BRECON TO TIRLEY GAS PIPELINE AND TIRLEY FEEDER CONNECTOR

Analysis of the Archaeological Record

Prepared by

NETWORK ARCHAEOLOGY LTD

For

MURPHY PIPELINES LTD

On behalf of

NATIONAL GRID

Report Number: 478

July 2013

DOCUMENT CONTROL SHEET

Project title	**Brecon To Tirley High Pressure Gas Pipeline and Tirley Feeder Connector**							
Document title	Analysis of the Archaeological Record							
Report no.	478							
Project code	BRT178							
Accession number	CPAT 06.12 and HRFD 2008-11							
File ref.	BRT178 v3.1							
Counties	Powys, Herefordshire, Gloucestershire							
NGR	303141 / 231949 to 381466/ 229465							
Client 1	Murphy Pipelines Ltd							
Client 2	National Grid							
Distribution	Richard Pope, Murphy Pipeline Ltd Tim Vaughan, National Grid Linda Bonnor, National Grid			Mark Walters, Clwyd Powys Archaeological Trust Julian Cotton, Herefordshire County Council Charles Parry, Gloucestershire County Council, Environment Department				
Document Comprises	Doc. Control sheet	Table of contents	List of tables	List of Figures	List of plates	List of appends	Text	App
	1	1	1	3	1	1	125	281

Ver	Status	Author(s)	Reviewer	Approver	Date
1 -2	First & Second issue	Graham Cruse Senior Project Officer	Dan Hounsell Project Manager	David Bonner Senior Project Manager	22/06/2012
3	Second issue	Graham Cruse Senior Project Officer	Dan Hounsell Project Manager	David Bonner Senior Project Manager	26/07/2013

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NON TECHNICAL SUMMARY

The Brecon to Tirley stretch of the Milford Haven to Tirley pipeline offered a rare opportunity to investigate a variety of sites across three counties in the Welsh Marches, and allow for comparisons between them. The vast majority of the sites uncovered were Roman in date, along with a smaller number of Iron Age/Roman transition period and Bronze Age sites; a total of 16 significant sites being identified across this stretch of the pipeline

Whilst the prehistoric evidence from the pipeline was relatively scarce, a number of Bronze Age sites were located – notably the cremation cemetery at plot 49 and the possible cemetery site at plot 464. However, the evidence is relatively scant and other than indicating the presence of Bronze Age populations there are few clues as to how and where those populations might have lived.

The evidence for the end of the prehistoric period, and the transition into the Roman era, along the pipeline is almost universally tied up with later Roman occupation. This appears to support existing evidence for the Welsh Marches, which indicates that the Roman invasion and subsequent occupation does not seem to have caused an abandonment of native sites, but instead there appears to be an unbroken continuation of habitation on the sites, suggesting a relatively docile population accepting the new regime.

The pipeline revealed significant evidence for late Iron Age and Roman metalworking at a number of sites along its route, though most significantly near Kingstone and Peterchurch in Herefordshire. Indeed, the evidence for Iron Age bloomsmithing at plot 331, near Kingstone, falls within a complete gap in existing knowledge, making the site significant on a national basis.

The dominant conclusion from the Brecon to Tirley project was the confirmation that the rural Roman landscape was not as sparsely occupied and exploited as the archaeological record implied. Instead, the pipeline sites suggested that the Welsh Marches in the 2nd century AD consisted of a network of small, enclosed farmsteads.

1 INTRODUCTION

1.1 Background to the Scheme

National Grid had determined that there was a need to reinforce their natural gas transmission network and provide increased gas transmission capacity. It was, therefore, decided to construct a 316km long pipeline running from Milford Haven in Pembrokeshire to Tirley in Gloucestershire, of which the Brecon to Tirley pipeline (BRT) was the easternmost, 107km long, section (NGR 303141 231949 to 381466 229465) (figure 1).

Subsequently a new ‘connector’ length of pipeline was required at the eastern end of the newly constructed Brecon to Tirley pipeline. This ‘Tirley Feeder Connector’ connected the new pipeline with the existing National Transmission System (NTS) pipeline. This length of pipeline was approximately 850m long, and ran from a temporary PIG trap established at the eastern end of the existing Brecon to Tirley pipeline to a new Pressure Reduction Installation (PRI), the Tirley PRI, located one kilometre to the south west of the village of Corse in Gloucestershire (NGR 381876 229520). The results of the archaeological work associated with this PRI are detailed in a separate report (Network Archaeology 2012).

1.2 Topography

The pipeline crossed a wide variety of soil types and geologies along its entire length. Predominantly these were fine loamy or fine silty soils, overlying drift geology comprised primarily of loams and silty soils, with alluvial gravels and silts in the river valleys (SSEW 1983). The height above sea level of the pipeline route also varied, starting at between 365m AOD at its highest and *c.*25m AOD at its lowest, near Tirley.

1.3 Archaeological Background

An initial desk based assessment (DBA) of the BRT pipeline route (Cotswolds Archaeology, 2006i) identified 40 potential sites in Powys (from Brecon to Hay-on-Wye); 62 sites in Herefordshire (from Cusop to Upton Bishop); and 12 sites in Gloucestershire (from Kempley to Tirley).

A further DBA was undertaken by Network Archaeology following the decision to alter the route of the pipeline around Hay-on-Wye (Network Archaeology 2006iii). Four potential route options were assessed, identifying 41 sites in the vicinity of these routes. Based on these findings, three further sites were identified for field-walking, and one further site was considered for earthwork survey.

Subsequent to the results of the DBA, four stages of non-intrusive fieldwork along the route of the BRT pipeline were undertaken:

- Reconnaissance survey along the whole of the proposed pipeline route (Cotswolds Archaeology, 2006i)
- Geophysical survey along the whole of the pipeline route (Bartlett-Clark Consultancy, 2006i and 2007)
- Fieldwalking survey within 42 suitable plots (Cotswolds Archaeology, 2006v-vii), and;
- Earthwork survey of 141 plots (Cotswolds Archaeology, 2006ii-iv)

Following the non-intrusive surveys it was decided, through consultation with all relevant parties, that archaeological evaluations be undertaken at targeted sites along the route of the pipeline and associated AGIs, mobilisation yards and laydown areas. A total of 194 trenches were proposed comprising 87 in Herefordshire, 41 in Powys and 13 in Gloucestershire (Network Archaeology 2009i) and a further 53 within ancillary areas (Network Archaeology 2009ii).

The evaluation trenches produced a combination of negative cut features, positive features, soil layers and finds and as a result nine plots (110, 111, 250, 269, 271, 331, 430, 454 and 496) were identified for full archaeological excavation. A watching brief was maintained on the remaining plots along the route of the pipeline and it's associated Above Ground Installations (AGIs). The results of this work, along with the methodologies used during them, are presented in a separate assessment report and associated Written Scheme of Investigation (Network Archaeology 2010).

The route of the Tirley feeder connector (all eight plots) was subject to a DBA and field reconnaissance survey in 2008, which fed into an Environmental Statement (Mouchel Parkman 2008). A separate geophysical survey of the route was also undertaken and reported on shortly thereafter (Bartlett-Clark Consultancy 2008). Whilst this work identified some areas of interest there was not thought to be anything of sufficient value present to justify large scale intrusive investigation (such as sample evaluation), or to require the delineation of areas of initial excavation. As a result only one plot (plot 4) was initially targeted for trial trench evaluation whilst the rest were assigned a watching brief.

2 METHODOLOGY

This document forms part of the MAP2 process set out by English Heritage (EH 1991), and is led by the same standards and guidance as laid out in the BRT Assessment Report (Network Archaeology (NAL) 2010).

This analysis report follows on from the BRT and TFC assessment reports (Network Archaeology 2010 and Appendix A of this report) which presented the technical results of the fieldwork and assessed the archaeological potential of these results, and an Updated Project Design (NAL 2011i) which examined the ability of the dataset recovered to contribute to the original aims and research objectives of the fieldwork, as presented in the Archaeological Framework Document (NG/RSK ENSR, 2006: section 3), as well as presenting new objectives for consideration in light of the assessment conclusions. The UPD also identified the specific analytical tasks that needed to be undertaken in order to address the objectives successfully.

2.1 Research Objectives

The objectives originally identified were;

Welsh Objectives:

- To undertake a comprehensive recording survey, where appropriate, of all extant historic field boundaries crossed by the working width of the pipeline corridor, with the intention, if at all possible, of gathering evidence of the construction, phasing, dating, extent and development of field systems, field boundaries, settlement patterns and general landscape development within the region. This will be augmented by a comprehensive record, where possible, of all buried field boundaries encountered within the pipeline corridor, with the aim, where possible, of identifying any evidence of prehistoric field systems.
- To address, where possible and appropriate within the working width of the pipeline, the regional bias towards prehistoric sites and find spots on the present day coastline, as there is very little known about inland sites, and sites in upland areas.

- Where possible and appropriate within the working width of the pipeline, to undertake palaeo-environmental analysis of suitable deposits, including those at river crossings and the examination of buried land surfaces beneath funerary and ritual monuments and prehistoric earthworks and enclosure banks, will be undertaken.
- To obtain, where possible and appropriate within the working width of the pipeline, data on prehistoric funerary and ritual landscapes and practices within the region
- To obtain, where possible and appropriate within the working width of the pipeline, data on prehistoric settlement

English Objectives:

- To extend the use of proven methodologies for site location and interpretation, and encourage the development of new techniques, within the project area
- Encourage works of synthesis within and across periods, settlements, monuments and areas, for the project as a whole
- Encourage wide involvement in archaeological research and present modern accounts of the past to the public
- Improve the quality and quantity of environmental data and our understanding of what it represents, from within the pipeline spread. Target specific soil and sediment contexts for environmental information

In addition the UPD identified a number of additional potential research objectives:

- Identify more Roman rural sites (in the West Midlands) and disentangle the local settlement pattern (Guest 2002).
- The identification of Bronze Age settlement in the English counties bordering Wales (Halsted 2000).
- Improve understanding of the Iron Age/Roman transition in the West Midlands

The fieldwork detailed in this and the previous, assessment level, reports, was just one element of larger sequence of archaeological investigations which took place along the length of the pipeline. The entire route of the pipeline ran from Milford Haven in the west to Tirley in the east. In terms of archaeological investigations, the pipeline was broken up into three segments. A Milford Haven to Aberdulais stretch (western), a Felindre to Brecon stretch (central) and this Brecon to Tirley stretch (eastern).

A combined analysis report for the western and central stretches of the pipeline (Milford Haven to Aberdulais and Felindre to Brecon) is currently in production. Upon completion, an overarching publication will be produced discussing the results from all three sections of the pipeline in order that the archaeological landscape of the route can be considered in its entirety. The work, thus organised, will meet the requirements of English Objective 2.

The work undertaken as part of the UPD indicated that the nature of the dataset collected was such that Welsh Objective 5 and English Objective 1 had been addressed as far as possible during the assessment report (Network Archaeology 2010). The rest of the objectives will at least partially, be addressed in the course of this work.

The work undertaken as part of this analysis report had three main strands;

1) **Specialist recommendations**: Analysis of the artefactual material as per the recommendations made by the various specialists as part of the assessment stage, and detailed in both the assessment report and the UPD.

2) **Analysis of the dataset**: Detailed analysis of the data collected during all stages of the work, and in light of the results of the above. This would involve such things as re-examining stratigraphic relationships in light of revised chronological data (gained from scientific dating techniques, re-examination of the pottery typology, etc), re-examining spatial relationships – in terms of both the features from within one site, and across sites. Also revisions to phasing in light of revised stratigraphic / chronological / spatial understandings and re-examining the interpretation of the nature of features, and sites as a whole, based on all of these factors. The individual tasks forming this work are detailed in the UPD.

3) **Place the findings into their regional context**: Fitting the archaeological features and sites discovered as part of the work into a broader, contemporary, archaeological landscape. This involved using the Historical Environment Records (HER) for the regions to locate contemporary sites and then mapping them, along with the sites discovered during the work. Many of these known HER sites were originally identified as part of the Desk Based Assessments (DBA – Network Archaeology 2006i-iii, Cotswolds Archaeology 2006i-vii) and framework documentation (NG/RSK ENSR, 2006). Examination of such mapping would allow spatial patterns of contemporary, ancient, use from across the region to become apparent and permit the discovered sites to be fitted into a regional context. Parallel site were also sought, as was evidence for trade and communication across the region, both from the mapped regional data (trackways, roadways, nearby resource sites such as mines as well as nearby industrial processing centres – kilns, smithies etc) and in the information recovered from analysis of the recovered artefacts. Again, the individual tasks forming this work are detailed in the UPD.

2.2 Report Structure

This report will firstly present a summary of the results of the archaeological works as associated with the Tirley Feeder Connector (TFC) and their potential to contribute toward the outlined research objectives.

The artefacts recovered during the course of the TFC work have been examined to analysis level, as has the archive. It was felt beneficial to take the TFC dataset to analysis as part of this document;this allows the archaeological data for the whole of the eastern end of the pipeline (Brecon to Tirley stretch of the main pipeline and associated TFC site) to be considered as a whole, thus offering a more complete picture of the archaeological landscape at this end of the pipeline.

Following the discussion of the TFC site each of the significant archaeological sites uncovered along the length of the Brecon to Tirley section of the pipeline will be discussed in detail. This section will build upon the discussions presented in the assessment report, incorporating the additional specialist analysis data and revised understandings of the each plot and its features based upon this data and the re-examination of the original data set (strands 1 and 2, as detailed above). The information thus presented contributing toward a variety of the research objectives.

The final, thematic, sections of this report will take certain key sites uncovered by this work and attempt place them into a, contemporary, wider regional context. Specifically this will include an overview of the nature of prehistoric activity within the region of the pipeline route, and an examination of Iron Age / Roman Settlement in the region (i.e. strand 3 from the above). Again this will contribute toward a variety of the identified research objectives.

3 TIRLEY FEEDER CONNECTOR – SUMMARY

This section is intended to provide a brief summary of the findings during the construction of the Tirley Feeder Connector pipeline. A full assessment of the archaeology discovered during the pipeline works is included in Appendix A.

The pipeline crossed eight separate plots of land (figure 11), including two road crossings at Lime Street (plot 3) and the B4211 (plot 6). The findings from these plots are summarised below and illustrated in figures 12 – 15.

3.1 Results

3.1.1 Plot 1 (NGR 381066 229406)

No new finds or features were identified during either the topsoil strip or the excavation of the tie-in trenching with the original Brecon to Tirley pipeline.

3.1.2 Plot 2 (NGR 381273 229478)

Plot 2 contained a number of Roman features (figure 13) including a broad, roughly N-S linear feature (probably a trackway), and at least two Roman enclosures. The earlier of these was a curvilinear enclosure with a possible internal division that pre-dated the track, whilst the later was a rectilinear enclosure, also with an internal division, that appeared to respect the track (figure 14).

In one corner of the rectilinear enclosure was an undated inhumation that contained a partially complete human skeleton, though there was no further evidence to suggest that this was a funerary enclosure, and the location of the skeleton within it might have been coincidental (figure 13).

A number of discrete pit type features were also uncovered throughout the plot, along with evidence of activity along the putative trackway route, predating the trackway itself (figures 14 & 15). Two further undated curvilinear features were also identified towards the southern end of the plot which may have been further enclosures but were more likely to be drainage ditches.

The ceramic assemblage indicated that the site was fairly short-lived, being predominantly occupied during the 2nd to 3rd centuries AD, whilst a small number of Mesolithic and Neolithic flints suggested that some degree of earlier prehistoric activity occurred within the vicinity.

3.1.3 Plots 3 and 6 (NGRs 381427 229562 and 381552 229582)

Plots 3 and 6, public roads, were under-passed by tunnel, and as such no archaeological data was obtained from them.

3.1.4 Plot 4 (NGR 381480 229595)

Vestigial ridge and furrow was recorded in the western portion of the plot, predating which were two undated ditches, one in the western portion and one in the eastern – probably forming part of a drainage system (figure 12a and b).

3.1.5 Plot 5 (NGR 381644 229759)

Plot 5 contained a surprising depth of apparently alluvial subsoil, but no archaeological finds or features.

3.1.6 Plot 7 (NGR 381557 229505)

Plot 7 contained a relatively significant quantity of pottery recovered from the topsoil strip, something which had not been seen elsewhere on the project, even in the vicinity of the enclosures in plot 2. The pottery was domestic in nature, including mortaria, and dated to the 2nd – 3rd centuries, and probably related to settlement activity in the close vicinity – possibly immediately to the east, where archaeological investigations in advance of construction of Tirley PRI have identified Roman settlement of this period (Network Archaeology 2013ii).

Running N-S across the site were a small number of narrow, irregular linear features. These were interpreted as fairly modern wheel ruts based on their nature and fills, though they did predate the extant orcharding suggesting a pre-World War II origin (figure 12c).

3.1.7 Plot 8 (NGR 381813 229449)

Plot 8 revealed no significant findings, despite the discovery of a Neolithic flint axe nearby during previous archaeological evaluation (Network Archaeology 2011ii).

3.2 Discussion of Potential

Of the three plots along the pipeline route which revealed finds or features only plot 2 produced sufficient data to have potential to contribute to the analysis themes established during the Brecon to Tirley UPD.

In particular, the discovery of two 2nd/3rd century Roman enclosures in close proximity adds to developing our understanding of the Roman rural settlement pattern and, in particular, expands the pipeline dataset for Gloucestershire, which was particularly sparse during the original Brecon to Tirley pipeline project.

Both enclosures were presumed to be agricultural in nature, as only limited ceramic evidence survived to indicate domestic usage. This would in turn suggest the presence of a rural habitation in the close vicinity, presumably closer than that identified during the concurrent works at the Tirley Pressure Reduction Installation (Network Archaeology 2013ii), approximately 850m away.

A relatively large number of the pits in plot 2 produced burnt material which may not relate to agricultural activity. These pits may well have been intended for deposition of small scale industrial waste, and whilst the nature and location of that industry was not determined during the excavation, it was most likely related to the eastern of the two enclosures which extended to the north of the pipeline easement.

4 BRECON TO TIRLEY AND TIRLEY FEEDER CONNECTOR GAS PIPELINES – SITE OVERVIEWS

During the course of the Brecon to Tirley (BRT) and Tirley Feeder Connector (TFC) project the term site was used to describe a defined area of archaeology located within the line of the pipeline route, covering anything from a single spot find to a large multi-phase settlement. These sites were then sub-divided into “major” and “minor” sites dependant on their assessed significance.

As such, the BRT and TFC projects, incorporating all stages of archaeological investigation from the earliest non-intrusive studies to full site excavations, produced 16 major sites and 52 minor sites in total (Figures 2-4).

4.1 Minor Sites

The 52 minor sites are summarised in Table 5.1 (below), and comprise predominantly isolated pits and boundary ditches, together with a small number of finds scatters, including a spread of human bone, and a single, isolated cremation.

These sites are discussed in more detail in the assessment report (Network Archaeology 2010) and in the assessment for the Tirley Feeder Connector (Appendix A).

The majority of these sites remain undated due to a lack of artefactual or stratigraphic evidence, though several were dated from the finds recovered and the cremated bone.in plots 60 and 461 was subjected to AMS dating.

Table 4.1 Summary of Archaeological Findings by Plot.

Plot No.	NGR	Findings	Date
2	303300 232100	Palaeo-channel – not sampled	Unknown
23	306010 234150	Palaeo-channel / pond - sampled	Unknown
29	306242 235076	Possible boundary ditch	Unknown

Plot No.	NGR	Findings	Date
31	306222 235380	Possible pond	Unknown
39	306404 236258	Possible boundary ditch	Unknown
48	307248 237673	Possible modern boundary ditch	Modern
59	308546 238746	Possible ditch	Unknown
60	308791 238861	Spread of burnt human bone	1940-1740 BC (Early Bronze Age)
61	309039 238997	Probable modern mound and quarry pit	Modern
74	311480 238167	Burnt pit/hearth	Unknown
75	311530 237980	Two pits, one of which was prehistoric	Prehistoric
78	311600 237510	Probable tree bole	Unknown
79	311618 237369	Possible field boundary wall	Post-Medieval
88b	313120 237520	Colluvium	Unknown
92	313160 237550	Possible modern metalled surface and pit	Modern
95	313700 236900	Four pits or tree throws, one containing burnt material	Unknown
98	314350 236940	Pit or tree bole	Unknown
99	314600 237000	Ditch and colluvium	Unknown
105	315416 237236	Small pit containing iron slag	Unknown
PIG Trap	316340 237860	NNE-SSW ditch of undetermined date	Unknown
126	317900 238207	Ditch of undetermined date (two Romano-British pot sherds and small quantity of undated fired clay and slag present in subsoil)	Unknown
132	318620 238800	Pit, possibly tree bole	Unknown
144	319730 240163	Pit or tree bole	Unknown
147	320333 240385	Probable tree bole	Unknown

Plot No.	NGR	Findings	Date
153	320750 240610	Pit	Unknown
178	323740 240630	Modified field boundary	Post-Medieval
181	324200 240400	Probable 19th century pond	C19th AD
182	324330 240520	Probable tree bole and post-medieval land drain	Post-Medieval
198	324360 242730	Probable tree boles	Unknown
199	324360 242810	Pits containing burnt material	Unknown
211	326188 244072	Pit containing post-medieval or modern material	Post-Medieval
314	336993 236156	Possible surface ridge-and-furrow and prehistoric pit	Medieval and Early Bronze Age
331	341088 235232	Ditch	Unknown
368	347357 231578	Flint cache	Prehistoric
375	348458 230684	Probable post-medieval stone culvert	Post-Medieval
390	349880 228260	Post-medieval agricultural structures	Post-Medieval
416	353431 224784	Ditch of undetermined date	Unknown
444	357621 227635	Modern drainage ditches	Modern
449	358423 227452	Post-medieval building wall foundations	Post-Medieval
459	360912 227481	Pit with burnt material and modern finds	Modern
461	361130 227730	Cremation	400-120 BC (Middle-Late Iron Age)
462	361500 227730	Industrial waste spread of undetermined date	Unknown
464	361831 227739	Fire-pit or ash / fire-waste dumping pit	Unknown
467	362600 227670	Beaker pottery	Bronze Age
486	366071 227961	Possible boundary ditch and pits of undetermined date	Unknown

Plot No.	NGR	Findings	Date
487	366391 228238	Charcoal spread and pits of undetermined date	Unknown
488	366601 228478	Pit with burnt fill	Unknown
489	366877 228773	Pit with burnt fill	Unknown
490	366936 228885	Burnt pit and pits containing burnt material	Unknown
562	377662 228815	Heavily truncated pot rich Romano-British ditch	C2nd AD
TFC Plot 4	381480 229595	Post-Medieval ridge-and-furrow and two earlier drainage ditches	Medieval/Post-Medieval
TFC Plot 7	381557 229505	Roman pottery scatter	C2nd AD

In general, these sites were indicative of relatively low level agricultural exploitation of the fertile river lands of Herefordshire and Gloucestershire, comprising tree clearance, boundary removal and isolated pits of unknown function. There was surprisingly little difference in the type of sites identified in the less fertile uplands of eastern Powys, though the assumption was that these represented more pastoral activities than arable.

The cremated material in plot 60 was AMS dated to the early Bronze Age, probably around 1850 BC, though analysis of the recovered bone did not provide any insights into the age, sex or nature of the individual, or indivduals cremated. The material was discovered during the removal of the modern field boundary, and was not near to any known or suspected settlement sites.

The cremation in plot 461 was about 1.1km west of further cremations and pits identified in the major site at plot 464, dated to the Bronze Age. The cremation in plot 461 was AMS dated to the mid-late Iron Age, probably around 300BC, suggesting that the two sites were not related, though their relative proximity may indicate a persistence of occupation in the area from the Bronze Age through to the Iron Age. Analysis of the cremated material from plot 461 was inconclusive as to the age, sex or nature of the cremated individual.

4.2 Major Sites

The following sites were those identified during assessment as having the most significance, either in terms of size or nature. During the analysis of these sites, and their artefacts and ecofacts, the phasing of the sites has been revisited and updated.

4.2.1 Plot 49 (Fig. 16 & 17)

Background

Plot 49 (NGR 30735 23785) was located next to a fork in the road opposite Werntoe Farm, near Llangoed and Landfalle Common in Powys. The site was positioned on a moderate southwest facing slope, ranging in height from 344m to 348m OD. The plot was utilised as pasture immediately prior to excavation.

The topsoil was mid grey to brown friable clayey silt overlaying orange brown loose sandy silt. These soils were well drained and overlay pale red clay consisting of moderate sandstone outcrops.

The archaeological desk-based assessment identified the existence of two post-medieval buildings, collectively known as Pen Yr Heol Einion House. Earthworks representing the remains of a probable housing platform were also identified (Cotswold Archaeology 2006i).

The geophysical survey revealed several anomalies, identified as “linear features: cultivation?” similar to all the fields to either side of the plot, and as such no evaluation trenches were targeted over these geophysical anomalies (Bartlett-Clark Consultancy 2007).

A post-medieval structure complex was discovered during the watching brief phase. This comprised wall foundations and flagged stone floor surfaces, together with a metalled surface which may have been a yard or barn floor, and a possible well.

Several urned and un-urned Bronze Age cremations were also discovered on the same site.

Phase 1 – Early Bronze Age (*c.*2200BC-1300BC)

Bronze Age activity on the site appears to be limited to a small cremation cemetery comprising eight pits in total, clustered around a sandstone outcrop and occupying an area 13m in diameter. The pits were no more than 0.5m in diameter, and averaged 0.1-0.2m deep, generally with a cremation fill and a capping backfill similar to the native subsoil. This capping backfill made the features very difficult to spot, and they were not identified until after benching of plot 49 (see description of construction methodology in National Grid/RSK 2006). As such the potential exists for further cremations to have been destroyed by that benching.

Three of the cremations were contained in urns, most notably in the case of **49050**, where the urn survived well enough to be visibly inverted (figure 18a, plate 1). Cremation **49003** contained at least two urns, though both were heavily fragmented. All of the urns have been identified as early Bronze Age collared urns, though the two more complete urns, from **49050** and **49052** suggested a typologically later date, belonging to Longworth's secondary series and Burgess' late series.

The urn from cremation **49050** has a use wear that points heavily to domestic usage, as it bears charred residue typical of starchy food, suggesting that the urn was not specifically created for the purpose of disposal of the dead, but had previously been utilised for cooking prior to being used to contain the cremated material.

Only the bone from **49050** survived in sufficient quantities and preservation to be definably human, though analysis of this material was unable to identify the age or sex of the individual interred.

As the cremations seem to vary in style and content, it is suggested that the cemetery may have spanned a significant period throughout the Bronze Age and represented a number of funerary styles as traditions changed. In order to determine whether this is the case a radiocarbon date was established for one of the un-urned cremations, from pit **49034**, which returned a calibrated date of 1950 ± 70 BC, putting it within the early to middle Bronze Age and indicating that the lifespan of the cemetery may have been fairly long if the typological assessment of the pottery forms as closer to 1300BC is accurate, though the specialist comments that "the Collared Urns were only partially preserved and so all comments on form must be made with reservation."

Bronze Age cremation cemeteries are not uncommon in the uplands of Powys, and are perceived as a continuation of Neolithic funerary practices in the area. However, few collared urns have been retrieved from the Brecon area, though the surrounding landscape is richly littered with early Bronze Age sites and artefacts. The lack of a visible cemetery marker, such as a cairn, is by no means unusual, though given the exposed situation of the site any such marker may well have long since eroded or been removed, as unmarked cemeteries tend to be a feature of the later Bronze Age. A study on early Bronze Age funerary and ritual sites within the adjacent Severn Valley, showed that although a good range of early Bronze Age vessel types had been recovered from excavations along the valley, sites containing Collared Urns appeared to be restricted to upland cairns, such as Carneddau Cairn (Gibson 2002).

Roughly central to the cremation cemetery was a larger, ninth pit (**49054**) which contained similar burnt material, but lacked the evidence of burnt bone or pot. It measured 0.8m in diameter and was 0.33m deep (figure 18b). During assessment it was unclear as to whether this pit might have been related to the cremation cemetery or whether it related to the later post-medieval activity on the site. In order to ascertain its nature a radiocarbon date of its burnt fill was obtained, dating the feature to 2085 ± 105 BC. As such, it is considered probable that the pit was dug for the disposal of excess fuel-ash from the earlier funerary rituals. The presence of charred grain amongst those fills, which does not appear in the cremations themselves, might indicate that this pit also served for disposal of funerary feasts that accompanied the cremations.

Phase 2 – Post-Medieval (1500AD-1900AD)

To the eastern end of the site, northeast of the cremation cemetery, stood the foundations of a 28m long x 0.3m high stone and turf wall (**49005** and **49007**) which appears to continue into an adjacent field, where an L-shaped earthwork was observed, possibly suggesting a return to this boundary. As the two fields are separated by a road, it is impossible to say for certain that they are the same structure.

A smooth cobbled surface, 8.7m wide (**49006** and **49009**), was exposed immediately east of the wall foundations, that may represent either a barn and associated yard surface, or a walled yard. Set within this floor was a small stone lined pit (**49025**), No finds were recovered from this feature, nor could a definitive purpose be assigned to it.

A second structure was located a little downhill of the possible barn at 344m AOD, which appeared to be the remains of a small farmhouse, with a footprint of about 23m2 (**49036**), incorporating a paved floor and possible hearth. Large amounts of post-medieval pottery, glass and iron objects (mostly horse trappings) were recovered from within the structure, in addition to roof slate, window glass and window leading. These finds, along with the cobbled yards and substantial walls, indicate that this was intended as more than a temporary shelter, despite its comparatively small size, and may have been part of a larger farm complex, probably relating to the Pen Yr Heol Einion House site mentioned in the DBA (Cotswold Archaeology, 2006i). The finds evidence suggests that the site may have been utilised for around two or three hundred years: from the 17th century to the end of the 19th century, with the majority of the finds evidence suggesting a predominantly 17th-18th century occupation, followed by more irregular, smaller scale occupation into the 19th century.

To the east of the farmhouse were a number of linear gully features (groups **49072** and **49073**), thought to be contemporary with the farm house and to be representative of drainage features, it is likely that gully **58613** (to the west of the farmhouse represents a continuation of this drainage system down slope. A patchy metalled track (**49011**) appears to link the possible farmhouse and barn, and was interpreted as a continuation of layer **49015** (bounded by stone kerb **49017**).

Near the western boundary of the plot were two large sub-oval pits (**49093** and **49096**). These were interpreted as rubbish pits as they contained a large quantity of domestic refuse. The soil samples taken from pit **49093** produced a small quantity of burnt material that had derived from burnt flooring or bedding material, suggesting that these pits were in use at the same time as the farmhouse, or were possibly used during the demolition of the property. Two postholes (**58607** and **58609**) were located close to the sides of pit **49096** which suggested some sort of contemporary structure.

Coins were recovered from four separate deposits throughout the post-medieval structures, including a George III penny (from the third issue, 1799) found on the cobbled surface **49006**; a George III halfpenny (from the first issue, 1770-1772) from pit **49093**; what appeared to be an Irish George II halfpenny (1726-1760) from pit **49096**; and a James II halfpenny (1685-1688) from the subsoil layer covering some of the demolition debris from structure **49036**.

Unphased – undated

A single feature remained unphased following analysis, which was a small circular pit (**49044**). It was located within the area of the phase 1 cremation cemetery, but contained no burnt material or artefactual evidence. It contained what appeared to be a post-pipe, and it may have related to either the cemetery or the possible barn structure.

4.2.2 Plot 110 (Fig. 19 & 20)

Background

Plot 110 (NGR 31629 23774) was located immediately south of a disused railway approximately 450m southwest of Pipton Farm, roughly 1km west of Aberllynfi in Powys. It was at the base of a hill, on a river terrace of the river Wye. The plot was under pasture at the time of excavation.

The topsoil was mid-dark brown clayey silt overlaying mid red brown gritty clayey silt. Below this was a thick layer of colluvium, which varied in thickness from just a few centimetres on the slope of the hill to nearly a metre thick close to the base of the hillside. It was generally mid brownish yellow clayey silt, though it varied locally throughout the plot, with areas of mid yellowish red clay, pale greyish yellow clayey silt and pale brownish yellow silty clay. This colluvium produced five Mesolithic flint flakes and two sherds of Roman pottery. The soils were well drained and overlay mid red brown silty gravel.

The archaeological desk-based assessment identified the presence of six Bronze Age ring ditches forming part of the Spread Eagle funerary landscape, and a post medieval or modern field system within the adjacent plot. An aerial photograph showed what appeared to be two parallel lines to the north-west, which was interpreted as a possible cursus monument associated with the Spread Eagle site (Cotswold Archaeology 2006).

The geophysical survey revealed several anomalies (Bartlett-Clark Consultancy 2007), based on which two evaluation trenches were targeted on this plot. These revealed archaeological remains in the northern end of trench 1 and throughout trench 2 (Network Archaeology 2009i), including a paved surface in trench 2.

Based on these findings it was decided that the area around trench 2 would be opened up for archaeological excavation in advance of construction.

The excavation identified a metalled Roman road, with what appeared to be several episodes of construction and maintenance, which ran NW-SE across the site, and continued in both directions under a protective layer of subsoil and colluvium. Dating based on the finds recovered suggested that the road was in use between the 1st and 2nd centuries AD. The road was flanked by two roadside drainage ditches, whilst a small number of discrete features were located nearby and may have been associated.

Phase 1a: Early Roman (*c.*1st century AD)

The dominant feature of the site was a NW-SE stretch of paved road exposed for 29m across the working width of the pipeline (plate 2). The road curved northward at its north-western extent. To the northwest it appeared to have been cut into the hillside, and subsequently buried by colluvium.

The earliest road surface was laid within a shallow cut (**70018**). Within this a series of four make-up deposits (**70031**, **70030**, **70038** and **70040**) which were built up to form a camber. Over the top of these was set a poor quality metalling stone surface, comprising mainly small to medium stones with only a few larger cobbles (**70029**) (plate 3).

To the southwest of the road, and parallel with it, was a ditch (**70058**). It was wider and deeper to the northwest (averaging 1.15m wide and 0.75m deep), where a greater depth of colluvium had helped preserve it. Here, the ditch had two fills, neither of which contained finds, whilst the central portion of the ditch revealed three deposits, again without finds. At its south-easternmost extent the ditch contained just one deposit which produced no finds. There appeared to be no consistency between these deposits which suggested a piecemeal backfilling of the ditch over a prolonged period, rather than a single event that affected a wide area.

On the northeast side of the road was a smaller ditch (**70057**). This disparity in size with **70058** may be due to heavier truncation as **70057** lay further downhill and so was afforded less protection by colluvium, or it may have been deliberately designed this way in antiquity, as the up-slope ditch would be expected to have experienced greater quantities of run-off from the hill slope. As with ditch **70058** there was no homogeneity to the fills, and it also seemed likely that it was filled in piecemeal fashion.

An aerial photograph of the site taken in the mid 20th century shows two parallel cropmark lines running approximately NW-SE across the fields to the north of plot 110. These cropmarks were interpreted as a possible cursus monument related to the nearby Spread Eagle funerary landscape, but there is a reasonable argument that these cropmark lines are in fact the vestiges of the roadside ditches continuing into those fields. The area of plot 111, to the north of plot 110, where the road continued, and where the aerial photograph shows the parallel lines as running, was not impacted during the construction of the pipeline, and as such the presence, or absence, of the road in that field could not be ascertained. However, the photograph clearly shows the parallel lines entering plot 111a in an area that *was* investigated, and no road was discovered here, though during the evaluation of that plot a ditch was identified at the very eastern end of the evaluated area, and this may have been a surviving roadside ditch. If so the road itself appears to have been entirely truncated at this point (See 4.2.4 below).

Phase 1b: Roman (*c.*1st/2nd century AD)

During this period the Road was re-surfaced with a second surface, (**70039**), which survived only patchily (seen as sparse stones **70027** in fig.20b). A Romano-British T-shaped copper alloy brooch, of a kind notably found around the Severn estuary and dating from the 1st or 2nd century AD, was found on top of this new stone surface.

From roughly the mid-point of the exposed road there appeared to be evidence of an additional small drainage gulley (**70050**), which ran on a NW-SE alignment down the eastern side of the roadway. It is likely that this feature represented natural erosion along the edge of the roadway - which had apparently undergone periodic repair.

The evidence suggested that the road fell into a period of disuse toward the end of the 1st century AD and into the early part of the 2nd century AD, gradually becoming covered in a natural deposition of colluvial material perhaps indicating a decline in the importance of the route, or possibly a shift in the course of the river Wye which made this particular crossing impractical.

Phase 1c: Roman (*c.*2nd century AD)

Directly over the colluvial material, and the silting of the secondary drainage gulley **70050**, which probably only had a very brief lifespan, was laid the final cobbled road surface (**70005**), from amongst which were gathered twenty-six 1st and 2nd century Roman potsherds, along with a pair of residual Mesolithic flints, probably transported unintentionally together with the road stone. Amongst the potsherds were fourteen Baetican olive oil amphorae fragments, imported from Southern Spain, perhaps indicating that the road was once again being used for trade of imported items.

Unphased

To the north of ditch **70057** was a small sub-circular feature (**70007**). Its single fill was rich in charcoal, and assessment of the material suggested it was charcoal and charred wood from a single episode of burning. This feature may have been related to an animal cremation pit uncovered *c.*25m to the south during the evaluation of plot 110, though no bone was recovered from amongst the burnt material, and no date could be ascribed to either feature. Lacking any stratigraphic relationship with the other features on site, the pit remains unphased.

4.2.3 Plot 111 (Fig. 19 & 21)

Background

Plot 111 (NGR 31635 23792) was located immediately north of a disused railway approximately 400m southwest of Pipton Farm, roughly 1km west of Aberllynfi in Powys. It was situated on a river terrace of the river Wye, alongside the A4079. The plot was under pasture at the time of excavation.

The topsoil was dark brown sandy silt overlaying mid red brown silty sandy clay. These soils were poorly drained and overlay mid red brown silty sand with abundant gravels.

The archaeological desk-based assessment identified the presence of six Bronze Age ring ditches forming part of the Spread Eagle funerary landscape, and a post medieval or modern field system within the plot (Cotswold Archaeology 2006i).

The geophysical survey revealed several anomalies (Bartlett-Clark Consultancy 2007), based on which two evaluation trenches were targeted on this plot. Trench 1 contained no archaeological features, but trench 2 revealed a series of features including a probable former field boundary.

Although the evaluation results were largely inconclusive it was decided, due to the apparent potential of the area, that a controlled strip of the entire plot should be undertaken.

A number of poorly defined discrete features and linear features were located on this site. The initial controlled strip did not reveal any distinct features, and only a subsequent exploratory trench along the centre line of the plot identified them. The scarcity of finds and the ill-defined nature of the features meant no clear function or form could be ascribed to the site. The prehistoric nature of some of the finds may indicate a relationship with the Spread Eagle funerary landscape located within this plot, though no definite evidence of the ring ditches visible in the early aerial photographs was located.

Unphased

The site was of specific interest as the DBA had highlighted the presence of the Spread Eagle Funerary landscape within the plot. This landscape comprised numerous ring ditches visible as crop marks on aerial photographs and a potential cursus monument, though this was later to be re-interpreted as the Roman road ditches discovered in plot 110 (see above).

A controlled strip of the topsoil within the plot revealed a plot-wide homogenous layer of colluvium (**72054**), which averaged 0.2m thick. In order to investigate beneath this layer a 2m wide trench was excavated along the entire line of the pipe trench in advance of construction. This trench was then widened where potential features were discovered which warranted further study.

A total of 25 features were revealed within this trench, but only three produced any form of diagnostic material and a lack of stratigraphic relationships meant that the site resisted useful phasing; the majority appeared likely to represent natural or tree clearance related features.

Four ditches were revealed (**72007**, **72012**, **72035** and **72058**), though none of them contained any datable material, and three of them were interpreted as probable former field boundaries, whilst the irregular, meandering course of **72035** suggested that it might have been a naturally occurring water-worn channel. A fragment of a curvilinear ditch feature (**72037**) was also seen, which contained three flint flakes, including a shattered distal flake, though none of these could be dated. The location of this feature could not be correlated with any of the ring ditches as seen on the aerial photographs, but it was possible, perhaps even probable, that this ditch formed part of a ring ditch associated with the Spread Eagle funerary landscape.

The majority of the pits uncovered were irregular, indistinct and amorphous features averaging between 0.2 and 0.7m in diameter and ranging from 0.05 to 0.5m in depth. These appeared to be most likely related to tree clearance, although three of them (**72004**, **72019** and **72055**) produced likely residual flint flakes of a probable Mesolithic or Neolithic date. It is worth noting that feature **72019** was only noted in section, it not being visible in plan

Due to the unconvincing nature of the archaeology revealed in the centre-line trench, the decision was made in conjunction with NG and CPAT that further stripping of the area was unwarranted, and the remainder of the plot was considered to be preserved *in-situ*.

4.2.4 Plot 111a (Fig. 19, 22 & 23)

Background

Along with plot 111, plot 111a (NGR 31615 23785), represented the mobilisation yard for the PIG trap (in Plot 110). It was located immediately north of a disused railway approximately 450m southwest of Pipton Farm, roughly 1km west of Aberllynfi in Powys. It was at the base of a hill, on a river terrace of the river Wye, just south of the A4079. In order to identify this area in terms of the plot number sequence it was referenced as plot 111a. The site was utilised as pasture immediately prior to excavation.

The topsoil was mid brown friable clayey silt overlaying dark red brown friable silty clay. These soils were poorly drained and overlay at least three distinct layers of alluvial deposits: Stony red brown friable silty sand, overlaying stony brown friable silty sand which in turn overlay grey green friable silty sand containing pea grit gravels.

The archaeological desk-based assessment identified the presence of six Bronze Age ring ditches forming part of the Spread Eagle funerary landscape, and a post medieval or modern field system within the vicinity. An aerial photograph from the University of Cambridge shows two parallel lines, which may represent the roman road discovered in plot 110, continuing into the northeast corner of this plot (Cotswold Archaeology 2006i).

No geophysical survey was conducted on this plot, so a programme of trenching was devised to evaluate the plot comprehensively (Network Archaeology 2009ii). As such fifteen trenches were proposed, though the area allocated to the mobilisation yard was reduced, and as such only thirteen trenches were excavated.

The majority of these trenches were either empty or revealed naturally formed features such as alluvial layers, interpreted at the time as individual palaeo-channels, or tree boles.

Trench 15, however, located in the north-eastern corner of the plot, contained a feature at the eastern end of the trench. This feature was linear in plan with a rounded U-shape profile, and measured 0.7m wide, 1.5m long and 0.56m deep and was oriented roughly N-S. The primary fill measured 0.34m deep and appeared to be slumped material or in-wash from the western edge. The secondary fill was 0.22m deep. No finds were retrieved from either of the fills. This feature was interpreted as a ditch, possibly a continuation of one of the road-side ditches from the Roman road in plot 110.

Given the potential of the overall area it was decided that a controlled strip of the plot in advance of construction would be an appropriate mitigation strategy.

A large Roman boundary ditch, probably a field boundary, divided this area, which was located during controlled strip. A gravel spread slightly overlying the earliest phase of this boundary may indicate that a metalled occupation surface was constructed against this boundary at a later point.

Below this spread were a cluster of prehistoric fire pits and postholes cut into what appeared to be a prehistoric occupation layer, which may relate to the neighbouring Spread Eagle site.

A number of irregular natural features of unknown date were also located around the site.

Phase 1: Mesolithic/Neolithic (8000BC-2500BC)

The earliest feature on site was a mixed buried soil layer (group **74079**).Sondages through these deposits showed them to be interleaved lenses forming a single layer (figure 23a shows a representative section of this group). Finds were recovered from all three deposits, including crumbs of pottery that could not be dated, fifteen undated flints, seven Mesolithic and Neolithic worked flint flakes and three undated sherds of undecorated quartz-filled pottery. The latter fabric type is commonly found in pottery dating to the middle Neolithic and late Bronze Age.

It is useful to remember that undisturbed substrate was not located in plot 111a, as the construction works there were solely for the establishment of a mobilisation yard. As such only topsoil was removed. It is quite possible, therefore, that early elements of the Spread Eagle landscape remain preserved beneath this layer, and only the later ring ditches and Roman activity was visible as cropmarks.

Phase 2: Roman (1st-2nd Century AD)

Splitting the excavation area roughly in two was a broadly N-S ditch (**74030**), 31m in length, averaging 1.3m wide and 0.6m deep, that weaved along its course, but broadly aligned NW-SE. The single fill of the ditch produced two sherds of Roman Severn valley ware and a fragment of unfinished shale bracelet, possibly originating from Dorset and brought to the site for finishing. The latter had parallels with similar bracelets found in Iron Age contexts in Somerset, though shale bracelets were also made during the Roman period. The ditch was interpreted as a field boundary, though a reasonably substantial one.

An aerial photograph of the plot showed two parallel lines running NW-SE across the eastern end of the field, *c.*50m from the focus of archaeology excavated. These lines were interpreted as representing the roadside ditches identified in plot 110, and showing the course of the road. Three evaluation trenches were excavated in this area prior to works commencing and only one showed any evidence of the road possibly continuing. This took the form of a single ditch at the eastern end of trench 15 (Network Archaeology 2009ii) which may have been a surviving roadside ditch (**88502**) with two fills. No evidence of the road itself was located. The controlled strip of the mobilisation yard did not cover this part of the field, as no impact was intended here, and so the true nature of this ditch was not revealed.

It was probable that the road course had been truncated by modern farming, and that the aerial photograph is the only surviving evidence of its course.

Phase 2a: Later Roman (2nd Century AD+)

After boundary ditch **74030** had fallen into disuse and largely filled, it was apparently re-cut, or, more likely, a second, smaller, boundary ditch (**74028**) was excavated along the same alignment to re-establish the former field boundary. As **74028** followed the alignment of **74030** exactly, including its slight weaving, it was highly probable that the line of the earlier boundary was still visible to some extent. The fill of this ditch contained four small sherds of Roman Severn valley ware and a Neolithic flint core trimming flake.

Phase 3: Late Saxon-Early Medieval (11th-13th century AD)

A group of five intercutting pits and a posthole (group **74075**) were excavated toward the southern end of the excavation area. Some of these pits were substantial – the largest measured 1.5m x 0.9m, though none was more than 0.31m deep – whilst the postholes averaged around 0.3m in diameter and less than 0.2m deep.

Though these pits are clearly not contemporaneous, with each one apparently replacing the one before it after it had been backfilled, they have been grouped together as their nature and dating suggest a relatively confined time spectrum in which they were utilised (figure 23b).

The pits contained a considerable quantity of charcoal, along with a small number of Neolithic and Mesolithic tools. As such the pits were initially interpreted as evidence of prehistoric activity on the site, possibly relating to the neighbouring Spread Eagle funerary landscape. However, radiocarbon dating of the charcoal from the pits revealed the date from the earliest pit (**74041**) to be from 1095 ± 75 AD, whilst that from the latest (**74078**) was from 1120 ± 90 AD, indicating a probable early medieval date for the pitting.

Assessment of the environmental samples from the pits suggested they were utilised for the disposal of burnt domestic waste, probably cooking waste.

To the east of group **74075** was a collection of five discrete postholes and stakeholes (group **74064**), though no obvious structure or pattern could be discerned from their location.

Just northwest of group **74064** was a small pit (**74060**). Its proximity and dimensions might indicate it should be included with group **74064**, but as it had no direct relationship with them it was left as an isolated feature.

The fill of the second boundary ditch (**74028**) was cut by three postholes (**74018**, **74023** and **74033**). Of these only the latter produced any finds: two undated flints. All three were interpreted as postholes, and the similarity in their natures suggested they were either part of the same feature, or were three consecutive attempts to achieve the same purpose, though this seemed unlikely. The three posts formed a line, perhaps indicating that they were a later demarcation of a similar boundary, though no other postholes survive along their alignment to corroborate that. This, however, may be due to the fact that the ditch fills would have provided less sturdy foundations for a post than the surrounding clays, and as such where the post-line crossed the ditch the posts were set much deeper to ensure stability. No exact date could be ascertained for these postholes, as the flint finds were clearly residual, but their stratigraphic relationship might indicate a contemporaneity with the postholes discovered beneath layer **74004**.

Unphased

Phase 3 groups 74064, 74075 and pit 74060 were all sealed by a layer of brown silt sand and frequent gravels (74004), which also lay over a small part of phase 2 ditch **74030**. Amongst the gravels were an undated flint flake and a single sherd of Roman Severn valley ware. It may have been a deliberate attempt to lay hard standing up to the boundary to the east, or it may have been a colluvial or alluvial deposit as the area was subjected to frequent flooding and standing water, even during excavation.

A total of seven further pits were identified across the site, though of them only pits **74032** (a probable posthole) and **74069** (a probable pit of uncertain function) were convincingly anthropogenic due to their regularity of form. The rest appeared to relate to tree clearance, though as no finds were recovered from any of the features, no date can be assigned to them.

It may be that some or all of these pits relate to the pitting activity identified in phase 3, but there is no evidence to definitively say one way or another, and as such they remain unphased.

4.2.5 Plot 160 (Fig. 24, 25 & 26)

Background

Plot 160 (NGR 32150 24135) lay to the southeast of Pen y-Maes in Powys, near Hay-on-Wye on roughly flat terrain at 101m OD. The site was located just to the north of a small stream. The site was utilised as pasture immediately prior to excavation.

The topsoil was mid brown friable clayey silt containing moderate small sub-rounded stone inclusion and post-medieval pottery. The subsoil was pale yellow brown soft silty clay consisting of occasional sub-angular medium stone inclusions. These soils were well drained and overlay dark brown red clay consisting of occasional large degraded sandstone.

The plot lay on a re-route of the pipeline, for which a separate archaeological desk-based assessment was undertaken (Network Archaeology 2006). This showed no features of interest in the vicinity of plot 160.

The geophysical survey of this plot identified a wide curving linear feature which was interpreted as a natural feature due to its close proximity to the stream, and extremely strong geophysical response. As such no evaluation trenches were targeted over it (Bartlett-Clark Consultancy 2007) , and the site was not identified until during construction.

Two areas of archaeological interest were discovered during the watching brief phase on plot 160. To the north of a small stream was a large, multi-phase Roman ditch and to the southeast of that was a post-medieval pottery dump and stone trackway.

Phase 1: Roman I (2nd Century AD-4th Century AD)

Towards the western end of the site, just north of a small stream, was a large curvilinear ditch (**160041**, plate 4) oriented broadly NW-SE and measuring 3m wide by 1m deep. Roughly 33m of the ditch was exposed. The ditch contained four fills, all of which included Roman pottery, abundant charcoal and slag (figure 26a). A single fragment of possibly later prehistoric pottery was recovered from the upper fill, but this was certainly residual. The lower fills contained material likely to be hearth sweepings.

The slag recovered was indicative of domestic hearth linings. The large quantity of pottery found also hinted at related occupation; however no structural remains were identified to either side of the ditch.

Only one feature was uncovered within the area to the north of the curvilinear ditch, this was a small pit (**160022**) containing 3rd century AD pottery, abundant charcoal and coal fragments. There was also a small amount of ferrous globules and hammerscale identified during an assessment of the deposit which indicated the presence of hearth or forge waste.

The size of the large curvilinear ditch suggested that it functioned as a substantial, probably defensive, boundary, possibly as the stream to the south was small and easily passable. In the field immediately to the northwest of the plot some substantial earthworks were noted; whether these were of archaeological or natural origin could not be determined during the course of this project.

The pottery recovered from the Roman sub-phases of occupation, whilst a relatively small assemblage of 205 sherds, was quite diverse, including examples of fabrics not found elsewhere on the Brecon to Tirley pipeline, such as imported Moselle black-slipped ware, Southwest white-slipped ware and Mancetter-Hartshill mortaria. Most of the pottery assemblage was made up of jars and flagons (86.4% between them), with a smaller number of dishes, tankards and mortaria, and a single bowl. The assemblage is fairly indicative of domestic occupation on the site, and of one with moderate trade connections and longevity from the 2nd century AD through to the later 3rd/4th century AD, with the greater emphasis on the later Roman period.

A re-visiting of the geophysical survey data for the plot following excavation seems to suggest that further features lay outside the scope of the pipeline excavations, notably linears to the west and east of the excavated easement and a possible “L” shaped feature to the southeast.

Phase 1a: Roman II/Post-Roman (4th century AD +)

A small area of the phase 1 ditch suggested a later phase of occupation. Once the ditch had largely filled up an area of it was re-cut (**160019**), and a layer of flat, compacted stones, was deposited (**160018**) (figure 26b). The purpose of this deposit remained unclear; though it may have been a type of levelling layer because the deposits that filled the phase 1 ditch were too soft to be easily traversed or constructed upon, and so the stone was laid to form a hard standing over the softer ground.

Curiously, ceramic evidence from amongst these stones dated from the 1st or 2nd century AD, predating the ditch they cover, which suggested that the stones may have been re-used from an earlier construction nearby, and that the pottery was transported along with them accidentally as part of the make-up material.

It is possible, therefore, that these stones were robbed from an abandoned structure associated with the ditch, or at least from the near vicinity. The ditch followed the same alignment as the nearby stream suggesting that the stone layer may have been related to the crossing of an early stream course.

Given the residual nature of the finds from this deposit, it was impossible to be certain of the date of this possible ford, other than that it post-dated the Roman boundary.

Phase 2: Post-medieval/Early modern

To the southeast of the ditch was a post-medieval dumping pit (**160030**) containing pottery, clay pipes, glass and a few iron objects dating to the 20th century which overlaid the remains of a northwest-southeast orientated trackway (group **160039**).

The finds recovered included post-medieval pottery, charcoal and a fragment of slate roof tile. This was probably the remains of a post-medieval farm track, and the finds assemblage suggested that it was in use from the late 16th to mid 18th century. By the 19th century, and the earliest surviving maps of the plot, it was no longer in use.

4.2.6 Plot 250 (Fig. 27 & 29a)

Background

Plot 250 (NGR 33051 24220) was located northwest of Dorstone and southeast of The Bage, in Herefordshire's Golden Valley. The plot lay just to the west of the B4348, on what appeared to be a former floodplain of the river Dore. The plot was under arable crop at the time of excavation.

The topsoil was dark brown firm clayey silt, which covered pink brown firm sandy silt subsoil. This subsoil was surprisingly deep compared to similar deposits along the pipeline route, 0.3m thick on average. These soils were poorly drained and overlay mottled brown and pink firm clay.

The archaeological desk-based assessment identified no known features, though a pollen analysis undertaken within 500m of the site produced a Flandrian (post-glacial) date (Cotswold Archaeology 2006i).

The geophysical survey conducted revealed a single anomaly of possible archaeological significance (Bartlett-Clark Consultancy 2007), and three trenches were excavated, one over the anomaly and two further trenches to evaluate the surrounding area (Network Archaeology 2009i).

Two of these trenches produced archaeological features, most notable amongst them a large ditch in trench 3. This ditch was interpreted as an Iron Age field boundary and, despite the lack of further evidence of occupation, given the scarcity of archaeological evidence of this period in the vicinity it was decided to undertake an open area excavation in advance of construction, centred on trench three.

A late Iron Age or early Roman enclosure ditch, or field system was located within this site, which had been identified by geophysical survey and evaluation. Little in the way of features were uncovered, but the nature and quantity of the artefacts recovered suggests proximity to a more significant site. A significant depth of subsoil may have masked additional features during the watching brief.

Phase 1: Late Iron Age/Early Roman (*c.*200 BC to 1st century AD)

The dominant feature of the site was an enclosure or boundary ditch (**65025**). This ran NE-SW across the site, turning nearly 90° at the NE end to run WNW-ESE. It was at its most substantial at the SW end (2.55m wide and 0.98m deep)and at its shallowest at the ESE end (1.09m wide and 0.44m deep).

The ditch had only one fill at the SW end, though a primary fill appeared roughly 16m from the south-western visible extent and continued to the ESE extent. There was also evidence of localised tipping or slumping into the ditch, which suggested it stood open for a relatively prolonged period. The primary fill contained four lumps of iron slag, dated as Iron Age or Roman, and 92 sherds of native pottery dating from anywhere between the mid-late Iron Age to the 1st century AD. The upper fill produced 19 sherds of late Iron Age or 1st century Roman pottery.

NW of the bend in this ditch was a narrow gulley (group **65024**). Its single fill produced two sherds of late Iron Age or 1st century Roman pottery.

It seems likely that these two features were contemporary and formed part of a later prehistoric enclosure and drainage system that continued in use into the early Roman period. Two sherds of 2nd century AD pottery were recovered from subsoil during evaluations within the plot, which may give some idea as to the longevity of activity on the site, but cannot be associated directly to the enclosure.

Phase 2: Later Roman/undated (1st Century AD +)

Pit (**65013**) was located on the terminus of phase 1 gulley **65024**, which may have been coincidental, but it appears more likely that the end of the gulley was still demarcated in some way when the pit was dug, suggesting that the pit may not have been much more modern than the linear features. As the location of the pit was at what appeared to be an entranceway between the two phase 1 linear features, it may be that the boundaries were still demarcated in some way, and that the pit was a marker or substantial post for that entrance.

The pit, however, produced no finds, so no date can be definitively assigned to it.

4.2.7 Plot 269 (Fig. 28 & 29b)

Background

Plot 269 (NGR **33332 23968**) was located approximately 200m north of Fine Street, and roughly 1.5km northwest of Peterchurch in Herefordshire. It was on a former floodplain of the river Dore. The plot was under pasture at the time of the excavation.

The topsoil was dark red-brown silty loam overlaying mid orange brown clayey silt. These soils were fairly well drained but overlay 0.5m of mid orange brown silt interpreted as alluvial silts, which in turn overlay mid pinkish orangey brown sandy clay and these did not drain very well.

The archaeological desk-based assessment did not identify anything of note within the immediate vicinity of the plot (Cotswold Archaeology 2006i).

The geophysical survey conducted by revealed several anomalies of possible archaeological significance, including what appeared to be a pit alignment (Bartlett-Clark Consultancy 2007). Based on this, two evaluation trenches were targeted in this plot (Network Archaeology 2009i).

Trench 1 did not reveal any archaeological features, but trench 2 found an E-W aligned linear feature with a bowl shaped profile at the SSW end of the trench, though the base was not revealed due to the high water table. This feature was in excess of 7.5m wide by 0.48m deep as revealed within the trench, and contained a succession of fills containing Roman pottery, worked flint and preserved unworked wood fragments. The feature was interpreted as a palaeo-channel, possibly a former course of the river Dore. The trenches were both very deep, with the first archaeological horizon being recorded at a depth of 1.2m.

Based on these findings a small open area excavation was targeted on trench 2, to expose more of the palaeo-channel and find evidence of the pit alignment that had not been revealed by the evaluation trenching.

A broad palaeo-channel of the River Dore was located on the fringe of this site identified by evaluation. Four pits forming part of a probable prehistoric pit alignment were also located, though unstable trench conditions and adverse weather meant that little investigative work could be undertaken. All the features were sealed beneath a considerable depth of alluvium.

Phase 1: Neolithic/later prehistoric (4000BC+)

Four large pits with stony fills were identified within the area, forming a roughly WNW-ESE alignment. Unfortunately the north-westernmost (**66014**) and south-easternmost (**66012**) of these could not be excavated as they were too close to unstable excavation edges at a depth of 1.1m below ground level.

Of the two which could be examined, the more westerly, (**66006**), was the larger. It contained a single fill which produced a single piece of non-diagnostic fired clay.

The other pit (**66004**) was smaller, but slightly deeper, and it produced a single, probably Neolithic, flint scraper fragment. The fills of both pits were sampled but produced only minute quantities of charcoal, insufficient for AMS dating, assessment of which gave no hint as to the nature of the pit alignment.

This pit alignment was noted in the geophysical survey to be a series of at least nine large pits forming a linear alignment oriented roughly WNW-ESE across the pipeline easement.

Prehistoric pit alignments are a phenomenon which can appear as either single or double pit alignments, with the latter being considered the rarer and often related to centres of ritual activity, whilst the former are often interpreted as representing field boundaries during the later prehistoric (Harding, 2000).

Phase 2: Roman or later

Along the entire length of the north-eastern edge of the excavation area ran a broad linear channel (**66009**) running roughly NW-SE continuing beyond the scope of the excavation to the northeast. Based on the dimensions indicated in the evaluation trench, the channel was *c.*8m wide at this point.

The feature was interpreted as a palaeochannel of the river Dore, and was not investigated during the excavations, but instead assessed by a hand auger transect undertaken from the surface, slightly to the northwest of the area excavated. This suggested a broad (*c.*15m wide), roughly U shaped profile with three distinct fills at a depth of *c.* 1m below ground level. The full extent of the feature could not be ascertained as it extended beyond the pipeline easement.

Whilst no finds were collected from the unexcavated palaeo-channel, and no stratigraphic relationship exists between the pits and palaeo-channel, it is considered that the palaeo-channel post-dates the pits because of a single Roman artefact (a sherd of Samian bowl) collected from it during the evaluation. This suggests that the palaeo-channel was either active during the Roman period or after it. As it is unlikely that the pit alignment, which based on the geophysical survey would have crossed the line of the channel to the east of the excavated area, would cross an active river course, and given that the pits appear prehistoric in nature, it seems reasonable to suggest that the channel belongs to a later phase than the pit alignment.

4.2.8 Plot 271 (Fig. 28, 30 & 31)

Background

Plot 271 (NGR 33336 23968) was located approximately 150m east of Fine Street, and roughly 1.5km northwest of Peterchurch in Herefordshire. It was on a former floodplain of the river Dore. The plot was utilised as pasture prior to excavation.

The topsoil was mid red brown sandy clay silt overlaying mid brownish red clayey silt. These soils were poorly drained and overlay up to 0.2m of firm mid brown clayey silt which was interpreted as alluvial silt, and in turn overlay mid pinkish orangey brown sandy clay.

The archaeological desk-based assessment did not identify anything of note within the plot, though worked flint and Roman pottery were identified nearby, to the east (Cotswold Archaeology 2006i).

The geophysical survey revealed several anomalies (Bartlett-Clark Consultancy 2007), on which three evaluation trenches were targeted, all of which produced positive archaeological findings at a depth of about 0.6m (Network Archaeology, 2009i).

The trenches all revealed archaeological features, including ditches and pits containing Roman and later prehistoric pottery.

Based on the broader picture visible from the geophysics, these various features were interpreted as forming a series of curvilinear enclosures, the dating evidence recovered from the trenches suggested a Roman or Iron Age date. As such it was determined that a full excavation of the plot would be undertaken, though where the impact of construction activity was likely to be limited i.e. beyond the pipe trench, it was decided that the alluvial silts, averaging 0.3m in thickness, would provide enough protection for the archaeology to be preserved *in-situ*, and as such the excavated area was restricted to a 7m wide strip along the centre line, with an adjoining “arm” to evaluate the nature of the projected enclosure beyond this rather narrow window, and to ensure that the protective deposits above did not thin out to either side of the central strip.

A Romano-British enclosure bounded by three concentric ditches was identified, with associated features including a metalled surface and a cow burial. A range of artefacts were recovered indicative of domestic occupation. There appears to have been small-scale prehistoric activity at the site, as well as later re-use of some elements of the site after the enclosure ditches had become less intensively occupied or had fallen into disuse. A significant depth of alluvium may have masked additional features during the watching brief.

Phase 1: Prehistoric, Mesolithic-Iron Age (8000 BC-43AD)

The earliest features within the plot appear to be prehistoric, and are dated primarily by the lithics recovered from them. The majority of the prehistoric material appears to be later Neolithic/Bronze Age, though some may be as early as Mesolithic and as late as Iron Age. As such this “phase” probably incorporates a prolonged period of activity, possibly covering several centuries.

Layer **67080** appears to be one of the earliest deposits on the site (figure 32a). It was a silty clay layer which formed a discrete patch approximately 9m in diameter. This contained an undated cattle tooth and a Neolithic flint with simple retouch and an unmodified edge. This layer may have represented an earlier phase of occupation than the subsequent Roman site.

Three probable pits (**67119**, **67030** and **67048**) were dated to this phase based on their artefactual assemblage, though the upper fill of **67048** produced a single sherd of 1st century AD samian pottery. Pit **67048** was sealed by phase 2a stone surface **67005**, which itself appeared to date to the Mid-Late Iron Age/1st century AD, suggesting that the upper backfill of **67048**, with the Samian pottery, may have been deliberately dumped into the depression left by the settling fills of the early pit to provide an even layer onto which surface **67005** could be laid.

Pit **67030** measured 1.19m in diameter, but only 0.16m deep. It contained a relatively substantial lithic assemblage of 31 flakes, which, where it was possible to date them, were Mesolithic and Neolithic. This comprised around 75% of the total flint collected from this plot. Eight pot sherds also recovered from the pit proved undiagnostic, but were most likely prehistoric in date.

Both **67119** and **67048** may have actually been the termini of ditches that extended beyond the scope of excavation. The former measured 4.0m long, 2.5m wide and over 1.9m in depth. The latter was 4.2m wide and at least 0.55m deep, but only protruded 0.5m into the excavation area. No clear function was determinable for either the pits or the putative ditches.

67005 also capped six other features: small pits or postholes (**67082** (figure 32a), **67084**, **67086**, **67128** and **67141**) and linear feature **67130**. None of these features produced any finds or other diagnostic material. A localised layer, **67121**, also partially covered **67128** and **67130**. This contained some daub of indeterminate date. These features may well have been prehistoric or very early Roman, though lacking any dating evidence to support either theory they have been included alongside pit **67048**. Two of these features (**67082** and **67141**) also cut layer **67080**, suggesting more than one phase of prehistoric activity may have been present.

The relatively high quantity of prehistoric finds within the site assemblage suggests that a significant degree of prehistoric activity was present in the area and it seems likely that the substantial Roman and later features have obliterated definitive traces of what that activity might have been. It is worth noting that the prehistoric pit alignment in plot 269 lies only 170m NW of pit **67030**, whilst the DBA recorded worked flints which were located less than 200m to the SSE (CA, 2006i, DBA ref. 5809).

Phase 2a: Roman I (1st century AD)

The first definably Roman activity was the large metalled area, **67005**. This appeared to have been deliberately laid to form a metalled surface, as hard standing, a yard area or possibly a trackway. From amongst the stones were collected a number of animal bones from creatures such as red deer, sheep/goat and cattle; an undated flint flake; a fragment of ferrous slag dating to the Roman period and six native potsherds dating from either the mid-late Iron Age or 1st century AD.

At the northwest end of the excavation area was a small undated linear feature (**67078**), averaging 0.5m wide and 7m long. This was backfilled by a very stony fill, including some that appeared to be shaped for structural use, and as such it was postulated that this might have been the base of a robbed out foundation trench, possibly part of an earlier defence predating the later enclosure, though given the shallowness of the feature any such wall would have been unlikely to have been very substantial, unless there had been significant truncation.

Another linear feature, NE-SW drainage gulley (**67018**) appeared to date from phase 2a, based purely on the material that covered it, as it contained no dating evidence of its own. It appeared to be an old water runnel or natural hollow under part of phase 2b layer **67020**, though it may have been the truncated remains of an earlier ditch. No finds were recovered from the silting of **67018**.

Phase 2b: Defensive Enclosure: Roman II (later 2nd century AD)

This phase saw the construction of the three large curvilinear enclosure ditches, **67072**, **67157** and **67159**. Whilst the ceramic evidence suggests that the innermost of the three ditches (**67159**) was in use until the 3rd century AD, it seemed highly likely that it was originally excavated contemporaneously with the other two ditches to form a heavily defended triple-ringed enclosure.

The outer of these rings was ditch **67072**, which averaged 2.2m wide by 1m deep and had two fills, the upper of which appeared to be a deliberately laid layer of stones, perhaps to offer a firmer surface than that provided by the settling ditch fill below. The lower fill produced two sherds of Roman Severn valley ware, whilst the upper fill had 35 Roman potsherds of 2nd century date. Environmental assessment of both deposits revealed detritus relating to domestic activity.

The central ditch (**67157**) was the most fully exposed of the three ditches. It ran roughly N-S parallel with **67072**, but after 25m it formed a broad curve and ran E-W for another 15m before it left the excavation area. The ditch varied in size along its length from 1.2m to 3m in width, and between 0.70 and 1.46m in depth. Surprisingly, comparatively few finds were recovered from this ditch: two residual lithics of probable Mesolithic or Neolithic date, two sherds of late Iron Age pot, a cattle tooth, 37 Roman potsherds and a possible loomweight. Samples of the ditch fills revealed evidence of domestic activity, though one produced ferrous globules, flakes of hammer scale and vitreous concretions possibly indicating that limited small-scale industrial activities were also occurring in the near vicinity.

The innermost of the three ditches (**67159**) was visible in the “spur” of the excavated area, and could be traced into the main trench where it appeared to mirror the bend of **67157** before disappearing under later layer **67120**. It measured 4.4m wide by 1.6m deep (plate 5), making it by far the most substantial of the three, and appeared to have been the longest lived, as it contained pottery dating to the 3rd century AD, along with daub and a residual Mesolithic flint. Environmental assessment of the upper fill produced evidence of domestic activity, similar to that found in ditch **67157**, though without the industrial material.

A triple-ditched enclosure would indicate a substantial defensive feature, though it appeared that the defences had become less necessary by the 3rd century AD and all but the inner ditch had fallen into disuse. Such a structure may have had a military origin, possibly occupying a defensive position on the banks of an early channel of the river Dore, such as that discovered in plot 269 to the north.

The bulk of the internal features relating to the enclosure which were visible on the geophysical survey were considered to be preserved *in-situ* beneath the alluvial silts of the Dore floodplain, and it is likely that they continue to the east of the pipeline route to where the DBA recorded findings of Roman pottery (CA, 2006, DBA ref. 5810).

Also within this phase alluvial accumulation **67098** was deposited over stone surface **67005**, suggesting that this material was no longer considered relevant to the new enclosure. No finds were recovered from this deposit, and it may indicate a prolonged period of localised disuse or substantial flooding between phases 2a and 2b. As the layer did not cover the enclosure ditches, nor the northwest end of the site, it may also indicate re-deposited natural upcast from the excavation of the boundary ditches, being spread over the top of the stone surface, perhaps the base of a truncated defensive bank between ditches **67157** and **67072**.

Another stone layer **67020** was laid over an area of approximately 11m2, in a single layer of stones. The layer came to an abrupt stop at the north-western edge of phase 2a gulley **67018**, and spread out as if to deliberately cap that feature. As such, they are interpreted as an attempt to lay an area of hard standing over the softer, siltier material within **67018** and to the southeast of it.

Phase 2c: Domestic Enclosure: Roman III (3rd century AD)

By this point the two outer ditches of the enclosure appeared to have gone out of use, being capped with a series of localised layers apparently naturally deposited, and hence presumably the effect of regular flooding. These layers, (**67120**, **67056**, **67106** and **67057**, the latter two surviving only in section), produced pottery dating from the late 2nd and 3rd centuries AD, and sealed both **67157** and **67018**.

An attempt at maintaining or re-establishing the middle ditch appeared to have been effected towards its northern visible extent (**67134**), though as this does not continue for the full circuit of the ditch, it appeared the idea was either short lived and abandoned, or that what appeared to be a recut may actually be related to other activity of uncertain nature (figure 32b). The feature produced pottery dating to the 2nd or 3rd century AD.

Also cut into the surface of the abandoned ditch was pit (**67102**) which measured 0.8m long by 0.75m wide and 0.3m deep. Environmental assessment of the pit fill indicated similar evidence of small-scale industrial activities as that found within phase 2b ditch **67157**, which might suggest either a continuation of the same activity, or perhaps more likely, that material from **67157** was re-deposited within pit **67102**.

At the very southeast end of site was a large ditch (**67161**), which varied in width between 2.2m and 3.5m, and in depth from 1.15m to 1.5m. The linear does not seem to follow the same orientation as the visible enclosure ditches, though it did not intersect any of the enclosure ditches within the excavation area. Its fills produced 34 Roman potsherds, a Mesolithic or Neolithic flint flake, three lumps of daub; and a late 19th or early 20th century square glass bottle base. The glass came from the upper fill, along with 30 of the 3rd century AD potsherds, and was most likely an intrusive find.

Cut into part of phase 2b layer **67098**, and recorded within a sondage trench, was pit **67096**, which contained no finds within its sole fill (figure 32a). Another part of layer **67098** was covered with a further stone layer (**67095**). Neither of these features produced any dating evidence of their own.

Phase 2d: Post Enclosure: Roman IV (4th century AD)

Following the final backfill of ditch **67159**, in the 3rd century AD, an attempt was made to re-establish it (**67152**), though – similar to the attempted recut of **67157** this was incomplete and localised perhaps, in fact, relating to later activity beyond the scope of excavation to the east, rather than a recut at all. Its upper fill produced 22 potsherds which dated from the later 3rd or 4th century AD. During the evaluation, the line of **67159** as seen on the geophysical survey, was intersected by trench 2 to the south of the final excavation area. This trench revealed a 4m wide, 0.5m deep ditch (**6206**) at this point, which contained 4th century AD pottery. This may represent an increased longevity for **67159** into the 4th century, or it may be another fragment of the attempted recut **67152**. This might indicate an attempt to re-establish the enclosure, which appeared by this point to be more or less abandoned.

Phase 2c stone layer **67095** was covered with another layer of silty material **67091**, in a similar event to that which deposited **67098** below. Over this another stone surface was laid, **67092**. Neither of these layers produced any finds or diagnostic material. As with **67098** and **67095**, it seems likely that these are continued attempts at achieving the same purpose – a hard standing for some activity.

A gulley, group **67158**, was orientated E-W and ran roughly parallel to, and partially truncated, the course of phase 2b ditch **67157**. It also truncated phase 2c layer **67056**. The fills of the gulley produced no finds, though it was sealed by later alluvial layer **67024**, suggesting it belonged to the Roman period.

During the evaluation of the site, an ovoid pit measuring 0.6m x 0.5m x 0.28m was identified at the north-eastern end of trench 3 (**6306**), well within the enclosure itself. This pit contained 4th century AD pottery, though no other clue as to the function of the pit could be ascertained. The presence of the pit, though, might suggest that occupation of the site continued for some time after the enclosure boundary itself had fallen into disuse.

Phase 2: Roman general

A number of features containing Roman material or stratigraphically linked to features with Roman material, were recorded but could not be specifically assigned to a definite Roman sub-phase.

At the southern end of site was posthole **67039**. It contained several large stones interpreted as packing stones for a deteriorated post and produced four sherds of Roman Severn valley ware. 2m away was posthole **67025**, which was very similar in nature, and might have formed part of the same structure.

Gulley **67160**, gulley **67007** and posthole **67025** all cut phase 2b surface **67005**. **67160** was a NE-SW linear gulley interpreted as a drainage gulley or possibly a wheel rut in the stone surface. Gulley **67007** represented the western terminus of an E-W linear. It was also interpreted as a drainage gulley. None of these features were sealed by any of the sporadic patchy layers that covered elements of **67005**, except site-wide alluvial layer **67024**, making them hard to place within the phased sequence.

67044 was an oval pit 1.36m long, 0.48m wide and 0.23m deep, with three dumped fills, one of which contained two sherds of Roman Severn valley ware. It was interpreted as a rubbish pit, and was one of a very small number of features from within the boundaries of the phase 2b and 2c enclosures.

Pit **67077** was cut into the upper fill of an un-“recut” section of phase 2b ditch **67159**. It contained two fills, neither of which produced any finds.

Pit **67093** (figure 32a) and ditch **67068** were considered part of this phase purely because they were capped by site-wide alluvial **67024**, which appeared to mark the end of Roman activity.

Pit **67004** was sub-rectangular and measured 1.35m by 0.8m, and 0.25m deep. It.contained a heavily degraded cattle skeleton. of which the head and neck vertebrae were articulated, but appeared to have been removed from the body of the skeleton prior to decomposition, and redeposited at one end of the cut. It was highly possible that the animal was skinned before burial, which often would result in the removal of the skull. No evidence of butchery was noticed on the bones, though this might have been the result of poor preservation. Cow burials have been found at both prehistoric and Roman sites in the UK, and without further dating it could not be assigned to either necessarily, though as it was capped by the post-Roman alluvial layers (**67132** and **67024**) it was determined to be no later than Roman in date.

Phase 3: Post-Roman/ Modern (500AD-1900AD)

Capping all the Roman features were alluvial layers **67024** and **67132**, which were most likely laid during a prolonged period of disuse at the site.

Cut into **67024** was a pit or ditch-like feature **67162**, which was only visible in a sondage section excavated near the eastern terminus of **67158**, and was orientated NE-SW. It measured 0.86m wide and up to 0.5m deep, though no trace was visible beyond the sondage suggesting that it either terminated within the sondage or that it shallowed to the SW and did not survive below the level of the alluvium. No finds were recovered from it. Whilst no date or function for this was established it was clearly post Roman due to its relationship with the alluvium.

4.2.9 Plot 331 (Fig. 32, 33 & 34)

Background

Plot 331 (NGR 341081 235248) was located just north of Nitchell's Coppice near Kingstone in Herefordshire. The site lay at the bottom of a gradual slope, at 110m OD. The plot was under arable crop prior to excavation.

The topsoil was a friable mid brown sandy clay with moderate sub-angular and sub-rounded stone inclusions. The subsoil was gravelly red brown silty clay with moderate sub-angular and sub-rounded stone inclusions. The subsoil was slowly permeable which led to waterlogging. The underlying geology was Old Red Sandstone.

The local landscape was characterised by a series of enclosed fields, sharing a similar alignment. It was suggested that this field system follows an early medieval boundary pattern.

The desk-based assessment identified circular and linear cropmarks of an undetermined date, a Neolithic worked flint tool and the projected line of the Kenchester to Abergavenny Roman road. Within the local area there are two known Iron Age Hillforts, one on Brampton hill (*c.*1km distant) and the other at Timberdine wood (*c.*2.5km). There are also two enclosures located within 5km to the east of plot 331, possibly of the same date. The field boundaries surrounding the site were recorded from 1840 1st Edition OS maps. No find scatters were observed during the fieldwalking survey (Cotswold Archaeology 2006i).

Possible traces of an enclosure at the west end of the plot and an area of magnetic activity were identified by the geophysical survey (Bartlett-Clark Consultancy 2007).

Following the geophysical survey, four trenches were targeted over geophysical anomalies of possible archaeological significance. Two of these trenches produced archaeology, including a series of dump layers which corresponded to the geophysical anomaly . These layers contained a large amount of material associated with iron-smithing including hammerscale and kiln lining. The pottery recovered was dated from the late Iron Age to AD 70 which together with animal bone and a quern stone fragment suggested domestic origins.

The excavations revealed an Iron Age or Roman curvilinear ditch at the western end of the plot, possibly representing some form of livestock enclosure or large hall. Radiocarbon dating of burnt material from postholes suggested an earlier phase of activity dating to the early Bronze Age was also occurring on site. A range of artefacts were recovered indicative of domestic occupation and iron working in the vicinity. A number of pits and gulleys were also uncovered across the site the majority of which are associated with a later post-medieval phase of tree plantation and clearance.

Phase 1: Prehistoric - Bronze Age

Three postholes were recorded within the internal area proscribed by the later (phase 1) pen-annular feature - **75003**, **75006** and **75067**. These contained varying amounts of charcoal and burnt animal bone – predominantly of medium mammals, such as sheep/goats or dogs. These features did not appear to form any sort of structure and there were no other related structural features recorded. However, scientific dating of the charred material from pits **75003** and **75006** returned dates of *c.* 2045 ± 95 B.C and *c.*1960 ± 70 B.C respectively – placing them in the Early Bronze Age. This indicates that there was at least a background presence dating to this period at this site, predating the more intensive Iron Age use of the site. It is possible that many of the small, uncertain, artefact poor, features currently allocated as ‘unphased’ may have originated at this time.

Phase 2: Mid-late Iron Age/Early Roman (500BC – 2nd Century AD)

At the west end of the plot was a penannular ditch (plate 6) which measured *c.*26m in diameter and averaged 1m in width (**75100**). The ditch varied between 0.16m and 0.48m in depth, averaging 0.35m, and contained pottery, burnt animal bone, slag, and fired clay. The western part of the enclosure ditch was heavily truncated by modern ploughing, drainage and tree root action.

The ditch produced 96 potsherds which dated from somewhere between the mid-late Iron Age and the 1st century AD through to the 2nd century AD. An apparently localised re-cut (**75047**) on the south side of the enclosure contained 28 1st and 2nd century AD pottery sherds, whilst the deposit it truncated produced mid-late Iron Age or 1st century AD pot, which suggested that the enclosure may have been in use for a protracted enough period to warrant some degree of maintenance.

It is possible that this large enclosure ditch was for the holding of livestock, or was the remains of some form of large hall or house, as the entrance is narrow for an animal pen. The pottery recovered from the backfill of the ditch was all domestic in nature, which might suggest that a habitation rather than agricultural function is more likely.

A total of 80 lumps of slag were recovered, mostly non-diagnostic or fired clay with slagging, from both the ditch and its' recut, 7.5m NE of the ditch. An evaluation trench located *c.*7.5m to the north of the enclosure previously recorded two large dumps of slag and other industrial residues (**3021** and **3052**) from which were recovered 124 fragments of archaeometallurgical residue, along with more domestic material such as pottery (dating from the late Iron Age through to *c.*70AD), nails and a fragment of quernstone. There were also two pits, the earlier of which (**3051**) contained three fragments of possible smithing slag, whilst the later, **3046**, produced five fragments of slag, mostly undiagnostic but containing fragments of hearth or furnace lining and small inclusions of non-ferrous metal. As these findings were beneath the topsoil bund during construction they were not rediscovered or further expanded upon during excavations or watching brief.

The presence and type of slag recovered from these dumps was indicative of a type of iron production process known as bloomsmithing taking place in the vicinity (possibly just outside the area of excavation), the ore being used in the process being of probable local origin, perhaps bog iron derived from nearby river valleys, rather than of Dean Forest origin, as is more typical for the region. This is of particular significance as it is the only known site undertaking this process (bloomsmithing) at this date (Late Iron Age / Early Roman) in this region (South Wales / Herefordshire) and therefore has the potential to contribute information toward filling in a significant gap in our knowledge.

A number of environmental samples were taken from the fills of the ditch, which produced a low density of charred grains, nutshells and burnt bone, most likely derived from food waste, along with ferrous residues and vitreous material probably derived from the intense burning of organic remains (i.e. 'fuel-ash slag').

To the east of this feature were two intercutting ditches (Groups **75098** and **75101**) aligned NW-SE. The ditches both averaged 1.2m wide by 0.3m deep and ran for about 21m, appearing to be roughly parallel. Both the primary ditch (**75098**) and the later ditch (**75101**) contained pottery dating anywhere from the mid-late Iron Age through to the 2nd century AD. The SE termini of both features were heavily truncated and the ditches may have continued eastwards or, in the case of the slight curve on the earlier ditch, (**75098**), northwards. The ceramic dates from the two ditches suggested that the later ditch was an almost immediate replacement for the earlier. No obvious function for either ditch was apparent, though the low permeability of the natural substrate might suggest that they were intended to assist in draining excess water away from the enclosure to prevent waterlogging.

Phase 3: Post-medieval

Along the southern baulk of the excavation site was part of a large rounded feature (**75031**) containing a waterlogged silty clay deposit with a possible stone lining. The only find from here was a piece of modern glass. It is likely that this feature was an extinct pond, probably post-medieval in date.

Across the site were a number of tree boles (**75009**, **75013**, **75011**, **75015**, **75019**, **75025**, **75033**, **75050**, **75052**, **75060**, **75074** and **75082**). Their nature, and the presence of some scrappy modern finds which were not retained, suggested a post-medieval tree plantation with later clearance.

These features may indicate the presence of a landscaped park, garden or coppice.

Unphased

Around the southern edge of the break in the pen-annular ditch (**75100**) were four postholes or small pits, (**75027**, **75029**, **75039** and **75041**), which contained no finds.

Another three postholes were recorded within the internal area proscribed by the pen-annular feature **-** **75003**, **75006** and **75067**. These contained varying amounts of charcoal and burnt animal bone – predominantly of medium mammals, such as sheep/goats or dogs. These features did not appear to form any sort of structure and there was no other related structural features recorded.

Two further postholes, **75045** and **75017** were also located near the pen-annular ditch, and may have related to the other postholes, though **75045** truncated part of the ring-ditch itself.

Towards the south east end of the site was a small, shallow pit **75048**. This appeared too regular and well-defined to be another tree bole, though no purpose or date could be established for it, and no finds were recovered from it.

4.2.10 Plot 400 (Fig. 35 & 36)

Background

Plot 400 (NGR 35054 22611) was located immediately west of Marsh Lane, south of The Hall, and northwest of Treberon, approximately 1km southwest of Pencoyd. The plot occupies a position on the east-facing slope of a low rise, with the west edge of the plot towards the crest. The plot was under arable crop prior to excavation.

The topsoil was mid-dark brown friable sandy silt overlaying firm mid reddish brown silty loam. These soils were fairly well drained and overlay firm mid reddish brown sandy clay.

The archaeological desk-based assessment did not identify any previous archaeological records within the vicinity (Cotswold Archaeology 2006i).

The geophysical survey did not reveal any significant geophysical anomalies within the plot although coverage was incomplete, and as such no evaluation trenches were excavated within this area (Bartlett-Clark Consultancy 2007.

Based on this evidence it was decided that an archaeological watching brief of the topsoil strip would be adequate mitigation for the plot.

Two separate sites were recorded within this plot, at the south-eastern end were a pair of discrete pits of postulated Bronze Age date, whilst at the north-western end of the plot was a Romano-British rectilinear enclosure, with an internal division, but few internal features.

Phase 1: Early Bronze Age (2000BC-1500BC)

At the southeast end of the plot was a pair of pits (figure 37b). Both pits were sub-circular, pit **40004** measured 0.86m x 0.83m x 0.2m and produced an undated burnt chunk of flint and a single sherd of Roman pot, whilst pit **40002** measured 0.8m x 0.78m x 0.25m and produced 14 sherds of early Bronze Age pot, probably from a Beaker, or possibly a Food Vessel.

The disparity in the dates from the ceramic evidence was intriguing, as given the scarcity of archaeological activity in this area it seemed unlikely that two near identical pits from two separate periods would be excavated side-by-side by coincidence. As such it seemed probable that either the Roman potsherd was intrusive or the Bronze Age pot was residual. To ascertain which was difficult because, whilst the Bronze Age assemblage was clearly larger than the Roman, it all appeared to derive from a single vessel, whilst the single Roman pot fragment was quite large and only slightly smaller than all the Bronze Age pieces put together. However, it was felt that, given the large quantity of Roman material present in sub-soil and topsoil that it was far more likely for a single sherd of Roman pot to intrude into a prehistoric pit, than it would be for a substantial fragment of Early Bronze Age pot to remain residual within a small Roman pit. Therefore, both of these pits have been deemed to be of Early Bronze Age date.

Despite the rarity of Beaker pottery from non-sepulchural deposits in Britain, it was not believed that these pits were funereal, primarily due to the lack of burnt material, and it appeared more likely that they were domestic waste pits or storage pits, which suggested that there would be a focus of Bronze Age settlement activity somewhere in the vicinity.

The area around the pits contained a number of irregular water worn channels of apparent natural origin (group **40020**), though they had no direct relationship to these pits, so whether they were contemporary with the prehistoric activity could not be determined.

Phase 2: Roman (1st Century AD – 3rd Century AD)

Approximately 220m northwest of this area of activity was the second locus of activity (figure 37a). This took the form of the southwest corner of what appeared to be a rectilinear enclosure. Two of the external boundary ditches were visible within the plot.

The western of the ditches (**40097**) ran NNE-SSW and was 36m long before it was truncated by a modern asbestos dump at the northernmost extent. No trace of it could be found beyond the asbestos dump. The ditch appeared in plan to have numerous "bulges" along its length varying between 1.62m and 2.42m wide, which would usually indicate activity alongside the ditch or recuts, but investigation of these anomalies revealed them to be part of the ditch's construction, either repairs or collapses. The ditch averaged between 0.74m and 0.85m deep.

Finds from the ditch comprised a single, undated fragment of iron slag, two fragments of mid-late Iron Age or 1st century AD pot, and 34 Roman potsherds dated to the mid-late 2nd century AD.

At its SSW extent **40097** cornered 90° to become an ESE-WNW ditch (**40098**). This ran for 21m, and then appeared to curve slightly to face ENE-WSW as it shallowed out and terminated. This was interpreted as the entranceway to the enclosure, as the western terminus of another ditch (**40070**) on the same alignment as **40098** was located 3m southeast of the eastern terminus of **40098**.

40098 was noticeably narrower and shallower than **40097**, varying between 0.83m and 1.45m wide and between 0.31 and 0.64m deep. Where it shallowed out toward the eastern terminus it was only 0.13m deep. This was likely to be the result of increased truncation rather than deliberate construction. This ditch produced 18 sherds of late Iron Age or 1st century AD pottery, 80 sherds of 1st or 2nd century AD pottery and animal bone, including a cow skull.

The course of **40098** was continued beyond the purported entranceway by ditch **40070**. This measured 4m long within the plot, extending beyond the pipeline easement to the ESE, and no finds were recovered from it.

Near the NNE visible extent of **40097** was a short gulley (**40074**) that formed part of an internal division within the enclosure. This division ran ESE-WNW, parallel to ditch **40098**. **40074** produced no finds. **40074** terminated after 3m, and after a 1.5m wide gap, another gulley (**40067**) began on the same alignment, suggesting the gap was a means of access from one internal division to the other. This gulley ran for 24m before terminating. Whether this terminus represented another access point is unknown, as the terminus was against the edge of the excavated area. The two ditches both averaged abour 0.8m wide and 0.25m deep.

40067 produced an enormous quantity of pottery for its size. From roughly 15% of the gulley was recovered a representative sample of 503 Roman potsherds, all dated to about the mid 2nd century AD. The pottery had a very unusual vessel profile, in that the dominant form were tankards, accounting for nearly 50% of the assemblage, followed by jars, bowls and dishes. A typical domestic Roman vessel profile would see jars dominating other vessel types, so a preponderance of tankards might suggest an inn or *mansio*, though a hilltop location with no known road in the vicinity make this unlikely. Another possibility, apparent at a site at Frilford, Oxfordshire, is a higher incidence of drinking vessels associated with temple sites (Timby, J. pers. Comm.), though the site at plot 400 does not appear to have any other evidence of high status occupation that might be expected of a temple site.

There were very few internal features within the enclosure ditches, probably due to historical truncation or ploughing. To the south of **40067**, near its ESE terminus, was a small pit, measuring 0.92m long x 0.56m wide x 0.19m deep, (**40076**) which contained a single sherd of Severn valley ware, dated to the 2nd century AD or later.

5m north of the entranceway in **40098** was the only other internal feature, a large, shallow pit measuring 4.9m long by 2.52m wide as exposed, but only 0.11m deep (**40085**). It had a single fill which produced 13 sherds of 2nd century AD Severn valley ware. No definite function could be ascribed to the feature.

Environmental assessment of the ditch fills revealed that most contained low densities of charred cereals and seeds. It would appear likely that the material is derived from scattered or wind-blown domestic or agricultural refuse, much of which was probably accidentally included within the feature fills. The fill of ditch **40067** produced notably higher quantities of burnt grains, together with burnt bone, indicating probable cooking waste.

4.2.11 Plot 430 (Figs. 37-40)

Background

Plot 430 (NGR 35590 22514) was located north of the A49, about ¼ mile east of Winter's Cross and ½ mile northwest of Peterstow. The site had three distinct loci, the first alongside the A49, on the brow of a slope; the second approximately halfway down the slope, and the third at the base of the slope, about 100m southwest of Wells Brook . The plot was under arable crop prior to excavation.

The topsoil in all three loci was mid red brown sandy loam overlaying dark red brown sandy loam. These soils were well drained and overlay mid red brown clayey sand.

The archaeological desk-based assessment identified a 17th century inn, the Red Lion, at Winter's Cross. This inn is still extant. Not far to the east of the site were three reputed iron working sites and a spot-find of medieval slag and pottery. Of these iron working sites, one was post-medieval, and two produced no evidence of iron working when investigated (Cotswold Archaeology 2006i).

The geophysical survey revealed several anomalies (Bartlett-Clark Consultancy 2007), based on which four evaluation trenches were targeted in this plot (Network Archaeology 2009i). Due to wet ground conditions and delayed access it was not possible to undertake these evaluations ahead of construction. For logistical reasons trench 4 was opened first, and when this revealed significant archaeological remains it was decided not to continue with the remaining trenches but instead to proceed straight to a full open area excavation of the plot. Finds from the trench comprised six horse bones, 125 Roman pot fragments (dated from the 1st -3rd centuries AD), 189 fragments of a single late Iron Age jar, 123 lumps of slag indicative of pre-Industrial iron production in close proximity, a post medieval tile, 17-18th century glass and clay pipe fragments, a piece of early modern pottery, a copper alloy object – most likely a fragment from a post-medieval domestic vessel, and an 18th or 19th century ivory comb.

This plot contained three distinct areas of activity: For ease of differentiation these are referred to as areas A-C. Area A was at the base of the hill and was a rectilinear enclosure bounded by a double ditch, with at least one internal ditch, and evidence of the inner boundary ditch being re-emphasised at a later date. A small number of discrete pits and postholes, along with the collected artefacts, appear to indicate domestic activity at the site, whilst a further linear to the south of the enclosure appears to be unrelated, and may be a later field boundary.

Area B was located midway down the hill-slope and comprised three concentric curvilinear ditches apparently forming a fragment of an enclosure that lay to the west of the pipeline route. The artefacts suggest a probable defended domestic enclosure.

Area C was at the top of the hill, alongside the A49, and was a pair of pit complexes with a small number of associated pits which produced considerable evidence of iron smithing and smelting in the vicinity. The two pit complexes may have represented bloomery furnaces.

Phase 1a: Roman I - Metalworking (1st century AD)

Plot 430 contained three discrete areas of activity that appeared to be part of the same extended site. The earliest of these areas (area C) was located just north of the road crossing at the A49.

A single, much worn, late Neolithic or early Bronze Age sherd was recovered from subsoil, but lacking any further evidence at the site it was not believed to indicate any significant early prehistoric exploitation of the area. Also from subsoil, a brooch of La Tene III, Nauheim derivative, form (Hattatt 1987) was discovered. This was dated to the first century BC/AD, though a panel at the top of the bow suggested the latter. It was considered to be good evidence of late Iron Age or early Roman activity (Leahy 2009).

This area was dominated by a large bloomery or furnace pit group (**86270**), which measured 4m long and 2.4m wide by 0.38m deep (plate 8). This feature appeared to have been in use for a prolonged period, with a number of later features having been cut into its earlier fills and sealed by its later fills (figure 40c). These comprised a smaller bloomery (**86234**),and a later pit dug to dump production waste (**86264**) which presumably indicated the end of the active life of the feature. In total ten deposits made up the fill of pit **86270**. These primarily represented tips and dumps of waste material into the cut of the pit during its active life.

These seem to make up a fairly conventional smelting furnace, presumably originally housed within a building, though little evidence for such a structure was identified beyond disparate postholes which do not seem to form a deliberate pattern. The base of the furnace lies at a lower level than where the tapping arch would be, which is slightly odd. This bears some similarities to the situation hinted at in the Chesters Villa report (Fulford and Allen, 1992) and might fit wth the evidence for almost "ponded" slag seen on some sites, including this one.

