.5043 | 22.8399 | 0.2327 | 0.0059 | 0.0010 | 3.6309 | 0.5877 | 0.5552 | 0.0717 | 3.1205 | 86.10 |
| 660 | 0.1839 | 0.3962 | 4.2810 | 25.1869 | 0.2763 | 0.0065 | 0.0018 | 4.1367 | 0.7906 | 0.5801 | 0.0764 | 3.6748 | 100.00 |
| 661 | 0.1455 | 0.3019 | 3.3199 | 20.0695 | 0.2087 | 0.0071 | 0.0015 | 3.4980 | 0.7115 | 0.5265 | 0.0482 | 3.2056 | 97.90 |
| 662 | 0.0867 | 0.2997 | 3.1998 | 23.0923 | 0.2281 | 0.0131 | 0.0015 | 3.2550 | 0.9294 | 0.4963 | 0.0812 | 2.9946 | 74.85 |
| 663 | 0.1687 | 0.3038 | 3.7033 | 23.6596 | 0.1775 | 0.0080 | 0.0014 | 3.9587 | 0.5902 | 0.5333 | 0.0440 | 3.1758 | 74.70 |

*Table 3. Analytical results from SFB 5. Figures in weight percent.*

| Sample No | Na | Mg | Al | Si | P | S | Cl | K | Ca | Ti | Mn | Fe | Mag Sus |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 664 | 0.1555 | 0.3293 | 3.8655 | 20.6159 | 0.0928 | 0.0069 | 0.0022 | 3.8521 | 0.4719 | 0.5240 | 0.0000 | 3.1008 | 67.05 |
| 665 | 0.1885 | 0.3307 | 3.8623 | 22.0215 | 0.1068 | 0.0069 | 0.0019 | 3.8289 | 0.4895 | 0.4809 | 0.0059 | 3.2599 | 61.50 |
| 666 | 0.1745 | 0.3540 | 4.3276 | 23.6214 | 0.1087 | 0.0083 | 0.0017 | 4.3428 | 0.5274 | 0.4771 | 0.0001 | 3.2623 | 76.95 |
| 667 | 0.2334 | 0.3702 | 4.0856 | 23.3842 | 0.1054 | 0.0073 | 0.0024 | 4.0483 | 0.5479 | 0.4701 | 0.0000 | 3.1290 | 80.65 |
| 668 | 0.1738 | 0.3628 | 4.3732 | 21.8390 | 0.1211 | 0.0083 | 0.0015 | 4.1827 | 0.6194 | 0.4954 | 0.0040 | 3.4466 | 90.30 |
| 669 | 0.2532 | 0.3566 | 4.7415 | 23.7640 | 0.1289 | 0.0092 | 0.0023 | 3.7522 | 0.5133 | 0.5301 | 0.0112 | 3.4439 | 78.75 |
| 670 | 0.2038 | 0.3611 | 4.3338 | 24.2172 | 0.0880 | 0.0051 | 0.0016 | 4.4715 | 0.4614 | 0.5375 | 0.0000 | 3.4955 | 79.30 |
| 671 | 0.1221 | 0.3360 | 4.1441 | 21.6806 | 0.0854 | 0.0056 | 0.0016 | 4.3031 | 0.4528 | 0.5045 | 0.0000 | 3.3320 | 53.70 |
| 672 | 0.2329 | 0.4192 | 4.0843 | 24.9606 | 0.0785 | 0.0060 | 0.0015 | 4.0359 | 0.4581 | 0.5079 | 0.0000 | 3.5103 | 101.45 |
| 673 | 0.1131 | 0.3593 | 4.2380 | 24.1430 | 0.1076 | 0.0054 | 0.0018 | 4.5822 | 0.4382 | 0.5084 | 0.0121 | 3.4436 | 60.35 |
| 674 | 0.1761 | 0.3263 | 4.0969 | 22.5081 | 0.1152 | 0.0084 | 0.0017 | 3.8549 | 0.3516 | 0.4390 | 0.0004 | 3.1987 | 77.70 |
| 675 | 0.1258 | 0.3464 | 4.3946 | 22.5331 | 0.1167 | 0.0069 | 0.0014 | 3.9651 | 0.3821 | 0.4730 | 0.0072 | 3.4638 | 84.50 |