A short channel-like feature (**86236**) which formed part of **86270** is also of interest, as it was originally believed to be a tapping channel, but on analysis looks like it may have been the base for a wooden support, suggesting this may have been part of the base of a raised hearth or domed smelting furnace, of which the former is more likely. Raised hearths, other than those made of stone, have not been documented in Roman Britain before, Unsurprisingly, the bulk of the finds from these fills are fragments of iron slag, 201 in total from the fills of **86270**. **86234** produced a further 16, whilst **86236** contained 30 more fragments and **86264** produced three. All of these pieces were dated as Roman, and assessment of this slag showed material from all stages of iron smelting; slag tapped from the furnace during operation, slag remaining in the base of the furnace and metals which may be the products of the furnace. **86270** also produced 13 potsherds, from the final fill, suggestive of a pre- or early Roman date.

86270 truncated two earlier pits (**86213** and **86214**). Both pits contained further iron slag in significant quantities – 21 fragments and 20 fragments respectively - but the sole fill of **86214** (fill 86199) also produced a significant quantity of early pottery: 46 potsherds in total, dated to the 1st century AD, which suggested there was little or no break in activity between the backfill of these two pits and the construction of **86270**.

Less than 0.5m to the side of pit **86270** was a small pit or posthole (**86189**). It had a single fill which produced a single lump of Roman iron slag, and whilst this could not be directly linked to the bloomery activity, it seemed likely that the feature represented the remains of a truncated posthole which formed part of the furnace structure.

Roughly 17m to the south of **86270** was a second complex of inter-cutting pits (**86138**). Similar to **86270**, this appeared to be a furnace or bloomery, and though smaller in scale than **86270**, the largest pit in the complex (**86138**) produced a total of 55 fragments of ferrous slag. These were all dated as Roman though no other dating evidence was recovered from the fills. The slag was identified with bloomery tapping and/or furnace activity.

It is likely that these two pit complexes were active at the same time, or within quick succession of one another, and assessment of the collected slag suggested that iron smelting was happening at the site, and possibly smithing as well, particularly when the material gathered during the evaluation (McKenzie, 2008) is also taken into consideration.

No artefactual evidence diagnostically dating to later than the 1st century AD was recovered from any of the furnace features or pits. There is nothing to suggest that these furnaces went out of use during this period, and in fact the regular re-cutting and dumping within **86270** in particular, suggest a prolonged usage.

The slag material recovered from these features indicated that the source of the ore for the Iron was the Forest of Dean. This is not entirely surprising as plot 430 lies approximately 19 km north of the Forest of Dean – and so within what is recognised as the Iron Ore 'hinterland' of the forest (extending 20km – 35km from the forest). Indeed, the chemical composition of the slag recovered at this site is very similar to that recovered from the site of Aricorium 8km to the east, which was utilising the same ore and sat on a similar geology (Young 2012).

Analysis of the slag material also indicated that the technology utilised at plot 430 was likely to be that of simple slag-tapping furnaces, similar to many other Dean smelting sites, but markedly different from the "major" and military centres of smelting / industry located to the SW of the Forest of Dean (Young 2012).

Phase 1b: Roman II – Lower enclosure (1st/2nd century AD)

Still in Area C, furnace **86138** was replaced with two smaller burning pits (**86142** and **86136**) suggesting continued occupation of the upper site. These pits produced 77 and 10 fragments of Roman slag respectively, which was assessed to be bloomery or tapping slag. A final burning pit (**86130**) was excavated through the remains of **86142**, marking the last activity in that area. Its sole fill produced 92 fragments of bloomery and furnace ferrous slag. This material indicated a continuation of the industry first seen in phase 1a, both in terms of the source of the ore utilised and the scale of the industry.

To the north of these features, in Area B, waste pit **86239** was excavated (figure 39a). This was a large pit, though it was heavily truncated. It was apparently used for domestic waste disposal as it produced a cow's tooth, 13 fragments of fired clay, six pieces of iron slag, seven lumps of coal and 438 sherds of Roman pot, predominantly dated to the 2nd century AD.

In Area A to the north-east, at the base of the slope, a large double-ditched enclosure was constructed (figure 38, plate 7). This enclosure was represented within the excavated area by a pair of parallel curvilinear ditches (The outer ditch comprising **86118** and **86103**; the inner ditch comprised **86120** and **86154**) which ran on a NE-SW alignment for about 35-40m before curving to head NNW-SSE for approximately 20m and then running beyond the edge of the excavation. Both ditches petered out to the SW due to the high levels of modern truncation on the site (the outer ditch also petered out at its NNW extent as well). Both ditches also possessed an intentional break in their circuit just before they curved to the NNW, apparently forming a deliberate causeway into the enclosure.

The ditches that made up the enclosure produced 539 sherds of Roman pot dated to the 1st or 2nd century AD, along with 32 fragments of iron slag including bloomery tap slag and furnace lining. Also recovered from these ditches were a fragment of a typically early Roman glass bead, a copper alloy penannular brooch, which dates to the 1st or 2nd century AD, and a residual Mesolithic or Neolithic flint.

It was notable that the pottery from the outer ditches seemed to indicate a 1st century date, whilst the inner ditch pointed more to a 2nd century date, albeit only along the northern curve. This may indicate a protracted occupation of the enclosure throughout the 1st and 2nd centuries, though the outer ditch possibly went out of use early in the 2nd century, whilst the inner ditch was still active until later that same century.

It was possible, indeed probable based on the metallurgical waste in the ditches, that the enclosure was active during the lifespan of the phase 1 metalworking site, and that it then outlived the more intensive phase of that industry into the early part of the 2nd century AD.

If any internal features survived within the enclosure they lay to the north of the pipeline easement, but given the domestic nature of the debris associated with the enclosure ditch backfills, and the rough correlation of dates with the phase 1 metalworking site above, it was considered likely that this was the settlement where workers at the bloomery in area C lived, and exploited the fertile low lands of the River Wye and the land around the Wells Brook.

Phase 1c: Roman III – Upper enclosure (2nd century AD)

In Area B significant development began with the construction of what appeared to be a three-ringed enclosure (figure 39a). The outer ditch of this enclosure (**86192**) truncated phase 1b pit **86239**, which might suggest that a smaller settlement located to the east of the pipeline easement was growing into a more significant one, or otherwise that defence had become more of a priority.

The innermost of these three ditches (**86230**) was revealed to a length of about 15m. Heavy truncation due to its location on a hill-slope, coupled with an inconsistent depth during its construction, meant that it petered in and out of existence along its length, which in turn meant that it could not be definitively ascertained as to whether the apparent NE terminus was an intentional part of the construction, or merely another break in the circuit due to truncation. It produced 140 Roman potsherds the majority of which were dated to the 2nd Century AD, or even later.

The second ditch (**86257**) was not as clearly visible in plan, but was more substantial. It had a distinct terminus at its west end, though for the remainder of its length it was often nebulous and difficult to define. *c.*23m of its circumference was within the excavated area. The fills produced 128 Roman pot fragments dated to the 2nd century AD, which suggested that this ditch was broadly contemporary with the inner ditch (**86230**), and 12 fragments of Roman iron slag, whose nature was sufficiently similar to that from the furnace site above to suggest that debris from there was transported downhill to backfill this ditch, either deliberately or by hillwash.

The outermost of the three ditches was **86192**. 32m of its circumference were exposed in the excavated area. This produced two animal bones; 81 fragments of Roman iron slag, again similar to that from the furnace site at the hilltop; and 527 sherds of Roman pottery. This pottery dated predominantly to the 2nd century AD, like that of the other two ditches.

As the interior of the enclosure lay to the north of the pipeline easement it was impossible to ascertain the nature of the enclosure. Three ditches would seem to indicate a defensive nature to the enclosure, yet the ditches are neither wide nor deep, and nor is there significant room for them to be much larger even taking into account severe truncation, with the rings as they are separated by between 2m and 5m at the most. As such it was considered most likely that defensive considerations were not paramount in its construction.

In Area A, at the apparent entrance to the double-ditched enclosure an effort was made to re-establish or re-emphasise that entrance. This took the form of features cut over either terminal of the inner ditch at the entrance.

Large pit (**86149**) truncated one terminal. This produced six fragments of Roman iron slag, one of which might have been tapped from the mouth of a furnace, as well as 15 potsherds dated to the 2nd century AD.

The other terminal contained what appeared to be the footings of a wall (**86157**). It survived for 6.7m of its length, standing to three courses. Just north of the terminal of **86120**, and curving inward toward the enclosure was an apparent continuation of this wall (**86158**), but it was heavily truncated and appeared only patchily, the stones apparently distributed more widely than their initial construction, either due to a tumbling of the wall in antiquity, or due to disturbance by ploughing at a much later date, or both. From amongst the stones of **86157** were recovered four lumps of Roman iron slag, and a surprisingly large assemblage of pottery – 121 potsherds in total - all of which were dated to the 2nd century AD. The stones of **86158** produced two fragments of iron slag, both of which were probably bloomery tap slag, and may have related to the furnaces on the hill top above.

Roughly in line with the south-westernmost surviving elements of both enclosure ditches was a perpendicular ditch (**86274**), probably an internal division which ran NW-SE for 14m. The ditch terminated 1.8m from **86120**, which might represent an access from one internally divided area of the enclosure to another. The ditch contained 406 Roman potsherds, which were dated to the 2nd century AD.

All three loci of activity appeared, based on the ceramic dating, to have fallen out of use by the end of the 2nd century AD.

Phase 2: Later Roman/Post Roman - Disuse

A series of natural features post date the 2nd century Roman activity, after both the lower and upper enclosures had fallen into disuse, though it is unclear at exactly what date they occurred. However, much of the unstratified Roman pottery from the site was dated to the 2nd or 3rd centuries AD, perhaps indicating a greater longevity of occupation than the *in-situ* ceramics suggested.

In Area B, small linear **86216** may belong to phase 1c, though it seems more likely that the scant 2nd century material amongst its fill was re-deposited during disturbance of the earlier finds-rich deposits of pit **86239** and ditch **86192**. If the material was deliberately deposited within **86216**, then it suggests that at least the outer ditch of the three-ringed enclosure had gone out of use earlier than the lower double-ditched enclosure, meaning it had had a comparatively limited lifespan. When the finds assemblage as a whole is considered, this seems very unlikely and the feature appeared more likely to be of natural origin, created by water run off.

Irregular linear **86276** truncated **86216** and the outer two ditches of the three-ringed enclosure midway up the slope, and along with gulley **86267** seemed to represent water erosion truncating enclosure ditch **86192**. Neither of these gullies produced any finds.

In Area A, tree boles (**86203** and **86207**) truncate the southern reaches of enclosure ditch **86120**.

Unphased

Three features had no stratigraphical relationship or artefactual evidence with which to date or phase them:

In Area A, E-W linear ditch (group **86155**) measuring 23m in length was located at the foot of the slope. It produced no finds, but was interpreted as a field boundary or drainage ditch. As it did not appear to match the orientation of the Roman features either in Area A or B, or contain the high quantities of artefacts and industrial residues found elsewhere, it most likely dated to a different period than these. The ditch was truncated toward its northern extent by a thin gulley (**85187**). Its single fill produced no finds, and it was interpreted as a modern plough scar.

At the curve of the inner enclosure ditch at the base of the hill, **86154**, just inside the enclosure, was an allantoidal pit (**86108**). No finds were recovered from it, and as such the feature could not be dated, nor could any function for the pit be determined. The pit was the only feature identified within the enclosure, but given the comparatively large quantity of pottery recovered from the other Roman features in the area it seemed strange that a pit of this size would contain none, if it were to be contemporary with the occupation of the site.

4.2.12 Plot 454 (Fig. 41-43)

Background

Plot 454 (NGR 35980 22760) was located just west of Hill of Eaton, approximately three quarters of a mile NNW of Brampton Abbotts. It lay on the brow of a slope, overlooking the river Wye to the west. The plot was under arable crop prior to excavation.

The topsoil was mid red brown sandy loam overlaying dark red brown sandy loam. These soils were well drained and overlay dark red brown clayey sand.

The archaeological desk-based assessment noted an 18th century report of an Iron Age camp within the plot, though such a camp was no longer visible as an extant earthwork by the time of the archaeological field reconnaissance survey (Cotswold Archaeology 2006i).

The geophysical survey revealed several anomalies, including the outline of a potential enclosure with internal sub-divisions (Bartlett-Clark Consultancy 2007), which were targeted by four evaluation trenches (Network Archaeology 2009i).

These trenches produced a significant quantity of linear features and pits, all of which pointed to a probable substantial Roman enclosure.

It was decided that a large open area excavation encompassing all of the geophysical anomalies and revealed archaeology would be undertaken prior to construction.

The site was dominated by a Romano-British rectilinear enclosure, apparently incorporating an earlier late Iron Age enclosure, and with evidence of re-emphasis of some of its boundaries at later dates.

Associated with this enclosure were a number of pits for the disposal of burnt waste, some small gullies possibly relating to drainage and a few postholes to which a clear purpose could not be assigned. There was also a pair of cremation interments, one containing Roman material from the 1st or 2nd century AD.

Phase 1a: Late Iron Age/Early Roman Enclosure (100BC-1st century AD)

At the northern end of the excavation area an "L" shaped curvilinear ditch was excavated forming the southern corner of an enclosed area, the majority of which lay beyond the excavation area to the north east. The south-western element of this boundary (**85119**) ran for 19m. This ditch curved at its south-eastern extent to run SW-NE, forming the south-eastern element of the enclosure (**85120**).

The earlier fills of this ditch produced 27 pieces of Iron Age or Roman iron slag, 14 of which appear to have come from the lining of a hearth or furnace and 118 sherds of native pottery that could date from anywhere between the late Iron Age and the 1st century AD, whilst an upper fill also contained 29 sherds of 1st or 2nd century AD Roman Severn valley ware. This indicated a prolonged period of occupation and use of the ditch. The native Malvernian pottery varies little in nature between the late Iron Age and the 1st century AD, so it may be that the feature had a considerably shorter lifespan, dating wholly to the 1st century AD.

The location of the enclosure, at the brow of a slope overlooking the river Wye would have been a very defensible and strategic position. It is also possible that this enclosure might relate to the putative Iron Age camp noted in the DBA (CA 2006i), listed as a single ditched feature based on the aerial photographs. As mentioned above, however, it could equally be a wholly Roman encampment dating from the 1st century AD into the 2nd century, indicating a much shorter span of occupation at the site.

Three pits within the enclosure also appear to date from this phase, (**85087**, **85089** and **85096**). The westernmost, and smallest, of these was post-pit **85087**, which contained two sherds of native pot of a type that changed little in form between the middle Iron Age and the 2nd century AD, and hence could not be accurately dated. Pit **85089** produced 12 potsherds dated to the 1st century AD, which combined with the relatively high charcoal content would suggest that the pit was used for dumping waste from domestic hearths within the enclosure. From pit **85096** was recovered three pieces of fired clay, one of which may have been a fragment of loomweight, and 33 pot sherds dating anywhere from the mid-late Iron Age to the 1st C AD. The feature was interpreted as a storage pit. A sample taken from this pit contained small quantities of domestic grain, and some trace evidence of hammerscale and other indicators of smithing in the vicinity.

The domestic nature of the assemblages recovered from these three features suggests that the enclosure, or this division of it at least, was utilised as a settlement, rather than as an agricultural enclosure.

Outside this enclosure, to the southeast, were two irregular gullies. 5m SE of **85120** was a curious feature: a short, comparatively wide gulley forming almost a “Z” shape (**85122**). From its single fill were recovered 28 sherds of 1st or 2nd century AD Severn valley ware. No clear function could be determined for this feature, and no comparisons could be located from similar sites. Gulley **85121** ran NW-SE for a little over 10m. Given its short length and shallowness it was likely that the gulley was heavily truncated, and as such no function is obvious, though it may be that both gullies **85121** and **85122** related to attempts to drain excess water away from the enclosure. Pit **85078** also dated to this phase, and may in fact be the south-eastern terminus of gulley **85121** given its location.

Located *c.*2m E of gulley **85121** was small pit **85020**, which was interpreted as a truncated posthole, though no function for such a post at this location was obvious.

Phase 1b: Roman – Expanded enclosure (2nd Century AD)

The earlier enclosure appeared to persist into this phase, and subsequently an additional area was enclosed to the southeast.

NE-SW ditch **85116** was the outer of two ditches which marked the south-eastern boundary of the extended enclosure, though this edge differed from the other boundaries in that it was the only element of the enclosure that possessed a double ditch (plate 9).

The earlier fills of this ditch produced 520 fragments of Roman pot predominantly dated to the 2nd century AD. From the upper fills were recovered a Mesolithic/ Neolithic mudstone blade, a burnt pig mandible, a possibly intrusive piece of lead and a further 1652 Roman potsherds dated to the 3rd century AD, suggesting a century or so of usage of the ditch before its final abandonment.

The inner of these two south-eastern boundary ditches (**85117**) ran parallel to **85116**, though where that ditch thinned and curved to the east, **85117** continued in a straight line to the northeast. It produced three lumps of Iron Age or Roman iron slag, and 57 fragments of Roman pot predominantly dated to the 2nd century AD.

At their south-western end, these two ditches joined a NW-SE ditch (**85118**), which extended the original phase 1a enclosure. This was roughly 16m long and produced six fragments of Iron Age or Roman iron slag, one of which may have been from a furnace lining and 1014 Roman potsherds predominantly dated to the mid-late 2nd century AD.

This expansion of the enclosure, and the quantity of pottery, suggested an increase in importance or occupation of the site, or perhaps a change in the function of the enclosure. The additional emphasis of a double ditch on the south-eastern side might suggest that this was either seen as the most vulnerable area of the defences, or that this was the direction the enclosure was most often approached by, and as such was intended to be grander. As the ground dropped away to the NW of the site, it was reasonable to assume that the river valley was deemed to provide sufficient additional defence to that side of the enclosure, and that the majority of traffic would approach from the south-east. The ceramic evidence suggested that ditch **85120** persisted as an internal division within the extended enclosure.

This phase also saw the excavation of a pair of postholes (**85022** and **85024**) within the newly enclosed area, and though there was no obvious structure or function that they represented their shallowness might indicate that other postholes were lost to modern truncation. **85024** produced 27 Roman potsherds, all dating to the 2nd century AD.

Within the original enclosure, truncating phase 1a pit **85089**, was a cremation interred in a steep-sided square cut with a flat base (**85018**). This had two fills, one of which appeared to be a localised “mound” in the centre of the feature, with the remainder dumped around and over it. The primary fill contained burnt human bone. The bone was sparse (only 11.9g survived) but fairly well preserved and comprised largely long bone and skull fragments, though not enough survived to identify the age or sex of the individual cremated. No material culture was included in the pit to help date the cremation, but its proximity to pit **85049** (see below) suggested that it would be Roman in date. The fills were sampled and revealed wheat, legumes, spelt, other indeterminate cereal grains, along with small elements of hammerscale, iron slag, and small coal fragments, which was a very similar profile to that found in **85049**, perhaps also suggesting a contemporaneity between the features. While unusual, it is not unknown for Roman interments to be made within active settlements.

8m to the east of this, within pit **85049**, was a second probable cremation. There was a single fill within the cut, and this produced 22 Roman potsherds, all dating to the 2nd century AD. Also amongst the fill was a copper alloy brooch of the “Polden Hill” type, dating to the 1st century AD, and an iron hobnail that could not be dated. The brooch had not been burnt and if associated with a cremation it must have represented a graveside offering. An environmental assessment of the deposit showed a very similar array of material to that identified within the deposit in **85018**, and the presence of burnt bone here may also indicate that this was a cremation, though in this instance it could not be definitively identified as human, as it was too small and fragmentary.

Just beyond the outermost of the south-eastern ditches, **85116**, a pit (**85037**) was excavated, This contained burnt material and 93 sherds of 1st or 2nd century Severn valley ware. Given its location outside the enclosure it is likely that this was a domestic waste pit.

Palaeo-environmental samples taken from the enclosure ditches and cremations were typical of material derived from dispersed domestic detritus, with all the samples (including the cremations) containing cereals along with a small quantity of chaff, weed seeds and nutshell fragments. Although the scarcity of chaff within the current assemblages may be an accident of preservation, it should be noted that similar low densities of chaff have been recorded from a number of contemporary sites within Lowland Britain (for example from the Norwich Southern Bypass (Murphy 2000)). In these instances, it is thought that the occupants of the sites were almost certainly engaged in a largely pastoral economy, and were importing batches of semi-cleaned or prime grain to meet their cereal requirements, thereby negating the necessity of on-site processing. As with Phase 1a pit, **85096**, hammerscale was recovered from the cremations, suggesting that iron smithing may have been occurring within that element of the enclosure, either throughout both phases, or in sufficient quantities during phase 1a that its residues were readily incorporated in the backfill of both cremations.

The lack of significant faunal remains may argue against a pastoral economy, but the preservation of animal bones on this site was very poor, and their absence is most likely due to that than an absence of the animals themselves.

Phase 1c: Roman – Enclosure disuse (Late 2nd century/3rd century AD)

The enclosure appears to be going out of use by this period. A large irregular pit (**85041**) truncated the eastern end of ditch **85120**. The pit contained a single fragment of iron slag, possibly furnace slag; and 45 Roman potsherds, all dating to the 2nd century AD. The scale and irregular nature of the pit led to the interpretation of it as a clay extraction pit.

Also truncating **85120** was another feature, **85110**. This was interpreted as a posthole, which together with posthole **85071** might have been intended to delineate the former course of **85120**, or replace it. Both of these were apparently later re-established, as **85111** and **85069** respectively, though as no dating was available from any of these postholes it was impossible to say when.

Pit **85034** was excavated at the southern corner of the phase 1b enclosure, where ditches **85118** and **85116** met. It contained 104 fragments of Roman pot dated to the 3rd century AD, which suggested that the pit was contemporary with the final filling of the outer ditch **85116**. The function of this pit was unclear, though it may have been an attempt to demarcate the extent of the now abandoned enclosure, or it may have been a waste pit coincidentally located on the corner of the old enclosure.

Gulley **85006** appeared to be a naturally formed water channel, which truncated the easternmost visible extent of ditch **85116**. It ran on a NW-SE alignment though both ends petered out due to modern truncation rather than as intentional termini. The gulley produced six sherds of Roman pottery, all dated to the 2nd century AD. It is plausible that these finds were washed into the feature from ditch **85116** as it wore that feature away.

Pit **85080** truncated the edge of phase 1a pit or gulley terminus **85078**, whilst another pit (**85014**) truncated the northern side of ditch **85116**. Neither of these features produced any datable finds, nor had a clear purpose.

Unphased

Remaining unphased due to a lack of artefactual or stratigraphic evidence were five features.

Pits **85060** and **85072** produced no finds, but did contain a reasonable quantity of charcoal and similar burnt material, and as such both features were interpreted as waste pits for the dumping of hearth waste relating to the domestic occupation of the enclosure further to the NW.

Similar in nature to these, but within the bounds of the extended enclosure was an oval pit (**85091**). It contained no finds, and as such could not be dated, though a palaeo-environmental sample taken from it revealed some domestic grain and hazelnut, so it may also have been a waste pit for the disposal of burnt material, such as hearth waste.

Two postholes were located within the original enclosure, near phase 1a posthole **85087**, 3m SE of **85087** was posthole **85084**, which produced no finds. The easternmost and smallest of the postholes, **85086** contained two fire-cracked stones which might have been old hearth stones re-used as post packing. The features do not appear to form any structure, but given their shallowness it was possible that further postholes had been entirely truncated and that these did initially serve a structural purpose, which in turn suggests that they might be contemporary with **85087**.

4.2.13 **Plot 464 (Fig. 44 & 45**)

Background

Plot 464 (NGR 362125 227690) was located 1.4km north of Phocle Green and 1.6km south east of Hole in the Wall and the River Wye. The plot occupied a relatively flat position and was under arable crop immediately prior to excavation.

The topsoil was 0.30m deep, friable, reddish brown, sandy silt. The subsoil was very similar in nature – if a little darker, while the underlying natural geology was a firm, mid orangey brown, clay and sandstone fragment mix.

The archaeological desk-based assessment, earthwork survey, fieldwalking survey (CA 2006i) and geophysical survey (Bartlett-Clark Consultancy 2007) did not highlight anything of significance in this plot.

As such no evaluation trenches were carried out, and the site was stripped under archaeological watching brief.

A concentration of pits and postholes at the eastern end of the plot produced Bronze Age pottery and what might have been cremated human remains, possibly indicative of a settlement or funerary site. A further lone pit was located at the western end of the plot, which may have been a fire pit or ash-dump, but no date could be ascribed to this.

Phase 1: Early Bronze Age pitting (2000BC-1500BC)

A total of 35 pits, postholes and stakeholes were identified at the eastern end of the plot.

Two pits, (**46433** and **46435**), were identified near the northern boundary of the plot, truncated by phase 2 ditch (**46465**). No finds were recovered from either feature, and no clear purpose could be assigned to them. It is probable they were part of the same phase of activity as the remainder of the pits, given the considerable timespan involved.

During assessment the majority of pits, postholes and stakeholes were grouped into four clusters, all deemed to date from the same phase.

Group 1 was arranged in a roughly X shaped pattern and possibly represented a structure. It consisted of features **46443**, **46425**, **46419**, **46412**, **46401**, **46450** and **46459**. This group also contained pit **46422** – a possible cremation feature (see below) and it may have been that the structure was in some way related to that cremation.

Group 2 was arranged in a rough east - west alignment, consists of features **46449**, **46447**, **46463** and **46433**. This group also contains **46403** – a possible cremation feature (see below).

Group 3 – arranged in a rough NW – SE alignment, consists of features **46435**, **46409**, **46415**, **46417** and **46453**.

Group 4 – a roughly circular cluster of pits, postholes and stakeholes. Centred around pit **46421**, with smaller postholes to the south west, **46436** and **46439**. Surrounding these postholes, and the south western quadrant of **46421**, were 14 small stakeholes (group **46460**), each 0.05m – 0.07m in diameter and *c.* 0.12m deep.

Of these, the only features with direct dating evidence were pits **46401**, **46403**, **46421**, **46433**, **46439** and one of the stakeholes, **46444** from **46460**. Pits **46401**, **46403**, **46421** and **46433** produced 33 pottery sherds of indeterminate prehistoric date, whilst pit **46439** and stakehole **46444** produced three early Bronze Age, possibly Beaker, sherds between them.

Two cremations were identified amongst the pits: **46403** contained a small quantity of burnt human bone, charcoal and eleven fragments of prehistoric pottery, possibly from a jar with a pointed rim. Truncating the backfill of this pit was a stakehole, **46463**, which may have been a form of grave marker.

C. 8m SW of pit **46403** was smaller pit **46422**, which also produced burnt human bone but no pottery. Neither of the cremations contained enough identifiable bone material for determining the age or sex of the individual cremated, with both assemblages producing less than 30% identifiable bone, most of which was long bone, whilst 22% of the identifiable bones in pit **46422** were skull fragments.

The site is interpreted as lying on the fringes of a Bronze Age settlement, somewhere beyond the pipeline easement, probably to the north as no evidence for a continuation of the site was identified within the pipeline easement to the south. The activity located in plot 464 was seen as both ritual disposal of the dead, and other forms of disposal such as habitation waste, though environmental sampling of the pit fills revealed a lack of food remains, with the majority of sampled deposits revealing little more than charcoal and charred roots or stems.

Phase 2: Boundary

Truncating phase 1 pits **46433** and **46435** was a NE-SW oriented ditch (**46465**). This ditch ran 4.2m SW from the northern limit of excavation, before ending in a rounded terminal, and then *c.*0.4m SW of this terminal it began again from another rounded terminal, running SW for another 2m before it was no longer visible due to modern truncation. The ditch averaged 0.16m deep and produced five sherds of prehistoric pot, of the same type and possibly the same vessel, as that found in pit **46433**. As such this pot cannot be used to securely date the ditch to the same period as the pits, as it is probable that when the ditch truncated **46433** a portion of a pot was upcast onto the sides of the feature and either slipped or was deliberately dumped back into the ditch following the disuse of the feature.

The ditch was interpreted as a field or enclosure boundary, possibly with a deliberate entranceway constructed in it, though at 0.4m the gap seems very narrow for an access, and it may be that the apparent break in the line of the ditch was just an undulation in the base of the feature, which immediately to the north of the "entranceway" was only 0.04m deep.

4.2.14 Plot 468-469 (re-routed)

A possible major Roman site was identified straddling plots 468 and 469 during the non-intrusive surveys undertaken prior to the construction of the Brecon to Tirley pipeline.

The plots lay on the projected course of the Ariconium to Leominster Roman road and a rectilinear enclosure was identified in plot 469 by aerial photograph in 1974 (CA 2006i). This was then supported by the field walking survey (CA 2006vi) which produced high proportions of Roman and prehistoric material.

A metal-detecting survey of the area collected significant proportions of Romano-British metallurgical material, and some limited evidence for Bronze Age utilisation of the site (Bartlett-Clark Consultancy 2006ii). Geophysical survey of the plots revealed a well-defined rectilinear enclosure, with numerous associated features (Bartlett-Clark Consultancy 2006i).

Compiling all this data, it was hypothesised that this enclosure might represent a villa or similar substantial rural Roman site, possibly relating to metal-working. As a result of this potential, an expanded geophysical survey was undertaken of the surrounding area, revealing further enclosures and ditches to the south of the main enclosure.

A trench evaluation program was decided upon to assess the nature of these results, but the extended geophysical survey also showed a relatively “blank” area to the north and east of the plot, and so the decision was made by National Grid to abandon the trench evaluation program for these plots and reroute the pipeline to the north and east of its original course. Trench evaluation of this new route confirmed the geophysical survey results that no archaeology was present in this area.

4.2.15 Plot 496 (Fig. 46 and 47)

Background

Plot 496 (NGR 36751 22944) was located about 100m north of Kempley Green in Gloucestershire, just to the east of a public bridleway. The site was utilised as pasture at the time of excavation.

The topsoil was mid red brown friable clayey silt overlaying mid red brown firm silty clay. These soils were fairly poorly drained and overlay pale brown red compacted clay.

The archaeological desk-based assessment did not identify any features of significance within the vicinity of the plot (Cotswold Archaeology 2006i).

The geophysical survey revealed an anomaly (Bartlett-Clark Consultancy 2007), based on which a single evaluation trench was targeted on this plot (Network Archaeology 2009i). This trench contained two cut features which produced a wealth of domestic debris amongst the finds suggesting that a settlement would be in the vicinity, so an open area excavation was defined in advance of construction.

The site contained two large Iron Age or early Roman pits, one of which was truncated by an early Roman waste disposal pit. Five other undated pits were in the vicinity, together with three undated tree bole and three undated post or stake holes.

A post-medieval pit was located on the northern edge of site.

Phase 1a: mid-late Iron Age/1st century AD

The site was dominated by two large pits in the centre (plate 10). The north-western of these, **90020** measured 3.05m in diameter and was 0.22m deep. A single charcoal rich deposit filled this pit, and that produced 24 fragments of animal bone: eight long bones of medium mammals, two large mammal ribs and an unidentifiable bone fragment; there were also small fragments of burnt bone, though the species from which they derived proved impossible to determine, and given the presence of human remains in phase 1b pit **90035** that possibility can also not be ruled out. Alongside the bones were four sherds of indeterminate mid-late Iron Age or 1st C Roman pottery, suggesting that the pit was used for the disposal of domestic waste.

Southeast of **90020** was the second pit (**90040**). This appeared to be much the same size and shape as **90020**. It contained two, very similar, charcoal rich fills, neither of which produced any finds, which may be due to the truncation of the feature. As such it could not be dated, nor could a function be ascribed to it, though it seemed likely, given their proximity and physical resemblance that it performed a similar role to **90020**.

The presence of two large refuse pits in close proximity suggested a significant Iron Age or 1st century occupation near the site, though no definitive evidence of such was noted within the width of the pipeline. It is possible that such a site might have been truncated by ploughing, and the relatively shallow nature of these pits compared to their diameter supported that possibility.

Phase 1b: 1st century AD

Phase 1a pit **90040** was truncated by a smaller, but deeper, pit (**90035**) (figure 48a). This pit contained no less than eight deposits, mainly tipped fills or dumps.

These fills produced animal bone, iron slag, globules of copper alloy melt, 272 sherds of prehistoric and Roman pottery dating between the mid-late Iron Age and 1st Century AD, and 82 fragments of burnt human bone with a total weight of 11g.

The presence of burnt human remains amongst the other finds was of interest, as the feature otherwise appeared to be a domestic waste disposal pit. Ignoring, for now, the possibility of cannibalism, it may be that the residue from nearby funeral pyres was dumped in what otherwise was a domestic waste pit, after the more substantial burnt bone had been carried off for a more decorous disposal. However, the burnt bone in this pit included the largest single fragment of burnt bone located amongst all the cremations on the pipeline project, at 38mm long, and most of the bone fragments were larger than those from the other cremations, as a result of which it was possible to identify that one of the cremated individuals was a young juvenile, of 6 years or younger.

Notably, the rib bone of the cremated juvenile had copper alloy staining on it, possibly indicating that the individual was wearing a copper alloy item on its chest at the time of cremation, or possibly related to the same activity as the droplets of molten copper alloy which were recovered from a later fill of the pit.

The environmental samples taken from the fills are almost entirely comprised of fuel ash, and include small fragments of burnt bone, considered too small and fragmentary to be usefully assessed, and vitrified material suggestive of intensive burning.

The intensive usage of this pit suggested that the predicted nearby occupation continued relatively unbroken through into the early Roman period, though it was apparently abandoned by the early 2nd century AD.

Phase 2: Post-medieval

A third pit of notable size (**90008**) protruded from the northern edge of the excavation area, and continued beyond the extent of the pipeline route. The feature contained a single fill, though a spread of re-deposited subsoil also covered the feature. The fill of the pit contained a pig mandible, two pieces of fired clay, two pieces of post-medieval or modern tile, barbed wire, and a sherd of 18th or 19th century AD creamware.

Unphased

The majority of the features on the site contained no artefactual evidence, nor did they have any stratigraphical relationship to any other feature, and as such they could not be assigned to any particular phase.

These comprised a total of 11 pits of varying sizes and forms. The nature of the pits was unclear, though many appeared to represent tree holes, probably representing a phase of land clearance, though no date could be assigned to this.

5 THEMATIC DISCUSSION

Based on the results of the post excavation assessment (Network Archaeology 2010) and in regard to national research objectives derived from established research agendas (see section 2.1) set out in the Archaeological Framework Document (National Grid/RSK 2006), a number of themes were identified for discussion within the Updated Project Design (Network Archaeology 2011i).

Section 5.1 analyses the prehistoric data recovered during the pipeline works, and seeks to place it within its regional context. The data was separated into ritual and funerary sites and settlement sites, and then addressed as a whole in order to understand the distribution of prehistoric activity along the pipeline.

Section 5.2 presents the Iron Age and Roman settlement activity along the pipeline, with particular regard to understanding the transition between these two periods.

Section 5.3 focuses on the predominant dataset recovered from the pipeline works: the Roman environment. The data is analysed in terms of settlement and within the wider context of roads, trade and industry.

5.1 Understanding Prehistoric Activity along the Pipeline

The Brecon to Tirley pipeline project revealed a total of eleven prehistoric sites, or sites incorporating features of a prehistoric origin, along with another eight which demonstrated some evidence for a prehistoric origin.

These were, from west to east, plots 49, 60, 75, 111, 111a, 269, 314, 331, 400, 461 and 464. Sites 271, 454 and 496 all contained pottery with potential Iron Age characteristics which might have indicated a prehistoric origin for the activity in those areas, though the majority of these pieces were of a fabric type which changed minimally between the late Iron Age and early Roman period, meaning that they may not be prehistoric in origin. Two further plots were identified containing significant prehistoric finds scatters, but no attendant features: plots 368 and 467; and three further plots may have had prehistoric elements prior to their Roman occupation: plots 250, 430 and TFC plot 2.

The sites are summarised in the table below:

Table 5.1 Summary of Prehistoric Sites

Plot	Description of Prehistoric Archaeology
49	Bronze Age cremation cemetery
60	Bronze Age cremation
75	Pit containing prehistoric pot, possibly one of two
111	Limited evidence for prehistoric features relating to Spread Eagle funerary landscape
111a	Large layer deposits containing prehistoric lithic material, possibly relating to neighbouring Spread Eagle funerary landscape
250	Possible Iron Age origins to small, rural Romano-British enclosure
269	Possible Neolithic pit alignment
271	Possible prehistoric pre-cursor to substantial Roman settlement
314	Prehistoric pit containing 46 sherds of possibly Early Bronze Age pot
331	Possible Iron Age precursor to Roman activity
368	Lithic scatter, retained by landowner and so not properly studied, though one was tentatively identified from photograph as an early Neolithic leaf-shaped arrowhead
400	Two pits containing Beaker pottery
430	Possible Iron Age precursor to early Roman metalworking
454	Possible late Iron Age enclosure expanding during Roman period
461	Iron Age cremation
464	Bronze Age cremation site
467	Scatter of possible Beaker pottery
496	Late Iron Age / Early Roman pot in apparently Early Roman waste pits
TFC Plot 2	Possible Iron Age precursor to Roman features

In addition to these a total of 46 prehistoric spot finds, sometimes including several individual finds, were identified along the course of the pipeline, predominantly (93.4%) consisting of lithic scatters, with the remainder being prehistoric potsherds (see figures 5 – 7)).

5.1.1 Ritual and Funerary

A map showing the distribution of prehistoric funerary sites was compiled from both the pipeline findings and previously known funerary features within 10km of the pipeline route. This map has been included with the archive for reference.

Spread Eagle Funerary Landscape

Highlighted by the Desk Based Assessment prior to construction was the Spread Eagle Funerary Landscape site, near Aberllynfi, in Powys. This site was described by the Clwyd-Powys Archaeological Trust HER as a ring-ditch group containing six ring-ditches, ranging from 6m to 20m in diameter, which appeared to form part of a barrow cemetery near the confluence of the rivers Llynfi and Wye. Based on the cropmark evidence a Neolithic cursus monument was also suggested, comprising two parallel ditches. Aerial photographs indicated that almost the entire cemetery appeared to be located within the wider field traversed by plot 111, though only three ring ditches were directly in the line of the pipeline easement (monuments 3101, 3103 and 3104). A a single ring ditch, monument 3090, was located a couple of fields away to the north, in an area beyond the scope of these works.

The alignment of the cropmarks from which the cursus monument (monument no. 3097) was hypothesised matched the orientation of the Roman roadside ditches identified in plot 110, therefore it is likely that this feature was not related to the barrow cemetery at all. Given that the cursus element of the Spread Eagle funerary landscape appears to have been a misinterpretation of the Roman road, it may be that the evidence for an expansive funerary landscape is also in doubt. Indeed, the excavations at plot 111, and the two neighbouring plots 110 and 111a, were relatively inconclusive with regard to prehistoric activity. Initial work seemingly identified a number of prehistoric pits in plot 111a, however subsequent further work revealed that these were in fact much later in date, probably early Medieval based upon the radiocarbon dates. The rather irregular and nebulous nature of the features in plots 111 (ditches and pits) was more suggestive of a natural rather than anthropomorphic, prehistoric, origin for many of them. Nevertheless, it must be borne in mind that the strategy of evaluating only a narrow window along the centre line of plot 111 presents the risk that further features may have been masked by the colluvium to either side of the pipe trench. A total of 51 flints recovered from plots 110, 111 and 111a, predominantly from alluvial layers in plot 111a and the colluvium in plot 111, with dates ranging from the Mesolithic through to the Bronze Age,do, however, confirm prehistoric activity in the area.

Other barrow cemetery sites in Powys, for example Four Crosses, near Llandysilio (Warrilow *et al*, 1986) and Trelystan Round Barrows, near Trewern (Britnell, 1982), bear little comparison to the findings in plot 111, with those sites producing much more substantial and definable features.

Further ring ditches have been identified closer to the Spread Eagle site, notably in Radnorshire, 23km to the northeast, where 29 such features have been identified; as yet none of those have been excavated and confirmed, except for an evaluation of the 100m diameter Walton Court Farm ring ditch in 2009, which was interpreted as a formative henge and is of little comparative value to the purported ring ditch cropmarks at the Spread Eagle site (Jones 2010).

The presence of Pipton Long Cairn (HER 511) 0.8km to the south, the Little Lodge Tomb (HER 512) at Three Cocks and the chambered tomb at Croes Llechan (HER 515) all suggest that the higher land to the south of the site *was* part of a pre-existing wider prehistoric funerary landscape (Jones, 2007), which may well have also comprised the river valley and hence the Spread Eagle site.

Inland and Upland Funerary Sites

Welsh Research Objectives 2 and 4 were both (at least in part) designed to address the shortfall in understanding of inland and upland sites, with Objective 4 being particularly focused on funerary and ritual landscapes and practices. The information gleaned from the investigation of a Bronze Age hilltop cremation cemetery in plot 49 can be applied to both.

The site had no visible surviving monument such as a cairn, which tended to be a feature of later Bronze Age sites. As the radiocarbon dates from the unurned cremation suggested an early Bronze Age date it may be that this was a long-lived cemetery originally established without a monument, and re-used through into the later Bronze Age.

Only one other Bronze Age cremation site without a cairn is listed on the Powys Historic Environment Record for the area: the Fan y Big cremation site (PRN 5697). This comprised two cordoned urns apparently contained within a pit, though due to erosion this could not be directly ascertained. No cairn was present at the site, but the site recorder felt that this was due to poor preservation rather than an absence of a cairn in the first place (Archwilio, 2012).

However, most of the cremations at plot 49 showed signs of truncation at some point in antiquity, most likely during post-Medieval agricultural activity, and it may be that any monument that did mark the cemetery was also truncated at this point. It is entirely likely that during the construction of the nearby turf-and-stone bank (**49005**) that a ready source of stone such as a cairn would have been robbed.

Analysis of the Collared Urns recovered from a small number of the cremations indicated that the date range for this type of vessel fell between *c.*2100 -1300 cal BC and that these examples were of a typologically late date type; suggesting a date more toward 1300 BC than 2100 BC (though the ceramic specialist noted that the pottery was only partially preserved, and as such her comments were made with reservation). This contrasted, however, with the radiocarbon dates recovered from one of the unurned cremations and the central pyre pit, which were both dated to between 2190 and 1880 cal BC.

As such, the cemetery may well have had an early Bronze Age origin (based on the radio carbon dating), where up to five un-urned cremations were interred around 2000 cal BC, with a second phase of use perhaps as much as six centuries later when a further three urned cremations were inserted into the cemetery (based on the pottery form). It is perhaps more likely that, given the specialist's reservations regarding identification of the Urn forms, that the entire cemetery is towards the earlier end of the Collared Urn's date range, probably around 2000 BC.

In terms of the location of the cemetery, assuming the presence of several extant springs near the site were contemporaneous, these would have made the vicinity an appealing place for upland, inland settlement, as well as potentially a site of ritual significance. The site was positioned on a moderate southwest facing slope, ranging in height from 344m to 348m OD. The cemetery itself was sited around a small rocky outcrop at the brow of the slope, making its location readily visible for some distance to the south and west. As such, it was perhaps surprising that the watching brief found only one other prehistoric site within 2.5km of the site (plot 60, see below). Within a simlar radius the Powys HER records the Tir Bach Bronze Age standing stone I (SMR no. 2851, 1.7km NE of plot 49); Cae Maen Hir possible standing stone (SMR no. 2812, 2.5km S of the plot); and the supposed Waun Diroedd Cairns (SMR no. 2860, 1.8km east of the site).

However, the Waun Diroedd cairns were three possible round barrow cairns identified from a 1972 Ordnance Survey aerial photograph. A site visit by CPAT in 1979 found no such features visible on the ground, and the site was considered to be a misinterpretation of depressions in a field of corn. Similarly a 2004 CPAT visit to the Tir Bach standing stone failed to locate anything other than a natural boulder, whilst the Cae Maen Hir stone site was only hypothesised from the place name.

Two confirmed cairned cremation sites of a similar date to that returned by the radiocarbon dating were, however, excavated *c.*19km to the SSW in the Brecon Beacons by Clwyd-Powys Archaeological Trust (CPAT) in the late 1980s and early 1990s, at Corn Dû and Pen-y-Fan (Gibson 1997). Both of these were standing monuments on prominent mountain-tops, and both had central burial cists. Whilst pit **49054** was roughly central to the surrounding cremations at plot 49, there was no evidence that this was a cist, and its shape was very irregular for it to be a deliberate burial pit. Similarly, the site at plot 49, despite being in an upland location, did not have the commanding aspect of either mountain top cairn.

Whilst few Collared Urns have been located in the immediate vicinity of plot 49, further afield they have been identified at a number of sites, with comparable urns almost exclusively from upland Cairn sites, such as Lan Fawr, near Churchstoke, Powys, roughly 60km to the north, and Llangynidr, Powys, about 15km to the south. Collared Urns were also recovered from round barrows at Jacket's Well, near Knighton (about 40km NE of plot 49) and Llansaintfred-in-Elvel, Powys (about 18km NE of plot 49). The urns from round barrows were, however, from Longworth's primary series, and as such not direct comparisons for the urns found at plot 49.

One of the Collared Urns from plot 49 showed signs of internal burning, indicating that it had been used prior to its role as a container for human remains. Collared Urns were named for their occurrence in funerary contexts, though they are also found in domestic contexts. An analysis of the residues on a number of Collared Urns from both domestic and cinerary contexts revealed that "Collared Urns were obviously heavily used for everyday cooking and later in their life history… participating in funerary rituals" (Šoberl *et al* 2009, p.10).

A further unurned cremation was located *c.*1.7km to the northeast of plot 49 in plot 60, located at around 280m above sea level on Ponde common. This lay just below topsoil, and took the form of an amorphous spread of burnt bone and charcoal. Analysis of the bone revealed it to be human, with the recovered bone comprising skull and long bone fragments only. No age or sex could be determined for the individual concerned. Sufficient material existed for an AMS date, and this showed the cremation to date from between 1940 and 1740 BC calibrated. Unurned cremations are not particularly rare in the early Bronze Age, and indeed the date of this cremation is roughly comparable to the unurned cremations in plot 49, however the discovery of one in isolation, without any attendant prehistoric activity, is considerably rarer, and is unique in Powys. This is most likely due to the inherent difficulty in locating such a deposit without any more substantial marker, or nearby features, to indicate its existence.

The amorphous spread of the cremated remains, together with the lack of smaller surviving bones, might suggest that an original, more complete, cremation was disturbed at some point in the nearly four millennia following its interment just below topsoil, and that disturbance resulting in the less robust elements of the unurned cremation being lost. Such a disturbance may also account for the lack of extant accompanying activity or grave markers. Another possibility is that the deposition of the cremation bore similarities with the modern tradition of scattering ashes, which tend to result in Aeolian dispersion of the smaller and lighter material, together with a more concentrated dump of the heavier bone and fuel ash. Evidence for prehistoric scattering of ashes is scant, but has been recorded at Bronze Age sites in Estonia (Lang 2011).

Perhaps the most likely interpretation of the deposit, given its shape and composition, is that it was a dump of pyre waste, though the lack of *in-situ* burning at plot 60 indicated that it had been transported from a nearby pyre, rather than simply dumped at the point of cremation. This was by no means uncommon in the Bronze Age, though discovery of such dumps is quite rare (McKinley 1997). This probably suggested that in the very near proximity to plot 60, most likely nearer than the 1.7km to plot 49, was another early Bronze Age funerary site. This might relate to the supposedly Bronze Age Mynydd Fforest cairn and stone less than 0.5km to the NE (HER 5534 and 5536), though a CPAT visit in 1979 felt the cairn might have related to post-medieval field clearance, and a subsequent site visit in 2004 considered that it may just be a stone outcrop. The stone was not located during the 2004 site visit, but was considered most likely to be a post-medieval boundary stone.

English Prehistoric Funerary Sites

In England, in plot 464, c*.*55km ESE of the plot 49 cemetery and the plot 60 cremation,another example of an apparently cairnless Bronze Age burial was recorded in the form of two further probable cremations associated with prehistoric pottery of indeterminate date. In close proximity to the cremations were further pits, postholes and stakeholes that produced pottery of early Bronze Age date, though beyond that generality they were indeterminate in nature. None of these features appeared to be ash dump pits.

Whilst no reliable patterns could be discerned from amongst the arrangements of the postholes and stakeholes, it was highly probable that a number were related to some form of structure. Assuming the indeterminate prehistoric pottery from the cremations was roughly comparable to that of the neighbouring pits, and that the site was largely contemporary it was probable that these related to some form of funerary structure (such as a pyre) as there is little evidence for Bronze Age burials directly within settlements, particularly within Herefordshire, where Bronze Age settlements themselves are extremely scarce.

Known Bronze Age activity within the close vicinity is limited to a Bronze Age axe recovered from Oldbury Camp, near Much Marcle a little over 5km to the northeast, and a hoard of Bronze Age axes reportedly ploughed up in the 18th century AD near Inglestone, on the ascent from Hole-in-the-Wall towards Old Gore, no more than a kilometre to the north of the site.

Further afield, numerous Neolithic and Bronze Age artefacts and three possible barrows are known at Walford, 8km to the SW of plot 464 (Herefordshire SMR, notably nos. 936, 7496 and 8488); a Bronze Age cist burial was identified at Trdychan Farm, Llangarron (HSMR 6410), 11.5km to the SW; a putative Bronze Age barrow was identified at Midsummer Hill Camp, near Eastnor (HSMR 7150) 14km to the NE; A standing stone and ring ditch were identified near Withington, 16km to the NW (HSMR 1270 and 7056); Bronze Age barrows and finds were discovered at Colwall, 18km to the NE (HSMR 3217, 3218 and 37021); and 21km to the NE was a Bronze Age urnfield at Mathon (HSMR 3759).

Though none of these was directly comparable to the site at plot 464, they do place the site within a fairly active late Neolithic/Early Bronze Age landscape, however no evidence for Bronze Age settlement is known other than a possible late Bronze Age hearth at Noakes Cottage, near Weston-Under-Penyard (HSMR 844) 4.5km to the SE.

Only 1.1km to the west of the Bronze Age activity in plot 464 was a further cremation, in plot 461. This feature lacked any associated pottery or artefacts, but the cremated material was AMS dated to the middle-late Iron Age. No other Iron Age cremations are recorded in Herefordshire, as such, this cremation may be of some significance, representing a burial tradition that was by no means commonplace in Herefordshire. Subsequent remedial works in and around plot 461 (Network Archaeology 2013i) did not reveal any further evidence of Iron Age activity, funerary or otherwise, though the presence of possibly quite substantial Roman activity in the vicinity may have affected the survival of other unurned cremations.

6.7km to the ENE of plot 461 were the large waste pits at Kempley Green (plot 496) which contained possible pyre waste from the early Roman period, though mixed with later Iron Age material, including mid-late Iron Age pottery. This might indicate a persistence of a local tradition of cremation in the vicinity from the mid-late Iron Age through to the 1st century AD.

5.1.2 Settlement

The Brecon to Tirley pipeline produced a fairly limited amount of evidence for non-ritual activity during the prehistoric, mostly restricted to pits and non-sepulchral ceramics, with little direct evidence for prehistoric settlement.

In plot 75 two pits containing what appeared to be waste from hearths were uncovered, the larger of which produced a single sherd of prehistoric pottery. Analysis of this sherd failed to clarify its date, whilst during assessment two separate specialists had dated it as Iron Age and Bronze Age respectively.

It was probable that these related to a fairly proximal settlement, though no such settlement was definitively identified within the pipeline easement, nor had any been uncovered by previous works in the area. A stone-lined hearth feature was identified in plot 74, *c.*150m to the north of the pits in plot 75, though no date could be ascribed to this due to a lack of artefactual evidence, nor could any direct correlation between the two sites be drawn beyond their relative proximity.

Plot 75 was located on an upland slope above and west of the village of Llyswen, in Powys, and a little over 1km from an earthwork at Tir Gwallter, argued to be variously an Iron Age hillfort, a medieval castle or a natural hill (Remfry, 1998; Remfry 1995). As neither the site at plot 75 nor the earthworks at Tir Gwallter could be definitively identified as Iron Age, then extrapolating an Iron Age landscape between them would be precipitous.

A prehistoric pit was revealed in plot 314, near Vowchurch, Herefordshire, containing 46 fragments of early Bronze Age pottery, possibly comprising at least two vessels. Four flint flakes were also recovered from the pit, including a blade shatter, though none were datable. Environmental evidence from the pit revealed charred barley grains and hazelnut, suggesting it may have been used for the deposition of food waste and hence was most likely a non-funerary context. Three possible Bronze Age barrows (SMR 1515, 4298 and 4308) and a cropmark of a potential prehistoric enclosure (SMR 30126) lie within 1.5km of the pit, though no definitive evidence for Bronze Age settlement has been identified within the vicinity. These add to a corpus of indicators that the area around Vowchurch was actively exploited during the Bronze Age, including more than 25 Bronze Age findspots in the area (Cotswold Archaeology 2006i).

Two further probable prehistoric pits were identified in plot 400, near Pencoyd in Herefordshire. These were notable as one produced 14 fragments from a single Beaker vessel dated to the late Neolithic or Early Bronze Age. Beaker pottery had been recovered from a small number of sites within Herefordshire previously, notably the relatively proximal sites of Merlin's Cave (11km SSE) and Pontshill (12km ESE), both near Ross-on-Wye, but all of these previous examples had been from funerary contexts. The Beaker pottery from plot 400 was a well made example with a complicated lozenge motif for decoration, and appeared to come from a non-funerary, possibly even domestic, feature. Two pieces of flint, including a retouched blade of late Mesolithic or early Neolithic date were also recovered from the site, though these were presumably residual, given the ceramic dating. It is possible that if the pits had contained inhumations then the bone may have decayed to nothing due to the poor preservation of Herefordshire's prevailing soil conditions, however in the nearest known Beaker burial, at Wellington Quarry (21km to the north), near Hereford (SMR 51608) the skeleton survived, albeit poorly preserved, and was also accompanied by a rich assemblage of grave goods.

Once again, there was no direct evidence for a contemporary settlement within the vicinity of plot 400, though a total of 18 lithics were recovered from nearby plots to the northwest and southeast, dating from as early as the Mesolithic through to the Bronze Age, though the majority (72%) remained undated. These might be used to infer the presence of proximal prehistoric activity, though the only flint that was definably contemporary with the Beaker pottery was found nearly 4km away, near Much Dewchurch (plot 382).

In plot 496, near Kempley Green in Gloucestershire, a further two large pits were uncovered, containing Iron Age and very early Roman pottery. The pits appeared to be receptacles for waste, possibly from a settlement with Iron Age origins that persisted into the early Roman period, though they were curious for containing, amongst apparently domestic waste, the burnt remains of a human juvenile, no more than 6 years old. As the pits also contained a high degree of fuel ash, it is possible that they were used for the disposal of cremation pyre waste, either along with more mundane domestic waste, or alternatively food and ceramic waste from funerary rituals.

It was notable that of all the cremations located along the course of the Brecon to Tirley pipeline the remains in these pits contained the largest single and average bone fragment size, suggesting that less care was taken in the gathering of burnt remains for more sepulchral disposal than from the other cremations, or that the cremation ritual involved selection of only particular remains for interment, though comparisons across such distances and differing periods are likely to be inherently flawed.

A significant scatter of flint and prehistoric pottery was identified during the topsoil strip in plot 368, northeast of Kilpeck, but the assemblage was taken into the possession of the landowner who refused to release it for assessment or analysis. Any features that might have been associated with the finds were not revealed during the topsoil stripping of the plot, nor during any subsequent construction activities, and as such it was impossible to say whether the finds related to an actual occupation area, or were merely indicators of activity in the vicinity.

Fieldwalking and metal-detector survey over the unexcavated enclosures in plots 468 and 469 produced some limited evidence for Bronze Age activity at the site, and though it is highly likely that the enclosures seen on the geophysical survey were Roman in origin, it cannot be dismissed that at least some of the features visible may have been prehistoric in nature.

Over 200 fragments of possible Beaker pottery were recovered from topsoil in plot 467, predominantly comprising degraded crumbs. It was impossible to tell from the condition of the pottery whether this was a single vessel damaged in topsoil, by ploughing or similar modern activity, or whether numerous vessels were involved. Unfortunately, these sherds were so badly degraded that by the time they were submitted for analysis no further, useful, study could be made of them, but their presence further indicates an earlier prehistoric presence in close proximity to the finds from plots 468 and 469.

The artefactual assemblages and stratigraphy at the Roman sites in plots 250, 271, 331 and 454 hinted that they may have possessed an Iron Age precursor, but these are discussed in more detail in section 5.2.1.

Overall, whilst the archaeological work hinted at early settlement (both Bronze Age and Iron Age) within its vicinity no direct, firm, evidence for settlement was uncovered, though the most likely locations for such settlement were to the north of plot 464 and around plot 314.

5.1.3 Distribution of Prehistoric Activity

In an attempt to expand upon the prehistoric information recovered during the project, all of the prehistoric sites and finds, including both individual lithics and flint scatters, were plotted onto a GIS map together with pre-existing data gathered from known sources such as the country HERs and the Prehistoric Funerary and Ritual Site Project (Jones and Owen 2002, 2004, 2005a+b, 2006a+b) to try and identify any land use patterns which might become evident (figures 5 - 7).

These figures show that there was a slight bias toward river valley locations for prehistoric finds during the pipeline project, with the following tables giving the proportions for the three counties crossed by the pipeline as identified by the DBA and by the pipeline construction:

Table 5.2 Geographical Distribution of Prehistoric Finds from the DBA

County	Hill	Valley	Total
Powys	14	37	51 (44%)
Herefordshire	12	49	61 (52%)
Gloucestershire	0	5	5 (4%)
Total	26 (22%)	91 (78%)	117

Table 5.3 Geographical Distribution of Prehistoric Finds from the Pipeline

County	Hill	Valley	Total
Powys	6	15	20 (32%)
Herefordshire	16	24	39 (63%)
Gloucestershire	0	3	3 (5%)
Total	20 (32%)	42 (68%)	62

The tables show that the data recovered by the pipeline works mirrored that already known prior to construction, though there was a relative *increase* in the proportion of prehistoric finds identified on hillside or hilltop locations.

It should be noted, as well, that the near 2:1 ratio of valley versus hill sites is somewhat misleading as the pipeline route itself had a preferential bias toward following the lower lying river valleys, only crossing upland areas where necessary.

The results also appeared to suggest that the prehistoric exploitation of the area of the pipeline route was fairly evenly spread throughout Powys and Herefordshire, given the relative distances crossed by the pipeline, with a marked drop off in discoveries in Gloucestershire. However, during the construction of the Tirley Feeder Connector pipeline, and the associated Tirley PRI works (Network Archaeology, 2012), the archaeological features were seen to be very hard to distinguish from the natural substrate upon initial topsoil stripping, becoming more distinct as the soils were exposed to the elements for a protracted time, a period well in excess of that available during the more rapid construction sequence of the pipeline; hence an apparent lack of sites in north-west Gloucestershire might actually result from a combination of the local geology and the construction methodology not allowing suitable time for less obvious features, such as prehistoric sites, to “weather out” before the construction process impacted and obscured them.

The sites identified during the DBA and the subsequent archaeological works, however, showed a marked bias toward hill locations for ritual sites, with nearly twice as many being located in hill areas as in the valleys. The remaining site types identified during all phases of work showed no significant preference, or were too small a sample to base reasonable extrapolations on, as shown in the following table:

Table 5.4 Geographic Distribution of Prehistoric Site Types

Site Type	Hill	Valley	Total
Ritual	20	11	31
Agricultural	0	1	1
Settlement	7	8	15
Industrial	0	2	2
Find spots	19	111	130
Total	46	133	179

The presumption had been that occupation and exploitation of the upland areas expanded in the benign climate of the Neolithic, and declined around 1100 BC (Late Bronze Age) as that climate deteriorated (CPAT, 2012). Unfortunately the vast majority of the prehistoric 'sites' identified during the Brecon to Tirley pipeline project consisted of undated spot-find sites. However, for those sites that could be dated, either by radiocarbon date, ceramic or lithic typology, the above dating hypothesis seems to be borne out, with all the Bronze Age activity located on the pipeline being from the early Bronze Age.

Caution should be exercised with the use of lithic typologies for such comparisons, though, as by the mid-late Bronze Age readily diagnostic features were less apparent except in the case of finished tools, and there was also a marked reduction in the use of lithic technologies in areas where flint was not readily available locally, with metal becoming the preferred material to be imported.

To avoid over-complication, the following table shows only the latest probable prehistoric date for each site (so a lithic spot-find site dated as Mesolithic/Neolithic would be charted as Neolithic).

Table 5.5 Geographic Distribution of Prehistoric Sites Identified by the Pipeline Works, by Period

Site Date	Hill	Valley	Total
Mesolithic	9 (75%)	3 (25%)	12 (31%)
Neolithic	11 (58%)	8 (42%)	19 (49%)
Bronze Age	5 (83%)	1 (17%)	6 (15%)
Iron Age	0	2 (100%)	2 (5%)
Total	25 (64%)	14 (36%)	39

This table suggests that activity was just as, if not more, prevalent on hills during the Mesolithic as it was during the Neolithic, indicating that the climate of Herefordshire and Powys was not particularly dissuasive to earlier prehistoric exploitation. The evidence for both periods, though, was scarce and consequently conclusions drawn from find spot data must be treated somewhat hesitantly.

Figures 5 to 7 do not show any particular prejudice towards east or west with regard to lithics recovered along the pipeline, with 21 lithic findspots in Powys, 14 in western Herefordshire (defined here as west of Hereford), 23 in eastern Herefordshire and 5 in Gloucestershire. The previously known finds scatters show a similar distribution, around the pipeline vicinity, though the large cluster around the Golden Valley in Herefordshire may relate more to intensive landscape surveys of that area in recent years rather than the area being a particular “hotspot” for Herefordshire lithics.

The pipeline lithics were very limited in number so one must be wary of drawing too many conclusions from them, but they appeared to highlight four separate areas where flints were recovered in greater numbers than elsewhere. These were:

- Between Llyswen and Three Cocks in Powys (10 findspots)
- Between Cusop and Hardwicke in Herefordshire (7 findspots)
- Around Wormelow Tump in Herefordshire (7 findspots)
- And from the east bank of the river Wye to Old Gore (9 findspots)

Of these, only the Llyswen to Three Cocks area was previously known to be an area of significant prehistoric exploitation.

The environmental data recovered from the prehistoric sites was almost universally poor across all three counties. Very little ecological information could be gained from any of the features sampled, with the vast majority returning no preservation beyond wind-blown weeds and charcoal. Of the identifiable plant macrofossils the most common was hazel shell, followed by indeterminate tubers. As the majority of these came from funerary contexts it was impossible to say how representative of the local palaeoenvironment these samples were.

An auger sample from an area of peat discovered in Herefordshire, in plot 346, returned a date of the end of the Neolithic into the start of the early Bronze Age (Rackham, 2009), but as there were no sites located on the easement within 1km of this peat deposit (the nearest prehistoric activity discovered being the Bronze Age pit in plot 314 – *c.*8km WNW - , the Iron Age activity at plot 331 – *c.*4km WNW - and possibly the flint cache discovered in plot 368 - *c.* 4km SE) it was felt that further analysis would add little to our understanding of the pipeline sites .

5.2 Iron Age and Roman Settlement Activity along the Pipeline

The vast majority of the finds recovered from the Brecon to Tirley pipeline project dated from the Roman occupation. These were predominantly from ten major Roman sites, at plots 110, 160, 250, 271, 331, 400, 430, 454, 468-9, 496 and plot 2 on the Tirley Feeder Connector, whilst the sites at plots 111a and 269 included Roman features.

Two further minor watching brief sites (plot 562 and Tirley Feeder Connector plot 7) produced smaller quantities of datable ceramics. Plot 562 revealed the rounded terminal of a NW-SE ditch, a single excavated slot through which produced a sizeable quantity of 2nd century AD pottery, indicating that some significant Roman activity was occurring in the vicinity at that time; plot 7 on the Tirley Feeder Connector produced a spread of Roman pottery from just below the topsoil which, given the lack of surface material elsewhere on the project, suggested that there might have been a focus of Roman activity in closer proximity to plot 7 than plot 2 (350m to the west) or the Tirley PRI site (320m to the SE).

Of all of these sites, the enclosure sites at plots 250, 271, 331, 454 and possibly the pit site at Plot 496 showed some evidence of originating during the Iron Age and persisting through the transition to the Roman period.

The Roman findings were plotted onto a GIS map of the pipeline route, together with the Roman findings from the Desk Based Assessment in order to place the Roman activity identified along the pipeline route into its wider regional context (figures 8 - 10).

5.2.1 Transition from Iron Age to Roman

Figures 8 to 10 show the distribution of known Roman and Iron Age sites along the pipeline route. The bulk of the previously known Iron Age sites were hill forts, presumably due to their more obvious nature, though aerial photograph analysis suggests that many more small rural settlement sites would have existed around these larger centres (Ray 2002). Many of the hillforts show evidence of continued usage into the early Roman period (Haselgrove 1997), and it is perhaps unsurprising that figures 8 to 10 show that where hillforts were known there are clusters of Roman activity, such as near Brecon and Clyro in Powys, and Vowchurch and St Owen's Cross in Herefordshire.

The only notable exceptions to this were the Hill of Eaton camp near Foy (HER 2697), Herefordshire and Twyn-y-Gaer (HER 5552) near Lower Chapel, Powys. Of these, the Brecon to Tirley pipeline uncovered two new Roman sites within 5km of the Hill of Eaton camp, plots 454 and subsequently plot 461 (recorded during the Ross Remedial works (Network Archaeology 2013)), along with two sherds of Roman pottery finds from topsoil on the western side of the river Wye (plot 441). No Roman remains were identified near Twyn-y-Gaer.

Though the reverse correlation could not be made, and the presence of Roman activity did not indicate prior Iron Age occupation, most notably in Gloucestershire (figure 10), this may be as much the result of the lack of identification of smaller rural Iron Age sites as it was due to the expansion of settlement into virgin land during the Roman period.

The four enclosure sites with possible Iron Age origins and Roman continuity consisted of a variety of enclosure types: Sites 250 and 331 containing single-ditched enclosures, with the enclosure at plot 250 being rectilinear whilst that at plot 331 was pen-annular; the Iron Age enclosure at plot 271 was represented by a single fragment of a curvilinear ditch; largely truncated by the later Roman triple-ditched enclosure, whilst the enclosure at plot 454 had a single ditched boundary, extended and reinforced as a double-ditch on one side.

Enclosures are very common along the Welsh border, with Rowan Whimster's 1989 survey of the Welsh Marches recording nearly 500 in Shropshire, Clwyd and Powys, whilst the Herefordshire SMR alone records over 400 enclosures. The vast majority of these are known only as cropmarks and so may be of any date or function.

All of the Iron Age/Roman enclosures revealed by this project were located in Herefordshire. The Herefordshire SMR lists seven further enclosures, investigated as part of other projects, which had revealed Iron Age origins and gone on to last into the early Roman period.

The Iron Age ceramic assemblages from the Brecon to Tirley sites were characterised by Palaeozoic limestone-tempered handmade wares, Malvernian rock-tempered wares, grog-tempered ware and early Severn Valley wares. One problem with such assemblages in this period is their longevity and broad date range, which makes it difficult to identify how late the sites may have been. It is likely that some sites continued with little perceptible change in the ceramic repertoire well into the Roman period with the inhabitants possibly even deliberately eschewing Roman culture in isolated areas, meaning that some sites whose ceramic assemblage might suggest Iron Age origins may in fact be very early Roman. Of those sites with apparent Iron Age and early Roman occupation, only plot 331 showed evidence of a continued occupation into the 2nd century with a few typical 2nd century products such as Central Gaulish samian, Dorset Black Burnished ware and Severn Valley ware forms that dated to the late 1st and 2nd centuries. The Frome Valley project by Herefordshire Archaeology revealed a broadly contemporary probable rectilinear enclosure at Brookhouse Farm, Avenbury, which was *c.*50m across and dated by the ceramics to being occupied between the late Iron Age and the 2nd Century AD (White, 2011).

The ceramics from Plot 271 appeared to show a break in activity around the later 1st-early 2nd century with subsequent reoccupation in the later Roman period. This ceramic dating suggested a more defined hiatus in occupation between phases 2a and 2b than the stratigraphy alone, and may have related to a native pre-Roman enclosure falling out of use during the years immediately following the Roman invasion and then later being re-established once the area was more settled. No direct correlations for this have been identified elsewhere in Herefordshire, and the apparent break in the ceramic record may be the result of the rather “keyhole” nature of the investigations in plot 271.

The site at plot 454 was in the approximate location of Foy Camp, as marked on Isaac Taylor’s 1754 map of Herefordshire (probably within 50m). By the time of Bryant’s 1835 map the supposed site of this camp had migrated *c.*1.5km to the northeast, nearer to Hole-in-the-Wall, and it was again marked in this location of the 1st edition OS map in the late 19th century (Archenfield Archaeology, 2012). Nothing of either purported camp was visible on the 1946 or 1966 aerial photographs of the area. The Herefordshire SMR lists this “camp” as a single large ditch, seen on a University of Birmingham aerial photograph, but also noted that no such ditch was visible on a 1959 Cambridge University aerial photograph, though two possible ring ditches were noted in the field immediately to the south of plot 454 (Herefordshire SMR, no.852, 7004 and 7132). Foy camp was marked by Taylor as a prehistoric promontory camp, occupying a defensive position over the banks of the River Wye, though it was unclear as to what evidence he had for the camp’s existence. Following completion of remedial works on the pipeline at Ross, another Roman site was postulated to the north of plot 461, which would be closer to the location of Bryant’s marked camp, though still around 1km away.

The ceramic assemblage from plot 454 was sizeable, comprising over half of the Roman and Iron Age pottery recovered from the entire project; this may be a slightly prejudiced perception as a deliberate process of pot recovery beyond the excavated slots was undertaken at this site and not elsewhere. Jane Timby's analysis of the recovered ceramics asserted that the site originated in the 1st century AD, and that the prehistoric material was residual. This hypothesis appeared to be backed up by the fact that the prehistoric finds came from features that also produced later Roman pottery. However, where the Iron Age pottery was found, it was predominantly in the primary fills of the main enclosure ditch, seemingly accumulated during the active use of the enclosure whilst the later Roman pottery was in the upper backfill of the same feature, likely accumulating as the feature declined into disuse. This indicated to this author that the enclosure may well have had a Late Iron Age origin and was subsequently occupied and extended during the Roman period, showing continuous occupation through until the 3rd century AD.

The geophysical survey of the site showed that the main L shaped rectilinear enclosure found at plot 454 extended to the north and east of the pipeline route, and as the true scale of the final enclosure was never fully defined it was impossible to say whether the early enclosure might have been a large, defended Iron Age promontory camp, or whether it was a smaller hilltop farmstead, that was later expanded and possibly fortified during the Roman period. The nature of the early enclosure ditch did not resemble a defensive structure, though the site was on an exposed hilltop and under arable cultivation, so the potential for significant erosion and modern truncation was high, and as such the original ditch may well have been markedly wider and deeper, making it a viable defensive feature. It is possible that the single large ditch seen on the University of Birmingham aerial photographs may relate to the findings in plot 454 (specifically the main ditch feature), but no direct correlation could be made.

The enclosure at plot 454 was part of a wider landscape, both in the later Iron Age and into the Roman period. The Roman site identified north of plot 461 during subsequent remedial works (Network Archaeology 2013) likely dated predominantly from the 2nd century AD, Approximately five kilometres to the south of plot 454 was the Roman town of Ariconium, near Weston-under-Penyard (Herefordshire SMR, no 842), which also had late Iron Age origins, and reached its peak in the 2nd to 3rd centuries AD, making the town roughly contemporary with plot 454, though the town persisted into the 4th century. One km to the north of Ariconium a group of four enclosures were identified from aerial photographs by the Dean Archaeology Group. Excavation of these interpreted them as at least two pre-Flavian fortlets (44-85 AD), though the interim report on the excavations suggested that at least one of the enclosures uncovered had an Iron Age origin (Halliwell, 1990).

Of the transition period enclosures located along the pipeline, only one – that in plot 331 – was fully contained within the pipeline spread. The transitional feature identified was an enclosure consisting of a pen-annular ring ditch, enclosing an area of roughly 450m2. The remaining enclosures, at plots 250, 271, 430 and 454, all extended beyond the limits of the pipeline construction easement, and as such no measurement of their true size could be obtained. In the table below the area enclosed refers only to that visibly enclosed within the pipeline easement.

Table 5.6 Size of Transition Period Enclosures

Plot	Area Enclosed Within Pipeline (m2)
250	904
271	Unknown
331	450
454	1058

The enclosure at plot 250 was only seen as a rough “L” shape, potentially continuing to the NW beyond a possible entranceway, though this would give the enclosure an unusually asymmetric shape. It may be, instead, that the ditch to the NW represented an associated field boundary or enclosure annexe. The “L” shaped ditch enclosed an area of just over 900m2 to the southeast within the pipeline spread, though how much more extended beyond that was uncertain.

The earlier enclosure at plot 454 enclosed an area of *c.* 580m2, whilst the later extension to the southeast nearly doubled that. Both the earlier and later enclosures extended to the north and east and could conceivably have been of any size.

The later triple-ditched enclosure at plot 271 enclosed an area of 2485m2 within the pipeline easement. As this had pretty much obliterated all trace of any earlier enclosure it was impossible to say how large this might have been, though the small scale of the short curvilinear ditch that represented the early enclosure perhaps suggested it was a much smaller area.

As the four enclosures also differed in form, as well as size, few direct comparisons can be drawn between them, with only the early enclosure at plot 454 and that at plot 250 having any similarity at all, both being single ditched rectilinear enclosures. There, though, the comparisons ended with the plot 250 enclosure being located on what appeared to be a former floodplain of the river Dore, whilst plot 454 occupied a high hillside overlooking the river Wye.

Indeed, it was possible that the plot 250 enclosure was not a settlement enclosure at all, given the lack of internal features, and it may be that it represented an agricultural enclosure, such as a stock pen or field system, though over 130 sherds of pottery recovered from the enclosure boundary perhaps suggests occupation.

The pen-annular enclosure at plot 331 was also originally interpreted as a possible stock enclosure, as with an internal diameter of *c.*25m it was extremely large for a single structure, but small for a domestic enclosure. In the 1930's Gerhard Bersu made a study of Iron Age roundhouses in Wessex, with a particular interest in finding very large roundhouses which he believed to be the residences of migrating Iron Age chiefs. He claimed a diameter of 25m for some houses on the Isle of Man, but this is felt to be highly exaggerated and that 4m to 15m is the normal range, with around 8m diameter being the average and 15m being exceedingly rare. Where roundhouse construction continued into the Roman period, predominantly in the north and west of Britain, they tended to be much smaller and constructed of stone, averaging 5m in diameter (Pope, 2008). The lack of a definable pattern to the postholes associated with the enclosure meant that it was impossible to ascertain whether there were internal structures to the enclosure, but the ceramics were largely domestic in nature, and together with evidence of bloomsmithing seemed to indicate that a small scale settlement was at least nearby, if not definitively within the pen-annular enclosure.

This industry itself is of particular interest and importance, as there are currently no other sites of this date involved in bloomsmithing from this region, meaning the site fills a gap in our knowledge of late Iron Age and early Roman metalworking (see section 5.3.2).

Plots 250 and 271 were similarly sited on former floodplains of the river Dore in the Golden Valley, whilst plot 331 was also sited on flat ground, near a minor tributary of the River Wye. Plot 454 was also in close proximity to a river, the Wye, though by contrast it was on high ground overlooking the floodplain.

Of the seven transition period enclosures listed in the Herefordshire SMR, three were close to rivers (Ashperton, Burrington and Pembridge), and four were on hills or slopes (Avenbury, Wigmore, the fortlets north of Ariconium and Ariconium itself).

None of these, with the exception of the enclosures at Ariconium, had been investigated sufficiently to draw reasonable comparisons between them and the sites located during this project. Likewise, the military nature of the enclosures north of Ariconium and the town of Ariconium itself were substantially different from all of the findings on the pipeline making it impossible to draw comparisons.

More useful comparisons could perhaps be drawn between the Iron Age and Roman enclosures that did not appear to bridge the two periods. The Herefordshire SMR lists 47 such enclosures, of which nineteen had been recorded by more than aerial photography and could give more useful comparative data for the sites discovered on the pipeline. A further six potential and confirmed Roman enclosures were identified during this project, at plots 160, 400, two at plot 430 and two at plot 2 on the Tirley Feeder Connector.

The table below shows the numbers of different forms and sizes recorded from both the pipeline and SMR enclosure sites, though this is somewhat prejudiced by the information available about some of the sites. Only data proved by excavation or geophysical survey has been included, whilst cropmark data has been omitted:

Table 5.7 Comparison of Iron Age, Transition Period and Roman Enclosures

Feature	Iron Age (800BC-42AD)	IA/Roman Transition (C1BC-C1AD)	Roman (C1t-4AD)
Single Ditch	4	9	8
Double Ditch	2	2	3
Triple Ditch	0	0	4
Annular/Pen-annular	0	1	1
Oval	0	2	1
D-Shaped	0	0	2
Rectangular/Square	5	8	10
Sited on low ground/ floodplains	2	7	8
Sited on hill/slope	3	4	5
Internal Features	3	7	7
<1500m2	1	1	0
1500-4000m2	0	1	6
4000m2 +	0	3	1

The table shows a relative continuity in style of enclosure across the two periods, with Iron Age, Roman and the transition period sites showing a preference for single-ditched rectilinear enclosures. From the end of the Iron Age there is a marked bias toward low land sites for the enclosures, with only a little over half as many enclosures located on hilltops and slopes. During the Iron Age the preference is reversed, though the sample of Iron Age enclosures was so small that this may be coincidental.

The number of enclosures with accurate sizing was very limited, but from the very small data set it appeared that primarily the larger Iron Age enclosures appeared more likely to persist into the Roman period, whilst no small Roman enclosures were excavated at all. This is possibly due to the nature of modern developer-led archaeology, whereby the large tracts of rural landscape in which smaller enclosures are suspected to flourish, based upon the aerial photographic evidence (Whimster, 1989), are rarely affected by construction except in the instance of infrastructure projects such as roads and pipelines.

Beyond the enclosures themselves, there were two other sites showing a persistence of occupation from the Iron Age into the Roman period. These were the iron-working site at plot 430, and possibly the pit site at plot 496, in Gloucestershire, the only potential transition period site located outside of Herefordshire on this project.

The ceramic evidence from the Roman bloomery at plot 430 was indicative of very early or pre-Roman use. It was entirely likely that there was some pre-Roman metalworking at the site, utilising the same sources of iron ore as the later, more substantial Roman bloomery. The use of bloomeries for producing iron started around 1200BC in the west, with Iron Age bloomeries recorded in the Forest of Dean *c.*12km to the south of plot 430.

The pits at plot 496, near Kempley Green in Gloucestershire, were large pits between 2.5 and 3m in diameter, and apparently filled over some time by prolonged periods of waste disposal, possibly for disposal of ritual waste relating to funerary pyres. The larger of the two pits was also re-cut, slightly offset, in the early Roman period, from when it appeared to be utilised in the same fashion as domestic waste disposal, suggesting a continuity of occupation in the vicinity. The pits arguably indicated a prolonged usage of the site throughout the later Iron Age and into the early Roman period, though the nature of the site to which they may have related was unclear, as no such site was located during the construction works. Very little evidence for Iron Age or Roman activity had been identified within a mile of the site, with the Roman findings *c.* two miles away at Dymock, Roman Macatonium, being the nearest of any significance (Tavener, 2001). The settlement at Dymock was inhabited in the pre-Roman period, and became a site of sizeable occupation and possibly a fort during the Roman period. As such it was quite possible that such a settlement had smaller satellite farms and micro-settlements to provision it, and that the pits at plot 496 were indicative of the presence of one such site. It was unlikely that such substantial waste pits would be located a long distance from the source of the waste, and as such it was probable that the related settlement or funerary site was within plot 496 itself, or close by to the southwest under modern Kempley Green, 100 metres away.

Across all the transition period sites the function of each site appeared to remain consistent from the Iron Age through into the Roman period, though the occupation at plot 271 arguably developed from a small scale farmstead to a larger, heavily defended triple-ditched enclosure.

5.3 Understanding the Ancient Environment – Analysis of Landscape, diet, Commerce and Agriculture

Very little can be learned about changes in the environment or landscape during the transition from Iron Age to Roman from these sites, due to the very poor preservation of both faunal remains and charred macrofossils.

Two main episodes of landscape reorganisation appear to be occurring based on the artefactual evidence. These comprised a major phase in the early 2nd century AD, seeing earlier sites abandoned and others appear; and a later shift towards the end of the 2nd century and start of the 3rd century AD. All of the Roman activity identified along the pipeline appeared to have ceased by the end of the 4th century AD, with less than 60 sherds from only two plots (160 and 271) suggesting any persistence into the 4th century at all.

Only 291 animal bones were recovered from all six transition period sites, and 145 of these (50%) were from undated contexts, notably the cow burial at plot 271. 120 came from Late Iron Age or 1st Century AD contexts, whilst the remaining 26 came from Roman contexts. Attempting to draw statistical conclusions from such a small sample is slightly spurious, but the bones from dated contexts are summarised in the table below:

Table 5.8 Summary of Animal Bone Discovered

Animal Bone	Iron Age	Roman
Cattle	3	3
Pig	0	2
Sheep/Goat	2	1
Large Mammal	13	0
Medium Mammal	38	2
Unidentified	63	18
Total	120	26

The table shows no significant shift in the animals present, other than the sudden appearance of pigs, though European wild boar were indigenous to the British Isles, and it is unlikely that the native populations at these sites were not taking advantage of that resource prior to the Roman conquest. The absence of any large mammal bones, beyond those that were identifiable, at the Roman sites is unusual, but is probably a quirk of the small sample rather than an indication of their absence.

The absence of smaller mammals and fowl from the sites is almost certainly due to the poor preservation of bones, rather than that these species were not being exploited.

The plant macrofossils, where present, were also consistent between the two periods, containing a scattering of cereals, weeds and nutshells, probably the detritus of domestic consumption rather than agricultural processing.

Though not much can be drawn in the way of conclusions from this data, it appeared that the enclosures were part of a largely pastoral economy upon which the Roman occupation had little impact, the types of animals and crops being raised and consumed not changing significantly throughout the whole transition period.

5.3.1 Roman Settlement

The location of ten previously unknown Roman enclosures along the Brecon to Tirley pipeline (at plots 160, 250, 271, 331, 400, 454, and two each at plot 430 and plot 2 on the Tirley Feeder Connector) has significantly increased the number of known rural settlement sites from that period in Powys and Herefordshire, with one and seven sites respectively. The two remaining Roman enclosures were located in Gloucestershire, at plot 2 on the Tirley Feeder Connector. These add to the larger corpus of knowledge on Roman settlements within Gloucestershire, including the enclosure located during the concurrent Tirley PRI construction (Network Archaeology 2013ii). The enclosures identified by geophysical survey in plots 468 and 469 are most likely also Roman in date, and add a further probable settlement site to Herefordshire.

It had been noted in 2002 that “In Herefordshire… little is known about the Roman period at all” – a few major settlements being separated by a largely unexplored hinterland with a scattering of Romanised farms (Guest, 2002). In Powys the majority of known Roman sites were military in nature, such as the forts at Brecon, Clyro and Walton, or part of the network of roads, such as the one found in plot 110. As such the apparently domestic activity within a possible settlement enclosure at plot 160 was of particular interest, though the fact that the majority of the internal area of the settlement lay beyond the scope of the pipeline easement meant that information about the site could only be inferred from waste material discarded in the enclosure ditch.

Powys Enclosure

The possible enclosure at plot 160 was located on the outskirts of Hay-on-Wye, less than a kilometre south of the Roman fort at Clyro, on the other side of the current course of the river Wye. The Clyro fort was investigated in 1964, and appeared to be a temporary camp occupied exclusively in the pre-Flavian period (Jarrett, 1969). This might indicate that the region was suitably “pacified” by the later 1st century AD, and the need for the fort at Clyro had diminished. Alternatively, as Wales was unusual in that it retained Roman military governance for several centuries, unlike most of the remainder of Britannia (CPAT, 2012), it may be that governance of the area was moved to the larger fort at Y Gaer, Brecon, which was constructed in AD75 and the smaller camp at Clyro was hence superseded.

The domestic enclosure at plot 160 was possibly unique among the Brecon to Tirley sites in having a fairly complete ceramic assemblage, dating from the 1st century AD through to the 4th century, though the sample of pottery recovered indicated that the enclosure was probably at its peak in the later Roman period, probably in the 3rd and 4th centuries. Indeed, the earlier 1st century material was redeposited over some of the later material, and may not be related to this enclosure at all, but imported accidentally with a quantity of stones, possibly for the establishment of a ford after the enclosure had gone out of use.

The ceramic assemblage from plot 160 contained common domestic items such as mortaria, but also several imported wares that were not seen elsewhere on the pipeline, such as Moselle black-slipped ware and Mancetter-Hartshill mortaria. This may have indicated that the enclosure here was of a higher status than the Herefordshire and Gloucestershire enclosures, and hence possessed greater trade links, or it might have simply been that this site thrived longer than the others, and as such could take advantage of more established trade routes.

The enclosure ditch at plot 160 was also the most substantial of all the enclosure ditches encountered on the Brecon to Tirley pipeline, at an average of 3m wide, though it was only 1m deep. Roman enclosure ditches of this size are not particularly common outside of larger settlements, or high status and military enclosures, though the fairly shallow U-shaped profile did not appear defensive in nature. As such, and combined with the trade evidence from the ceramic material, it may be that the enclosure at plot 160 was one of reasonably high status, perhaps an affluent farmstead.

Herefordshire Enclosures

In comparison, the 1st century AD continuation of the plot 250 rectilinear enclosure appeared to be of particularly low status based upon the finds assemblage, particularly the native ceramics from which Jane Timby suggests “the dominance of jars in the assemblage and the very limited range of any more specialised vessels is … typical of fairly low status rural settlements” and it was debatable as to whether it represented a settlement enclosure at all, as discussed in section 5.2.1 above.

The triple ditched enclosure at plot 271 appeared, from the ceramic analysis, to have a break in occupation, between the 1st century AD and the later 2nd century AD. As the ceramics included material from the Iron Age through to the early 4th century AD it may well be the longest occupied site discovered on the project, though it appeared to be at its peak in the 3rd century AD. This peak appeared to coincide with a reduction of the triple ditch to a single ditch, which has been interpreted as the site becoming a more domestic, undefended enclosure, with its early incarnation as a triple ditched enclosure at the end of the 2nd century being a defensive statement.

There was no evidence that the earliest enclosure at the site had met a destructive end in the 1st century AD, but it appeared likely that the native enclosure was in some way abandoned for a protracted period before the construction of the 2nd century Roman defences. This may have indicated the presence of a local native population resistant to the Roman occupation of the area, necessitating the more significant defences of the first Roman enclosure. If this was this case it could be inferred that this resistance was no longer a threat by the 3rd century AD, with the reduction of the site's defences. A less dramatic interpretation of this break may relate to the location of the site on a former floodplain of the river Dore, and may simply suggest that the area had become inhabitable due to changes in the climate or river course.

Geophysical survey of the site at plot 271 appeared to show internal features within the enclosure, but as these were not going to be impacted by the pipeline construction it was considered, in conjunction with Herefordshire Archaeology and National Grid, best if these features were preserved *in-situ*. Though geophysical data can be somewhat difficult to interpret, there appeared to be two rectangular structures within the enclosure, probably of timber post construction.

The dominant period of use of plot 331 was the Iron Age, however a small number of features, which contained Roman pottery, indicated that there was some, at least limited use, of this site into this later period. These features comprised the main pen-annular ring ditch (which had Iron Age origins, but which appeared to survive unchanged into the early 2nd century AD) and a number of small discrete features (pits / postholes) located around this feature. The postholes within and around the enclosure could not be rationalised into a pattern indicative of structures, though their shallow nature may have indicated that further postholes which might have completed the pattern had been lost to arable truncation.

The paucity of remains from this site meant that it was impossible to say for certain whether the enclosure was a settlement site at all, although the ceramic assemblage contained largely domestic material, and the presence of higher status imported wares such as samian reduced the likelihood of the site being a simple stock enclosure.

In plot 400, near Pencoyd, a sizeable rectilinear enclosure was uncovered. The ceramic assemblage suggested that the site was occupied for nearly 250 years from the 1st to the end of the 3rd century AD, though it lacked notable internal features, other than an internal division from which much of the pottery was recovered. The pottery comprised largely jars, bowls and tankards and similar domestic material, which suggested the enclosure was primarily a domestic settlement. It was highly probable, given the hilltop location of the site that the internal features of the enclosure were eroded either in antiquity or by recent ploughing, and as such its true nature could not be determined. It was also probable that the enclosure continued to the north of the site as revealed, though a dump of modern asbestos had obscured the course of the enclosure ditch, and it did not appear to continue on the far side of that dump. It was considered probable that the enclosure returned along the line of the extant track to The Halt, which lay to the north of the site. As exposed, the enclosure covered a little over 1000m2, though if the supposition as to its full northerly extent were correct that would increase to nearly 1800m2 within the pipeline's working width, and assuming the apparent entranceway to the south was roughly halfway along that boundary, as is often, but by no means exclusively, the case, the full enclosure might have been as much as 4000m2.

Plot 430, near Peterstow, contained two enclosures in close proximity to each other, and possibly contemporary in date. Toward the end of the 1st century AD and into the early 2nd century AD a double ditched rectilinear enclosure with curved corners was constructed at the base of the slope atop which was an earlier bloomery whose usage persisted into this period.

No significant internal features were discovered within the enclosure, though the bulk of the enclosure lay beyond the extent of the pipeline to the north. The nature of the waste ceramics deposited in the enclosure was sufficiently indicative of domestic occupation that the enclosure was interpreted as the habitation for the workers at the hilltop bloomery site, taking advantage of the more fertile ground around Wells Brook.

In the 2nd century AD the second enclosure was constructed mid-way up the slope between the bloomery and the lower enclosure. This was a triple ditched enclosure, which was suggestive of defence, but the ditches were of relatively small size, and even if an attempt were made to account for truncation to the ditches over time, they would be unusually small for defensive features. This might indicate that the triple ditch here was designed more as a statement of power, rather than as a purely defensive feature, similar to the affectation of crenellations on Decorated or Perpendicular period architecture between the 13th and 16th centuries.

Similar to the lower lying enclosure, which appeared to co-exist with the triple ditched enclosure, the internal area of the enclosure lay beyond the scope of the excavation to the north. However, the circuit of the enclosure ditches suggested a fairly small enclosure, with the outermost of the ditches appearing to be no more than 30-35m in diameter. This might suggest that the enclosure contained a single structure of considerable import, perhaps a high status habitation or a shrine. However none of the finds from the enclosure ditches appear to be particularly high status, nor was there any evidence elsewhere on the plot that a particularly high status site was present in the vicinity.

The extension of the smaller Iron Age enclosure at plot 454 during the Roman period seemed to indicate an increase in activity at the site, and the large quantity of ceramic wares from the site pointed to a considerable degree of domestic habitation at the site. A similar Roman extension of an Iron Age enclosure was recorded at Stapleton in Herefordshire, some 35 miles to the northwest of the site at plot 454. At Stapleton the extension was interpreted as the addition of a stock pen to the original enclosure, but at plot 454 the extension appeared to be the addition of a more substantial frontage to the enclosure, with the construction of a double-ditched boundary on the south-eastern side. As the other boundaries were not likewise extended, it was probable that this was intended to create an impressive approach to the enclosure from the east, rather than as a functional element.

This may have been an attempt by the arriving Romans to claim ownership over an existing native structure that already held local import, holding as it did a strongly defensive position overlooking the river Wye.

The site was approximately 3km to the west of the supposed high status Roman sub-rectangular enclosure identified at plots 468 and 469, which sat near to the projected course of the Roman road north from the Roman town of Ariconium, near Weston-under-Penyard. The site at plot 454 appeared from the ceramic evidence to be occupied between the 1st and 3rd centuries AD, with its peak during the later 2nd century AD. This would have made it roughly contemporary with Ariconium, though that town persisted into the 4th century and beyond, and it was likely that the site at plot 454 was a form of outlying settlement tied politically to Ariconium.

The two Roman enclosures in Gloucestershire were both located in plot 2 of the Tirley Feeder Connector, and were situated either side of a probable Roman trackway. The earlier of the two enclosures had a curved, “Shepherd’s Crook” appearance at its eastern end. As seen the enclosure contained an area of about 600m2.

The pottery from the enclosure was largely Malvernian wares, an industry which spanned the entire Roman period, and even started earlier in the Iron Age. Due to the small quantities of pottery recovered and the broad date range the ware covered, Jane Timby suggested with reservations that the entire assemblage could be from around the 2nd century AD, contemporary with the more datable elements of it. The stratigraphic phasing, however, suggested at least two periods of occupation, with that represented by this enclosure being the earliest, and as such the author would tentatively suggest an earlier Roman date, or possibly even a later prehistoric one for the enclosure.

The second, later, enclosure appeared to respect, and hence probably be broadly contemporary with, the trackway. This was a single-ditched rectilinear enclosure covering more than 620m2. The majority of the datable pottery came from this enclosure ditch, suggesting that it was firmly dated to the 2nd century AD. Aside from an internal division in each enclosure, neither had any internal features and no clear evidence for their usage was apparent.

The presence of an inhumation in the corner of the rectilinear enclosure was considered likely to be coincidental, as no artefactual or stratigraphic dating was available to say whether it was Roman or not. If the enclosure were to have had a mortuary aspect it was felt likely that further evidence of funerary rites or interments would have been visible, but the area where the skeleton was uncovered was the most heavily truncated of the entire enclosure.

The shepherd’s crook form is very rare in Roman enclosures, and no comparable enclosure could be identified within Gloucestershire or the neighbouring counties. As such it may be that the shape of the enclosure was misleading and the result of its truncation by the trackway to the west and the fact that any continuation of the enclosure to the north lay beyond the scope of the pipeline construction.

A number of smaller,sites and pottery scatters were also identified which add to the wider picture of Roman activity. These are marked on figures 8-10. Most notable amongst these was the ditch terminus identified in plot 562 in Gloucestershire, near Staunton. This produced evidence indicative of 2nd century AD settlement in its vicinity, making it broadly contemporary with the activity identified in plot 2 of the Tirley Feeder Connector *c.*3.5km to the east. Similarly the pottery scatter in plot 7 of that project indicated that another habitation site may have been in the vicinity, closer than the enclosures at plot 2 or the Tirley PRI, both of which were approximately 350 metres away.

With the possible exception of the mid-slope enclosure at plot 430, all of the Roman settlements identified along the pipeline appeared to be fairly low status rural habitations, based on their size and finds assemblages, probably relatively isolated farmsteads. In the case of the enclosure at plot 2 on the Tirley Feeder Connector, a further enclosure was also identified *c.*800m to the southeast during the construction of the Tirley PRI (Network Archaeology, 2012). The evaluation for this project had also suggested another possible focus of Roman activity about 500m to the east of that, which might have indicated the presence of another such farmstead in the vicinity (Network Archaeology, 2011). The pottery assemblages from all three sites appeared to be contemporary, and three such settlements in close proximity might be an indicator that these farmsteads were not as isolated as might be imagined from the narrow view that a pipeline presents. Equally, though, the cluster of small enclosures at Tirley might be indicative of a more intensively exploited landscape to provide for nearby larger population centres such as Ariconium (15m west), Gloucester (8m south) or Worcester (14m north).

The presence of ten previously unknown Roman rural settlement sites along the pipeline help to prove that the Roman west midlands was not the largely unoccupied hinterland that the previous archaeological record indicated, but a fairly well settled landscape providing for the larger, and better known, urban centres.

The sites at plots 160, 250, 271, 331, the lower enclosure from plot 430 and the two enclosures from plot 2 on the Tirley Feeder Connector, were all located in the fertile river valleys of Powys and Herefordshire, indicating that they were taking advantage of the better farming conditions and trade options that living near a river could bring.

Plots 400, 454 and the triple-ditched enclosure at plot 430 all occupied hillside positions. This may have shown a defensive intent, though none of the sites appeared to be particularly military in nature. The functions of the three sites may well have been different: plot 400 appeared to be an upland enclosure, possibly a pastoral farmstead, whilst the triple-ringed enclosure at plot 430 appeared to be a small enclosure constructed to impress, possibly a small ritual site. The larger, expanded, enclosure at plot 454 may have been designed to impress the local population, as well as provide a watchful vantage point over the river Wye. This might be indicative of a Roman occupier making his mark on a native camp, or the local native elite displaying the benefits of association with the Romans to the nearby population.

Similar to the transition period sites, very little useful information could be garnered from the poor preservation of both the plant macrofossils or the faunal remains.

Due to this only a little over 600 fragments of animal bone were recovered from all the pipeline sites, and very few of these survived in a condition where pathology, butchery or even species identification could be determined.

The poor preservation appears to be a result of the acidic soils along the pipeline route, and this is reflected in other nearby sites with a notable lack of animal bone data from sites in the Brecon region (Wood, 2012).

Due to the small size and degraded state of the assemblage, it was impossible to ascertain underlying animal husbandry and utilisation practices for the various sites, with the exception that it was possible to identify the species present on site. As might be expected, of the 138 bones where identification was possible, all of the bones came from medium (e.g. sheep and pigs) or large (e.g. cows and horses) animals, with the exception of a single bone from a domestic goose that came from a post medieval context, perhaps giving some idea as to the timescale for which less robust bones might survive. This prevalence of larger animals was undoubtedly due to the levels of preservation, rather than the absence of smaller boned animals such as rabbit, fowl or fish.

The palaeoenvironmental remains, with the exception of the deep auger cores summarised in the assessment report (Network Archaeology, 2010), also displayed poor preservation of the plant macrofossils, and most contained insufficient material for quantification (<100 specimens). This pattern was continued on the Tirley Feeder Connector, and no detailed analysis could be attempted, nor conclusions derived, from any of the collected material.

5.3.2 Roads, Trade and Industry.

Roads

In plot 110, near Aberllynfi in Powys, was discovered a stretch of paved road with ditches to either side. Two sondages through the road suggested that it might have had up to three phases of use, tentatively dated to the 1st century AD, the later 1st and earlier 2nd century AD, and the 2nd century AD respectively.

The road ran roughly NW-SE, with a sondage excavated at the edge of the plot seeming to suggest that it turned slightly more NNW-SSE as it approached the NW edge of the plot. There was no obvious reason for this slight variation in direction, though it might have been intended to align the road perpendicularly to the River Wye and allow a crossing at a ford here. The fort at Clyro was presumed to have been constructed in order to observe the ford at Aberllynfi (CPAT, 2012), though this ford was presumed to have been closer to the extant crossings at Glasbury-on-Wye and Hay-on-Wye, about 1.5km and 8km to the northeast respectively.

There is no known Roman Road which exactly matches the location and orientation of this discovered road (Mattingley, 2002), although it sits close to the presumed route of the Kenchester (Magnis) to Brecon (Cicucium) road, which is assumed to have roughly followed the course of the present A438, about 1km to the southeast of plot 110. This road, however, would by nature have been oriented NE-SW, i.e. perpendicular to the stretch located in plot 110, suggesting that either the road had made a localised detour, or the stretch located in plot 110 was not the Kenchester to Brecon road.

Another possibility was the postulated Mortimer's Cross to Clyro road. In the 1954 Centenary volume of the Woolhope Naturalist's Field Club it is mentioned that the paved surface of a probable Roman road is exposed along a route passing thought Shobdon, Lyonshall and as far as Michaelchurch-on-Arrow (Woolhope Field Naturalist's Club, 1954), though no corroboratory evidence exists. The termination of the road at the fort at Clyro is a presumption, based on alignment rather than an observation, and it may be that the road in plot 110 marked a continuation of this road past Clyro and possibly linking with the Kenchester to Brecon road.

The Brecon to Tirley project identified limited instances of Roman activity within the vicinity of the road in plot 110. These were the field boundary ditch in plot 111a, and another ditch identified during the evaluation of plot 111a, *c.*100 m to the NW, and the enclosure site at plot 160, *c.*7km to the east. The ditch identified during the evaluations may have been the truncated remains of the deeper of the two roadside drainage ditches, though this could not be definitively ascertained. Neither of the other features appeared to be directly associated with the line of the road, though the ditch in plot 111a may have been a boundary associated with the road, if the road continued to turn toward the north once it left plot 110. The enclosure at plot 160 was sited closer to the predicted line of the Brecon to Kenchester road, and was unlikely to be linked to the stretch of road in plot 110.

It is possible, therefore that the road was a previously unidentified road spurring from the Brecon to Kenchester road to the northwest. There are no known major settlements northwest of Aberllynfi, but two possible sites may have been the intended destination of the road – the 2nd century AD marching camp at Caerau, near Esgairperfedd, and the fort at Castell Collen, 1.5km northwest of Llandrindod.

Of these, the fort at Castell Collen is the more likely destination. The camp at Caerau was abandoned in the early 2nd century, and was only a temporary marching camp (Jones, 1957), making it an unlikely focus for the considerable effort a road would entail. The fort at Castell Collen, however, was occupied from around 75AD until the end of the 4th century AD and notably the vicus, or civilian settlement, associated with that fort lay to the southeast of the fort and had a roadway through it. Approximately 25 miles southeast of Castell Collen is the fort at Clyro, and approximately the same distance again beyond that lay the Roman towns of Burrium (Usk) and Gobanium (Abergavenny) and it is plausible that the road through the vicus may have linked up with the road located in plot 110.

There seemed to have been two breaks in occupation at Castell Collen: From about AD80 to AD98 when the basic Flavian fort was reoccupied and developed under Trajan, and again during the Hadrianic period (117-138AD). This might correlate to the apparent disuse phases of the road during the later part of the 1st and the early part of the 2nd century AD, with ceramic evidence from Castell Collen suggesting the site was re-occupied by the later 2nd century AD (Alcock, 1964).

The fairly poor condition of the road surface in plot 110, and the absence of evidence of the road to the north, in plot 111a, might indicate that the road only survives patchily, or it may be that arable farming or the construction of the railway in between plots 110 and 111 led to significant ground disturbance on the flatter ground to the north, and the course of the road was severely impacted.

The Desk Based Assessment (CA, 2006) identified a number of other possible and known road lines that were transected by the pipeline corridor. These included the Leominster to Ariconium road, predicted to cross the pipeline around plot 468, where the geophysical survey suggested a possible high status Roman enclosure, possibly a villa site. This site was avoided by a pipeline reroute, and as such not investigated, but in the fields to the north of it, where the new course of the pipeline ran, and where course of the Roman Road was also predicted to extend through, no evidence of the road was located.

Similarly the line of Stone Street, near Madley, presumed to lie on the route of the old Caerleon to Wroxeter road, generally known as Watling Street, was predicted to be impacted by the works at a point just to the west of the Roman enclosure site in plot 331, but again no evidence of a Roman road was discovered.

Of the 66 other roads identified during the DBA, the majority were not projected to cross the pipeline route, though the line of the Brecon Gaer to Kenchester road appeared to be visible as an earthwork on the LiDAR images near Pool Farm, in Powys, approximately 0.5km northeast of Brecon Gaer on the Felindre to Brecon portion of the pipeline. The results of this section of the pipeline are still undergoing analysis, but several stretches of Roman road were identified during the project (NLMJV, 2012a and b). The same road was also due to be intersected where the pipeline crossed the A438 at Aberllynfi, but as the pipeline was drilled under the road at this point, no large scale overburden stripping was undertaken and thus nothing was revealed to confirm whether or not the A438 overlay an earlier Roman road.

The Roman road network in the region traversed by the pipeline appeared to develop from military supply lines to commercial trade over the duration of the Roman occupation. The major roads linked the affluent towns of western England with each other and the military hubs in eastern Wales. The two dominant stretches of road were the SW-NE aligned Brecon to Kenchester road, which continued east beyond Kenchester to meet up with the great N-S artery, Watling Street, that linked northwest England with southeast Wales.

From these major routes, a number of minor roads also projected, and these are presumed to link the more minor settlements to the major hubs. The construction of these roads would have allowed a disparate rural community greater access to regional trade, whilst the scope of the Roman empire would have made continental trade more commonplace. The roads would also take the emphasis for trade routes from the rivers, meaning that more substantial settlements, and military enclosures, could be established away from major water courses.

Of the enclosures located by this project, three lie near to these major roads: Plot 160 is just south of the predicted route of the Brecon to Kenchester road, plot 331 is just east of the suspected line of Watling Street, whilst plot 454 lay just west of the Leominster to Ariconium road. The presence of a former, Roman period, river channel of the Dore in plot 269 was not entirely surprising, though as many of the identified Roman enclosures were in close proximity to such waterways, it does help identify likely locations of further sites, such as the Roman enclosure at plot 271, along the course of that palaeochannel. Of the remaining enclosures, plot 250 also lay near the river Dore, and plot 430 near the river Wye.

Plot 400 and plot 2 on the Tirley Feeder Connector were neither near known roads nor substantial water courses, though the track at plot 2 might have linked the later enclosure there to a more substantial road connected to Gloucester. It is also notable that if the suggested Castell Collen to Clyro road passing through plot 110 did continue on to Abergavenny or Usk, then it would potentially use the Golden Valley as a route, meaning that it would pass close to the enclosures at plots 250 and 271.

Trade

The evidence for trade was limited, predominantly, to the sourcing of the ceramic assemblage and, to some extent, the metallurgical remains.

Of the 9626 sherds of Roman pottery the vast majority (86.2%) were from local sources, most notably the ubiquitous Severn Valley ware, which comprised well over half of the entire assemblage. Several 2nd and 3rd century kiln sites for Severn Valley ware have been identified along the valley, the closest to the pipeline sites being at Ledbury, in Herefordshire, and Malvern, in Worcestershire. Jane Timby suggested that Severn Valley ware might have origins pre-dating the conquest (Timby, 1990). The earliest production centres have not been discovered but are most likely to be around Gloucester. The next most common local pottery was the native Malvernian coarse wares, These were made near Malvern, in Worcestershire, and change very little from their earliest forms in the middle Iron Age until the 2nd century AD. After that date the pottery becomes predominantly wheel thrown and influenced by black burnished ware, suggesting an increase in regional imports to the area (Peacock, 1968).

This is borne out by the ceramic evidence from the pipeline sites, as the most common regional import was Dorset black burnished ware, from kilns in the Wareham/Poole Harbour region, which showed a fairly consistent presence from the early-mid 2nd century onwards. Overall it contributed 13.2% of the pipeline assemblage which broadly conforms to the pattern of pottery presence for the area (from the limited amount of data available), (cf. Allen and Fulford 1996, fig. 7). Dorset black burnished ware occurred on most investigated sites in the wider region, for example, it is well represented at the larger Roman settlements at Kenchester and Wroxeter and from smaller sites in the Welsh Marches such as the Breidden (Young 1991).

Continental imports are particularly poorly represented on the pipeline with samian only accounting for 0.5% and amphora for 0.2%. The only other imported sherd was a single small piece of Moselle black-slipped ware. Other regional imports are equally poorly represented.

The dominance of jars in the assemblage and the very limited range of any more specialised vessels is perhaps also typical of fairly low status rural settlements. The preponderance of tankards is very much a West Country phenomenon and presumably reflects local drinking traditions (Timby, appendix B).

A comparison of the pottery from the pipeline sites was made with three other sites from the general region where quantified data is available: the Romano-British small town at Deansway, Worcester (Bryant and Evans 2004); Longdon, a rural late Iron Age-early Roman agricultural settlement in Worcestershire (Timby 2010) and Dymock, a Roman settlement near the Forest of Dean (Timby 2007). As might be expected the levels of samian are markedly higher for the two larger settlements of Deansway and Dymock at 3.6% and 2.2% respectively, but more comparable with Longdon with 0.3%. These sites also have a greater variety of fine and coarse-ware continental imports some of which may be the result of a possible military presence, for example the Lyon ware at Deansway. In terms of regional imports BB1 was surprisingly much higher on the Brecon pipeline sites at 13.2%, compared with less than 5% at the other sites. This seemed to be compensated for by higher levels of Severn Valley wares in the main settlements, and much higher levels of Malvernian wares at Longdon. This suggested a different marketing mechanism in operation with perhaps BB1 getting to the more rural sites, with mobile traders moving between farmsteads, but the Severn Valley wares being sold through local markets or direct from the producers some of which were based in the Malvern Link area. However, additional data from other sites would be needed to explore this patterning further (Timby, 2012).

Industry

Analysis of the metallurgical remains (slag) also contributed to our understanding of trade and communication through the region. The material recovered from plot 430 appeared to originate from the Forest of Dean. This fits the pattern for other sites engaged in smelting activity within a 20 – 35km radius of the Forest – which appear to be utilising the resources of the forest and the transport facilities afforded by the Severn. The most comparable of these sites being nearby Ariconium (8km to the east) the slag from which shows that is was also sourced from the Forest of Dean and that the processing site (Ariconium) sat on a similar geology to plot 430 (demonstrated by the trace minerals and other impurities in the slag). This evidence shows that the Late Iron Age /Early Roman inhabitants of plot 430 were taking advantage of the emerging road network, and existing transport infrastructure provided by the River Severn, to undertake localised trade with nearby settlements which had a supply of the Forest of Dean ore, or direct with those who were mining the ore at the Forest, or more likely, both.

Evidence for Iron Age mines within the Forest appeared to be largely obliterated by the later Roman and early modern iron working sites. The Iron Age industry in the Forest of Dean appeared to be centred on Bream, with a trade outlet at Lydney, whilst the Roman industry seemed to have two foci: Ariconium and Blestium (Cleere, 1981). Bream is approximately 20km south of the site at plot 430, with Lydney a further 3.5km southeast of that, which would seem an impractical distance from the source of iron ore to construct a bloomery at. As such, it is probable that the site was related to one of the northern Roman mines whose Iron Age origins were obliterated by the later workings there. Analysis of the material collected from plot 430 appeared to demonstrate a small scale smelting industry which also utilised ore from the Forest of Dean.

Peterstow had been identified as a site of Roman ironworking since the 19th century (Nicholls, 1866), though in the latter part of the 20th century, Cleere reported that “there are still large mounds of cinder and slag in the parish…the beds were in places 6m thick.” (Cleere,1981). Cleere also mentions reports of bloomery furnaces on Peterstow common, and the presence of Roman coins giving dates from the 1st to the 4th century AD.

Plot 430 revealed evidence of being an additional smithing site in this region. The assemblage collected comprised dense tapped slags, porous/charcoal rich furnace slags, some slag ‘runners’ and rare examples of slag ‘rods’. Such an assemblage is typical of many sites in the area. The runners themselves are interesting, for they indicate the use of a channel to carry the slag through the tap arch area. They have been found at several other sites (e.g. Miskin, Frocester, Caerleon) and are a characteristic component of the residue assemblage from these sites.

Unfortunately, very few furnaces have themselves been investigated in the region. The best known, but still with many questions attached, is the large furnace at the ‘Chesters’ villa, Woolaston (Fulford & Allen 1992). Furnaces at *Ariconium* were dug by Bridgewater (Bridgewater 1965), but appear to have been heavily truncated. The evidence for the nature of the furnace structures in Plot 430 is therefore very important. Although simple slag tapping, relatively low-shaft, furnaces are the most likely class of furnace to have produced the observed residue assemblage, other morphologies are possible.

The range of textures and mineralogy demonstrated by these samples is unusual, compared with smithing slags in general, but there is little data available on comparably-dated material. The general chemical composition of the samples is however, broadly in line with other Iron Age and Roman smithing slags from the area.

It appears that Plot 430 shows a similar style of iron smelting to other sites in the hinterland of the Forest of Dean, but a technology distinct from that of major, possibly military, centres of smelting. The ore was from Dean, but provenancing ore sources within Dean requires data for elements not analysable under the Scanning Electron Microscope (SEM).

The possible furnace building at plot 430 is of potential importance, as the post-pad structure at Chesters Villa has tended to be the model for buildings associated with Roman rural iron production. Post-pad structures, though, are not reported often considering the comparatively large quantity of rural iron production sites, and the rarity of such structures suggests that perhaps they are usually less clear. No clear structure was visible at plot 430, but the sunken nature of the large bloomery furnace and its lack of well defined walls was comparable to an early medieval iron smithing building discovered at South Hook, Pembrokeshire (Crane and Murphy, 2010).

The identification of the base of a possible wooden raised hearth would make the site currently unique in Roman Britain, though insufficient evidence survived to make a definitive case for the presence of such a feature either way.

The material recovered, and analysed, from plot 331 suggested that something else may also have been going on. The nearest known source of Ore is the Forest of Dean, however this is located some 50km from this plot, placing this plot out of the currently understood hinterland of ore dispersal for this source (20 – 35km beyond the Forest). Whilst it is possible that some form of low level, elongated, multi point trade was occurring, moving small amounts of ore over this distance via a number of trade partners, this is unlikely and has not been seen to be the pattern elsewhere. It is much more likely that some, as yet unknown, local source of ore (see below) was being utilised– either locally traded for or (less likely given the small scale of the industry involved) mined directly.

Of greater importance is the type of industrial process being undertaken here; the weight range of the material together with the high iron contents, suggests that these are the residues from the processes broadly known as bloomsmithing or bloom-refining, a class of residues poorly understood at present. The only assemblage of material available for direct comparison is that from Coldfurrow, Lyonshall, Herefordshire (approximately 22km NNW of Plot 331). The assemblage (Young 2006) included a number of large, dense, iron-rich Smithing Hearth Cakes (SHCs) from deposits associated with a smithy in a small, enclosed, Romano-British farmstead. The assemblage was interpreted as being from bloomsmithing, but there is no identified local source of iron or known smelting sites. Transport of iron ore, or part finished blooms from the Forest of Dean area is possible, but unlikely given the distance. Other, as yet unknown, local sources are more likely. The Milford Haven to Brecon gas pipeline (Young 2011d) produced evidence for Roman smelting in the valley of the Afon Honddu just north of Brecon. This location would suggest a local, probably bog iron ore, source was being exploited. If such sources exist in the river valleys around Brecon, then they may well exist in the Wye valley to the NE too.

Iron Age bloomsmithing structures have been described in North Wales (Crew 1987, 1989, 1998), and early to middle Iron Age bloomsmithing residues have been described from southern England from Risely (McDonnell 1984) and from Truro (Young 2008). The occurrence of early Roman (1st century AD) bloomsmithing residues at sites such as Caergwanaf (Young 2010), and Cardiff Castle (Young & Kearns 2011) is known, but these materials have not yet been analysed in detail. Later Roman bloomsmithing has been identified at Lyonshall (Young 2006), Dymock (Young & Kearns 2010) and Caerwent (Young 2006). At none of these Roman sites is there yet good evidence for the physical nature of the bloomsmithing facility.

6 CONCLUSIONS

The Brecon to Tirley stretch of the Milford Haven to Tirley pipeline offered a rare opportunity to expose a variety of sites across three counties in the Welsh Marches, and allow for comparisons between them. Eventual consideration of the results from all three pipelines will add further to the value of the Brecon to Tirley data.

The vast majority of the sites uncovered were Roman in date, along with a smaller number of Iron Age/Roman transition period and Bronze Age sites.

Of the three counties crossed by the pipeline, both Powys and Herefordshire have a relative dearth of information on rural sites, with the majority of Historic Environment Record data restricted to aerial photographs and early investigations where archaeological techniques were at times perhaps more haphazard.

As such, the addition of thirteen significant sites and another 48 minor sites, plus the potentially significant site at plots 468-9, has made a considerable addition to the corpus of knowledge in these two counties.

To a lesser degree, the addition of two significant sites and four minor sites has helped develop our understanding of northwest Gloucestershire's Roman and pre-Roman landscape, though they add to a much more substantial pre-existing dataset than in the other two counties.

The dominant conclusion from the Brecon to Tirley project is the confirmation that the rural Roman landscape was not as sparsely occupied and exploited as the archaeological record implied. Instead, the pipeline sites suggested that the Welsh Marches in the 2nd century AD were, in fact, a network of small, enclosed farmsteads; the evidence from the neighbouring Tirley PRI suggests that each smallholding might have worked an area of 2000-12000m2, or between half an acre to three acres (Network Archaeology, 2013ii).

Whether these smallholdings existed in relative isolation, or in small clusters as the activity on the Tirley PRI site and Tirley Feeder Connector pipeline suggested, could not be definitively confirmed by the pipeline due to the keyhole nature of its investigations: only the larger, open area exposure of the PRI construction works enabled a wider view of the area around the enclosures at TFC plot 2. It may be the case that if similar large open-area investigations were undertaken around the other enclosures located during the pipeline then a similar pattern of clustered occupation might become apparent. Equally, though, the relatively proximal group of enclosures at Tirley might be indicative of the more intensively occupied landscape in-between Roman Gloucester and Worcester, and the enclosures elsewhere were much more isolated habitations.

Whilst the prehistoric evidence from the pipeline was relatively scarce, a number of Bronze Age sites were located – notably the cremation cemetery at plot 49, near Ponde Common in Powys, and the possible cemetery site at plot 464 near Hole-in-the-Wall, in Herefordshire. Whilst these add to the general understanding of the Welsh marches during the early Bronze Age, the evidence from both was relatively scant and other than indicating the presence of a Bronze Age population gave little clue as to how and where that population might have existed.

The evidence for the end of the prehistoric period, and the transition into the Roman era, along the pipeline is universally tied up with later Roman occupation, with only the small scale enclosure at plot 250, near Dorstone in Herefordshire, and the pit site at plot 496 near Kempley Green, in Gloucestershire, having no firm evidence of Roman occupation after the end of the 1st century AD.

The sites appear to correlate with others discovered previously in the Welsh Marches, such as at Avenbury and Weston-under-Penyard in Herefordshire, where the Roman invasion and subsequent occupation does not seem to have caused an abandonment of native sites, but instead there appears to be an unbroken continuation of habitation on the sites, suggesting a relatively docile population accepting the new regime.

One of the more significant elements identified during the pipeline project was the metallurgical remains at plot 331, near Kingstone, and plot 430, near Peterstow, both in Herefordshire. The evidence for metalworking from plot 331 is of particular significance. Very few Iron Age bloomsmithing sites have been described; none with both full residue descriptions accompanying physical evidence for the nature of the hearth and process. The evidence from Plot 331 therefore falls within a complete gap in existing knowledge, making the site significant on a national basis.

The limited environmental data able to be recovered from the pipeline sites meant that very little could be concluded with regard to changes in the landscape, ecology and economy of the areas crossed by the pipeline. All of the settlement sites show an apparent leaning toward a pastoral economy, based on the lack of grain processing or storing features, but even this may be misleading.

Following completion of the analysis of the results from the Milford Haven to Felindre and Felindre to Brecon sections of the pipeline project, the results of all three sections will be reviewed as part of a single, overarching report, thus providing a comprehensive study of the results of the project as a whole.

7 ACKNOWLEDGEMENTS

Network Archaeology would like to thank the following people:

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Phil Allen	National Grid	Project Manager
Bryony Brown	National Grid	Project Engineer
Linda Bonnor	National Grid	Archaeological Advisor
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David Andrews, Kerry Ashworth, Ed Blinkhorn, Les Bognar, David Browne, Jessica Bryan, Paul Clarke, Anthony Clifton-Jones, Geraldine Crann, Mark Dennett, Christine Elcock, Eleri Farley, Margaret Feryok, John Foulkes, Matt Gault, Claire Gannon, Anthony Haskins, Marcus Headifan, Yvonne Heath, Sean Jackson, Sam Keenan, Ray Kennedy, Rachel Kidd, Alison Lane, Ross Lane, Rupert Lotherington, Jeff Lowrey, Michelle Maguire, Gwynfor Maurice, Fiona McGill, Chris Merrifield, Krissy Moore, Lydia Northcott, Dawn Powell, Russell Priest, Brian Pugh, Diana Quinn, Hayley Saul, Daniel Sausins, David Simon, Fay Slater, Catherine Smyth, Fraser Stewart, Martin Thorburn and Jay Wood	Network Archaeology Ltd	Project Assistants

8 BIBLIOGRAPHY

Source	Year	Title	Publisher
Alcock, L	1964	Castell Collen in Archaeologica Cambriensis, p.64-96	Archaeologica Cambriensis
Allen, J.R.L. and Fulford, M.G.	1996	The Distribution of South-East Dorset Black Burnished Category 1 Pottery in South West Britain	Britannia 27, p223-282
Archenfield Archaeology	Accessed June 2012	Landscape Origins of the Wye Valley on www.bosci.net/LOWV	River Wye Preservation Trust
Archwilio	Accessed July 2012	CPAT Regional Historic Environment Record	http://www.cofiadurcahcymru.org.uk/arch/cpat/english/cpat_interface.html
Bartlett-Clark Consultancy	2006i	Felindre to Tirley Proposed Gas Pipeline: Report on Archaeogeophysical Surveys	Unpublished Client Report
Bartlett-Clark Consultancy	2006ii	Wobage Farm, Crow Hill, Herefordshire: Metal Detection Survey Report	Unpublished Client Report
Bartlett-Clark Consultancy	2007	Felindre to Tirley Gas Pipeline: Report on Archaeogeophysical Surveys: Revised with corrections	Unpublished Client Report
Bartlett-Clark Consultancy	2008	Brecon to Tirley Gas Pipeline: Report on Archaeo-geophysical survey	Unpublished Client Report
Bridgewater, N.P.	1965	Romano-British iron working near Ariconium	Transactions of the Woolhope Naturalists' Field Club, 38, 124-135.
Briggs, S.	2003	A Research Framework for the Archaeology of Wales	British Archaeological report, British Series 343
Britnell, W.J.	1982	The excavation of two round barrows at Trelystan, Powys	Proceedings of the Prehistoric Society 48, 133-202
Bryant, V. and Evans, J.	2004	Excavations at Deansway Worcester, 1988-89. Romano British small town to late Medieval city	CBA Res Rep 139, p. 235-80
Cleere, H.F.	1981	The Iron Industry of Roman Britain	London University
Clwyd Powys Archaeological Trust	Accessed May 2012	www.cpat.org.uk	Clwyd Powys Archaeological Trust
Cotswolds Archaeology	CA Report 05140, 2006i	Felindre to Tirley Natural Gas Pipeline: Archaeology and Heritage Survey	Unpublished Client Report
Cotswolds Archaeology	CA Report 06031, 2006ii	Felindre to Tirley Natural Gas Pipeline: Gloucestershire Section Earthwork Survey	Unpublished Client Report

Source	Year	Title	Publisher
Cotswolds Archaeology	CA Report 06032, 2006iii	Felindre to Tirley Natural Gas Pipeline: Herefordshire Section Earthwork Survey	Unpublished Client Report
Cotswolds Archaeology	CA Report 06030, 2006iv	Felindre to Tirley Natural Gas Pipeline: Powys Section Earthwork Survey	Unpublished Client Report
Cotswolds Archaeology	CA Report 06025, 2006v	Felindre to Tirley Natural Gas Pipeline: Gloucestershire Section Field Walking Survey	Unpublished Client Report
Cotswolds Archaeology	CA Report 06027, 2006vi	Felindre to Tirley Natural Gas Pipeline: Herefordshire Section Field Walking Survey	Unpublished Client Report
Cotswolds Archaeology	CA Report 06026, 2006vii	Felindre to Tirley Natural Gas Pipeline: Powys Section Field Walking Survey	Unpublished Client Report
Crane, P. and Murphy, K.	2010	Early medieval settlement, iron smelting and crop processing at South Hook, Herbranston, Pembrokeshire, 2004-5	Archaeologica Cambriensis 159, p117-195
Crew, P.	1987	Bryn y Castell Hillfort – a Late Prehistoric Iron Working settlement in north-west Wales.	In: SCOTT, B.G. & CLEERE, H. (eds) The Crafts of the Blacksmith. 91-100.
Crew, P.	1989	Crawcwellt West excavations 1986-1989. A late prehistoric ironworking settlement.	Archaeology in Wales, 29, 11-16.
Crew, P.	1998	Excavations at Crawcwellt West, Merioneth, 1990-98: A late prehistoric upland ironworking settlement.	Archaeology in Wales, 38, 22-35.
English Heritage	1991	Management of Archaeological Projects, 2nd Edition	English Heritage, London
Fulford, M.G. & Allen, J.R.L..	1992	Iron-making at the Chesters villa, Woolaston, Gloucestershire: survey and excavation 1987-91.	Britannia, 23, 159-215
Gibson, A.	1997	Survey, excavation and palaeoenvironmental investigations on Pen-y-fan and Corn-du Brecon Beacons, Powys, 1990-1992	Studia Celtica 31, 1-81
Gibson, A.	2002	Earlier prehistoric funerary and ritual sites in the Upper Severn Valley	Montgomery Collections, vol 90
Guest, P.	2002	The Iron Age-Roman Interface	West Midlands Regional Research Framework

Source	Year	Title	Publisher
Halliwell, P.R. (ed)	1990	Herefordshire Archaeology News no.54 p6-11	Woolhope Club Archaeological Research Section
Harding, J.	2000	Later Neolithic ceremonial centres, ritual and pilgrimage: the monument complex of Thornborough, North Yorkshire, in A. Richie (ed) Neolithic Orkney in its European Context	Cambridge: McDonald Institute for Archaeological Research, 31-46
Hazelgrove, C.	1997	Reconstructing Iron Age Societies: New Approaches to the British Iron Age in Oxbow Monograph 71 pp51-72	Oxford
Herefordshire Council	Accessed May 2012	www.herefordshire.gov.uk/htt/smrSearch	HCC
Holbrook, N. (ed)	2008	Iron Age And Romano British Agriculture in the North Gloucestershire Severn Vale in Cotswold Archaeology British and Gloucestershire Archaeology report 6	Cirencester, Cotswold Archaeology
Jarrett, M.G.	1969	Roman Frontier in Wales, 2nd Ed	University of Wales Press
Jones, G.D.B.	1957	The Roman Fort at Caerau in Brycheiniog, Vol 3, p.127	Brycheiniog
Jones, N.W.	2007	Prehistoric Funerary & Ritual Monuments in Breconshire in Brycheiniog, Vol.39 p.23-45	Brycheiniog
Jones, N.W.	2010	Walton Court Farm Ring Ditch. Trial Excavation and survey 2009-10	CPAT report no. 1025
Jones, N.W. and Owen, W.J.	2002	Prehistoric Funerary & Ritual Sites: Brecknockshire, Initial Project Report	CPAT report no. 465
Jones, N.W. and Owen, W.J.	2004	Prehistoric Funerary & Ritual Sites: Black Mountains, Brecknockshire, Project Report	CPAT report no. 600
Jones, N.W. and Owen, W.J.	2005a	Prehistoric Funerary & Ritual Sites: Western Brecon Beacons, Project Report	CPAT report no. 692
Jones, N.W. and Owen, W.J.	2005b	Prehistoric Funerary & Ritual Sites: Central Brecknock, Project Report	CPAT report no. 693
Jones, N.W. and Owen, W.J.	2006a	Prehistoric Funerary & Ritual Sites: Eastern Brecon Beacons, Project Report	CPAT report no. 770
Jones, N.W. and Owen, W.J.	2006b	Prehistoric Funerary & Ritual Sites: Northern Brecknock, Project Report	CPAT report no. 771

Source	Year	Title	Publisher
Lang, V.	2011	Traceless Death. Missing Burials in Bronze and Iron Age Estonia	Estonian Journal of Archaeology, vol 15, 2, 109-129
Leahy, K.	2009	Brecon to Tirley Gas Pipeline: Assessment of the Metal Finds in Brecon to Tirley High Pressure Gas Pipeline: Post Excavation Assessment, Network Archaeology	Unpublished Client Report
Mattingley, D	2002	Atlas of Roman Britain	Oxbow
McDonnell, J.G.	1984	Interim Report: Slags, Risely Farm, Berkshire	English Heritage Ancient Monuments Laboratory Report 4422
McKinley, J.I.	1997	Bronze Age 'barrows' and funerary rites and rituals of cremation	Proceedings of the Prehistoric Society 63, 129-145
Mouchel Parkman	2008	Environmental Statement for Tirley PRI, Brecon to Tirley proposed gas pipeline	Unpublished Client Report
Murphy, P.	2000	Environmental and botanical evidence in Ashwin, T. and Bates, S., 'Excavations on the Norwich Southern Bypass, 1989-91. Part 1: Excavations at Bixley, Caistor St. Edmund, Trowse, Cringleford and Little Melton	East Anglian Archaeology 91, 217-223
NACAP Land and Marine Joint Venture (NLMJV)	2012a	Milford Have to Aberdulais High Pressure Gas Pipeline, Archaeology Assessment of Potential for Analysis	Unpublished Client Report
NACAP Land and Marine Joint Venture (NLMJV)	2012b	Felindre to Brecon High Pressure Gas Pipeline, Archaeology Assessment of Potential for Analysis	Unpublished Client Report
National Grid/RSK	2006	Felindre to Tirley Natural Gas Pipeline: Archaeological Framework Document	Unpublished Report
Network Archaeology	2006i	Corse Pressure Reduction Installation, Brecon to Tirley Pipeline: Archaeological Desk Based Assessment	Unpublished Client Report
Network Archaeology	2006ii	Treaddow Pressure Reduction Installation, Brecon to Tirley Pipeline: Archaeological Desk Based Assessment	Unpublished Client Report
Network Archaeology	2006iii	Archaeological Desk Based Assessment of Four Proposed Route Options around Hay-on-Wye, Powys in RSK ENSR, 2006, Felindre to Tirley Pipeline: Environmental Statement	Unpublished Client Report
Network Archaeology	2007	Corse Pressure Reduction Installation, Tirley to Brecon Gas Pipeline: Archaeological Trench Evaluation	Unpublished Client Report

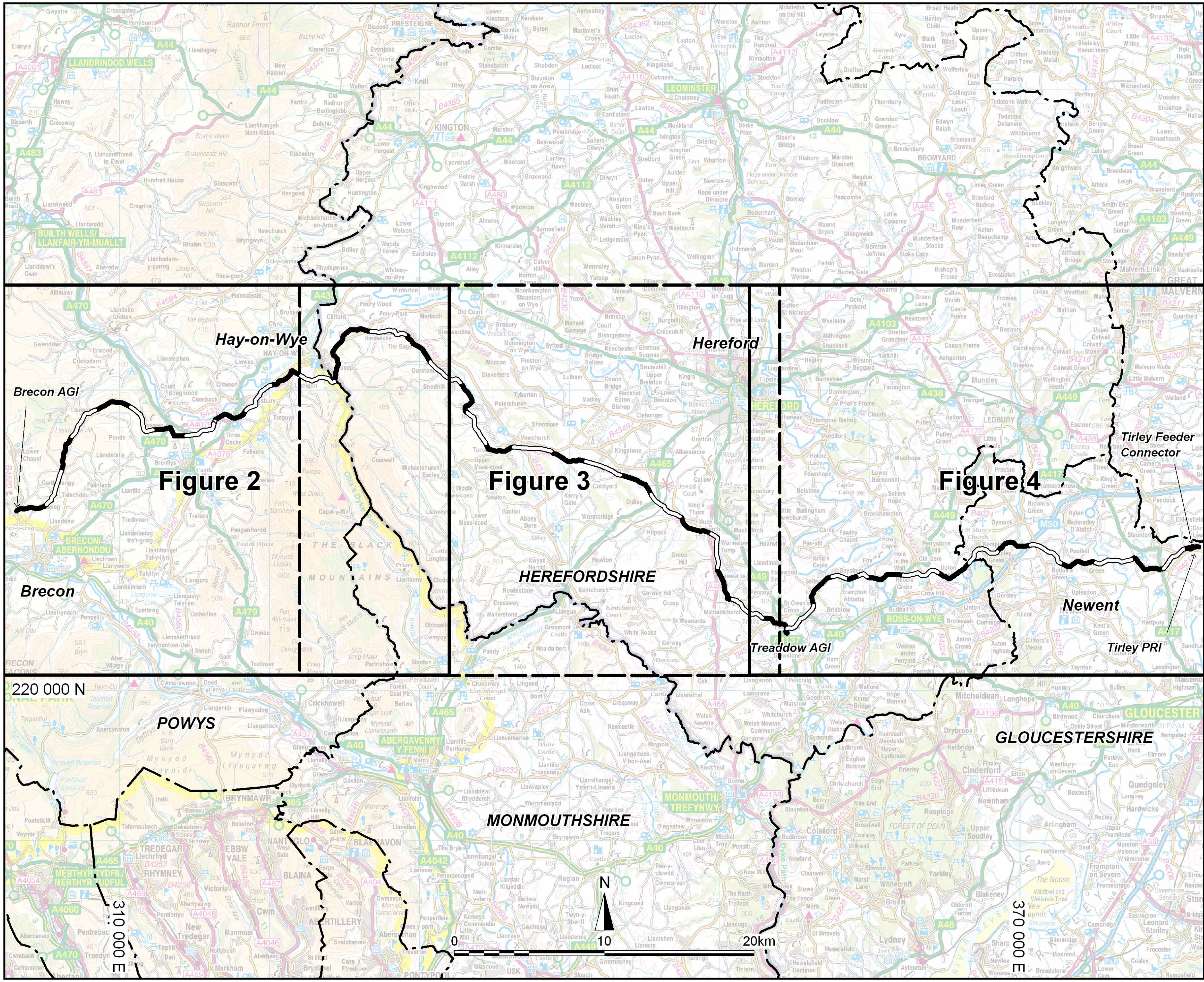
Source	Year	Title	Publisher
Network Archaeology	2009i	Brecon to Tirley High Pressure Gas Pipeline: Archaeological Trench Evaluation	Unpublished Client Report
Network Archaeology	2009ii	Brecon to Tirley High Pressure Gas Pipeline: Ancillary Trench Evaluations	Unpublished Client Report
Network Archaeology	2010	Brecon to Tirley High Pressure Gas Pipeline: Post Excavation Assessment	Unpublished Client Report
Network Archaeology	2011i	Brecon to Tirley: High Pressure Gas Pipeline: Updated Project Design	Unpublished Client Report
Network Archaeology	2011ii	Tirley Pressure Reduction Installation: Archaeological Evaluation	Unpublished Client Report
Network Archaeology	2011iii	Tirley Feeder Connector: Written Scheme of Investigation for Archaeological Trench Evaluation and Monitoring	Unpublished Client Report
Network Archaeology	2012	Tirley Pressure Reduction Installation: Archaeological Post Excavation Assessment and Updated Project Design	Unpublished Client Report
Network Archaeology	2013i	Sections 120 and 122, Ross Remedial Works on the Brecon to Tirley Pipeline: Archive Report of Archaeological Monitoring and Recording	Unpublished Client Report
Network Archaeology	2013ii	Tirley Pressure Reduction Installation: Archaeological Analysis Archive Report	Client Report
Nichols, P.W.	2006	An archaeological excavation at Bourton-on-the-Water Primary School, Gloucestershire, 2003	Client Report
Nicholls, H.G.	1866	Iron Making in the Olden Times, as instanced in the Ancient Mines, Forges and Furnaces of the Forest of Dean	2008 ebook at www31.us.archive.org/stream/ironmakingintheo24330gut/24330.txt
Olivier, A.	1996	Frameworks for our Past: a review of research frameworks, strategies and perceptions	English Heritage
Peacock, D.P.S.	1968	A petrological study of certain Iron Age pottery from Western England in PPS 34, pp.414-427	Proceedings of the Prehistoric Society 34
Pope, R.E.	2008	Roundhouses: 3000 years of prehistoric design	Current Archaeology, 222, 14-21
Rackham, J.	2009	Assessment report on the Palaeo-environmental potential of a series of sites along the route of the Felindre to Tirley Natural Gas Pipeline	Unpublished Client Report

Source	Year	Title	Publisher
Ray, K.	2002	The Romano British Period in Herefordshire in West Midlands Regional Research Framework for Archaeology, Seminar 3	University of Birmingham
Remfry, P.	1995	Four Castles of the Middle Reaches of the River Wye, 1066 to 1282	SCS Publishing
Remfry, P.	1998	Castles of Breconshire	Logaston Press
Šoberl, L., Pollard, J., Evershed, E.	2009	Pots For The Afterlife: Organic Residue Analysis of British Bronze Age Pottery from Funerary Contexts	PAST, vol 63, Nov 2009, 8-10
Soil Survey of England and Wales	1983	Soils of England and Wales, Scale 1:250000	SSEW
Tavener, N.	2001	Land adjacent to Rose Cottage and 'Winserdine', Dymock, Gloucestershire: assessment report on the excavation and watching brief	Client Report
Timby, J.R.	1990	Severn Valley wares: a reassessment in Britannia 21, pp.243-251	Britannia 21
Timby, J.R.	2007	Pottery, in T. Catchpole, Excavations at the Sewage Treatment Works, Dymock, 1995	Trans Bristol Gloucestershire Archaeol Soc 125, 137-219, esp 155-71
Timby, J.R.	2010	The pottery, in A. Simmonds, G. Thacker and N. Shepherd, An investigation of the evolution of a wetland environment of Longdon Marsh and the excavation of a Late Iron Age – Romano-British farmstead	Trans Worcestershire Archaeol Soc 22, (2010) 3rd ser 1-58, esp 23-32
Timby, J.R.	2012	Roman Pottery – Brecon to Tirley pipeline	Appendix B
Woolhope Field Naturalist's Club,	1954	Herefordshire: To mark the Centenary of the Woolhope Field Naturalists Club	Woolhope Field Naturalists Club
Warrilow, W., Owen, G. and Britnell, W.	1986	Eight Ring-ditches at Four Crosses, Llandysilio, Powys, 1981-85	Proceedings of the Prehistoric Society 52, 53-87
Whimster, R	1989	The Emerging Past: Air Photography and the Buried Landscape	RCHME
White, P	2011	Herefordshire Studies in Archaeology: Series 3: The Frome Valley, Herefordshire: Archaeology, Landscape Change and Conservation	Herefordshire Archaeology

Source	Year	Title	Publisher
Whittle, A.	1984	The Pits, in Danebury: an Iron Age hillfort in Hampshire: Volume 1: The excavations 1969-78: the site	CBA Research Report 52a
Wichbold, D.I.	1998	Watching brief at Bishop’s Frome Village Hall	Worcestershire Archaeological Service Report No. 709
Young, C.J.	1991	Romano British Pottery in C.R. Musson, The Breidden hillfort.. A later prehistoric settlement in the Welsh Marches	CBA Res Rep 76, 127-30
Young, T.P	2006	Archaeometallurgical residuesfrom the Caerwent Forum-Basilica (provisional report).	GeoArch Report 2006/01
Young, T.P.	2008	Archaeometallurgical residues from Richard Lander School (RLS04) and Truro College (TCF05).	GeoArch Report 2007/22
Young, T.P.	2010	In: Caergwanaf. Pp. 214-216	B.C Burnham & J.L. Davies (eds) The Roman Frontier in Wales and the Marches. Royal Commission on the Ancient and Historical Monuments of wales.380pp
Young, T.P.	2011d.	Assessment of the archaeometallurgical residues from the Milford Haven to Brecon High Pressure Gas Pipeline.	GeoArch Report 2011/40
Young, T.P . & Kearns, T.	2011	Evaluation of metallurgical residues from the New Interpretation Centre, Cardiff Castle, Cardiff [ST181765].	GeoArch Report 2011/02
Young, T.P.	2012	Archaeometallurgical residues from the Brecon to Tirley Gas Pipeline	Unpublished Client Report

Appendix C

Figures



Pipeline route

County boundary

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Milford Haven to Felindre

Felindre to Brecon

Brecon to Tirley

Ver	Date	Description	Drn	Chk	App
2.00	14/05/12	Edits	SAF	GC	DH
1.00	26/01/12	First issue	SAF	GC	DH

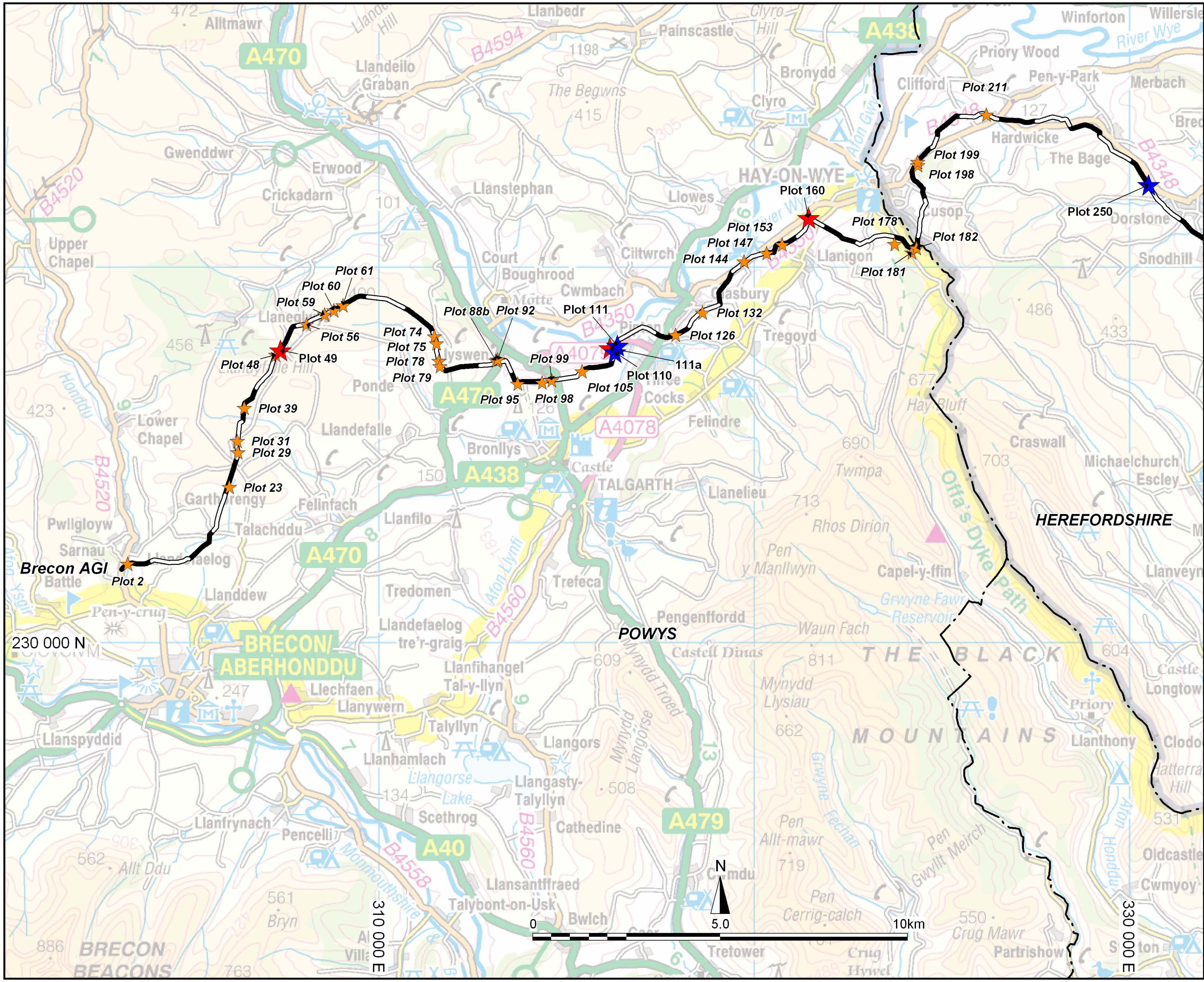
network archaeology

Brecon to Tirley pipeline

Figure 1
Location of pipeline route

Scale: 1:250 000

FILE NAME: \BRT\178\report\illustrations\GIS\ver02.00\workspaces\figure01.wor



Pipeline route

County boundary

Excavation site

Major watching brief site

Minor watching brief site

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Ver	Date	Description	Drn	Chk	App
2.00	14/05/12	Edits	SAF	GC	DH
1.00	26/01/12	First issue	SAF	GC	DH

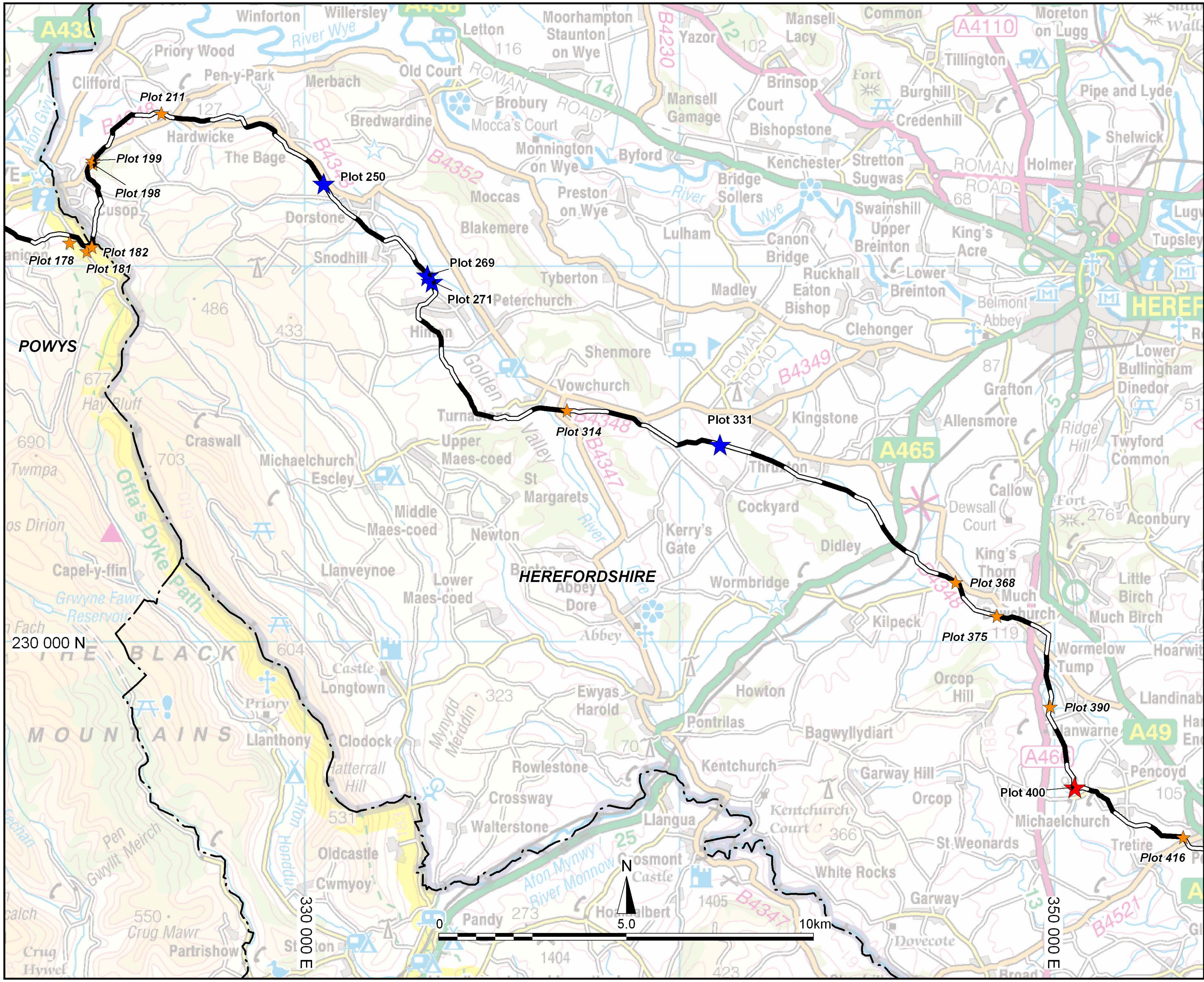
network archaeology

Brecon to Tirley pipeline

Figure 2
Location of identified sites and watching brief sites in Powys

Scale: 1:100 000

FILE NAME: \BRT178\report\illustrations\GIS\ver02.00\workspaces\figure02.wor



Pipeline route

County boundary

Excavated site

Major watching brief site

Minor watching brief site

Ver	Date	Description	Drn	Chk	App
2.00	14/05/12	Edits	SAF	GC	DH
1.00	26/01/12	First issue	SAF	GC	DH

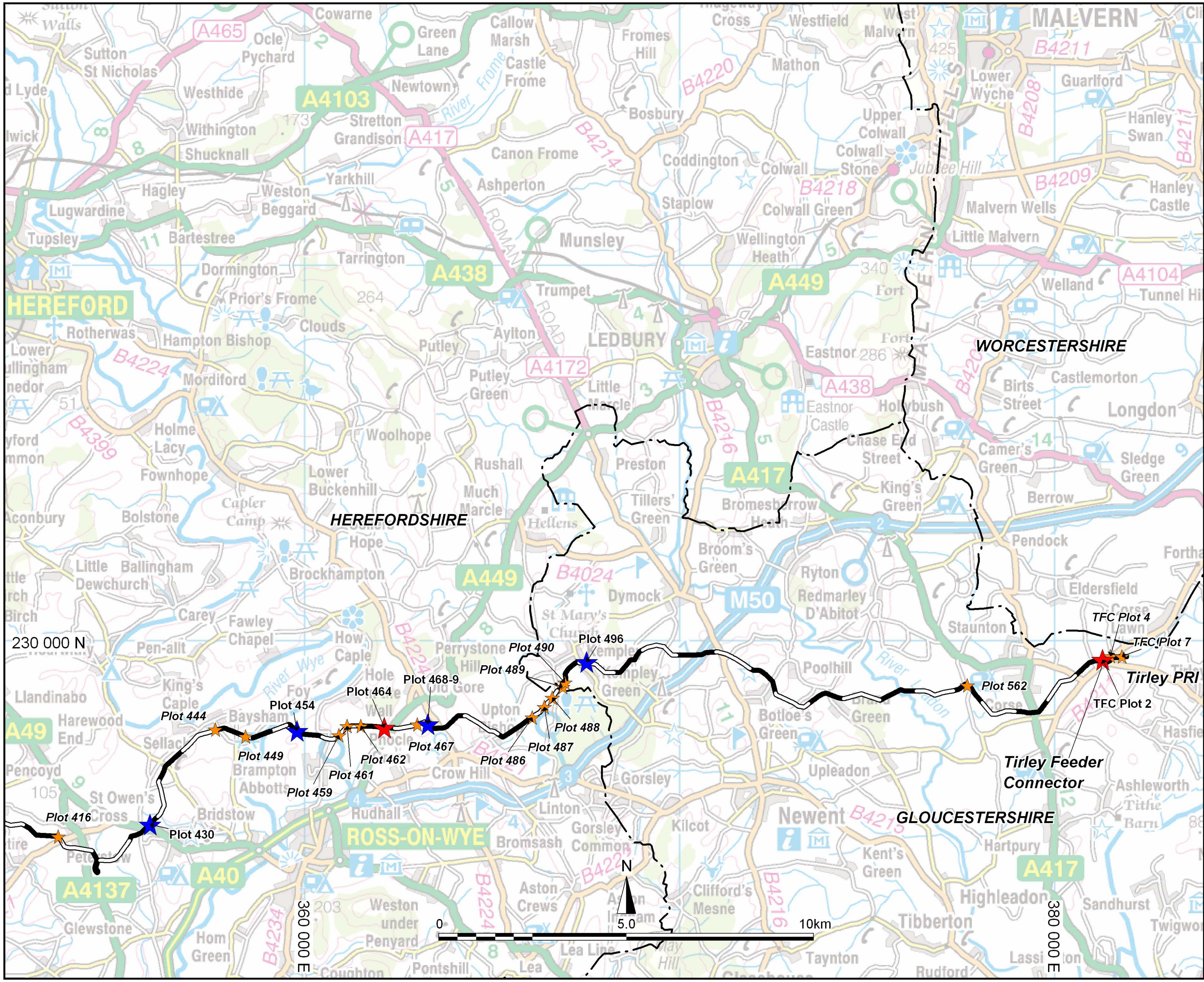
network archaeology

Brecon to Tirley pipeline

Figure 3
Location of identified sites and watching brief sites in Herefordshire

Scale: 1:100 000

FILE NAME: \BRT\178\report\illustrations\GIS\ver02.00\workspaces\figure03.wor



Pipeline route

County boundary

Excavation site

Major watching brief site

Minor watching brief site

Ver	Date	Description	Drn	Chk	App
2.00	14/05/12	Edits	SAF	GC	DH
1.00	26/01/12	First issue	SAF	GC	DB

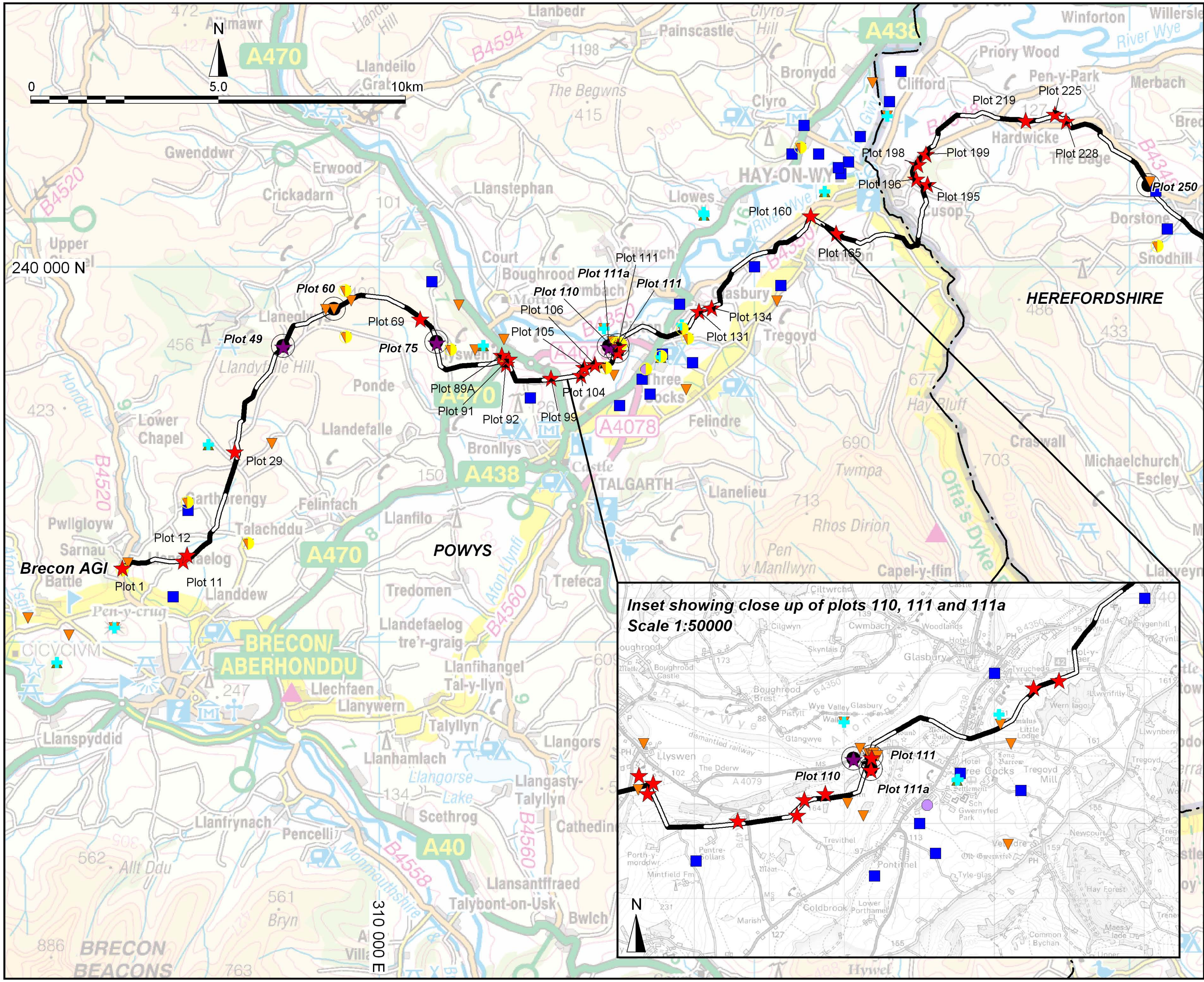
network archaeology

Brecon to Tirley pipeline

Figure 4
Location of identified sites and watching brief sites in Herefordshire and Gloucestershire

Scale: 1:100 000

FILE NAME: \BRT\178\report\illustrations\GIS\ver02.00\workspaces\figure04.wor



Pipeline route

County boundary

Newly discovered archaeology

Prehistoric site

Prehistoric pottery

Prehistoric flints

Known archaeology (from DBA)

Agriculture

Finds scatter

Funerary

Industrial

Military

Ritual

Settlement

Ver	Date	Description	Drn	Chk	App
2.00	14/05/12	Edits	SAF	GC	DH
1.00	07/02/12	First issue	SAF	GC	DH

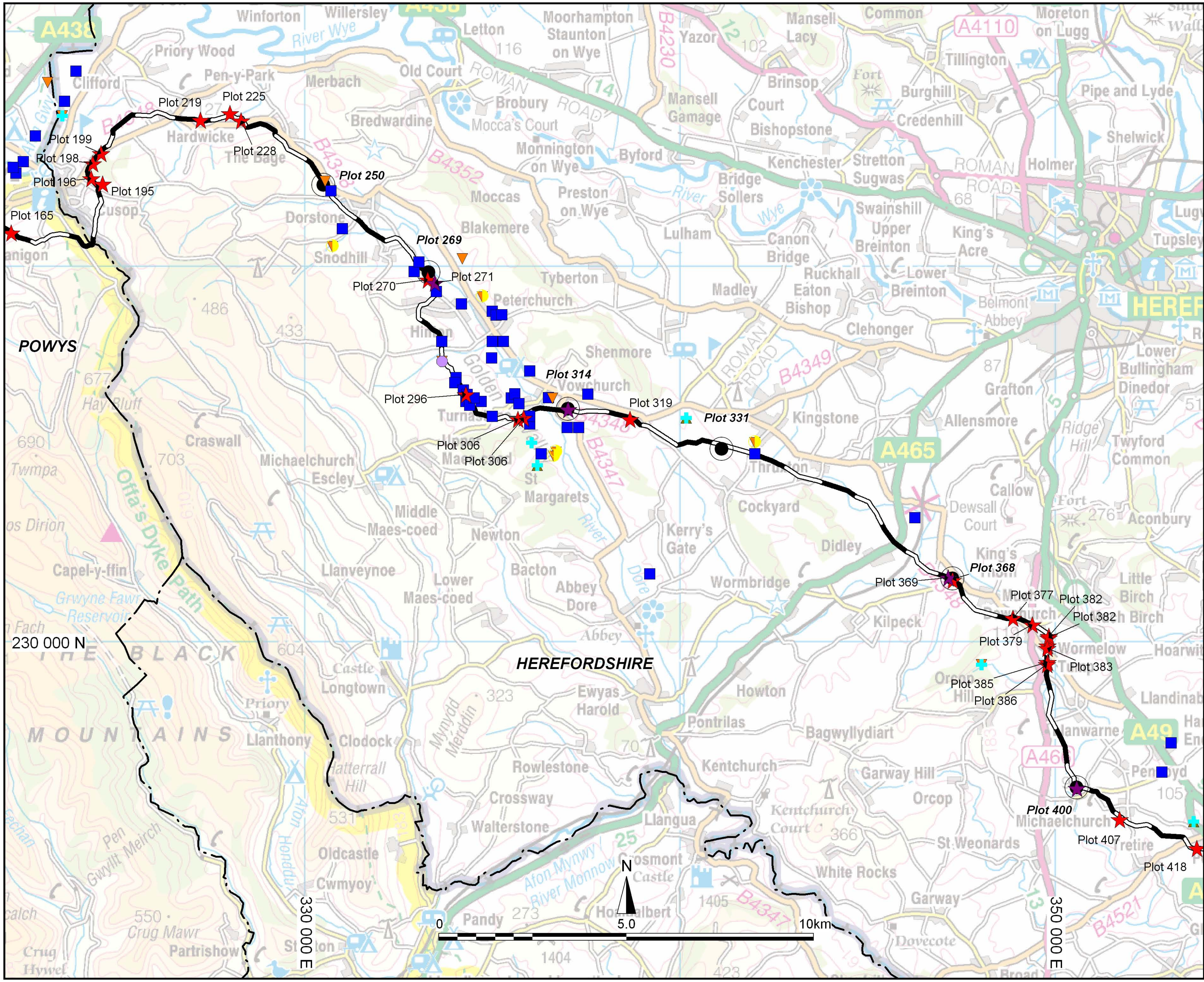
network archaeology

Brecon to Tirley pipeline

Figure 5
Prehistoric sites within the vicinity of the BRT route (Powys)

Scale: 1:100 000

FILE NAME: \BRT\178\report\illustrations\GIS\ver02.00\workspaces\gc\figure05.wor



Pipeline route

County boundary

Revealed archaeology

Prehistoric site

Prehistoric pottery

Prehistoric flints

Known archaeology (from DBA)

Agriculture

Finds scatter

Funerary

Industrial

Military

Ritual

Settlement

2.00	14/05/12	Edits	SAF	GC	DH
1.00	07/02/12	First issue	SAF	GC	DH
Ver	Date	Description	Drn	Chk	App

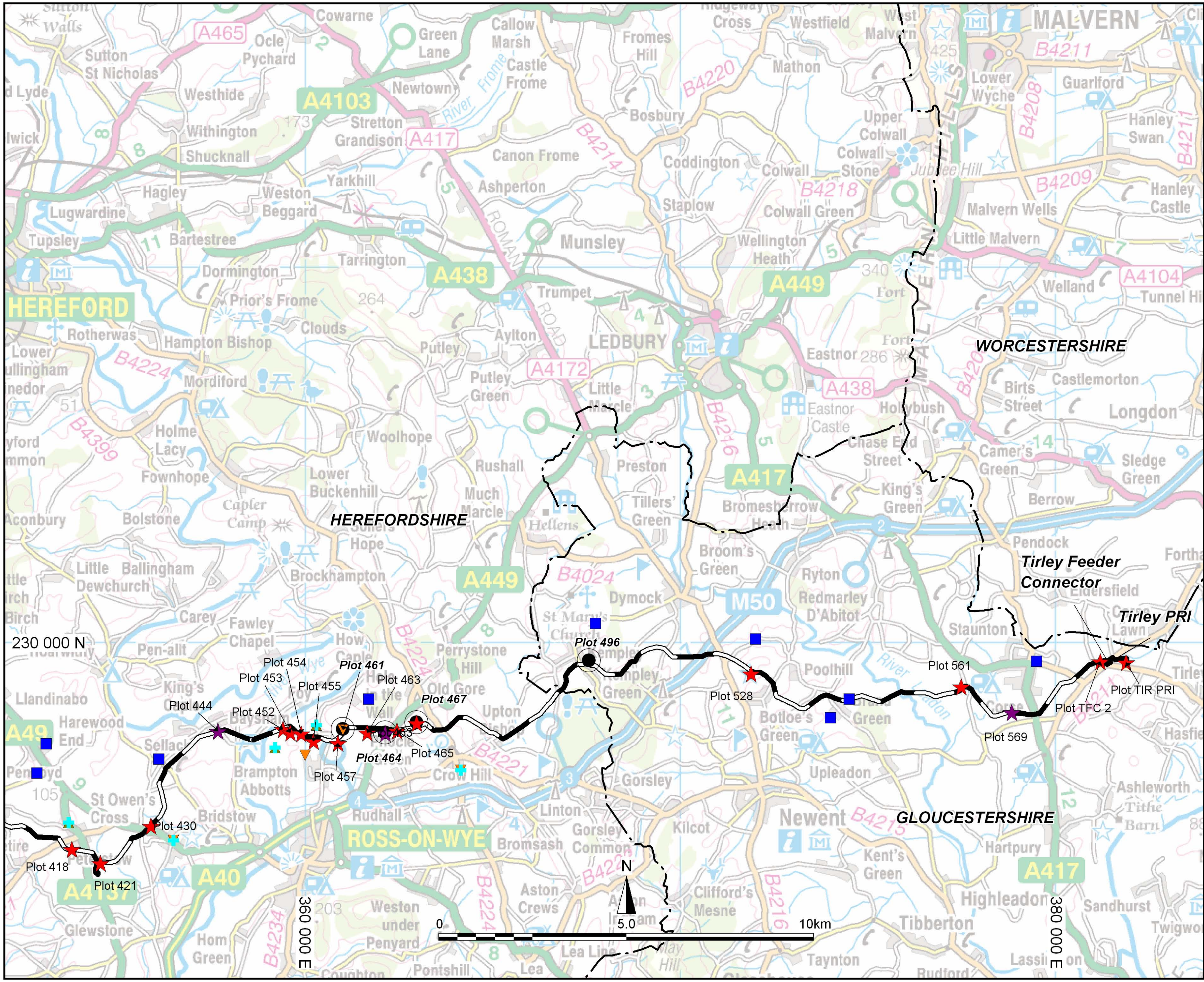
network archaeology

Brecon to Tirley pipeline

Figure 6
Prehistoric sites within the vicinity of the BRT route (Herefordshire)

Scale: 1:100 000

FILE NAME: \BRT\178\report\illustrations\GIS\ver02.00\workspaces\figure06.wor



Pipeline route

County boundary

Revealed archaeology

Prehistoric site

Prehistoric pottery

Prehistoric flints

Known archaeology (from DBA)

Agriculture

Finds scatter

Funerary

Industrial

Military

Ritual

Settlement

Ver	Date	Description	Drn	Chk	App
2.00	14/05/12	Edits	SAF	GC	DH
1.00	07/02/12	First issue	SAF	GC	DH

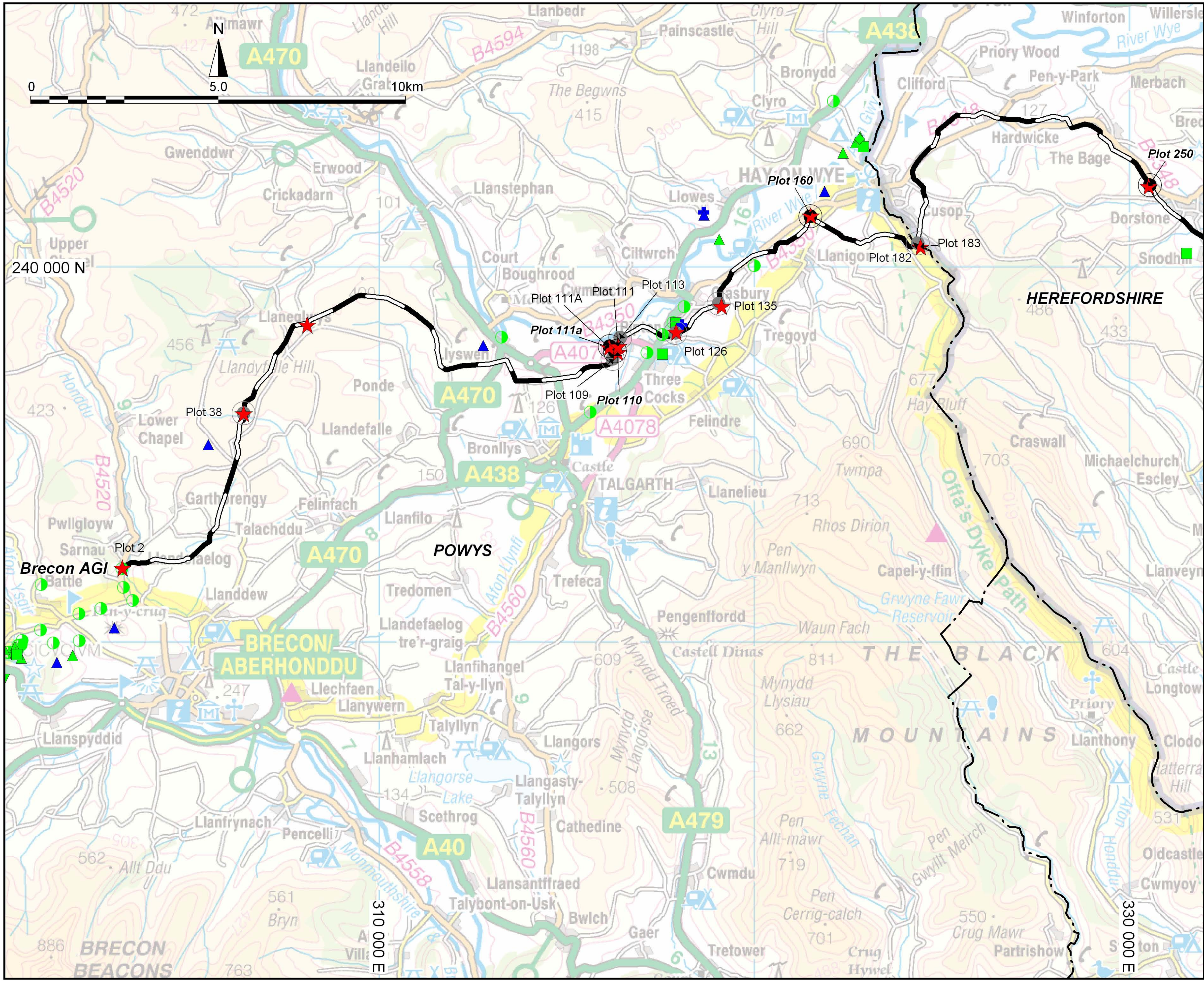
network archaeology

Brecon to Tirley pipeline

Figure 7
Prehistoric sites within the vicinity of the BRT and TFC route (Herefordshire and Gloucestershire)

Scale: 1:100 000

FILE NAME: \BRT\178\report\illustrations\GIS\ver02.00\workspaces\figure07.wor



- Pipeline route
- County boundary

Newly discovered archaeology

- Roman site
- Roman find scatters
- Roman pottery

Known archaeology (from DBA)

- Agriculture
- Finds scatter
- Industrial
- Military
- Ritual
- Settlement
- Roman roads

Iron age　Roman

Ver	Date	Description	Drn	Chk	App
2.00	14/05/12	No change	SAF	GC	DH
1.00	02/07/12	Edits	SAF	GC	DH

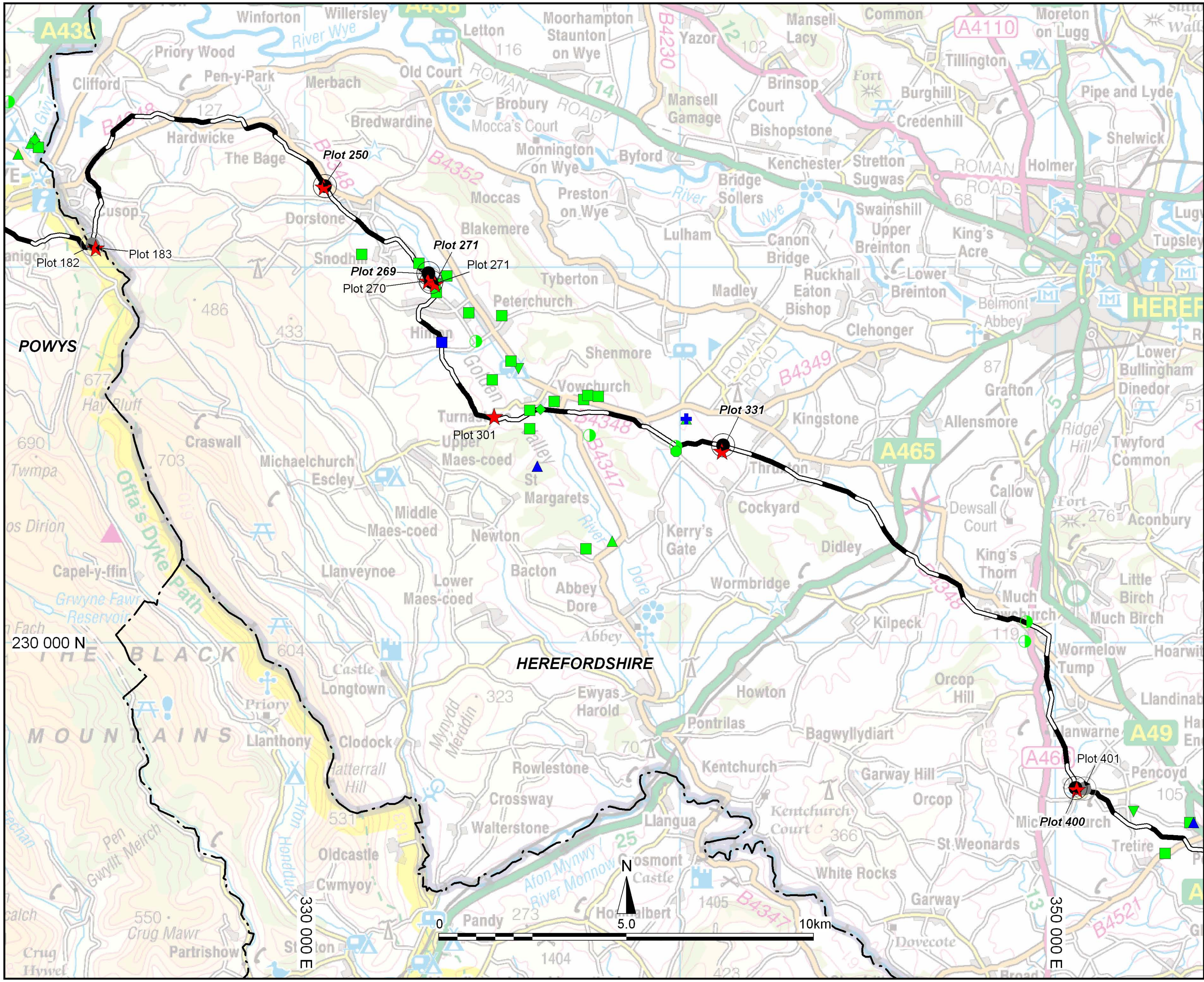
network archaeology

Brecon to Tirley pipeline

Figure 8
Iron age and Roman sites within the vicinity of the BRT route (Powys)

Scale: 1:100 000

FILE NAME: \BRT\178\report\illustrations\GIS\ver02.00\workspaces\figure08.wor



Pipeline route

County boundary

Newly discovered archaeology

Roman site

Roman find scatters

Roman pottery

Known archaeology (from DBA)

Agriculture

Finds scatter

Industrial

Military

Ritual

Settlement

Roman roads

Iron age Roman

2.00	14/05/12	No change	SAF	GC	DH
1.00	02/07/12	Edits	SAF	GC	DH
Ver	Date	Description	Drn	Chk	App

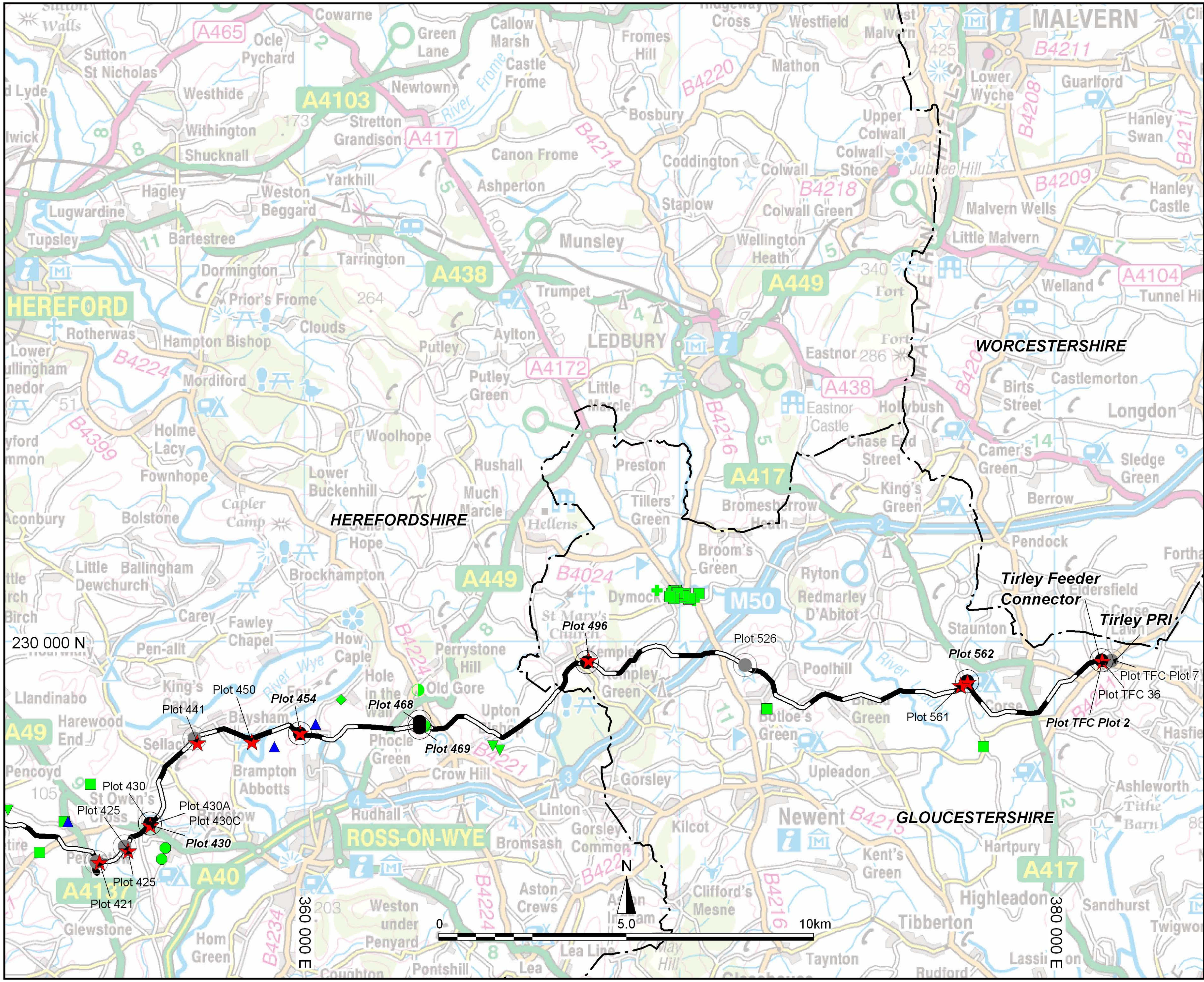
network archaeology

Brecon to Tirley pipeline

Figure 9
Iron age and Roman sites within the vicinity of the BRT route (Herefordshire)

Scale: 1:100 000

FILE NAME: \BRT\178\report\illustrations\GIS\ver02.00\workspaces\figure09.wor



Pipeline route

County boundary

Newly discovered archaeology

Roman site

Roman find scatters

Roman pottery

Known archaeology (from DBA)

Agriculture

Finds scatter

Industrial

Military

Ritual

Settlement

Roman roads

Iron age

Roman

2.00	14/05/12	No change	SAF	GC	DH
1.00	02/07/12	Edits	SAF	GC	DH
Ver	Date	Description	Drn	Chk	App

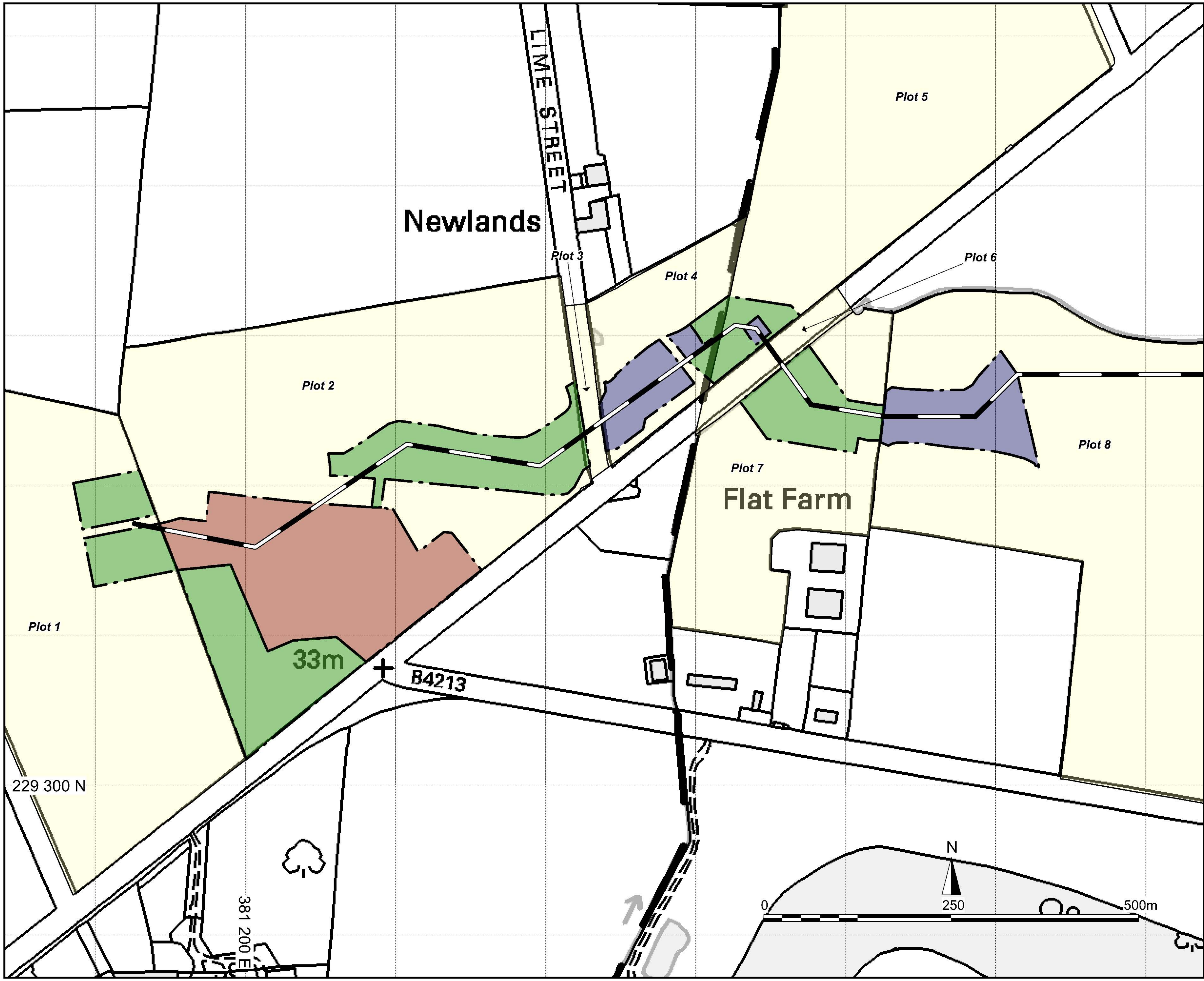
network archaeology

Brecon to Tirley pipeline

Figure 10
Iron age and Roman sites within the vicinity of the BRTand TFC route (Herefordshire and Gloucestershire)

Scale: 1:100 000

FILE NAME: \BRT\178\report\illustrations\GIS\ver02.00\workspaces\figure10.wor



Proposed pipeline
Controlled strip
Watching brief (2011)
Watching brief (pre 2011)
Survey plot

Ver	Date	Description	Drn	Chk	App
2.00	14/05/12	No change	SAF	GC	DH
1.00	24/04/12	First issue	SAF	GC	DH

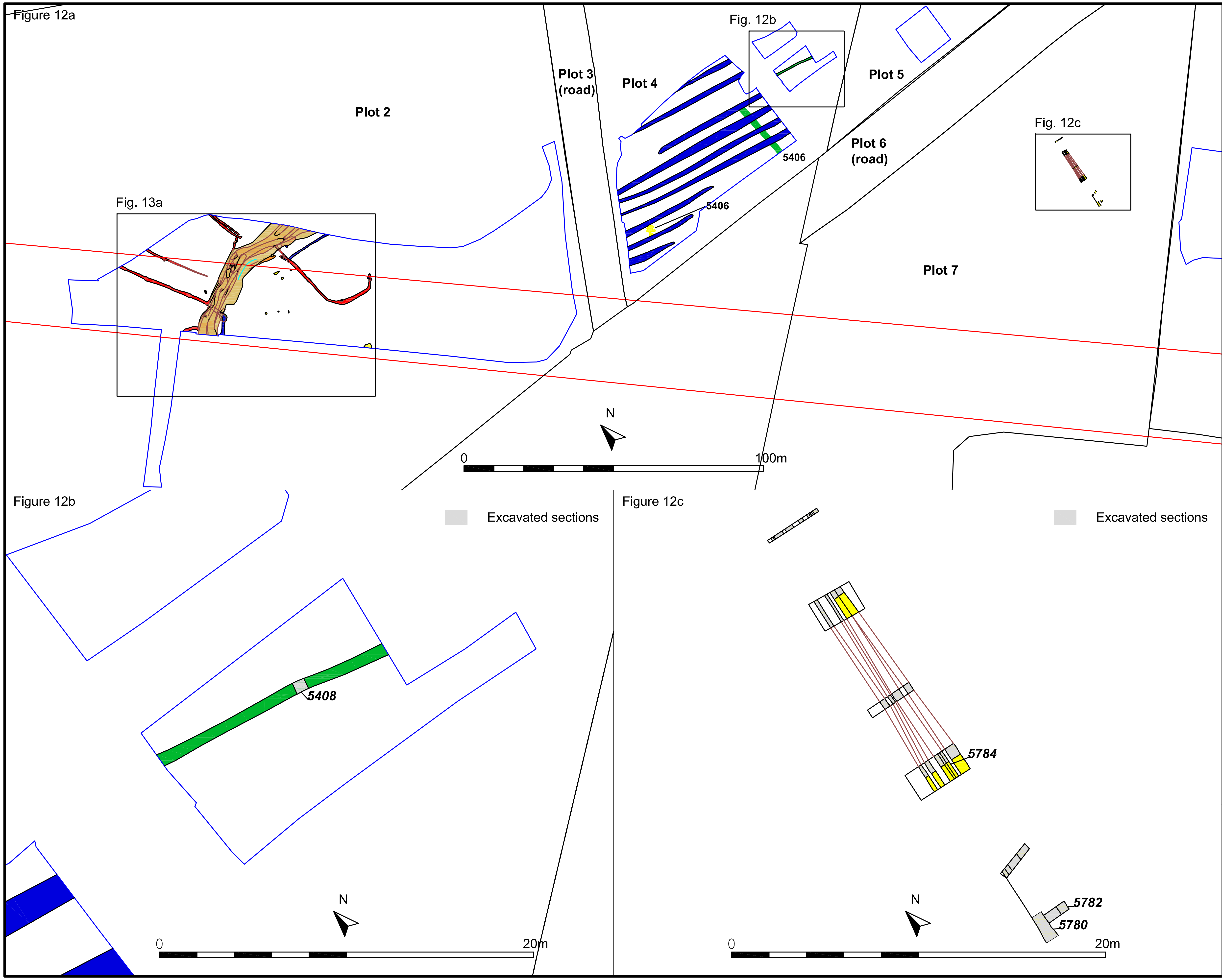
network archaeology

Brecon to Tirley pipeline

Figure 11
Location of Tirley Feeder Connector controlled strip areas

Scale: 1:2500

FILE NAME: \BRT\178\report\illustrations\GIS\ver02.00\workspaces\figure11.wor



Limit of excavation
Cut line
Layer line
Projected line
Extant modern pipelines
1234 Cut number
Phase 1
Phase 2
Phase 3
Phase 4
Phase 5
Undated

Ver	Date	Description	DM	Chk	App
2.0	9/5/13	Second release	SAF	DH	DB
1.0	6/7/12	First issue	JLC	GC	DH

network archaeology

Tirley Feeder Connection Pipeline

Figure 12: Plan showing archaeological features discovered during TFC watching brief

Scale 1:1250 and 1:200

FILE NAME:\BRT178\report\illustrations\CAD\ver02.00 TFC BRT combined\Fig 12 13 14 TFC plot 02 04.dwg

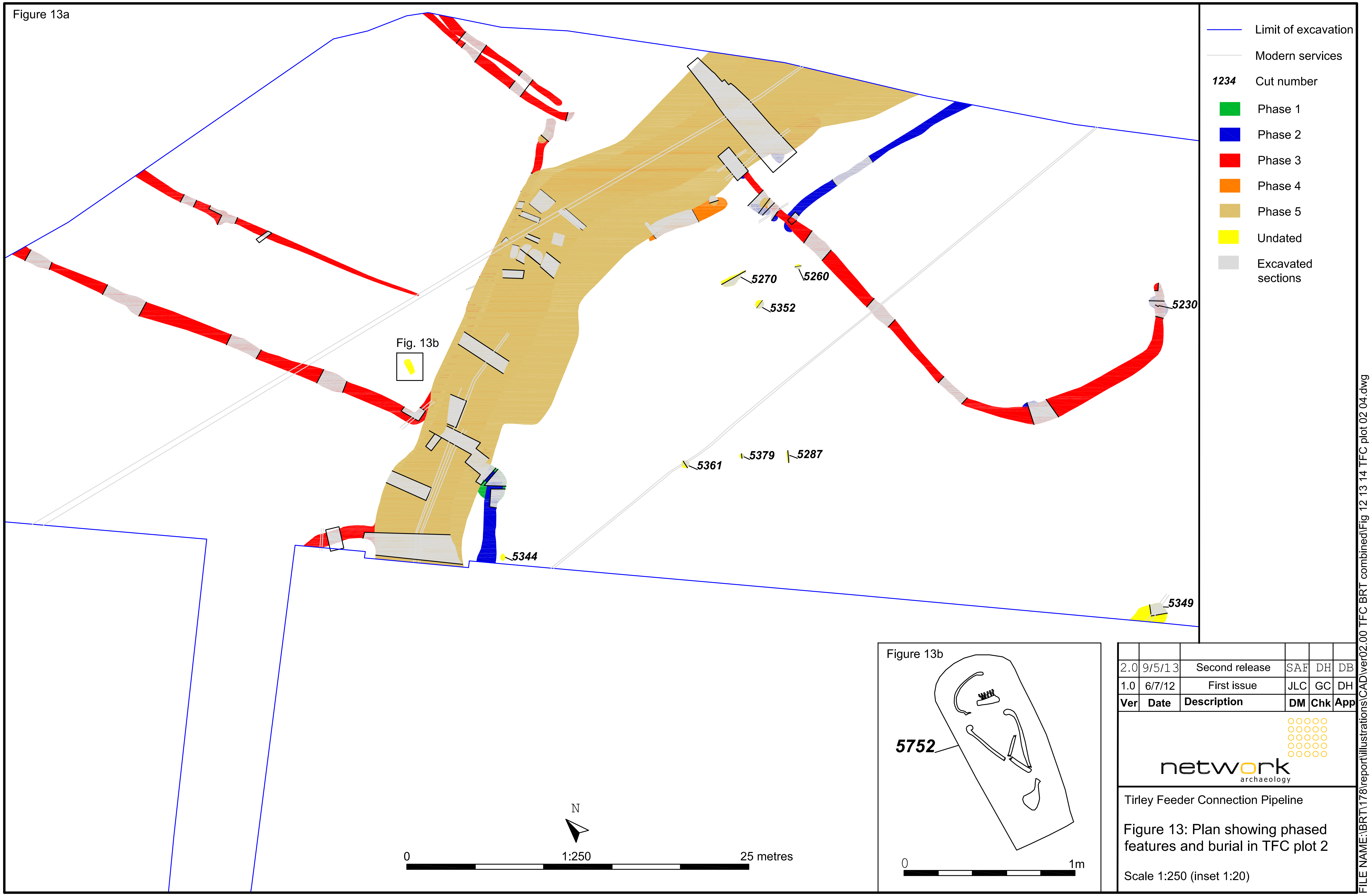
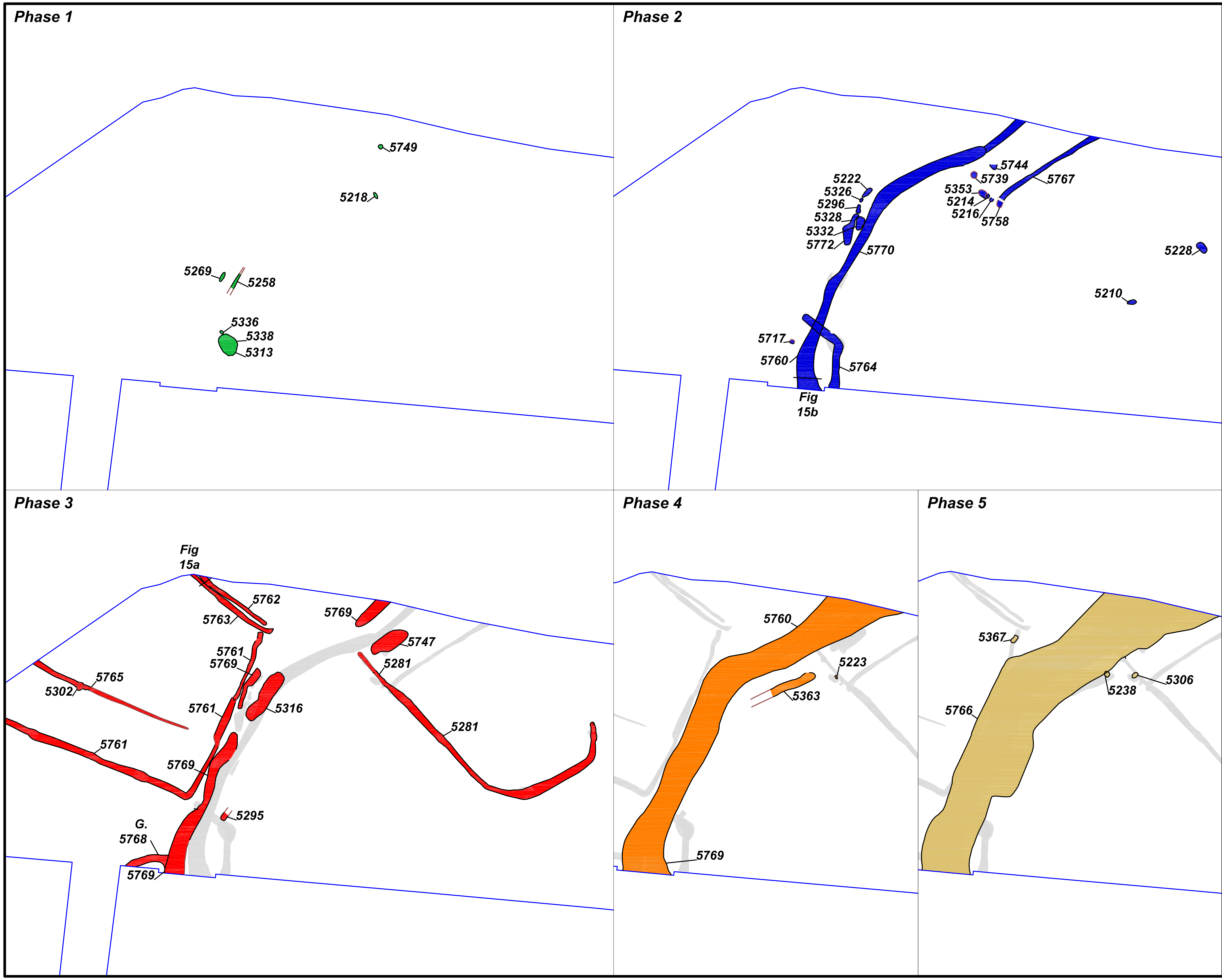