| 676 | 0.2029 | 0.4150 | 4.3706 | 24.4114 | 0.0933 | 0.0055 | 0.0014 | 4.1015 | 0.5025 | 0.5318 | 0.0219 | 3.3520 | 70.15 |
| 677 | 0.2385 | 0.3250 | 3.8925 | 22.3383 | 0.1011 | 0.0067 | 0.0018 | 3.7620 | 0.5266 | 0.4902 | 0.0071 | 3.1682 | 70.55 |
| 678 | 0.0093 | 0.1771 | 2.5327 | 16.4570 | 0.0835 | 0.0081 | 0.0017 | 2.5967 | 0.5409 | 0.5283 | 0.0304 | 2.6267 | 92.35 |
| 679 | 0.1189 | 0.4239 | 3.7841 | 21.9697 | 0.1103 | 0.0049 | 0.0013 | 3.5894 | 0.6787 | 0.4501 | 0.0074 | 3.2463 | 54.55 |
| 680 | 0.1468 | 0.3656 | 4.2180 | 20.6408 | 0.1011 | 0.0068 | 0.0012 | 4.2617 | 0.4561 | 0.4921 | 0.0000 | 3.3201 | 64.90 |
| 681 | 0.1482 | 0.3597 | 4.1157 | 24.1594 | 0.1140 | 0.0056 | 0.0015 | 4.3596 | 0.3965 | 0.4493 | 0.0123 | 2.8751 | 59.55 |
| 682 | 0.2423 | 0.3648 | 4.1746 | 22.5564 | 0.1082 | 0.0074 | 0.0015 | 3.8725 | 0.4970 | 0.4441 | 0.0000 | 3.2238 | 74.45 |
| 683 | 0.2107 | 0.3523 | 4.0747 | 21.5598 | 0.1124 | 0.0079 | 0.0019 | 3.8535 | 0.4458 | 0.4605 | 0.0000 | 3.4655 | 78.45 |
| 684 | 0.1775 | 0.3159 | 3.5726 | 21.1222 | 0.0779 | 0.0072 | 0.0017 | 3.5535 | 0.3376 | 0.4500 | 0.0000 | 3.0647 | 65.15 |
| 685 | 0.1600 | 0.4081 | 4.7547 | 25.4148 | 0.0892 | 0.0060 | 0.0022 | 4.2329 | 0.5096 | 0.5625 | 0.0038 | 3.4576 | 80.85 |
| 686 | 0.1250 | 0.3541 | 4.1709 | 21.0490 | 0.1162 | 0.0092 | 0.0023 | 3.7504 | 0.3941 | 0.4440 | 0.0000 | 3.3309 | 85.90 |
| 687 | 0.1779 | 0.4201 | 4.3537 | 23.4011 | 0.1063 | 0.0050 | 0.0010 | 3.8619 | 0.5359 | 0.5149 | 0.0098 | 3.1238 | 79.60 |
| 688 | 0.1414 | 0.2803 | 3.3510 | 21.8455 | 0.1106 | 0.0070 | 0.0012 | 3.5519 | 0.4764 | 0.4993 | 0.0146 | 2.9850 | 63.55 |
| 689 | 0.0870 | 0.2441 | 3.1048 | 17.8798 | 0.1145 | 0.0133 | 0.0018 | 2.8334 | 1.2490 | 0.5299 | 0.0193 | 2.5068 | 27.40 |
| 690 | 0.2125 | 0.3493 | 4.1949 | 21.5826 | 0.1398 | 0.0091 | 0.0020 | 3.8293 | 0.5403 | 0.5164 | 0.0048 | 3.4429 | 17.40 |
| 691 | 0.1552 | 0.2581 | 3.2640 | 20.3899 | 0.0972 | 0.0072 | 0.0015 | 3.2604 | 0.5516 | 0.5554 | 0.0109 | 2.7857 | 25.95 |
| 692 | 0.0323 | 0.2757 | 3.5742 | 21.2164 | 0.1131 | 0.0090 | 0.0016 | 3.5882 | 0.5776 | 0.5532 | 0.0219 | 3.1172 | 22.50 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 693 | 0.1584 | 0.3393 | 4.1092 | 21.5389 | 0.0991 | 0.0061 | 0.0016 | 4.6909 | 0.4529 | 0.4956 | 0.0176 | 3.4914 | 86.25 |