Figure 13: Plan showing phased features and burial in TFC plot 2



	Limit of excavation
	Cut line
	Layer line
	Projected line
1234	Cut number
	Phase 1
	Phase 2
	Phase 3
	Phase 4
	Phase 5
	Earlier features

2.0	9/5/13	Second release	SAF	DH	DB
1.0	6/7/12	First issue	JLC	GC	DH
Ver	Date	Description	DM	Chk	App

network archaeology

Tirley Feeder Connection Pipeline

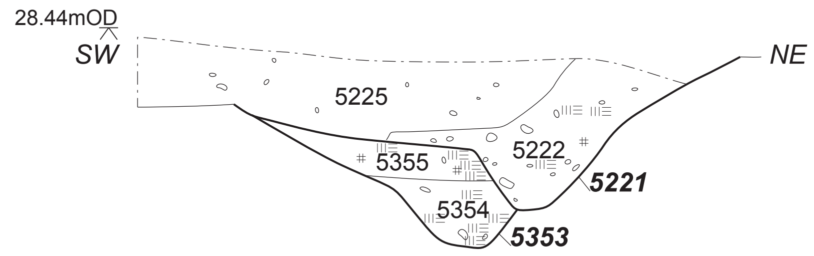
Figure 14: Individual phased plans of TFC plot 2

Scale 1:500

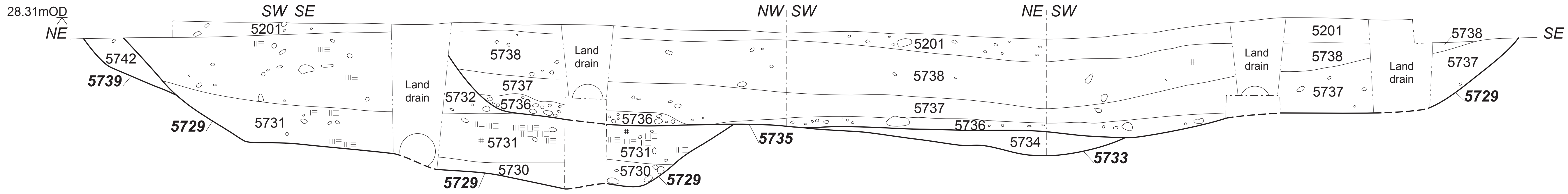
FILE NAME:\BRT\178\report\illustrations\CAD\ver02.00 TFC BRT combined\Fig 12 13 14 TFC plot 02 04.dwg

— · — · —	Limit of excavation
———	Cut line
———	Layer line
- · - · -	Field drain/modern features
1234	Cut number
1233	Layer/fill number
	Clay
	Charcoal
	Stones

a)



b)



2.00	10/05/13	Second issue	SAF	DH	DB
1.00	13/7/12	First issue	JLC	GC	DH
Ver	**Date**	**Description**	**DM**	**Chk**	**App**

network
archaeology

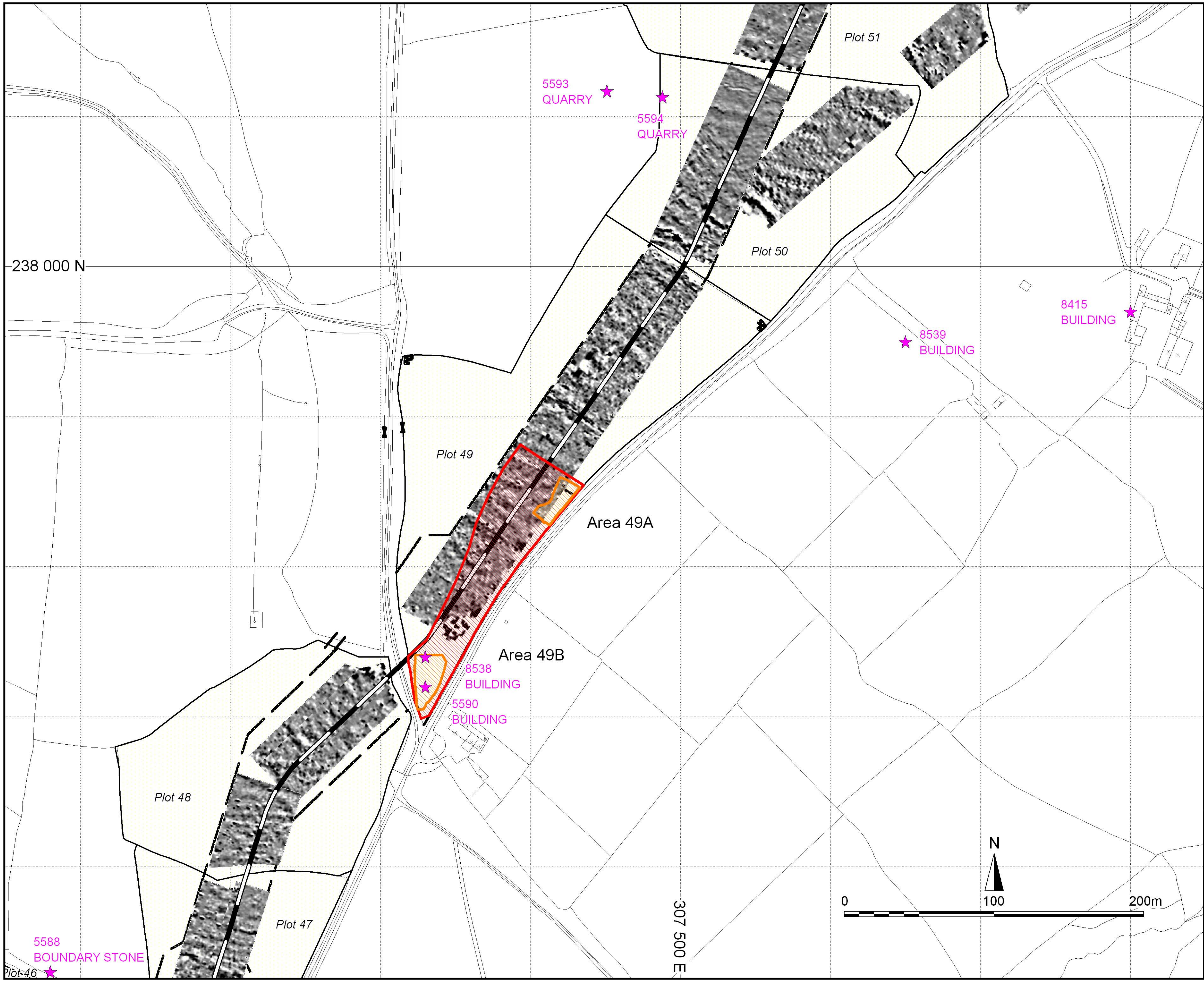
Brecon to Tirley Pipeline and Tirley Feeder Connection

Figure 15: Selected sections of features

a) Section of ditches 5221 and 5353, TFC
b) Section of trackway, TFC

Scale 1:20

FILE NAME:BRT\178\report\illustrations\illustrator\ver02.00\Fig 15_BRT-TFC_Sections.pdf



- Pipeline route
- Working width
- Plot
- Geophysical survey
- WSI area
- Evaluation trench
- Area of archaeological focus
- Identified site - excavation area
- Major watching brief site
- DBA site

2.00	10/05/13	First issue	AH	DH	DB
Ver	Date	Description	Drn	Chk	App

network archaeology

Brecon to Tirley pipeline

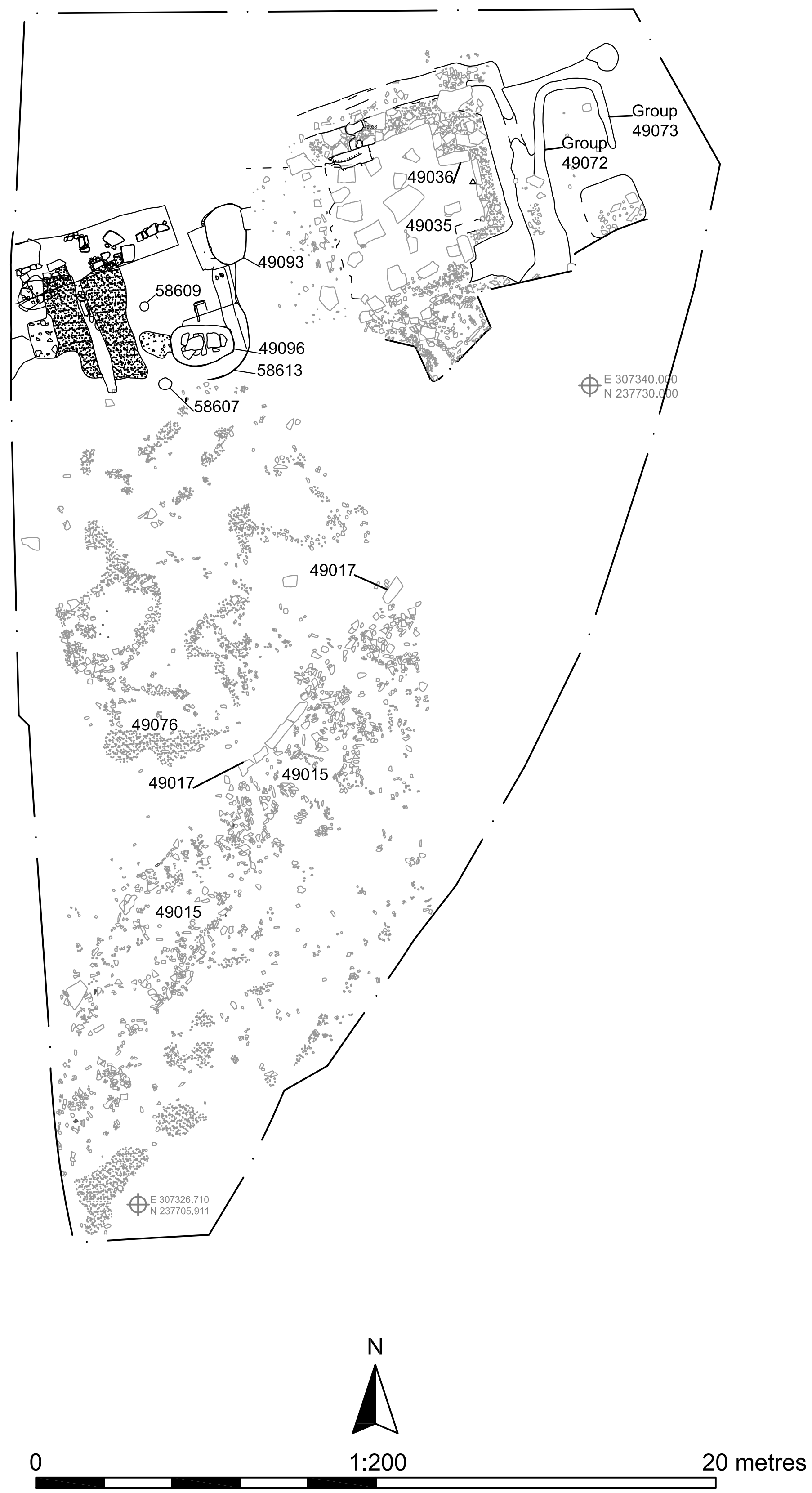
Figure 16
Plot 49: Identified sites and watching brief sites in relation to geophysical survey and evaluation trenches

Scale: 1:2500

FILE NAME: \BRT\178\report\illustrations\GIS\ver02.00\workspaces\figure16.wor

Figure 17a

Figure 17b



Area of archaeological focus

Archaeological feature

22567 Feature number

Stones

Mortar flecks

Charcoal

Phase 1

Phase 2

Phase 3

Unphased

Ver	Date	Description	DM	Chk	App
2.0	9/5/13	Second release	SAF	DH	DB
1.0	6/7/12	First issue	JLC	GC	DH

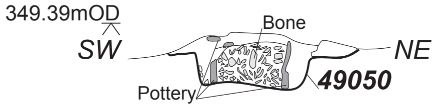
network archaeology

Brecon to Tirley Pipeline

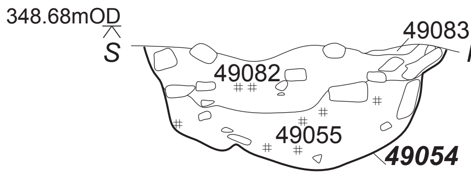
Figure 17: Plot 49: Plan showing post-medieval farmstead and Bronze Age cremation cemetery

Scale 1:200

FILE NAME:\BRT\178\report\illustrations\CAD\ver02.00 TFC BRT combined\Fig 17BRT plot049.dwg a)



b)



0 1:20 2m

—·—·—	Limit of excavation
———	Cut line
——	Layer line
—··—··—	Field drain/modern features
1234	Cut number
1233	Layer/fill number
	Charcoal
	Stones

2.00	10/05/13	2nd issue	SAF	DH	DB
1.00	10/07/13	1st issue	JC	DH	DB
Ver	Date	Description	DM	Chk	App

network archaeology

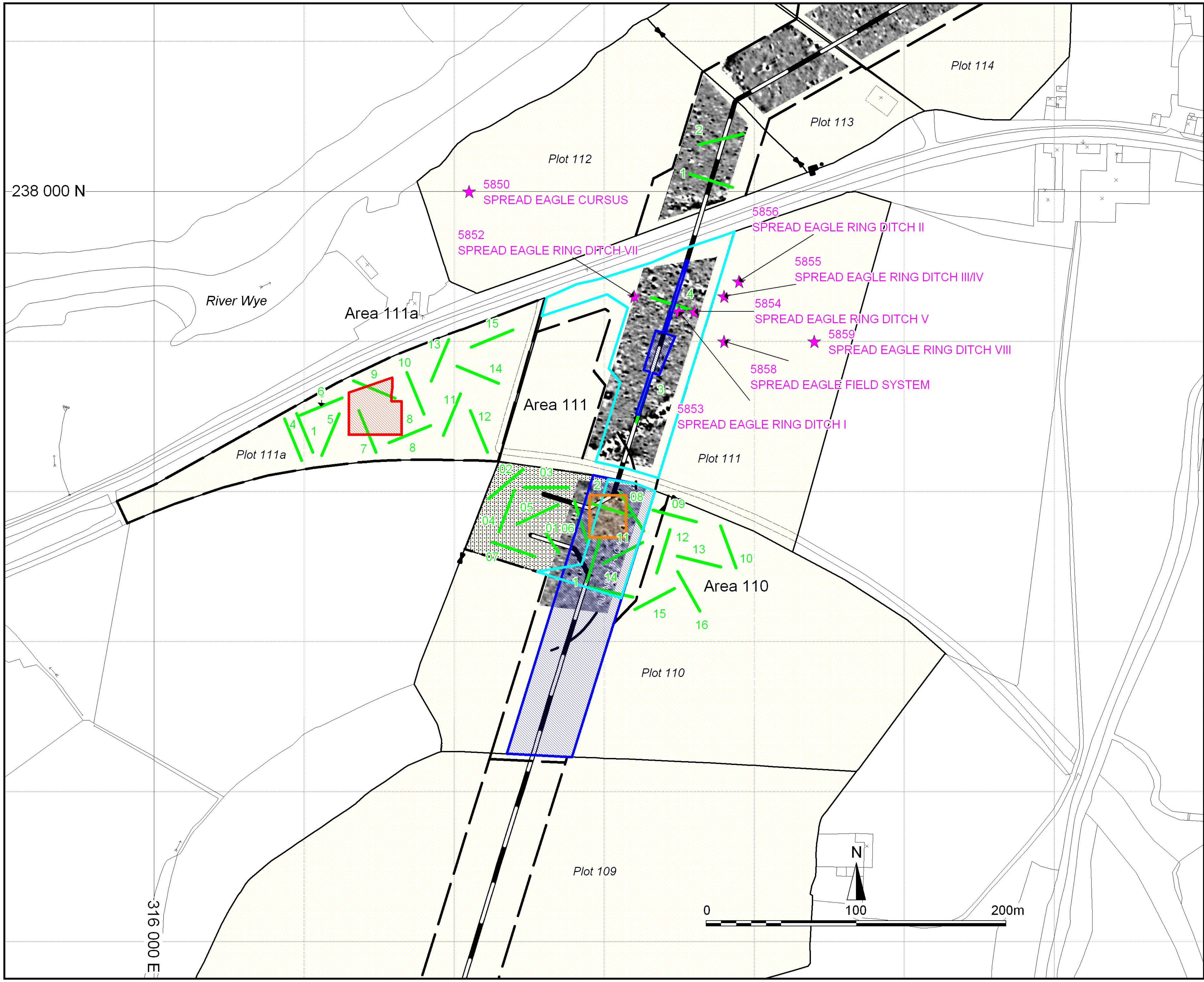
Brecon to Tirley Pipeline

Figure 18: Selected sections of features

a) Section of cremation 49050, Plot 49
b) Section of pit 49054, Plot 49

Scale 1:20

FILE NAME: BRT\178\report\illustrations\illustrator\ver02.00\Fig 18_BRT_sections.pdf



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Ver	Date	Description	Drn	Chk	App
2.00	10/05/13	First issue	AH	DH	DB

network archaeology

Brecon to Tirley pipeline

Figure 19
Plots 110, 111 and 111a: Identified sites and watching brief sites in relation to geophysical survey and evaluation trenches

Scale: 1:2500

FILE NAME: \BRT\178\report\illustrations\GIS\ver02.00\workspaces\figure19.wor

Fig. 20a

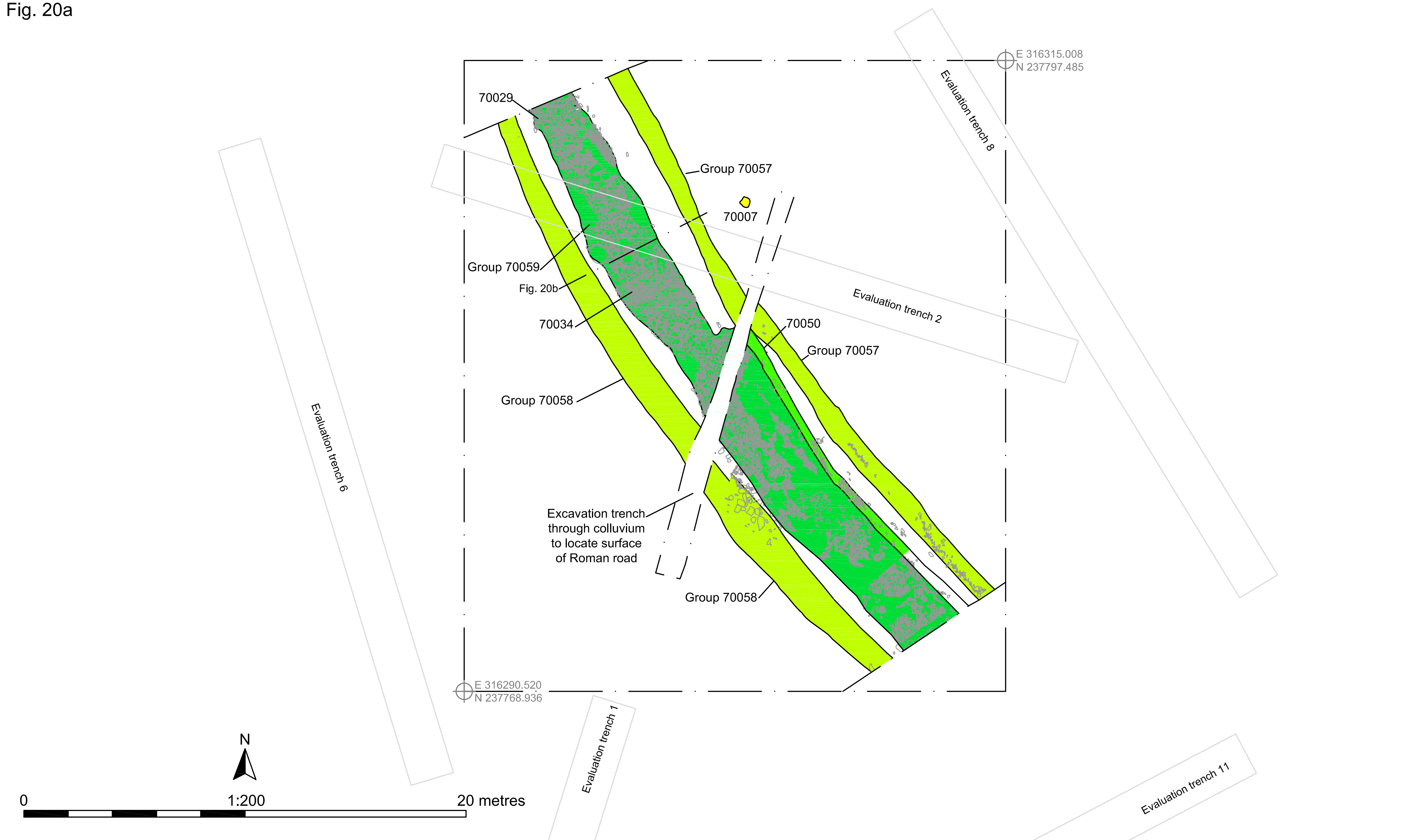
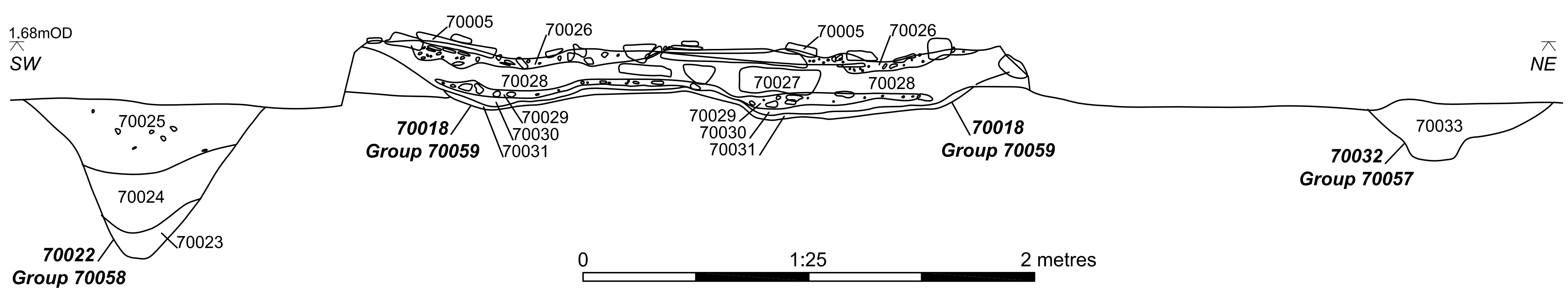


Fig. 20b



- Area of archaeological focus
- Archaeology
- Fill layer
- 22567 Feature number
- Stones
- Mortar flecks
- Charcoal
- Phase 1
- Phase 1a
- Phase 1b
- Phase 1c
- Phase 2
- Phase 2a
- Phase 2b
- Phase 2c
- Phase 2d
- Phase 2e
- Phase 3
- Unphased

1.0	6/7/12	First release	JLC	GC	DH
Ver	**Date**	**Description**	**DM**	**Chk**	**App**

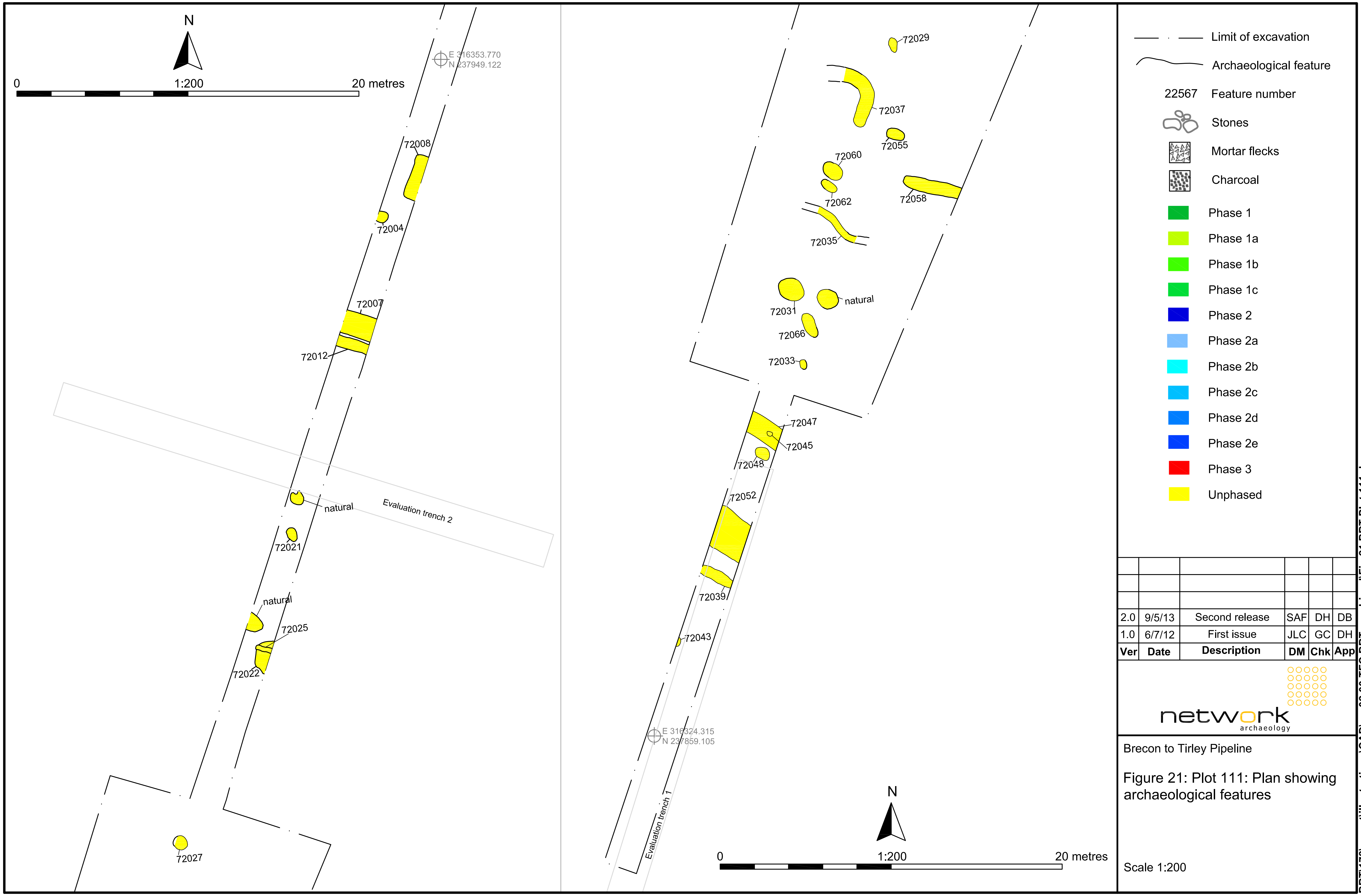
network archaeology

Brecon to Tirley Pipeline

Figure 20: Plot 110: Plan and section of Roman road

Scale Plan 1:200 and section 1:25

FILE NAME:\BRT178\report\illustrations\CAD\ver02.00 TFC BRT combined\Fig 20 BRT Plot 110.dwg



Ver	Date	Description	DM	Chk	App
2.0	9/5/13	Second release	SAF	DH	DB
1.0	6/7/12	First issue	JLC	GC	DH

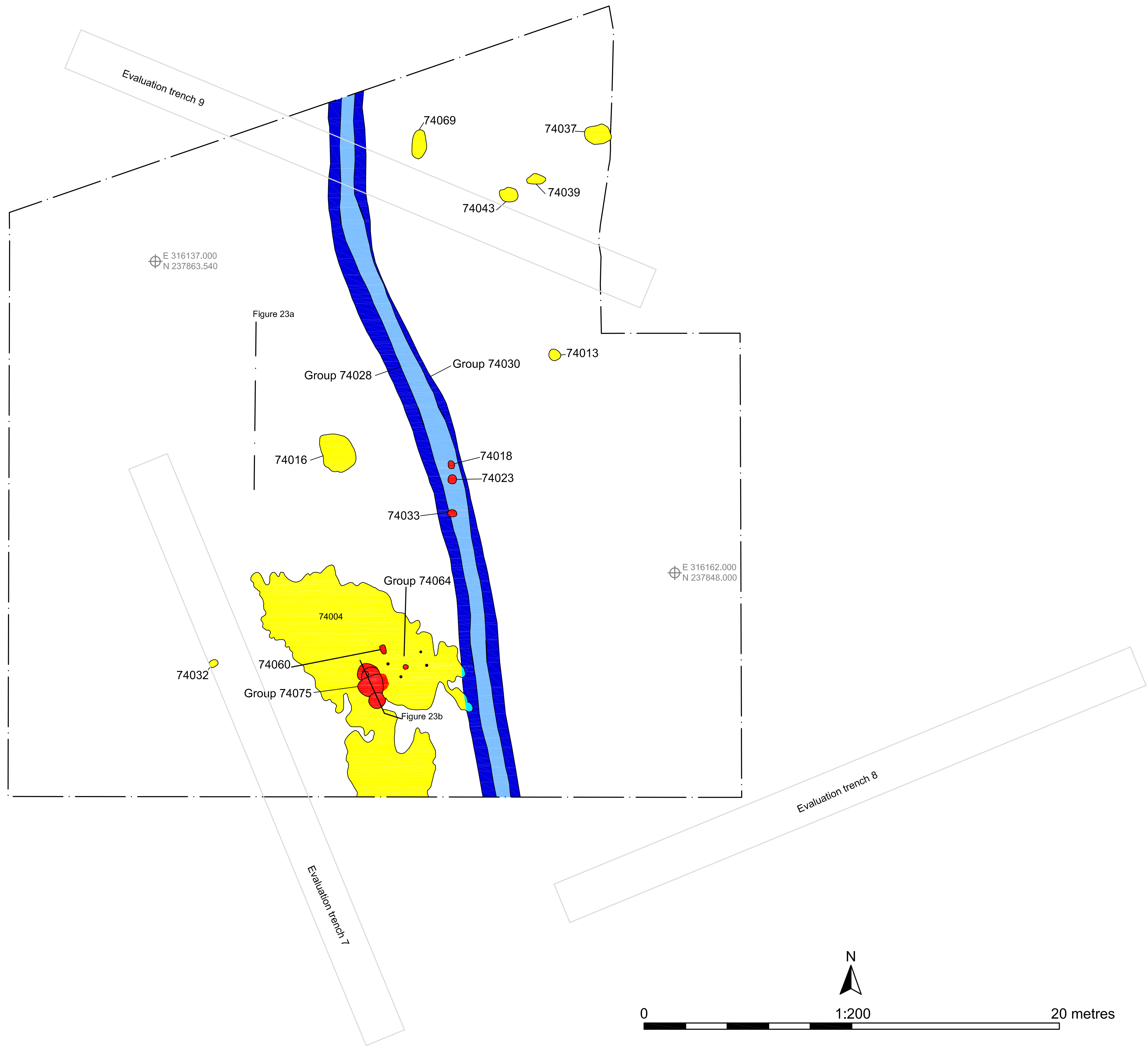
network archaeology

Brecon to Tirley Pipeline

Figure 21: Plot 111: Plan showing archaeological features

Scale 1:200

BRT178\report\illustrations\CAD\ver02.00 TFC BRT combined\Fig 21 BRT Plot 111.dwg



Limit of excavation
Archaeological feature
22567 Feature number
Stones
Mortar flecks
Charcoal
Phase 1
Phase 1a
Phase 1b
Phase 1c
Phase 2
Phase 2a
Phase 2b
Phase 2c
Phase 2d
Phase 2e
Phase 3
Unphased

2.0	9/5/13	Second release	SAF	DH	DB
1.0	13/7/12	First issue	JLC	GC	DH
Ver	**Date**	**Description**	**DM**	**Chk**	**App**

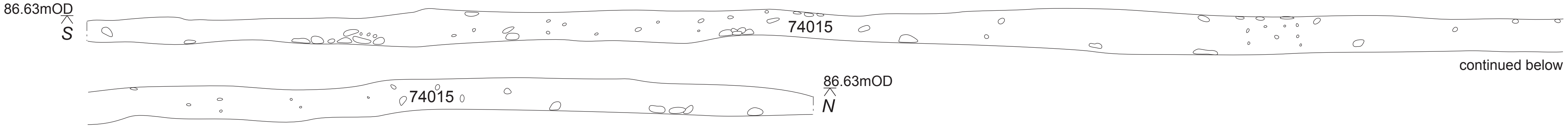
network archaeology

Brecon to Tirley Pipeline

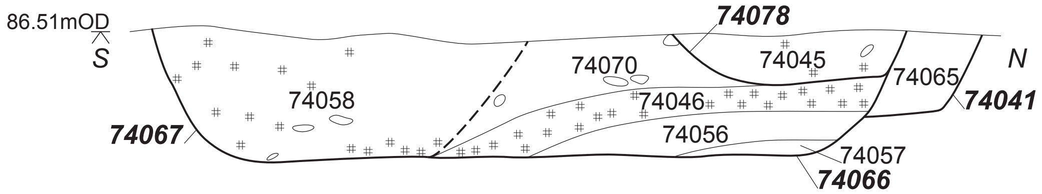
Figure 22: Plot 111a: Plan showing archaeological features

Scale 1:200

FILE NAME: BRT178\report\illustrations\CAD\ver02.00 TFC BRT combined\Fig 22 BRT Plot 111a.dwg a)



b)



0 1:20 2m

- Limit of excavation
- Cut line
- Layer line
- Field drain/modern features
- ***1234*** Cut number
- 1233 Layer/fill number
- Charcoal
- Stones

2.00	10/05/13	Second issue	SAF	DH	DB
1.00	13/7/12	First issue	JLC	GH	DH
Ver	**Date**	**Description**	**DM**	**Chk**	**App**

network archaeology

Brecon to Tirley Pipeline

Figure 23: Selected sections of features

a) Representative section, Plot 111a
b) Section of pits 74041, 74066, 74067 and 74078, Plot 111a

Scale 1:20

FILE NAME: BRT1178\report\illustrations\illustrator\ver02.00\Fig 23_BRT_sections.pdf

Pipeline route

Working width

Plot

Geophysical survey

WSI area

Evaluation trench

Area of archaeological focus

Identified site - excavation area

Major watching brief site

DBA site

Ver	Date	Description	Drn	Chk	App
2.00	10/05/13	First issue	AH	DH	DB

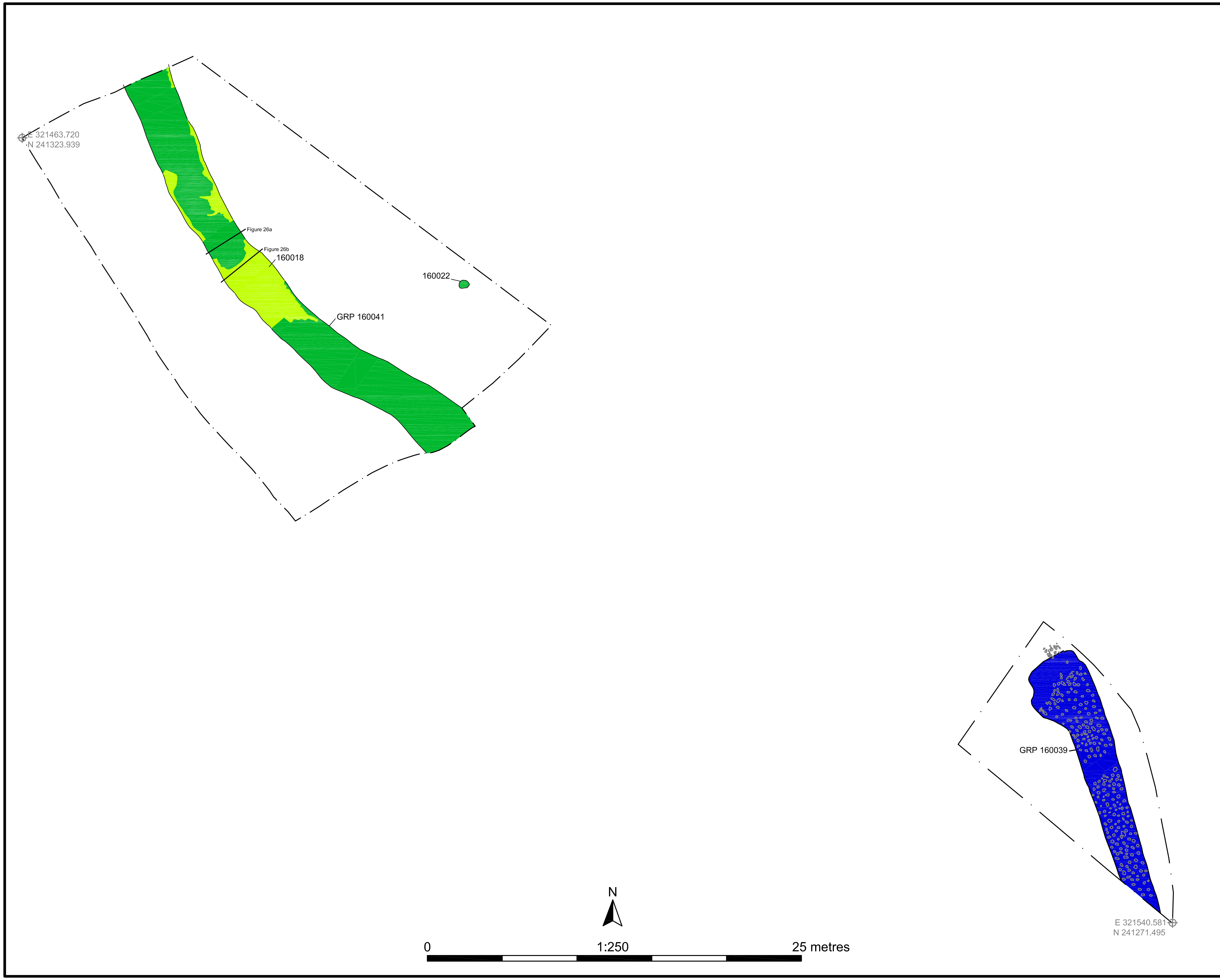
network archaeology

Brecon to Tirley pipeline

Figure 24
Plot 160: Identified sites and watching brief sites in relation to geophysical survey and evaluation trenches

Scale: 1:2500

FILE NAME: \BRT\178\report\illustrations\GIS\ver02.00\workspaces\figure24.wor



Area of archaeological focus

Archaeological feature

22567 Feature number

Stones

Mortar flecks

Charcoal

Phase 1

Phase 1a

Phase 1b

Phase 1c

Phase 2

Phase 2a

Phase 2b

Phase 2c

Phase 2d

Phase 2e

Phase 3

Unphased

2.0	9/5/13	Second release	SAF	DH	DB
1.0	6/7/12	First issue	JLC	GC	DH
Ver	**Date**	**Description**	**DM**	**Chk**	**App**

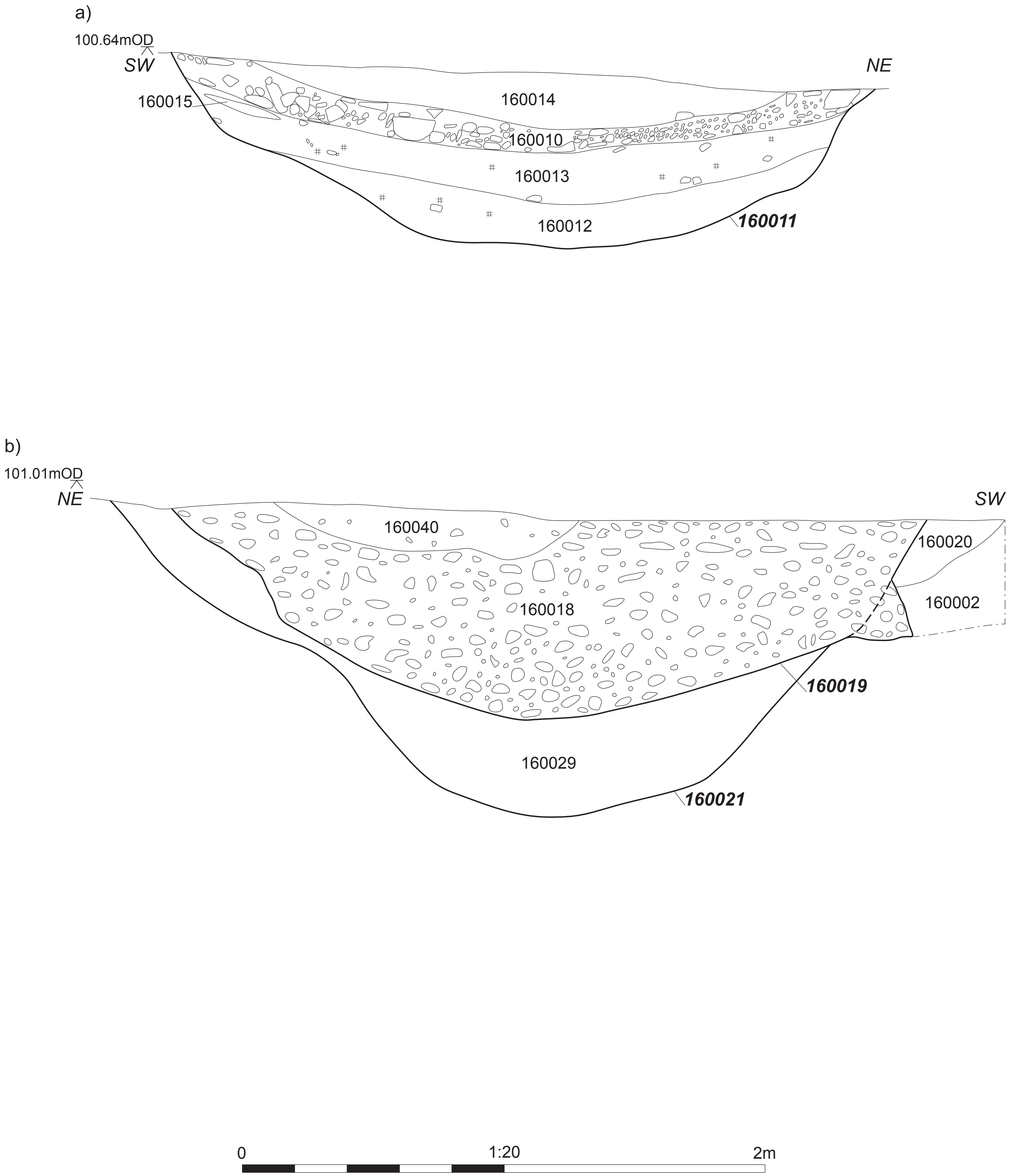
network archaeology

Brecon to Tirley Pipeline

Figure 25: Plot 160: Plan showing archaeological features

Scale 1:250

FILE NAME: BRT1178\report\illustrations\CAD\ver02.00 TFC BRT combine\Fig 25 BRT Plot 160.dwgd



Limit of excavation
Cut line
Layer line
Field drain/modern features
1234 Cut number
1233 Layer/fill number
Charcoal
Stones

Ver	Date	Description	DM	Chk	App
2.00	10/05/13	Second issue	SAF	DH	DB
1.00	13/7/12	First issue	JLC	GH	DH

network archaeology

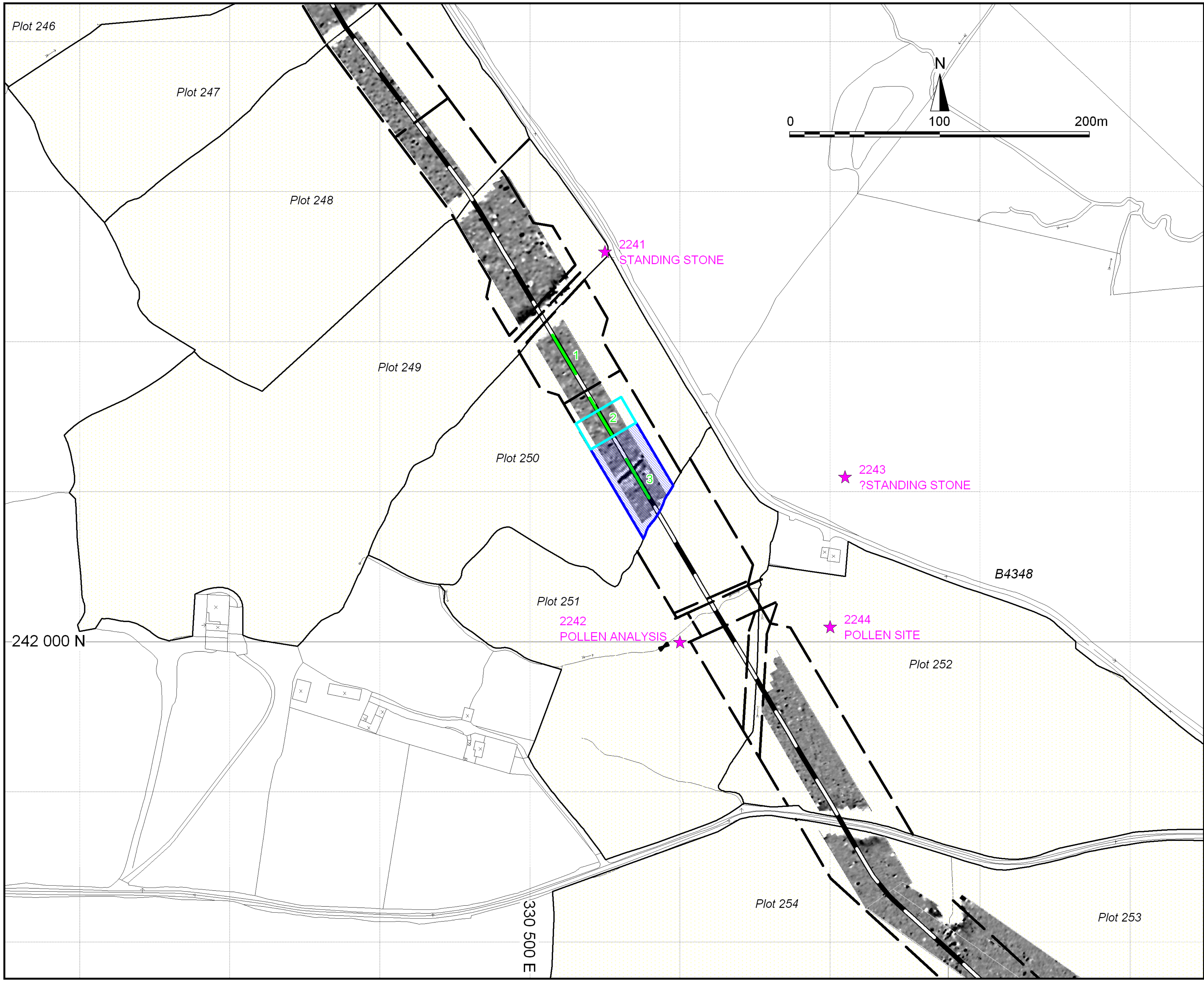
Brecon to Tirley Pipeline

Figure 26: Selected sections of features

a) Section of ditch 106011, Plot 160
b) Section of ditches 160019 and 160021, Plot 160

Scale 1:20

FILE NAME: BRT178\report\illustrations\illustrator\ver02.00\Fig 26_BRT_sections.pdf



Ver	Date	Description	Drn	Chk	App
2.00	10/05/13	First issue	AH	DH	DB

network archaeology

Brecon to Tirley pipeline

Figure 27
Plot 250: Identified sites and watching brief sites in relation to geophysical survey and evaluation trenches

Scale: 1:2500

FILE NAME: \BRT\178\report\illustrations\GIS\ver02.00\workspaces\figure27.wor

Pipeline route

Working width

Plot

Geophysical survey

WSI area

Evaluation trench

Area of archaeological focus

Identified site - excavation area

Major watching brief site

DBA site

2.00	10/05/13	First issue	AH	DH	DB
Ver	Date	Description	Drn	Chk	App

network archaeology

Brecon to Tirley pipeline

Figure 28

Plots 269 and 271: Identified sites and watching brief sites in relation to geophysical survey and evaluation trenches

Scale: 1:2500

FILE NAME: \BRT\178\report\illustrations\GIS\ver02.00\workspaces\figure28.wor

Figure 29a: Plot 250

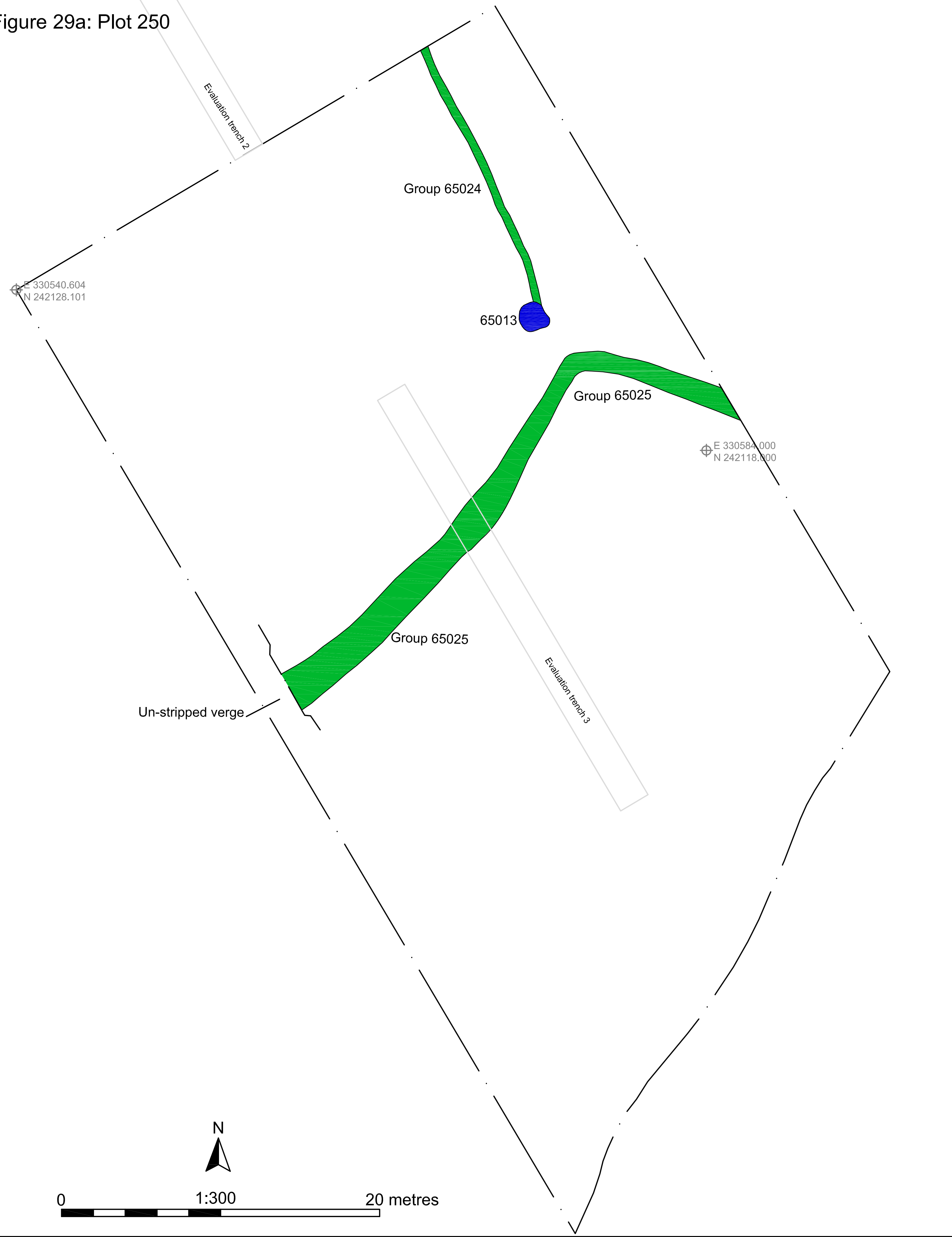


Figure 29b: Plot 269

Limit of excavation
Archaeological feature
22567 Feature number
Stones
Mortar flecks
Charcoal
Phase 1
Phase 2
Phase 3
Unphased

2.0	9/5/13	Second release	SAF	DH	DB
1.0	6/7/12	First issue	JLC	GC	DH
Ver	**Date**	**Description**	**DM**	**Chk**	**App**

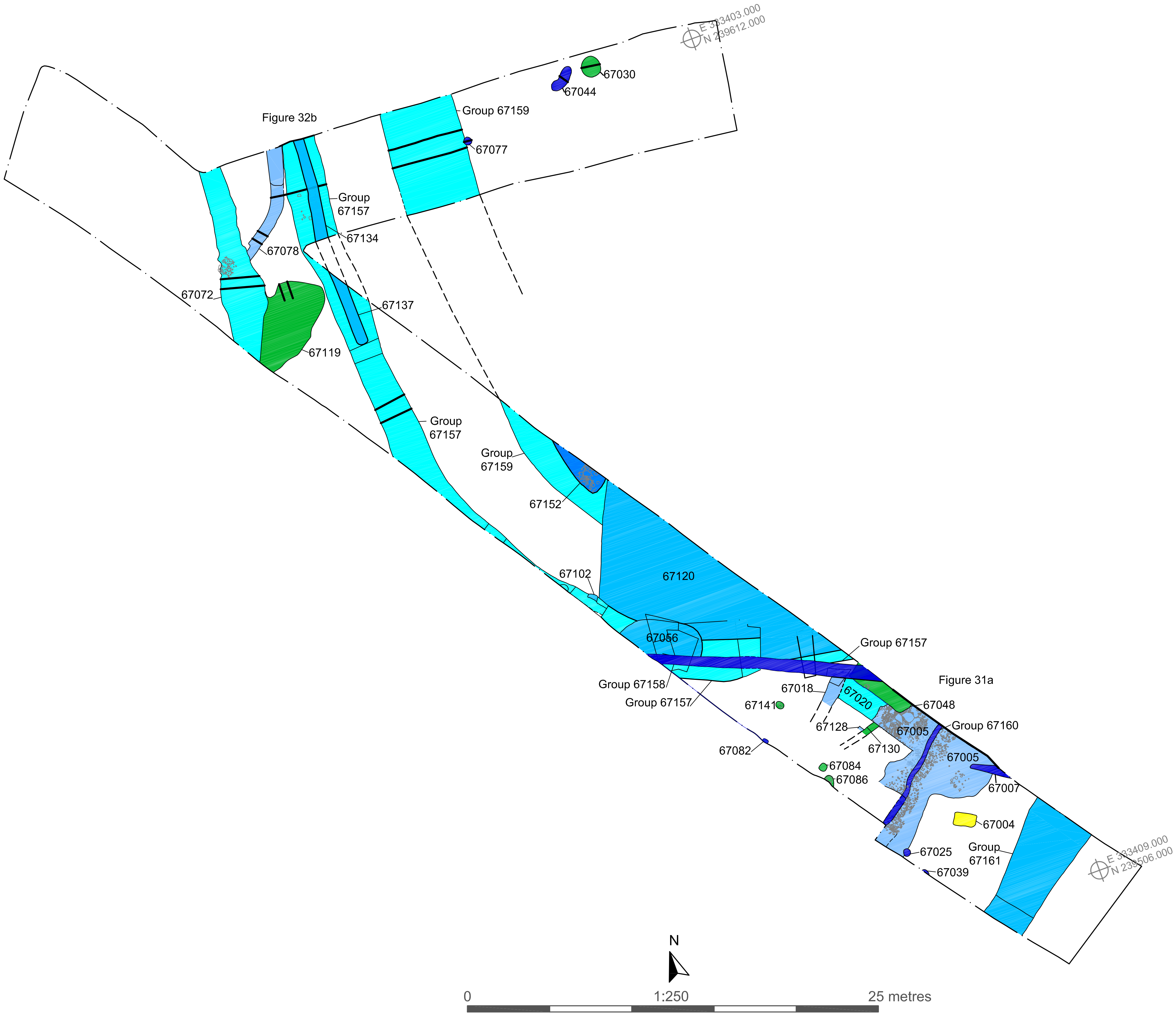
network archaeology

Brecon to Tirley Pipeline

Figure 29: Plot 250 and 269: Plan showing archaeological features

Scale 1:300 and 1:250

FILE NAME: BRT\178\report\illustrations\CAD\ver02.00 TFC BRT combined\Fig 29 BRT Plot 250-269.dwg



Limit of excavation
Archaeological feature
Projected
22567 Feature number
Stones
Mortar flecks
Charcoal
Phase 1
Phase 1a
Phase 1b
Phase 1c
Phase 2
Phase 2a
Phase 2b
Phase 2c
Phase 2d
Phase 2e
Phase 3
Unphased

Ver	Date	Description	DM	Chk	App
2.0	9/5/13	Second release	SAF	DH	DB
1.0	6/7/12	First issue	JLC	GC	DH

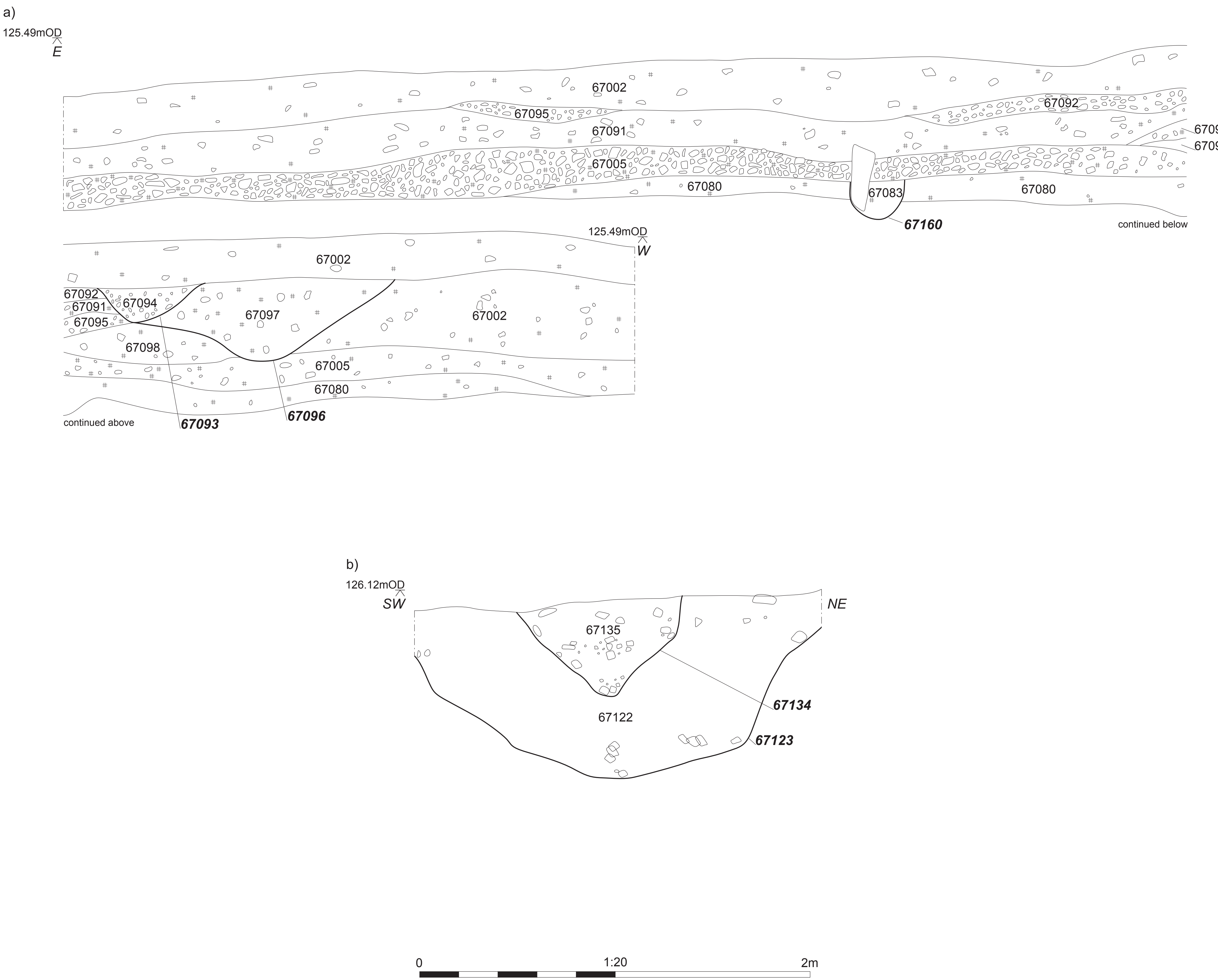
network archaeology

Brecon to Tirley Pipeline

Figure 30: Plot 271: Plan showing archaeological features

Scale 1:250

FILE NAME: BRT\178\report\illustrations\CAD\ver02.00 TFC BRT combined\Fig 30 BRT Plot 271.dwg



Limit of excavation
Cut line
Layer line
Field drain/modern features
1234 Cut number
1233 Layer/fill number
Clay
Charcoal
Charcoal lump
Stones
Burnt stone
Pottery
Bone
Flint

Ver	Date	Description	DM	Chk	App
2.00	10/05/13	Second issue	SAF	DH	DB
1.00	13/7/12	First issue	JLC	GC	DH

network archaeology

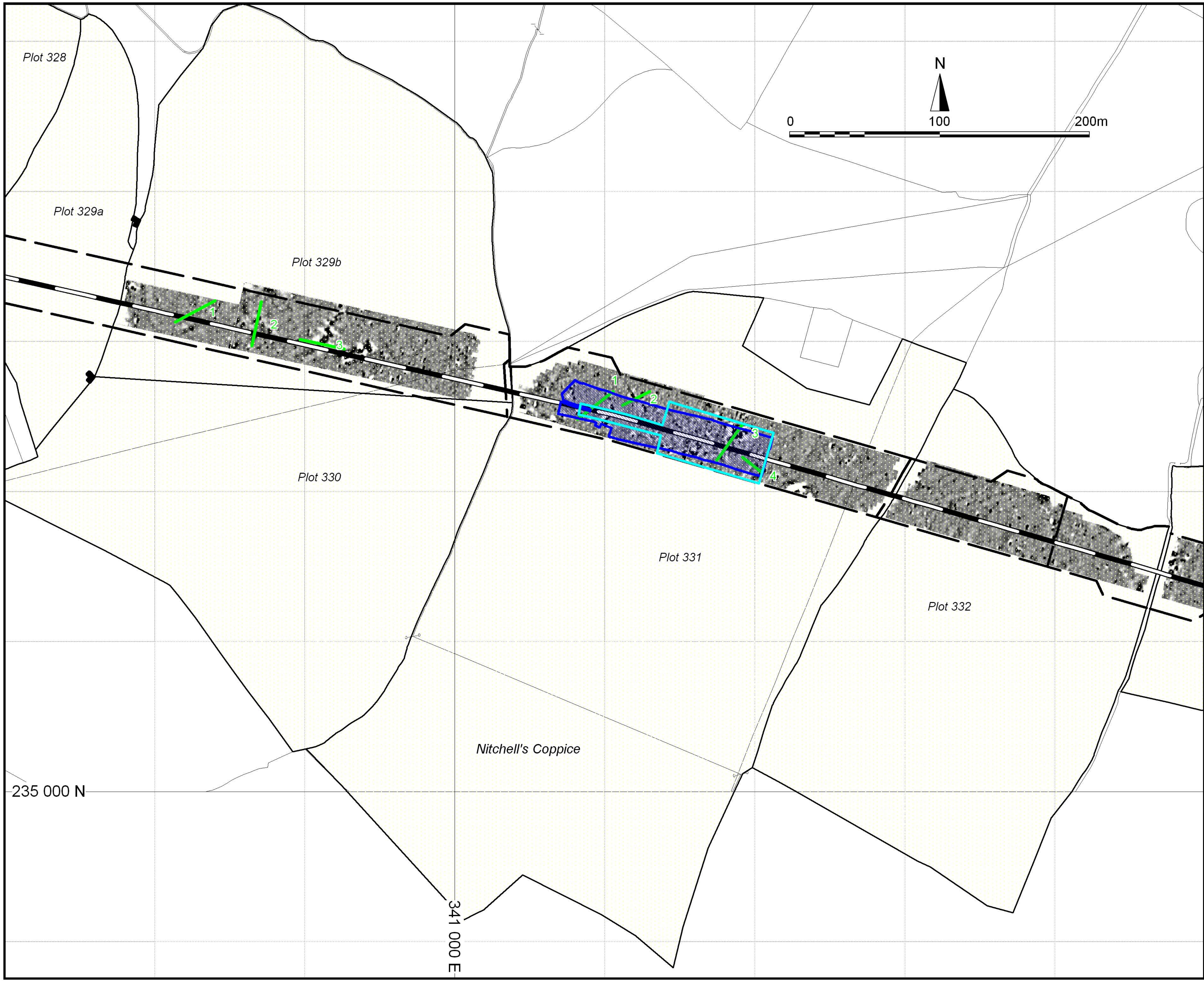
Brecon to Tirley Pipeline

Figure 31: Selected sections of features

a) Section of stone layer 67005, Plot 271
b) Section of ditch 67123, Plot 271

Scale 1:20

FILE NAME: BRT178\report\illustrations\illustrator\ver02.00\Fig 31_BRT_Sections.pdf



Pipeline route

Working width

Plot

Geophysical survey

WSI area

Evaluation trench

Area of archaeological focus

Identified site - excavation area

Major watching brief site

DBA site

2.00	10/05/13	First issue	AH	DH	DB
Ver	Date	Description	Drn	Chk	App

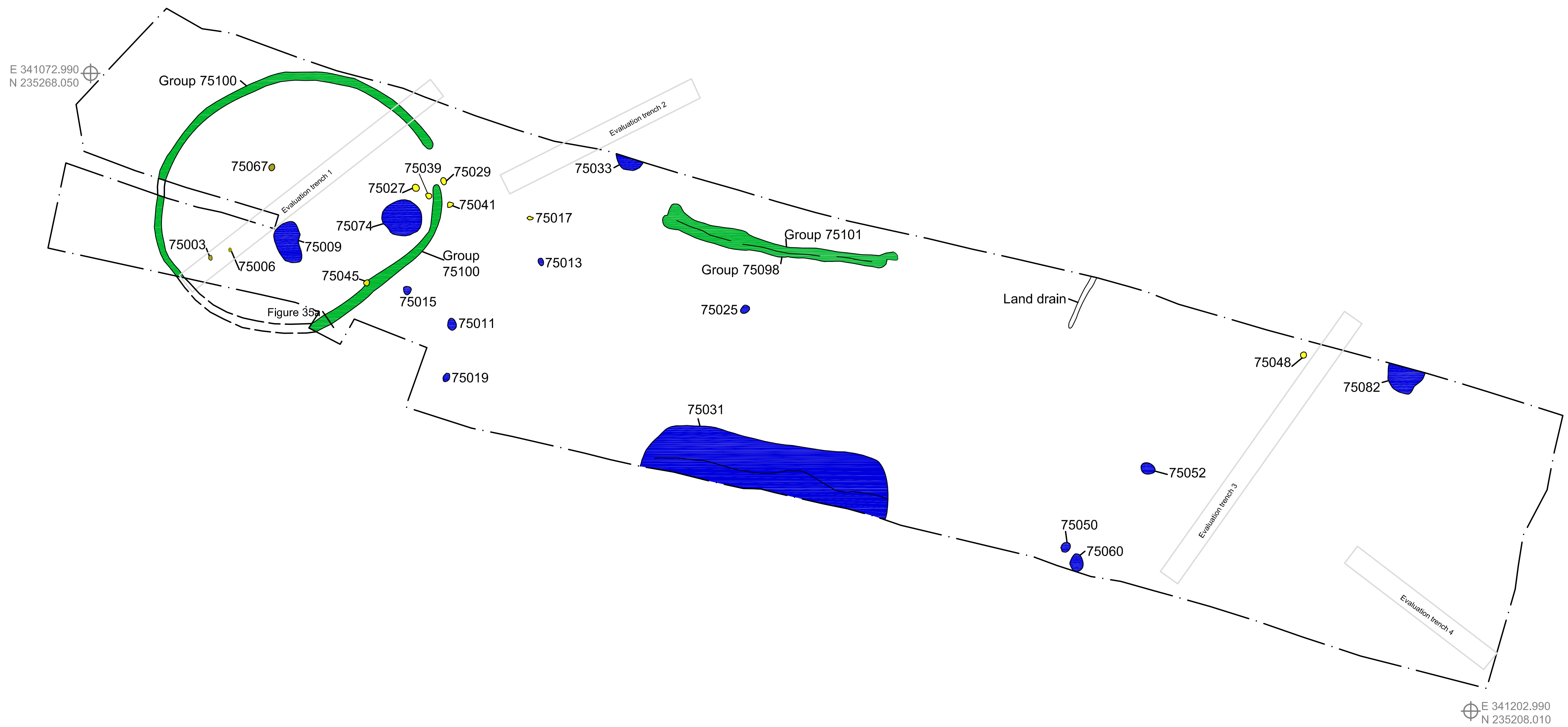
network archaeology

Brecon to Tirley pipeline

Figure 32
Plot 331: Identified sites and watching brief sites in relation to geophysical survey and evaluation trenches

Scale: 1:2500

FILE NAME: \BRT\178\report\illustrations\GIS\ver02.00\workspaces\figure32.wor



2.0	9/5/13	Second release	SAF	DH	DB
1.0	6/7/12	First issue	JLC	GC	DH
Ver	**Date**	**Description**	**DM**	**Chk**	**App**

network archaeology

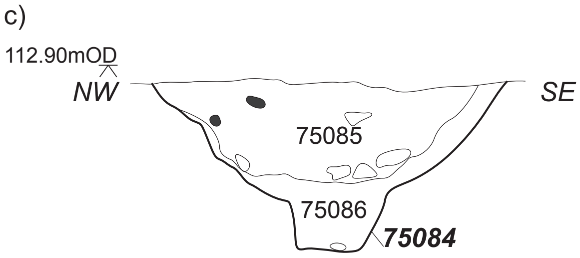
Brecon to Tirley Pipeline

Figure 33: Plot 331: Plan showing archaeological features.

Scale 1:500

FILE NAME: BRT1178\report\illustrations\CAD\ver02.00 TFC BRT combined\Fig 33 BRT Plot 331.dwg

c)



0 1:20 2m

— · — · — Limit of excavation

Cut line

Layer line

Field drain/modern features

1234 Cut number

1233 Layer/fill number

Charcoal

Stones

2.00	10/05/13	2nd issue	SAF	DH	DB
1.00	10/07/13	1st issue	JC	DH	DB
Ver	Date	Description	DM	Chk	App

network archaeology

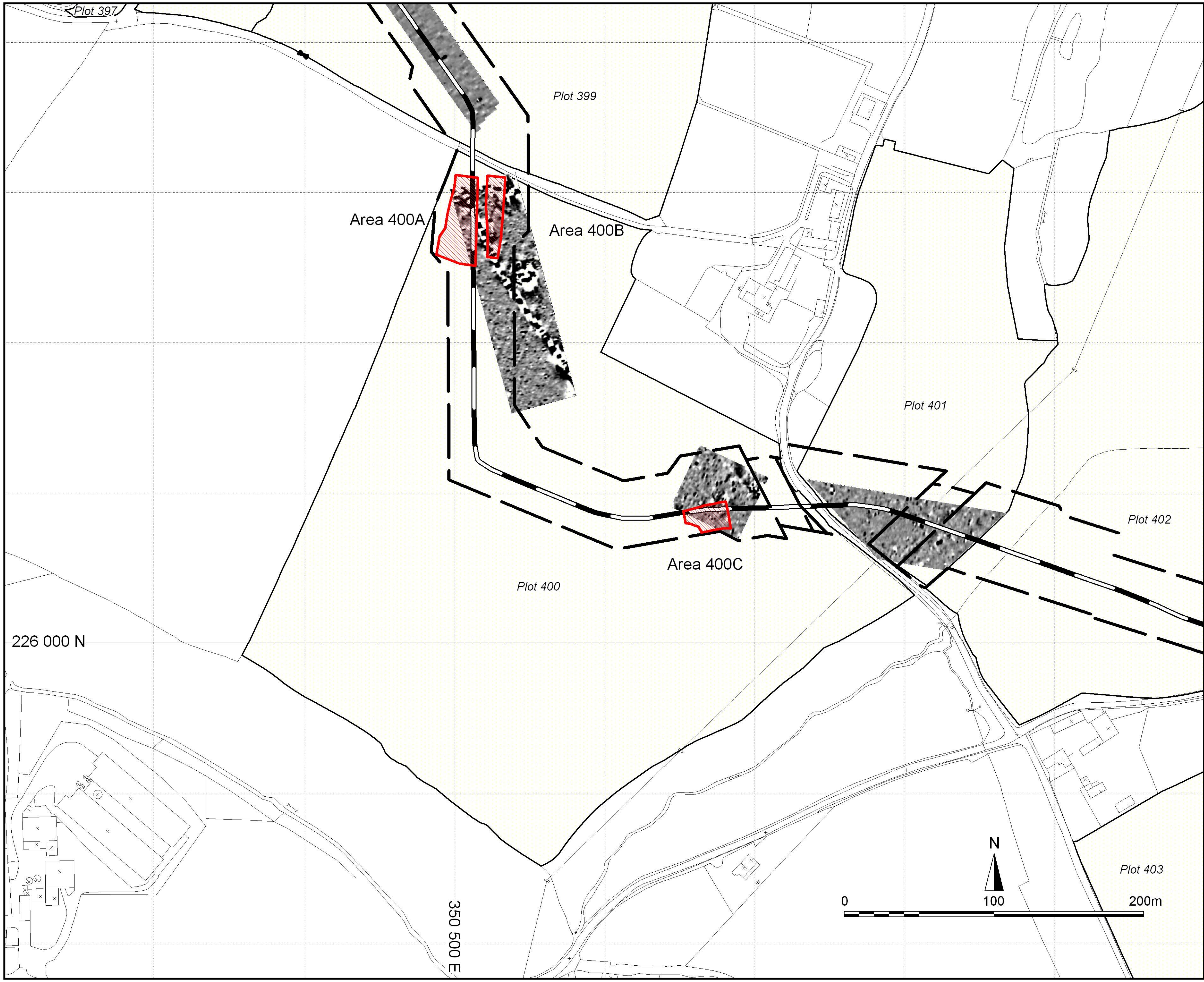
Brecon to Tirley Pipeline

Figure 34: Section of archaeolog-cal features

a) Section of ring ditch 75084, Plot 331

Scale 1:20

FILE NAME: BRT\178\report\illustrations\illustrator\ver02.00Fig 34_BRT-TFC_Sections.pdf



Pipeline route
Working width
Plot
Geophysical survey
WSI area
Evaluation trench
Area of archaeological focus
Identified site - excavation area
Major watching brief site
DBA site

Ver	Date	Description	Drn	Chk	App
2.00	10/05/13	First issue	AH	DH	DB

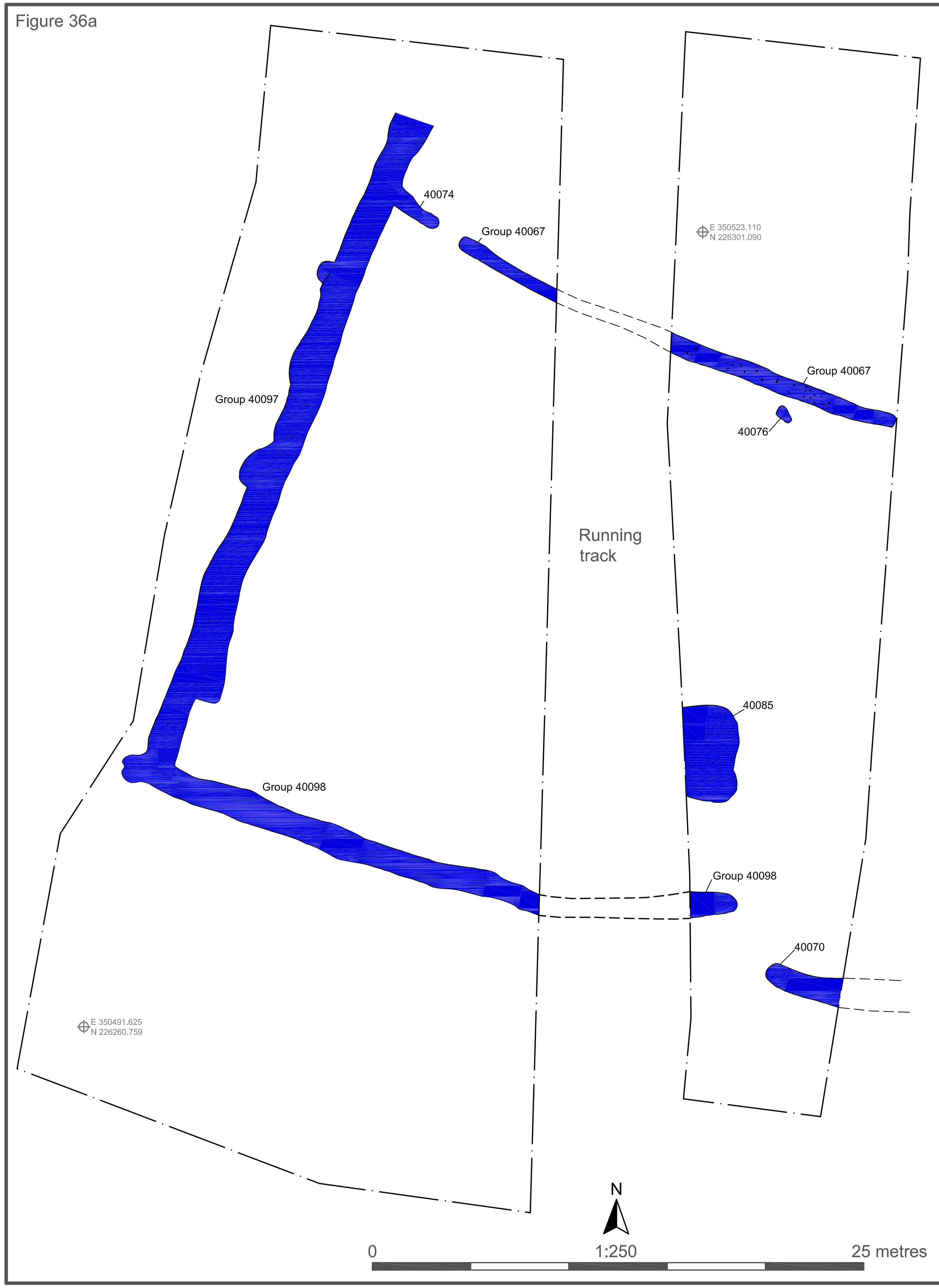
network archaeology

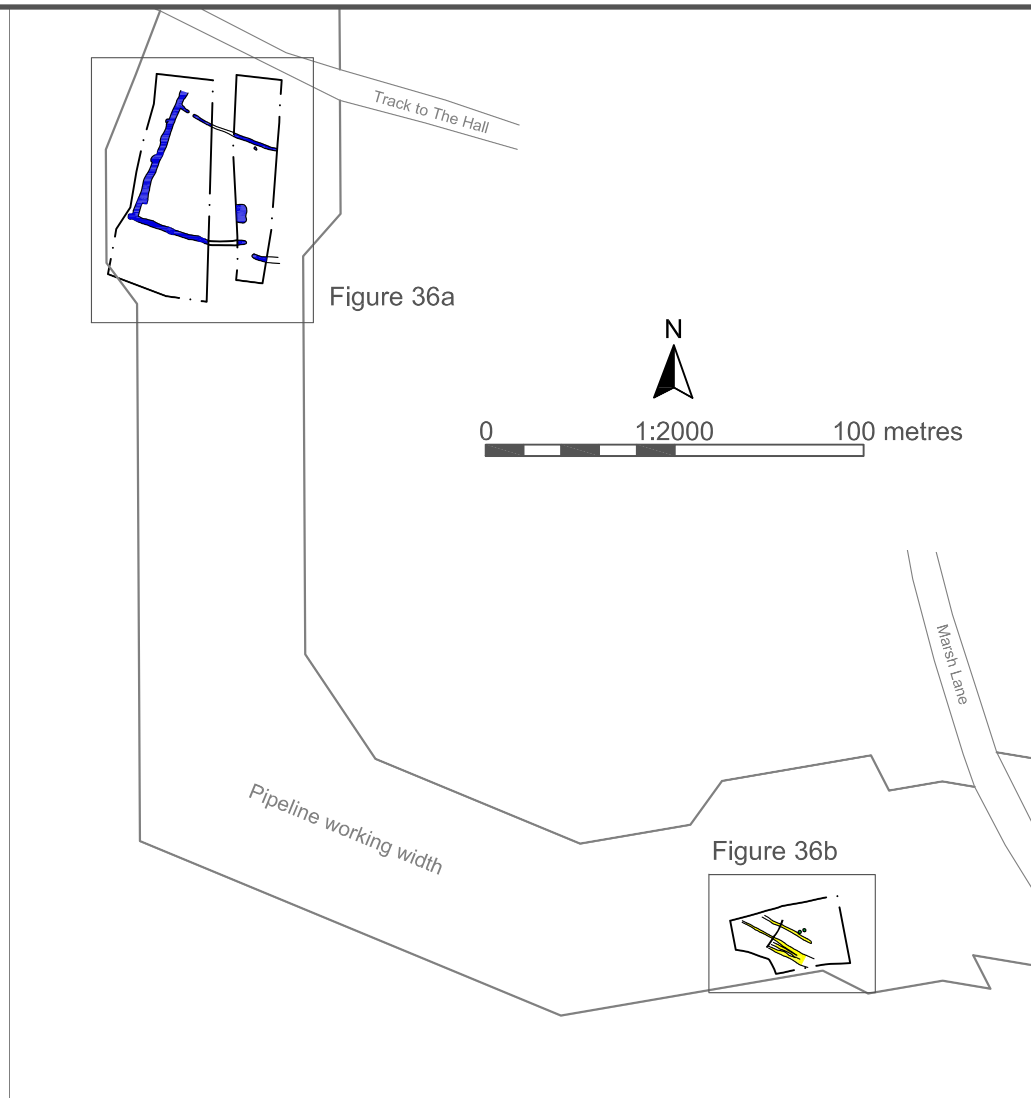
Brecon to Tirley pipeline

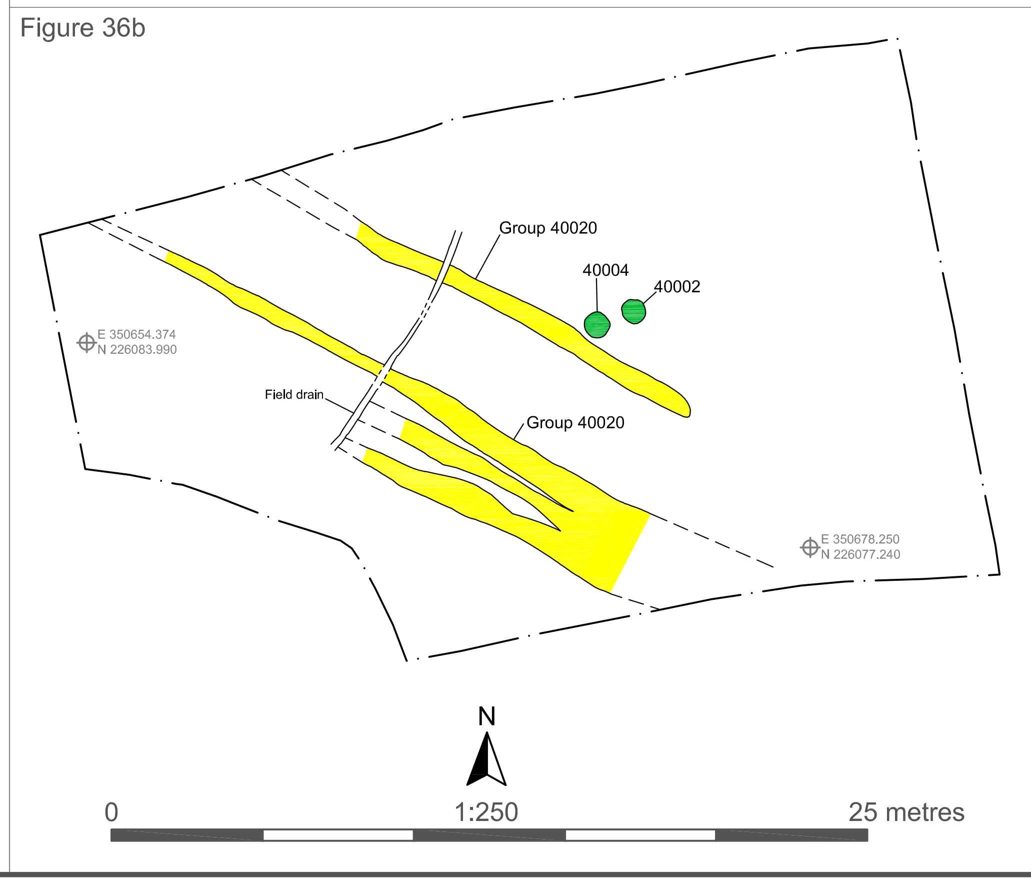
Figure 35
Plot 400: Identified sites and watching brief sites in relation to geophysical survey and evaluation trenches

Scale: 1:2500

FILE NAME: \BRT\178\report\illustrations\GIS\ver02.00\workspaces\figure35.wor







Limit of excavation
Archaeological feature
Projected
22567 Feature number
Stones
Mortar flecks
Charcoal
Phase 1
Phase 2
Phase 3
Unphased

Ver	Date	Description	DM	Chk	App
2.0	9/5/13	Second release	SAF	DH	DB
1.0	6/7/12	First issue	JLC	GC	DH

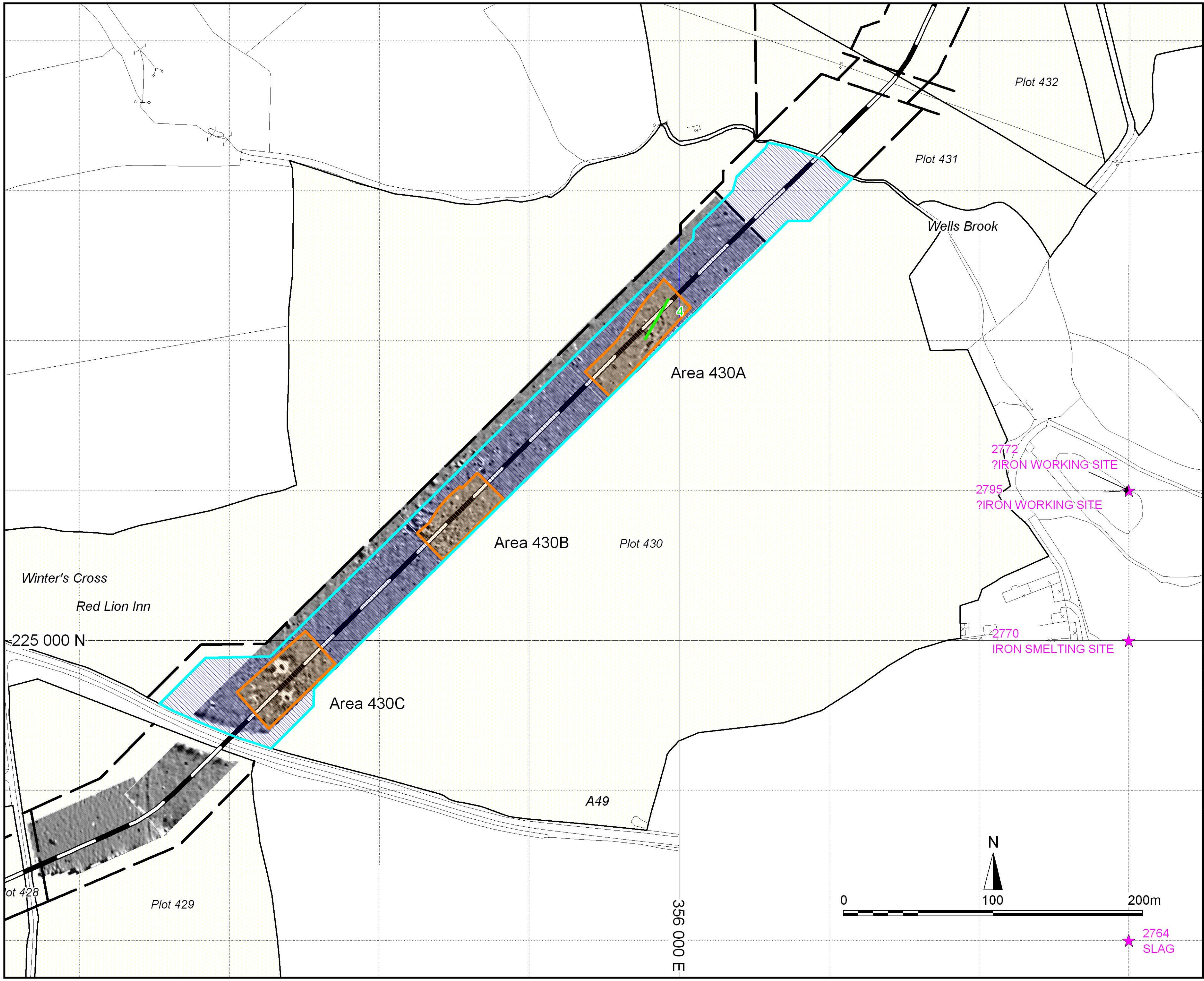
network archaeology

Brecon to Tirley Pipeline

Figure 36: Plot 400: Plan showing enclosures and other archaeological features

Scale 1:250

FILE NAME: BRT\178\report\illustrations\CAD\ver02.00 TFC BRT combined\Fig 36 BRT Plot 400.dwg



Ver	Date	Description	Drn	Chk	App
2.00	10/05/13	First issue	AH	DH	DB

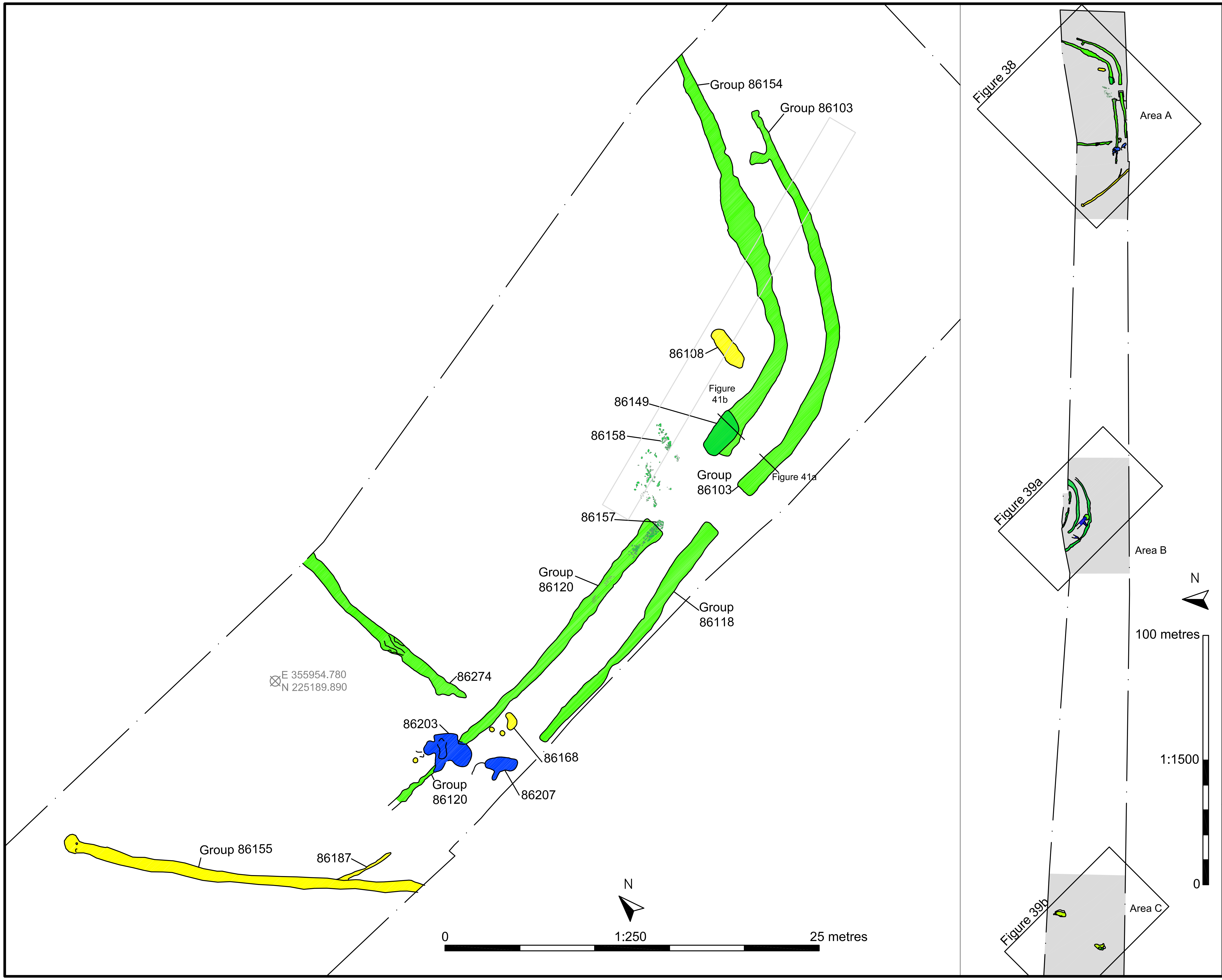
network archaeology

Brecon to Tirley pipeline

Figure 37
Plot 430: Identified sites and watching brief sites in relation to geophysical survey and evaluation trenches

Scale: 1:2500

FILE NAME: \BRT178\report\illustrations\GIS\ver02.00\workspaces\figure37.wor



- Area of archaeological focus
- Limit of excavation
- Archaeological feature
- Feature number
- Stones
- Mortar flecks
- Charcoal
- Phase 1
- Phase 1a
- Phase 1b
- Phase 1c
- Phase 2
- Phase 2a
- Phase 2b
- Phase 2c
- Phase 2d
- Phase 2e
- Phase 3
- Unphased

Ver	Date	Description	DM	Chk	App
2.0	9/5/13	Second release	SAF	DH	DB
1.0	6/7/12	First issue	JLC	GC	DH

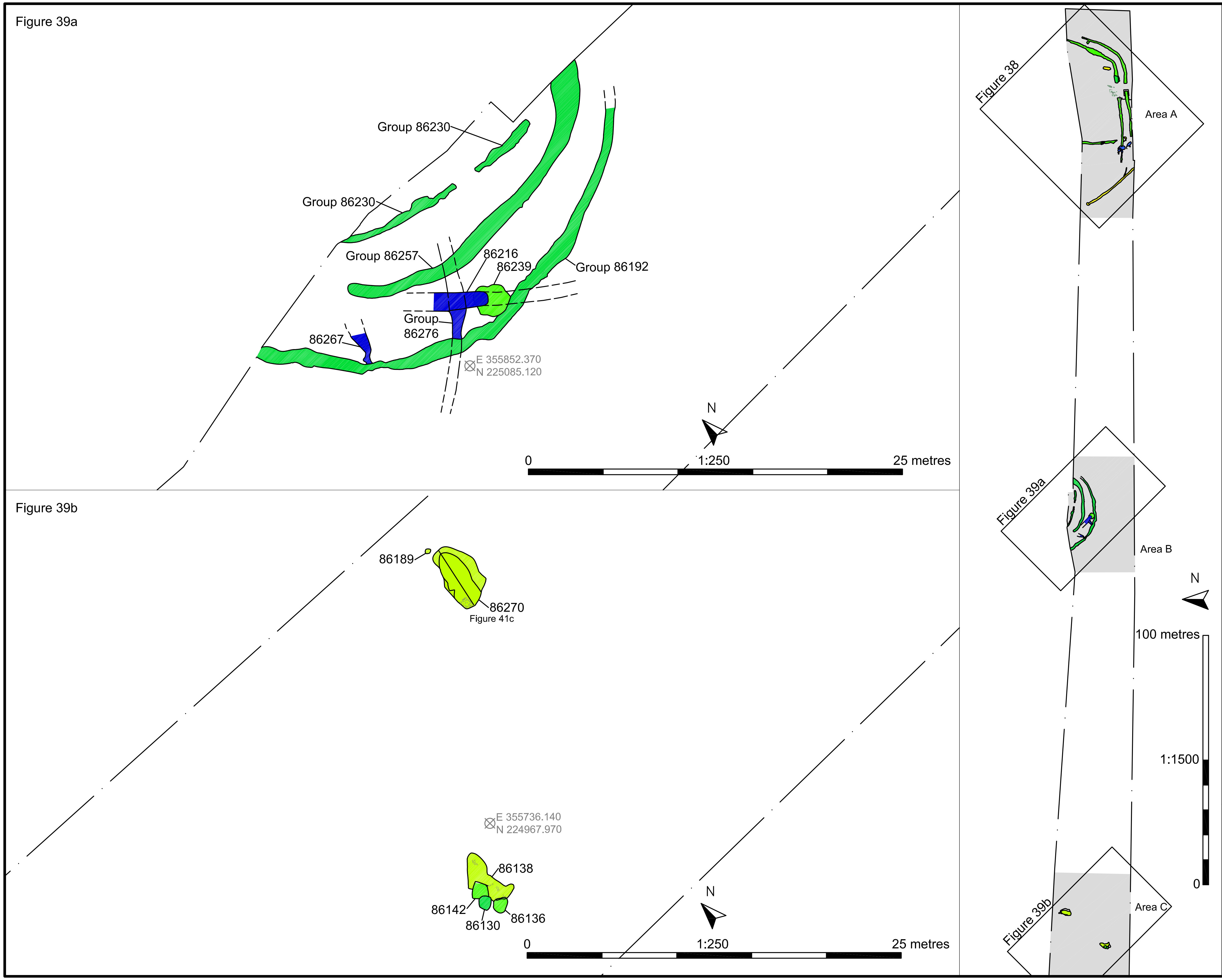
network archaeology

Brecon to Tirley Pipeline

Figure 38: Plot 430: Plan showing enclosures and other archaeological features

Scale 1:250

FILE NAME: BRT178\report\figures\CAD\BRT illustrations\ver01.00\BRT_Fig 38 39 Plot 430.dwg



Area of archaeological focus
Limit of excavation
Archaeology feature
Feature number
Stones
Mortar flecks
Charcoal
Phase 1
Phase 1a
Phase 1b
Phase 1c
Phase 2
Phase 2a
Phase 2b
Phase 2c
Phase 2d
Phase 2e
Phase 3
Unphased

Ver	Date	Description	DM	Chk	App
1.0	6/7/12	First issue	JLC	GC	DH

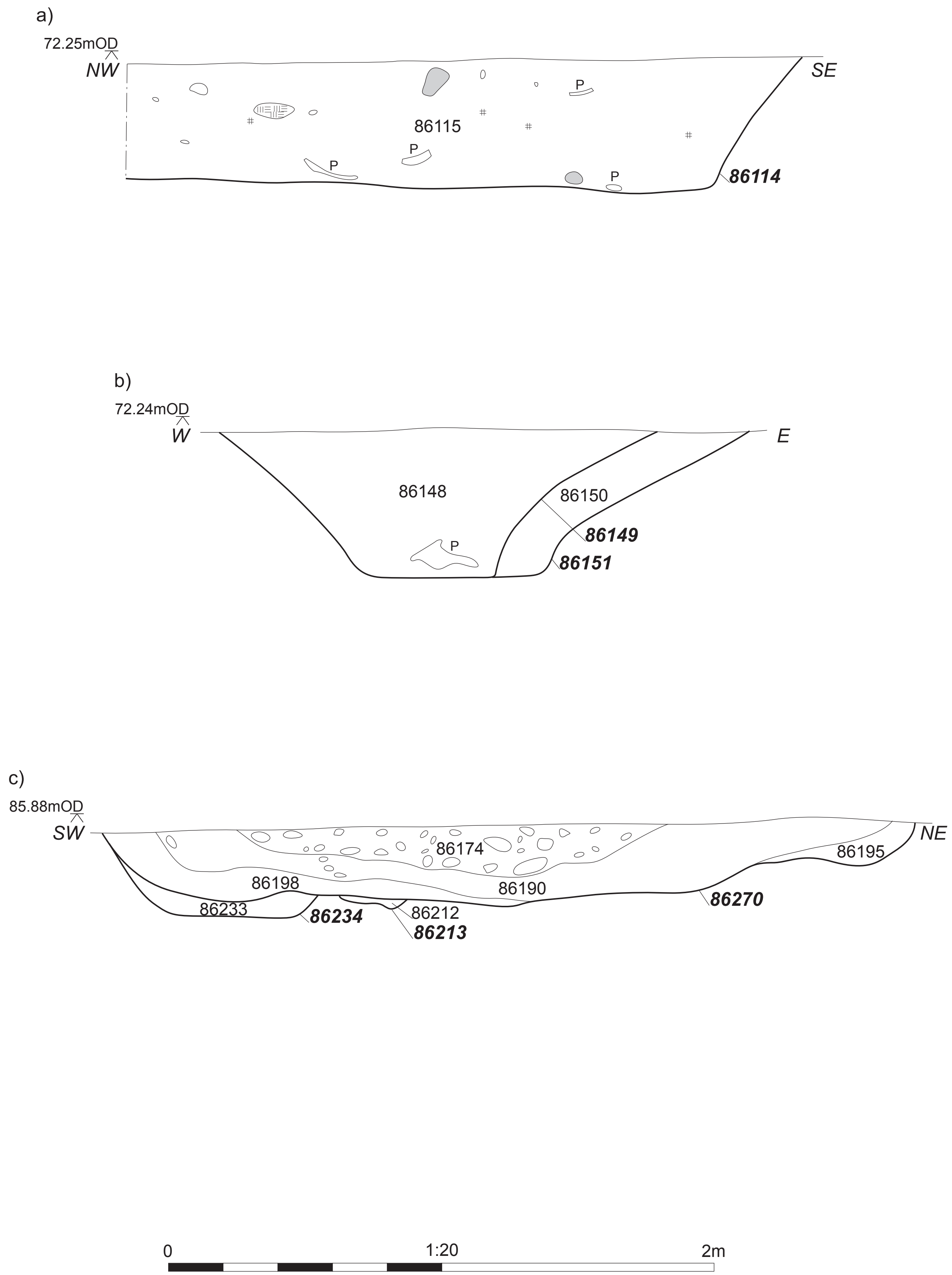
network archaeology

Brecon to Tirley Pipeline

Figure 39: Plot 430: Plan showing enclosures and other archaeological features

Scale 1:250

FILE NAME: BRT1178\report\illustrations\CAD\ver02.00 TFC BRT combined\Fig 38 39 BRT Plot 430.dwg



Limit of excavation
Cut line
Layer line
Field drain/modern features
1234 Cut number
1233 Layer/fill number
Clay
Charcoal
Charcoal lump
Stones
Burnt stone
Pottery
Bone
Flint

Ver	Date	Description	DM	Chk	App
2.00	10/05/13	Second issue	SAF	DH	DB
1.00	13/7/12	First issue	JLC	GC	DH

network archaeology

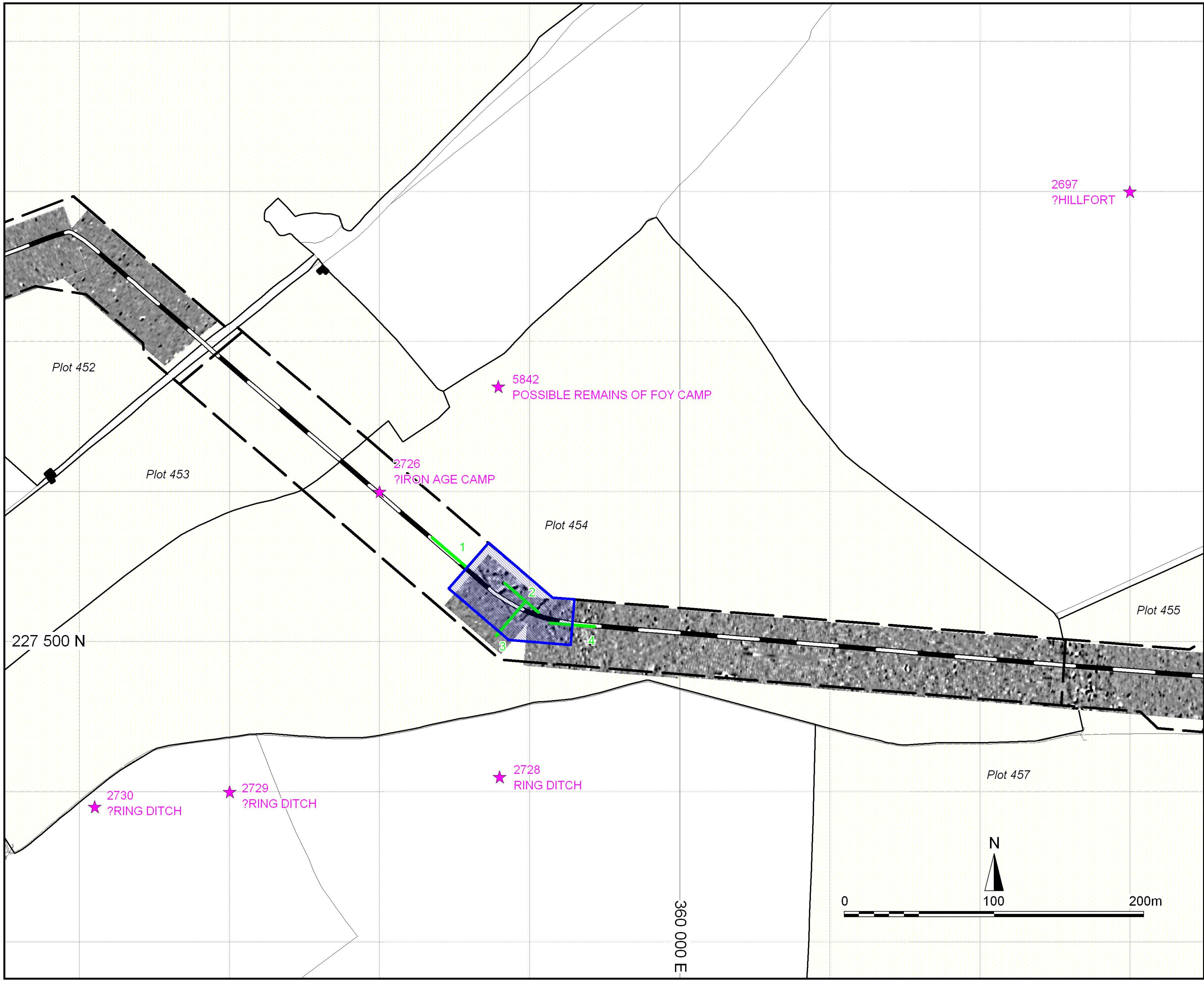
Brecon to Tirley Pipeline

Figure 40: Selected sections of features

a) Section of ditch 86114, Plot 430
b) Section of ditch 86151, Plot 430
c) Section of kiln 86270, Plot 430

Scale 1:20

FILE NAME: BRT1178\report\illustrations\illustrator\ver02.00\Fig 40_BRT_Sections.pdf



Pipeline route
Working width
Plot
Geophysical survey
WSI area
Evaluation trench
Area of archaeological focus
Identified site - excavation area
Major watching brief site
DBA site

Ver	Date	Description	Drn	Chk	App
2.00	10/05/13	First issue	AH	DH	DB

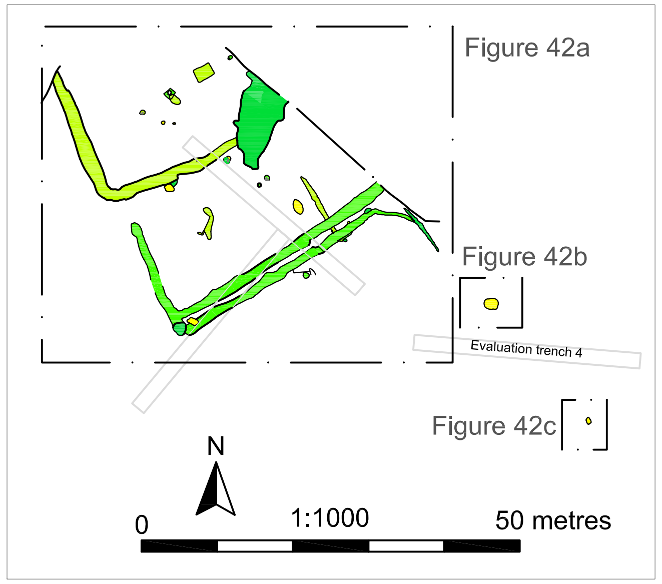
network archaeology

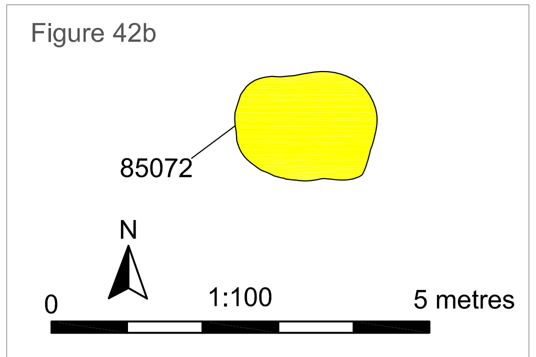
Brecon to Tirley pipeline

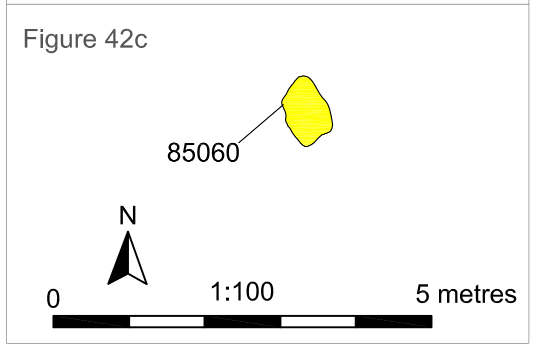
Figure 41
Plot 454: Identified sites and watching brief sites in relation to geophysical survey and evaluation trenches

Scale: 1:2500

FILE NAME: \BRT\178\report\illustrations\GIS\ver02.00\workspaces\figure41.wor







Limit of excavation

Archaeological feature

22567 Feature number

Stones

Mortar flecks

Charcoal

Phase 1a

Phase 1b

Phase 1c

Phase 2

Phase 3

Unphased

2.0	9/5/13	Second release	SAF	DH	DB
1.0	13/7/12	First issue	JLC	GC	DH
Ver	Date	Description	DM	Chk	App

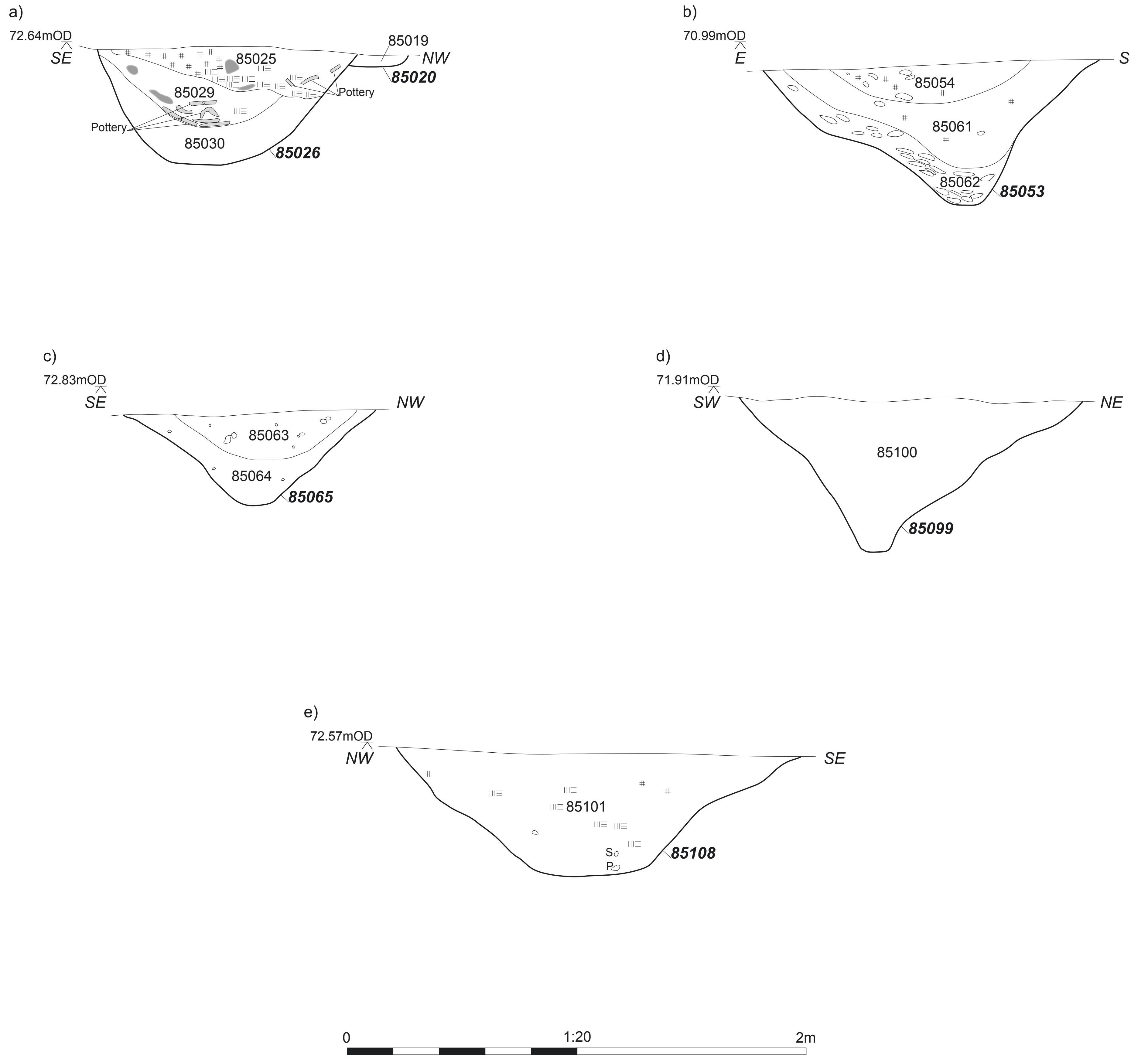
network archaeology

Brecon to Tirley Pipeline

Figure 42: Plot 454: Plan showing enclosures and other archaeological features

Scale 1:100 and 1:200

FILE NAME: BRT\178\report\illustrations\CAD\ver02.00 TFC BRT combined\Fig 42 BRT Plot 454.dwg



- Limit of excavation
- Cut line
- Layer line
- Field drain/modern features
- ***1234*** Cut number
- 1233 Layer/fill number
- Clay
- Charcoal
- Stones
- Pottery
- Slag
- Degraded sandstone

Ver	Date	Description	DM	Chk	App
1.00	6/7/12	First issue	JLC	GC	DH

network archaeology

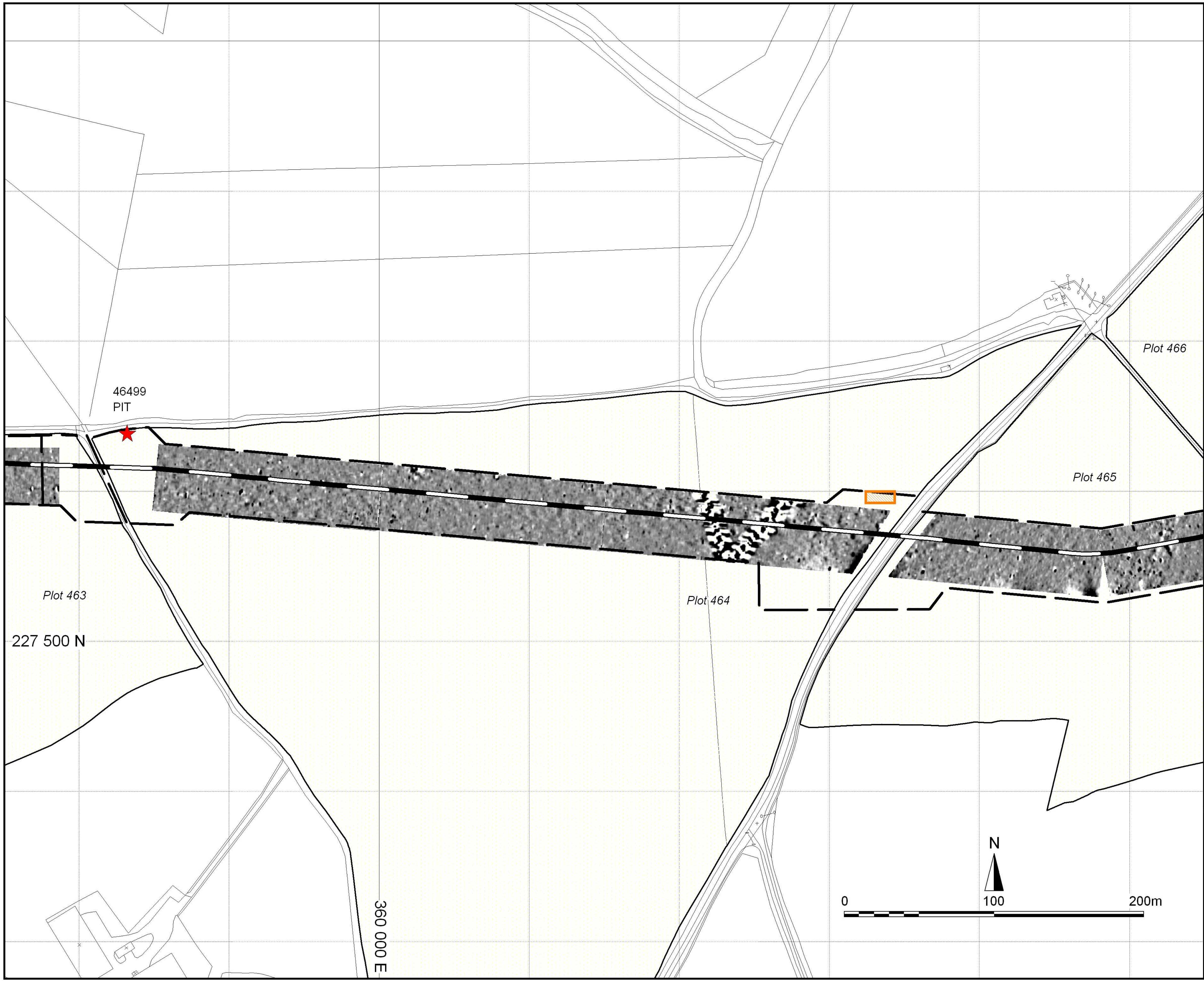
Brecon to Tirley Pipeline

Figure 43: Selected sections of features

a) Section of ditch 85026, Plot 454
b) Section of ditch 85053, Plot 454
c) Section of ditch 85065, Plot 454
d) Section of ditch 85099, Plot 454
e) Section of ditch 85108, Plot 454

Scale 1:20

FILE NAME: BRT1178\report\illustrations\illustrator\ver02.00\Fig 43_BRT_Sections.pdf



Pipeline route

Working width

Plot

Geophysical survey

WSI area

Evaluation trench

Area of archaeological focus

Identified site - excavation area

Major watching brief site

Watching brief site

DBA site

Ver	Date	Description	Drn	Chk	App
2.00	10/05/13	First issue	AH	DH	DB

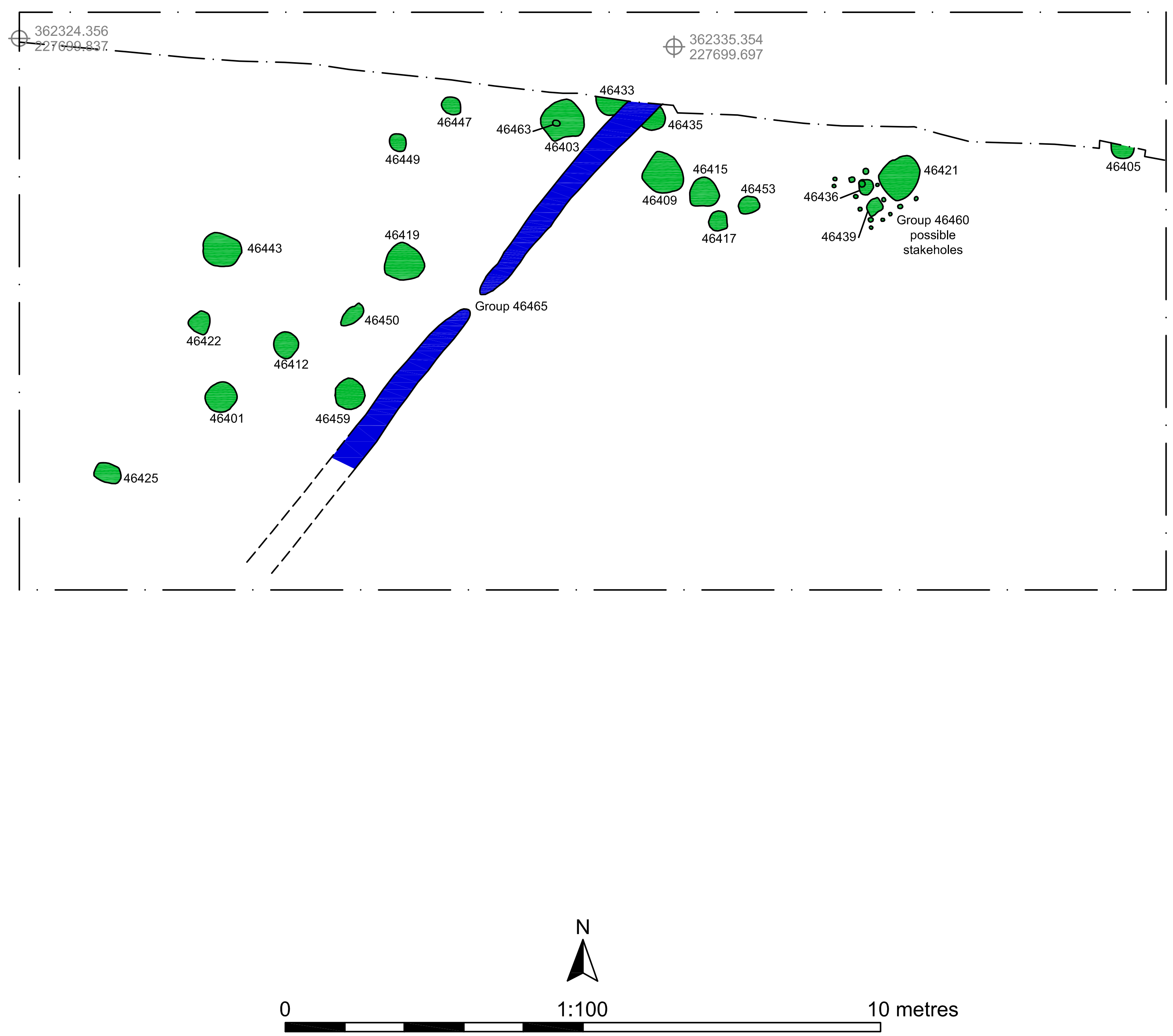
network archaeology

Brecon to Tirley pipeline

Figure 44
Plot 464: Identified sites and watching brief sites in relation to geophysical survey and evaluation trenches

Scale: 1:2500

FILE NAME: \BRT178\report\illustrations\GIS\ver02.00\workspaces\figure44.wor



Area of archaeological focus

Archaeological feature

Fill layer

22567 Feature number

Stones

Mortar flecks

Charcoal

Phase 1

Phase 2

Phase 3

Unphased

Ver	Date	Description	DM	Chk	App
2.0	9/5/13	Second release	SAF	DH	DB
1.0	6/7/12	First issue	JLC	GC	DH

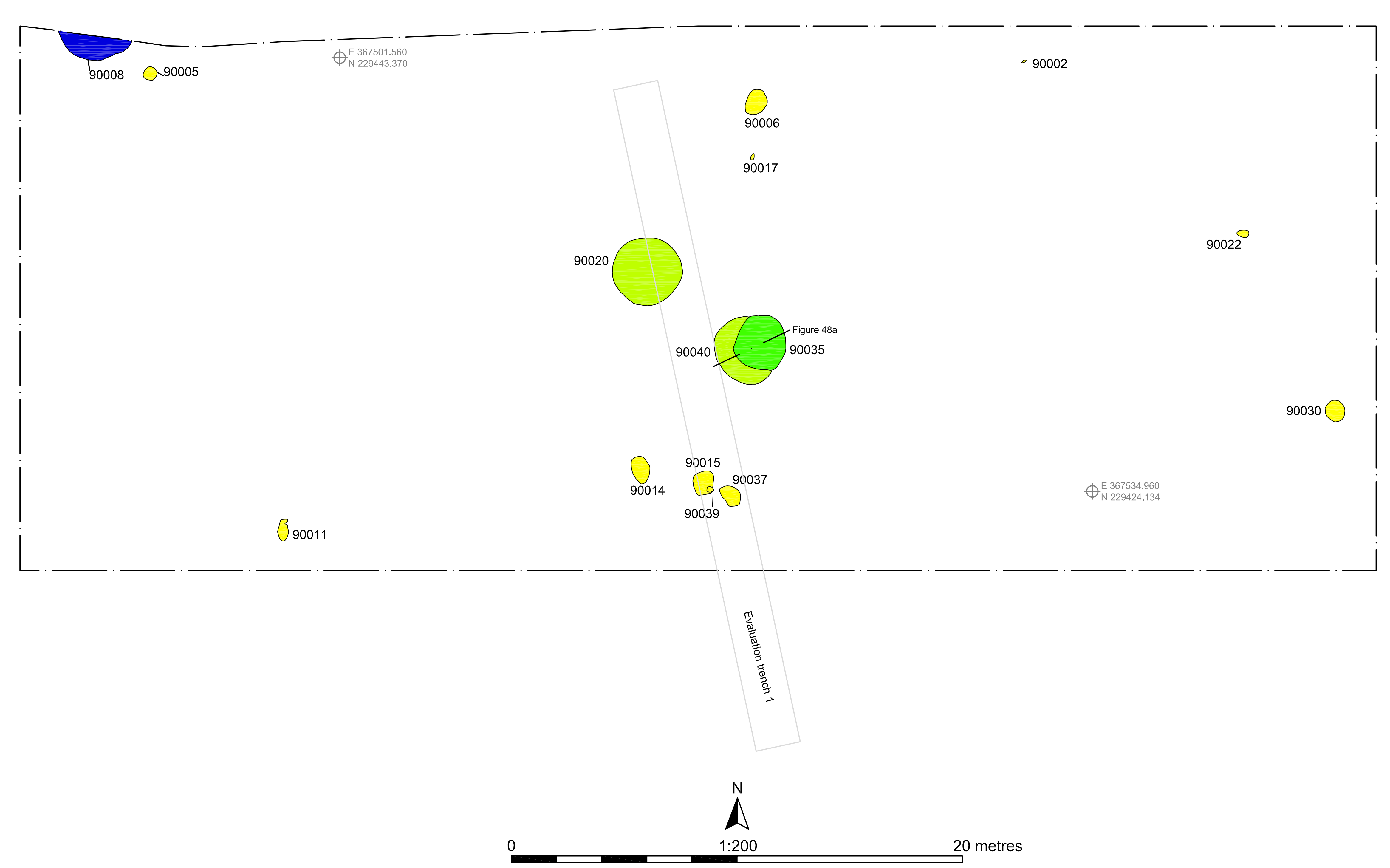
network archaeology

Brecon to Tirley Pipeline

Figure 45: Plot 464: Plan showing archaeological features within eastern area of focus

Scale Plan 1:100

FILE NAME: BRT1178\report\illustrations\CAD\ver02.00 TFC BRT combined\Fig 56 BRT Plot 464.dwg



Area of archaeological focus

Archaeological feature

22567 Feature number

Stones

Mortar flecks

Charcoal

Phase 1a

Phase 1b

Phase 1c

Phase 2

Phase 3

Unphased

2.0	9/5/13	Second release	JLC	DH	DB
1.0	6/7/12	First issue	JLC	GC	DH
Ver	**Date**	**Description**	**DM**	**Chk**	**App**

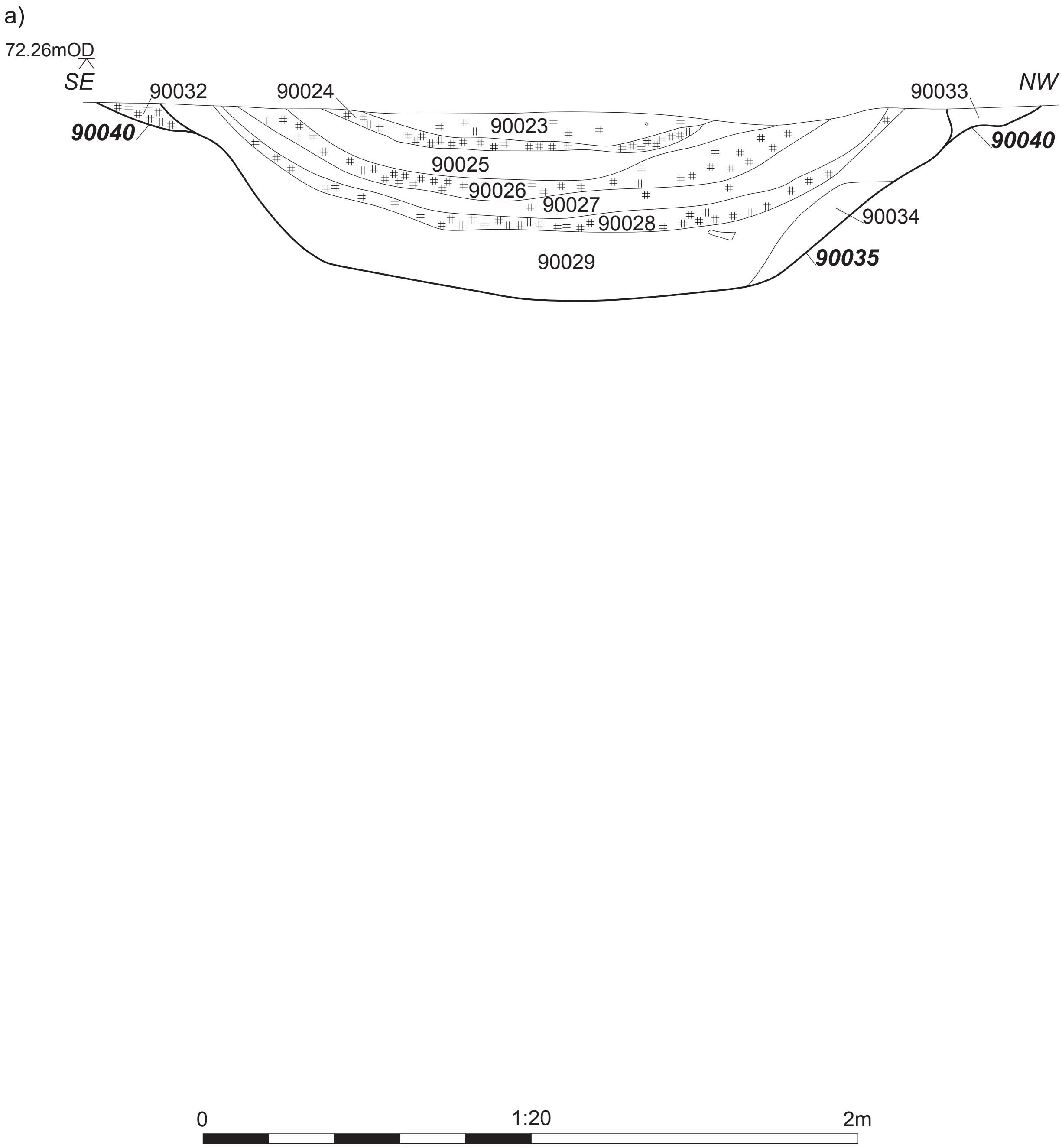
network archaeology

Brecon to Tirley Pipeline

Figure 46: Plot 496: Plan showing archaeological features

Scale 1:200

FILE NAME: BRT178\report\illustrations\CAD\ver02.00 TFC BRT combined\Fig 46 BRT Plot 496.dwg



	Limit of excavation
	Cut line
	Layer line
	Field drain/modern features
1234	Cut number
1233	Layer/fill number
	Charcoal
	Stones

Ver	Date	Description	DM	Chk	App
2.00	10/05/13	2nd issue	SAF	DH	DB
1.00	10/07/13	1st issue	JC	DH	DB

network archaeology

Brecon to Tirley Pipeline

Figure 47: Section of archaeolog-cal features

a) Section of pit 90035, Plot 496, BRT

Scale 1:20

FILE NAME: BRT\178\report\illustrations\illustrator\ver02.00Fig 47_BRT-TFC_Sections.pdf

Appendix D

Plates

Plate 1 : Cremation 49050, plot 49, Powys

Plate 2: Roman road, plot 110, Powys

Plate 3: Section through Roman road, plot 110, Powys

Plate 4: Section through enclosure ditch, plot 160, Powys


Plate 5: Section through inner enclosure ditch, plot 271, Herefordshire


Plate 6: Overview of pen-annular enclosure, plot 331, Herefordshire

Plate 7: Overview of double ditched enclosure, plot 430, Herefordshire

Plate 8: Bloomery 86270 post excavation, plot 430, Herefordshire

Plate 9: Section across double enclosure ditch, plot 454, Herefordshire

Plate 10: Iron Age/Roman pits, plot 496, Gloucestershire

APPENDIX A

TIRLEY FEEDER CONNECTOR: POST-EXCAVATION ASSESSMENT

1 TIRLEY FEEDER CONNECTOR – ASSESSMENT

This section provides a narrative assessment of the results of archaeological work undertaken along the section of pipeline known as the Tirley Feeder Connector (TFC). It was decided that providing this information within this report was preferable to undertaking a separate assessment report as it would allow the results of the work undertaken along the Brecon to Tirley Pipeline, and this connector (effectively a small extension to the main pipeline) to be considered holistically, and be presented in one place. An assessment level report was produced for the main pipeline (Network Archaeology 2010 report number 413)

Within this section we have adopted a convention whereby cut features are identified by numbers in bold, and deposits by numbers in normal text.

1.1 Aims and Objectives

1.1.1 General Objectives

To identify, appropriately manage and fully record the archaeological resource affected by the proposed development;

To consider, in all cases of archaeological discovery, whether preservation *in-situ* is desirable or achievable as the foremost response;

To determine, where preservation *in-situ* is not desirable or achievable, an appropriate strategy for preservation by record;

To develop, where possible, knowledge and understanding of the historic landscape and archaeological resource through recording of threatened remains;

To determine and understand the nature, function and character of any archaeological remains in their cultural and environmental setting;

To obtain a chronological sequence for any human activity along the pipeline route and to place it within its regional context;

To establish the ecofactual and environmental sequence and context of archaeological deposits and features;

To engage in a programme of post excavation, archiving, synthesis and study, leading to publication and dissemination of results, and

To ensure the long-term survival of the information through deposition of a project archive.

1.1.2 Regional Research Frameworks

All archaeological work considered existing and developing research frameworks and planning from the surrounding regions (Briggs 2003; Holbrook 2008; Olivier 1996). The following relevant research objectives (RO) were identified:

RO1 To extend the use of proven methodologies for site location and interpretation, and encourage the development of new techniques, within the project area;

RO2 Encourage works of synthesis within and across periods, settlements, monuments and areas, for the project as a whole;

RO4 Encourage wide involvement in archaeological research and present modern accounts of the past to the public;

RO17 & 18 Improve the quality and quantity of environmental data and our understanding of what it represents. Target specific soil and sediment contexts for environmental information.

The numbering of these research objectives mirrors the Research Objectives identified and discussed in the BRT pipeline post excavation assessment (Network Archaeology 2010). This reflects the fact that the analysis portion of this document considers the BRT pipeline and TFC pipeline findings as a whole.

1.2 Methodology

The methodologies used during this work are outlined in a separate written scheme of Investigation (WSI) document (Network Archaeology 2011iii). This document and the methodologies presented within it were approved by the County Council Senior Archaeological Officer prior to the work commencing and were adhered to throughout the investigation

On the whole there were no major changes to the methodology finally used on site when compared to that outlined in the WSI. Where such changes did occur they are detailed in the summary section of the plot descriptions below. All such changes to methodology were approved by both the client and the County Council Senior Archaeological officer. The methodologies employed are deemed to have been suitable and appropriate for this site and were successful in identifying and recording the archaeological remains present.

1.3 Results

The Tirley Feeder Connector project crossed eight plots, numbered 1 to 8 from west to east (figure 11). The findings from these plots are discussed below and illustrated in figures 12 – 14.

1.3.1 Plot 1 (NGR 381066 229406)

Plot 1 was located at the eastern end of the Brecon to Tirley pipeline, and consisted of a small fenced-off area near the eastern boundary of the final plot of that pipeline route. A large pit was excavated here to allow the feeder connector pipeline to be tied into the Brecon to Tirley pipeline.

No new finds or features were identified during either the topsoil strip or the excavation of the tie-in trenching.

1.3.2 Plot 2 (381273 229478)

Summary

Plot 2 contained a number of Roman features including a broad, roughly N-S linear feature (probably a trackway), two enclosure ditches and one rectilinear arrangement of ditches. An earlier Roman curvilinear ditched enclosure with a possible internal division was also recorded.

In one corner of the rectilinear enclosure was an undated inhumation that contained a partially complete human skeleton. A number of discrete pit type features were also uncovered, along with evidence of activity along the putative trackway route, predating the trackway itself. Two further undated curvilinear features were also identified towards the southern end of the plot.

Archaeological Background

In 2008 an area in the southwest corner of plot 2 was topsoil stripped to provide a temporary PIG trap for the Brecon to Tirley pipeline project. This area was then further extended in 2010 and 2011. This work revealed no finds or features. The geophysical survey failed to reveal any prospective archaeological features. No evaluation trenches were excavated in plot 2.

Results

Plot 2 contained 5 distinct phases, which have been identified through a combination of stratigraphic and ceramic phasing:

Phase 1: Pre- or early Roman

This phase comprised six features, five of which were partially truncated pits, whilst the sixth was a heavily truncated linear feature (figure 14).

Pit **5218** was a sub-circular feature measuring 0.76m x 0.68m x 0.23m, which was truncated by phase 2 pit **5353**. The pit had two fills, neither of which produced any finds or material. However both fills did contain a moderate quantity of unidentifiable charred plant remains (charcoal), which may have indicated that the pit was used as a dump for burnt waste generated elsewhere (material raked out from fire pits / hearths etc).

Pits **5313** and **5336** were both truncated by phase 2 curvilinear feature **5764**. Pit **5313** was the largest of the two, being 0.9m in diameter and 0.5m deep, compared to **5336** which was only 0.03m deep. The former contained two fills, which produced no datable material or evidence of usage whilst the latter had only one. This sole fill (a firm, reddish brown, silty clay) did contain a single sherd of 2nd – 3rd century Roman pottery.

Pit **5749** was the remnant of a feature measuring 0.37m x 0.18m x 0.12m, which was truncated by a shallow linear feature (**5770**) that in turn pre-dated the phase 4 putative trackway **5760**. The single fill of pit **5749** produced no finds or other evidence as to its date or function.

Feature **5258** was a roughly N-S aligned linear feature, only the eastern side of the feature was revealed – surviving to a width of 0.73m. The rest of the feature was truncated by phase 2 linear feature **5770**. Little of its fill remained, only 0.22m in depth, and that produced no finds or evidence to suggest a function for the gully.

Feature **5269** protruded from the baulk of a sondage cut through the phase 4 putative trackway **5760**. As seen it was interpreted as a pit measuring 0.64m x 0.43m x 0.25m deep, though it may have been the northern terminal end of a short gully. The feature contained two fills, neither of which produced any finds or evidence which could shed light on the true nature of the feature. It was truncated by phase 2 ditch **5770**.

Phase 2: Early Roman

This phase consisted of fifteen features, comprising five linear features and ten pits.

Pit **5210** was a wide (1.2m) but shallow (0.14m) pit truncated by the inner curve of phase 3 enclosure ditch **5281**. The pit had a single fill, with no finds or other evidence as to date or function.

Pits **5214**, **5216** and **5353** were all part of a small cluster of pits which were also truncated by phase 3 enclosure ditch **5281**. Pit **5353** truncated phase 1 pit **5218**, and it may have been that at least one of these pits indicated a continuation of function from that pit, though it was unclear what that function might have been. Pits **5214** and **5216** were of a similar size, approximately 0.5m x 0.4m, though pit **5214** was nearly twice as deep at 0.3m. Both pits contained single fills which produced burnt stone, though none of it was worked. Pit **5353** was a little larger, measuring 0.69m in diameter and 0.38m deep. It had two fills, both of which also contained evidence of burning, including burnt stone and charcoal. None of these pits contained any finds.

Pit **5228** was also truncated by the phase 3 enclosure ditch **5281**, toward its apparent eastern terminus. This pit was considerably more substantial than the pits noted along the line of **5281**, measuring 1.13m wide and 0.52m deep. Its primary fill (a light brown, silty, clay) produced fragments of undiagnostic fired clay. No finds were recovered from its other two fills (lighter coloured silty clays). In the centre of the feature was the base of a possible posthole **5230**, which measured 0.3m in diameter but only 0.08m deep. It had a single fill which produced no finds. It was considered likely that rather than being a later posthole that coincidentally occupied the centre of pit **5228**, that **5230** was actually the remnants of a post-pipe within **5228**.

Pit **5739** was a fragment of a pit, truncated by phase 3 ditch **5281**.The pit measured

0.39m wide and 0.4m deep, and appeared to have filled naturally over time, though no finds were recovered from the sole fill to suggest a date or purpose.

Pit **5758** was a broad, shallow pit (0.64m diameter and 0.13m deep) truncated at its northern and eastern extents by phase 3 ditch **5281**. The pit had a single fill, which was a greyish silt darkened by disseminated charcoal, and containing a small quantity of heated stone. No other finds were recovered from this pit, but the nature of its fill suggested that it filled naturally and in proximity to hearths/fires – i.e. it was being used as a dumping pit for hearth waste produced elsewhere.

It was possible that all the phase 2 pits truncated by enclosure **5281** represented an early boundary demarcated by pit alignment, possibly with a substantial post-marker at the boundary's terminus, marked by pit **5228** and post-pipe **5230**, the line of which was later reinforced by the excavation of ditch **5281**. However, the pits showed no consistency in size, shape or profile, nor were they spaced in a recognisable pattern along the course of the later boundary, to suggest that they were related to one another, and as such their situation may have been a coincidence, or they may be the line of an earlier ditch of which only the deepest parts of an uneven base survived its subsequent reiteration as **5281**..

Ditch **5770** appeared to be an irregular curvilinear ditch, following the course of a natural depression, or possible former water course, and it may be that ditch **5770** was an attempt to augment that natural channel and manage seasonal changes in water levels. Ditch **5764** appeared to be contemporary with **5770**, though it also seemed to cross the feature, terminating slightly to the west. The reason for this was unclear, though it may have related to the line of phase 3 feature **5769**. Ditch **5770** contained two fills (both brownish clayey silts) the basal deposit did not contain any artefacts. The upper fill contained a small quantity of Roman pottery (2nd – 3rd century) and the long bone from a medium sized mammal as well as moderate quantity of unidentifiable charred plant remains (charcoal) and small fragments of fired clay.

5322 was a north-south oriented linear feature, truncated by phase 3 linear **5769**, and seen only within a sondage through phase 4 putative trackway **5760**. It was visible within the sondage for a length of 1.3m north-south, and was 0.98m wide and 0.19m deep. Its single fill contained a high quantity of rounded stones, possibly suggesting it carried water at some point. No finds were recovered from this fill.

5326 was a shallow (0.08m deep) irregular linear feature, containing no finds, and may well have been a continuation of **5322** beyond where it had been truncated by **5769**. It may have owed its origins to water erosion, based on its irregular form.

Similar short ditch segments **5328** and **5296** may also have been part of the same feature, though again no direct relationship survived due to truncation by phase 3 feature **5769** and phase 4 feature **5760**. If **5322**, **5326**, **5328** and **5296** were all one feature then it would have been a shallow, irregular linear more than 4m long and averaging *c.* 0.6m wide and 0.1m deep. It may well have been a naturally formed water channel, or a ditch intended to mitigate seasonal flooding of the water channel within which **5770** was excavated.

Feature **5332** was also only visible within a sondage through phase 4 putative trackway **5760**. This appeared to be a sub-rectangular pit or ditch terminus, most likely the former as no continuation was identified in a further sondage *c.*7m to the south. The pit measured 1.1m wide and 0.3m deep, and had two fills, the primary apparently a weathering of the surrounding natural deposits suggesting that the pit was open to the elements for some time. No finds were recovered from either fill.

Pit **5717** was a small oval pit, 0.55m in diameter and 0.26m deep, and of uncertain function, truncated by phase 3 ditch **5769**. Its single fill (a reddish brown silty clay) yielded a single sherd of 2nd – 3rd century Roman pottery. The purpose of the feature remained unclear.

Pit **5744** was a bell shaped pit measuring 0.86m x 0.65 x 0.14m deep, truncated by phase 3 pit **5747**. The pit had a single fill, which contained a lot of heat affected stones, but no further evidence as to its date or function. It is likely, given the lack of evidence for *in-situ* burning, that the pit was used to dispose of the residue of nearby fires.

Ditch **5764** was a broad curvilinear, averaging *c.*1m wide and 0.35m deep. It ran north-south as it protruded from the southern extent of the excavation area, and ran for approximately 8m before turning a sharp, near 90° turn to the west from where it ran into, and was truncated by, the eastern edge of phase 4 putative trackway **5760**. Ditch (**5764**) appeared to terminate within the line of **5760** suggesting that there was a pre-existing landscape feature/boundary which the later trackway may have followed. Ditch **5764** contained three fills. The basal fill (a dark clayey silt) did not contain any artefacts. The second fill, a firm, mid yellowish clayey silt produced a small quantity (4) of Roman pot sherds of 2nd – 3rd century date. The upper fill, a lighter coloured clayey silt, contained no finds. Ditch **5764**, together with the postulated boundary which pre-dated the trackway, may have formed an enclosure.

Ditch **5767** ran roughly northeast-southwest for about 8m, and averaged 0.45m wide and a little under 0.2m deep. It extended beyond the limit of excavation to the north, but terminated to the south on the line of phase 3 enclosure ditch **5281**, which truncated it. Ditch **5767** was interpreted as a potential internal division to an enclosure that predated **5281**, but followed the same alignment, perhaps demarcated by a series of pits such as **5210**, **5214**, **5216**, **5228**, **5353**, **5739** and **5758**. No finds were recovered from the single fill of **5767**, though its steep sided U-shaped profile might indicate that it was intended as a drainage feature as well as an internal division.

Pit **5772** was located fairly central to the plot, to the west of **5770**. It was a large, irregular feature roughly lozenge-shaped in plan, longer N-S than E-W. It measured 4.05m long, 1.5m wide and 0.65m deep at its deepest. The pit had six fills, the earliest of which contained a high quantity of pebbles. The remainder of the fills were indicative of numerous deliberate deposits, apparently of excavated substrate, with a tendency to be tipped in from the eastern side. No finds were recovered from any of the fills, and it was impossible to determine a function for the feature, though its irregularity might suggest a natural origin, such as a tree throw. The resulting hole may then have subsequently been utilised to dump earth excavated from other phase 2 features.

Phase 3: 2nd century Roman

This phase consisted of seven features, comprising two enclosures, three ditches and two pits.

Curvilinear ditch **5281** formed a roughly WNW-ESE line with a tight curve at the ESE extent, creating a “shepherd’s crook” enclosure, approximately 35m NW-SE and 17m NE-SW, enclosing an area of about 600m2. within the excavated area. The ditch survived to a greater depth to either end and was shallower in the centre due to recent truncation. The ditch is likely to have formed a non-defensive settlement boundary, possibly reinforcing and remarking a previous boundary established by a series of earlier pits (**5210**, **5214**, **5216**, **5228**, **5353**, **5739** and **5758**). The single dark yellow brown, silty, infill produced two sherds of Roman pottery dated to the 2nd –

3rd Centuries AD as well as small pieces of fired clay, a fractured cobblestone and a residual worked flint Mesolithic or Neolithic end scraper. The environmental evidence consisted of moderate amount quantity of unidentifiable charred plant remains (charcoal) as well as a small amount of an unidentifiable tuber, black organic concretion, unidentifiable animal bone, fired clay fragments and small coal fragments.

Pit **5295** was only 0.15m deep as it had been heavily truncated by phase 4 feature **5760**. The sole remaining fill produced a single Roman pot sherd of 2nd – 3rd century date. Too little remained of the pit to be certain of its function.

N-S linear feature **5316** was a 2.1m wide, shallow depression situated over part of phase 2 features **5332** and **5770**. The sole fill of **5316** contained frequent rounded stones, and it may have been a deliberate attempt to deposit stone over the top of the softer material filling ditch **5770** and pit **5332**. This indicated that the water-course mitigated by phase 2 feature **5770** had dried up and left a natural holloway that was being utilised as a track. These stones were neither substantial nor consistent enough to have been a deliberately laid metalled surface, and it was more likely that this depression marked a “patching” of an area about 5m long that had grown boggy and treacherous underfoot, rather than being a remnant of a fully metalled track.

Pit **5747** was a large pit exposed beneath phase 4 putative trackway **5760**. It measured 1.25m in diameter and 0.53m deep. It contained two fills, neither of which produced any finds to help suggest a date or purpose for the feature.

Rectilinear enclosure **5761** was, in plan, an “L” shape - located on the western side of plot 2, with the anticipated western return lying outside the scope of excavation. Two further gullies, **5762** and **5763**, may have defined the northern side of this enclosure, though they were not physically connected to the remainder of the boundary ditch. Whilst it could not be said for certain that either one or both of gullies **5762** or **5763** related to enclosure **5761**, their position in relation to it seemed an unlikely coincidence. The southern of the two gullies (**5763**) was heavily disturbed by rooting, and may well have been a hedgeline, with **5762** being an external ditch beyond it. Operating together, these features enclosed an area of 27m x >23m (>621m2) within the excavated area. No entrance into the enclosed area was seen, but this may have lain along the, unexposed, western side.

Enclosure **5761** also had an apparent internal division gully **5765**. This ran roughly E-W about 7m from the southern edge of the enclosure, parallel with the southern boundary of the enclosure, and for nearly the full exposed length. It was approximately a metre wide at its widest point, narrowing to just 0.25m wide at its eastern end, where it was truncated by a modern land drain, and did not continue beyond this. This may have been the result of modern truncation, as the gully was only 0.03m deep at this point as opposed to 0.2m deep at the western end, or it may have indicated an opening in the internal division against the eastern boundary of the enclosure.

At roughly the central point of gully **5765** was what appeared to be a pit, or potentially a terminus (**5302**). It measured 1.12m x 0.96m x 0.22m and contained a single fill. This appeared to be contemporary with the fills of gully **5765** to both the west and east, which suggested that it was either a contemporary discrete feature located along the line of the gully, such as a posthole, or a pit designed to catch water run-off from either end of the gully. The brownish yellow silty clay fill did not contain any artefacts.

The single light yellowy brown, silty clay, fill of **5761** produced a moderate quantity of Roman pottery sherds datable to the 2nd - 3rd Centuries, along with a small, undiagnostic fragment of fired clay. Whilst the single, brownish, silty clay fills of **5762**, **5763** and **5765** produced 5, 3 and 30 sherds of Roman pottery respectively, all dated from the 2nd – 3rd centuries.

In the SE corner of the enclosure was an undated and unphased burial (**5752**), which might have intimated that enclosure **5761** was used as a trackside burial area. The lack of any further interments, however, suggested that this was probably not the case, and that the location of the burial within the enclosure was coincidental.

Ditch **5768** protruded from the southern limit of excavation in plot 2, and ran roughly east to west for about 6m before being truncated by the western flank of phase 4 putative trackway **5760**. Only a small stretch of the ditch (**5768**) survived within the excavation area, so little could be determined of its nature, though it had a slight curve southward at its westernmost visible extent. As seen it averaged *c.*0.9m wide and had a maximum depth of 0.21m. It was probable that it was intended to drain water into the course of **5769**. No finds were recovered from its fills.

5769 was an “interrupted” linear feature, comprising an alignment of short gully/pit-like features roughly parallel to that of phase 2 ditch **5770**. Most of these features were shallow and irregular, and showed evidence of weathering or slumping, suggesting that they might represent the truncated remnants of what was originally a single continuous feature, *c.* 6m long and up to 1m wide and 0.16m deep (with typically shallow, concave, irregular sides and base). The nature of its components, and their fills, suggested that this postulated single feature may have been a water management ditch, possibly taking advantage of the depression within which it ran. Although feature **5769** has been assigned to this phase, its broadly parallel course with ditch **5770** suggested that the two could have been contemporary. The single, pale, brownish yellow, clayey silt, fill of this feature contained a cattle molar, a piece of burnt long bone from a medium sized mammal, a small quantity of unidentifiable charred plant remains (charcoal) and a fragment of un-worked burnt stone.

Phase 4: Later 2nd and 3rd century Roman

This phase consisted of a trackway, a possible hedgeline and a small pit.

The dominant feature within plot 2 was a broad linear depression (**5760**) running roughly S-N across the approximate centre of the plot for *c.*25m before curving slightly to face NE-SW and running NE for a further 15m before continuing to the NE beyond the scope of excavation. This feature measured about 5.5m wide, and about 0.3m deep at its deepest part. It had shallow slopes to either side and a generally flat base. It seemed to take advantage of a natural depression at that point within the plot, with the ground seen to rise gently to either side of it, though it was considered unlikely that the feature was a natural occurrence. At the base of the feature was a thin layer of stones, arguably too thin to be of use as a hard standing or metalling, yet too evenly distributed to be naturally deposited, say by slumping or washing in. This layer was interpreted as remnant metalling, with the bulk of the material eroded during use and disuse. Finds from amongst these stones included a small quantity of Roman sherds (eight) datable to the 2nd – 3rd Centuries, as well as small fragments of undiagnostic fired clay. The second fill was a light yellow brown, friable silt, that contained a smaller quantity of similar pottery, as well as cattle teeth and iron nails. The upper fill was a pale red, friable, silt that contained a single iron nail. The feature was thought to be a Roman trackway, possibly utilising an earlier droveway represented in part by phase 3 features **5316** and **5769**.

Feature **5363** was a 1.1m wide linear feature running roughly NE-SW, to the SW of, and following the same alignment as, the putative phase 4 track way **5760**. It was shallow, no more than 0.21m deep and heavily disturbed during antiquity by root action, leading to an interpretation of it as a hedge ditch. No finds were recovered from the single fill of **5363**. As much of **5760**, and the SW end of **5363**, were obscured by phase 5 feature **5766** no direct stratigraphic relationship between **5363** and **5760** could be established. Both **5363** and **5670** have been placed in this phase on the basis of similarity in alignment and their stratigraphic relationship with **5766**

Pit **5223** had been cut into the top of Phase 3 curvilinear ditch **5281**, after it had gone out of use. It measured 0.27m wide and 0.25m deep. No finds were recovered from the single fill of **5223** to help date the feature, nor to suggest a function for it.

Phase 5: Post-Roman

Pit **5238** was a small sub-circular feature roughly 0.7m in diameter and 0.13m deep. Its single fill contained a large amount of burnt flint, and it seemed likely that the pit was dug for the disposal of such material. It cut into the northeastern end of possible phase 4 hedgeline **5363**.

Pit **5306** was ovoid and measured 0.92m x 0.6m and 0.17m deep. It also contained a single fill containing a large quantity of burnt stone. Pit **5306** truncated phase 4 pit **5223**. The similarity and close proximity of **5238** and **5306** suggested that the two pits may have been related in function and therefore broadly contemporary.

Pit **5367** appeared to have been a tree bole, or heavily root disturbed pit truncating part of enclosure **5761**. It was an irregular feature 1.2m x 0.76m x 0.05m deep. It contained two fills, a compact, dark red, basal clay and a lighter upper clay. No finds were recovered from its single fill, and it was considered more likely to have been tree root disturbance than an anthropogenic pit.

5766 was a broad layer of colluvium or subsoil which had accumulated in the depression left by phase 4 putative trackway **5760**. This deposit extended beyond the bounds of the trackway and contained late medieval / post-medieval material such as two partial clay pipes (dated to 1682 – 1757 for one and *c.*1780 for the other) and fragmentary pieces of iron (including nails). This layer appeared to represent a post-Roman disuse phase of the trackway.

Unphased

Nine features remained unphased due to a lack of finds or stratigraphic relationships (figure 13a).

5260 was a small pit, measuring *c.*0.4m diameter and 0.14m deep. Its single fill was rich in burnt flint and charcoal, though no other finds were recovered from it. The feature was identified as a probable fire pit based on evidence of *in-situ* burning, and it may have been related to similar features **5214**, **5216**, **5353** or **5744**.

Pit **5270** was also filled with burnt material, and may well be related to the same phase of activity as **5260**. The pit was broadly oval, with a small scoop to the ENE edge, possibly indicative of raking, and measured 2m long x 0.68m wide and 0.34m deep. Its single fill contained a small quantity of burnt stone and moderate amount of unidentifiable charred plant remains (charcoal), but no other finds to help date the feature.

5344 was a large irregular pit, 1.15m x 0.9m x 0.19m, bearing characteristic evidence of being a tree throw. It had a single fill which produced no finds.

The terminus of what appeared to be a linear feature, **5349**, or possibly a large pit, protruded for 3m from the southern limit of excavation. The feature measured 1.3m wide and 0.36m deep and contained a single fill (a compact, dark greyish brown silty clay), which produced seven fragments of undiagnostic fired clay. The feature was presumed to have been a former field boundary, though its alignment did not match that of any existing boundaries.

Pit **5352** was another pit containing evidence of burning, though without the burnt flint deposits of **5260** and **5270**. It measured *c.* 0.65m in diameter and 0.15m deep, and contained no finds. It was considered likely to have been a disposal pit for burnt material, rather than a fire pit, due to the lack of *in-situ* burning.

Pit **5361** was a round pit, roughly 0.6m in diameter and 0.3m deep. It contained a single fill with frequent charcoal flecks in it. No clear date or function could be ascribed to the pit.

Pit **5379** was a small pit, 0.45m in diameter and only 0.08m deep. It contained a single fill which contained no finds or evidence of function. The size of the pit suggested that it may have been heavily truncated, and that it may have been the base of a larger pit, or possibly a posthole.

5287 was a broad, shallow scoop-shaped feature, measuring 0.88m long by 0.35m wide and 0.08m deep. It had a single fill which produced no finds. The feature seemed likely to have been the truncated remains of a larger pit, but from what survived it was impossible to ascribe a date or function.

These latter three pits were relatively evenly spaced along an east-west line, but there was no clear evidence that they were related to one another in any way, given their wildly varying profiles, nor what the function of any combination of the three might have been.

Inhumation **5752** was discovered in the south-east corner of phase 3 rectilinear enclosure **5761** (figure 13a and b). The skeleton was incomplete (*c.* 5% of it remained), missing all the bones below the pelvis, though whether this was the result of modern truncation, such as ploughing, or had happened prior to deposition was unclear. The arms were pulled up to the chest, and the skull flattened, presumably resulting from post-depositional damage. The skeleton was oriented N-S, with its head at the south end, and it was lying on its right side, facing east. The bone survived in very poor condition and had to be collected as a sample, rather than as individual bones. Analysis of the remains determined that is was likely that of a single male individual of approximately 46 years of age. No grave goods were associated with the burial, and no clear date could be ascribed to it, but it was probable that its presence in the corner of enclosure **5761** might have been coincidental, rather than evidence of a Roman date. The environmental sample taken from the grave fill contained a small quantity of unidentifiable charred plant remains (charcoal) as well as small volume of an unidentifiable black porous and tarry material.

1.3.3 Plots 3 (NGR 381427 229562) and 6 (NGR 381552 229582)

Plots 3 and 6 were under-passed by tunnel, and as such no archaeological data was obtained from them.

1.3.4 Plot 4 (NGR 381480 229595)

Summary

Plot 4 was a large plot divided in two by the course of an electricity cable running roughly north-south just east of centre.

Vestigial ridge and furrow was visible in the plot.

Archaeological Background

Neither the Desk-based Assessment nor the geophysical survey highlighted any significant archaeological potential for plot 4. Evaluation was scheduled for two minor geophysical anomalies within the plot, but a change in methodology (as originally outlined in the WSI, Network Archaeology 2011iii) resulted in the plot being subjected to controlled strip instead. This controlled strip revealed an increased depth of subsoil to the north of the plot, and the decision was taken between Network Archaeology, NG and GCCED to preserve any archaeology beneath this material *in-situ*.

Results

Two distinct phases of activity were identified (figure 12a):

Phase 1: Undated

This phase comprised four discrete features: two small ditches or gullies, and two pits or probable plant-holes.

Linear feature **5406** was a narrow ditch or gully, which measured 0.45m wide and 0.36m deep, with a U-shaped profile running roughly NW-SE across the western part of plot 4. Its single fill produced no finds or other evidence as to its function or date, though it seemed likely that it related in some way to linear feature **5408**, which was a near identical ditch or gully in the eastern part of plot 4, running WNW-ESE (figure 12b). **5408** measured 0.51m wide and 0.29m deep. This also produced no finds and so no date could be ascribed to it.

As the two ditches ran at slightly oblique angles to one another it seemed unlikely that they formed part of an enclosure, so it was considered more likely that they performed some water management function, perhaps draining the plot into the brook that marked the eastern boundary of plot 4.

Pit **5410** was a large and amorphous feature located during excavation of the pipe trench, probably a plant hole, measuring 2.03m x 1.2m and 0.08m deep. Its single fill produced a single worked flint flake

Pit **5412** was also discovered during excavation of the pipe trench, and measured nearly 3m in diameter and 0.75m deep and had an asymmetric V-shaped profile. No finds were recovered from its single fill to suggest a date or function for the feature, but its irregular, sharp profile suggested that it was a large tree throw.

Phase 2: Post-Medieval

Nine broad furrows crossed the plot, oriented northeast to southwest. Excavation of one furrow, **5404**, proved it to measure *c.* 1.5m wide and 0.15m deep and to contain a single dark greyish brown silty clay, that contained a quantity of 19th – 20th century glass, including the remains of two bottles, fragments of window glass and pieces of sheet glass.

1.3.5 Plot 5 (NGR 381644 229759)

Plot 5 was a small, triangular field containing a surprising depth of apparently alluvial subsoil, but no archaeological finds or features.

1.3.6 Plot 7 (NGR 381557 229505)

Plot 7 was an extant orchard field. No archaeological features were revealed during construction, though some relatively modern wheel tracks, **5780**, **5782** and **5784**, apparently pre-dating the orchard were identified.

Of more interest was a relatively significant quantity of pottery recovered from the topsoil strip, something which had not been seen elsewhere on the project, even in the vicinity of the enclosures in plot 2. The pottery was domestic in nature, including mortaria, and dated to the 2nd – 3rd centuries, and probably related to settlement activity in the close vicinity – possibly immediately to the east, where archaeological investigations in advance of construction of Tirley PRI had proved Roman settlement of this period (Network Archaeology 2012).

1.3.7 Plot 8 (NGR 381813 229449)

Plot 8 was the field in which the Tirley PRI was constructed, and as such the majority of the plot was topsoil stripped under the auspices of that project (Network Archaeology 2012). Monitoring of the topsoil strip and pipeline trench at the western end of the field, undertaken as part of the TFC works, revealed no significant findings, despite the discovery of a Neolithic flint axe during previous archaeological evaluation (Network Archaeology 2011).

1.4 Conclusions

Of the eight plots crossed by the Tirley Feeder Connector, only three produced any finds and only two any features.

The presence of scattered Roman domestic pottery in plot 7 was indicative of a probable small scale domestic settlement in the vicinity, possibly immediately to the east of the plot, near where Roman pottery was also recovered during the concurrent works at Tirley Pressure Reduction Installation (NAL, 2012).

The findings in plot 4 confirmed the presence of ridge-and-furrow identified there during the non-intrusive surveys, as well as a pair of earlier drainage ditches. The two ditches were identical in form, but were set at an oblique angle to one another, and it was supposed that they formed part of a contemporary water management system, draining into the Newhall Brook.

The majority of the archaeology uncovered during the project was located within plot 2. This comprised at least two Romano-British enclosures (**5761** and **5281**) separated by a probable Romano-British trackway (**5760**) utilising a pre-existing boundary defined by two ditches. As the trackway truncated the easterly of the two enclosures (**5281**), whilst respecting the westerly (**5761**), it was considered possible that the western enclosure and trackway dated from the same phase of activity, whilst the eastern enclosure may have been concurrent with the pre-existing boundary features beneath the track. Another possibility would be that the trackway originally respected both enclosures, but continued to be used after the eastern enclosure fell into disuse and the trackway “wandered” slightly over the abandoned enclosure..

The earlier enclosure had a “shepherd’s crook” appearance at its eastern end, and as no internal features survived to suggest a function, it may have formed an animal pen or similar non-settlement enclosure. A possible internal division (**5767**) was truncated by the enclosure ditch itself, but didn’t continue beyond it, suggesting that it might have been part of a pre-cursor enclosure that was either extended or replaced by the later shepherd’s crook boundary.

The western enclosure was rectilinear, and appeared to have a double ditch on its northern edge (**5762** and **5763**), though the inner of these (**5763**) was heavily disturbed by roots, and may have been a former hedge line, however the coincidence of this matching the enclosure perfectly would seem a little unlikely. The enclosure had a small internal division (**5765**), and an interment in the south-eastern corner

(**5752**). It was considered unlikely that this indicated the enclosure to be a roadside cemetery, as no further remains were uncovered, and it was felt more likely that the location of the burial was either coincidental, or a burial within an enclosure whose primary purpose was not interment of the dead..

The burial was in a crouched position with its arms pulled up to its chest, and its legs removed, either prior to deposition or truncated by ploughing or similar activity. As no finds were recovered from the burial, it was impossible to date the skeleton, unless sufficient material remained to attempt a carbon date.

Given a lack of solid evidence, it was felt that the two further possible enclosures (**5764** and **5768**) to the south of plot 2, either side of the trackway and truncated by it, were more likely to be drainage features draining into the pre-existing boundary.

The discrete pits and possible postholes discovered were largely of unclear function and probably represented storage or waste pits, though a small number contained a large quantity of burnt material, including burnt stones and these may relate to pot-boilers and other cooking waste or to tempering agents and fuel ash, possibly relating to small scale light industrial works..

The possible trackway itself covered two previous linear features: **5770** was a broad, shallow depression that may have been an earlier footpath or the base of a more substantial drainage or boundary feature truncated by the later trackway. Feature **5769** was actually a series of small gully and ovoid pit features that appeared to form a linear parallel with **5770**. This may have represented piecemeal activity along the entire length of that boundary or track, but was considered more likely to be deeper areas at the base of a heavily truncated continuous linear feature, such as areas of poaching at the base of a track or field ditch.

Investigations of the area when the pipe trench was excavated suggested that the whole area of the trackway lay along the route of a possible palaeochannel, possibly that identified during the Corse PRI evaluation in 2007 (NAL, 2007), though that feature was considerably narrower and shallower, and may be more likely to have been a continuation of **5770**.

As such it was felt that putative Roman trackway **5760** may have followed the course of a smaller, less heavily used pre-Roman droveway (represented by **5769** and **5770**) along a dried-up palaeochannel.

The activity at plot 2 appeared to have been by and large agricultural in nature, with neither enclosure **5281** or **5761** producing any significant evidence of domestic occupation beyond the presence of pottery sherds. It was presumed that the more substantial activity during the 2nd to 3rd centuries followed the same general principles of the earlier activity, with the ditched enclosure **5281** directly replacing an earlier pit-boundary, and the metalled track replacing an earthen droveway. The rectilinear enclosure indicated an increase in the degree of activity along the trackside in the Roman period, but did not suggest a change in the nature of that activity.

The relatively large number of pits producing burnt material is of greater interest, and may not relate to agricultural activity. The pits may well have been intended for deposition of small scale industrial waste, though the nature and location of that industry was not determined during the excavation. As pits containing burnt stone were found throughout all the phases of activity on the site it appeared likely that this industry had some longevity and was most likely undertaken within, or related to, enclosure **5281** and its speculated predecessor, the bulk of which lay beyond the scope of excavation to the north.

1.5 Finds Summary

A number of artefacts, of various types, were recovered during the archaeological works – these have been mentioned along with the context from which they were recovered in the preceding section. This section aims to briefly provide more in depth information about the material discovered by summarising the specialist assessment reports of these finds.

1.5.1 Roman Pottery (Jane Timby)

The archaeological work at site TFC 36 resulted in the recovery of a small assemblage of 99 sherds of Roman pottery weighing 627 g. The fragmentation rate is quite high reflected in an overall average sherd weight of 6.3 g, possibly indicative of material that has undergone some ongoing disturbance or a consequence of the soft nature of some of the fabrics.

Roman pottery was recovered from 23 individual contexts; thus the incidence of material by contexts is very low which has clear ramifications on the accuracy of the dating. The material recovered fell into four categories;

Table 1.1 The Roman pottery

Category	Description	No Sherds	% of assemblage	Wt	% Wt
Native	Malvernian Peacock Gp A	1	1.0	11	1.8
	Malvernian Peacock Gp B	3	3.0	16.5	2.6
Imports	Central Gaulish samian	3	3.0	38	6.1
Regional	Midlands pink grog tempered ware	1	1.0	18	2.9
Local	Severn Valley ware (oxidised)	90	91.0	536.5	85.6
	Severn Valley ware (reduced)	1	1.0	7	1.1
TOTAL		99	100.0	627	100.0

As can be seen, by far the most common material was the Local Severn Valley Ware Material (accounting for 92% of the pottery assemblage).

The assemblage is very small and collectively seems to suggest activity in the 2nd-3rd centuries. Most of the sherds are representative of quite long-lived industries spanning much or all of the Roman period. The absence of any products of the later colour-coated industries would suggest no activity after the mid 3rd century; the latest datable piece being the sherd of Midlands pink grog tempered ware.

No further work is recommended for this assemblage.

1.5.2 The Animal Bone (Jennifer Wood)

A total of 20 (14g) fragments of animal bone were recovered from the fill of a possible hollow way (**5391**), and ditch fills (**5740**) and (**5754**).

Table 1.2 Summary of Identified Bone

Cut	Context	Taxon	Element	Side	number	weight	Comments
5389	5391	Cattle	Tooth	X	1	12	Upper molar enamel fragments
5741	5740	Medium Mammal Size	Long Bone	X	1	1	Broken into 4 pieces
5755	5754	Cattle	Tooth	X	1	<1	Molar fragment
5755	5754	Medium Mammal Size	Long Bone	X	6	1	Burnt white

As can be seen from the above table, the assemblage consisted mostly of fragmentary cattle teeth and medium mammal size long bone fragments. Due to the limited size of the assemblage, little further information can be gained, the presence of the remains on site.

No further work is required on this assemblage.

1.5.3 The Struck Flint (Hugo Lamdin – Whymark)

Eight struck flints were recovered from excavations at Tirley, Gloucestershire (TFC 36). Most were recovered from within the overburden (and are identified via a GPS number). However two were recovered from within more defined archaeological contexts;

End scraper. Regularly manufactured on a flake. Moderate white cortication. Context **5205**. Weight: 8g. Probably Mesolithic or Neolithic.

Flake. Modern damage on one edge. heavy white cortication. Context **5409**. GPS 6105256. Weight: 1g. Prehistoric.

Flake with moderate edge-damage. GPS 6105072. Weight: 7g. Prehistoric.

Broad flake with moderate edge-damage and possibly slight edge-retouch. GPS 6105055. Weight: 17g. Prehistoric.

Flake with heavy edge damage and moderate white cortication. GPS 6105101. Weight: 5g. Prehistoric.

Broken parallel-sided blade that was stuck from a bipolar core. Orange iron-staining. GPS 6105102. Weight: 2g. Mesolithic.

Burnt and broken flake. GPS 6113024. Weight: 10g. Prehistoric.

Broken flake with heavy edge damage. GPS 6113026. Weight 3g. Prehistoric

The flakes exhibited few technological attributes to assist with dating and thus in many cases only a broad prehistoric date could be suggested. The blade exhibited parallel sides and dorsal flake scars indicating that it was stuck from an opposed-platform (bipolar) blade core. These attributes indicated that this artefact was probably Mesolithic. The end scraper was regularly manufactured on a flake that exhibits platform-edge abrasion. Scrapers are, however, not intrinsically datable and only a broad Mesolithic or Neolithic date can be proposed.

The artefacts all exhibited some degrees of edge-damage and none were recovered from contemporary archaeological contexts. The assemblage therefore has no potential for further analysis.

1.5.4 The Glass (Mike Wood)

Five items of glass weighing 25g were recovered archaeological work at the Tirley Feeder Connection (TFC). The material was derived from contexts **5403** (the fill of furrow **5404**, plot 4) and **5201** (the topsoil in plot 2) and dates to the 19th or 20th century.

The assemblage contained a single fragment of clear modern window glass (from **5201**), probably a variety of drawn sheet or polished plate rather than 'float glass' which suggests a pre-1950s date is likely.

No further work is recommended on this assemblage.

1.5.5 The Stone (Mike Wood)

Thirty nine fragments of stone weighing 1.9kg were recovered, from topsoil and the fills of a possible hearth, a fire pit, a tree bole and ditches and gulleys.

The assemblage contained a mix of unworked fossil mudstone, quartz cobbles and natural cobbles.

Several of the fragments appear to have been heated, which is not surprising given that part of the assemblage was derived from a possible hearth and fire pit. Such stones may have been deliberately heated as pot boilers or perhaps for later use as tempering agents, where heating weakens the stone structure and will make grinding easier.

No further work is recommended for the stone finds, which could have occurred locally in scattered Pleistocene Drift. Quartzite has been noted as possibly being used for polishing in the region, however there is no evidence for this on the recovered finds.

1.5.6 The Clay Pipe (Mike Wood)

Two fragments of clay tobacco pipes were recovered from the overburden, both datable to the 18th century and represented by stem fragments. Both pipes exhibited signs of weathering as would be expected from their recovery from topsoil and subsoil layers.

None of the material warrants any further work or illustration. A photographic record of the decorated bowl will be included with the final archive.

1.5.7 The Metal Objects (Kevin Leahy)

This archive consisted of five iron objects. The objects were corroded, but relatively well preserved, although some detail was hidden by corrosion products. None of the artefacts could be accurately dated.

Table 1.3 Summary of Metal Objects

Context	Description	Material	Mass
5390	Nail or fitting	Iron	34.03g
5391	Nail	Iron	2.78g
5391	Nail	Iron	3.00g
5718	Corrosion products	Iron oxide	1.44g
5713	Nail	Iron	11.94g

It is not thought that any of this material has any intrinsic archaeological importance although in some cases it may have come from a context which makes it worthy of note. There are no recommendations for further work.

1.5.8 CBM and Fired Clay (Rachel Hall)

The CBM

A single fragment of roof tile was recovered from layer (**5225**). It is dated to the post-Medieval period base on form and fabric.

The Fired Clay

A total of 15 fragments of Fired Clay weighing 163g were recovered from 6 contexts. With the exception of a five fragments that have surfaces, the assemblage comprises small and abraded, undiagnostic fragments. They are all in a sandy fabric with sparse Iron Oxide inclusions with variable firing.

The objects were recovered from layers (**5205**), (**5229**) and (**5388**). They have at least one surface and an edge/ corner. These represent possible objects such as loomweights or kiln bricks/mould fragments.

The remaining fragments may represent daub fragments from house structures.

Table 1.4 Summary of CBM and Fired Clay

Context	Material	Form	Number	Weight (g)	Date
5225	CBM	Tile	1	12	Pmed
5205	Fired Clay	Object	1	67	Undated
5209	Fired Clay	Undiagnostic	2	12	Undated
5229	Fired Clay	Object	2	15	Undated
5237	Fired Clay	Undiagnostic	1	1	Undated
5388	Fired Clay	Object	2	28	Undated
5350	Fired Clay	Undiagnostic	7	40	Undated
TOTAL		16	175		

The small amount of material offers little potential for further research. No further work is required.

1.5.9 Environmental Evidence (Val Fryer)

Samples for the retrieval of the plant macrofossil assemblages were taken from a number of contexts, and ten were submitted for assessment.

Although charcoal/charred wood fragments were present throughout, other plant macrofossils were exceedingly scarce. However, a single, large fragment of hazel (Corylus avellana) nutshell was recorded within the assemblage from sample 8 (ditch **5282**), and sample 5 (ditch **5221**) contained a possible indeterminate tuber fragment. The charcoal was mostly very small and abraded, possibly indicating that it was exposed to the elements for some considerable period prior to deposition.

A limited range of other materials types was also recorded. Small, and very abraded bone fragments are present within the assemblages from samples 5, 32 (ditch terminal **5706**), 33 (ditch **5741**) and 34 (deposit **5718**), and form the major component of sample 35, which was taken from a deposit containing very fragmentary skeletal remains (**5752**). Occasional splinters of heat altered stone are also recorded, and sample 33 appeared to contain numerous small pellets of burnt or fired clay.

In summary, the assemblages were mostly small and very limited in composition. As hearths and/or fire pits were recorded on the site, it is tentatively suggested that much of the charcoal/charred wood was probably derived from the ‘rake-out’ from these features. However, it is noted that the material was mostly of a very uniform size, possibly suggesting that it was sifted or graded prior to dispersal and/or deposition. The intended purpose of these fire pits and hearths is currently unclear, but the lack of cereals or other food residues probably suggests that their primary function was not domestic.

As plant macrofossils other than charcoal are so scarce, no further analysis of these assemblages is recommended at this stage. However, a summary of this assessment should be included within any publication of data from the site.

1.5.10 Human Remains (Malin Holst)

The excavations of the Brecon to Tirley pipeline produced an inhumation at Plot 2. The skeleton lay in a south to north orientation, on its right side with the arms up by the chest. The burial was very badly damaged and is unphased.

Table 1.5 Inventory of skeleton examined

Skeleton No	Preservation	Complete	Age	Sex	Stature	Pathology
1	Very poor	5%	46+	Male?	-	Dental calculus

The skeleton from TFC36 is in a very poor condition, with considerable fragmentation and erosion. The only bones that are partly preserved are the left humerus shaft, distal shaft of the left ulna and radius, anterior mandible, a small portion of the skull in fragments and seventeen teeth. The skeleton is therefore only 5% complete.

Based on the bones present, the minimum number of individuals represented is one. Analysis of the eye orbit, the anterior mandible and the general robusticity suggests that this is a possible male skeleton. The dental wear is moderate to severe on the anterior and posterior teeth. On the basis of the wear, the individual has been aged to 46 years old or older.

With regards to skeletal pathology, none could be observed. However, the dental wear is unusual and uneven. There is slight dental calculus (dental plaque) on six of the seventeen teeth.

1.6 Statement of Potential by Research Objective

1.6.1 English Research Objective 1

To extend the use of proven methodologies for site location and interpretation, and encourage the development of new techniques, within the project area

In apparent contrast to the remainder of the Gloucestershire stretch of the Brecon to Tirley pipeline project, the geophysical survey undertaken on the Tirley Feeder Connector appeared to have been largely unsuccessful.

The large, multiple enclosure site at plot 2 was not detected by the geophysical survey, and it was notable that the majority of the features were not easily visible immediately after stripping, taking some time to “weather out”. This was only possible because the entire pipeline was stripped solely by 360° mechanical excavator. A re-examination of the methodologies employed during the non intrusive investigation of the site, may assist in avoiding such ‘false negative’ results in the future. Additionally the success of the particular stripping methodology employed here should be recognised and taken into account when considering the specific methodology for mechanical stripping at future similar sites. This project was considered to have had a moderate potential to address this research objective.

1.6.2 English Research Objective 2

Encourage works of synthesis within and across periods, settlements, monuments and areas, for the project as a whole

The discovery of an inhumation, a possible Roman trackway and at least two Romano-British enclosures within plot 2 can all be incorporated into discussions of related find types along the Brecon to Tirley pipeline route.

This synthesis is included within this document, and a further overarching report is planned amalgamating all the data from every aspect of the entire South West Pipeline Project, from Milford Haven to Tirley, incorporating the Tirley Feeder Connector and remedial works along the main pipeline.

1.6.3 English Research Objective 4

Encourage wide involvement in archaeological research and present modern accounts of the past to the public

The site discovered at plot 2 has moderate potential to be of public interest, and will be presented in a publicly available format after the completion of the analysis stage.

1.6.4 English Research Objectives 17 and 18

Improve the quality and quantity of environmental data and our understanding of what it represents, from within the pipeline spread. Target specific soil and sediment contexts for environmental information.

Bulk palaeo-environmental samples were collected from a number of features and sent for analysis with Val Fryer. Her report concluded that the material collected was of such poor quality, so sparse and of such limited type (mainly charcoal) that there was little value of further work in this area. As a result this project must be seen as having a low potential of addressing this research objective.

1.7 Potential of the Artefact Assemblage

The nature of the artefact assemblage collected by this work is generally small, of limited scope and poor preservation and very typical of the period and region. As a result the majority of the finds recovered have no potential to contribute information toward the various research objectives, beyond their contribution to the understanding of the nature of the sites as a whole, which is summarised above.. The two exceptions to this are;

1.7.1 The Roman Pottery

As part of the analysis process undertaken following this assessment, the stratigraphic and contextual data was reassessed, and the phasing checked against anomalies within the Roman pottery record. Following that check, no further changes were required, and the phasing remained as presented above.

1.7.2 Human Remains

Should scientific dating of elements of the skeleton recovered from plot 2 prove possible then this has a high potential for contributing information toward our understanding of ritual and funerary sites along the pipeline, as part of Research Objective 2. .

1.8 Summary Table of Potential

Table 10.6 Table of Potential for TFC site plots

Table 1.6 Table of Potential for TFC site plots

Plot	Research Objective			
	1	**2**	**4**	**17 & 18**
1				
2	1a	2b	2a	1a
3				
4				
5				
6				
7				
8				

Key to Potential and importance

Blank = No/negligible potential and importance

1 = Low potential

2 = Moderate potential

3 = High potential

a = Local importance

b = Regional importance

c = National importance

Appendix B

Specialist Reports

Early Prehistoric pottery

By Emily Edwards

NOTE

A number of the pottery fragments recovered during the work, and assessed shortly afterwards, were in such poor condition that by the time of the analysis they had degraded to such a state that further analytical work was no longer possible – in particular this applied to the numerous small crumbs of Beaker pottery recovered from plot 467.

Introduction

A total of 577 sherds of pottery (2016g) were analysed as part of the production of this report; these had been recovered from 19 features from eight sites. Key features included pits from site BRT 106, which contained the partial remains of Collared Urns, one of which (490051) was covered with charred residue and the other of which was internally pitted (490053). These sherds represented only a small proportion of either vessel. The remainder of the material included a possible middle Iron Age rim sherd and some Beaker sherds.

Aims of the report

The aims of this report are to fully record, characterise and describe the assemblage, and to put the Collared Urn and Beaker fragments within local, regional and chronological contexts. The research objectives listed below are relevant to the early prehistoric pottery; the Collared Urns and Beaker material are important additions to the regional corpus. The conclusion to this report will discuss the assemblage's merits in these terms. The assessment stage has concluded that the material has little else to contribute to research objectives and that it does not pose any new ones.

Methodology

Quantification of the assemblage is being demonstrated according to sherd group weight and number (See Table 1), where a group constitutes sherds of one vessel element and fabric type, from one context, probably representing a single, specific vessel. Refitting breaks have not been excluded from the sherd count; numbers of refitting sherds have been recorded separately and it has been difficult to differentiate between old and fresh breaks.
The pottery is characterised by fabric, form, surface treatment and colour. The sherds were examined using a x20 hand lens and were divided into fabrics according to principal inclusions.
The site specific bedrock and superficial deposits described below are sourced from the BGS open source website (BGS).
Size range for inclusions has been recorded in the original data using the following system: 1: <1 mm, fine; 2: 1-3 mm, medium; 3: 3 mm and upwards, coarse. Inclusion types are denoted using standard codes (PCRG 2011):

- A: Sand

- B: Bone
- C: Calcareous, possibly chalk
- F: Flint
- G: Grog
- Q: Quartzite
- R: Rock (to be further examined)
- V: Voids (usually leeched calcareous material or burned out organic material)
- NT: No temper/opening material

Analysis of pottery by site

Pottery from Site 49; Werntoe Farm, south east of Llanglwys Wood, north east of Llandyfalle Hill

Introduction

Three pits from this plot contained a total of 480 sherds (1279 g) deriving from early Bronze Age urned cremations, from pits **49003** (P3, context 49004, 36 body and base sherds), **49050** (P1, context 49051, 298 sherds, 706 g) and **49052** (P2, context 49053, 146 sherds, 536 g).

Fabric

Bedrock is Raglan Mudstone Formation, Siltstone and Mudstone, interbedded. Formed from rivers, sand, gravel, detrital material, fine silt and clay. Borehole data from farms near Llandfalle (SO 119 368 and SO 1175 3500) describes medium brown marls up to a depth of 33 meters.
Observations on Fabrics
The pottery comprised three early Bronze Age Urns manufactured from G1, SG1 and B3 fabrics; the clays did not appear to contain significant amounts of either naturally present material or locally gathered material, but instead contained opening materials made by human agency, such as cremated bone and grog.

Fabric Descriptions:

G1: Regular amounts of fired clay, pellets or grog. Other inclusions are random and include granite, calcareous material and fine quartzitic sand.

B3: Regular amounts. Partially leeched bone, up to 6 or 7 mm. Some voids are cylindrical.

SG1: Appearances are of a non-tempered fabric. Very fine sparse to rare amounts of white calcareous material, hackly fracture with possible grog elements

Form and Chronology

The Collared Urns were only partially preserved and so all comments on form must be made with reservation. The Collared Urn from 49053 (P2) was a Tripartite form 1 (Longworth 1984, 7) with an expanded, flat internally bevelled rim (Longworth Type 6 with some expansion of wall thickness), a flat hat-like Type B collar with a continuous unbroken inner curve (no internal moulding). The neck and shoulder area is represented by only the smallest fragments, which do suggest an upright, concave form (Longworth Type A), whilst the shoulder fragments show a sharp change of angle created by a smoothed step (Longworth Type A). The featured sherds representing the Collared Urn from 49051 (P1) included a simple squared rim (Longworth Type B) and Type B collar and Type A neck and shoulder sherds (see above). The base sherds from context 49004 (P3) represented a pedestal base (Longworth Type B). The span of Collared Urns falls between 2100 and 1300 cal BC. The vessel elements present on the two more complete vessels suggest a typologically late date, belonging to Longworth's Secondary Series and to Burgess's Late Series (Burgess 1986).

Surface Treatment and Decoration

The Urns were all smoothed both internally and externally, with no decoration being present on the sherds from 49004. Urn 49053 was smoothed but pitted on the inside whilst the external face appeared also to have been trimmed. The two better-preserved vessels were decorated using twisted cord maggots, with the external wall of the collar on urn 49053 being decorated with hurdle patterns (Longworth) whilst that on urn 49051 was covered with rows. Neither of these bore decoration on any other sherds; rim bevels and body sherds were undecorated.

Function and Use

Urn 49051 showed signs of internal burning; the rim top was smoke blackened and the internal face covered with charred residue and further smoke blackening. This was not consistent; not all of the rim sherds displayed this residue and it is not clear whether or not this inconsistency is genuine or related to post-excavation cleaning. This vessel is also manufactured from a fabric containing burned bone and it is possible that some of the voids are not due to leeching but caused by the burning of seeds and other organic materials. This use wear points heavily towards domestic use, as charred residue such as this is often starchy food.

Disposal

All three vessels were part of urned cremations recovered from apparently truncated pits. The vessel recovered from **49050** (context 49051) was largely intact, from rim to mid-belly, upon excavation, whereas those from 49053 and 49004 were more fragmentary. It is thought that P1 (context 49051) was buried inverted; it is possible that this was the case with P2 (context 49053). It is not certain, but it is probable that both vessels were deposited intact.