| 694 | 0.1764 | 0.3930 | 4.0880 | 21.5388 | 0.0890 | 0.0072 | 0.0019 | 3.9877 | 0.4351 | 0.4773 | 0.0000 | 3.2342 | 88.05 |
| 695 | 0.2059 | 0.3652 | 4.1969 | 23.8005 | 0.0807 | 0.0075 | 0.0016 | 3.9990 | 0.4588 | 0.5406 | 0.0000 | 3.4669 | 58.75 |
| 696 | 0.1586 | 0.3815 | 4.1190 | 21.0072 | 0.0656 | 0.0047 | 0.0018 | 4.7739 | 0.3810 | 0.5708 | 0.0017 | 3.3970 | 94.90 |
| 697 | 0.1424 | 0.4049 | 4.2452 | 23.2821 | 0.1073 | 0.0052 | 0.0012 | 3.9271 | 0.5314 | 0.5022 | 0.0226 | 3.6870 | 61.55 |
| 698 | 0.2001 | 0.3373 | 4.0372 | 23.9471 | 0.0668 | 0.0048 | 0.0012 | 4.2965 | 0.4193 | 0.5117 | 0.0000 | 3.2411 | 59.30 |
| 699 | 0.0875 | 0.3042 | 3.6932 | 22.0847 | 0.1301 | 0.0095 | 0.0020 | 3.7798 | 0.5568 | 0.5928 | 0.0306 | 3.0520 | 29.15 |
| 700 | 0.2320 | 0.2889 | 3.7815 | 22.9437 | 0.1294 | 0.0083 | 0.0015 | 3.5551 | 0.4647 | 0.6247 | 0.0414 | 3.0896 | 39.75 |
| 701 | 0.1099 | 0.2542 | 3.1390 | 19.7317 | 0.1015 | 0.0082 | 0.0014 | 3.2616 | 0.4361 | 0.5406 | 0.0174 | 2.7404 | 47.15 |
| 702 | 0.0986 | 0.2561 | 3.3900 | 21.0826 | 0.1109 | 0.0084 | 0.0019 | 3.3199 | 0.5321 | 0.5497 | 0.0264 | 2.8673 | 32.30 |
| 703 | 0.1334 | 0.2885 | 4.1526 | 23.3243 | 0.1356 | 0.0104 | 0.0019 | 3.8100 | 0.8117 | 0.6682 | 0.0124 | 3.1136 | 49.45 |
| 704 | 0.1826 | 0.3255 | 3.8177 | 23.5319 | 0.0752 | 0.0062 | 0.0017 | 4.3432 | 0.3705 | 0.5952 | 0.0113 | 3.2477 | 61.65 |
| 705 | 0.0805 | 0.3632 | 4.3265 | 19.9962 | 0.1146 | 0.0079 | 0.0017 | 3.8466 | 0.5662 | 0.5527 | 0.0045 | 3.4977 | 74.00 |
| 706 | 0.1515 | 0.3331 | 4.3892 | 22.8496 | 0.0904 | 0.0040 | 0.0013 | 4.5512 | 0.4671 | 0.5287 | 0.0000 | 3.5034 | 75.30 |
| 707 | 0.1753 | 0.4294 | 4.4223 | 20.8579 | 0.0925 | 0.0060 | 0.0014 | 4.1238 | 0.3916 | 0.5361 | 0.0025 | 3.9125 | 71.15 |
| 708 | 0.0638 | 0.4134 | 4.4806 | 21.8031 | 0.1034 | 0.0065 | 0.0017 | 4.4611 | 0.5829 | 0.5586 | 0.0000 | 3.6643 | 65.95 |
| 709 | 0.2049 | 0.3540 | 4.2125 | 21.6470 | 0.0958 | 0.0057 | 0.0013 | 4.4356 | 0.5296 | 0.5481 | 0.0103 | 3.5938 | 58.60 |
| 710 | 0.0966 | 0.2862 | 3.6935 | 20.4819 | 0.1177 | 0.0064 | 0.0015 | 3.4851 | 0.4705 | 0.5434 | 0.0188 | 3.3038 | 74.45 |
| 711 | 0.0034 | 0.2524 | 3.6693 | 23.6821 | 0.1183 | 0.0103 | 0.0014 | 3.6874 | 0.5545 | 0.6017 | 0.0351 | 2.9864 | 25.25 |
| 712 | 0.0432 | 0.2865 | 3.5250 | 20.0806 | 0.0868 | 0.0081 | 0.0020 | 3.9364 | 0.5485 | 0.5988 | 0.0337 | 2.7831 | 40.15 |