Regional Context

Few Collared Urns have been retrieved from the Brecon area but the surrounding early Bronze Age landscape is richly littered with early Bronze Age sites and artefacts; this is the context into which these vessels must be placed, rather than in isolation. A study on early Bronze Age funerary and ritual sites within the adjacent Severn Valley, for example, showed that although a good range of early Bronze Age vessel types had been recovered from excavations along the valley, sites containing Collared Urns appeared to be restricted to upland cairns at Carneddau (see below). A single example in Longworth was recovered from Llangynidr (Longworth 1984, p329, Pl 212c) and constituted a similar tripartite form to that of P2, with typical late features such as the restriction of decoration to the collar, concave, upright neck and flat, upright collar. Twisted cord was also used, as with P1 and P2. Another was found at Lan Fawr (Britnell 1988, fig 1; Hughes 2004) on Mynedd Du. Further afield, in Montgomeryshire, excavations at the Carneddau Cairn (Gibson 1997; Gibson 2002) recovered eight, one latter being very similar in form and appearance to P2. Another possible example was recovered from Nant Maden Cairn, but this one remains undiagnostic as it is not discussed in Longworth (CPAT HER PRN 33556). The examples from Plot 49 are not complete enough to facilitate detailed analysis but they are regionally significant additions to a small corpus, not least in terms of their depositional contexts.

Site 111A, near to Pipton Farm, near Aberllynfi, Powys

Introduction

An excavated buried soil layer (74036) contained three undiagnostic sherds (7 g) manufactured from a quartzite fabric. These were plain, abraded body sherds.

Fabric

Bedrock is Raglan Mudstone Formation, Siltstone and Mudstone, interbedded. Formed from rivers, sand, gravel, detrital material, fine silt and clay. Borehole data from farms near Llandfalle (SO 119 368 and SO 1175 3500) describes medium brown marls up to a depth of 33 meters.

Observations on Fabric

The quartzite present in the fabric from site 111A is ubiquitous throughout England and Wales and thus difficult to source. Here, it is not easy to establish whether or not it is present locally. Regular, coarse amounts of quartzite are commonly found in pottery fabrics dating to the middle Neolithic and to the late Bronze Age.

Fabric Description

Q3: Regular amounts of coarse quartzite.

Site 75, West of Llyswen, Powys

Introduction

An unphased posthole, **75006**, contained one plain, prehistoric body sherd, of indeterminate fabric.

Site 271, Near Peterchurch, Herefordshire

Introduction

A single thick walled, Bronze Age body sherd was recovered from ditch **67050**. This plain sherd was manufactured from a fabric containing large fragments of quartzite and granitic rock and was fired to a bright red-brown on both external and internal face.

Fabric

Bedrock is Devensian Till (boulder clay), diamicton (mixed content sediment), no recorded superficial deposits. A borehole at SO33NW described Marl up to 10 feet and red sandstone, thereafter.

Observations on Fabric:

The quartzite and rock may have local origins but it is difficult to ascertain whether or not either is present.

Fabric Descriptions:

QR3: Sparse amounts of coarse quartzite and rock (possibly granitic)

Plot 314 – 1.4 km south of Vowchurch, 1.3km to the south west of the Motte and Bailey at Monnington, Herefordshire.

Introduction

A total of 46 sherds were recovered from context 31401; these represented two vessels, one being manufactured from a fine walled sandy and the other being a thick walled, grog tempered vessel.

Fabric
:
Alluvial deposits can be found to the south of Vowchurch, along the River Dore. Underlying this are the Lower Devonian beds and the Pridoli Rocks, both consisting of Mudstone, Siltstone and Sandstone.

Fabric Descriptions:

G1: Regular amounts of angular grog, different colour to the matrix of the fabric, varying in sizes from 1mm to 5 mm across.

Plot 400, Pencoyd, The Hall, Herefordshire

Introduction

A pit (**40002**) contained 14 sherds (77 g), including one internally bevelled rim (8 g), from a Beaker vessel. These were thin walled and fired to a red/yellow-brown externally; decoration comprised complicated incised lozenge motifs (P5).

Fabric

Bedrock : Devonian Brownstones Formation, micaceous sandstone. Part of the Old Red Sandstone group, red brown and purple sandstones.
Superficial deposits: none recorded.
Nearby borehole documents marls and Quaternary sands and gravels, overlying the sandstone.

Observations on fabrics

The sand present in the fabric may have derived from local sources.

Fabric Descriptions

Fabric AV1: Sparse amounts of fine sand in a leeched matrix

Decoration and Form

The Beaker was too fragmentary and poorly represented to facilitate any analysis of form, beyond the internally bevelled rim. The incurved rim suggested a closed form which in turn points to vessel shapes such as Clarkes Southern and Northern styles, or indeed, bowl forms such as the Edingthorpe bowl, which also has an internally bevelled rim (Clarke 1970, 918, p393). It was a well fired and finished Beaker which had been fired to a red-brown both internally and externally and then smoothed; the decorative motif was worn but comprised a complicated lozenge pattern which had been applied using either a sharp implement or a comb.

Deposition and Regional Context

There is a small body of evidence for the late Neolithic-early Bronze Age in Herefordshire (Jackson 2011, 102). A similar vessel was excavated from the Bronze Age Cemetery at Southend Farm, Mahon (Malverns) during the 1930s. This was also decorated with horizontal bands and filled lozenge patterns whilst the hour glass form of the S3 style includes a closed rim and upper body. Other examples include a single fragmented vessel from Merlin's Cave (Clarke 1970, p483), near Ross-on-Wye, two vessels from cists at Olchon Valley (Clarke 1970, p311 and 483, catalogue 234-4) and Aymestrey (Herefordshire SMR 7060) and another from a cremation at Pontshill (Herefordshire SMR
) near Ross-on-Wye. The Beaker from Plot 400, by comparison, appears to have been found within a pit, which may be an indication of a non-sepulchural, even domestic, context.

Plot 464, Phocle Green and Hole in the Wall, near the River Wye, Herefordshire

Introduction

A total of 20 sherds (143 g) were analysed from those recovered from Plot 464. This included eleven plain body sherds (113g) from cremation pit **46403** (context 46402); these were of uncertain date and indeterminate fabric. Several refitting fragments included a possible pointed rim; it was very difficult to ascertain whether or not the abraded condition of the material had given the sherd a misleading appearance. Three plain body sherds, two sand tempered and one sand and grog body, were recovered from stakeholes **46939** and **46444**. These were of early Bronze Age date, but beyond this generality, they were indeterminate.

Fabric

The local bedrock comprised Brownstones Formation, Micaceous sandstone of the Devonian Era. No superficial deposits were recorded. Part of the Old Red Sandstone group, red brown and purple sandstones. Nearby borehole document marls and Quaternary sands and gravels, overlying the sandstone.

Fabric Description

Fabric A1: Sparse fine sand

Observations on fabrics:

The sand present in the fabric may well be locally derived.

Plot 430A, Winter's Cross, Peterstow, Herefordshire

Introduction

A total of one single, much worn, plain body sherd was recovered from context 86272 (the number assigned to unstratified finds). Largely indeterminate in date, it was manufactured from fine rare sand and grog and could be placed within the late Neolithic or the late Neolithic/early Bronze Age.

Fabric

Bedrock – Brownstones Formation, Micaceous sandstone. Devonian. No superficial deposits recorded. Part of the Old Red Sandstone group, red brown and purple sandstones. Nearby borehole document marls and Quaternary sands and gravels, overlying the sandstone.

Fabric Description

Fabric AG1: Sparse amounts of fine sand and grog.

Observations on fabrics:

The sand present in the fabric may have been locally derived.

Plot 250 (Evaluation Site Road Crossing (RDX) 75/11)

Introduction

The rim sherd from context 1003 (P4), the secondary fill of a ditch later to be identified as **65025**, has a slack shouldered profile with a simple squared rim, is well fired, with a fine, common quartzitic fabric, which may place it in the middle Iron Age.

Fabric Description

Sparse amounts of flint, 2 mm, and rare fine sand.

Plot 444 (Evaluation Site RDX 109/1)

Introduction

A single sherd was found during this evaluation, from context 55102, the upper of two colluvial layers located within the trench. Being manufactured from a coarse, quartzite tempered fabric, this small sherd could have been placed either within the early to mid Neolithic or during the later Bronze Age.

Fabric Description

Q3, sparse amounts of coarse quartzite.

Plot 454 (Evaluation site RDX 111/5) and Plot 557 (Watching Brief GPS point 60204)

Context 14315, the sole fill of a ditch, part of what was to be later identified as ditch **85117**, contained a single prehistoric sherd (3g) manufactured from a leeched sand fabric.

A single flint tempered body sherd (7 g), of possible Iron Age date, was recovered from topsoil, at GPS point 60204 in plot 557, near Redmarley D'Abitot in Gloucestershire.

Fabric Descriptions

VA2: Leeched fabric with sparse amounts of fine sand.
AF2: Sparse amounts of fine to coarse sand and rare fine flint.

Bibliography

Britnell, W, 1988, *A Collared Urn and Cremation Burial from a small upland cairn near Lan Fawr, Church Stoke, Powys*

Burgess, Colin 1986 `*'Urnes of no small variety': collared urns reviewed*' Proc Prehist Soc 52, 1986 339-51,

Clarke, D, 1970, '*The Beaker Pottery of Great Britain and Ireland'*, Cambridge University Press

Gibson, A, 2002, '*Earlier prehistoric funerary and ritual sites in the Upper Severn valley'* In *Montgomeryshire Collections*, volume 90, 1-40

Jackson, R, Miller, D, 2011, '*Wellington Quarry, Herefordshire (1986-96): Investigations of a landscape in the Lower Lugg Valley'*. Oxbow Books.

Longworth, I, 1984, '*Collared Urns of the Bronze Age in Britain and Ireland'*, Cambridge University Press.

PCRG 2011, *The Study of Later Prehistoric Pottery: General Policies and Guidelines for Analysis and Publications*. Occasional Papers number 1 and 2. 3rd edition revised.

Web Sources

BGS, http://www.bgs.ac.uk/opengeoscience/

Table 1 Catalogue

site code	Feature	Date	Type	Fabric	Count	Weight (g)	Th mm	Description
BRT 106, Plot 49	Pit 49051, Context 49051	EBA	CU	B3	9	81	10 mm	**F**ragments of a Collared Urn that formed a larger, intact fragment before excavation. Simple rim and hat-like collar decorated with impressed cord maggots forming horizontal bands and oblique lines. Bone tempered.
BRT106, Plot 49	Pit 49052, context 49053	EBA	CU	G1	8	47	9 mm	Fragments of a Collared Urn with internally bevelled rim and hat-like collar. Decoration over collar comprises twisted cord impressions forming a hurdle pattern.
BRT106, Plot 49	Pit 49003, context 49004	EBA	Unknown	SG1	14	143		Fragments of an early Bronze Age pedestal base and carinated body sherds. Possibly lower part of a tripartite Collared Urn.
BRT75, Plot 111A	buried soil layer 74036	PRE		Q3	3	7		
BRT96, Plot 464	Cremation Pit 46403, Context 46402		jar?	IND	11	113		
BRT 44, Plot 444	Colluvial layer 55102	NEO OR LBA	PW?	Q3	1	5		
BRT106, Plot 75	unphased posthole, 75006	PREH		IND	1	9		
BRT44 Plot 454	Ditch fill 14815	PREH		VA2	1	3		
BRT 44, Plot 250	Ditch fill 1003	MIA		FA2	1	34		Simple rim and slack shouldered profile, which could be middle Iron Age.
BRT75, Plot 430	Context 86272	LN-LNEBA	GW/BKR	AG1	1	5		
BRT 96, Plot 400	Feature 40002, Context 4001	LNEBA	bkr	AV1	14	77		Fragments of Beaker decorated with incised lines, forming complex pattern of filled lozenges and horizontal bands. Two refitting rim sherds show a closed, simple intermal bevel. Form uncertain.
BRT96, Plot 464	Stakehole 46444, Context 46445	EBA	x	AG1	1	4		
BRT75, Plot 271	Pit/Ditch 67048, Context 67050	BA	x	QR3	1	8		
BRT96, Plot 464	Stakehole46439 , Context 46441	EBA	x	A1	1	9		
BRT96, Plot 464	Stakehole46444 , Context 46445	LN OR EBA	x	A1	1	3		
BRT54, Plot 557	GPS point 60204	IA		AF	1	7		

Roman pottery - Brecon to Tirley Pipeline

Jane Timby

Amendment to the Assessment Recommendations.

The assessment report of this material (Timby 2009) listed the following recommendations, which entered the UPD;

1. *The earlier prehistoric pottery needs to be seen by an appropriate specialist.*

2. *It is recommended that the potentially mid-later Iron Age material is studied in conjunction with the Roman assemblage against the stratigraphic information, as it is likely that there is a continuum of use present the character of which will be lost if the group is split.*

3. *Although the samian assemblage is small and in some cases quite abraded and scrappy it might benefit from the input of a samian specialist to confirm the source attributions and dating. It would not warrant a lengthy report.*

4. *A number of vessel profiles can be reconstructed for illustration.*

5. *Further work should characterise the individual sites and place them in a wider local and regional framework.*

Recommendation 1 has been met by placing the early prehistoric pottery initially, and erroneously, incorporated into this assemblage back into the main prehistoric pottery assemblage - where it has been examined by the relevant specialist as part of the analysis of this material type (above).

Recommendations 2, 4 and 5 form the bulk of this specialist report.

Following this analysis, Timby stated that she thought recommendations 2 and 3 were no longer necessary having been adequately fulfilled by this analysis;

I think both recommendations [2 and 3] *have been adequately covered* [by the analysis works already undertaken]*. The comment with regard the IA* [Iron Age material] *was to suggest it was not separated before the analysis stage because of the overlap IA to Roman in these areas where LIA traditions continue into the Roman period. I think we have all got better at samian id*[entification]*s in recent years through training and the publication of the stamp corpus so again I don't think any further input would be of great benefit in this particular instance* (Timby, *pers comms* May 2013).

ANALYSIS - Introduction and methodology

The archaeological work on the Brecon section of the pipeline collectively resulted in the recovery of some 9522 sherds of Roman pottery weighing c132 kg with 93.78 estimated vessel equivalents (EVE). Roman pottery was recovered from 22 individual plots with quantities ranging from single sherds up to just over 4500 sherds. In general terms the assemblage is in good condition. The overall average sherd weight is 14 g, quite typical of rubbish material in this region where some of the fabrics can be quite soft although individual sites will vary slightly. Surface preservation variable ranging from very good to quite poor where surface finishes have been lost suggesting different archaeological or environmental processes at work. Calcareous-tempered sherds have also become completely leached creating very vesicular fabrics. There are several semi-complete or complete, but broken, vessels with profiles.

The pottery was sorted into fabrics based on the type, size and frequency of inclusions and firing colour. Named traded wares were coded using the National Roman reference codes (Tomber and Dore 1998 (=T & D) (see Table 2). Other sherds are coded more generically by colour. The sorted material was quantified by sherd count, weight and estimated vessel equivalent (rim only). Where sherds had evidently broken during or after retrieval these were counted as one. Rim sherds were coded according to vessel type. The quantified data was entered onto a MS Excel spreadsheet, a copy of which is deposited with the site archive. Some 319 crumbs weighing 175 g was recorded where material was too small or degraded to classify and this is omitted from Table 2.

In the following report the fabrics and associated forms are briefly described for the complete recovered assemblage. This is followed by a discussion of the larger groups of pottery from each of the excavated plots. The final section places the assemblage into its regional context.

Discussion of fabrics and associated forms

ROMAN NATIVE WARES

Malvernian metamorphic ware (T & D 1998, 147, MAL RE A); (Peacock 1968, fabric Group A). A handmade reduced ware containing weathered fragments of metamorphic and igneous rocks which originate from the Malvern Hills. This is a pre-Roman industry dating from the mid-later Iron Age but continuing, initially with no real change, into the early-mid Roman period. It accounts for 7.3% by sherd count and 10.1 % by weight of the total assemblage. Forms: vessels are handmade, usually simple forms with horizontal or vertical burnished finish. The main present are straight-sided ‘tubby’ jars (Fig. 00. 63), everted rim necked jars and an ovoid bodied jar (Fig. 00. 41). One ‘tubby’ jar is decorated with a burnished line lattice and one shows the edge of a handle springing (Fig. 00.64). There are also two examples (rim) from very large expanded heavy rim bowls (Fig. 00. 45, 52).

Malvernian limestone-tempered. (Peacock 1968, Group B; MAL RE B). A distinctive limestone-tempered ware originating from the May Hill, Malvern Hills, or Woolhope Hills. The latter is suspected as the most likely source at present (Morris 2005, 119). This is another pre-Roman industry which continues into the second half of the 1st century AD. A moderately large group of sherds accounting for 14% by count to the total recovered assemblage although only 4.4% by weight a reflection of the very friable nature of the fabrics many of which are much leached. Forms: Nearly exclusively handmade jar forms with beaded, everted, necked and plain rim types (Fig. 00. 2, 7, 8; 00. 62, 65-7). Some vessels show a burnished finish. One very small sherd from Ditch 40068 (Plot 400) shows the edge of impressed dot decoration.

Malvernian variant. Two bodysherds with a sandstone temper.
Grog-tempered ware (GR). A handmade generally brown or black ware containing sub-angular pieces of grog. The vessels have a smooth soapy feel. These wares first appear in the early 1st century AD and continue to feature into the early Roman period. Forms: Jars with everted necked, sharply everted rims (Fig. 00. 6, 13) and larger storage jars with rolled rims (Fig. 00.50).

Limestone-tempered ware (LIME). A small group of just three handmade sherds with a limestone temper, possibly Jurassic rather than Palaeozoic limestone but mainly showing as voids. Probably a pre-Roman tradition and residual here. Sherds have a burnished finish.

ROMAN: CONTINENTAL IMPORTS

South Gaulish samian (T & D 1998, 28, LGF SA). Some 23 sherds were recorded. Recognisable forms include dishes Drag. 18, 18/31R and 29. The latter comprised nine very friable sherds from ditch [86126] and is the only decorated vessel present. A base from a dish stamped PASS… from cremation 85049 is probably by the potter Passienus who was active at La Graufesenque in the period AD 50-75 (Hartley et al. 2011, 13, possibly die 57b). One dish from pit [86239] has a lead rivet repair.

Central Gaulish samian (T & D 1998, 32, LEZ SA). A small assemblage of 29 sherds of Central Gaulish samian was present, 0.3% of the total assemblage. Forms appears to be mainly dishes Drag. 31 and perhaps 18/31R. There is a single sherd from a decorated bowl Drag 37. A basesherd with an illegible broken, eroded stamp was recovered form ditch [86226].

Moselle black-slipped ware (T & D 1998, 60. MOS BS). A single very small sherd was recovered from Plot 160.

Baetican amphora (T & D 1998, 84-86, BAT AM). This amphora type used to transport olive-oil and made in the Guadalquivir Valley, Baetica, Southern Spain, is one of the commonest amphora types found in British sites. It is the only amphora present from the pipeline sites and is represented by 18 bodysherds. Fourteen of these came from road surface [70005] (Plot 110) and may have used as hard core.

ROMAN: REGIONAL WARES

Alice Holt grey ware (T & D 1998, 138, ALH RE). A single late Roman flanged-rim conical bowl with a white slip over the upper body was recovered from evaluation trench context (6207), Plot 271.

Dorset black-burnished ware (T & D 1998, 127, DOR BB1). This is the third commonest fabric by count accounting for 13.6% by sherd count, third by weight at 7.7 % second in terms of EVE. Forms: jars dominate the assemblage accounting for 83.5% of the EVE's (Fig. 00. 5, 17, 26-8, 42, 56). The remaining 16.5% comprises flat rim bowls (Fig. 00. 10), grooved rim bowls, flanged-rim conical bowls, plain-sided dishes and a single handled mug. Many of the jars have burnished wavy lines around the neck and the burnishing ranged from early Roman acute lattice typical through to later Roman oblique lattice. One vessel is decorated with a triple line lattice. The assemblage thus spans the 2nd through to the 4th century. One jar from ditch 85002 (Plot 454) shows a lead rivet repair (Fig. 0. 27).

Lower Nene Valley colour-coated ware (T & D 1998, 118, LNV CC). A single very small sherd from the colluvium on Plot 271.

Mancetter-Hartshill white-ware mortarium (T & D 1998, 189. MAH WH). A single hammer-head mortarium from Plot 160, a form typical of the mid 3rd-4th century.

Oxfordshire colour-coated ware (T & D 1998, 176, OXF RS). Eight sherds, one of which is from a mortarium Young (1977) type C100. All the pieces came from Plot 271.

Oxfordshire white-ware (T & D 1998, 175, OXF WH). Three white-ware mortaria sherds from Plots 160 and 271 amongst which is an examples of Young (1977), type M19 dating to the later 2nd to mid 3rd century.

Southwest black burnished ware (T & D 1998, 129, SOW BB1). Three sherds from a single jar (Gillam 1976, type 31) from ditch 86210 (Plot 430B) (Fig. 00. 20).

Southwest oxidised ware (SOW OX). Ten small sherds from cremation 85049 (Plot 454).

Southwest white-slipped ware (T & D 1998, 192, SOW WS). A single flanged-rim bowl from Plot 160.

Verulamium white-ware (T & D 1998, 154, VER WH). Two mortarium sherds; one from ditch 86140 (Plot 430A); the other from ditch 86140 (Plot 430A) (Fig. 0. 9). The latter probably dates to the early 2nd century and has a worn interior.

Wroxeter white ware mortaria (T & D 1998, 179, WRX WH). A single small sherd from a mortarium from ditch 67072 (Plot 271).

ROMAN WARES: LOCAL SEVERN VALLEY WARES

Severn Valley ware (T & D 1998, 148-9, SVW OX). This fabric was by far the commonest accounting for 51.4% by sherd count, 63.2% by weight, 58.6% EVE of the total assemblage. A number of sherds of the reduced grey ware version are also present (SVW RE) accounting for a further 4.8%. Forms: a diverse range of forms is present largely dating to the 1st to 3rd centuries. Jars and tankards dominate; the former accounting for 53% EVE; the latter 32% of the oxidised range. The former include both wide-mouthed and narrow necked versions with everted, flared rim, triangular and pendant forms (Fig. 00. 6, 15-6, 21, 35-6, 43, 49, 52, 60-1). The tankards include several semi-complete examples (Fig. 00. 14, 32-4, 38-9, 51, 59). Other forms include bowls with large wide flat or expanded-rims; necked; segmented rims; flanged rim hemispherical types (Fig. 00. 12, 37, 44, 66); shallow dishes (Fig. 23, 40, 48); carinated cups (Fig. 00. 53); handled jugs (Fig. 00. 18); flagons (Fig. 00. 58) and a single lid. The reduced range has a more limited range of forms but broadly similar to the oxidised repertoire with everted rim jars (Fig. 00. 46), and bowls, tankards, a segmented rim bowl (Fig. 00. 55), flanged rim bowls (Fig. 00. 31) and a handled jug (Fig. 00.57). Two vessels appears to have been deliberately holed, one in the base (Fig. 00. 5); the other on the shoulder (Fig. 00. 57).

Early Severn Valley ware variants (SVW EA). A small group of wares are distinguished as being particularly characteristic of the early variants of the industry. The fabrics are less standardized with grog, charcoal and other inclusions and the vessels often handmade. One variant has a black surface finish on an orange fabric; others are oxidised. Forms include carinated cups or bowls sometimes cordoned (Fig. 00.3) and everted rim necked jars/ bowls.

Severn Valley colour-coated ware (SVW CC). A single flanged rim hemispherical bowl (Fig. 00. 4) from Plot 400 has a fine powdery fabric visually very similar to SVW OX but also shows traces of a matt red-brown colour-coat. Occasional rare vessels have been noted which appear to be loosely part of this industry.

Malvernian (Roman) (Peacock 1967). The later Malvernian ware still contains the distinctive fragments of metamorphic rock but mainly occurs as wheel-made forms although some handmade types persist. This variant appears on various grey, black or brown guises from the 2nd century through to the 4th century. Forms: Vessels frequently copy BB1 or SVW forms, for example, everted rim, necked jars (Fig, 00. 29; 47), flat-rim and grooved-rim bowls/ dishes (Fig. 00.30).

ROMAN: SOURCE UNKNOWN

Black-burnished ware copies (BB1 copy). Black sandy wares copying BB1 forms but as wheel-made vessels. This is a small group which appears to mainly feature jars including an almost complete miniature one from ditch [86222] (Plot 430B) (Fig. 00.22).

Unknown colour-coated ware (CC). A single curved wall bowl with an expanded, rolled rim came from ditch 67122 (Plot 271). The vessel has a pale, fine, sandy fabric with traces of a red colour-coated finish.

Grey sandy ware (GREY). A miscellaneous group of wares, not necessarily from a single source. Forms: everted rim jars flat-rim bowls and grooved-rim bowls (Fig. 00. 24-5).

Micaceous grey ware (GYMIC). A small group of wares the only feature sherd being from an everted rim jar. Micaceous grey wares were made somewhere in the Lower Severn Valley, possibly around the Oldbury Flats area from the later 2nd-4th centuries and these sherds may be part of that industry,

White-slipped oxidised ware (WSOXIDF). Two flagons, one with a bifid rim and internally cupped in a fine oxidised fabric with a thin white slip (Fig. 00. 19); the other ring-necked with an expanded upper ring (Fig. 00. 1).

Discussion of the site assemblages by plot

PLOTS 109, 110, 111A, 113, 126 AND 135

All the above plots produced very small assemblages of pottery ranging from single sherds up to a maximum of 29 from Plot 110. None of the pieces are featured and in many cases the fabrics were not chronologically diagnostic enough to date other than Roman.

Plot 109: two pieces of SVW OX.
Plot 110: 26 sherds from the road surface (70005): 14 sherds of Baetican amphora and 12 sherds of SVW OX. It is possible that the sherds had been put down as hard core. Baetican amphorae were imported from the 1st-3rd centuries but frequently reused. Other pottery from the plot came from the colluvium or was unstratified and comprise SVW OX and a minute sherd of MAL RE A. A single sherd of grog-tempered ware of pre or early Roman date came from the fill of a pit containing burnt material, possibly hearth waste, identified during evaluation [34214].
Plot 111A: eight sherds of SVW OX /RE.
Plot 113: a single sherd of SVW OX.
Plot 126: single sherds of SVW OX and DOR BB1.
Plot 135: two sherds of SVW OX.

PLOT 160 (Table 3)

This plot produced a slightly larger assemblage of 205 sherds of Roman pottery weighing 1391 g and with 1.61 EVE's. Pottery was recovered from 17 defined contexts with quantities ranging from single sherds up to a maximum of 37 sherds form cxt (16006). The overall average sherd size is low at just 6.8 g.

Overall the material appears to span the 2nd to later 3rd /4th centuries with the greater emphasis on the later Roman period. Severn Valley wares dominate the group and account for 66.8% by count followed by DOR BB1 at 26.3%. Samian accounts for 2%, a typical figure for a rural site. Despite the modest overall size the assemblage from Plot 160 is quite diverse and contains single examples of fabrics not found on the other plots, for example Moselle black-slipped ware, Mancetter-Hartshill mortaria and South-west white-slipped ware. It also has two sherds of Oxfordshire mortaria.

Of the contexts that can be dated, cxts (16001), (16006), (16007) and (16023) appear to be the latest on the basis of the DOR BB1 with sherds of flanged-rim conical bowl or oblique lattice jars which indicate a date from the later 3rd century. Contexts (16009) and (16016) could be earlier 3rd century. Context (16008) with a ring-necked flagon (Fig. 00.1) suggests a 2nd-century date. Other groups were too small to give an accurate date.

In terms of forms the figures are slightly skewed by a single flagon which accounts for 43.5% of the EVE's followed by jar at 42.9% EVE (Table 5). In terms of minimum vessels jars dominate.

PLOTS 183, 250, 270

Plot 183 produced just two sherds of SVW OX of Roman date.

Plot 250 produced a total 116 sherds weighing 384 g from five contexts. These comprised 18 sherds of handmade grog-tempered ware; 93 sherds of Palaeozoic limestone-tempered ware (MAL RE B) and two sherds of Malvernian rock-tempered ware (MAL RE A) and single sherds of DOR BB1 and SVW OX. Curvi-linear GN 65025 produced 79 sherds of MAL RE B jars, one piece from cut [65009], the rest from cut [65022]. Grog-tempered ware and further MAL REB came from layer (65021) and a sherd of MAL REA from ditch [65011]. All these wares are typical of pre-Roman later Iron Age traditions in this area but could date to anywhere within the 1st century AD. The Malvernian wares could date back to the mid-late Iron Age but the grog-tempered tradition only appears in the early years of the 1st century AD. All these wares continue to feature into the early Roman period especially in rural areas. The two Roman sherds came from context (1101) evaluation and cannot be closely dated other than 2nd century or later.

Plot 270 produced six sherds of MAL RE B from pit [67006] including another jar rim. A single, abraded, sherd of Central Gaulish samian Drag. 37 bowl was noted from the primary fill ditch 6420 in the evaluation report.

PLOT 271 (Table 3)

A total 292 sherds of Roman pottery was recovered from this plot weighing 3332 g and with 3.34 EVE's. A similar pattern prevailed as with the other plots in that Severn Valley wares dominate the assemblage accounting for 55.5% by count followed by DOR BB1 at 31.5%. A slightly longer chronology for the occupation in this area is reflected in the moderately high presence of MAL RE B which is the third most common fabric in the group accounting for 4.5%. The only continental import is samian which only accounts for less than 1%. Overall the pottery was in better condition compared to plot 160 with an overall average sherd size of 11.4 g. Pottery was recovered from 24 defined contexts.

The earliest features on the site appear to be ditch [67054] and pit [67030] both of which contained sherds of MAL RE B although the quantities are small, a single sherd from the pit and two from the ditch. These could suggest a later Iron Age or early Roman date. There then appears to be a break in continuity with the next features to produce pottery likely to date to the 2nd century or slightly later. This includes ditches [67072] and [67147] which produced 19 and 38 sherds respectively from their upper fills. Ditch [67072] produced the only sherd of Wroxeter-type mortaria from the site along with a flat-rim DOR BB1 bowl and triangular-rimmed SVW OX jars. Ditch [67147] just contained SVW OX, SVW RE and DOR BB1 with few featured pieces. Probably slightly later in the sequence are ditches [67028], [67032] and [67152] dating to the later 3rd or early 4th centuries although the assemblages in all cases are quite modest. The latest features appear to be ditch [6206] and pit [6306] dating to the 4th century. The former contained Oxfordshire colour-coated wares (OXF RS) including a mortarium Young (1977) type C100, a white ware Oxfordshire mortarium, ibid. type M19, later DOR BB1 and an Alice Holt grey ware flanged bowl. The pit produced a flanged rim DOR BB1 bowl and a further sherd of OXF RS.

Looking at the forms overall for Plot 271 jars dominate at 62.7% (Table 5) followed by bowls/dishes at 30%. The only other forms represented by rims are mortaria (5%) and tankard (2.3%).

PLOT 331

The excavation produced 193 sherds of pottery weighing 1295 g and with 2.20 EVE's. The overall average sherd size was low at 6.4 g partly a consequence of the high proportion of fabric MAL RE B present which account for 35% of the assemblage by count. Further sherds of this ware came from the evaluation along with two Roman sherds.

Pottery was recovered from ten contexts nine of which fall into two ditch groups: GN 75100 and GN 75101. The first of these, GN 75100 produced pottery from cuts [75072], [75023], [75047] and [75084], a total 91 sherds. This comprised 46 sherds of MAL RE B, one sherd of MAL RE A and 44 sherds of SVW OX. The latter are all products of the earlier phase of this industry with carinated cups, a carinated bowl (Fig. 00. 3), necked everted rim bowls / wide-mouthed jars and flaring rim jars. The Malvernian wares include tubby jars and everted rim jars. This assemblage could potentially date to the pre or early Roman period. It has been suggested that the Severn Valley ware industry dates back into the immediate pre-Roman period (Timby 1990) and this site matches a number of others from the Gloucestershire and Worcestershire areas where this combination of wares have been found.

The second ditch group, GN 75101, produced 101 sherds of pottery from four cuts [75063], [75081], [75059] and [75104]. In this case all the pottery is MAL REB with in some cases multiple sherds from single vessels. This might suggest the ditch marginally predates GN 75100. A further rim-sherd of MAL REB came from ditch [75102]. The evaluation work produced a few later Roman sherds including Central Gaulish samian, DOR BB1 and Severn Valley ware suggesting activity dating to the 2nd century or later in the vicinity.

PLOT 400 (Table 3)

This plot produced one of the larger Roman assemblages with some 654 sherds weighing 7183 g and with 8.06 EVE’s. Sherd preservation is average with an overall average sherd weigh of 11 g. Pottery was recovered from 18 contexts with two particularly large groups from ditches [40063] and [40067] which effectively account for 67% of the total assemblage. Looking at the group overall Severn Valley wares dominate accounting for 75% by count, 84.5% by weight followed by MAL RE B at 10.9% and DOR BB1 at 9%. The group has a very unusual vessel profile in that the dominant form by EVE are tankards which account for 48.4% EVE followed by jars at 41.5%. The remaining 10.1% comprise bowls and dishes (Table 5).

The earliest phase of activity based on the ceramics appears to date to the 1st century. The assemblages comprise sherds of Malvernian wares, grog-tempered ware and early Severn Valley wares. This includes linear [40057], ditches [40068, 40078, 40080, 40093] and pit [40085]. The largest group of material came from ditch [40093] with 37 sherds and it is just possible some of this material is redeposited as there is a triangular rim SVW OX jar present which could be a 2nd century or later type. Ditch [40068] produced a total of eight very small sherds which includes a scrap of punch decorated MAL RE B ware alongside some small pieces of SVW OX. Pit [40085] produced a small SVW OX hemispherical bowl with a plain rim and a sherd of SVW RE.

The other ditch groups appear to date to the 2nd and perhaps later 2nd-3rd centuries. This includes enclosure ditch [40089] with a DOR BB1 acute lattice jar; ditch [40061] with just six sherds including DOR BB1, an anvil rim SVW OX bowl (Webster 1976, types 47-50; Evans et al. 2000, type BT6-10) and a SVW OX tankard. Further examples of the anvil-rim bowls and tankards came from ditch [40063] alongside Central Gaulish samian, Malvernian later ware and DOR BB1. Ditch [40067] with the largest assemblage had rims from at least eleven SVW OX tankards alongside a MAL RE A tubby jar, DOR BB1 jars and a flat-rim bowl and a colour-coated flanged bowl (Fig. 00. 4) possibly also a Severn Valley ware product. The final ditch in this group, ditch [40083], produced a plain- walled DOR BB1 dish and a MAL RE B residual jar.

PLOTS 421 and 425

Plot 421 produced just two sherds of later Roman DOR BB1 jar whilst ***Plot 425*** yielded just two sherds of SVW OX, not closely datable other than Roman.

PLOTS 430, 430A, 430B and 430C (Table 4)

Collectively the excavations of these plots produced some 2742 sherds of Roman pottery weighing 34814 g and with 31.09 EVE's. The groups shows slightly lower overall fragmentation rate with an overall average sherd weight of 12.7 g. Severn Valley wares dominate the total assemblage accounting for 53.5% of the assemblages by count 72.4% by weight. The second commonest ware are the Palaeozoic limestone wares (MAL RE B) at 18.9% followed by DOR BB1 at 12.7%; a similar pattern to that seen in Plot 400. Jars again dominate the vessel repertoire at 64.3% (Table 5) followed by bowls at 15.1% and then tankards at 13.9%,

Plot 430 produced 243 sherds of pottery (1165 g), two from contexts 86199, 86271. The rest were mainly from topsoil and subsoil contexts. The group is predominately composed of non-diagnostic Severn Valley ware sherds accompanied by small amounts of DOR BB1 and MAL RE B and generally suggests a 2nd or 3rd century date.

Plot 430A produced a further 1185 sherds, 14243 g, from 14 contexts most of which come from the two enclosure ditches. The southern external ditch only produced pottery from terminal [86116] which amounts to some 111 sherds. This includes mainly Malvernian wares (A and B) and Severn Valley wares. One SVW OX base has three small post-firing holes drilled through. A date in the early 2nd century is likely for this group. The northern outer enclosure ditch GN 86103 produced pottery from section [86114] at the terminal and section [86110], a total 170 sherds most of which came from the terminal. Section [86110] with 10 sherds produced a sherd of Verulamium mortaria and SVW OX. The sherds from [86114] produced multiple pieces from a SVW OX necked jar which had been deliberately holed (Fig. 00. 5); the substantial part of a grog-tempered jar (Fig. 00, 6) and several sherds from at least two MAL RE B jars (Fig. 00. 7). This would seem to be a specialised deposit of material rather than accumulated rubbish, indicating placed pottery rather than casually discarded waste, such as might be expected in a well or burial. As this ditch section was neither, one possibility is that unusual depositions of this kind are sometimes associated with religious sites or activities.

The southern-most inner ditch produced pottery from sections [86171, 86120, 86126. 86129 and 86135] a total 269 sherds with the highest incidence, 177 sherds from the section [86126]. The pottery includes 1st and 2nd-century material including a sherd of a South Gaulish decorated Drag. 29 bowl, grog-tempered wares, Malvernian wares (Fig. 00. 8) and Severn Valley ware. Section [86135] produced sherds of DOR BB1 jar with a wavy line around the neck, SVWOX anvil-rim bowls, a sherd of South Gaulish samian and a sherd of Baetican amphora. The BB1 pushes it into the early 2nd century. The northern inner ditch GN 86154 produced pottery from sections [86149, 86132, 86172 and 86146] a total 427 sherds of which 393 came from [86172]. This is also a slightly curious deposit as it contained several DOR BB1 jars all with wavy burnished lines around the necks, two anvil rim, an S-profile bowl and tankards in SVW OX, Malvernian wheel-made wares, a warped SVW RE necked jar suggesting a second, and some grey sandy wares. The composition of the group is unusual, though it may simply represent someone clearing out their kitchen. All these sherds point to an early-mid 2nd century date of abandonment at the earliest. Further DOR BB1 came from [86149], in this case the profile of a flat-rim bowl (Fig. 00.10) and [86146]. This BB1 bowl was associated with several sherds from a SVW OX necked jar (Fig. 00. 11).

Wall [86167] produced 121 sherds. This is quite a mixed group with early 2nd century DOR BB1 jar, SVW OX bowls with anvil rims, a segmented bowl, flanged rim bowl (Fig. 00. 12) and tankards, at least two grog-tempered handmade jars (Fig. 00. 13), a MAL RE B sharply everted rim jar and a sherd of Baetican amphorae. Overall this suggests a date in the first half of the 2nd century with some residual 1st-century material.

The only other feature on the site with pottery is the NE-SW interior ditch which produced pottery from [86176] and [86140], a small group of 13 sherds but including a worn Verulamium mortarium (Fig. 00.9). This displays a low bead and dropped flange traits which appear in the 1st century but persisted into the 2nd century. It is associated with sherds of MAL RE B.

Plot 430B produced some 1308 sherds of Roman pottery weighing 19465 g from 19 contexts. The material appears broadly contemporary with that from Plot 430A with the same spectrum of wares. The outermost curved ditch, GN 86192 produced a total 494 sherds of pottery from seven sections. In all cases sherds of DOR BB1 are present alongside large quantities of SVW OX and a sherd of Lezoux samian with an eroded illegible potter's stamp. The biggest group of wares from this plot came from ditch [86210] with 289 sherds. This included 2nd-century DOR BB1 jars (Fig. 00. 17), a SOW BB1 jar with a short rim (Fig. 00. 20), a range of SVW OX forms (Fig. 00. 14-16, 18, 21) and a white-slipped oxidised ware flagon (Fig. 00.19).

The middle curved ditch produced pottery from [86222], [86252] and [86263], 143 sherds in total. Of note from [86222] is a small jar copying a BB1 form (Fig. 00. 22) accompanied by sherds from a SVW OX tankard. The larger groups from the other sections included sherds of DOR BB1, MAL RE A and SVW OX.

The inner ditch produced 138 sherds [86194 / 86232 / 86265 / 86194] with further DOR BB1, Lezoux samian, local BB1 copies and grog-tempered ware suggesting broad contemporaneity with the other ditch groups. A large group of wares was also recovered from pit [86239] with 414 sherds. Amongst these was a Lezoux bowl Drag 31; a South Gaulish dish repaired with a lead rivet; DOR BB1 jar and a handled mug and a large quantity of SVW OX accounting for 82.6% by count of the pit assemblage with a range of forms including jars, bowls, a dish (Fig 00. 23), tankards and single examples of a lid and a handled jug.

Isolated ditch [86216] with a small group of 11 sherds of unfeatured DOR BB1 and SVW OX can only be loosely dated to the 2nd century or later.

Plot 430 C produced just 13 sherds from the final fill of bloomery/furnace [86270] which includes MAL RE B everted rim jar and early Severn Valley ware suggesting a pre or early Roman date.

PLOTS 441 and 450

Plot 441 produced just four sherds commensurate with a 1st-century AD date with MAL RE B, sandstone tempered Malvernian ware and SVW OX. ***Plot 450*** also produced a small late Iron Age or early Roman assemblage of 54 sherds. These included several sherds from a black-burnished early Severn Valley ware wheel-made jar and sherds of MAL RE B.

PLOT 454 (Table 4)

This area was ceramically quite rich and an assemblage of some 4594 sherds weighing 78.7 kg and with 42.52 EVE's was found. Pottery was recovered from 28 defined feature cuts with an additional 327 sherds from topsoil contexts and 407 sherds from the evaluation features. In broad terms the assemblage largely spans the 1st and 3rd centuries AD. Severn Valley wares account for just over 55% of the plot assemblage by count, 65.2% by weight followed by DOR BB1 at 14.3% and MAL RE A at 10.7%. The vessel repertoire, as with other plots, is dominated by jars at 65% EVE (Table 5) followed by tankards at 20.4% and bowls at 10.3%.

The north-western enclosure ditch produced pottery from all five investigated sections, a total 456 sherds with the greatest concentration of material coming from [85102] with 311 sherds. Sections [85042], [85053], [85099] and [85107] produced predominately Palaeozoic limestone-tempered wares (MAL RE B) with a few sherds of SVW OX/ RE which if the only material recovered would have suggested a date in the second half of the 1st century. The larger group from [86102] has several sherds from at least one DOR BB1 jar with an acute burnished lattice and a large quantity of SVW OX suggesting continued accumulation of material into this ditch into the 2nd century.

Of the features within the area enclosed by the ditch pottery was recovered from post pit [85087]; pits [85089], [85096] and cremation [86049]. All three pits contained pottery suggesting a 1st-century date, mainly MAL RE B and grog-tempered ware. Cremation [85049] produced 22 sherds including the South Gaulish stamped sherd dated to c 50-75, three sherds of DOR BB1 and sherds of south-west oxidised ware and SVW OX. The BB1 would push this into the early 2nd century although it is not clear whether these are incidental sherds or are specifically associated with the cremation. Pit [85041] on the eastern edge contains 2nd-century pottery with a flat-rim BB1 dish, a residual sherd of South Gaulish samian, SVW OX including a flagon (Fig. 00. 58) and later Malvernian ware.

The westernmost arm of the second attached enclosure GN 85118, produced a very large assemblage from the ditch terminal [85081] of 814 sherds (Fig. 00. 50-6). Grog-tempered wares and Severn Valley wares are present in almost equal proportions at 36.8 and 26.1% respectively. Dorset black burnished ware makes up 7% and other wares include South Gaulish samian dish Drag 18 and Malvernian rock-tempered wares including the rim of a large bowl. The DOR BB1 appears to be exclusively jars, with rims from at least eight vessels clearly putting the deposit in the early-mid 2nd century at the earliest. The only pottery from the inner northern ditch came from the eastern end from sections [86056] and [86108] with 56 sherds with just DOR BB1 and SVW OX suggesting broad contemporaneity with the western ditch fills. The parallel outer ditch GN 85116, produced pottery from five sections a total 1963 sherds with the greatest concentration of material, 1437 sherds, coming from section [85002] (Fig. 00. 24-43), particularly the upper fill and [85026] with 349 sherds. The lower and primary fills of [85002] produced 176 sherds with DOR BB1 jars, several SVW OX tankards and two platters and a Malvernian (MAL RE A) tubby jar which might all indicate a 2nd -century date. The richer upper fills include a greater range of DOR BB1 (17% count) with oblique lattice jars, one repaired with a lead rivet, plain-walled dishes, one sherd of Lezoux samian, significant (25%) quantities of Malvernian ware and Severn Valley ware (49%). The BB1 indicates a later date probably in the 3rd century. The pottery from [85026] (Fig. 00. 44-9) similarly has mainly 2nd-century pottery from the lower fills including a deliberately holed SVW OX vessel, but also a 3rd-century sherd of DOR BB1 and further later 2nd-3rd century material from the upper fill. Of note is a large sherd of Baetican amphora from the upper fill. Section [85104] produced an almost complete, slightly asymmetrical, single-handled flagon missing its rim (Fig. 00.57). The vessel had been deliberately holed through its shoulder.

Interior features within this enclosure with pottery include gully [85052], posthole [85024] and linear [85058]. This last feature contained quite a large group, some 204 sherds, the latest of which is a flat-rimmed DOR BB1 bowl with a champfered base which first seems to appear away from its source area from the Hadrianic period on. Much of the pottery seems residual with sherds of Malvernian ware (A and B) but also the slightly later wheel made version which probably date from the 2nd century on. Gully [85052] only produced unfeatured SVW OX; posthole [85024] with DOR BB1 is 2nd century or later.

Pit [85034] at the junction of GN 85118 and 85116 produced 104 sherds of pottery with several sherds of SVW OX tankard and five sherds of DOR BB1 including an oblique lattice jar sherd indicating a date into the 3rd century and thus broadly contemporary with fills [85002 and 85026].

A small pit beyond the second enclosure, [85037] appears to predate the enclosure. This contain 93 sherds from a single early fine grog-tempered Severn Valley ware simple everted rim jar probably dating to the second half of the 1st century.

The only other ceramic find of note from this plot was an unstratified find of a perforated disk made from a sherd of SVW OX. (Fig 00.68). A small group of material was recovered from the evaluation trenches which included a few well preserved vessels (Fig.00.59-62). Of particular note is a bowl with a shallow spout in SVW OX (Fig. 00. 62). A similar vessel in later Malvernian ware was found at Bishop Cleeve, Glos, although the spout was absent (Timby 1998, fig. 6.2).

PLOT 496 (Table 4)

This plot produced a moderately small assemblage of just 283 sherds weighing 1603 g and with 1.86 EVE’s. The material was in fragmented condition with an overall average sherd weight of 5.7 g. Palaeozoic limestone-tempered wares account for 61.2% of the total assemblage. MAL RE A for 31.3%, grog-tempered wares for 1.1% and Severn Valley wares for 4.9%.

The only features with pottery were pit [90020] with two sherds of MAL RE A and pit [90035] with a much larger group of 278 sherds (Fig. 00. 63-7). The primary fill of this pit produced sherds of Malvernian rock-tempered and Palaeozoic limestone-tempered ware. Further sherds of these occurred in the middle fills accompanied by early Severn Valley wares which again feature in the upper fills. The vessel rims are exclusively from jars which include tubby straight-walled forms, one with the edge of a handle springing and more ovoid jars with rolled or everted rims. The date for these features presumably lies around the immediate pre or post-conquest period.

PLOT 562

A total 55 sherds were recovered from this area all of which with one exception were from SVW OX jars. The exception is a single base from a Lezoux dish Drag. 18/31R or 31R suggesting 2nd –century occupation nearby.

Discussion

In total Roman pottery was recovered from some 22 individual plots. Thirteen of these produced extremely small numbers of sherds, in a few cases just single pieces which cannot be characterised very closely other than Roman. Of these 13 sites just one, Plot 421, produced two sherds of Dorset BB1 of later Roman date; one, Plot 441, would appear to be early Roman; the rest can only be loosely placed in the later 2nd-3rd century bracket.

Nine plots produced slightly larger assemblages ranging from just 56 sherds from Plot 450 to a maximum of 4593 from Plot 454. Of these nine plots, five (Plots 250, 450, 496, 331 and 271) appear to have been occupied from the later pre-Roman Iron Age or early Iron Age periods (Table 6). The assemblages are characterised by Palaeozoic limestone-tempered handmade wares, Malvernian rock-tempered wares, grog-tempered ware and early Severn Valley wares. One problem with such assemblages in this period is identifying how late they might be. It is likely that some sites continued with little perceptible change in the ceramic repertoire well into the Roman period and perhaps the inhabitants even deliberately eschewed Roman culture in isolated areas. Of these five plots, only plot 331 shows continued occupation into the 2nd century with a few typical 2nd century products such Central Gaulish samian, DOR BB1 and Severn Valley wares. Plot 271 appears to show a break around the later 1st-early 2nd century to be reoccupied in the later Roman period. It is the only site to show clear 4th-century occupation and this is reflected in the presence of products of the Oxfordshire industries, late BB1 forms such as the flanged rim conical bowls, and the only sherds of Lower Nene Valley colour-coated ware and Alice Holt grey ware from the pipeline. Occupation on Plots 160, 400, 430 and 454 all seems to date from the later 1st century/early 2nd century. The area covered by Plots 430 A-C seems to be the shortest lived with little or no evidence of any continuation into the 3rd century. The assemblages are dominated by Severn Valley wares, South and Central Gaulish samian, DOR BB1 and Malvernian wares.

Of note from this plot are two sherds of Verulamium white-ware mortaria. Plots 400 and 454 survive into the later 2nd-early 3rd century marked by BB1 jars with oblique latticing and, in the case of 454, plain-rimmed dishes but no flanged bowls. The latter is also one of the few sites with Baetican amphora. Plot 160 does appear to continue into the later 3rd or early 4th century. It is the only site to produce a Mancetter-Hartshill mortarium and Moselle black-slipped ware. It has late BB1 jars and flanged-rim conical bowls but no Oxfordshire wares. This general dearth of Oxfordshire products apart from those from Plot 271 and a complete absence of later Roman shell-tempered wares might suggest all the sites had become abandoned before the end of the 4th century. The overall pattern for these sites appears to show a period of change in the early 2nd century with some sites stopping and others appearing; a second major phase of landscape reorganisation appears to be happening around the later 2nd-early 3rd century and then complete abandonment before the end of the 4th century.

The assemblage from the pipeline sites as a whole has a very local emphasis with a limited range of continental or regional imports, the most significant import being Dorset black burnished ware which tends to show a consistent presence from the early-mid 2nd century onwards. Overall it contributes 13.6% of the pipeline sites which broadly conforms to that which might be expected from the limited amount of data available from the area (cf. Allen and Fulford 1996, fig. 8). Dorset black burnished ware occurs on most investigated sites in the wider region, for example, it is well represented at the larger Roman settlements at Kenchester and Wroxeter and from smaller sites in the Welsh Marches such as the Breidden (Young 1991). Continental imports are particularly poorly represented on the Brecon pipeline with samian only accounting for 0.6% and amphora for 0.2%. The only other sherd is a small piece of Moselle black-slipped ware. Other regional imports are equally poorly represented. The dominance of jars in the assemblage and the very limited range of any more specialised vessels is perhaps also typical of fairly low status rural settlements. The preponderance of tankards is very much a West Country phenomenon and presumably reflects local drinking traditions.

Table 7 makes a comparison of the pipeline sites with three other sites from the general region where quantified data is available: the Romano-British small town at Deansway, Worcester (Bryant and Evans 2004); Longdon, a rural late Iron Age-early Roman agricultural settlement in Worcestershire (Timby 2010) and Dymock, a Roman settlement in the Forest of Dean (Timby 2007). As might be expected the levels of samian are markedly higher for the two larger settlements of Deansway and Dymock at 3.6% and 2.2% respectively but more comparable with Longdon with 0.3%. These sites also have a greater variety of fine and coarse-ware continental imports some of which may be the result of a possible military presence, for example the Lyon ware at Deansway. In terms of regional imports BB1 is surprisingly much higher on the Brecon pipeline sites at 13.6% with less than 5% at the other sites. This seems to be compensated for by higher levels of Severn Valley wares in the main settlements and much higher levels of Malvernian wares at Longdon. This possibly suggests different marketing mechanism in operation with perhaps BB1 getting to the more rural sites with mobile traders moving between farmsteads but the Severn Valley wares being sold through local markets or direct from the producers some of which were based in the Malvern Link area. Additional data from other sites is needed to explore this patterning further.

Catalogue of illustrated sherds

Plot 160
1. Ring-necked flagon with triangular expanded upper ring. Fabric: WSOXIDF. (160018). Plot 160.

Plot 250
2. Handmade small jar with a slight horizontal groove around the neck. Fabric: MAL RE B. Layer (65021). Plot 250.

Plot 331
3. Handmade, carinated, cordoned bowl. Fabric: SVW OX with grog tempering. Ditch [75084] (75085). Plot 331.

Plot 400
4. Flanged rim, hemispherical bowl. Fine orange powdery fabric with traces of a dull matt red-brown colour-coat. Fabric: SVW CC. Ditch [40067] (40066). Plot 400.

Plot 430A

5. Almost complete but broken necked bowl with a double girth groove. Deliberately holed base after firing. Fabric: SVW OX. Ditch terminus [86114] (86115). Plot 430A.
6. Handmade everted rim jar. Black surfaces. Fabric: GR. Ditch terminus [86114] (86115). Plot 430A.
7. Handmade wide-mouthed jar with a short upright rim. Fabric: MAL RE B. Ditch terminus [86114] (86115). Plot 430A.
8. Handmade, wide-mouthed, beaded rim jar. Fabric: MAL RE B in very leached condition. Ditch [86126] (86127). Plot 430A.
9. Mortarium with a hooked flange and low bead. Fabric: VER WH. Worn interior surface. Ditch [86140] (86141). Plot 430A.
10. Flat-rim dish with a champfered base. Fabric: DOR BB1. Ditch [86149] (86148). Plot 430A.
11. Simple everted rim, narrow necked jar. Fabric: SVW OX. Ditch [86149] (86148). Plot 430A.
12. Flanged rim bowl. Fabric: SVW OX. Wall (86157). Plot 430A.
13. Handmade beaded rim jar. Fabric: GR (Glos TF 2A). Wall (86157). Plot 430A.

Plot 430B

14. Flared wall, handled tankard. Fabric: SVW OX. Ditch [86210] (86211), Plot 430B.
15. Simple everted rim jar. Fabric: SVW OX. Ditch [86210] (86211), Plot 430B.
16. Wide-mouthed everted rim jar. Fabric: SVW OX. Ditch [86210] (86211). Plot 430B.
17. Everted rim jar decorated with an acute burnished line lattice. Fabric: DOR BB1. Ditch [86210] (86211). Plot 430B.
18. Handled wide-mouthed jug. Fabric: SVW OX. Ditch [86210] (86211). Plot 430B.
19. Single handled flagon with a bifid rim. Fabric: WSOXID. Ditch [86210] (86211). Plot 430B.
20. Handmade jar with a short upright rim. Fabric: SOW BB1. Sooted exterior. Ditch [86210] (86211). Plot 430B.
21. Wide-mouthed jar with a rolled rim. Fabric: SVW OX. Ditch [86210] (86211). Plot 430B.
22. Almost complete but broken handmade miniature jar with decorated with burnished line lattice. Coarse sandy fabric with sparse grains of limestone. Fabric: BB1COPY. Ditch [86222] (86223). Plot 430B.
23. Flared wall dish with a thickened flat-topped rim. Fabric: SVW OX. Pit [86239] (86240). Plot 430B.

Plot 454

24. Grooved, flat rim dish. Fabric: GREY. Ditch [85002] (85003). Plot 454.
25. Grooved rim bowl. Fabric: GREY. Ditch [85002] (85003). Plot 454.
26. Everted rim jar decorated with an oblique line lattice. Fabric: DOR BB1. Ditch [85002] (85003). Plot 454.
27. Everted rim jar with part of a lead rivet repair through the neck. Fabric: DOR BB1. Ditch [85002] (85003). Plot 454.
28. Everted rim jar. Fabric: DOR BB1. Ditch [85002] (85003). Plot 454.
29. Wide-mouthed, wheel-made everted rim jar. Fabric: MAL RO. Ditch [85002] (85003). Plot 454.
30. Expanded rim bowl. Fabric: MAL RO. Ditch [85002] (85003). Plot 454.
31. Flanged hemispherical bowl. Fabric: SVW RE. Ditch [85002] (85003). Plot 454.
32. Slightly flared wall handled tankard. Fabric: SVW OX. . Ditch [85002] (85003). Plot 454
33. Flared wall handled tankard. Fabric: SVW OX. Ditch [85002] (85003). Plot 454.
34. Slightly flared wall handled tankard. Fabric: SVW OX. Ditch [85002] (85003). Plot 454.
35. Narrow necked flared rim jar. Fabric: SVW OX. Ditch [85002] (85003). Plot 454.

36. Everted rim, cordoned neck jar. Fabric: SVW OX. Ditch [85002] (85003). Plot 454.
37. Flanged rim hemispherical bowl. Fabric: SVW OX. Ditch [85002] (85003). Plot 454.
38. Tankard with double upper and single lower girth grooves. Fabric: SVW OX. Ditch [85002] (85028). Plot 454.
39. Handled tankard. Fabric: SVW OX. Ditch [85002] (85028). Plot 454.
40. Shallow dish with an internally stepped profile. Fabric: SVW OX. Ditch [85002] (85028). Plot 454.
41. Simple ovoid jar with a slightly thickened rolled rim. Slightly irregular burnished line decoration on the exterior. Fabric: MAL RE A. Ditch [85002] (85028). Plot 454.
42. Everted rim jar. Fabric: DOR BB1. Ditch [85002] (85028). Plot 454.
43. Multiple sherds from a single cordoned neck jar. Fabric: SVW OX. Ditch [85002] (85028). Plot 454.
44. Flanged rim, hemispherical bowl. Fabric: SVW OX. Ditch [86026] (85025). Plot 454.
45. Large handmade bowl with a rounded rim which has been trimmed creating facets. Fabric: MAL RE A. Ditch [86026] (85025). Plot 454.
46. Simple everted rim jar with a slight girth groove. Fine grey micaceous ware. Fabric: SVW RE. Ditch [86026] (85025). Plot 454.
47. Wheel-made everted rim jar with rouletted decoration. Fabric: MAL RO. Ditch [86026] (85029). Plot 454.
48. Stepped platter. Fabric: SVW OX. Ditch [86026] (85029). Plot 454.
49. Very large wide-mouthed jar. Decorated with a zone of latticing on the shoulder. Wheel-made but probably made from sections luted together. Fabric: SVW OX. Ditch [86026] (85029). Plot 454.
50. Large handmade storage jar. Fabric: GR. Ditch terminus [85081] (85082). Plot 454.
51. Large bowl with a heavy rim facetted on the outer face. Fabric: MAL RE A. Ditch terminus [85081] (85082). Plot 454.
52. Handled tankard. The upper part of the handle has been pegged through the wall; the lower join is obscured. Fabric: SVW OX. Ditch terminus [85081] (85082), Plot 454.
53. Wide-mouthed jar with everted rim. Fabric: SVW OX. Ditch terminus [85081] (85082). Plot 454.
54. Carinated cup. Fabric: SVW OX. Ditch terminus [85081] (85082). Plot 454.
55. Segmented bowl. Fabric: SVW RE. Ditch terminus [85081] (85082). Plot 454.
56. Everted rim jar. Fabric: DOR BB1. Ditch terminus [85081] (85082). Plot 454.
57. Almost complete single-handled flagon missing the rim. The vessel is asymmetrical and has a post-firing hole through the shoulder. Fabric: SVW RE. Ditch [85104] (85113), SF 87000. Plot 454.
58. Flagon. Fabric: SVW OX. Pit [85041] (86039). Plot 454.
59. Tankard. Fabric: SVW OX. Ditch (14202).Plot 454.
60. Large wide-mouthed storage jar. Fabric: SVW OX. Ditch (14203).Plot 454.
61. Large jar with a constricted neck. Fabric: SVW OX. Ditch (14303).Plot 454.
62. Almost complete flanged rim, spouted bowl. Fabric: SVW OX. Ditch [14200] (14204). Plot 454.

Plot 496

63. Handmade tubby jar with horizontal and vertical burnishing. Fabric: MAL RE A. Pit [90035] (90026). Plot 496.
64. Handmade tubby jar with traces of a handle springing. Fabric: MAL REA. Pit [90035] (90026) (90029). Plot 496.
65. Handmade wide-mouthed jar. Fabric: MAL RE B. Pit [90035] (90029). Plot 496.

66. Handmade everted rim jar. Fabric: MAL RE B. Pit [90035] (90029) (90029).Plot 496.
67. Handmade everted rim jar with a thickened neck. Fabric: MAL RE B. Pit [90035] (90029). Plot 496.

Pottery objects

68. Perforated disk. Fabric: SVW OX. (85114). Unstratified . Plot 454.

Bibliography

Allen J R L, and Fulford, M G, 1996, *The distribution of South-East Dorset black burnished category 1 pottery in South-west Britain*, Britannia 27, 223-282

Bryant, V, and Evans, J, 2004, *Iron Age and Romano-British pottery*, in H. Dalwood and R. Edwards, *Excavations at Deansway, Worcester 1988-89. Romano-British small town to late medieval city*, CBA Res Rep 139, 235-80

Evans, C J, Jones, J, and Ellis, P, 2000, *Severn Valley ware production at Newland Hopfields. Excavation of a Romano-British kiln site at North End Farm, Great Malvern, Worcestershire* in 1992 and 1994, BAR 313, Oxford

Hartley, B R, Dickinson B M with Dannell G B, 2011, *Names on Terra sigillata: an index of maker's stamps and signatures on Gallo-Roman terra sigillata (samian)*,Vol 7 P=Rxead. Bull Instit Classical Stud supp, London

Peacock, D P S, 1967 *Romano-British pottery production in the Malvern district of Worcestershire*, Trans Worcestershire Archaeol Soc 3rd ser Vol 1 (1965-1967), 15-28

Peacock, D P S, 1968 *A petrological study of certain Iron Age pottery from western England,* Proc Prehist Soc 34, 414-28.

Timby, J R, 1990, *Severn Valley wares: a reassessment*, Britannia 21, 243-51

Timby, J, 1998, *Pottery (and fired clay),* in A.J. Barber, G.T. Walker, *Home Farm. Bishop's Cleeve: excavation of a Romano-British occupation site* 1993-4, Trans Bristol Gloucestershire Archaeol Soc 116, 117-39, esp 126-8

Timby, J, 2007, *Pottery*, in T. Catchpole, *Excavations at the Sewage Treatment Works, Dymock*, 1995, Trans Bristol Gloucestershire Archaeol Soc 125, 137-219, esp 155-71

Timby, J, 2010, *The pottery*, in A. Simmonds, G. Thacker and N. Shepherd, *An investigation of the evolution of a wetland environment of Longdon Marsh and the excavation of a Late Iron Age – Romano-British farmstead*, Trans Worcestershire Archaeol Soc 22, (2010) 3rd ser 1-58, esp 23-32

Tomber, R, and Dore, J, 1998 *The National Roman fabric reference collection: a handbook*, Museum of London / English Heritage/ British Museum

Webster, P V, 1976 *Severn Valley wares*, Trans Bristol & Gloucestershire Archaeol Soc 94, 18-46

Young, C J, 1977, *Oxfordshire Roman pottery*, BAR 43, Oxford

Young, C J, 1991, *Romano-British pottery*, in C.R. Musson, *The Breidden hillfort.. A later prehistoric settlement in the Welsh Marches*, CBA Res Rep 76, 127-30

Tables

Table 2 Quantified summary of Roman pottery from all plots

	Fabric	Description	No	% No	Wt	% Wt	EVE	% EVE
Native	MAL RE A	Malvernian Peacock Gp A	704	7.6	13881	10.5	430	4.3
	MAL RE B	Malvernian Peacock Gp B	1426	15.5	6188	4.7	607	6.2
	MAL VAR	Malvernian variant	2	0.0	16	0.0	0	0.0
	GR	hm grog-tempered	471	5.1	8930	6.8	248	2.7
	LIME	limestone-tempered	3	0.0	34	0.0	7	0.1
Imports	LGF SA	South Gaulish samian	23	0.2	377	0.3	60	0.6
	LEZ SA	Central Gaulish samian	30	0.3	423.25	0.3	57	0.6
	MOS BS	Moselle black slipped ware	1	0.0	0.5	0.0	0	0.0
	BAT AM	Baetican amphorae	18	0.2	743	0.6	0	0.0
Regional	ALH RE	Alice Holt whiteslipped grey ware	1	0.0	33	0.0	6	0.1
	DOR BB1	Dorset black burnished ware	1218	13.2	10116	7.7	1203	12.9
	LNV CC	Lower Nene Valley colour-coat	1	0.0	1	0.0	0	0.0
	MAH WH	Mancetter-Hartshill	1	0.0	11	0.0	3	0.0
	OXF RS	Oxfordshire colour-coated ware	7	0.1	52	0.0	0	0.0
	OXF RS(M)	Oxfordshire colour-coated mortaria	1	0.0	18	0.0	5	0.1
	OXF WHM	Oxfordshire whiteware mortaria	3	0.0	97	0.1	7	0.1
	SOW BB1	Southwest BB1	3	0.0	58	0.0	35	0.4
	SOW OX	Southwest oxidised ware	10	0.1	21	0.0	0	0.0
	SOW WS	Southwest white-slipped ware	1	0.0	9	0.0	0	0.0
	VER WH(M)	Verulamium mortaria	2	0.0	513	0.4	18	0.2
	WRX WH	Wroxeter whiteware mortaria	1	0.0	135	0.1	5	0.1
Local	SVW CC	?Severn Valley ware colour-coat	1	0.0	43	0.0	10	0.1
	SVW OX	Severn Valley ware (oxidised)	4620	50.2	82662.5	62.6	5462	58.6
	SVW RE	Severn Valley ware (reduced)	430	4.7	4859	3.7	583	6.3
	SVW EA	Severn Valley early variants	44	0.5	330	0.2	50	0.5
	MAL RT	Malvernian wheelmade	145	1.6	2026	1.5	334	3.6
Unknown	BB1 copy	BB1 black sandy copy	15	0.2	129	0.1	69	0.7
	CC	misc colour-coated ware	1	0.0	10	0.0	6	0.1
	GREY	grey sandy ware	11	0.1	154	0.1	68	0.7
	GYMIC	micaceous grey ware	6	0.1	35	0.0	17	0.2
	WSOXIDF	white slipped oxidised ware	5	0.1	133	0.1	95	1.0
	MISC	misc sandy wares	1	0.0	75	0.1	0	0.0
TOTAL			**9206**	**100.0**	**132113**	**100.0**	**9325**	**100.0**

Table 3 Quantified summary of Roman pottery from plots 160, 217 and 400

			Plot 160						Plot 271						Plot 400					
	Fabric	**Description**	**No**	**% No**	**Wt**	**% Wt**	**EVE**	**% EVE**	**No**	**% No**	**Wt**	**% Wt**	**EVE**	**% EVE**	**No**	**% No**	**Wt**	**% Wt**	**EVE**	**% EVE**
Native	MAL RE A	Malvernian rock tempered	0	0.0	0	0.0	0	0.0	5	1.7	32	1.0	10	3.0	16	2.4	74	1.0	17	23.0
	MAL RE B	Malvernian limestone	0	0.0	0	0.0	0	0.0	13	4.5	59	1.8	8	2.4	71	10.9	177	2.5	10	13.5
	GR	hm grog-tempered	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	8	1.2	46	0.6	0	0.0
	LIME	limestone tempered	3	1.5	34	2.4	7	4.3	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Imports	LGF SA	South Gaulish samian	1	0.5	2	0.1	0	0.0	2	0.7	6	0.2	0	0.0	0	0.0	0	0.0	0	0.0
	LEZ SA	Central Gaulish samian	4	2.0	54	3.9	2	1.2	0	0.0	0	0.0	0	0.0	1	0.2	49	0.7	0	0.0
	MOS BS	Moselle black slipped ware	1	0.5	0.5	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Regional	ALH RE	Alice Holt reduced ware	0	0.0	0	0.0	0	0.0	1	0.3	33	1.0	6	1.8	0	0.0	0	0.0	0	0.0
	DOR BB1	Dorset black burnished ware	54	26.3	392	28.2	33	20.5	92	31.5	1011	30.3	164	49.1	59	9.0	611	8.5	78	105.5
	LNV CC	Lower Nene Valley colour-coat	0	0.0	0	0.0	0	0.0	1	0.3	1	0.0	0	0.0	0	0.0	0	0.0	0	0.0
	MAH WH	Mancetter-Hartshill	1	0.5	11	0.8	3	1.9	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
	OXF RS	Oxfordshire colour-coated ware	0	0.0	0	0.0	0	0.0	8	2.7	70	2.1	5	1.5	0	0.0	0	0.0	0	0.0
	OXF WHM	Oxfordshire whiteware mortaria	2	1.0	52	3.7	0	0.0	1	0.3	45	1.4	5	1.5	0	0.0	0	0.0	0	0.0
	SOW WS	Southwest white-slipped ware	1	0.5	9	0.6	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
	WRX WH	Wroxeter whiteware mortaria	0	0.0	0	0.0	0	0.0	1	0.3	135	4.1	5	1.5	0	0.0	0	0.0	0	0.0
	SVW CC	?Severn Valley ware colour-coat	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	0.2	43	0.6	10	13.5
Local	SVW OX	Severn Valley ware (oxidised)	133	64.9	801	57.6	46	28.6	132	45.2	1536	46.1	105	31.4	462	70.6	5779	80.5	599	810.1
	SVW RE	Severn Valley ware (reduced)	0	0.0	0	0.0	0	0.0	30	10.3	310	9.3	20	6.0	29	4.4	274	3.8	58	78.4
	MAL RO	Malvernian wheelmade	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	2	0.3	91	1.3	7	9.5
Unknown	BB1 copy	BB1 black sandy copy	1	0.5	9	0.6	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
	BWSY	black sandy ware	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	0.2	7	0.1	0	0.0
	CC	misc colour-coated ware	0	0.0	0	0.0	0	0.0	1	0.3	10	0.3	6	1.8	0	0.0	0	0.0	0	0.0
	GREY	grey sandy ware	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	0.2	6	0.1	10	13.5
	GYMIC	micaceous grey ware	0	0.0	0	0.0	0	0.0	4	1.4	9	0.3	0	0.0	1	0.2	23	0.3	17	23.0
	WSOXIDF	white slipped oxidised	4	2.0	26	1.9	70	43.5	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
	MISC	misc sandy wares	0	0.0	0	0.0	0	0.0	1	0.3	75	2.3	0	0.0	2	0.3	3	0.0	0	0.0
TOTAL			**205**	**100.0**	**1391**	**100.0**	**161**	**100.0**	**292**	100.0	**3332**	100.0	**334**	100.0	**654**	**100.0**	**7183**	**100.0**	**806**	**1090.0**

Table 4 Quantified summary of Roman pottery from plots 430/430A-C, 454 and 496

		Plot 430/430A-C						Plot 454						Plot 496					
Fabric	**Description**	**No**	**% No**	**Wt**	**% Wt**	**EVE**	**% EVE**	**No**	**% No**	**Wt**	**% Wt**	**EVE**	**% EVE**	**No**	**% No**	**Wt**	**% Wt**	**EVE**	**% EVE**
MAL RE A	Malvernian Peacock Gp A	97	3.5	399	1.1	74	2.4	491	10.7	12140	15.4	238	5.6	81	20.9	1179	44.5	79	32.1
MAL RE B	Malvernian Peacock Gp B	518	18.9	2857	8.2	226	7.3	163	3.5	939	1.2	85	2.0	284	73.2	1159	43.7	152	61.8
MAL VAR	Malvernian variant	1	0.0	1	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
GROG	hm grog-tempered	132	4.8	1376	4.0	126	4.1	306	6.7	7191	9.1	115	2.7	7	1.8	200	7.5	0	0.0
LGF SA	South Gaulish samian	18	0.7	239	0.7	58	1.9	6	0.1	195	0.2	25	0.6	0	0.0	0	0.0	0	0.0
LEZ SA	Central Gaulish samian	0	0.0	0	0.0	0	0.0	16	0.3	78.25	0.1	25	0.6	0	0.0	0	0.0	0	0.0
BAT AM	Baetican amphora	2	0.1	39	0.1	0	0.0	2	0.0	244	0.3	0	0.0	0	0.0	0	0.0	0	0.0
DOR BB1	Dorset black burnished ware	347	12.7	3062	8.8	325	10.5	659	14.3	5013	6.4	603	14.2	0	0.0	0	0.0	0	0.0
SOW BB1	South west BB1	3	0.1	58	0.2	35	1.1	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
SOW OX	Southwest oxidised ware	0	0.0	0	0.0	0	0.0	10	0.2	21	0.0	0	0.0	0	0.0	0	0.0	0	0.0
VER WHM	Verulamium whiteware mortaria	2	0.1	523	1.5	18	0.6	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
SVW EA	Severn Valley ware early variant	0	0.0	0	0.0	0	0.0	96	2.1	219	0.3	20	0.5	2	0.5	10	0.4	0	0.0
SVW OX	Severn Valley ware (oxidised)	1289	47.0	23298	66.9	1744	56.1	2441	53.1	49162	62.5	2678	63.0	10	2.6	88	3.3	15	6.1
SVW RE	Severn Valley ware (reduced)	178	6.5	1919	5.5	315	10.1	90	2.0	2109	2.7	172	4.0	4	1.0	14	0.5	0	0.0
MAL RT	Malvernian wheelmade	73	2.7	743	2.1	95	3.1	70	1.5	1192	1.5	232	5.5	0	0.0	0	0.0	0	0.0
BB1 copy	BB1 black sandy copy	2	0.1	102	0.3	40	1.3	6	0.1	8	0.0	29	0.7	0	0.0	0	0.0	0	0.0
BWF SY	medium-fine black sandy ware	1	0.0	3	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
GREY	grey sandy ware	6	0.2	72	0.2	28	0.9	4	0.1	76	0.1	30	0.7	0	0.0	0	0.0	0	0.0
GYMIC	micaceous grey ware	0	0.0	0	0.0	0	0.0	1	0.0	3	0.0	0	0.0	0	0.0	0	0.0	0	0.0
WSOX	white-slipped oxidised ware	1	0.0	63	0.2	25	0.8	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
MISC	misc sandy wares/crumbs	72	2.6	60	0.2	0	0.0	233	5.1	107	0.1	0	0.0	0	0.0	0	0.0	0	0.0
TOTAL		**2742**	**100.0**	**34814**	**100.0**	**3109**	**100.0**	**4594**	**100.0**	**78697**	**100.0**	**4252**	**100.0**	**388**	**100.0**	**2650**	**100.0**	**246**	**100.0**

Table 5

	Plot 160		Plot 271		Plot 400		Plot 430, A-C		Plot 454		Plot 496	
Forms	EVE	EVE %	EVE	EVE%	EVE	EVE%	EVE	EVE%	EVE	EVE%	EVE	EVE%
Jars	69	42.9	215	62.7	330	41.5	1972	64.3	2735	65.0	186	100.0
Dish	15	9.3	14	4.1	23	2.9	50	1.6	80	1.9	0	0.0
Bowl	1	0.6	89	25.9	58	7.3	463	15.1	435	10.3	0	0.0
Platter	0	0.0	0	0.0	0	0.0	0	0.0	96	2.3	0	0.0
Mortaria	3	1.9	17	5.0	0	0.0	18	0.6	0	0.0	0	0.0
Flagon	70	43.5	0	0.0	0	0.0	25	0.8	5	0.1	0	0.0
Jug	0	0.0	0	0.0	0	0.0	98	3.2	0	0.0	0	0.0
Tankard	3	1.9	8	2.3	385	48.4	425	13.9	857	20.4	0	0.0
Mug	0	0.0	0	0.0	0	0.0	12	0.4	0	0.0	0	0.0
Lid	0	0.0	0	0.0	0	0.0	5	0.2	0	0.0	0	0.0
TOTAL	**161**	**100.0**	**343**	**100.0**	**796**	**100.0**	**3068**	**100.0**	**4208**	**100.0**	**186**	**100.0**

Table 6 Duration of sites based on pottery

Plot	LIA-ERO	C1-C2	C2	C2-C3	C3-eC4	Tot no	Tot Wt
250						116	384
450						56	217
496						283	1603
331						193	1295
271						292	3332
430A-C						2742	34814
400						654	7183
454						4593	78695
160						205	1391
TOTAL						7989	120692

Table 7 Comparison of named traded wares from the Brecon pipeline sites with Deansway, Worcester, Longdon and Dymock

			Brecon		Deansway		Longdon		Dymock	
	Fabric	**Description**	**No**	**% No**	**No**	**% No**	**No**	**% No**	**No**	**% No**
Native	MAL RE A	Malvernian Peacock Gp A	704	7.6	353	2.7	559	23.1	76	2.7
	MAL RE B	Malvernian Peacock Gp B	1426	15.5	0	0.0	308	12.7	27	0.9
	MAL VAR	Malvernian variant	2	0.0	0	0.0	10	0.4	17	0.6
	GR	hm grog-tempered	471	5.1	40	0.3	9	0.4	92	3.2
Imports	Samian	samian (all)	53	0.6	479	3.6	7	0.3	62	2.2
	ARG CC	Argonne colour-coated ware	0	0.0	0	0.0	0	0.0	1	0.0
	LYO CC	Lyons ware	0	0.0	2	0.0	0	0.0	0	0.0
	KOL CC	Cologne colour-coated ware	0	0.0	0	0.0	0	0.0	4	0.1
	MOS BS	Moselle black slipped ware	1	0.0	0	0.0	0	0.0	0	0.0
	NOG WH	North Gaulish white ware	0	0.0	0	0.0	0	0.0	1	0.0
	Amphorae	amphorae (all)	18	0.2	103	0.8	1	0.0	16	0.6
Regional	ALH RE	Alice Holt whiteslipped grey ware	1	0.0	0	0.0	0	0.0	0	0.0
	DOR BB1	Dorset black burnished ware	1218	13.2	464	3.5	36	1.5	132	4.6
	LNV CC	Lower Nene Valley colour-coat	1	0.0	18	0.1	0	0.0	0	0.0
	MAH WH	Mancetter-Hartshill	1	0.0	25	0.2	0	0.0	0	0.0
	NFO CC	New forest	0	0.0	8	0.1	0	0.0	0	0.0
	OXF RS	Oxfordshire colour-coated ware	8	0.1	126	0.9	0	0.0	6	0.2
	OXF WH	Oxfordshire whiteware	3	0.0	67	0.5	1	0.0	7	0.2
	OXF WS	Oxfordshire white-slipped	0	0.0	70	0.5	0	0.0	0	0.0
	SAV GT	Savernake ware	0	0.0	0	0.0	3	0.1	10	0.3
	SOW BB1	Southwest BB1	3	0.0	0	0.0	42	1.7	0	0.0
	SOW OX	Southwest oxidised ware	10	0.1	0	0.0	0	0.0	4	0.1
	SOW WS	Southwest white-slipped ware	1	0.0	0	0.0	0	0.0	0	0.0
	VER WH(M)	Verulamium mortaria	2	0.0	1	0.0	0	0.0	1	0.0
	WRX WH	Wroxeter whiteware mortaria	1	0.0	0	0.0	0	0.0	0	0.0
Local	SVW OX	Severn Valley ware (oxidised)	4620	50.2	8470	63.8	1134	46.8	1803	62.9
	SVW RE	Severn Valley ware (reduced)	430	4.7	1304	9.8	75	3.1	58	2.0
	SVW EA	Severn Valley variants	44	0.5	360	2.7	10	0.4	72	2.5
	MAL RT	Malvernian wheelmade	145	1.6	371	2.8	171	7.1	19	0.7
Unknown	Other	unnamed other	43	0.5	1021	7.7	58	2.4	457	16.0
TOTAL			**9206**	**100.0**	**13282**	**100.0**	**2424**	**100.0**	**2865**	**100.0**

Table 8 Catalogue of Roman pottery

Plot	Context	Cut	Type	Fabric	Form	Type	Wt	No	Rim	Eve	Comment
38	38001			SVWOX?			3	1	0	0	
109	55102			SVWOX			16	1	0	0	2=1
109	55110			SVWOX			12	1	0	0	
110	70004	0	layer: colluvium	MALREA			1	1	0	0	probably prehistoric
110	70004	0	layer: colluvium	SVWOX			0.5	1	0	0	
110	70005	0	road surface	BATAM			460	14	0	0	
110	70005	0	road surface	SVWOX			20	12	0	0	
110	70999	0	us	SVWOX			8	1	0	0	
113	80306			SVWOX			7	1	0	0	
126	126001			SVWOX			8	1	0	0	
126	129000			DORBB1			5	1	0	0	
135	135000			SVWOX			15	2	0	0	2=1 fbk
160	160000			DORBB1	IIC	dish	10	0	1	6	
160	160000			SVWOX			21	3	0	0	
160	160001			SVWOX	I	jar	175	16	1	2	
160	160001			SVWOX	I	jar	9	0	1	5	
160	160001			SVWOX	I9	jar	45	0	1	20	
160	160001			DORBB1			25	4	0	0	oblique
160	160001			LGFSA			2	1	0	0	
160	160001			OXFWHM?			17	1	0	0	
160	160006			DORBB1	I	jar	4	0	1	3	
160	160006			DORBB1	I	jar	13	0	1	7	
160	160006			DORBB1	IV4	bowl	69	13	1	1	
160	160006			SOWWS	IV4	bowl	9	1	0	0	
160	160006			MAHWH	IX	mortaria	11	0	1	3	hammer-rim 240-400
160	160006			MOSBS			0.5	1	0	0	
160	160006			OXFWHM			35	1	0	0	
160	160006			SVWOX			139	17	0	0	
160	160007			LIME	I	jar	12	1	1	7	
160	160007			DORBB1			42	5	0	0	oblique, incl IV4
160	160007			LEZSA			27	1	0	0	
160	160007			SVWOX			134	18	0	0	
160	160008			LEZSA??	18; 1831	dish	4	1	1	2	18 or 18/31 matt surfs
160	160008			DORBB1			54	5	0	0	
160	160008			SVWOX			10	3	0	0	
160	160009			DORBB1	I	jar	20	5	1	2	
160	160009			DORBB1	I	jar	7	0	1	7	just oblique

Plot	Context	Cut	Type	Fabric	Form	Type	Wt	No	Rim	Eve	Comment
160	160009			SVWOX	I	jar	55	0	1	16	
160	160009			SVWOX	XIV	tankard	5	1	1	3	
160	160014			SVWOX			4	3	0	0	
160	160016			DORBB1	IIC	dish	15	0	1	7	
160	160016			LEZSA			23	1	0	0	
160	160016			SVWOX			2	1	0	0	
160	160018			WSOXIDF	VIIRN	flagon	26	0	4	70	v. micaceous fine oxid
160	160018			SVWOX?			118	49	0	0	
160	160020			LIME			22	1	0	0	eburn. ?LIA/LIA-ERO
160	160023			BBICOPY			9	1	0	0	
160	160023			DORBB1			60	9	0	0	oblique
160	160023			SVWOX			24	3	0	0	
160	160026			DORBB1			73	6	0	0	
160	160026			SVWOX			52	13	0	0	
160	160028			SVWOX			8	1	0	0	
183	183001			SVWOX			13	2	0	0	
250	65021	0	layer	GR	I	jar	33	11	1	1	Glos TF2a
250	65021	0	layer	GR	I	jar	84	5	1	6	Glos TF 2a
250	65021	0	layer	MALREB	I	jar	70	11	1	3	
250	65021	0	layer	MALREB	I	jar	95	57	2	5	
250	65021	0	layer	MALREB	I3	jar	19	0	3	20	
250	65006	65009	curvi-linear	MALREB			5	1	0	0	
250	65010	65011	ditch	MALREA	I	jar	15	0	2	12	
250	65019	65022	curvi-linear	MALREB	I3	jar	26	16	1	5	
250	65019	65022	curvi-linear	MALREB	I3	jar	22	0	1	15	
250	1101			DORBB1			4	1	0	0	
250	1101			MALREA			5	1	0	0	?preh
250	1101			SVWOX			6	1	0	0	
270	67005	67006	pit	MALREB	I	jar	5	5	1	2	
271	67001	0	topsoil	MALREA			13	1	0	0	
271	67001	0	topsoil	MALREB			10	1	0	0	
271	67001	0	topsoil	SVWOX			39	3	0	0	
271	67056	0	colluvium	SVWOX	I2	jar	25	3	1	10	
271	67056	0	colluvium	LNVCC			1	1	0	0	
271	67056	0	colluvium	SVWOX?			10	3	0	0	no surfaces ??oxfrc
271	67057	0	sealing layer	DORBB1	I	jar	22	0	1	7	
271	67057	0	sealing layer	LGFSA			5	1	0	0	
271	67057	0	sealing layer	SVWOX			30	1	0	0	
271	6207	6204	ditch	DORBB1	I	jar	22	0	2	17	

Plot	Context	Cut	Type	Fabric	Form	Type	Wt	No	Rim	Eve	Comment
271	6207	6204	ditch	DORBB1	I	jar	207	0	4	52	C3
271	6207	6204	ditch	SVWOX	I	jar	79	2	2	20	
271	6207	6204	ditch	DORBB1	I2	jar	12	0	2	10	
271	6207	6204	ditch	MALREA	I2	jar	9	0	2	10	
271	6207	6204	ditch	ALH RE	IV4	bowl	33	0	1	6	
271	6207	6204	ditch	OXFRSM	IX	mortaria	18	0	1	5	flanged c100
271	6207	6204	ditch	OXFWHM	M19	mortaria	45	0	1	7	240-300
271	6207	6204	ditch	DORBB1			353	51	0	0	
271	6207	6204	ditch	OXFRS			38	6	0	0	
271	6207	6204	ditch	SVWOX			6	3	0	0	
271	6305	6306	pit	DORBB1	IV4	bowl	170	1	2	31	
271	6305	6306	pit	OXFRS			14	1	0	0	
271	6305	6306	pit	SVWOX			132	3	0	0	
271	67009	67008	ditch upper	SVWOX			10	2	0	0	
271	67073	67022	ditch primary	SVWOX			17	2	0	0	
271	67027	67028	ditch upper	DORBB1	I	jar	33	4	1	8	
271	67027	67028	ditch upper	SVWOX	I11	jar	390	23	1	5	pendant
271	67061	67028	ditch primary	SVWOX			12	1	0	0	
271	67029	67030	pit upper	MALREB			10	9	0	0	v vesicular
271	67033	67032	ditch upper	SVWOX	IV	bowl	345	20	1	14	triangular grooved rim
271	67033	67032	ditch upper	DORBB1			21	7	0	0	oblique
271	67033	67032	ditch upper	MALREA			5	1	0	0	
271	67033	67032	ditch upper	SVWRE			51	1	0	0	
271	67034	67033	ditch primary	SVWOX			11	1	0	0	
271	67039	67039	posth	SVWOX	XIV	tankard	8	3	1	8	
271	67045	67044	pit	SVWOX			5	2	0	0	
271	67049	67048	ditch primary	LGFSA?			1	1	0	0	
271	67065	67054	ditch 2ndary	MALREB			20	2	0	0	
271	67043	67072	ditch upper	SVWOX	I7	jar	17	0	1	7	
271	67043	67072	ditch upper	SVWOX	I7	jar	20	10	1	3	
271	67043	67072	ditch upper	DORBB1	IVB	bowl	48	0	2	15	
271	67043	67072	ditch upper	WRXWHM	IX	mortaria	135	0	1	5	
271	67043	67072	ditch upper	MICGW			9	4	0	0	
271	67104	67103	gully/ditch	SVWOX			5	3	0	0	
271	67122	67123	ditch primary	MALREB	I	jar	19	0	1	8	
271	67122	67123	ditch primary	SVWOX	I	jar	41	1	1	13	
271	67122	67123	ditch primary	CC	IV12	bowl	10	0	1	6	pale sy fabric
271	67143	67147	ditch upper	SVWOX	I7	jar	128	11	2	3	
271	67143	67147	ditch upper	DORBB1			14	3	0	0	

Plot	Context	Cut	Type	Fabric	Form	Type	Wt	No	Rim	Eve	Comment
271	67143	67147	ditch upper	SVWOX			10	2	0	0	
271	67143	67147	ditch upper	SVWRE			221	20	0	0	
271	67036	67152	ditch recut upper	DORBB1	IIC	dish	14	0	1	7	
271	67036	67152	ditch recut upper	DORBB1	IV3	bowl	27	0	1	8	
271	67036	67152	ditch recut upper	DORBB1	IV4	bowl	15	0	1	7	
271	67036	67152	ditch recut upper	DORBB1			45	8	0	0	oblique
271	67036	67152	ditch recut upper	SVWOX			126	9	0	0	
271	6004			SVWRE	I2	jar	37	5	2	20	
271	6004			DORBB1	IVB	bowl	8	0	1	2	
271	6004			MALREA			5	1	0	0	
271	6004			SVWOX			3	4	0	0	
271	6004			SVWOX			32	8	0	0	
271	6004			SVWRE			1	2	0	0	
271	6010			OX/BWFMIC	X	base	75	1	0	0	2=1
271	6300			SVWOX	I11	jar	35	0	1	22	3=1
271	6307			LEZSA	31	dish	17	0	1	7	
331	75001	0	topsoil	pm			6	1	0	0	probably pm
331	75102	0	ditch	MALREB	I	jar	9	0	1	2	
331	75024	75023	ditch	SVWOX	I11	jar	11	0	1	6	
331	75024	75023	ditch	SVWOX	I12	jar	168	8	1	5	
331	75024	75023	ditch	SVWOX	I12	jar	12	0	1	7	
331	75024	75023	ditch	SVWOX	XIV	tankard	10	0	1	10	
331	75046	75047	ditch	SVWOX	XIV	tankard	37	4	1	10	
331	75046	75047	ditch	SVWOX	XIV//IIcar	tankard/cup	311	10	8	85	*
331	75046	75047	ditch	SVWOX	XIV/II car	tankard/cup	126	4	1	10	
331	75058	75059	ditch	MALREB	I	jar	70	14	4	25	
331	75064	75063	ditch primary	MALREB	I	jar	46	10	1	10	
331	75073	75072	ditch	MALREB	I2	jar	150	44	1	3	
331	75057	75081	ditch	MALREB	I	jar	23	12	1	5	
331	75085	75084	ditch upper	MALREB	I tub	jar	3	0	1	3	
331	75085	75084	ditch	SVWOX	XIV/ II car	tankard/cup	128	2	2	18	PROFILE *
331	75085	75084	ditch	MALREA			18	1	0	0	
331	75066	75104	ditch	MALREB	I12	jar	173	54	5	21	
331	3018		subsoil	LEZSA			5	1	0	0	
331	3030			DORBB1			3	3	0	0	
331	3030			SVWOX			26	4	0	0	
331	3021		furnace	MALREB			91	78	0	0	331
331	3021		furnace	MALREB			86	16	0	0	331
331	3025		ditch	MALREB			42	10	`0	0	331

Plot	Context	Cut	Type	Fabric	Form	Type	Wt	No	Rim	Eve	Comment
331	3025		ditch	MALREB			16	13	0	0	331
400	40060	0	subsoil	DORBB1	(IV3)	bowl	17	1	0	0	
400	40060	0	subsoil	DORBB1	I	jar	18	0	1	5	
400	40060	0	subsoil	SVWOX	I11	jar	22	0	1	12	
400	40060	0	subsoil	SVWOX	XIV	tankard	197	15	1	20	
400	40060	0	subsoil	SVWOX			42	5	0	0	
400	40060	0	subsoil	SVWOX			5	3	0	0	
400	40060	0	subsoil	SVWRE			11	1	0	0	
400	40003	40004	pit	MAL RO			53	1	0	0	Glos TF 19c
400	40059	40057	linear upper	MALREB			4	1	0	0	
400	40062	40061	ditch	SVWOX	IV	bowl	80	2	1	8	ANVIL RIM
400	40062	40061	ditch	SVWRE	XIV	tankard	20	0	1	17	
400	40062	40061	ditch	DORBB1	I	jar	50	1	1	10	
400	40064	40063	ditch	DORBB1	I	jar	94	7	1	15	
400	40064	40063	ditch	SVWRE	I	jar	133	14	1	10	
400	40064	40063	ditch	GREY	I2	jar	6	0	1	10	
400	40064	40063	ditch	MICGW	I2	jar	23	0	1	17	
400	40064	40063	ditch	SVWOX	I2	jar	112	0	6	38	
400	40064	40063	ditch	MAL RO	I3/11	jar	38	0	1	7	Glos TF 19
400	40064	40063	ditch	SVWOX	I7	jar	53	0	1	9	
400	40064	40063	ditch	LEZSA	IV	bowl	49	1	0	0	
400	40064	40063	ditch	SVWOX	IV anvil	bowl	134	0	2	25	
400	40064	40063	ditch	SVWOX	XIV	tankard	55	0	2	26	
400	40064	40063	ditch	SVWOX	XIV	tankard	40	0	3	26	
400	40064	40063	ditch	SVWOX	XIV2	tankard	17	0	1	5	
400	40064	40063	ditch	DORBB1			14	7	0	0	
400	40064	40063	ditch	SVWOX			1344	122	0	0	
400	40066	40067	ditch	SVWOX	I	jar	34	0	1	22	
400	40066	40067	ditch	SVWOX	I	jar	99	0	7	67	
400	40066	40067	ditch	SVWRE	I11	jar	18	0	1	7	
400	40066	40067	ditch	SVWRE	I12	jar	13	0	1	14	
400	40066	40067	ditch	DORBB1	I2	jar	113	18	1	7	
400	40066	40067	ditch	DORBB1	I2	jar	15	0	1	10	
400	40066	40067	ditch	SVWOX	I2	jar	13	0	1	10	
400	40066	40067	ditch	SVWOX	I2	jar	5	0	1	7	
400	40066	40067	ditch	SVWRE	I2	jar	15	0	1	10	
400	40066	40067	ditch	DORBB1	IVB	bowl	80	0	2	8	
400	40066	40067	ditch	MALREA	I tub	jar	32	0	1	7	
400	40066	40067	ditch	SVWCC	IV4 hemi	bowl	43	0	1	10	or Caerleon?

Plot	Context	Cut	Type	Fabric	Form	Type	Wt	No	Rim	Eve	Comment
400	40066	40067	ditch	SVWOX	XIV	tankard	1062	49	1	12	
400	40066	40067	ditch	SVWOX	XIV	tankard	19	0	2	20	
400	40066	40067	ditch	SVWOX	XIV	tankard	44	0	1	20	
400	40066	40067	ditch	SVWOX	XIV	tankard	44	0	2	18	
400	40066	40067	ditch	SVWOX	XIV	tankard	30	0	2	18	
400	40066	40067	ditch	SVWOX	XIV	tankard	8	0	1	6	
400	40066	40067	ditch	SVWOX	XIV	tankard	9	0	1	110	
400	40066	40067	ditch	SVWOX	XIV	tankard	13	0	1	8	
400	40066	40067	ditch	SVWOX	XIV	tankard	15	0	1	7	
400	40066	40067	ditch	SVWOX	XIV	tankard	8	0	1	8	
400	40066	40067	ditch	SVWOX	XIV2	tankard	4	0	1	7	
400	40066	40067	ditch	GR			19	3	0	0	Glos Tf 2A
400	40066	40067	ditch	MALREB			12	1	0	0	
400	40066	40067	ditch	SVWOX			1554	156	0	0	
400	40066	40067	ditch	SVWRE			60	8	0	0	
400	40069	40068	ditch	MALREB			4	2	0	0	decorated *
400	40069	40068	ditch	OO			2	3	0	0	
400	40069	40068	ditch	SVWOX			5	3	0	0	
400	40073	40072	ditch	SVWOX	XIV	tankard	71	8	4	35	
400	40079	40078	ditch primary	MALREB	I	jar	23	16	2	3	
400	40078	40080	ditch	BW			7	1	0	0	
400	40078	40080	ditch	GR			4	1	0	0	Glos Tf 2A
400	40078	40080	ditch	MALREB			90	30	0	0	
400	40078	40080	ditch	SVWOX			27	3	0	0	
400	40084	40083	ditch upper	MALREB	I	jar	21	0	1	7	
400	40084	40083	ditch upper	DORBB1	IIC	dish	200	13	4	23	1 vessel
400	40086	40085	pit	SVWOX	IV	bowl	97	11	1	7	small hemi, plain rim
400	40086	40085	pit	SVWRE			4	1	0	0	
400	40088	40087	ditch	SVWOX	XIV2	tankard	203	4	1	15	
400	40090	40089	encl ditch	SVWOX	XIV	tankard	60	8	1	7	
400	40090	40089	encl ditch	DORBB1			10	1	0	0	acute
400	40090	40089	encl ditch	MALREB			4	1	0	0	
400	40094	40093	ditch primary	SVWOX	I11	jar	31	0	1	6	
400	40094	40093	ditch primary	MALREA	I12	jar	10	0	1	3	
400	40094	40093	ditch primary	SVWOX	I7	jar	71	1	2	20	
400	40095	40093	ditch upper	MALREA	I12	jar	32	12	2	7	
400	40095	40093	ditch upper	GR			23	4	0	0	Glos TF2A
400	40095	40093	ditch upper	MALREB			5	1	0	0	
400	40095	40093	ditch upper	SVWOX			100	13	0	0	

Plot	Context	Cut	Type	Fabric	Form	Type	Wt	No	Rim	Eve	Comment
400	60087			MALREB			3	13	0	0	
400	60096			MALREB			11	3	0	0	
400	60096			SVWOX			52	7	0	0	
401	60086			MALREA			18	9	0	0	
421	58801			DORBB1			15	2	0	0	?oblique
425	42500			SVWOX			36	2	0	0	3=2 fb
430	86001	0	topsoil	MALREB	I	jar	656	180	9	57	
430	86001	0	topsoil	SVWRE	I2	jar	16	1	2	27	
430	86001	0	topsoil	SVWOX	I2/12	jar	12	0	1	13	
430	86001	0	topsoil	SVWOX	IV4 hemi	bowl	23	5	2	15	
430	86001	0	topsoil	SVWOX	XIV	tankard	27	6	1	6	
430	86001	0	topsoil	DORBB1			2	1	0	0	
430	86001	0	topsoil	SVWOX			81	1	0	0	XIV
430	86001	0	topsoil	SVWOX			6	1	0	0	
430	86001	0	topsoil	SVWOX			27	1	0	0	
430	86001	0	topsoil	SVWOX			6	1	0	0	
430	86001	0	topsoil	SVWOX			7	1	0	0	
430	86001	0	topsoil	SVWOX			16	1	0	0	
430	86001	0	topsoil	SVWOX			7	2	0	0	
430	86001	0	topsoil	SVWOX			3	2	0	0	
430	86001	0	topsoil	SVWRE			5	1	0	0	
430	86001	0	topsoil	SVWRE			1	1	0	0	
430	86010	0	subsoil	SVWOX	I12	jar	5	0	1	3	
430	86010	0	subsoil	SVWOX	XIV	tankard	16	0	1	11	
430	86010	0	subsoil	DORBB1			22	2	0	0	
430	86010	0	subsoil	SVWOX			58	6	0	0	
430	86010	0	subsoil	SVWOX			39	4	0	0	
430	86010	0	subsoil	SVWRE			3	1	0	0	
430	34215			MALREB?			5	1	0	0	burnt, vesic Cremation
430	58707			SVWOX	IV4 hemi	bowl	82	2	1	17	
430	58707			SVWRE			19	1	0	0	
430	58707			DORBB1	I	jar	18	0	1	12	
430	86199			SVWBB	I2	jar	171	29	3	25	1 vessel. Wm, black burnished
430	86199			MALREB			5	2	0	0	
430	86199			OO			5	10	0	0	
430	86199			SVWOX			6	2	0	0	
430	86271			MALREB	I	jar	30	9	1	7	
441	44106			MALREB			11	1	0	0	
441	44106			MALVSY			15	1	0	0	

Plot	Context	Cut	Type	Fabric	Form	Type	Wt	No	Rim	Eve	Comment
441	44106			SVWOX			4	2	0	0	
454	85000	0	topsoil	SVWOX			1293	49	0	0	
454	85000	0	topsoil	DORBB1	I	jar	173	17	1	9	oblique
454	85000	0	topsoil	DORBB1	I	jar	109	43	2	6	
454	85000	0	topsoil	SVWOX	I	jar	14	0	1	5	
454	85000	0	topsoil	SVWOX	I11	jar	30	0	1	15	
454	85000	0	topsoil	SVWOX	I4	storage jar	56	0	1	3	
454	85000	0	topsoil	SVWRE	IV2	bowl	33	4	1	10	
454	85000	0	topsoil	GREY	IVB	bowl	20	0	1	0	
454	85000	0	topsoil	MALRO	IVB	bowl	204	5	2	9	TF19A; PROFILE
454	85000	0	topsoil	SVWOX	III?	platter	10	0	1	5	
454	85000	0	topsoil	SVWOX	XIV	tankard	16	0	1	10	
454	85000	0	topsoil	SVWOX	XIV	tankard	7	0	1	7	
454	85000	0	topsoil	DORBB1			820	102	0	0	rt angle-just obtuse
454	85000	0	topsoil	MALREA			2	1	0	0	
454	85000	0	topsoil	MALREA			36	1	0	0	
454	85000	0	topsoil	MALREA			40	4	0	0	
454	85000	0	topsoil	MALREB			12	2	0	0	
454	85000	0	topsoil	MICGW			3	1	0	0	
454	85000	0	topsoil	SVWEA			9	3	0	0	black surfs, burn; oge fab
454	85000	0	topsoil	SVWOX			238	74	0	0	
454	85000	0	topsoil	SVWRE			62	3	0	0	
454	85000	0	topsoil	SVWRE			11	4	0	0	
454	85114	0	us	SVWOX	SWHORL	swhorl	4	1	0	0	* 30 X 28 mm
454	14204	14200	ditch	SVWOX	IV	bowl	717	0	1	80	* profile, hole through base
454	14228	14200	ditch	SVWOX	I6/12	jar	17	3	1	25	
454	14228	14200	ditch	LEZSA			0.25	1	0	0	
454	14228	14200	ditch	SVWOX			52	47	0	0	
454	14226	14225	linear	SVWOX			26	1	0	0	
454	14815			MALREB			2	1	0	0	
454	85003	85002	ditch upper	MALREA			6	1	0	0	
454	85003	85002	ditch upper	LGFSA	18/31 ?R	dish	77	0	1	20	
454	85003	85002	ditch upper	SVWOX	as C45	dish	27	0	1	10	Newlands Hopfield BT68
454	85003	85002	ditch upper	SVWOX	as C45	dish	14	0	1	7	Newlands Hopfield BT68
454	85003	85002	ditch upper	DORBB1	I	jar	30	0	1	10	lead rivet repair
454	85003	85002	ditch upper	DORBB1	I	jar	24	2	1	5	
454	85003	85002	ditch upper	DORBB1	I	jar	82	0	3	25	
454	85003	85002	ditch upper	DORBB1	I	jar	85	0	2	28	oblique lattice
454	85003	85002	ditch upper	DORBB1	I	jar	46	0	2	38	

Plot	Context	Cut	Type	Fabric	Form	Type	Wt	No	Rim	Eve	Comment
454	85003	85002	ditch upper	DORBB1	I	jar	15	0	1	12	
454	85003	85002	ditch upper	DORBB1	I	jar	31	0	2	18	
454	85003	85002	ditch upper	DORBB1	I	jar	11	0	1	5	
454	85003	85002	ditch upper	DORBB1	I	jar	13	0	1	5	
454	85003	85002	ditch upper	DORBB1	I	jar	10	0	1	10	
454	85003	85002	ditch upper	DORBB1	I	jar	16	0	2	17	
454	85003	85002	ditch upper	DORBB1	I	jar	7	0	1	5	
454	85003	85002	ditch upper	DORBB1	I	jar	28	0	3	15	
454	85003	85002	ditch upper	DORBB1	I	jar	107	0	4	57	
454	85003	85002	ditch upper	DORBB1	I	jar	69	0	1	30	
454	85003	85002	ditch upper	SVWOX	I	jar	36	0	1	17	
454	85003	85002	ditch upper	SVWOX	I11	jar	17	0	1	22	
454	85003	85002	ditch upper	SVWOX	I11	jar	40	0	1	12	
454	85003	85002	ditch upper	SVWOX	I11	jar	20	0	1	10	
454	85003	85002	ditch upper	SVWOX	I11	jar	28	0	3	15	
454	85003	85002	ditch upper	SVWOX	I11	jar	13	0	1	5	
454	85003	85002	ditch upper	SVWOX	I11	jar	108	0	4	70	
454	85003	85002	ditch upper	SVWOX	I11	jar	56	0	1	10	
454	85003	85002	ditch upper	SVWOX	I11	jar	94	0	5	68	
454	85003	85002	ditch upper	SVWOX	I11	jar	96	0	1	10	
454	85003	85002	ditch upper	SVWOX	I11	jar	113	0	2	37	
454	85003	85002	ditch upper	SVWOX	I11	jar	33	0	1	7	
454	85003	85002	ditch upper	SVWOX	I12	jar	80	0	2	35	
454	85003	85002	ditch upper	GREY	I2	jar	4	0	1	5	
454	85003	85002	ditch upper	MALREA	I2	jar	85	0	1	18	
454	85003	85002	ditch upper	MALREA	I2	jar	14	0	1	10	
454	85003	85002	ditch upper	MALREA	I2	jar	15	0	1	5	
454	85003	85002	ditch upper	MALREA	I2	jar	15	0	2	10	
454	85003	85002	ditch upper	MALREA	I2	jar	85	0	2	33	
454	85003	85002	ditch upper	MALREA	I2	jar	92	0	3	38	
454	85003	85002	ditch upper	MALREA	I2	jar	42	0	1	18	
454	85003	85002	ditch upper	MALRO	I2	jar	269	0	12	95	TF19
454	85003	85002	ditch upper	SVWOX	I2	jar	6	0	1	5	
454	85003	85002	ditch upper	SVWOX	I2	jar	24	0	1	20	
454	85003	85002	ditch upper	SVWOX	I2	jar	11	0	1	17	
454	85003	85002	ditch upper	SVWOX	I2	jar	5	0	1	7	
454	85003	85002	ditch upper	MALREA	I3	jar	1075	99	1	3	
454	85003	85002	ditch upper	SVWOX	I6	jar	264	0	2	65	
454	85003	85002	ditch upper	SVWOX	I7	jar	120	0	2	35	

Plot	Context	Cut	Type	Fabric	Form	Type	Wt	No	Rim	Eve	Comment
454	85003	85002	ditch upper	SVWOX	Ihook	jar	23	0	1	12	
454	85003	85002	ditch upper	SVWOX	Ihook/7	jar	317	0	2	60	
454	85003	85002	ditch upper	MAL RO	IVB	bowl	40	1	1	5	Glos TF 19C
454	85003	85002	ditch upper	DORBB1	IIC	dish	18	0	1	8	
454	85003	85002	ditch upper	GYSY	IV3	bowl	40	0	1	17	straight
454	85003	85002	ditch upper	MAL RO	IV3	bowl	95	0	2	18	Glos TF 19
454	85003	85002	ditch upper	SVWRE	IV4	bowl	18	0	1	15	hemi
454	85003	85002	ditch upper	SVWRE	IV4 hemi	bowl	5	0	1	2	
454	85003	85002	ditch upper	MALRO	IVB	bowl	367	0	8	68	
454	85003	85002	ditch upper	SVWOX	XIV	tankard	9	0	1	5	
454	85003	85002	ditch upper	SVWOX	XIV	tankard	19	0	1	15	
454	85003	85002	ditch upper	SVWOX	XIV	tankard	35	0	1	17	
454	85003	85002	ditch upper	SVWOX	XIV	tankard	15	0	1	10	
454	85003	85002	ditch upper	SVWOX	XIV	tankard	68	0	1	23	
454	85003	85002	ditch upper	SVWOX	XIV	tankard	20	0	1	10	
454	85003	85002	ditch upper	SVWOX	XIV	tankard	9	0	1	5	
454	85003	85002	ditch upper	SVWOX	XIV	tankard	174	0	1	34	
454	85003	85002	ditch upper	SVWOX	XIV	tankard	201	0	2	50	
454	85003	85002	ditch upper	SVWOX	XIV2	tankard	12	0	1	17	
454	85003	85002	ditch upper	DORBB1			3	1	0	0	
454	85003	85002	ditch upper	DORBB1			86	54	0	0	
454	85003	85002	ditch upper	DORBB1			874	110	0	0	oblique; triple line lattice
454	85003	85002	ditch upper	DORBB1			54	3	0	0	
454	85003	85002	ditch upper	DORBB1			38	18	0	0	
454	85003	85002	ditch upper	MAL RO			22	9	0	0	Glos TF 19
454	85003	85002	ditch upper	MALREA			267	170	0	0	
454	85003	85002	ditch upper	MALREB			12	2	0	0	
454	85003	85002	ditch upper	OO			37	110	0	0	
454	85003	85002	ditch upper	SVWOX			1905	98	0	0	
454	85003	85002	ditch upper	SVWOX			2029	108	0	0	
454	85003	85002	ditch upper	SVWOX			4042	220	0	0	
454	85003	85002	ditch upper	SVWOX			1226	31	0	0	
454	85003	85002	ditch upper	SVWOX			1396	80	0	0	
454	85003	85002	ditch upper	SVWOX			685	7	0	0	
454	85003	85002	ditch upper	SVWOX			40	21	0	0	
454	85003	85002	ditch upper	SVWRE			11	1	0	0	
454	85027	85002	ditch	SVWRE	IV4hemi	bowl	78	1	3	28	black
454	85027	85002	ditch	DORBB1			61	3	0	0	
454	85027	85002	ditch	SVWOX			32	3	0	0	

Plot	Context	Cut	Type	Fabric	Form	Type	Wt	No	Rim	Eve	Comment
454	85028	85002	ditch primary	SVWOX	I11	jar	15	0	1	15	
454	85028	85002	ditch primary	DORBB1	I2	jar	244	19	2	12	
454	85028	85002	ditch primary	DORBB1	I2	jar	70	0	3	23	
454	85028	85002	ditch primary	SVWOX	I6	jar	325	0	2	77	*profile?
454	85028	85002	ditch primary	SVWOX	III	platter	130	0	1	43	
454	85028	85002	ditch primary	SVWOX	III	platter	7	0	1	5	
454	85028	85002	ditch primary	MALREA	I tub	jar	352	19	7	68	burnished lattice type décor
454	85028	85002	ditch primary	SVWOX	XIV	tankard	103	0	1	35	
454	85028	85002	ditch primary	SVWOX	XIV	tankard	27	0	1	17	
454	85028	85002	ditch primary	SVWOX	XIV	tankard	34	0	1	15	
454	85028	85002	ditch primary	SVWOX	XIV	tankard	14	0	1	10	
454	85028	85002	ditch primary	SVWOX	XIV	tankard	9	0	1	9	
454	85028	85002	ditch primary	SVWOX	XIV	tankard	378	0	2	38	* profile, 1 vess can recons
454	85028	85002	ditch primary	DORBB1			8	4	0	0	
454	85028	85002	ditch primary	SVWOX			618	45	0	0	
454	85028	85002	ditch primary	SVWOX			1884	15	0	0	
454	85028	85002	ditch primary	SVWOX			42	29	0	0	
454	85028	85002	ditch primary	SVWOX			25	11	0	0	
454	85007	85006	ditch	DORBB1	IIC	dish	15	0	1	5	
454	85007	85006	ditch	SVWOX			32	5	0	0	
454	85010	85011	linear	SVWOX			653	19	0	0	
454	85010	85011	linear	SVWRE			3	1	0	0	
454	85019	85020	posthole	SVWOX			15	2	0	0	
454	85023	85024	posthole	DORBB1			2	1	0	0	
454	85023	85024	posthole	MALREA			317	23	0	0	
454	85023	85024	posthole	SVWOX			60	3	0	0	
454	85025	85026	ditch upper	GR	I	jar	24	1	1	10	Glos TF2A
454	85025	85026	ditch upper	DORBB1	I2	jar	69	3	1	8	just oblique
454	85025	85026	ditch upper	SVWOX	I2	jar	52	0	4	20	
454	85025	85026	ditch upper	SVWRE	I2	jar	30	0	1	12	
454	85025	85026	ditch upper	MALREA	IV12/I4	bowl	744	1	1	14	
454	85025	85026	ditch upper	SVWRE	IV2	bowl	90	7	1	10	
454	85025	85026	ditch upper	SVWOX	IV4hemi	bowl	39	0	2	32	
454	85025	85026	ditch upper	SVWOX	XIV	tankard	36	0	2	23	
454	85025	85026	ditch upper	BATAM			146	1	0	0	
454	85025	85026	ditch upper	SVWOX			1448	87	0	0	
454	85025	85026	ditch upper	SVWOX			941	62	0	0	
454	85029	85026	ditch	SVWOX	I11	jar	143	0	1	21	
454	85029	85026	ditch	SVWOX	I11	jar	60	0	2	20	

Plot	Context	Cut	Type	Fabric	Form	Type	Wt	No	Rim	Eve	Comment
454	85029	85026	ditch	SVWOX	I11/12	jar	160	0	2	40	
454	85029	85026	ditch	SVWOX	I12	jar	28	0	1	20	
454	85029	85026	ditch	SVWOX	I12	jar	5	0	1	3	
454	85029	85026	ditch	MAL RO	I2	jar	89	0	1	27	rouletted; Glos TF 19
454	85029	85026	ditch	SVWOX	I2	jar	256	0	3	60	
454	85029	85026	ditch	SVWOX	I6/11	jar	170	0	6	60	
454	85029	85026	ditch	SVWOX	I7	jar	150	0	1	17	
454	85029	85026	ditch	SVWOX	III	platter	100	0	2	43	
454	85029	85026	ditch	SVWOX	XIV	tankard	42	0	2	32	
454	85029	85026	ditch	DORBB1			39	3	0	0	acute
454	85029	85026	ditch	GR			63	1	0	0	Glos TF2C
454	85029	85026	ditch	LGFSA			2	1	0	0	
454	85029	85026	ditch	MALREA			7	1	0	0	
454	85029	85026	ditch	SVWOX			5215	145	0	0	x1 deliberately holed base
454	85029	85026	ditch	SVWRE			42	1	0	0	
454	85033	85034	ditch	SVWOX	XIV	tankard	690	55	6	67	
454	85033	85034	ditch	SVWOX	XIV	tankard	77	36	1	5	
454	85033	85034	ditch	DORBB1			17	5	0	0	oblique
454	85033	85034	ditch	MALREA			64	1	0	0	
454	85036	85036	ditch	SVWRE			32	1	0	0	
454	85038	85037	pit	SVWEA	I2	jar	210	92	1	20	early variant fine grog
454	85039	85041	pit	SVWOX	I	jar	64	1	1	11	
454	85039	85041	pit	SVWOX	I2	jar	12	0	1	7	
454	85039	85041	pit	SVWOX	I2	jar	20	0	1	5	
454	85039	85041	pit	SVWOX	I7/XII	jar/jug	19	0	1	12	greyish
454	85039	85041	pit	DORBB1	IVB	bowl	59	4	1	10	
454	85039	85041	pit	LGFSA			1	1	0	0	
454	85039	85041	pit	MAL RO			14	3	0	0	Glos TF 19
454	85039	85041	pit	OO			1	2	0	0	
454	85039	85041	pit	SVWOX			187	29	0	0	
454	85043	85042	ditch	MALREB			50	13	0	0	
454	85047	85048	gully	SVWOX	VII	flagon	85	3	1	5	5 rib strap handle
454	85050	85049	cremation	SVWRE	I	jar	50	1	1	20	
454	85050	85049	cremation	DORBB1			10	3	0	0	
454	85050	85049	cremation	LGFSA			105	1	0	0	stamp PASS[..] Passienus
454	85050	85049	cremation	OO			1	3	0	0	
454	85050	85049	cremation	SOWOX			21	10	0	0	
454	85050	85049	cremation	SVWOX			73	3	0	0	
454	85051	85052	gully	SVWOX			368	24	0	0	

Plot	Context	Cut	Type	Fabric	Form	Type	Wt	No	Rim	Eve	Comment
454	85054	85053	ditch	MALREB	I	jar	286	83	1	3	
454	85054	85053	ditch	MALREB	I	jar	67	0	4	21	
454	85054	85053	ditch	MALREB	I	jar	143	0	8	44	diagonal burnish
454	85054	85053	ditch	SVWOX	XIV	tankard	243	25	1	10	
454	85055	85056	ditch	DORBB1	I	jar	18	0	1	10	
454	85055	85056	ditch	SVWOX			32	1	0	0	
454	85057	85058	linear	SVWOX			75	5	0	0	
454	85067	85058	linear	SVWOX	I12	jar	30	0	2	15	
454	85067	85058	linear	DORBB1	I2	jar	47	0	1	13	
454	85067	85058	linear	MAL RO	I2	jar	32	0	1	10	Tf19
454	85067	85058	linear	SVWRE	IV	bowl	68	4	1	15	
454	85067	85058	linear	DORBB1	IVB	bowl	168	2	1	12	champfered base
454	85067	85058	linear	DORBB1			8	4	0	0	
454	85067	85058	linear	MAL RO			50	24	0	0	Glos TF19
454	85067	85058	linear	MALREA			96	10	0	0	
454	85067	85058	linear	MALREB			7	1	0	0	
454	85067	85058	linear	MALREB			7	2	0	0	abraded, rounded frags
454	85067	85058	linear	OO			67	117	0	0	
454	85067	85058	linear	SVWOX			31	25	0	0	
454	85067	85058	linear	SVWRE			9	4	0	0	
454	85075	85076	ditch	SVWOX			218	1	0	0	
454	85082	85081	ditch terminus	LGFSA	18	dish	10	1	1	5	
454	85082	85081	ditch terminus	DORBB1	I	jar	47	0	2	23	
454	85082	85081	ditch terminus	DORBB1	I	jar	22	0	1	10	
454	85082	85081	ditch terminus	DORBB1	I	jar	63	2	1	12	
454	85082	85081	ditch terminus	DORBB1	I	jar	16	0	1	10	
454	85082	85081	ditch terminus	DORBB1	I	jar	10	0	1	5	
454	85082	85081	ditch terminus	DORBB1	I	jar	10	0	1	10	
454	85082	85081	ditch terminus	DORBB1	I	jar	48	5	1	5	
454	85082	85081	ditch terminus	DORBB1	I	jar	40	0	1	12	
454	85082	85081	ditch terminus	GR	I	jar	31	0	4	28	Glos TF2A
454	85082	85081	ditch terminus	SVWOX	I	jar	9	0	1	7	
454	85082	85081	ditch terminus	SVWOX	I	jar	6	0	1	5	
454	85082	85081	ditch terminus	SVWOX	I11	jar	13	0	1	6	
454	85082	85081	ditch terminus	SVWOX	I11	jar	366	0	4	37	
454	85082	85081	ditch terminus	SVWOX	I11	jar	149	0	4	27	
454	85082	85081	ditch terminus	SVWOX	I11	jar	97	0	3	16	
454	85082	85081	ditch terminus	SVWOX	I11	jar	92	0	2	37	
454	85082	85081	ditch terminus	SVWOX	I11	jar	320	0	3	50	

Plot	Context	Cut	Type	Fabric	Form	Type	Wt	No	Rim	Eve	Comment
454	85082	85081	ditch terminus	SVWOX	I11	jar	34	0	1	8	
454	85082	85081	ditch terminus	SVWOX	I11	jar	24	0	1	8	
454	85082	85081	ditch terminus	SVWOX	I11	jar	19	0	1	15	
454	85082	85081	ditch terminus	SVWOX	I11/12	jar	10	0	1	7	
454	85082	85081	ditch terminus	BB1COPY	I2	jar	5	0	1	3	
454	85082	85081	ditch terminus	GR	I4	storage jar	1216	36	2	5	Glos TF 2C
454	85082	85081	ditch terminus	GR	I4	storage jar	1754	10	7	72	Glos TF2A
454	85082	85081	ditch terminus	SVWOX	I4	storage jar	43	0	1	2	
454	85082	85081	ditch terminus	SVWOX	I4	storage jar	10	0	1	5	
454	85082	85081	ditch terminus	SVWOX	I4	storage jar	14	0	1	12	
454	85082	85081	ditch terminus	SVWOX	I7	jar	51	0	2	15	
454	85082	85081	ditch terminus	MALREA	IV	bowl	3168	10	3	21	large hammer rim
454	85082	85081	ditch terminus	SVWRE	IV	bowl	57	0	1	20	*
454	85082	85081	ditch terminus	SVWOX	I	jar	43	0	1	17	narrow necked
454	85082	85081	ditch terminus	SVWRE	IV seg	bowl	95	3	1	11	*
454	85082	85081	ditch terminus	SVWRE	IV4 hemi	bowl	42	1	1	2	
454	85082	85081	ditch terminus	SVWOX	XIV	tankard	128	0	4	77	flared
454	85082	85081	ditch terminus	SVWOX	XIV	tankard	37	0	1	18	flared
454	85082	85081	ditch terminus	SVWOX	XIV	tankard	10	0	1	10	
454	85082	85081	ditch terminus	SVWOX	XIV	tankard	26	0	1	10	
454	85082	85081	ditch terminus	SVWOX	XIV/V car	tankard/cup	27	0	1	5	
454	85082	85081	ditch terminus	SVWOX	XIVh	tankard	306	0	6	79	PROFILE
454	85082	85081	ditch terminus	SVWOX	XIVh	tankard	164	0	4	62	
454	85082	85081	ditch terminus	DORBB1			126	14	0	0	
454	85082	85081	ditch terminus	DORBB1			40	28	0	0	
454	85082	85081	ditch terminus	GR			5	1	0	0	Glos Tf 2A
454	85082	85081	ditch terminus	GR			3847	148	0	0	Glos TF 2C
454	85082	85081	ditch terminus	GR			211	81	0	0	Glos TF2C
454	85082	85081	ditch terminus	MAL RO			10	1	0	0	Glos TF 19C
454	85082	85081	ditch terminus	MALREA			4621	82	0	0	
454	85082	85081	ditch terminus	MALREA			929	12	0	0	
454	85082	85081	ditch terminus	MALREA			45	31	0	0	
454	85082	85081	ditch terminus	SVWOX			21	3	0	0	
454	85082	85081	ditch terminus	SVWOX			2915	179	0	0	
454	85082	85081	ditch terminus	SVWOX			105	71	0	0	
454	85082	85081	ditch terminus	SVWRE			28	6	0	0	
454	85082	85081	ditch terminus	SVWRE			1	1	0	0	
454	85082	85081	ditch terminus	SVWRE			6	1	0	0	
454	85082	85081	ditch terminus	BB1COPY	I	jar	3	1	4	26	

Plot	Context	Cut	Type	Fabric	Form	Type	Wt	No	Rim	Eve	Comment
454	85082	85081	ditch terminus	GR	I	jar	28	1	4	20	Glos Tf 2A
454	85088	85087	postpit	MALREB			2	2	0	0	
454	85090	85089	pit	GR			12	9	0	0	Glos TF 2C
454	85090	85089	pit	SVWRE			123	3	0	0	
454	85095	85096	pit	MALREB	I	jar	35	0	1	7	
454	85095	85096	pit	MALREB	I	jar	35	0	1	5	
454	85095	85096	pit	MALREB			121	7	0	0	
454	85095	85096	pit	MALREB			83	22	0	0	
454	85098	85097	ditch	SVWOX	I12	jar	106	0	2	13	
454	85098	85097	ditch	SVWOX	IV	bowl	38	0	1	7	
454	85098	85097	ditch	DORBB1			411	39	0	0	
454	85098	85097	ditch	DORBB1			60	45	0	0	
454	85098	85097	ditch	SVWOX			529	29	0	0	
454	85098	85097	ditch	SVWOX			42	22	0	0	
454	85098	85097	ditch	GREY	IIC	dish	12	0	1	8	
454	85098	85097	ditch	DORBB1	I	jar	100	0	7	52	
454	85100	85099	ditch	MALREB			10	5	0	0	
454	85100	85099	ditch	OO			1	1	0	0	
454	85100	85099	ditch	MALREB	I	jar	5	0	1	5	
454	85103	85102	ditch	MALREB			35	3	0	0	
454	85105	85102	ditch	DORBB1	I	jar	317	28	2	26	acute
454	85105	85102	ditch	SVWOX	I	jar	64	0	1	22	
454	85105	85102	ditch	SVWOX	I	jar	153	0	2	20	
454	85105	85102	ditch	SVWOX	I	jar	42	12	3	5	
454	85105	85102	ditch	SVWOX	I/II	jar	3	0	1	2	
454	85105	85102	ditch	SVWOX	I12	jar	36	0	2	12	
454	85105	85102	ditch	SVWOX	I3/11	jar	14	0	1	10	
454	85105	85102	ditch	SVWOX	I3/11	jar	14	0	1	8	
454	85105	85102	ditch	SVWOX	I7	jar	100	0	1	15	
454	85105	85102	ditch	SVWOX	I7/XII	jar/jug	102	0	1	13	
454	85105	85102	ditch	SVWOX	XIV	tankard	43	0	1	25	
454	85105	85102	ditch	SVWOX	XIV2	tankard	57	0	2	30	
454	85105	85102	ditch	MALREA			19	1	0	0	
454	85105	85102	ditch	MALREB			8	1	0	0	
454	85105	85102	ditch	SVWOX			5058	158	0	0	
454	85105	85102	ditch	SVWOX			90	90	0	0	
454	85113	85104	ditch primary	SVWRE	XIIh	jug	1047	3	0	0	complete apart from rim * hole
454	85106	85107	ditch	MALREB			9	2	0	0	
454	85106	85107	ditch	SVWRE			2	1	0	0	bw

Plot	Context	Cut	Type	Fabric	Form	Type	Wt	No	Rim	Eve	Comment
454	85101	85108	ditch	DORBB1			1	1	0	0	
454	85101	85108	ditch	SVWOX			360	32	0	0	
454	85101	85108	ditch	SVWOX			106	7	0	0	
454	85101	85108	ditch	SVWRE	I11	jar	104	11	3	27	
454	14002		subsoil	SVWOX			3	1	0	0	
454	14201			LEZSA	31	dish	67	10	3	25	
454	14201			SVWOX	I11	jar	160	0	1	20	
454	14201			SVWOX	IV?	bowl	26	0	1	12	
454	14201			SVWOX	XIV	tankard	125	17	3	40	1 vessel
454	14201			DORBB1			0.5	4	0	0	
454	14201			SVWOX			779	42	0	0	
454	14201			SVWRE			25	5	0	0	
454	14202			SVWOX	XIV	tankard	214	4	1	25	PROFILE*
454	14203			SVWOX	I4	storage jar	1067	0	4	40	*
454	14203			SVWOX			917	27	0	0	
454	14232		subsoil	SVWOX			8	6	0	0	
454	14237			SVWOX	I2	jar	12	0	1	11	
454	14237			SVWOX	XIV	tankard	10	0	1	12	
454	14237			DORBB1			5	2	0	0	
454	14237			LEZSA			9	1	0	0	
454	14237			MALREA			4	1	0	0	
454	14237			SVWOX			256	43	0	0	
454	14237			SVWRE			8	3	0	0	
454	14237			DORBB1	I	jar	31	11	1	2	oblique
454	14240			MALREB			10	1	0	0	
454	14240			SVWOX			24	3	0	0	
454	14300			DORBB1			0.5	1	0	0	
454	14300			SVWOX			92	20	0	0	
454	14300			SVWRE			2	1	0	0	
454	14302			DORBB1	I2	jar	11	0	1	8	
454	14302			SVWOX			23	8	0	0	
454	14303			DORBB1	I	jar	70	14	3	32	
454	14303			SVWOX	I12	jar	240	0	7	100	
454	14303			SVWOX	IV	bowl	36	1	2	17	
454	14303			BATAM			98	1	0	0	
454	14303			LEZSA			2	1	0	0	
454	14303			SVWOX			1654	90	0	0	x1 base 2+ holes
454	14303			SVWOX			44	2	0	0	
454	14303			SVWRE			27	3	0	0	

Plot	Context	Cut	Type	Fabric	Form	Type	Wt	No	Rim	Eve	Comment
454	14311			SVWOX			94	1	0	0	
496	50306	50305	ditch	SVWOX	I12	jar	144	21	2	30	
496	50306	50305	ditch	GROG			183	6	0	0	
496	50306	50305	ditch	MALREA			25	1	0	0	
496	50306	50305	ditch	MALREB	I	jar	21	15	1	3	
496	50306	50305	ditch	MALREB			128	23	3	17	
496	50306	50305	ditch	SVWEA			9	1	0	0	
496	50307	50305	ditch	MALREA			18	7	0	0	
496	50307	50305	ditch	MALREA			29	0	2	10	
496	50307	50305	ditch	MALREA	ITUB	jar	29	0	1	8	
496	50307	50305	ditch	MALREA			400	27	0	0	
496	50307	50305	ditch	MALREA	X	base	102	7	0	0	
496	50307	50305	ditch	MALREB	I	jar	21	6	1	2	
496	50307	50305	ditch	MALREB	I	jar	8	0	1	5	
496	50308	50305	ditch	MALREA	ITUB	jar	74	1	2	15	
496	90000	0	topsoil	SVWOX	I12/1	jar	4	0	1	8	
496	90000	0	topsoil	MALREA	I tub	jar	17	1	1	5	
496	90019	90020	pit	MALREA	I	jar	38	1	1	4	
496	90023	90035	pit upper	MALREA			10	3	0	0	
496	90023	90035	pit upper	MALREA			21	2	0	0	
496	90023	90035	pit upper	MALREB			1	1	0	0	
496	90023	90035	pit upper	MALREB			6	1	0	0	
496	90023	90035	pit upper	SVWEA			1	1	0	0	grog tempered
496	90023	90035	pit upper	SVWOX			5	1	0	0	
496	90023	90035	pit upper	SVWRE			1	1	0	0	
496	90024	90035	pit	GR			17	1	0	0	Glos TF 2C
496	90024	90035	pit	SVWRE			13	3	0	0	
496	90025	90035	pit	MALREA	I tub	jar	99	5	1	11	
496	90025	90035	pit	MALREB			3	2	0	0	
496	90026	90035	pit	MALREA	I tub	jar	68	6	1	13	
496	90026	90035	pit	SVWEA	I2	jar	10	0	1	7	early variant
496	90026	90035	pit	MALREB			47	18	0	0	
496	90026	90035	pit	SVWOX			54	6	0	0	
496	90027	90035	pit	MALREB	I	jar	51	6	1	15	
496	90027	90035	pit	MALREB			19	15	0	0	
496	90028	90035	pit	MALREB	I	jar	30	3	1	10	
496	90028	90035	pit	SVWOX			15	1	0	0	
496	90029	90035	pit primary	MALREB	I	jar	290	22	2	15	
496	90029	90035	pit primary	MALREB	I	jar	38	0	2	13	

Plot	Context	Cut	Type	Fabric	Form	Type	Wt	No	Rim	Eve	Comment
496	90029	90035	pit primary	MALREB	I	jar	357	150	1	5	
496	90029	90035	pit primary	MALREA	I tub	jar	208	5	2	13	handle spr
496	90029	90035	pit primary	MALREB	I12/3	jar	109	0	6	35	
496	90029	90035	pit primary	MALREB	I2	jar	30	0	3	32	
496	90029	90035	pit primary	MALREA			41	4	0	0	
562	56202			SVWOX	I2	jar	956	41	4	100	
562	56202			SVWOX	I2	jar	38	8	1	19	
562	56202			LEZSA			38	1	0	0	rouletted wreath
111A	74003	0	subsoil	SVWOX			10	1	0	0	
111A	74004	0	gravel	SVWOX			2	1	0	0	
111A	74015	0	subsoil	OO			1	1	0	0	nd/?preh
111A	74008	74007	ditch recut	SVWOX			2	1	0	0	
111A	74011	74012	ditch	SVWRE			6	2	0	0	
111A	74002	74025	ditch recut	SVWOX			2	3	0	0	
430A	86100	0	topsoil	DORBB1	I	jar	97	2	1	20	acute
430A	86100	0	topsoil	SVWRE	I2	jar	128	20	3	20	
430A	86100	0	topsoil	SVWOX	IV	bowl	13	0	1	13	
430A	86100	0	topsoil	SVWOX	IVB	bowl	11	0	1	5	anvil rim
430A	86100	0	topsoil	SVWOX			58	3	0	0	
430A	86100	0	topsoil	SVWOX			308	42	0	0	
430A	86104	0	us	SVWRE			4	1	0	0	
430A	86157	0	wall	DORBB1	I	jar	22	1	1	10	wavy line neck
430A	86157	0	wall	MALREB	I12/3	jar	108	16	2	14	
430A	86157	0	wall	SVWRE	I2	jar	133	5	1	10	
430A	86157	0	wall	GR	I3	jar	216	23	1	7	Glos Tf 2A
430A	86157	0	wall	GR	I3	jar	40	0	2	12	Glos TF2A
430A	86157	0	wall	SVWOX	IV	bowl	50	0	1	7	anvil rim
430A	86157	0	wall	SVWOX	IV	bowl	99	0	1	10	anvil rim
430A	86157	0	wall	SVWOX	IV	bowl	119	0	2	25	segmented, profile *
430A	86157	0	wall	SVWOX	XIV	tankard	10	0	1	7	
430A	86157	0	wall	BATAM			4	1	0	0	
430A	86157	0	wall	GR			33	12	0	0	Glos TF2A
430A	86157	0	wall	MAL RO			190	8	0	0	Glos TF 19
430A	86157	0	wall	MALREB			19	11	0	0	
430A	86157	0	wall	OO			10	20	0	0	
430A	86157	0	wall	SVWOX			388	12	0	0	
430A	86111	86110	ditch	SVWOX	XIV	tankard	178	4	1	10	
430A	86111	86110	ditch	SVWRE	XIV	tankard	15	1	3	16	
430A	86111	86110	ditch	VERWHM			99	1	0	0	

Plot	Context	Cut	Type	Fabric	Form	Type	Wt	No	Rim	Eve	Comment
430A	86115	86114	ditch terminus	MALREB	I	jar	334	25	4	31	
430A	86115	86114	ditch terminus	MALREB	I	jar	196	33	4	17	
430A	86115	86114	ditch terminus	SVWOX	I2	jar	499	4	5	100	* ?profile; holed base
430A	86115	86114	ditch terminus	GR	IV2	bowl	789	47	6	100	* profile, 1 vess
430A	86115	86114	ditch terminus	SVWOX	XIV	tankard	115	1	1	15	*
430A	86115	86114	ditch terminus	SVWOX			380	29	0	0	
430A	86115	86114	ditch terminus	SVWRE			18	1	0	0	
430A	86117	86116	ditch terminus	MALREB	I	jar	525	54	3	50	
430A	86117	86116	ditch terminus	MAL RO	I11	jar	50	2	1	16	Glos TF 19
430A	86117	86116	ditch terminus	SVWOX	I11	jar	0	0	1	15	
430A	86117	86116	ditch terminus	SVWOX	I2	jar	178	0	1	33	
430A	86117	86116	ditch terminus	SVWOX	I2	jar	1436	30	1	23	some sherds glued
430A	86117	86116	ditch terminus	MALREA			12	6	0	0	
430A	86117	86116	ditch terminus	SVWOX			244	10	0	0	
430A	86117	86116	ditch terminus	SVWOX			286	2	0	0	x3 postfir small base holes
430A	86121	86120	ditch upper	MALREA			24	19	0	0	
430A	86121	86120	ditch upper	SVWOX			20	2	0	0	
430A	86121	86120	ditch upper	SVWRE			4	2	0	0	
430A	86127	86126	ditch	LGFSA	29	bowl	36	8	1	8	very friable
430A	86127	86126	ditch	MALREB	I	jar	904	140	8	47	
430A	86127	86126	ditch	SVWOX	XIV	tankard	9	0	1	7	
430A	86127	86126	ditch	BW			3	1	0	0	Wilts -type
430A	86127	86126	ditch	GR			66	1	0	0	Glos TF2C
430A	86127	86126	ditch	SVWOX			428	17	0	0	
430A	86128	86129	ditch	SVWOX	I3/11	jar	119	7	1	16	
430A	86128	86129	ditch	GR			2	1	0	0	Glos TF 2C
430A	86128	86129	ditch	GREY			44	3	0	0	
430A	86128	86129	ditch	MALREB			10	4	0	0	
430A	86128	86129	ditch	MALREB			16	2	0	0	
430A	86128	86129	ditch	SVWOX			3	3	0	0	
430A	86133	86132	ditch	SVWOX			94	3	0	0	
430A	86134	86135	ditch	DORBB1	I2	jar	61	5	1	8	wavy line neck
430A	86134	86135	ditch	SVWOX	I3/11	jar	152	13	1	17	
430A	86134	86135	ditch	SVWOX	IV anvil	bowl	40	0	1	5	
430A	86134	86135	ditch	BATAM			35	1	0	0	
430A	86134	86135	ditch	GR			110	18	0	0	Glos TF2A
430A	86134	86135	ditch	LGFSA			1	2	0	0	
430A	86134	86135	ditch	SVWOX			5	4	0	0	
430A	86141	86140	ditch	VERWHM	IX	mortaria	414	0	1	18	

Plot	Context	Cut	Type	Fabric	Form	Type	Wt	No	Rim	Eve	Comment
430A	86141	86140	ditch	MALREB			5	5	0	0	
430A	86147	86146	ditch	DORBB1			7	3	0	0	
430A	86147	86146	ditch	MALREB			25	2	0	0	
430A	86147	86146	ditch	SVWOX			61	8	0	0	
430A	86147	86146	ditch	MALREA	I	jar	20	1	2	13	
430A	86148	86149	ditch	LGFSA	18	dish	4	0	1	5	
430A	86148	86149	ditch	SVWOX	I2	jar	1110	7	1	100	*
430A	86148	86149	ditch	DORBB1	IVB	bowl	105	3	2	19	PROFILE
430A	86148	86149	ditch	SVWRE			36	1	0	0	
430A	86170	86171	ditch	SVWRE	I2/6	jar	18	0	1	7	
430A	86170	86171	ditch	SVWOX			7	1	0	0	
430A	86173	86172	ditch	SVWRE	I2	jar	28	0	2	45	warped
430A	86173	86172	ditch	MAL RO	I11	jar	70	0	3	36	Glos TF 19
430A	86173	86172	ditch	SVWRE	I11	jar	294	26	3	46	
430A	86173	86172	ditch	DORBB1	I2	jar	60	0	2	23	
430A	86173	86172	ditch	DORBB1	I2	jar	18	0	1	7	
430A	86173	86172	ditch	DORBB1	I2	jar	13	0	1	10	
430A	86173	86172	ditch	DORBB1	I2	jar	308	49	3	15	
430A	86173	86172	ditch	DORBB1	I2	jar	25	0	1	8	wavy line neck
430A	86173	86172	ditch	DORBB1	I2	jar	10	0	1	7	wavy line neck
430A	86173	86172	ditch	DORBB1	I2	jar	48	0	2	15	wavy line neck
430A	86173	86172	ditch	GREY	I2	jar	6	0	1	15	
430A	86173	86172	ditch	GREY	I2	jar	10	0	1	13	
430A	86173	86172	ditch	MAL RO	I2	jar	310	34	3	43	Glos TF 19
430A	86173	86172	ditch	SVWRE	I2	jar	100	0	2	65	
430A	86173	86172	ditch	SVWOX	IV	bowl	153	0	4	37	
430A	86173	86172	ditch	SVWOX	IV anvil	bowl	20	0	1	7	
430A	86173	86172	ditch	SVWOX	IV anvil	bowl	40	0	3	16	
430A	86173	86172	ditch	SVWOX	IV s-shape	bowl	5	0	1	12	
430A	86173	86172	ditch	SVWOX	XIV	tankard	85	0	2	52	
430A	86173	86172	ditch	SVWOX	XIV	tankard	28	0	1	15	
430A	86173	86172	ditch	SVWOX	XIV	tankard	13	0	2	10	
430A	86173	86172	ditch	DORBB1			80	9	0	0	
430A	86173	86172	ditch	DORBB1			73	41	0	0	
430A	86173	86172	ditch	MAL RO			21	11	0	0	Glos TF 19
430A	86173	86172	ditch	MAL RO			65	9	0	0	Glos TF 19
430A	86173	86172	ditch	SVWOX			675	49	0	0	
430A	86173	86172	ditch	SVWOX			130	98	0	0	
430A	86173	86172	ditch	SVWRE			110	12	0	0	

Plot	Context	Cut	Type	Fabric	Form	Type	Wt	No	Rim	Eve	Comment
430A	86173	86172	ditch	SVWRE			13	15	0	0	
430A	86175	86176	ditch terminus	MALREB			20	7	0	0	
430B	86101	0	subsoil	SVWOX	I3	jar	722	59	1	7	
430B	86101	0	subsoil	DORBB1			41	23	0	0	
430B	86193	86194	ditch	SVWOX	I11	jar	143	0	3	63	
430B	86193	86194	ditch	SVWOX	I11	jar	15	0	1	13	
430B	86193	86194	ditch	SVWOX	XIV	tankard	256	36	1	20	
430B	86193	86194	ditch	BB1COPY			5	1	0	0	
430B	86193	86194	ditch	DORBB1			3	1	0	0	
430B	86193	86194	ditch	LEZSA			34	1	0	0	
430B	86193	86194	ditch	MAL RO			37	2	0	0	Glos TF 19
430B	86193	86194	ditch	SVWOX			5	4	0	0	
430B	86193	86194	ditch	SVWRE			13	9	0	0	
430B	86193	86194	ditch	SVWRE			3	1	0	0	
430B	86201	86200	ditch	SVWOX	XIV	tankard	591	30	1	15	
430B	86211	86210	ditch	SOWBB1	G31	jar	58	0	3	35	
430B	86211	86210	ditch	MALREA	I	jar	20	1	1	7	
430B	86211	86210	ditch	SVWOX	I	jar	9	0	1	5	
430B	86211	86210	ditch	SVWOX	I11	jar	19	0	1	20	
430B	86211	86210	ditch	SVWOX	I11	jar	169	0	4	80	
430B	86211	86210	ditch	SVWOX	I11	jar	109	0	1	12	
430B	86211	86210	ditch	SVWOX	I11/12	jar	67	0	2	35	
430B	86211	86210	ditch	SVWOX	I12	jar	23	0	1	12	
430B	86211	86210	ditch	DORBB1	I2	jar	820	48	3	35	ACUTE
430B	86211	86210	ditch	SVWOX	I2	jar	76	0	2	8	
430B	86211	86210	ditch	SVWOX	I2	jar	14	0	1	5	
430B	86211	86210	ditch	SVWOX	I4	storage jar	180	0	1	7	
430B	86211	86210	ditch	SVWOX	I7	jar	23	0	1	5	
430B	86211	86210	ditch	SVWOX	I7	jar	28	0	1	2	
430B	86211	86210	ditch	SVWOX	IHOOK	jar	86	0	3	34	
430B	86211	86210	ditch	SVWOX	IV	bowl	10	0	1	7	
430B	86211	86210	ditch	SVWOX	I	jar	19	0	1	12	narrow necked
430B	86211	86210	ditch	SVWOX	I	jar	18	0	1	18	narrow necked
430B	86211	86210	ditch	SVWOX	IV4hemi	bowl	10	0	1	1	
430B	86211	86210	ditch	WSOXIDF	VIIbif	flaon	63	0	1	25	powdery oxidised, cupped rim
430B	86211	86210	ditch	SVWOX	XII	jug	9	0	1	5	
430B	86211	86210	ditch	SVWOX	XII?	jug	10	0	1	8	handled
430B	86211	86210	ditch	SVWOX	XIIh	jug	87	0	3	40	
430B	86211	86210	ditch	SVWOX	XIIh	jug	16	0	1	7	

Plot	Context	Cut	Type	Fabric	Form	Type	Wt	No	Rim	Eve	Comment
430B	86211	86210	ditch	SVWOX	XIV	tankard	20	0	1	15	
430B	86211	86210	ditch	SVWOX	XIV	tankard	70	0	1	32	
430B	86211	86210	ditch	DORBB1			20	15	0	0	
430B	86211	86210	ditch	GREY			12	1	0	0	
430B	86211	86210	ditch	MALREA			2	1	0	0	
430B	86211	86210	ditch	OO			26	19	0	0	
430B	86211	86210	ditch	SVWOX			65	38	0	0	
430B	86211	86210	ditch	SVWOX			1301	50	0	0	
430B	86211	86210	ditch	SVWOX			481	65	0	0	
430B	86211	86210	ditch	SVWRE			406	12	0	0	
430B	86217	86216	ditch	DORBB1			13	2	0	0	
430B	86217	86216	ditch	SVWOX			42	1	0	0	
430B	86217	86216	ditch	SVWOX			9	5	0	0	
430B	86217	86216	ditch	SVWRE			9	3	0	0	
430B	86219	86218	ditch	MALREA	I	jar	42	2	1	6	
430B	86219	86218	ditch	SVWOX	I	jar	90	2	1	7	
430B	86219	86218	ditch	DORBB1	I2	jar	80	6	1	18	
430B	86220	86221	ditch	LGFSA	18	dish	13	0	1	10	
430B	86220	86221	ditch	DORBB1	G31	jar	96	17	2	17	
430B	86220	86221	ditch	SVWOX	I11	jar	58	0	1	25	
430B	86220	86221	ditch	SVWOX	I11	jar	50	0	1	10	
430B	86220	86221	ditch	SVWOX			283	12	0	0	
430B	86220	86221	ditch	SVWRE			5	1	0	0	
430B	86223	86222	ditch	BB1COPY	I	jar	97	1	4	40	*miniature jar; acute
430B	86223	86222	ditch	SVWOX	XIV	tankard	34	8	2	15	
430B	86225	86224	ditch	DORBB1	I	jar	132	13	2	28	
430B	86225	86224	ditch	SVWOX	I	jar	74	0	1	15	
430B	86225	86224	ditch	SVWOX	IV	bowl	24	0	1	15	
430B	86225	86224	ditch	SVWOX			2060	40	0	0	sev TF23 sherds
430B	86225	86224	ditch	SVWRE			20	1	0	0	
430B	86227	86226	ditch	SVWRE	I	jar	64	5	3	37	
430B	86227	86226	ditch	LEZSA			77	1	0	0	bkn eroded stamp
430B	86227	86226	ditch	SVWOX			786	36	0	0	
430B	86228	86229	ditch	SVWOX			43	2	0	0	
430B	86228	86229	ditch	DORBB1			12	10	0	0	acute
430B	86228	86229	ditch	SVWRE			60	8	0	0	
430B	86231	86232	ditch	SVWOX	I2	jar	55	0	1	10	
430B	86231	86232	ditch	GR	I3	jar	16	0	1	7	Glos TF2A
430B	86231	86232	ditch	SVWOX	XIV2	tankard	64	0	4	37	

Plot	Context	Cut	Type	Fabric	Form	Type	Wt	No	Rim	Eve	Comment
430B	86231	86232	ditch	GR			12	7	0	0	Glos TF2A
430B	86231	86232	ditch	SVWOX			342	27	0	0	
430B	86231	86232	ditch	SVWRE			10	7	0	0	
430B	86240	86239	pit	LEZSA	31	dish	10	0	1	8	
430B	86240	86239	pit	LEZSA	31	dish	55	1	1	15	
430B	86240	86239	pit	DORBB1	I	jar	370	14	3	24	acute
430B	86240	86239	pit	DORBB1	I/mug	mug	22	0	1	12	handled
430B	86240	86239	pit	SVWOX	I11	jar	24	0	1	22	
430B	86240	86239	pit	SVWOX	I11	jar	27	0	1	7	
430B	86240	86239	pit	SVWOX	I11	jar	12	0	1	7	
430B	86240	86239	pit	SVWOX	I12	jar	74	0	2	28	
430B	86240	86239	pit	SVWOX	I2	jar	12	0	1	5	
430B	86240	86239	pit	SVWOX	I7	jar	19	0	1	6	
430B	86240	86239	pit	SVWOX	IV	bowl	150	0	3	28	
430B	86240	86239	pit	SVWOX	IV	bowl	138	0	2	25	
430B	86240	86239	pit	SVWOX	IV	bowl	14	0	1	7	
430B	86240	86239	pit	SVWOX	IV	bowl	61	0	2	12	
430B	86240	86239	pit	SVWOX	IVB	bowl	27	0	1	15	
430B	86240	86239	pit	SVWOX	IV flange	bowl	18	0	1	12	
430B	86240	86239	pit	SVWOX	IV4 hemi	bowl	53	0	2	17	
430B	86240	86239	pit	SVWOX	XI	lid	12	0	1	5	
430B	86240	86239	pit	SVWOX	XII	jug	46	0	1	16	
430B	86240	86239	pit	SVWOX	XIV	tankard	58	0	1	6	
430B	86240	86239	pit	SVWOX	XIV	tankard	8	0	1	15	
430B	86240	86239	pit	SVWOX	XIV	tankard	70	0	1	21	
430B	86240	86239	pit	SVWOX	XIV2	tankard	101	0	1	42	
430B	86240	86239	pit	SVWOX	XIV2	tankard	85	0	1	32	
430B	86240	86239	pit	DORBB1			40	14	0	0	
430B	86240	86239	pit	MALREA			32	4	0	0	
430B	86240	86239	pit	OO			10	18	0	0	
430B	86240	86239	pit	SVWOX			1598	106	0	0	
430B	86240	86239	pit	SVWOX			1432	79	0	0	
430B	86240	86239	pit	SVWRE			50	6	0	0	
430B	86240	86239	pit	SVWRE			24	1	0	0	
430B	86245	86239	pit	LGFSA	18R	dish	120	0	1	12	lead rivet repair
430B	86245	86239	pit	SVWOX	I	jar	16	0	1	15	
430B	86245	86239	pit	SVWOX	I	jar	34	0	1	12	
430B	86245	86239	pit	DORBB1	I2	jar	274	9	2	37	acute
430B	86245	86239	pit	SVWOX	I2	jar	16	0	1	12	

Plot	Context	Cut	Type	Fabric	Form	Type	Wt	No	Rim	Eve	Comment
430B	86245	86239	pit	SVWOX	I2	jar	11	0	1	4	
430B	86245	86239	pit	SVWOX	IV	bowl	45	0	1	16	*
430B	86245	86239	pit	SVWOX	IV-S-shape	bowl	70	0	1	12	
430B	86245	86239	pit	SVWOX	XIIh	jug	76	0	1	22	*
430B	86245	86239	pit	SVWOX	XIV	tankard	54	0	1	12	
430B	86245	86239	pit	SVWOX	XIV	tankard	10	0	1	2	
430B	86245	86239	pit	DORBB1			32	2	0	0	
430B	86245	86239	pit	MALREV			1	1	0	0	
430B	86245	86239	pit	SVWOX			1266	64	0	0	sev lge jar sherds
430B	86245	86239	pit	SVWOX			94	47	0	0	
430B	86245	86239	pit	SVWRE			126	4	0	0	
430B	86242	86241	ditch	SVWOX			65	28	0	0	
430B	86243	86244	ditch	SVWOX	I12	jar	138	5	2	20	
430B	86243	86244	ditch	OO			1	2	0	0	
430B	86251	86252	ditch	MALREA	I tub	jar	247	53	6	48	
430B	86251	86252	ditch	SVWOX			3	1	0	0	
430B	86262	86263	ditch	SVWOX	I2	jar	460	18	1	3	
430B	86262	86263	ditch	SVWOX	I2	jar	33	0	2	30	
430B	86262	86263	ditch	SVWRE	I2/11	jar	109	2	3	42	
430B	86262	86263	ditch	SVWOX	XIV	tankard	191	2	1	12	PROFILE*
430B	86262	86263	ditch	DORBB1			138	26	0	0	acute
430B	86262	86263	ditch	OO			13	13	0	0	
430B	86266	86265	ditch	GR			92	13	0	0	Glos TF 2C
430B	86266	86265	ditch	SVWOX			17	3	0	0	
430B	86266	86265	ditch	SVWRE			75	6	0	0	
430C	86174	86270	Pit/bloomery	MALREB	I2	jar	34	7	1	10	
430C	86174	86270	Pit/bloomery	SVWEA			11	5	0	0	early variant, black
Tr 1	50307			SVWRE			8	1	0	0	
Tr2	6419			LEZSA	37dec	bowl	6	1	0	0	
	9014			SVWOX			4	1	0	0	
	50306			SVWOX	I12	jar	144	21	2	30	

Site	Context	Plot	Cut	Type	Fabric	Form	Wt	No	Rim	Eve	Comment
BRT 75	40078	400	40080	ditch	CBM		12	4	0	0	
BRT 75	67005	271	0	stone surface	CBM/FC		4	1	0	0	
BRT 96	67011	271	67008	ditch primary	FC		4	2	0	0	
BRT 96	67011	271	67008	ditch primary	FC		3	1	0	0	
BRT 96	67056	271	0	colluvium	FC		5	3	0	0	
BRT 96	86199	430			FC		6	3	0	0	

BRT 96	85095	454	85096	pit	FC		4	1	0	0	
BRT 96	90029	496	90035	pit primary	FC		2	1	0	0	
BRT 96	67110	271	67102	pit	FC/SVW		5	2	0	0	
BRT 96	85100	454	85099	ditch	FC/SVW		3	1	0	0	
BRT 96	86245	430B	86239	pit	FC/SVW		10	14	0	0	
BRT 75	14237				MED		3	1	0	0	glazed
BRT 75	135000	135			MALVSY		9	0	1	5	Ro or Med
BRT 44	85095	454	85096	pit	SY		22	2	0	0	hm fine sy ?LIA; thickwalled
BRT 44	85095	454	85096	pit	VITRIF		0	1	0	0	frag

Roman pottery – Tirley Feeder Connector

Jane Timby

Introduction

The archaeological work at site TFC 36 resulted in the recovery of a small assemblage of 99 sherds of Roman pottery weighing 627 g. The fragmentation rate is quite high reflected in an overall average sherd weight of 6.3 g, possibly indicative of material that has undergone some ongoing disturbance or a consequence of the soft nature of some of the fabrics.

Roman pottery was recovered from 23 individual contexts; thus the incidence of material by contexts is very low which has clear ramifications on the accuracy of the dating. In the following report, following a statement on the methodology, a brief description is given of the fabrics and associated forms.

Methodology

The pottery was sorted into fabrics based on the type, size and frequency of inclusions and firing colour. Named traded wares were coded using the National Roman reference codes (Tomber and Dore 1998 (=T & D) (see Table 9). The sorted material was quantified by sherd count and weight. Where sherds had evidently broken during or after retrieval these were counted as one. Rim sherds were sparse but were coded according to vessel type. The quantified data was entered onto a MS Excel spreadsheet, a copy of which is deposited with the site archive.

Discussion of fabrics and associated forms

Roman native wares

Malvernian metamorphic ware (T & D 1998, 147, MAL REA). This ware accounts for 1% by sherd count and 1.8 % by weight. Forms: the only featured sherd is from a handmade tubby jar from cxt (5277).

Malvernian limestone-tempered. (Peacock 1967, Group B; MAL REB).
A small group of three sherds contributing 3% by count to the total recovered assemblage. No featured pieces.

Roman: continental imports

Central Gaulish samian (LEZ SA). A small assemblage of three sherds of Central Gaulish samian was recovered indicative of 2nd-century activity.

Roman: regional wares

Midlands pink grog-tempered ware (T & D 1998, 210, PNK GT). A single bodysherd probably from a storage jar was recovered from cxt (5740). These wares were generally in circulation fro the later 2nd century onwards.

Roman wares: local Severn Valley wares

Severn Valley ware (T & D 1998, 148-9, SVW OX). This fabric was by far the commonest accounting for 91.9 % by sherd count, 86.7 by weight of the total assemblage. This includes a single sherd of the reduced greyware version (SVW RE); the rest is oxidised. Forms: the only featured sherds come from two everted rim jars and a tankard.

Discussion

This is a very small assemblage of pottery which collectively seems to suggest activity in the 2nd-3rd centuries. Most of the sherds are unfeatured and come from quite long-lived industries spanning much or all of the Roman period. The absence of any products of the later colour-coated industries would suggest no activity after the mid 3rd century; the latest datable piece being the sherd of PNK GT jar.

References

Peacock, D P S, 1967 *Romano-British production in the Malvern district of Worcestershire*, Trans Worcestershire Archaeol Soc 3rd series, 1, 15-28

Tomber, R, and Dore, J, 1998 *The national Roman fabric reference collection: a handbook*, Museum of London / English Heritage/ British Museum

Table 9: The Roman pottery

	Fabric code	Description	No	% No	Wt	% Wt
Native	MAL RE A	Malvernian Peacock Gp A	1	1.0	11	1.8
	MAL RE B	Malvernian Peacock Gp B	3	3.0	16.5	2.6
Imports	LEZ SA	Central Gaulish samian	3	3.0	38	6.1
Regional	PNK GT	Midlands pink grog tempered ware	1	1.0	18	2.9
Local	SVW OX	Severn Valley ware (oxidised)	90	90.9	536.5	85.6
	SVW RE	Severn Valley ware (reduced)	1	1.0	7	1.1
TOTAL			**99**	**100.0**	**627**	**100.0**

Table 10: Catalogue of Roman pottery

SITE	Context	Feature	Gp	Description	Fabric	Form	Wt	No	Rim	Eve	Comment
TFC 36	5205	5204		ditch fill	MALREB		6	1	0	0	
TFC 36	5227	5226		ditch fill	MALREA	I	11	0	1	7	tubby jar
TFC 36	5235	5234		ditch fill	SVWOX		4	1	0	0	
TFC 36	5237	5236		ditch fill	SVWOX		3	1	0	0	
TFC 36	5241	NA		finds recovery	SVWOX		193	6	0	0	
TFC 36	5248	NA		Colluvium	SVWOX		15	1	0	0	
TFC 36	5261	5262		ditch fill	SVWOX		1	1	0	0	
TFC 36	5266	5265		ditch fill	SVWOX		64	19	0	0	
TFC 36	5277	5278		ditch fill	LEZSA		30	1	0	0	
TFC 36	5288	5290		ditch fill	SVWOX		1	1	0	0	
TFC 36	5292	5293		trackway fill	LEZSA		6	1	0	0	
TFC 36	5294	5295		pit fill	SVWOX		11	1	0	0	
TFC 36	5299				SVWOX		4	2	0	0	

SITE	Context	Feature	Gp	Description	Fabric	Form	Wt	No	Rim	Eve	Comment
TFC 36	5301				SVWOX	XIV	15	30	2	21	
TFC 36	5308				SVWOX		80	3	0	0	
TFC 36	5335	5336		pit fill	MALREB		10	1	0	0	
TFC 36	5345	5346		ditch fill	SVWOX	I2	76	2	4	23	
TFC 36	5383	5382		ditch fill	SVWOX		7	3	0	0	
TFC 36	5388	5389		hollow way fill	LEZSA		2	1	0	0	
TFC 36	5388	5389		hollow way fill	SVWOX	I2	58	5	2	7	WM
TFC 36	5388	5389		hollow way fill	SVWRE		7	1	0	0	
TFC 36	5701	5700		gulley fill	MALREB		0.5	1	0	0	
TFC 36	5710	5709		ditch fill	SVWOX		4	5	0	0	
TFC 36	5716	5717		pit fill	SVWOX		0.5	1	0	0	PLOT 2
TFC 36	5740	5741		ditch fill	PNKGT		18	1	0	0	
TFC 36	5786				TF52		0.5	1	0	0	
TOTAL							**293.5**	**58**	**8**	**51**	

Faunal Remains – Brecon to Tirley Pipeline

By Jennifer Wood BSc MA MIFA

INTRODUCTION

A total of 589 (2300g) refitted fragments of bone were recovered by hand during archaeological works undertaken by Network Archaeology Ltd on behalf of Murphy Pipelines Ltd for National Grid, along the Brecon to Tirley natural gas pipeline. A further 232 (19g) fragments of bone were recovered from sieved deposits.
The remains were recovered from a total of 13 individual plots along the route of the gas pipeline; the assemblages are quantified by plot within Table 11. The remains were recovered from a series of different deposits.

Table 11 Quantification of Hand and Sieved bone assemblages, by Plot

Plot	49	108	110	160	271	331	400	430	449	545	464	496	Total
Hand Collected N=	3	1	1	207	163	89	58	3	5	18	21	20	589
Weight (g)	27	5	0	7	1775	226	51	4	162	6	2	35	2300
Sieve Collected N=					25	180						27	232
Weight (g)					4	14						1	19

The assemblages from Plots 49, 108 and 110 were all recovered from post-medieval/undated topsoil, sub-soil, colluvium and cobbled surfaces. Whilst the assemblage from Plot 449 was recovered from a demolition deposit dated from the 17th century and the material from Plot 464 was recovered from a Prehistoric pit/posthole. The remaining assemblages were predominantly recovered from ditches and pits; the majority of which were dated from the late Iron Age- Romano-British periods.

METHODOLOGY

Identification of the bone was undertaken with access to a reference collection and published guides. All animal remains were counted and weighed, and where possible identified to species, element, side and zone (Serjeantson 1996). Also fusion data, butchery marks (Binford 1981), gnawing, burning and pathological changes were noted when present. Ribs and vertebrae were only recorded to species when they were substantially complete and could accurately be identified. Undiagnostic bones were recorded as being: micro (rodent size), small (rabbit size), medium (sheep size) or large (cattle size). The separation of sheep and goat bones was done using the criteria of Boessneck (1969) and Prummel and Frisch (1986), in addition to the use of the reference material. Where distinctions could not be made, the bone was recorded as sheep/goat (S/G).

The condition of the bone was graded using the criteria stipulated by Lyman (1996). Grade 0 being the best preserved bone and grade 5 indicating that the bone had suffered such structural and attritional damage as to make it unrecognisable.

Quantification of species was carried out using the total fragment count, in which the total number of fragments of bone and teeth was calculated for each taxon. Where fresh breaks were noted, fragments were refitted and counted as one.
Tooth eruption and wear stages were measured using a combination of Halstead (1985), Grant (1982) and Levine (1982), and fusion data was analysed according to Silver (1969). Measurements of adult, that is, fully fused bones were taken according to the methods of von den Driesch (1976), with asterisked (*) measurements indicating bones that were reconstructed or had slight abrasion of the surface.

RESULTS

Condition of Material

The overall condition of the hand collected bone was moderate to poor, averaging between grades 3 and 4 on the Lyman Criteria. For the individual plots, the assemblages for 49, 110, 331, 449 and 496 are predominantly of moderate overall condition. Plots 160, 271, 400, 454 and 464 are all of a poorer condition.
The remains from the sieve collected assemblage were of an overall moderate condition, which may be attributed to most of the bone being burnt.

Table 12 Number of fragments by Condition Grade Score (Lyman, 1996), Hand Collected

	Plot												
Condition	**49**	**108**	**110**	**160**	**271**	**331**	**400**	**430**	**449**	**454**	**464**	**496**	**Total**
1		1											1
2	1					1	1		1			2	6
3	1		1	2	20	81	1		2			18	126
4	1			205	140	7	56	3	2	18	21		453
5					3								3
N=	3	1	1	207	163	89	58	3	5	18	21	20	589

Table 13 Number of fragments by Condition Grade Score (Lyman, 1996), Sieve Collected

	Plot			
Condition	**271**	**331**	**496**	**Total**
2		1		1
3	20	179	25	224
4			2	2
5	5			5
N=	25	180	27	232

Due to the small size of the assemblages and the moderate to poor condition of the remains the number of remains that could be scored for pathology, butchery, gnawing, measurements and tooth wear age scores were minimal. The assemblage was very fragmentary, which is illustrated by the lack of measurable bones identified within the assemblage. However, a large number of the bone fragments (47%) were recorded as burnt. Burnt remains are slightly more resistant to decay and therefore are more likely to survive in poor conditions.

Burning

The burnt assemblages were recovered from Plots 110, 160, 271, 331, 430, 454, 464 and 496. Sixty-six percent of the remains were unidentifiable to species or taxa. The largest assemblage of burnt bone was recovered from Plot 331 with the majority

recovered from the late Iron Age-1st century ditch [75081]. The burnt bone is probably a result of the disposal of hearth sweepings and incidental burning events.
Butchery
Two fragments of cattle bone recovered from undated ditch [75069] from Plot 331 and 17th century demolition layer (449), display evidence of butchery. The cut marks are consistent with butchery practices associated with jointing the carcass and meat removal.

Animal Burial [67004], Plot 271

A relatively complete cattle burial in poor condition was recovered from Plot 271. The excavator noted that the animal's head was placed on top of the carcase and indicated that it may have been removed prior to burial. No evidence of butchery was noted on the remains, although this maybe a product of poor preservation. It is highly possible that the animal was skinned before burial, which often would result in the removal of the skull.

Species Representation

Tables 14 and 15 summarises the identified taxa, by plot and by date, for the hand and sieve collected assemblages.

As can be seen from the two tables, very little of the animal bone assemblage is identifiable to species. Cattle remains was the most abundant species identified within the assemblage, although this number does include a single undated cattle burial recovered from Plot 271. Sheep/goat were the next most abundant species identified, followed by pig, with single fragments of goose (Anser sp.) and red deer (Cervus Elaphus) were also identified.

When examined by the individual plots, the assemblages of identifiable bone are too small to provide any meaningful data on animal husbandry and utilisation, save the presence of the species on site.

DISCUSSION

The animal bone recovered from the route of the Brecon to Tirley gas pipeline is very small in size considering the area traversed, while the condition of the assemblage is moderate to poor with a high frequency of fragmentation. There is a distinct lack of animal bone data for the Brecon area. The preservation of this assemblage would suggest that the ground conditions are too acidic to allow for the survival of the majority of remains, with the exception of burnt material, which appears to be slightly more resistant to decay in these circumstances.

Due to the given size and state of the assemblage, it is impossible to ascertain underlying animal husbandry and utilisation practices for the various sites, with the exception that the identified species were present on site.

BIBLIOGRAPHY

Binford, L., 1981, *Ancient Men and Modern Myths*, New York: Academic Press.

Boessneck, J, 1969 *Osteological Differences in Sheep (Ovis aries Linné) and Goat (Capra hircus Linné),* in D Brothwell and E Higgs (eds) *Science in Archaeology*, Thames and Hudson, 331-358 von den Driesch, A, 1976 *A Guide to the Measurement of Animal Bones from Archaeological Sites*, Peabody Museum

Grant, A, 1982 '*The Use of Tooth Wear as a Guide to the Age of Domestic Ungulates'*, in B Wilson et al. *Ageing and Sexing Animal Bones from Archaeological Sites*, BAR British Series 109, 91-108, Oxford

Halstead, P, 1985 *A Study of Mandibular Teeth from Romano-British Contexts at Maxey,* in F Pryor, *Archaeology and Environment in the Lower Welland Valley*, East Anglian Archaeology Report 27:219-224

Levine, M A, 1982 *The Use of Crown Height Measurements and Eruption-Wear Sequences to Age Horse Teeth*. In Wilson, B et al. *Ageing and Sexing Animal Bones from Archaeological Sites*. BAR British Series 109. 223 - 250

Lyman, R L, 1996 *Vertebrate Taphonomy*, Cambridge Manuals in Archaeology, Cambridge University Press, Cambridge

Prummel, W and Frisch, H-J, 1986 *A Guide for the distinction of species, sex and body size in bones of sheep and goat*, Journal of Archaeological Science XIII., 567–77

Serjeantson, D., 1996: '*The animal bones' in Needham S. and Spence A. Refuse and Disposal at Area 16 East Runnymede. Runnymede Bridge Research Excavations*, Volume 2 (London, British Museum Press) 194-222

Silver, I. A., 1969, `*The Ageing of Domestic Animals´*, in Brothwell, D. and Higgs,E.S., *Science in Archaeology* (Thames and Hudson) 283

Table 14 Number of Taxa Identified from the Hand Collected Assemblage, by Plot and Phase

	Plot													
	49	108	110	160			271				331			400
Taxon	Post Medieval	Undated	Undated	2nd Century +	Late Iron Age- 1st Century	Romano-British	Late 2nd- 3rd Century	LIA or Earlier	Romano-British	Undated	Late Iron Age- 1st Century	1st Century- 2nd Century	Undated	Late Iron Age- 1st Century
Cattle	1									26	3	1	2	1
Sheep/Goat	1	1								3	1	1	2	
Pig									1					
Domestic Goose	1													
Red Deer										1				
Large Mammal										10	10			1
Medium Mammal			1	1			1	15		1	9	1		11
Unidentified					6	200		4	1	100	59			45
N=	3	1	1	1	6	200	1	19	2	141	82	3	4	58

	Plot									
	430	430	449	454		464	496			
Taxon	2nd Century	2nd Century	17th Century +	2nd Century	Romano-British	Prehistoric	Late Iron Age	Iron Age- 1st Century	Post Medieval	Total
Cattle	1	1	2							38
Sheep/Goat			1					1		11
Pig				1					1	3
Domestic Goose										1
Red Deer										1
Large Mammal								3		25
Medium Mammal			1				2	12		55
Unidentified			1		17	21		1		455
N=	1	1	5	1	17	21	2	17	1	589

Table 15 Number of Taxa Identified from the Sieve Collected Assemblage, by Plot and Phase

	Plot							
	271		331			496		Total
Taxon	Romano- British	Undated	1st-2nd Century	Iron Age- 1st Century	Undated	Iron Age- 1st Century	Undated	
Sheep/Goat				8				8
Pig	1			1				2
Large Mammal			1					1
Medium Mammal	5	8		29	25	2		69
Unidentified	6	5	21	95		11	14	152
N=	12	13	22	133	25	13	14	232

Key:

Codes and references used in cataloguing animal bone

Taxon: Species, family group or size category.
Non-species specific codes: -
: Equid- Horse Family
: Gadidae- Cod Family
: Passer- Passerine, Small songbirds i.e. Sparrow or Finches
: Turdid- Turdidae, Blackbird/Thrush family
: Corvid- Covidae, Crow family i.e. Crow, Rook or Jackdaw
: Galliform- Fowl or Pheasant
: Large Mammal – Cattle, Horse, Red Deer size
: Medium Mammal- Sheep/Goat, Pig, Dog, Roe Deer size
: Small Mammal- Cat, Rabbit size
: Micro Mammal- Mouse sized
: Unidentified- Not identified to species

Element: Skeletal element represented.
: Unidentified- Not identified to element

Side: L-Left, R- Right, B- Both

Zones: Records presence/absence of individual areas of the bone. Based on Zone illustrations in Serjeantson, D, 1996 The Animal Bones, in Refuse and Disposal at Area 16, East Runnymede: Runnymede Bridge Research Excavations, Vol. 2, (eds) E S Needham and T Spence, British Museum Press, London.

Prox & Dist: Fusion of proximal and distal epiphyses
: X- Not present, F- Fused, U- Unfused, B- Unfused diaphysis and epiphysis present, V- Fusion Line visible.

Age Range: Age range based on age at fusion. Based on Silver, I, A, 1969, The Ageing of Domestic Animals, in D. Brothwell and E.S. Higgs, Science in Archaeology, Thames and Hudson.

Path: Presence of pathology, details in notes column.

Butch: Presence of butchery, details in notes column.

Burnt: Presence of burning, details in notes column.

Gnaw: Presence of gnawing, details in notes column.

Worked: Fragment shows evidence of working, details in the notes column.

Fresh Break: Fresh break noted, fragments re-fitted as one bone.

Associated: Articulating or adjoining bones.

Measured: Measurements taken as according to Von den Driesch, A, 1976 A Guide to the Measurement of Animal Bones from Archaeological Sites, Peabody Museum.

Tooth Wear: Tooth wear score for aging data, taken as according to:

- Grant, A, 1982 'The Use of Tooth Wear as a Guide to the Age of Domestic Ungulates', in B Wilson et al. Ageing and Sexing Animal Bones from Archaeological Sites, BAR British Series 109, 91-108, Oxford

- Halstead, P, 1985 A Study of Mandibular Teeth from Romano-British Contexts at Maxey, in F Pryor, Archaeology and Environment in the Lower Welland Valley, East Anglian Archaeology Report 27:219-224

- Levine, M A, 1982 The Use of Crown Height Measurements and Eruption-Wear Sequences to Age Horse Teeth. In Wilson, B *et al*. Ageing and Sexing Animal Bones from Archaeological Sites. BAR British Series 109. 223 – 250

Surface: Taphonomies noted on the bone surface:

W- Weathered
A- Abraded
R- Rootlet etched
D- Chemical etching from digestion

Condition: Grades 0-5, where 0 = pristine and 5= indicating that the bone had suffered such structural and attritional damage as to make it unrecognisable. Based on Lyman, R L, 1996 Vertebrate Taphonomy, Cambridge Manuals in Archaeology, Cambridge University Press, Cambridge

No.: Number of individual bones/fragments

(g): Weight in grams

Notes: Notes on observed taphonomies, differences and associations.

Table 16 Catalogue of animal bone

Plot	Ctxt No	Cut	Sample No	Phase	Feature	Taxon	Element	Side	Z1	Z2	Z3	Z4	Z5	Z6	Z7	Z8	Prox	Dist	Path	Butch	Burnt	Gnaw	Fresh Break	Associated	Measured	Tooth Wear	Surface	Condition	No	(g)	Notes
49	49028	49028	0	PMED	Subsoil	Domestic Goose	Carpo-metacarpus	R	1	1	1	1	1	1	1	1	F	F	0	0	0	0	0	0	1	0	X	2	1	2	GL=78, Bp=18m Did=10
49	49014	49014	0	PMED	Colluvium	Cattle	Tooth	R	0	0	0	0	0	0	0	0	X	X	0	0	0	0	1	0	0	0	X	4	1	12	Upper PM
49	58610	58910	0	PMED	Cobbled Surface	Sheep/Goat	Mandible	R	0	0	0	0	0	0	0	0	X	X	0	0	0	0	1	0	0	0	X	3	1	13	Tooth Row, tooth wear not scorable
108	108001	108001	0	UND	Topsoil	Sheep/Goat	Phalanx (I)	R	1	1	1	1	1	1	1	1	F	F	0	0	0	0	0	0	1	0	X	1	1	5	GLPE=37, Bp=15, SD=14, Bd=15, Modern?
110	70001	70001	0	UND	Topsoil	Medium Mammal	Rib	X	0	0	0	0	0	0	0	0	X	X	0	0	1	0	0	0	0	0	X	3	1	0	Burnt white
160	160029	160021	0	LIA/C1	Ditch	Unidentified	Unidentified	X	0	0	0	0	0	0	0	0	X	X	0	0	1	0	0	0	0	0	X	4	6	1	Burnt white
160	160007	160005	0	C2+	Ditch	Medium Mammal	Long Bone	X	0	0	0	0	0	0	0	0	X	X	0	0	1	0	0	0	0	0	X	3	1	1	Burnt white
160	160016	160017	0	RB	Ditch	Unidentified	Tooth	X	0	0	0	0	0	0	0	0	X	X	0	0	0	0	0	0	0	0	X	4	199	5	
160	160016	160017	0	RB	Ditch	Unidentified	Unidentified	X	0	0	0	0	0	0	0	0	X	X	0	0	1	0	0	0	0	0	X	3	1	0	Burnt white
271	67029	67030	0	LIA or Earlier	Pit	Medium Mammal	Long Bone	X	0	0	0	0	0	0	0	0	X	X	0	0	1	0	0	0	0	0	X	4	15	6	Burnt white
271	67029	67030	0	LIA or Earlier	Pit	Unidentified	Unidentified	X	0	0	0	0	0	0	0	0	X	X	0	0	1	0	0	0	0	0	X	4	4	0	Burnt white
271	67056	67059	0	L C2/C3	Ditch	Medium Mammal	Long Bone	X	0	0	0	0	0	0	0	0	X	X	0	0	1	0	0	0	0	0	X	3	1	0	Burnt white
271	67065	67054	0	UND	Ditch	Cattle	Tooth	X	0	0	0	0	0	0	0	0	X	X	0	0	0	0	1	0	0	0	X	3	1	4	Fragmentary molar/pm
271	67080	67080	0	UND	Colluvium	Cattle	Tooth	L	0	0	0	0	0	0	0	0	X	X	0	0	0	0	1	0	0	0	X	4	1	15	Upper M2
271	67087	67086	0	UND	Shallow Pit	Large Mammal	Rib	X	0	0	0	0	0	0	0	0	X	X	0	0	1	0	0	0	0	0	X	3	1	0	Burnt white
271	67087	67086	0	UND	Shallow Pit	Sheep/Goat	Tooth	X	0	0	0	0	0	0	0	0	X	X	0	0	0	0	1	0	0	0	X	3	2	2	Two fragmentary upper molars
271	67135	67134	0	UND	Ditch Re-Cut	Cattle	Tooth	X	0	0	0	0	0	0	0	0	X	X	0	0	0	0	1	0	0	0	X	3	1	7	Fragmentary molar
271	67089	67072	0	UND	Ditch	Cattle	Tooth	R	0	0	0	0	0	0	0	0	X	X	0	0	0	0	0	0	0	1	X	3	1	10	Lower M1=j
271	67005	67005	0	UND	Layer Stoney Deposit	Large Mammal	Rib	X	0	0	0	0	0	0	0	0	X	X	0	0	0	0	1	0	0	0	X	4	1	10	
271	67005	67005	0	UND	Layer Stoney Deposit	Medium Mammal	Long Bone	X	0	0	0	0	0	0	0	0	X	X	0	0	0	0	0	0	0	0	X	3	1	2	
271	67005	67005	0	UND	Layer Stoney Deposit	Large Mammal	Thoracic	X	0	0	0	0	0	0	0	0	X	X	0	0	0	0	0	0	0	0	X	4	1	11	Spinous process
271	67005	67005	0	UND	Layer Stoney Deposit	Red Deer	Metacarpal	R	0	0	0	0	1	1	1	1	X	F	0	0	0	0	0	0	1	0	X	4	1	50	Dd=22, Bd=46

Plot	Ctxt No	Cut	Sample No	Phase	Feature	Taxon	Element	Side	Z1	Z2	Z3	Z4	Z5	Z6	Z7	Z8	Prox	Dist	Path	Butch	Burnt	Gnaw	Fresh Break	Associated	Measured	Tooth Wear	Surface	Condition	No	(g)	Notes
271	67005	67005	0	UND	Layer Stoney Deposit	Large Mammal	Long Bone	X	0	0	0	0	0	0	0	0	X	X	0	0	0	0	1	0	0	0	X	4	1	19	
271	67005	67005	0	UND	Layer Stoney Deposit	Sheep/Goat	Metacarpal	R	1	1	1	1	0	0	0	0	F	X	0	0	0	0	1	0	0	0	X	4	1	3	
271	67005	67005	0	UND	Layer Stoney Deposit	Unidentified	Unidentified	X	0	0	0	0	0	0	0	0	X	X	0	0	1	0	0	0	0	0	X	3	2	2	Burnt white
271	67005	67005	0	UND	Layer Stoney Deposit	Unidentified	Unidentified	X	0	0	0	0	0	0	0	0	X	X	0	0	0	0	0	0	0	0	X	4	12	4	
271	67005	67005	0	UND	Layer Stoney Deposit	Cattle	Tooth	X	0	0	0	0	0	0	0	0	X	X	0	0	0	0	1	0	0	0	X	4	2	32	fragmentary molars
271	67011	67008	67908	RB	Ditch	Pig	Tooth	X	0	0	0	0	0	0	0	0	X	X	0	0	1	0	1	0	0	0	X	3	1	0	Fragmentary molar
271	67011	67008	67908	RB	Ditch	Medium Mammal	Long Bone	X	0	0	0	0	0	0	0	0	X	X	0	0	1	0	0	0	0	0	X	3	5	1	Burnt white
271	67011	67008	67908	RB	Ditch	Unidentified	Unidentified	X	0	0	0	0	0	0	0	0	X	X	0	0	1	0	0	0	0	0	X	3	6	0	Burnt white
271	67003	67004	67901	UND	Animal Burial	Unidentified	Unidentified	X	0	0	0	0	0	0	0	0	X	X	0	0	0	0	0	0	0	0	X	5	5	2	Cancellous bone
271	67089	67072	67911	UND	Ditch	Medium Mammal	Long Bone	X	0	0	0	0	0	0	0	0	X	X	0	0	1	0	0	0	0	0	X	3	6	1	Burnt white
271	67089	67072	67911	UND	Ditch	Medium Mammal	Long Bone	X	0	0	0	0	0	0	0	0	X	X	0	0	1	0	0	0	0	0	X	3	2	0	Burnt grey/white
271	67043	67072	0	RB	Enclosure Ditch	Pig	Tooth	X	0	0	0	0	0	0	0	0	X	X	0	0	0	0	0	0	0	0	X	3	1	2	Molar fragment
271	67027	67028	0	RB	Enclosure Ditch	Unidentified	Unidentified	X	0	0	0	0	0	0	0	0	X	X	0	0	1	0	0	0	0	0	X	3	1	1	Burnt white
271	67012	67004	0	UND	Animal Burial	Cattle	Humerus	R	0	0	1	1	1	1	0	1	X	F	0	0	0	0	0	0	0	0	X	4	1	116	
271	67012	67004	0	UND	Animal Burial	Cattle	Tibia	R	0	0	0	1	1	1	0	0	X	X	0	0	0	0	0	0	0	0	X	4	1	73	
271	67012	67004	0	UND	Animal Burial	Cattle	Tibia	L	0	0	1	0	1	1	0	0	X	U	0	0	0	0	0	0	0	0	X	4	1	90	
271	67012	67004	0	UND	Animal Burial	Cattle	Femur	L	0	0	1	1	1	0	0	0	X	X	0	0	0	0	0	0	0	0	X	5	1	57	
271	67012	67004	0	UND	Animal Burial	Cattle	Femur	R	0	0	1	1	0	1	0	0	X	X	0	0	0	0	0	0	0	0	X	4	1	93	
271	67012	67004	0	UND	Animal Burial	Cattle	Radius	R	1	1	1	1	0	1	0	0	F	X	0	0	0	0	0	0	0	0	X	4	1	59	
271	67012	67004	0	UND	Animal Burial	Cattle	Radius	L	1	1	1	1	1	1	0	0	X	X	0	0	0	0	0	0	0	0	X	5	1	80	
271	67012	67004	0	UND	Animal Burial	Large Mammal	Long Bone	X	0	0	0	0	0	0	0	0	X	X	0	0	0	0	0	0	0	0	X	5	1	14	
271	67012	67004	0	UND	Animal Burial	Cattle	Mandible	L	0	0	1	1	0	1	1	1	X	X	0	0	0	0	1	0	0	1	X	4	1	226	PM4=V, M1=j, M2=f, M3=b
271	67012	67004	0	UND	Animal Burial	Cattle	Mandible	R	0	0	1	1	1	0	1	1	X	X	0	0	0	0	1	0	0	1	X	4	1	225	dpm4=k, M1=j, M2=f, M3=b
271	67012	67004	0	UND	Animal Burial	Cattle	Humerus	L	0	0	1	1	1	1	0	1	X	F	0	0	0	0	0	0	0	0	X	4	1	76	
271	67012	67004	0	UND	Animal Burial	Large Mammal	Long Bone	X	0	0	0	0	0	0	0	0	X	X	0	0	0	0	0	0	0	0	X	4	5	37	

Plot	Ctxt No	Cut	Sample No	Phase	Feature	Taxon	Element	Side	Z1	Z2	Z3	Z4	Z5	Z6	Z7	Z8	Prox	Dist	Path	Butch	Burnt	Gnaw	Fresh Break	Associated	Measured	Tooth Wear	Surface	Condition	No	(g)	Notes
271	67012	67004	0	UND	Animal Burial	Cattle	Metacarpal	L	1	1	1	1	0	0	0	0	F	X	0	0	0	0	0	0	0	0	X	4	1	25	
271	67012	67004	0	UND	Animal Burial	Cattle	Axis	B	1	1	0	0	0	0	0	0	X	X	0	0	0	0	0	0	0	0	X	4	1	9	
271	67012	67004	0	UND	Animal Burial	Cattle	Tooth	R	0	0	0	0	0	0	0	0	X	X	0	0	0	0	0	0	0	0	X	3	4	80	Upper tooth row, M1, M2, M3
271	67012	67004	0	UND	Animal Burial	Cattle	Tooth	L	0	0	0	0	0	0	0	0	X	X	0	0	0	0	0	0	0	0	X	3	4	82	Upper tooth row, M1, M2, M3
271	67012	67004	0	UND	Animal Burial	Unidentified	Unidentified	X	0	0	0	0	0	0	0	0	X	X	0	0	0	0	0	0	0	0	X	4	86	253	
331	75085	75084	0	LIA/C1	Ditch	Medium Mammal	Long Bone	X	0	0	0	0	0	0	0	0	X	X	0	0	1	0	0	0	0	0	X	3	1	1	Fully calcined
331	75085	75084	0	LIA/C1	Ditch	Large Mammal	Long Bone	X	0	0	0	0	0	0	0	0	X	X	0	0	0	0	1	0	0	0	X	4	1	17	
331	75085	75084	0	LIA/C1	Ditch	Cattle	Tooth	R	0	0	0	0	0	0	0	0	X	X	0	0	0	0	0	0	0	1	X	3	1	21	Lower M3=j
331	75085	75084	0	LIA/C1	Ditch	Cattle	Astragalus	R	0	0	1	0	1	1	1	1	X	X	0	0	0	0	0	0	0	0	X	4	1	17	
331	75085	75084	0	LIA/C1	Ditch	Large Mammal	Long Bone	X	0	0	0	0	0	0	0	0	X	X	0	0	0	0	0	0	0	0	X	4	1	1	
331	75054	75069	0	UND	Ditch	Cattle	Metacarpal	L	1	1	1	1	1	1	1	1	F	F	0	0	0	0	1	0	0	0	X	4	1	80	GL=179*, SD=25*, Dd=20, Bd=46
331	75054	75069	0	UND	Ditch	Sheep/Goat	Metacarpal	L	0	0	0	0	1	1	0	0	X	X	0	0	0	0	0	0	0	0	X	4	1	3	5
331	75054	75069	0	UND	Ditch	Cattle	Tibia	R	0	0	0	0	1	1	1	1	X	F	0	1	0	0	0	0	0	0	X	3	1	47	Knife cuts on the lateral side of the shaft
331	75073	75072	0	LIA/C1	Ditch	Sheep/Goat	Tibia	R	0	0	0	0	1	1	1	1	X	F	0	0	1	0	1	0	0	0	X	3	1	5	Burnt white
331	75073	75072	0	LIA/C1	Ditch	Medium Mammal	Long Bone	X	0	0	0	0	0	0	0	0	X	X	0	0	1	0	1	0	0	0	X	3	4	2	Burnt white
331	75073	75072	0	LIA/C1	Ditch	Unidentified	Unidentified	X	0	0	0	0	0	0	0	0	X	X	0	0	0	0	1	0	0	0	X	3	3	0	
331	75057	75081	0	LIA/C1	Ditch	Large Mammal	Skull	X	0	0	0	0	0	0	0	0	X	X	0	0	1	0	0	0	0	0	X	3	1	2	Burnt white
331	75057	75081	0	LIA/C1	Ditch	Large Mammal	Rib	X	0	0	0	0	0	0	0	0	X	X	0	0	1	0	0	0	0	0	X	3	1	0	Burnt white/grey
331	75057	75081	0	LIA/C1	Ditch	Cattle	Mandible	L	0	0	0	0	0	0	0	1	X	X	0	0	1	0	0	0	0	0	X	3	1	1	Burnt white
331	75057	75081	0	LIA/C1	Ditch	Large Mammal	Long Bone	X	0	0	0	0	0	0	0	0	X	X	0	0	1	0	0	0	0	0	X	3	6	3	Burnt white
331	75057	75081	0	LIA/C1	Ditch	Medium Mammal	Long Bone	X	0	0	0	0	0	0	0	0	X	X	0	0	1	0	0	0	0	0	X	3	4	0	Burnt white
331	75057	75081	0	LIA/C1	Ditch	Unidentified	Unidentified	X	0	0	0	0	0	0	0	0	X	X	0	0	1	0	0	0	0	0	X	3	56	9	Burnt white
331	75046	75047	0	C1/C2	Ditch	Medium Mammal	Thoracic	B	0	0	0	0	0	0	0	0	X	X	0	0	1	0	0	0	0	0	X	3	1	1	Burnt white
331	75054	75069	0	UND	Ditch	Sheep/Goat	Metacarpal	R	0	0	0	0	1	1	0	0	X	X	0	0	0	0	0	0	0	0	X	4	1	2	
331	75046	75047	0	C1/C2	Ditch	Cattle	Metacarpal	L	0	0	0	0	1	1	0	0	X	X	0	0	0	0	1	0	0	0	X	4	1	11	
331	75046	75047	0	C1/C2	Ditch	Sheep/Goat	Tooth	L	0	0	0	0	0	0	0	0	X	X	0	0	0	0	0	0	0	0	X	2	1	3	Upper M3
331	75073	75072	77026	LIA/C1	Ditch	Medium Mammal	Long Bone	X	0	0	0	0	0	0	0	0	X	X	0	0	1	0	0	0	0	0	X	3	15	2	Burnt white
331	75073	75072	77026	LIA/C1	Ditch	Sheep/Goat	Ulna	L	1	0	0	0	0	0	0	0	U	X	0	0	1	0	0	0	0	0	X	3	1	1	Burnt white
331	75073	75072	77026	LIA/C1	Ditch	Medium Mammal	Phalanx (I)	X	0	0	0	0	0	0	0	1	X	F	0	0	1	0	0	0	0	0	X	3	1	0	Burnt white
331	75073	75072	77026	LIA/C1	Ditch	Unidentified	Unidentified	X	0	0	0	0	0	0	0	0	X	X	0	0	1	0	0	0	0	0	X	3	18	2	Burnt white
331	75073	75072	77026	LIA/C1	Ditch	Unidentified	Unidentified	X	0	0	0	0	0	0	0	0	X	X	0	0	1	0	0	0	0	0	X	3	32	2	Burnt grey/white

Plot	Ctxt No	Cut	Sample No	Phase	Feature	Taxon	Element	Side	Z1	Z2	Z3	Z4	Z5	Z6	Z7	Z8	Prox	Dist	Path	Butch	Burnt	Gnaw	Fresh Break	Associated	Measured	Tooth Wear	Surface	Condition	No	(g)	Notes
331	75085	75084	77036	LIA/C1	Ditch	Pig	Tooth	L	0	0	0	0	0	0	0	0	X	X	0	0	0	0	0	0	0	0	X	2	1	1	Lower PM2
331	75085	75084	77036	LIA/C1	Ditch	Sheep/Goat	Tooth	X	0	0	0	0	0	0	0	0	X	X	0	0	0	0	0	0	0	0	X	3	7	0	Enamel fragments
331	75085	75084	77036	LIA/C1	Ditch	Unidentified	Unidentified	X	0	0	0	0	0	0	0	0	X	X	0	0	1	0	0	0	0	0	X	3	21	1	Burnt white
331	75004	75004	77001	UND	Stone Surface	Medium Mammal	Long Bone	X	0	0	0	0	0	0	0	0	X	X	0	0	1	0	0	0	0	0	X	3	1	1	Burnt white/grey
331	75007	75006	77002	UND	Posthole	Medium Mammal	Long Bone	X	0	0	0	0	0	0	0	0	X	X	0	0	1	0	0	0	0	0	X	3	8	1	Burnt white
331	75057	75081	77024	LIA/C1	Ditch	Medium Mammal	Long Bone	X	0	0	0	0	0	0	0	0	X	X	0	0	1	0	0	0	0	0	X	3	12	1	Burnt white
331	75057	75081	77024	LIA/C1	Ditch	Unidentified	Unidentified	X	0	0	0	0	0	0	0	0	X	X	0	0	1	0	0	0	0	0	X	3	1	0	Burnt white
331	75057	75081	77024	LIA/C1	Ditch	Medium Mammal	Phalanx (III)	L	0	0	0	0	0	0	0	0	X	X	0	0	1	0	0	0	0	0	X	3	1	0	Burnt white
331	75057	75081	77024	LIA/C1	Ditch	Unidentified	Unidentified	X	0	0	0	0	0	0	0	0	X	X	0	0	1	0	0	0	0	0	X	3	23	0	Burnt grey/white
331	75044	75045	77014	UND	Posthole	Medium Mammal	Long Bone	X	0	0	0	0	0	0	0	0	X	X	0	0	1	0	0	0	0	0	X	3	16	1	Burnt white
331	75046	75047	77015	C1/C2	Ditch	Large Mammal	Long Bone	X	0	0	0	0	0	0	0	0	X	X	0	0	1	0	0	0	0	0	X	3	1	0	Burnt grey/white
331	75046	75047	77015	C1/C2	Ditch	Unidentified	Unidentified	X	0	0	0	0	0	0	0	0	X	X	0	0	1	0	0	0	0	0	X	3	2	0	Burnt grey/white
331	75046	75047	77015	C1/C2	Ditch	Unidentified	Unidentified	X	0	0	0	0	0	0	0	0	X	X	0	0	1	0	0	0	0	0	X	3	19	1	Burnt white
400	40079	40080	0	LIA/C1	Ditch	Cattle	Skull-occipital	R	0	0	0	0	0	0	0	0	X	X	0	0	0	0	0	0	0	0	X	3	1	7	
400	40079	40080	0	LIA/C1	Ditch	Large Mammal	Axis	X	0	1	0	0	0	0	0	0	X	X	0	0	0	0	0	0	0	0	X	2	1	6	
400	40079	40080	0	LIA/C1	Ditch	Medium Mammal	Long Bone	X	0	0	0	0	0	0	0	0	X	X	0	0	0	0	0	0	0	0	X	4	11	3	
400	40079	40080	0	LIA/C1	Ditch	Unidentified	Unidentified	X	0	0	0	0	0	0	0	0	X	X	0	0	0	0	0	0	0	0	X	4	45	35	
430	86211	86210	0	C2+	Ditch	Cattle	Tooth	X	0	0	0	0	0	0	0	0	X	X	0	0	0	0	1	0	0	0	X	4	1	2	Fragmentary Molar
430	86211	86210	0	C2+	Ditch	Large Mammal	Long Bone	X	0	0	0	0	0	0	0	0	X	X	0	0	1	0	1	0	0	0	X	4	1	1	Burnt white
430	86240	86239	0	C2	Waste Pit	Cattle	Tooth	X	0	0	0	0	0	0	0	0	X	X	0	0	0	0	1	0	0	0	X	4	1	1	Fragmentary PM
449	44909	44909	0	C 17th +	Demolition Layer	Cattle	Tibia	R	0	0	1	1	0	0	0	0	X	X	0	1	0	0	1	0	0	0	R	3	1	99	Knife cuts on the lateral side, chopped through the midshaft
449	44909	44909	0	C 17th +	Demolition Layer	Sheep/Goat	Radius	L	0	0	1	1	1	1	0	0	X	X	0	0	0	0	0	0	0	0	X	2	1	4	
449	44909	44909	0	C 17th +	Demolition Layer	Medium Mammal	Rib	X	0	0	0	0	0	0	0	0	X	X	0	0	0	0	0	0	0	0	X	3	1	1	
449	44909	44909	0	C 17th +	Demolition Layer	Unidentified	Unidentified	X	0	0	0	0	0	0	0	0	X	X	0	0	0	0	0	0	0	0	X	4	1	0	
449	44909	44909	0	C 17th +	Demolition Layer	Cattle	Humerus	R	0	0	0	0	1	1	0	0	X	X	0	0	0	0	0	0	0	0	X	4	1	58	
454	85105	85104	0	C2	Ditch	Pig	Mandible	L	0	1	0	0	0	0	0	0	X	X	0	0	0	0	1	0	0	0	X	4	1	5	PM4 and PM4 in occlusion PM4=b
454	85038	85037	0	RB	Circular Feature	Unidentified	Unidentified	X	0	0	0	0	0	0	0	0	X	X	0	0	1	0	0	0	0	0	X	4	17	1	Burnt white

Plot	Ctxt No	Cut	Sample No	Phase	Feature	Taxon	Element	Side	Z1	Z2	Z3	Z4	Z5	Z6	Z7	Z8	Prox	Dist	Path	Butch	Burnt	Gnaw	Fresh Break	Associated	Measured	Tooth Wear	Surface	Condition	No	(g)	Notes
464	46402	46401	0	PRE	Pit/Posthole	Unidentified	Unidentified	X	0	0	0	0	0	0	0	0	X	X	0	0	1	0	0	0	0	0	X	4	21	2	Burnt white
496	90025	90035	0	LIA/C1	Pit	Medium Mammal	Rib	X	0	0	0	0	0	0	0	0	X	X	0	0	1	0	0	0	0	0	X	3	1	1	Fully calcined
496	90025	90035	0	LIA/C1	Pit	Large Mammal	Rib	X	0	0	0	0	0	0	0	0	X	X	0	0	1	0	0	0	0	0	X	3	1	3	Fully calcined
496	90025	90035	0	LIA/C1	Pit	Medium Mammal	Long Bone	X	0	0	0	0	0	0	0	0	X	X	0	0	1	0	0	0	0	0	X	3	3	0	Fully calcined
496	90025	90035	0	LIA/C1	Pit	Sheep/Goat	Mandible	R	0	0	0	0	1	0	0	0	X	X	0	0	1	0	0	0	0	0	X	3	1	2	Fully calcined
496	90019	90020	0	LIA/C1	Pit	Medium Mammal	Long Bone	X	0	0	0	0	0	0	0	0	X	X	0	0	1	0	0	0	0	0	X	3	8	7	Fully calcined
496	90019	90020	0	LIA/C1	Pit	Large Mammal	Rib	X	0	0	0	0	0	0	0	0	X	X	0	0	1	0	0	0	0	0	X	3	2	2	Fully calcined
496	90019	90020	0	LIA/C1	Pit	Unidentified	Unidentified	X	0	0	0	0	0	0	0	0	X	X	0	0	1	0	0	0	0	0	X	3	1	1	Fully calcined
496	90009	90008	0	PMED	Tree bole	Pig	Mandible	L	0	0	1	0	0	0	0	0	X	X	0	0	0	0	0	0	0	1	X	2	1	18	M1=a, M2=V
496	90029	90035	0	LIA	Pit	Medium Mammal	Long Bone	X	0	0	0	0	0	0	0	0	X	X	0	0	1	0	0	0	0	0	X	2	1	1	Fully calcined
496	90029	90035	0	LIA	Pit	Medium Mammal	Rib	X	0	0	0	0	0	0	0	0	X	X	0	0	1	0	0	0	0	0	X	3	1	0	Fully calcined
496	90028	90035	91006	UND	Pit	Unidentified	Unidentified	X	0	0	0	0	0	0	0	0	X	X	0	0	1	0	0	0	0	0	X	3	14	1	Burnt white
496	90019	90020	91007	LIA/C1	Pit	Medium Mammal	Long Bone	X	0	0	0	0	0	0	0	0	X	X	0	0	1	0	0	0	0	0	X	4	2	0	Burnt white/grey
496	90019	90020	91007	LIA/C1	Pit	Unidentified	Unidentified	X	0	0	0	0	0	0	0	0	X	X	0	0	1	0	0	0	0	0	X	3	11	0	Burnt white/grey

Faunal Remains – Tirley Feeder Connector

By Jennifer Wood BSc MA MIFA

INTRODUCTION

A total of 20 (14g) fragments of animal bone were recovered during a scheme of archaeological works undertaken by Network Archaeology Ltd at the Tirley Feeder Connector, Gloucestershire. The remains were recovered from the fill of a possible hollow way (5391), and ditch fills (5740) and (5754).