| 713 | 0.1749 | 0.3154 | 3.8159 | 24.0820 | 0.1178 | 0.0073 | 0.0014 | 3.8248 | 0.5353 | 0.5961 | 0.0465 | 3.1507 | 36.00 |
| 714 | 0.1544 | 0.3014 | 3.3172 | 21.7974 | 0.1067 | 0.0099 | 0.0019 | 3.3355 | 0.4487 | 0.4907 | 0.0435 | 2.6837 | 47.70 |
| 715 | 0.0899 | 0.2608 | 3.4628 | 22.6464 | 0.0697 | 0.0074 | 0.0019 | 3.5039 | 0.3470 | 0.5203 | 0.0052 | 2.6816 | 72.95 |
| 716 | 0.2149 | 0.3494 | 4.2179 | 22.6298 | 0.0876 | 0.0064 | 0.0023 | 4.6056 | 0.3816 | 0.5516 | 0.0024 | 3.4755 | 130.70 |
| 717 | 0.0049 | 0.3249 | 3.9771 | 21.4207 | 0.1206 | 0.0095 | 0.0020 | 3.7948 | 0.4272 | 0.4672 | 0.0000 | 3.0822 | 62.05 |
| 718 | 0.1162 | 0.3027 | 3.7245 | 27.7584 | 0.0697 | 0.0064 | 0.0015 | 3.9809 | 0.3181 | 0.4630 | 0.0000 | 2.6288 | 57.90 |
| 719 | 0.2411 | 0.3972 | 4.1647 | 20.1877 | 0.0857 | 0.0053 | 0.0014 | 4.0628 | 0.4413 | 0.5354 | 0.0130 | 3.6114 | 112.30 |
| 720 | 0.0763 | 0.3215 | 3.7017 | 20.9822 | 0.0866 | 0.0065 | 0.0018 | 3.6872 | 0.2939 | 0.4593 | 0.0000 | 3.0002 | 84.45 |
| 721 | 0.2621 | 0.2757 | 4.0253 | 24.2665 | 0.1347 | 0.0088 | 0.0016 | 3.9335 | 0.5688 | 0.6213 | 0.0198 | 3.2090 | 40.05 |
| 722 | 0.2057 | 0.2347 | 3.3725 | 22.1993 | 0.1063 | 0.0100 | 0.0019 | 3.4093 | 0.5223 | 0.5967 | 0.0171 | 2.7644 | 55.30 |
| 723 | 0.2624 | 0.2750 | 3.5415 | 22.4564 | 0.1296 | 0.0093 | 0.0016 | 3.3577 | 0.5495 | 0.6134 | 0.0094 | 2.9830 | 36.35 |
| 724 | 0.1204 | 0.2669 | 3.6865 | 23.0986 | 0.1186 | 0.0087 | 0.0019 | 3.6421 | 0.4984 | 0.6227 | 0.0305 | 2.7856 | 31.75 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 725 | 0.0016 | 0.2678 | 3.8063 | 23.3634 | 0.1205 | 0.0080 | 0.0013 | 3.7516 | 0.4570 | 0.5907 | 0.0497 | 3.1109 | 35.30 |
| 726 | 0.1176 | 0.3226 | 3.9613 | 21.5324 | 0.0923 | 0.0062 | 0.0013 | 4.0899 | 0.4371 | 0.5732 | 0.0096 | 3.3058 | 91.15 |
| 727 | 0.1482 | 0.3629 | 4.3061 | 25.5137 | 0.0856 | 0.0051 | 0.0014 | 4.2150 | 0.3368 | 0.5679 | 0.0045 | 3.3756 | 103.50 |
| 728 | 0.1202 | 0.3562 | 4.2206 | 22.9183 | 0.1005 | 0.0061 | 0.0013 | 4.3613 | 0.3930 | 0.5082 | 0.0092 | 3.5002 | 96.35 |
| 729 | 0.1569 | 0.3251 | 3.7195 | 23.0624 | 0.1020 | 0.0070 | 0.0017 | 3.8114 | 0.3735 | 0.4815 | 0.0000 | 2.8448 | 73.90 |
| 730 | 0.1374 | 0.3437 | 4.2682 | 22.2824 | 0.1147 | 0.0064 | 0.0016 | 4.2078 | 0.3909 | 0.5173 | 0.0000 | 3.4277 | 94.10 |
| 731 | 0.1119 | 0.3769 | 4.6325 | 25.2210 | 0.1144 | 0.0053 | 0.0016 | 4.6379 | 0.5212 | 0.5895 | 0.0119 | 3.7133 | 97.10 |
| 732 | 0.1348 | 0.3137 | 3.7697 | 21.0821 | 0.1080 | 0.0066 | 0.0012 | 3.7856 | 0.4546 | 0.5815 | 0.0404 | 3.5020 | 65.20 |
| 733 | 0.1397 | 0.2629 | 3.7205 | 21.5668 | 0.1196 | 0.0084 | 0.0020 | 3.6186 | 0.5506 | 0.6477 | 0.0311 | 3.1827 | 35.45 |
| 734 | 0.1244 | 0.1779 | 3.0863 | 18.9837 | 0.0966 | 0.0081 | 0.0019 | 3.1787 | 0.5280 | 0.6019 | 0.0202 | 2.7394 | 43.35 |
| 735 | 0.0976 | 0.2497 | 3.8086 | 22.8318 | 0.1292 | 0.0103 | 0.0022 | 3.6103 | 0.5035 | 0.6520 | 0.0083 | 3.0406 | 42.85 |
| 736 | 0.1229 | 0.2974 | 3.5971 | 25.6494 | 0.0906 | 0.0069 | 0.0019 | 3.7132 | 0.3712 | 0.5920 | 0.0867 | 3.1588 | 42.50 |
| 737 | 0.1242 | 0.3461 | 4.2763 | 24.9386 | 0.1068 | 0.0042 | 0.0011 | 4.6125 | 0.4142 | 0.5460 | 0.0256 | 3.2636 | 102.05 |
| 738 | 0.1747 | 0.3334 | 3.9068 | 21.0022 | 0.0924 | 0.0053 | 0.0015 | 4.0419 | 0.4436 | 0.5383 | 0.0076 | 3.3779 | 86.50 |
| 739 | 0.1698 | 0.2640 | 3.6026 | 23.0491 | 0.1267 | 0.0096 | 0.0022 | 3.4791 | 0.3672 | 0.5095 | 0.0000 | 3.1716 | 80.10 |
| 740 | 0.0226 | 0.3058 | 3.4173 | 19.1307 | 0.0952 | 0.0082 | 0.0021 | 3.1209 | 0.3715 | 0.4603 | 0.0079 | 2.9203 | 81.60 |
| 741 | 0.2142 | 0.4138 | 4.5050 | 21.7784 | 0.0856 | 0.0044 | 0.0015 | 4.5827 | 0.4366 | 0.5365 | 0.0007 | 3.6322 | 104.75 |
| 742 | 0.2525 | 0.3897 | 4.3978 | 21.9526 | 0.0853 | 0.0042 | 0.0010 | 4.6229 | 0.4542 | 0.6068 | 0.0047 | 3.8059 | 89.10 |
| 743 | 0.1110 | 0.3163 | 3.5395 | 20.3192 | 0.1279 | 0.0072 | 0.0019 | 3.5649 | 0.6002 | 0.6047 | 0.0271 | 3.3087 | 45.50 |
| 744 | 0.0911 | 0.1946 | 3.1417 | 21.0076 | 0.1278 | 0.0096 | 0.0020 | 3.2635 | 0.4834 | 0.5194 | 0.0175 | 2.6240 | 46.25 |
| 745 | 0.1431 | 0.2367 | 3.4610 | 20.3407 | 0.1087 | 0.0100 | 0.0027 | 3.2811 | 0.6182 | 0.6558 | 0.0101 | 2.7747 | 19.45 |
| 746 | 0.1713 | 0.2536 | 3.4235 | 21.4928 | 0.1220 | 0.0076 | 0.0022 | 3.2482 | 0.4603 | 0.5412 | 0.0439 | 3.0386 | 60.90 |
| 747 | 0.0965 | 0.2298 | 3.5502 | 20.0853 | 0.1112 | 0.0076 | 0.0013 | 3.5108 | 0.4627 | 0.5921 | 0.0439 | 3.2778 | 61.65 |
| 748 | 0.2423 | 0.3218 | 3.7153 | 22.6466 | 0.0933 | 0.0060 | 0.0025 | 3.8750 | 0.3379 | 0.4820 | 0.0001 | 3.0355 | 70.90 |
| 749 | 0.1933 | 0.3683 | 4.1615 | 22.5381 | 0.0844 | 0.0059 | 0.0018 | 4.2009 | 0.3738 | 0.5478 | 0.0006 | 3.5795 | 77.55 |
| 750 | 0.2031 | 0.3292 | 3.2280 | 16.2941 | 0.0846 | 0.0073 | 0.0018 | 3.1687 | 0.3792 | 0.4394 | 0.0017 | 3.0004 | 72.35 |
| 751 | 0.1386 | 0.3047 | 3.5469 | 21.9166 | 0.0877 | 0.0089 | 0.0016 | 3.2348 | 0.3469 | 0.4271 | 0.0000 | 3.4286 | 75.75 |
| 752 | 0.1612 | 0.3501 | 3.9053 | 18.9077 | 0.0843 | 0.0048 | 0.0014 | 4.0635 | 0.4681 | 0.5109 | 0.0000 | 3.8202 | 98.15 |
| 753 | 0.1478 | 0.3924 | 4.5963 | 21.5046 | 0.1074 | 0.0074 | 0.0018 | 4.2564 | 0.6076 | 0.5489 | 0.0013 | 3.7723 | 65.60 |
| 754 | 0.1246 | 0.1988 | 3.3020 | 23.1146 | 0.1059 | 0.0072 | 0.0015 | 3.4703 | 0.4530 | 0.4959 | 0.0307 | 2.7826 | 61.30 |
| 755 | 0.1909 | 0.2968 | 3.6291 | 21.4334 | 0.1119 | 0.0070 | 0.0011 | 3.5199 | 0.5238 | 0.6384 | 0.0648 | 3.3080 | 30.30 |
| 756 | 0.1424 | 0.2505 | 3.4790 | 20.8426 | 0.1205 | 0.0086 | 0.0017 | 3.5105 | 0.6025 | 0.6058 | 0.0628 | 3.0337 | 69.20 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 757 | 0.0882 | 0.2609 | 3.6345 | 21.4908 | 0.1152 | 0.0076 | 0.0021 | 3.4229 | 0.6065 | 0.5860 | 0.0300 | 2.7456 | 31.40 |
| 758 | 0.1911 | 0.2075 | 3.1305 | 18.8844 | 0.0977 | 0.0079 | 0.0016 | 3.1700 | 0.5524 | 0.6039 | 0.0287 | 2.8337 | 38.55 |
| 759 | 0.0986 | 0.2857 | 3.7879 | 22.0024 | 0.0714 | 0.0058 | 0.0013 | 3.6351 | 0.3841 | 0.5262 | 0.0295 | 3.0347 | 71.80 |
| 760 | 0.0348 | 0.3091 | 3.9281 | 23.6541 | 0.0801 | 0.0055 | 0.0019 | 4.4421 | 0.3629 | 0.5451 | 0.0016 | 3.1885 | 72.15 |
| 761 | 0.2439 | 0.4065 | 4.2020 | 23.3645 | 0.0696 | 0.0061 | 0.0018 | 4.2153 | 0.3991 | 0.5197 | 0.0000 | 3.1428 | 86.25 |
| 762 | 0.1616 | 0.3814 | 3.7089 | 19.4665 | 0.0799 | 0.0067 | 0.0032 | 3.4160 | 0.4651 | 0.5218 | 0.0031 | 3.5738 | 52.85 |
| 1608 | 0.3314 | 0.4424 | 4.5707 | 21.7796 | 0.1000 | 0.0051 | 0.0016 | 4.2185 | 0.4523 | 0.5384 | 0.0051 | 3.6411 | 98.45 |
| 1609 | 0.2451 | 0.4562 | 5.3215 | 24.0818 | 0.1243 | 0.0055 | 0.0012 | 5.0753 | 0.5787 | 0.6993 | 0.0174 | 4.0103 | 123.10 |
| 1610 | 0.1125 | 0.3962 | 4.7356 | 25.3353 | 0.1521 | 0.0080 | 0.0018 | 4.4944 | 0.4925 | 0.5787 | 0.0095 | 3.6414 | 68.15 |
| 1611 | 0.1600 | 0.3972 | 4.3342 | 22.9358 | 0.1179 | 0.0062 | 0.0014 | 4.1511 | 0.5156 | 0.5933 | 0.0145 | 3.5024 | 78.65 |
| 1612 | 0.1226 | 0.1759 | 3.2297 | 24.0196 | 0.0934 | 0.0087 | 0.0015 | 3.2419 | 0.4834 | 0.5840 | 0.0385 | 2.8048 | 40.90 |
| 1613 | 0.1801 | 0.2328 | 3.6503 | 23.6017 | 0.1155 | 0.0090 | 0.0013 | 3.7585 | 0.4927 | 0.5650 | 0.0158 | 2.8031 | 73.30 |
| 1614 | 0.1178 | 0.3344 | 3.9284 | 23.8447 | 0.1413 | 0.0061 | 0.0013 | 3.6069 | 0.3532 | 0.4301 | 0.0052 | 3.0256 | 96.60 |
| 1615 | 0.0921 | 0.3425 | 4.1603 | 22.4328 | 0.1165 | 0.0073 | 0.0018 | 4.0285 | 0.3822 | 0.4881 | 0.0000 | 3.1953 | 93.65 |
| 1616 | 0.1749 | 0.4571 | 5.0667 | 23.1808 | 0.1273 | 0.0060 | 0.0013 | 4.5175 | 0.5359 | 0.5982 | 0.0197 | 4.0452 | 88.35 |
| 1617 | 0.2298 | 0.4521 | 4.9785 | 23.1614 | 0.1166 | 0.0068 | 0.0015 | 4.8999 | 0.6499 | 0.5986 | 0.0053 | 3.8633 | 75.25 |
| 1618 | 0.2300 | 0.4178 | 4.9415 | 26.2975 | 0.1034 | 0.0055 | 0.0018 | 4.7282 | 0.4454 | 0.6169 | 0.0181 | 3.7602 | 91.65 |
| 1619 | 0.1145 | 0.4253 | 4.9073 | 22.9173 | 0.1391 | 0.0092 | 0.0019 | 3.6486 | 0.5646 | 0.5330 | 0.0071 | 3.9591 | 79.10 |
| 1620 | 0.2725 | 0.3516 | 4.2972 | 23.2329 | 0.1105 | 0.0055 | 0.0023 | 4.3187 | 0.4904 | 0.5590 | 0.0071 | 3.4690 | 87.95 |
| 1621 | 0.1673 | 0.3647 | 4.2424 | 24.0180 | 0.1045 | 0.0061 | 0.0014 | 4.2927 | 0.4257 | 0.5325 | 0.0049 | 3.1467 | 79.45 |
| 1622 | 0.1069 | 0.3172 | 4.0943 | 22.7081 | 0.0774 | 0.0053 | 0.0015 | 3.9282 | 0.3739 | 0.5890 | 0.0969 | 2.9874 | 90.45 |
| 1623 | 0.1986 | 0.3440 | 3.8747 | 24.3817 | 0.1023 | 0.0066 | 0.0017 | 3.9823 | 0.3814 | 0.5006 | 0.0000 | 2.9348 | 98.05 |
| 1624 | 0.1515 | 0.3200 | 4.0843 | 24.8391 | 0.1011 | 0.0064 | 0.0013 | 4.4099 | 0.4626 | 0.5008 | 0.0081 | 3.1435 | 101.30 |
| 1625 | 0.1855 | 0.3696 | 4.3194 | 23.2649 | 0.0928 | 0.0055 | 0.0012 | 4.2993 | 0.4413 | 0.5644 | 0.0000 | 3.6399 | 104.75 |
| 1626 | 0.1627 | 0.3098 | 3.7549 | 23.6077 | 0.1140 | 0.0085 | 0.0020 | 3.6106 | 0.4445 | 0.4608 | 0.0038 | 3.0743 | 86.20 |
| 1627 | 0.0893 | 0.2933 | 3.5684 | 24.1897 | 0.1060 | 0.0081 | 0.0019 | 3.5326 | 0.4328 | 0.4938 | 0.0000 | 2.7898 | 62.90 |
| 1628 | 0.2857 | 0.3670 | 3.9736 | 22.1963 | 0.0973 | 0.0101 | 0.0022 | 3.3413 | 0.5071 | 0.5240 | 0.0188 | 3.5013 | 74.80 |
| 1629 | 0.1206 | 0.3503 | 4.1730 | 25.6118 | 0.1023 | 0.0069 | 0.0014 | 4.0379 | 0.4410 | 0.5465 | 0.0145 | 3.4172 | 61.30 |

*Table 4. Analytical results from SFB 6. Figures in weight percent.*