Results

The remains were fragmentary and generally of a poor overall condition, averaging at grade 4 on the Lyman criteria (1996).

No evidence of butchery, gnawing or pathology was noted on any of the remains.

A total of 16 fragments of medium mammal-sized long bone fragments recovered from deposit (5754) were burnt white (fully calcined), which suggests that the remains were burnt at a high temperature or over a prolonged period of time.

Table 17 Summary of Identified Bone

Cut	Context	Taxon	Element	Side	Number	Weight	Comments
5389	5391	Cattle	Tooth	X	1	12	Upper molar enamel fragments
5741	5740	Medium Mammal Size	Long Bone	X	1	1	Broken into 4 pieces
5755	5754	Cattle	Tooth	X	1	<1	Molar fragment
5755	5754	Medium Mammal Size	Long Bone	X	16	1	Burnt white

As can be seen from Table 17, the assemblage consists mostly of fragmentary cattle teeth and medium mammal size long bone fragments. Due to the limited size of the assemblage, little further information can be gained, the presence of the remains on site.

No further work is required on this assemblage.

References

Lyman, R L, 1996 *Vertebrate Taphonomy*, Cambridge Manuals in Archaeology, Cambridge University Press, Cambridge

Osteological analysis, Cremated Human Bone – Brecon to Tirley Pipeline.

Malin Holst

Summary

York Osteoarchaeology Ltd was commissioned by Network Archaeology Ltd to carry out the osteological analysis of eight cremated bone assemblages recovered from the Brecon to Tirley Pipeline in the counties of Gloucestershire, Herefordshire and Powys. The assemblages dated from the Early Bronze Age to the Iron Age or Romano-British period, though two assemblages were undated.

All the cremated bone assemblages were well to moderately well preserved, but very fragmented, with most of the bone recovered being between 2mm to 5mm in size. The quantity of bone recovered from the cremated bone assemblages represented 0.1% to 2.7% of the expected mean quantity of bone recovered from modern cremations and none of the assemblages contained more than 43.1g of bone. The bone was well cremated and had lost its organic portion in all eight assemblages. It was not possible to determine sex in any of burials, nor could pathology be identified. However, it was possible to determine age in one assemblage, which contained a young juvenile (BRT75, Plot 496, Context 90025).

INTRODUCTION

In January 2012 York Osteoarchaeology Ltd was commissioned by Network Archaeology Ltd to carry out the osteological analysis of eight assemblages of cremated human bone. The skeletal remains were recovered from the excavations of the Brecon to Tirley Pipeline in Gloucestershire, Herefordshire and Powys.
The remains dated from the Early Bronze Age to the Iron Age or Romano-British period. Some of the remains were from obvious cremation burials, while others were recovered from a layer (Context 60003), pits and postholes (Table 18).

AIMS AND OBJECTIVES

The skeletal assessment aimed to determine age and sex, as well as any manifestations of disease from which the individuals may have suffered. Additionally, information was sought regarding the cremation techniques.

METHODOLOGY

The cremated bone was sieved through a stack of sieves, with 10mm, 5mm and 2mm mesh sizes. The bone recovered from each sieve was weighed and sorted into identifiable and non-identifiable bone. The identifiable bone was divided into five categories: skull, axial (excluding the skull), upper limb, lower limb and long bone (unidentifiable as to the limb). All identifiable groups of bone were weighed and described in detail.

OSTEOLOGICAL ANALYSIS

Osteological analysis is concerned with the determination of the demographic profile of the assemblage based on the assessment of sex, age and non-metric traits. This information is essential in order to determine the prevalence of disease types and age-related changes. It is also crucial for identifying gender dimorphism in occupation, lifestyle and diet, as well as the role of different age groups in society.

PRESERVATION

Skeletal preservation depends upon a number of factors, including the age and sex of the individual as well as the size, shape and robusticity of the bone. Burial environment, post-depositional disturbance and treatment following excavation can also have a considerable impact on bone condition. Preservation of human remains is assessed subjectively, depending on the severity of bone surface erosion and post-mortem breaks, but disregarding completeness.

Preservation was assessed using a grading system of five categories: very poor, poor, moderate, good and excellent. Excellent preservation implied no bone erosion and very few or no post-depositional breaks, whereas very poor preservation indicated complete or almost complete loss of the bone surface due to erosion and severe fragmentation.

The majority of the bone (72%) was in a good condition, including both the obvious cremation burials and three of the assemblages recovered from pits. The remaining three assemblages (38%) were moderately well preserved, with erosion of the bone surface and edges and more severe fragmentation. These assemblages were recovered from a posthole or pit, a pit and a ditch (see Table 18).

Little warping and bone cracking, which occurs commonly during the cremation process, was evident. This is probably because the bone had broken along the cracks and this was supported by the fact that the larger bone fragments did exhibit fissures. The fragment size of cremated bone is frequently attributed to post-cremation processes. This is because skeletal elements retrieved from modern crematoria tend to be comparatively large before being ground down for scattering or deposition in the urn. Bone is also prone to fragmentation if it is moved while still hot (McKinley 1994, 340).

The majority of burials (75%) contained bone fragments that were 10mm in size or larger (Table 19), however, 10mm large or larger fragments only constituted the greatest proportion of bone in two assemblages (25%). The greatest proportion of the bone was derived from the 5mm sieve in a further two burials (25%), while in the remaining four burials, the largest quantity of bone was 2mm in size. This supports the view that the bone from these burials was subject to disturbance while it was still hot and possibly also post-mortem fragmentation along fissures and cracks.

The quantity of cremated bone recovered per assemblage varied from 1.5g to 43.1g (see Table 19), with an overall mean weight of 11.0g. The amount of bone retrieved from all of the assemblages weighed considerably less than the average bone weight produced by modern crematoria, which tends to range from 1000.5g to 2422.5g with a mean of 1625.9g (McKinley 1993). Wahl (1982, 25) found that archaeologically recovered remains of cremated adults tend to weigh less (between 250g and 2500g) as a result of the commonly practised custom of selecting only some of the cremated bone from the pyre for inclusion in the burial, thereby representing a symbolic, or token, interment.

The cremated bone was very well burnt in all the assemblages, causing the complete loss of the organic portion of the bone and producing a white colour in seven assemblages and a light grey colour in the bone from Context 85017 (see Table 18). According to McKinley (1989), the body requires a minimum temperature of 500° Celsius over seven to eight hours to achieve complete calcination of the bone. Because of the severe fragmentation of the bone elements, it was only possible to identify a limited quantity of skeletal elements in the assemblages (Table 20). Between 19.5% and 83% of bone from each burial could be identified (Table 20).

The majority of identifiable bones were mostly long bone shaft fragments (between 25% and 100% of the identifiable fragments), though it was not possible to determine whether they derived from the upper or lower limb. Generic cranial vault (skull) fragments were found in six of the eight bone assemblages. However, diagnostic fragments and teeth were not found. Since the cranial vault is very distinctive and easily recognisable, even when severely fragmented, it often forms a large proportion of identified bone fragments in cremated remains (McKinley 1994). In two assemblages, rib fragments were found. Bones representing other parts of the body were not recovered.

MINIMUM NUMBER OF INDIVIDUALS

A count of the ‘minimum number of individuals’ (MNI) recovered from a cemetery is carried out as standard procedure during osteological assessments of inhumations in order to establish how many individuals were represented by the articulated and disarticulated human bones (without taking the archaeologically defined graves into account). The MNI is calculated by counting all long bone ends, as well as other larger skeletal elements, such as the hip joints and cranial elements.
It is not possible to calculate the MNI for cremation burials, because only a token selection of bone from the pyre tends to be buried. Double burials can be identified only if skeletal elements are duplicated, or if skeletons of different ages are represented in one burial. In this instance, no double burials were identified.

ASSESSMENT OF AGE

Age was determined using standard ageing techniques, as specified in Scheuer and Black (2000a; 2000b) and Cox (2000). Age estimation relies on the presence of the pelvis and uses different stages of bone development and degeneration in order to calculate the age of an individual. Age is split into a number of categories, from foetus (up to 40 weeks in utero), neonate (around the time of birth), infant (newborn to one year), juvenile (1-12 years), adolescent (13-17 years), young adult (ya; 18-25 years), young middle adult (yma; 26-35 years), old middle adult (oma; 36-45 years), mature adult (ma; 46+) to adult (an individual whose age could not be determined more accurately as over the age of seventeen).

Because none of the criteria normally used for age determination were represented in any of the burials, age determination was based on less reliable criteria. The bone size suggested that the individual from Context 90025 was a young juvenile, under the age of six years old (Table 21), but possibly younger.

SEX DETERMINATION

Sex determination is usually carried out using standard osteological techniques, such as those described by Mays and Cox (2000). Assessment of sex in both males and females relies on the preservation of the skull and the pelvis and can only be carried out once sexual characteristics have developed, during late puberty and early adulthood.
It was not possible to estimate sex in any of the assemblages.

METRIC ANALYSIS AND NON-METRIC TRAITS

Cremated bone shrinks at an inconsistent rate (up to 15%) during the cremation process and it was therefore not possible to measure any of the bones from these burials.

Non-metric traits are additional sutures, facets, bony processes, canals and foramina, which occur in a minority of skeletons and are believed to suggest hereditary affiliation between skeletons (Saunders 1989). The origins of non-metric traits have been extensively discussed in the osteological literature and it is now thought that while most non-metric traits have genetic origins, some can be produced by factors such as mechanical stress (Kennedy 1989) or environment (Trinkhaus 1978). Non-metric traits were not observed in any of the individuals.
Non-metric traits were not identified.

PATHOLOGICAL AND DENTAL ANALYSIS

The analysis of skeletal and dental manifestations of disease can provide a vital insight into the health and diet of past populations, as well as their living conditions and occupations. In this case, manifestations of disease were not observed.
Analysis of the teeth from archaeological populations can provide vital clues about health, diet and oral hygiene, as well as information about environmental and congenital conditions. No dental remains were recovered.

DISCUSSION AND SUMMARY

Excavations along the Brecon to Tirley Pipeline in the counties of Gloucestershire, Herefordshire and Powys produced eight assemblages of human bone, all of which weighed less than 45g and weighted on average 11g. These assemblages were therefore much smaller than the quantity of bone normally expected from a modern cremation (1625.9g; McKinley 1993). Despite the small quantity of bone, identifiable fragments were recovered from all the assemblages, which consisted mostly of long bone shaft fragments which could not be identified further. Skull vault fragments were also recovered from some assemblages, as were rib fragments.

The assemblages showed a high degree of fragmentation and were well to moderately well preserved. The majority of bone was recovered from the 2mm mesh sieve, although some bone fragments were larger than 10mm and the largest fragment was 38mm long (Context 90025).

Age could only be estimated in one burial (Context 90026) and this was based on the size of the bone fragment. This was a rib belonging to a young juvenile aged six years old or younger. Sex could not be estimated in any of the assemblages and skeletal pathology was not identified. No teeth were recovered from the assemblages.

BRT75, PLOT 454, Context 85017, Herefordshire

A cremation burial was recovered from an Iron Age/Romano-British pit. The small assemblage (11.9g) contained one 14mm long bone fragment, although the majority of bone was 2mm in size. The bone was well preserved, lacking surface and edge erosion and was white in colour, indicative of good calcination. A total of 32% of the bone could be identified, most of which included long bone shaft fragments (82%), while the remainder were skull fragments (18%). Neither age nor sex could be estimated.

BRT75, PLOT 496, Context 90025, Gloucestershire

A pit thought to date to the Iron Age or Romano-British period produced 4.7g of human bone. It was associated with charcoal and slag. The longest bone fragment was 38mm long, by far the largest cremated bone fragment from the pipeline. In fact, most bone fragments (68%) in this assemblage were larger than 10mm. The bone was well preserved and thoroughly calcined. A total of 43% of the assemblage was identifiable, and most of it consisted of long bone shaft fragments (52%) or a single rib fragment that exhibited copper alloy staining. In this instance it was possible to suggest that the individual was a young juvenile, aged six years or younger.

BRT75, PLOT 496, Context 90026, Gloucestershire

An Iron Age or Romano-British pit containing charcoal and slag also produced a quantity of human bone (6.3g). The longest bone fragment was 17mm in size; however, the majority of the fragments were 2mm to 5mm in size. The bone was well preserved and thoroughly calcined. A total of 52% of the assemblage was identifiable, and most of this consisted of long bone shaft fragments (61%), skull fragments (27%) and a single rib fragment (12%). It was not possible to determine age or sex.

BRT96, Plot 461 Context 46102, Herefordshire

The biggest quantity of bone (43.1g) was recovered from a cremation burial dated by AMS to the mid-late Iron Age, also containing fragments of charcoal. The largest fragment was 20mm long, but the majority of the remains were 5mm (42%) or 2mm (41%) in size. The bone was white and well calcined and well preserved. A total of 58% of the assemblage could be identified and this constituted of long bone shaft fragments. Age or sex could not be identified.

BRT96, Plot 464, Context 46402, Herefordshire

An Early Bronze Age posthole or pit contained 1.5g of human bone. The largest fragment was 9mm long, but most of the bone was 2mm in size (73%). The bone was moderately well preserved with some surface and edge erosion. It was well calcined and white in colour. A total of 27% of the assemblage could be identified; these were all long bone shaft fragments. Age or sex could not be determined.

BRT96, Plot 464, Context 46423, Herefordshire

An undated pit contained 4.6g of human bone. The largest fragment was 10mm long, but almost all of the bone was 2mm in size (72%). The bone was moderately well preserved with eroded edges. It was well calcined and white in colour. A total of 19.5% of the assemblage could be identified; the majority of this consisted of long bone shaft fragments (78% of identifiable bone) or skull fragments (22% of identifiable bone). It was not possible to determine age or sex.

BRT106, PLOT 49, Context 49051, Powys

A single Early Bronze Age cremation burial was excavated, which contained 2.4g of human bone, as well as Early Bronze Age pottery. The longest bone fragment was 22mm long and in fact all of the assemblage was 10mm in size or larger. Preservation was good and the bone was white and well calcined. It was possible to identify 83% of the assemblage, including a large proportion of cranial vault fragments (50% of the identifiable bone), one rib fragment (25%) and one long bone shaft fragment (25%). Neither age nor sex could be assessed.

BRT106, PLOT 60, Context 60003, Powys

A total of 13.7g of burnt bone was recovered from a spread of material just beneath the topsoil dated by AMS to the early to mid Bronze Age. The largest fragment was 19mm long, however, the majority of bone was in the 5mm (45%) and 2mm (42%) category. The bone was moderately well preserved with some erosion on the fragment edges and was white in colour, suggesting full calcination of the bone. A total of 29% of the assemblage could be identified, with skull fragments (55.5% of identifiable bone) making the largest proportion, followed by long bone shaft fragments (44.5%). Age or sex could not be identified.

References

Cox, M. 2000. ‘*Ageing adults from the skeleton*’, in M. Cox and S. Mays (eds), Human Osteology in *Archaeology and Forensic Science* (London): 61-82

Kennedy, K.A.R. 1989. ‘*Skeletal markers of occupational stress’*, in M.Y. □şcan. and K.A.R. Kennedy (eds), *Reconstruction of Life from the Skeleton* (New York): 129-160

Mays, S. and Cox, M. 2000. ‘*Sex determination in skeletal remains’*, in M. Cox and S. Mays (eds), *Human Osteology in Archaeology and Forensic Science* (London): 117-130

McKinley, J.I. 1994. ‘*Bone fragment size in British cremation burials and its implications for pyre technology and ritual’*, Journal of Archaeological Science 21: 339-342

McKinley, J.I. 1993. ‘*Bone fragment size and weights of bone from modern British cremations and the implications for the interpretation of archaeological cremations*’, International Journal of Osteoarchaeology 3: 283-287

McKinley, J.I. 1989. ‘*Cremations: expectations, methodologies, and realities’*, in C.A. Roberts, F. Lee and J. Bintliff (eds.), *Burial Archaeology: Current Research, Methods and Developments*, BAR British Series 211 (Oxford): 65-76

Saunders, S.R. 1989. ‘*Non-metric variation’*, in M.Y. Işcan and K.A.R. Kennedy (eds) *Reconstruction of Life from the Skeleton* (New York): 95-108

Trinkhaus, E. 1978. ‘*Bilateral asymmetry of human skeletal non-metric traits’*, American Journal of Physical Anthropology 49: 315-318

Scheuer, L. and Black, S. 2000a. '*Development and ageing of the juvenile skeleton'*, in M. Cox and S. Mays (eds), *Human Osteology in Archaeology and Forensic Science* (London): 9-22

Scheuer, L. and Black, S. 2000b. *Developmental Juvenile Osteology* (San Diego)

Wahl, J. 1982. '*Leichenbranduntersuchungen. Ein Überblick über die Bearbeitungs- und Aussagemöglichkeiten von Brandgräbern'*, Prähistorische Zeitschrift 57: 2-125

Table 18 Summary of cremated bone assemblages

Code	Plot No	Context No	County	Feature Type	Period	Artefacts and Inclusions	Bone Colour	Preservation	Weight (g)	Percentage of Expected Quantity of Bone
BRT75	454	85017	Herefordshire	Pit	Iron Age/Romano-British	-	Light grey	Good	11.9g	0.7%
	496	90025	Gloucestershire	Pit	Iron Age/Romano-British	Charcoal and Slag	White	Good	4.7g	0.3%
		90026	Gloucestershire	Pit	Iron Age/Romano-British	Charcoal and Slag	White	Good	6.3g	0.4%
BRT96	461	46102	Herefordshire	Sub-rectangular cut/cremation pit?	Undated	Charcoal	White	Good	43.1g	2.7%
	464	46402	Herefordshire	Posthole/pit	Early Bronze Age	Early Bronze Age pottery	White	Moderate	1.5g	0.1%
		46423	Herefordshire	Pit	Bronze Age or Iron Age	-	White	Moderate	4.6g	0.3%
BRT106	49	49051	Powys	Cremation burial	Early Bronze Age	-	White	Good	2.4g	0.2%
	60	60003	Powys	Boundary ditch	Undated	-	White	Moderate	13.7g	0.9%

Table 19 Summary of cremated bone fragment size

Burial No	10mm (g)	10mm (%)	5mm (g)	5mm (%)	2mm (g)	2mm (%)	<2mm	Weight (g)
46102	6.7	15.5	18.1	42	17.8	41	-	43.1
46402	-	-	0.4	27	1.1	73	-	1.5
46423	-	-	1.3	20	3.3	72	-	4.6
49051	2.4	100	-	-	-	-	-	2.4
60003	1.4	10	6.2	45	5.8	42	0.3	13.7

Burial No	10mm (g)	10mm (%)	5mm (g)	5mm (%)	2mm (g)	2mm (%)	<2mm	Weight (g)
85017	0.5	4	4.6	39	6.6	55	0.2	11.9
90025	3.2	68	1.0	21	0.5	11	-	4.7
90026	1.3	21	2.6	41	2.4	38	-	6.3

Table 20 Summary of identifiable elements in the cremation burials

Burial No	Skull (g)	Skull (%)	Axial (g)	Axial (%)	UL (g)	UL (%)	LL (g)	LL (%)	UIL (g)	UIL (%)	Total ID (g)	Total ID (%)	Total UID (g)	Total UID (%)
46102	-	-	-	-	-	-	-	-	24.8	100	24.8	58	18.3	42
46402	-	-	-	-	-	-	-	-	0.4	100	0.4	27	1.1	73
46423	0.2	22	-	-	-	-	-	-	0.7	78	0.9	19.5	3.7	80.5
49051	1.0	50	0.5	25	-	-	-	-	0.5	25	2.0	83	0.4	17
60003	3.0	55.5	-	-	-	-	-	-	2.4	44.5	5.4	39	8.3	61
85017	0.7	18	-	-	-	-	-	-	3.1	82	3.8	32	8.1	68
90025	1.3	48	-	-	-	-	-	-	1.4	52	2.7	43	2	57
90026	0.9	27	0.4	12	-	-	-	-	2	61	3.3	52	3	48

Table 21 Summary of osteological results

Burial No	Preservation	Age	Sex	Weight (g)
46102	Good	-	-	43.1
46402	Moderate	-	-	1.5
46423	Moderate	-	-	4.6
49051	Good	-	-	2.4
60003	Moderate	-	-	13.7
85017	Good	-	-	11.9
90025	Good	Juvenile	-	4.7
90026	Good	-	-	6.3

Osteological analysis, Human Skeletal Remains – Tirley Feeder Connector.

Malin Holst

The excavations of the Brecon to Tirley pipeline produced an inhumation at Plot 2. The skeleton lay in a south to north orientation, on its right side with the arms up by the chest. The burial was very badly damaged and is unphased. The majority of other features at the site dated to the Roman period.

Table 22 Inventory of skeleton examined

Skeleton No	Preservation	Completeness	Age	Sex	Stature	Pathology
1	Very poor	5%	46+	Male?	-	Dental calculus

The skeleton from TFC36 is in a very poor condition, with considerable fragmentation and erosion. The only bones that are partly preserved are the left humerus shaft, distal shaft of the left ulna and radius, anterior mandible, a small portion of the skull in fragments and seventeen teeth. The skeleton is therefore only 5% complete.

Based on the bones present, the minimum number of individuals represented is one. Analysis of the eye orbit, the anterior mandible and the general robusticity suggests that this is a possible male skeleton. The dental wear is moderate to severe on the anterior and posterior teeth. On the basis of the wear (Brothwell 1981), the individual has been aged to 46 years old or older.

With regards to skeletal pathology, none could be observed. However, the dental wear is unusual and uneven. There is slight dental calculus (dental plaque) on six of the seventeen teeth.

Because of the fragmentary and incomplete nature of the skeleton, further analysis is not recommended, as no further information could be gained. Some of the bone fragments would, however, be suitable for AMS dating and could therefore provide a date for this burial.

Table 23: Catalogue

Skeleton Number	**1**
Preservation	Very poor
Completeness	5%, fragments of skull and the left arm
Age	Adult, 46+
Sex	Male?
Stature	-
Non-Metric Traits	-
Pathology	-
Dental Health	17 teeth, 6/17 calculus

	Right Dentition								Left Dentition							
Present	-	-	-	P	-	P	P	-	P	P	-	P	P	-	P	-
Calculus	-	-	-	-	-	-	-	-	-	Sb	-	Fb	-	-	-	-
DEH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Caries	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wear	-	-	-	6	-	6	5	-	6	4	-	4	4	-	7	-
Maxilla	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Mandible	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Present	-	-	P	-	-	-	-	B	P	P	P	P	P	P	P	-
Calculus	-	-	-	-	-	-	-	-	Sd	Sbd	-	Sb	Fm	-	-	-
DEH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Caries	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wear	-	-	6	-	-	-	-	-	5	5	6	4	4	6	4	-

KEY:

Present - Tooth presence; am - ante-mortem tooth loss; pm - post-mortem tooth loss; p - tooth present; - - jaw not present; CA/UE- congenitally absent/ un-erupted; E- erupting

Caries - Calculus; F - flecks of calculus; S - slight calculus; M - moderate calculus; H - heavy calculus; a - all surfaces; b - buccal surface; d - distal surface; m - mesial surface; l - lingual surface; o - occlusal surface

DEH - dental enamel *hypoplasia*; l - lines; g - grooves; p - pits

Caries - caries; s - small lesions; m - moderate lesions; l - large lesions

Wear - dental wear; numbers from 1-8 - slight to severe wear

Metalwork – Brecon to Tirley Pipeline

Dr Kevin Leahy

The following presents a description of, and recommendations, for each of the metal objects recovered during the archaeological works.

Site and Context Number: BRT 44 Plot 430 (58706)

Fragment of a cast copper alloy object, truncated across its width leaving it tongue-shaped. At the point of fracture is a 6.7mm diameter cast hole. The section of the plate tapers in all directions away from this hole. Both faces are covered in transverse scratch marks which are sharp on one side and worn on the other. The edge of the hole is also worn on this side. The unbroken edges of the plate are rounded. Condition good.

Both the function and date of this object are unknown, however it is unlikely to be Roman and a post-Medieval date seems likely.

Dimensions: Length 34.0mm, Width 42.0mm, Thickness 4.3mm
Mass: 27.13g
Find Context: Top soil over Roman enclosure –the same one as 58707
Describe and illustrate.

Site and Context Number: BRT 75 Plot 454 (85050)

Cast copper alloy brooch, condition good and complete but for the pin and the end of the foot-plate. An elongated lentoid rib runs around the head and part way down the bow. The wings are plain and hollow underneath to accommodate the coiled spring. At the end of each wing is a perforated circular plate which retains the pin holding the spring.

Romano-British brooch of 'Polden Hill' type (Hattatt, 1987, 96 – 100 fig. 34) and dating to the first century AD. This is an interesting find if it formed part of a cremation deposit. It clearly has not been burnt and was not on a pyre. If it was associated with the cremation it might represent a grave-side offering].

Dimensions: Length 39.8mm, Width 14.3mm, Height 14.4mm
Mass: 4.95g
Find Context: Fill of a potential cremation burial, 2nd century AD (from ceramics)
Describe and illustrate.

Site and Context Number: BRT 75 430a (86134) Find Number 18

Copper alloy penannular brooch made from 2.3mm diameter wire, terminals plain and folded back for 6.3mm in the plane of the ring. Poor condition, corroded with much loss of surface

Penannular brooch of Fowler's (1960) Type D, Roman, probably 1st – 2nd century

Dimensions: Diameter 27.3mm
Mass: 1.64g
Condition:
Find Context: Primary fill of Roman enclosure ditch, 2nd Century AD (from ceramics)
Describe and illustrate.

Site and Context Number: BRT 75 110 (70001)

Lead spindle whorl, consisting of a small biconical whorl set within an integrally cast lead ring to which it is linked by four spokes. The ring has an oval section measuring 4.8mm x 3.4mm. Both elements are decorated with small raised bosses.

Both the shape and decoration of the central part of this whorl are typical of Medieval lead spindle whorls but the surrounding ring is unusual. A date in the thirteen-fifteenth century is likely.

Dimensions: Diameter (of outer ring) 35.0mm, Diameter of central ring 21.3mm Height 9.2mm
Mass: 26.72g
Find Context: Topsoil over Roman road
Describe and illustrate.

Site and Context Number: BRT 75 Plot 110 (70035) Find Number 71202

Remains of a copper alloy bow brooch in poor condition, corroded with much loss of surface. Long, thin bow and foot with a square section expanding into a triangular catch plate. The bow is decorated with longitudinal bands of what appear to be continuous lines of small, square, stamp impressions, two bands on its upper surface, one on each side. The wings are plain and beneath them is a hinged, self-sprung pin mechanism.

Romano-British ‘T’ shaped brooch of first-second century date (Hattatt, 1987, 100 – 16, fig. 37 -9). This is a type of brooch which is notably found around the Severn Estuary.

Dimensions: Length 73.1mm, Width 31.0mm, Height 13.7mm
Mass: 5.88g
Find Context: Colluvial layer over Roman road.
Describe and illustrate.

Site and Context Number: BRT 75 Plot 430 (86117) Find Number 17

Oblate glass bead, now broken, with about 50% surviving. It is made from translucent, mid-blue glass applied to which were five (?) bulls-eye motifs, two of which survive with the edge of a third. These consist of circular patches of opaque white glass onto which were applied spots of translucent light brown and pale green glass. The white glass contains spots of light brown.

Glass bead, probably belonging to Guido’s Class 3, South Harting type (Guido, 197849 – 50, Fig. 8 and 9, pl. 3a). These beads are characterised by the use of applied ‘eye’ decoration in which the eyes are laid on a patch of white and are often of different colours (as is the case here). South Harting type beads are widespread in Britain but the main concentration lies around the Severn Estuary. Beads of this type appeared in the first century BC but most seem to date from the early Roman period.

Dimensions: Diameter 18.9mm, Height 11.0, Diameter of hole 7.8mm
Mass: 2.88g
Find Context: Ditch fill containing Roman pottery
Describe and illustrate.

Site and Context Number: BRT 75 Plot 111a (74011) Find Number 74705

Fragment of a shale bracelet with a hexagonal section, the top and bottom faces being flat. Transverse tooling (knife) marks can be seen on the better preserved faces. It is difficult, in the absence of analysis to distinguish between jet and shale, particularly with the better grades of shale. It is likely, although not certain, that this object originated at Kimmeridge, Dorset where there is evidence of their manufacture from locally occurring bituminous shales. This material is, however, wide spread in Britain.

Bracelet or armlet, probably unfinished. The best parallel for this fragment is from Meare Village East, Somerset where large numbers of shale armlets were found in Iron Age contexts (Coles, 1987, 130 – 34, Figs. 3.56 -3.57). Most of the armlets found at Meare share similar dimensions to that of 74705 but are notably polished and well finished. The exception, K1, shares the same angular profile and is described as unfinished. There is evidence that shale bracelets were roughly shaped near the point of origin and then finished and polished at their final destination (Taylor and May, 1996, 376). Shale bracelets were in use during both the Iron Age and Roman periods.

Dimensions: Diameter (outside) 80.0mm, Width of ring 10.0mm, Thickness 9.2mm
Mass: 11.48g
Condition: Incomplete, c. 60% of ring surviving, some signs of lamination/splitting.
Find Context: Ditch fill containing small quantity of Roman pottery
Describe and illustrate.

Site and Context Number: BRT 75 Plot 430 (86101) Find Number 19

Fragment of a copper alloy bow brooch, poor condition, corroded and with most of bow, foot and one wing missing. The bow is decorated with a central longitudinal rib either side of which are two smaller ribs. On the surviving wing these are supplemented by a short, parallel rib. The undersides of the wings are hollow to accommodate the coiled spring (missing) which would have also been threaded through a lug on the end of the bow.

Romano-British brooch of 'Polden Hill' type (Hattatt, 1987, 96 – 100 fig. 34, first century AD

Dimensions: Length 17.7mm, Width 19.0mm, Height 8.6mm
Mass: 3.98g
Find Context: Subsoil
Describe and illustrate.

Site and Context Number: BRT 75 Plot 430 (86101) Find Number 21

Copper alloy brooch made from a single casting with the pin and spring being integral with the body of the brooch. Condition good but with some corrosion. The foot tapers and bore a triangular catch plate. The bow is marked by a sharp change in angle towards the pin mechanism. At the top of the bow the section expands to form a small rectangular panel which bears three longitudinal grooves. The expansion is also marked by three small notches on either side of the bow.

La Tène III, Nauheim derivative, brooch (Hattatt, 1987, 20 – 24 fig. 8), first century BC/AD although the small panel at the top of the bow might suggest that this brooch is a little later in date

Dimensions: Length 41.8mm, Width 10.5mm, Height 14.9mm
Mass: 4.77g
Find Context: Subsoil
Describe and illustrate.

Site and Context Number: BRT 75 Plot 454 (85050)

Iron hob-nail or tack, the details of which are concealed by corrosion. Not datable.

Dimensions: Length (corroded) 17.0mm, Head diameter (corroded) 9.0mm
Mass: 1.44g
Find Context: Fill of a potential cremation burial, 2nd century AD (from ceramics)
Describe and illustrate. Important in view of its context

Site and Context Number: BRT 75 Plot 454 (85003)

Piece of lead sheet bearing a circular boss, 5.0mm diameter x 6.0mm high. Now in two pieces, damaged and disintegrating.

Unidentified and undatable.

Dimensions: Length 28.6mm, Width 17.0mm, Thickness 1.4mm
Mass: 5.00g
Find Context: Ditch fill containing Roman pottery
Describe and illustrate.

Site and Context Number: BRT 75 Plot 496 (90023)

Description: Three solidified droplets of copper alloy melt, corroded and in poor condition. Two have a laminated appearance and are less dense on the x-rays suggesting that they may be casting dross rather than metal.

Probably casting waste, undatable.

A. Irregular, noduled shape, 17.7mm x 10.7mm x 8.1mm, Mass 1.90g

B. Flattened, scale-like shape, laminated, 8.2mm x 7.3mm x 3.7mm, Mass 0.27g

C. Strip-like, laminated, 9.7mm x 5.4mm x 2.4mm, Mass 0.19g
Dimensions: See above

Mass: See above
Find Context: Upper fill of pit containing lots of pot debris dating from MIA-1st Century AD
Describe only

Site and Context Number: BRT 106 Plot 49 (49098)

Description: Object made up from thin sectioned cast lead. It appears to have originally had an 'H' shaped section.

Dimensions: Length 28.4mm, Width 8.2mm, Height of central web c. 2.0mm
Mass: 2.15g
Condition: Crushed and corroded
Identification: Fragment of window came used to secure the glass into a window
Dating: Probably post Medieval
Find Context: Post-med or early modern rubble spread/demolition material from farmhouse
Describe and illustrate only if useful in the context of other finds from this post-Medieval site.

Dr Kevin Leahy, FSA, MIfA 22 February, 2012

Bibliography

Coles J, 1987 Meare *Village East, The Excavations of A Bulleid and H St.George Gray, 1932 – 1956*, Somerset Levels Papers No. 13.

Fowler E, 1960 '*The origins and development of the pen-annular brooch in Europe'* Proceedings of the Prehistoric Society, vol. 26, 149 – 77.

Guido M 1978 *The Glass Beads of the Prehistoric and Roman Periods in Britain and Ireland*, Report of the Research Committee of the Society of Antiquaries of London No. XXXV, London, The Society of Antiquaries

Hattatt, R 1987 *Brooches of Antiquity*, Oxbow, Oxford

Taylor D and May J 1996 '*Shale and jet artefacts' in J. May, Dragonby, Report on Excavations at an Iron Age and Romano-British Settlement in North Lincolnshire, 376 – 7*, Oxbow, Oxford.

Metalwork –Tirley Feeder Connector

Dr Kevin Leahy

Introduction

The finds were received in an as found condition and no radiographs were available or required at the time of initial examination. This archive consisted of five iron objects from TFC 36. The iron objects were corroded, but relatively well preserved, although some detail was hidden by corrosion products.

Finds were examined at x10 magnification, sketched and described in detail. Materials were identified visually and dimensions were recorded using vernier callipers. Masses were obtained on an electronic balance to an accuracy of 0.01g.

Discussion

None of the artefacts could be accurately dated.

Recommendations

It is not thought that any of this material has any intrinsic archaeological importance although in some cases it may have come from a context which makes it worthy of note.

Table 24: Summary Catalogue

Context	Description	Material	Mass	Dating
5390	Nail or fitting?	Iron	34.03g	?
5391A	Nail	Iron	2.78g	?
5391B	Nail	Iron	3.00g	?
5718	Corrosion products	Iron oxide	1.44g	?
5713	Nail	Iron	11.94g	?

Catalogue

TFC 36

Context:	(5390) <>	
Material	Iron	
Condition:	Corroded but good	
Description:	Iron object, T shaped topped by a curved topped bar 31.7mm wide x 12.0mm across x 10.8mm deep. Shaft 13.9 x 9.2mm tapering in one plane. Blunt ended.	
Dimensions:	Length 61.1mm, Width 31.7mm, 12.0mm	
Mass:	34.3g	
Identification:	Nail or fitting	
Dating of find:	Not datable	
Context description		
Further action	None required	None required

Context:	(5391)A <>	
Material	Iron	
Condition:	Corroded but good	
Description:	Iron nail, square sectioned head 8.7 x 7.9mm developing from a 5.8 x 4.2mm tapering shaft. Blunt ended.	
Dimensions:	Length 24.9mm	
Mass:	2.78g	
Identification:	Nail	
Dating of find:	Not datable	
Context description		
Further action	None required	None required

Context:	(5391)B <>
Material	Iron
Condition:	Corroded and exfoliating
Description:	Iron nail, square sectioned head 9.9 x 6.8mm (damaged) developing from a 6.3 x 5.6mm tapering shaft tapering in one plane, shaft now slightly curved
Dimensions:	Length 27.2mm
Mass:	3.0g
Identification:	Nail
Dating of find:	Not datable
Context description	
Further action	None required

Context:	(5718) <>
Material	Iron
Condition:	Good, stable
Description:	Three fragments of iron corrosion product exfoliated from a larger object
Dimensions:	Irregular shapes, 1.3mm thick
Mass:	1.44g
Identification:	Not identifiable
Dating of find:	Not datable

Context description	
Further action	None required

Context:	(5713)	<>
Material	Iron	
Condition:	Corroded, fair	
Description:	Iron nail, shaft square sectioned 6.3 x 5.6mm pointed at end; now curved suggesting that it has been pulled from the wood into which it had been hammered. Head now irregular 12.0 x 9.9mm	
Dimensions:	Length 64.6mm	
Mass:	11.94g	
Identification:	Nail	
Dating of find:	Not datable	
Context description		
Further action	None required	

CBM and fired clay –Tirley Feeder Connector

Rachel Hall

CBM

A single fragment of roof tile was recovered from layer (5225). It is dated to the post-Medieval period base on form and fabric.

FIRED CLAY

A total of 15 fragments of Fired Clay weighing 163g were recovered from 6 contexts (see Table 25). With the exception of a five fragments that have surfaces, the assemblage comprises small and abraded, Undiagnostic fragments. They are all in a sandy fabric with sparse Iron Oxide inclusions with variable firing.

The objects were recovered from layers (5205), (5229) and (5388). They have at least one surface and an edge/ corner. These represent possible objects such as loomweights or Kiln bricks/mould fragments.

The remaining fragments may represent daub fragments from house structures.

Recommendations

The small amount of material offers little potential for further research. No further work is required.

Table 25: TFC36 CBM & Fired Clay by Context, Form, Number, Weight and Date

Context	*Material*	*Form*	*Number*	*Weight (g)*	*Date*
5225	CBM	Tile	1	12	Pmed
5205	Fired Clay	Object	1	67	Undated
5209	Fired Clay	Undiagnostic	2	12	Undated
5229	Fired Clay	Object	2	15	Undated
5237	Fired Clay	Undiagnostic	1	1	Undated
5388	Fired Clay	Object	2	28	Undated
5350	Fired Clay	Undiagnostic	7	40	Undated
TOTAL			**16**	**175**	

Clay tobacco pipe report – Tirley Feeder Connector

Mike Wood BA (hons) MLitt MIfA

Introduction

Two fragments of clay tobacco pipes were recovered from archaeological works at the Tirley Feeder Connector (TFC).

Methodology

The material was counted and weighed in grams, then examined visually to identify any diagnostic pieces and the overall condition of the assemblage. Reference was made to published guidelines (Higgins & Davey 2004). Where no other identification has been possible, stems have been dated by established stem bore guidelines (Oswald 1975). It should be noted that dates provided by stem bore size can have an appreciable margin for error and are intended only as a general guide. A summary of the material is recorded in Table 26.

Discussion

The assemblage comprises a mixture of 18th century clay pipes all represented by stem fragments.

Condition

Both pipes exhibit signs of weathering as would be expected from their recovery from topsoil and subsoil layers.

Recommendations for further work

None of the material warrants any further work or illustration. The decorated bowl would, however, benefit from a photographic record to go with the final archive. All the artefacts are in a stable condition and require no further conservation.

Reference:

Higgins, D A & Davey, P J, 2004, ‘Appendix 4: Draft guidelines for using the clay tobacco pipe record sheets’ in S D White, The Dynamics of Regionalisation and Trade: Yorkshire Clay Tobacco Pipes c1600-1800, The Archaeology of the Clay Tobacco Pipe, XVIII, British Archaeological Reports (British Series 374), Oxford, 487-490 (567pp)
Oswald, A, 1975 Clay Pipes for the Archaeologist BAR 14, Oxford

Table 26: Clay Tobacco Pipe Assemblage

Context	Deposit	Date range	Count	Weight (g)	Stem bore	Comments
gps 6113025	na	1780+	1	1	3/64"	stem

5713		1682-1757	1	3	5/64"	thick, fractured stem

The struck flint – Tirley Feeder Connector

By Dr Hugo Lamdin-Whymark

Summary

Eight struck flints were recovered from excavations at Tirley, Gloucestershire (TFC 36). These flints comprise six flakes, a blade and an end scraper. The flakes exhibit few technological attributes to assist with dating and only a broad prehistoric date can be suggested. The blade exhibits parallel sides and dorsal flake scars indicating that it was stuck from an opposed-platform (bipolar) blade core. These attributes indicate this artefact is probably Mesolithic. The end scraper is regularly manufactured on a flake that exhibits platform-edge abrasion. Scrapers are, however, not intrinsically datable and only a broad Mesolithic or Neolithic date can be proposed.

The artefacts all exhibit some degrees of edge-damage and none were recovered from contemporary archaeological contexts. The assemblage therefore has no potential for further analysis.

Catalogue

End scraper. Regularly manufactured on a flake. Moderate white cortication. Context 5205. Weight: 8g. Probably Mesolithic or Neolithic.

Flake. Modern damage on one edge. heavy white cortication. Context 5409. GPS 6105256. Weight: 1g. Prehistoric.

Flake with moderate edge-damage. GPS 6105072. Weight: 7g. Prehistoric.

Broad flake with moderate edge-damage and possibly slight edge-retouch. GPS 6105055. Weight: 17g. Prehistoric.

Flake with heavy edge damage and moderate white cortication. GPS 6105101. Weight: 5g. Prehistoric.

Broken parallel-sided blade that was stuck from a bipolar core. Orange iron-staining. GPS 6105102. Weight: 2g. Mesolithic.

Burnt and broken flake. GPS 6113024. Weight: 10g. Prehistoric.

Broken flake with heavy edge damage. GPS 6113026. Weight 3g. Prehistoric.

Stone – Tirley Feeder Connector

Mike Wood BA (hons) MLitt MIfA

Introduction

Thirty nine fragments of stone weighing 1.9kg were recovered during archaeological work at Tirley Feeder Connector (TFC) in Gloucestershire. The material was derived from topsoil and the fills of a possible hearth, a fire pit, a tree bole and ditches and gulleys.

Methodology

The material was counted and weighed in grams, then examined visually to identify any diagnostic pieces and the overall condition of the assemblage. A summary of the material is recorded in Table 27.

Discussion

The assemblage contained a mix of unworked fossil mudstone, quartz cobbles and natural cobbles.

Several of the fragments appear to have been heated, which is not surprising given that part of the assemblage was derived from a possible hearth and fire pit. Such stones may have been deliberately heated as pot boilers or perhaps for later use as tempering agents, where heating weakens the stone structure and will make grinding easier.

Recommendations for further work

No further work is recommended for the stone finds, which could have occurred locally in scattered Pleistocene Drift. Quartzite has been noted as possibly being used for polishing in the region (Roe 1999, 417); however there is no evidence for this on the recovered finds. All of the unworked artefacts could be passed to suitable teaching collections, returned to the landowner or be discarded.

References:

Roe, F 'The Worked Stone' in Mudd, A, Williams, R.J and Lupton, A *Excavations alongside Roman Ermin Street Gloucestershire and Wiltshire. The Archaeology of the A419/A417 Swindon to Gloucester Road Scheme*. 1999 Oxford Archaeology Unit:Oxford

Assemblage

Table 27: Worked Stone Catalogue

Context	Deposit	SF No.	Count	Weight (g)	Condition	Comments
5201	topsoil	5	1	92	abraded	fossil mudstone
5209	fill of ditch 5208		8	688	heated	fractured cobbles
5239	fill of hearth? 5238		21	573	heated	fractured cobbles
5271	fill of fire pit 5270		2	34		fractured quartz
5303			3	58	heated	fractured quartzite cobble
5369	fill of tree bole 5367		2	278		cobbles
5701	fill of gulley 5700		1	267		fractured cobble
5771			1	9		fractured quartzite

Glass – Tirley Feeder Connector

Mike Wood BA (hons) MLitt MIfA

Introduction

Five items of glass weighing 25g were recovered archaeological work at the Tirley Feeder Connector (TFC). The material dates to the 19th or 20th century.

Methodology

The material was counted and weighed in grams, then examined visually to identify any diagnostic pieces and the overall condition of the assemblage. Reference was made to published sources (Davis 1973, Dumbrell 1983). A summary of the material is recorded in Table 28.

Discussion

The assemblage contained a single fragment of clear modern window glass, probably a variety of drawn sheet or polished plate rather than 'float glass' which suggests a pre-1950s date is likely.

Recommendations for further work

No further work is recommended on this assemblage. The artefact could be passed to suitable teaching collections, returned to the landowner or be discarded.

References:

http://www.londoncrownglass.co.uk/London_Crown_Glass/History.html (accessed 27th January 2012)

Assemblage

Table 28: Glass Assemblage

Context	Form	Colour	Date	Shds	Wt (g)	Comments
5201	window	clear	19th-20th	1	1	1mm thick, fractured
5403	bottle	dark green	19th-e20th	1	9	fractured piece
5403	bottle	dark green	19th-20th	1	2	thin walled
5403	window	pale aqua	l19th-e20th	1	9	Machine drawn? 2mm thick
5403	sheet	clear	19th-20th	1	4	Thin sheet (1mm) with faint lip.

An Assessment of The Charred Plant Macrofossils And Other Remains From The Tirley Feeder Connector Site, Gloucestershire (TFC 36)

By Val Fryer

Introduction and method statement

Excavations at the Tirley Feeder Connector site, which were undertaken by Network Archaeology as part of an ongoing project of works, recorded a number of pits, ditches and other discrete deposits, most of which were undated at the time of writing. Pottery of 2nd to 3rd century A.D. date was recovered from the site, but it is currently unclear whether any of this was present within the sampled features. Samples for the retrieval of the plant macrofossil assemblages were taken from a number of contexts, and ten were submitted for assessment.

The samples (or sub-samples thereof) were processed by manual water flotation and the flots were collected in a 300 micron mesh sieve. The dried flots were scanned under a binocular microscope at magnifications up to x 16 and the plant macrofossils and other remains noted are listed in Table 29. Nomenclature within the table follows Stace (1997). All plant remains were charred. Modern fibrous roots, arthropod remains and seeds were present throughout.

The non-floating residues were collected in a 1mm mesh sieve and will be sorted when dry. Any artefacts/ecofacts will be retained for further specialist analysis.

Results

Although charcoal/charred wood fragments are present throughout, other plant macrofossils are exceedingly scarce. However, a single, large fragment of hazel (*Corylus avellana*) nutshell is recorded within the assemblage from sample 8 (ditch [5282]), and sample 5 (ditch [5221]) contains a possible indeterminate tuber fragment. The charcoal is mostly very small and abraded, possibly indicating that it was exposed to the elements for some considerable period prior to deposition.

A limited range of other materials types is also recorded. Small, and very abraded bone fragments are present within the assemblages from samples 5, 32 (ditch terminal [5706]), 33 (ditch [5741]) and 34 (deposit [5718]), and form the major component of sample 35, which was taken from a deposit containing very fragmentary skeletal remains. Occasional splinters of heat altered stone are also recorded, and sample 33 appears to contain numerous small pellets of burnt or fired clay.

Conclusions and recommendations for further work

In summary, as with the previous samples from Tirley (Fryer 2011), the assemblages are mostly small and very limited in composition. As hearths and/or fire pits are recorded on the site, it is tentatively suggested that much of the charcoal/charred wood is probably derived from the 'rake-out' from these features. However, it is noted that the material is mostly of a very uniform size, possibly suggesting that is was sifted or graded prior to dispersal and/or deposition. The intended purpose of these fire pits and hearths is currently unclear, but the lack of cereals or other food residues probably suggests that their primary function was not domestic.

As plant macrofossils other than charcoal are so scarce, no further analysis of these assemblages is recommended at this stage. However, a summary of this assessment should be included within any publication of data from the site.

Reference

Stace, C., 1997 *New Flora of the British Isles*. 2nd edition. Cambridge University Press

Table 29: Charred Macrofossils and Other Remains

Sample No.	5	6	7	8	30	31	32	33	34	35
Context No.	**5222**	**5259**	**5271**	**5285**	**5219**	**5220**	**5707**	**5743**	**5718**	**SK 1**
Feature No.	**5221**	**5260**	**5270**	**5282**	**5218**	**5218**	**5706**	**5741**		
Feature type	**Ditch**	**H/FP**	**?FP**	**Ditch**	**Pit**	**Pit**	**Ditch T.**	**Ditch**	**Depos.**	**Skel.**
Plant macrofossils										
Corylus avellana L.				x						
Charcoal <2mm	xxxx	xxx	xxxx	xxxx	xxxx	xxxx	xxx	xxx	xx	x
Charcoal >2mm	x	x	xxx	xx	x	x	x			
Charcoal >5mm			x	x						
Charcoal >10mm			x							
Charred root/stem				x						
Indet. tuber	xcffg									
Other remains										
Black porous and tarry material		x					x	x		x
Black organic concretion	x									
Bone	x						x	x	xx	xxxx
Burnt/fired clay	x							xxcf		
Burnt stone			x		x	x				
Mineral concretions				xxxx	xxxx		xxxx			
Mineralised ?faecal material		xcf								
Small coal frags,	x									
Sample volume (litres)	**24ss**	**10**	**24**	**14**	**24**	**20ss**	**20ss**	**20ss**	**24ss**	**28**
Volume of flot (litres)	**0.2**	**<0.1**	**0.2**	**<0.1**	**<0.1**	**0.2**	**<0.1**	**<0.1**	**<0.1**	**<0.1**
% flot sorted	**50%**	**100%**	**50%**	**100%**	**100%**	**50%**	**100%**	**100%**	**100%**	**100%**

Key to Table

x = 1 - 10 specimens
xx = 11 – 50 specimens
xxx = 51 – 100 specimens
xxxx = 100+ specimens
cf = compare fg = fragment ss = sub-sample H = hearth
FP = fire pit T = terminal Depos = deposit Skel = skeleton

Radio Carbon Dates

Summary

In relation to the graphs on the following pages, the following table equates the Beta Sample number to the Context number from which the sample was taken (along with feature and plot), and provides the Calibrated Date for each sample.

Table 30: Summary of Radio Carbon Dates

Beta Sample Number	**Context number**	**Context Description**	**Plot**	**Calibrated dates**
315439	49033	Fill of cremation **49034**	49	BC 2020 – 1990 & BC 1980-1880
315440	49055	Primary fill of pit **49054**	49	BC 2190 – 2180, BC 2140 – 2010 & BC 2000 – 1980
315441	74045	Fill of Fire pit **74078**	111a	AD 1030 – 1190 & AD 1200 - 1210
315442	74065	Fill of Fire pit **74041**	111a	AD 1020 - 1170
315443	75004	Fill of posthole **75003**	331	BC 2140 - 1950
315444	75007	Fill of posthole **75006**	331	BC 2030 - 1890
318512	46102	Fill of cremation **46103**, sample A	461	BC 360-280, BC 260-240, BC 240-160 & BC 130-120
318513	46102	Fill of cremation **46103**, sample B	461	BC 400-360, BC 280-260 & BC 240-240
318514	60003	Spread of burnt bone below subsoil, sample A	60	BC 1890-1740
318515	60003	Spread of burnt bone below subsoil, sample B	60	BC 1940-1770

CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12=-20.9:lab. mult=1)

Laboratory number: **Beta-315439**

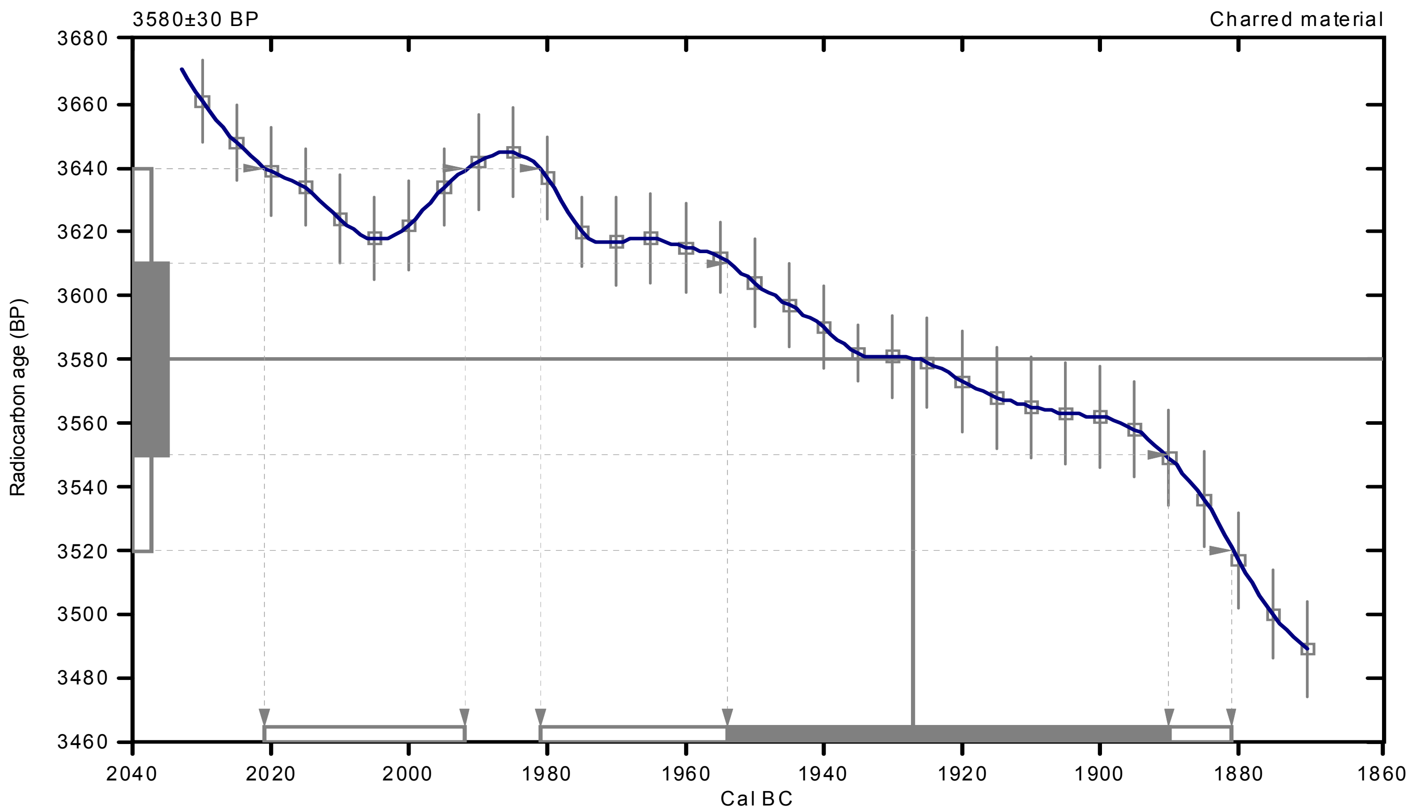
Conventional radiocarbon age: **3580±30 BP**

2 Sigma calibrated results: (95% probability) **Cal BC 2020 to 1990 (Cal BP 3970 to 3940) and Cal BC 1980 to 1880 (Cal BP 3930 to 3830)**

Intercept data

Intercept of radiocarbon age with calibration curve: Cal BC 1930 (Cal BP 3880)

1 Sigma calibrated result: (68% probability) Cal BC 1950 to 1890 (Cal BP 3900 to 3840)



References:

Database used

INTCAL09

References to INTCAL09 database

Heaton,et.al.,2009, Radiocarbon 51(4):1151-1164, Reimer,et.al, 2009, Radiocarbon 51(4):1111-1150, Stuiver,et.al,1993, Radiocarbon 35(1):137-189, Oeschger,et.al.,1975,Tellus 27:168-192

Mathematics used for calibration scenario

A Simplified Approach to Calibrating C14 Dates

Talma, A. S., Vogel, J. C., 1993, Radiocarbon 35(2):317-322

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CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12=-25.7:lab. mult=1)

Laboratory number: **Beta-315440**

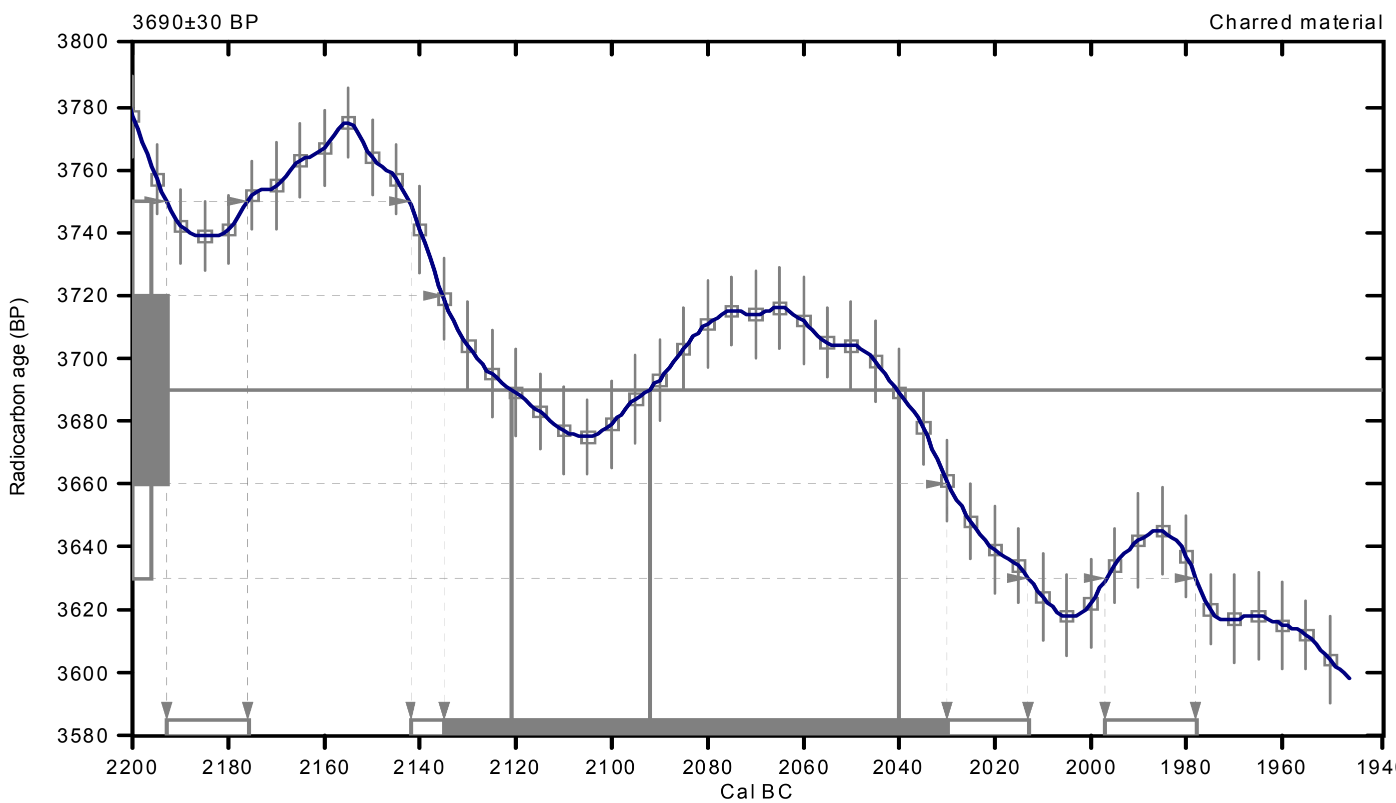
Conventional radiocarbon age: **3690±30 BP**

2 Sigma calibrated results: (95% probability) **Cal BC 2190 to 2180 (Cal BP 4140 to 4130) and Cal BC 2140 to 2010 (Cal BP 4090 to 3960) and Cal BC 2000 to 1980 (Cal BP 3950 to 3930)**

Intercept data

Intercepts of radiocarbon age with calibration curve: Cal BC 2120 (Cal BP 4070) and
Cal BC 2090 (Cal BP 4040) and
Cal BC 2040 (Cal BP 3990)

1 Sigma calibrated result: (68% probability) Cal BC 2140 to 2030 (Cal BP 4080 to 3980)



References:

Database used
INTCAL09
References to INTCAL09 database
Heaton,et.al.,2009, Radiocarbon 51(4):1151-1164, Reimer,et.al, 2009, Radiocarbon 51(4):1111-1150, Stuiver,et.al,1993, Radiocarbon 35(1):137-189, Oeschger,et.al.,1975,Tellus 27:168-192
Mathematics used for calibration scenario
A Simplified Approach to Calibrating C14 Dates
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CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12=-23.9:lab. mult=1)

Laboratory number: **Beta-315441**

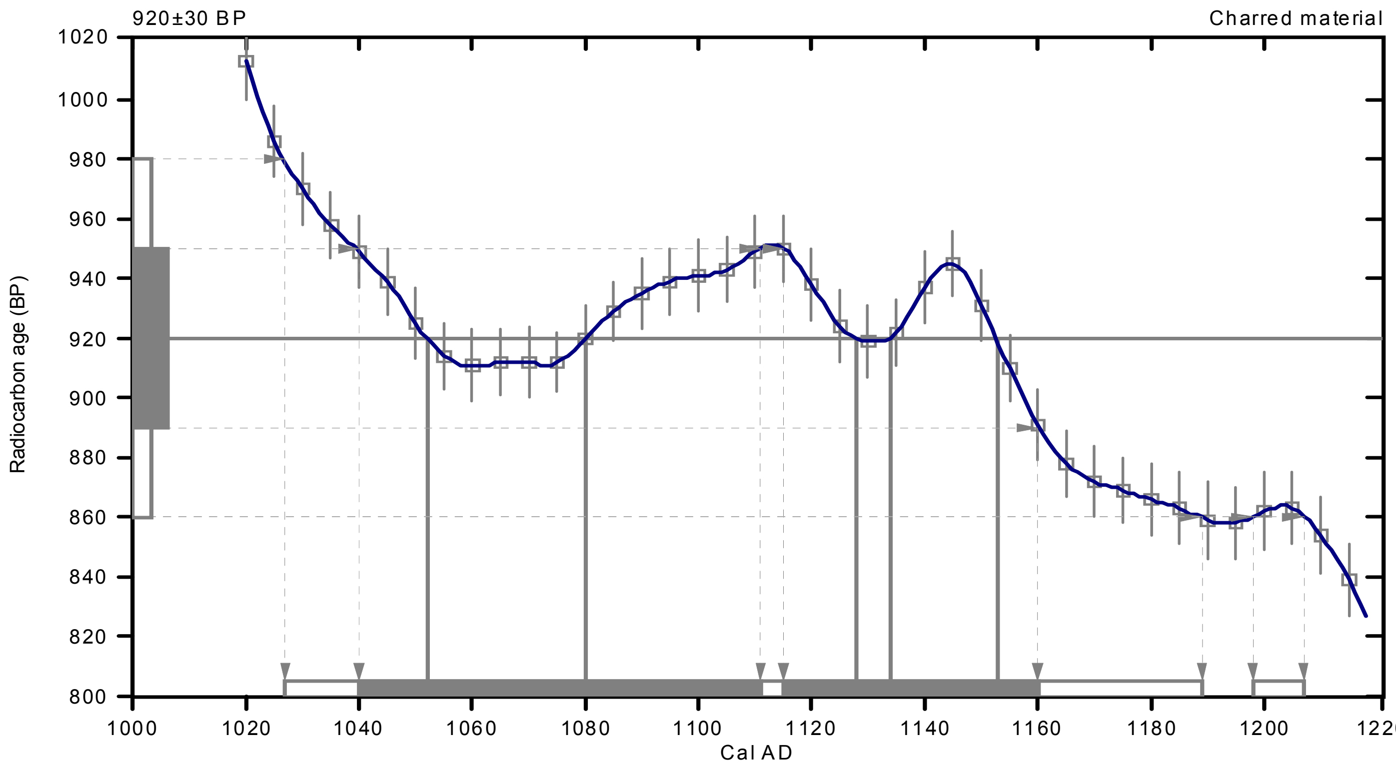
Conventional radiocarbon age: **920±30 BP**

2 Sigma calibrated results: **Cal AD 1030 to 1190 (Cal BP 920 to 760) and**
(95% probability) **Cal AD 1200 to 1210 (Cal BP 750 to 740)**

Intercept data

Intercepts of radiocarbon age
with calibration curve: Cal AD 1050 (Cal BP 900) and
Cal AD 1080 (Cal BP 870) and
Cal AD 1130 (Cal BP 820) and
Cal AD 1130 (Cal BP 820) and
Cal AD 1150 (Cal BP 800)

1 Sigma calibrated results: Cal AD 1040 to 1110 (Cal BP 910 to 840) and
(68% probability) Cal AD 1120 to 1160 (Cal BP 840 to 790)



References:

Database used
INTCAL09
References to INTCAL09 database
Heaton,et.al.,2009, Radiocarbon 51(4):1151-1164, Reimer,et.al, 2009, Radiocarbon 51(4):1111-1150, Stuiver,et.al,1993, Radiocarbon 35(1):137-189, Oeschger,et.al.,1975,Tellus 27:168-192
Mathematics used for calibration scenario
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CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12=-24.6:lab. mult=1)

Laboratory number: **Beta-315442**

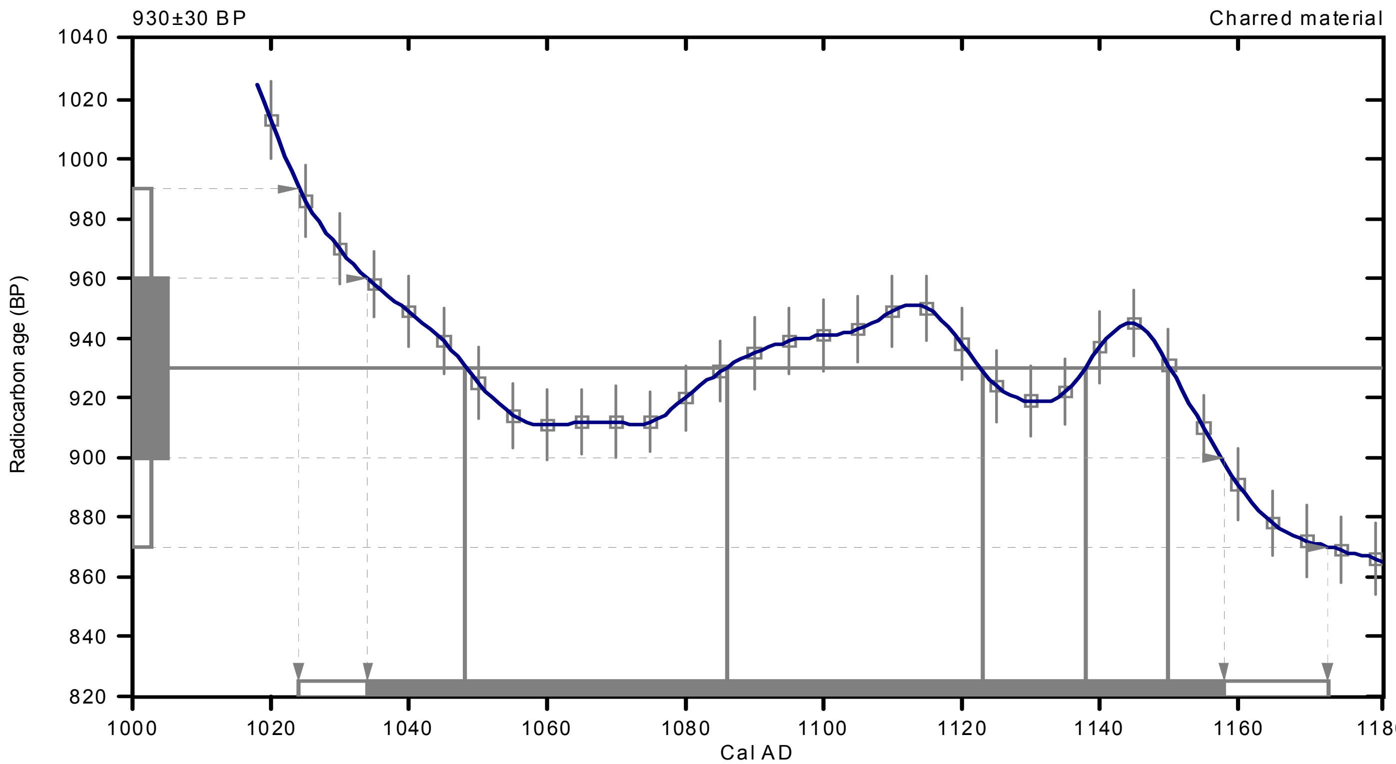
Conventional radiocarbon age: **930±30 BP**

2 Sigma calibrated result: (95% probability) **Cal AD 1020 to 1170 (Cal BP 930 to 780)**

Intercept data

Intercepts of radiocarbon age with calibration curve: Cal AD 1050 (Cal BP 900) and
Cal AD 1090 (Cal BP 860) and
Cal AD 1120 (Cal BP 830) and
Cal AD 1140 (Cal BP 810) and
Cal AD 1150 (Cal BP 800)

1 Sigma calibrated result: (68% probability) Cal AD 1030 to 1160 (Cal BP 920 to 790)



References:

Database used
INTCAL09
References to INTCAL09 database
Heaton,et.al.,2009, Radiocarbon 51(4):1151-1164, Reimer,et.al, 2009, Radiocarbon 51(4):1111-1150, Stuiver,et.al,1993, Radiocarbon 35(1):137-189, Oeschger,et.al.,1975,Tellus 27:168-192
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CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12=-24.9:lab. mult=1)

Laboratory number: **Beta-315443**

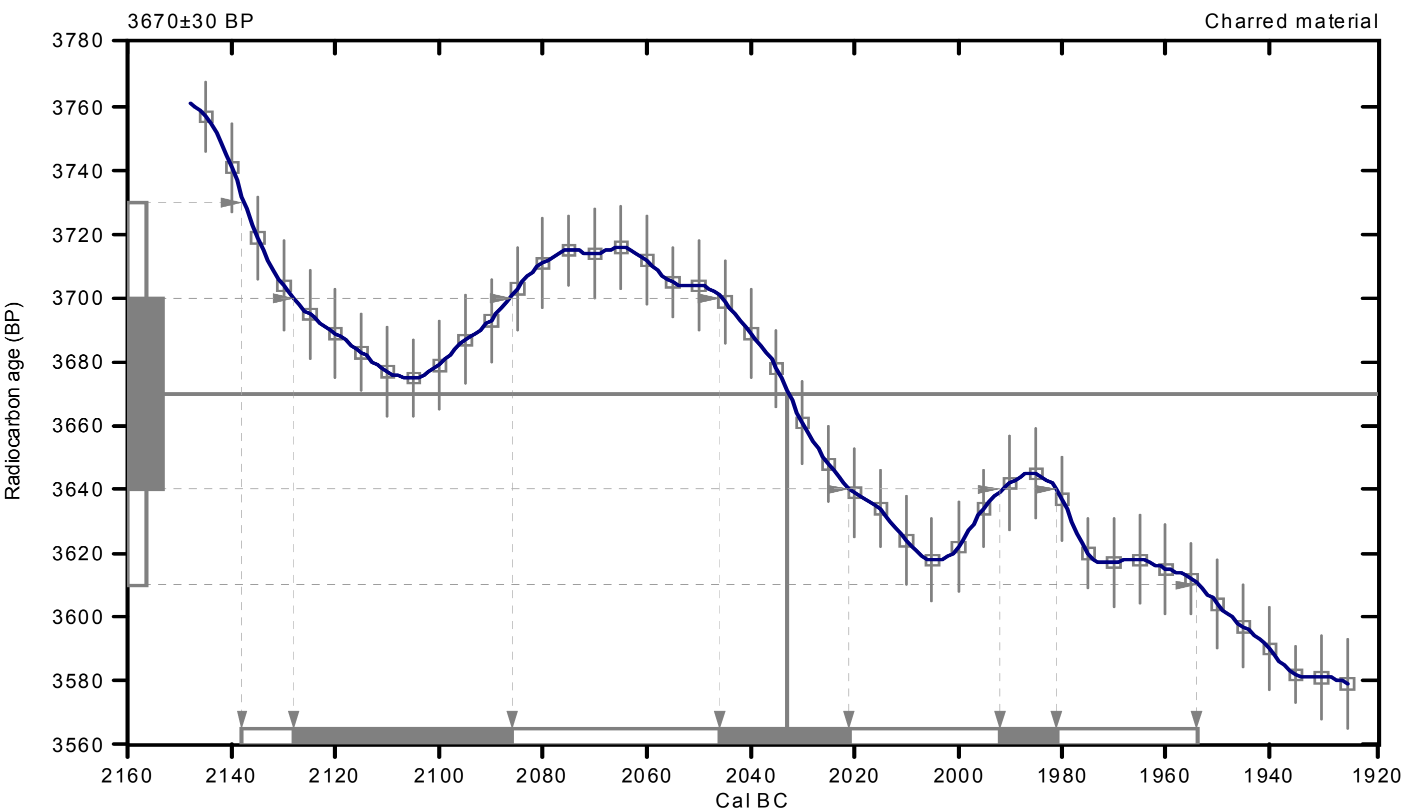
Conventional radiocarbon age: **3670±30 BP**

2 Sigma calibrated result: **Cal BC 2140 to 1950 (Cal BP 4090 to 3900)**
(95% probability)

Intercept data

Intercept of radiocarbon age
with calibration curve: Cal BC 2030 (Cal BP 3980)

1 Sigma calibrated results: Cal BC 2130 to 2090 (Cal BP 4080 to 4040) and
(68% probability) Cal BC 2050 to 2020 (Cal BP 4000 to 3970) and
Cal BC 1990 to 1980 (Cal BP 3940 to 3930)



References:
Database used
INTCAL09
References to INTCAL09 database
Heaton,et.al.,2009, Radiocarbon 51(4):1151-1164, Reimer,et.al, 2009, Radiocarbon 51(4):1111-1150, Stuiver,et.al,1993, Radiocarbon 35(1):137-189, Oeschger,et.al.,1975,Tellus 27:168-192
Mathematics used for calibration scenario
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CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12=-24:lab. mult=1)

Laboratory number: **Beta-315444**

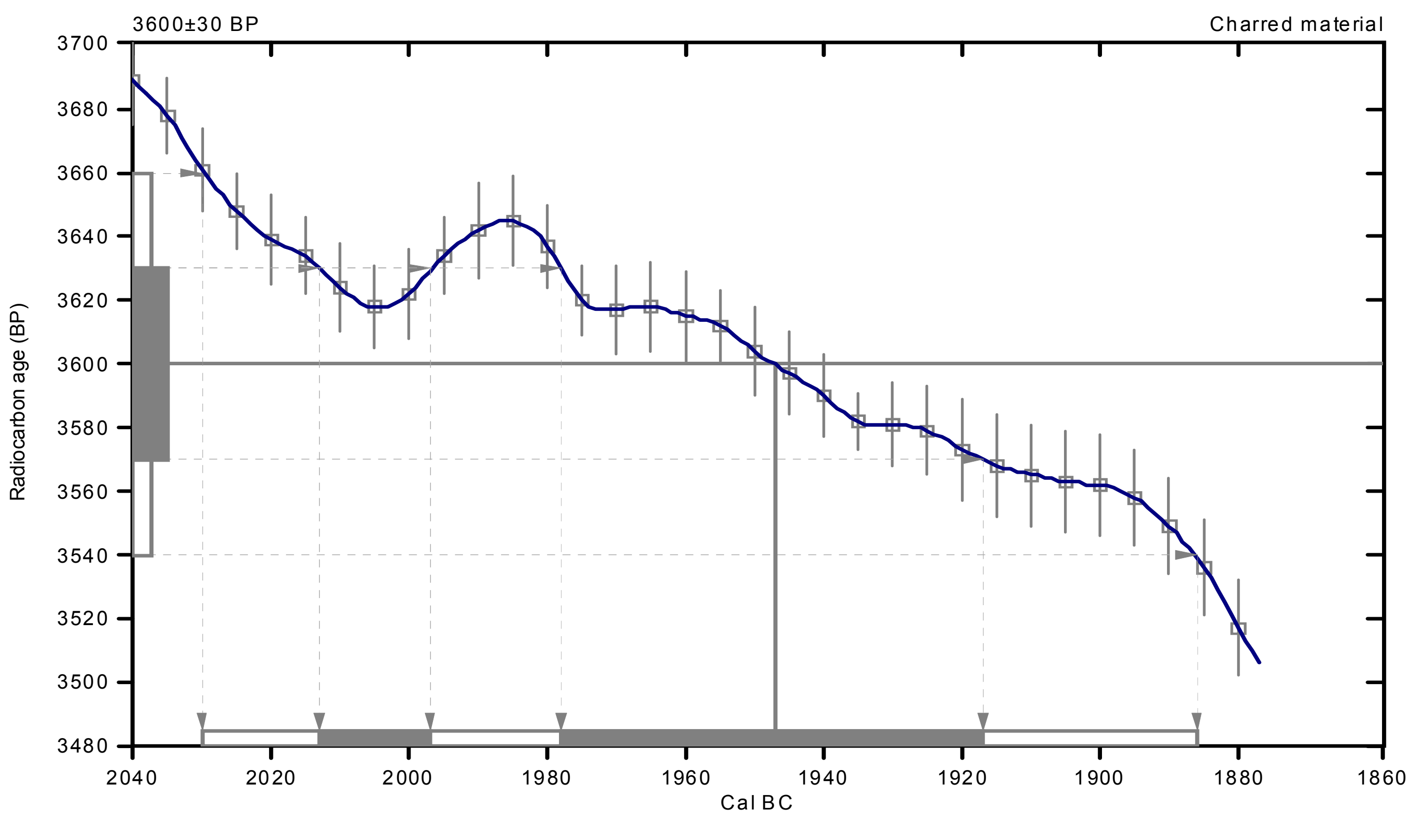
Conventional radiocarbon age: **3600±30 BP**

2 Sigma calibrated result: (95% probability) **Cal BC 2030 to 1890 (Cal BP 3980 to 3840)**

Intercept data

Intercept of radiocarbon age with calibration curve: Cal BC 1950 (Cal BP 3900)

1 Sigma calibrated results: (68% probability) Cal BC 2010 to 2000 (Cal BP 3960 to 3950) and Cal BC 1980 to 1920 (Cal BP 3930 to 3870)



References:

Database used

INTCAL09

References to INTCAL09 database

Heaton,et.al.,2009, Radiocarbon 51(4):1151-1164, Reimer,et.al, 2009, Radiocarbon 51(4):1111-1150, Stuiver,et.al,1993, Radiocarbon 35(1):137-189, Oeschger,et.al.,1975,Tellus 27:168-192

Mathematics used for calibration scenario

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CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12=-21:lab. mult=1)

Laboratory number: **Beta-318512**

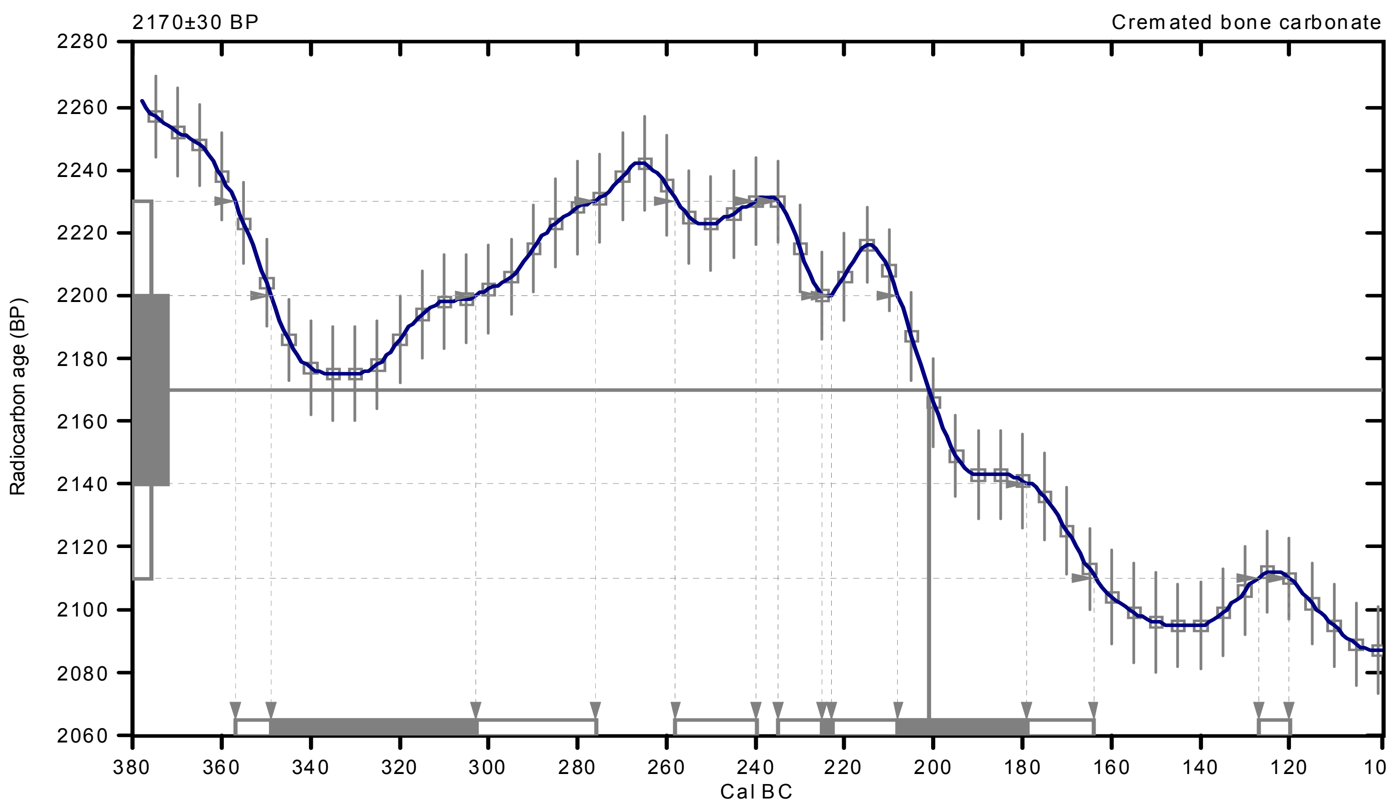
Conventional radiocarbon age: **2170±30 BP**

2 Sigma calibrated results: **Cal BC 360 to 280 (Cal BP 2310 to 2230) and**
(95% probability) **Cal BC 260 to 240 (Cal BP 2210 to 2190) and**
Cal BC 240 to 160 (Cal BP 2180 to 2110) and
Cal BC 130 to 120 (Cal BP 2080 to 2070)

Intercept data

Intercept of radiocarbon age
with calibration curve: Cal BC 200 (Cal BP 2150)

1 Sigma calibrated results: Cal BC 350 to 300 (Cal BP 2300 to 2250) and
(68% probability) Cal BC 220 to 220 (Cal BP 2180 to 2170) and
Cal BC 210 to 180 (Cal BP 2160 to 2130)



References:

Database used
INTCAL09

References to INTCAL09 database
Heaton,et.al.,2009, Radiocarbon 51(4):1151-1164, Reimer,et.al, 2009, Radiocarbon 51(4):1111-1150, Stuiver,et.al,1993, Radiocarbon 35(1):137-189, Oeschger,et.al.,1975,Tellus 27:168-192

Mathematics used for calibration scenario
A Simplified Approach to Calibrating C14 Dates
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CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12=-21:lab. mult=1)

Laboratory number: **Beta-318513**

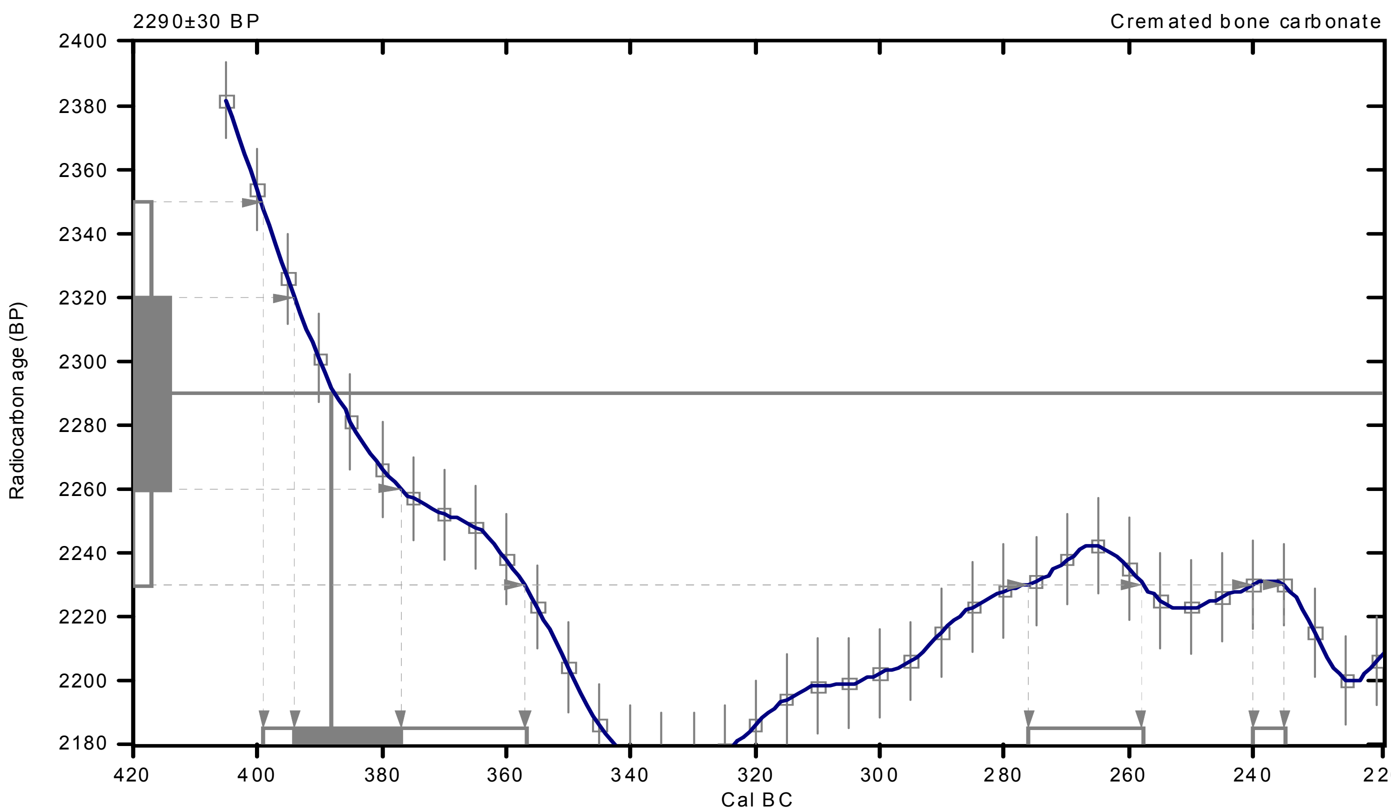
Conventional radiocarbon age: **2290±30 BP**

2 Sigma calibrated results: (95% probability) **Cal BC 400 to 360 (Cal BP 2350 to 2310) and Cal BC 280 to 260 (Cal BP 2230 to 2210) and Cal BC 240 to 240 (Cal BP 2190 to 2180)**

Intercept data

Intercept of radiocarbon age with calibration curve: Cal BC 390 (Cal BP 2340)

1 Sigma calibrated result: (68% probability) Cal BC 390 to 380 (Cal BP 2340 to 2330)



References:

Database used

INTCAL09

References to INTCAL09 database

Heaton,et.al.,2009, Radiocarbon 51(4):1151-1164, Reimer,et.al, 2009, Radiocarbon 51(4):1111-1150, Stuiver,et.al,1993, Radiocarbon 35(1):137-189, Oeschger,et.al.,1975,Tellus 27:168-192

Mathematics used for calibration scenario

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CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12=-24.4:lab. mult=1)

Laboratory number: **Beta-318514**

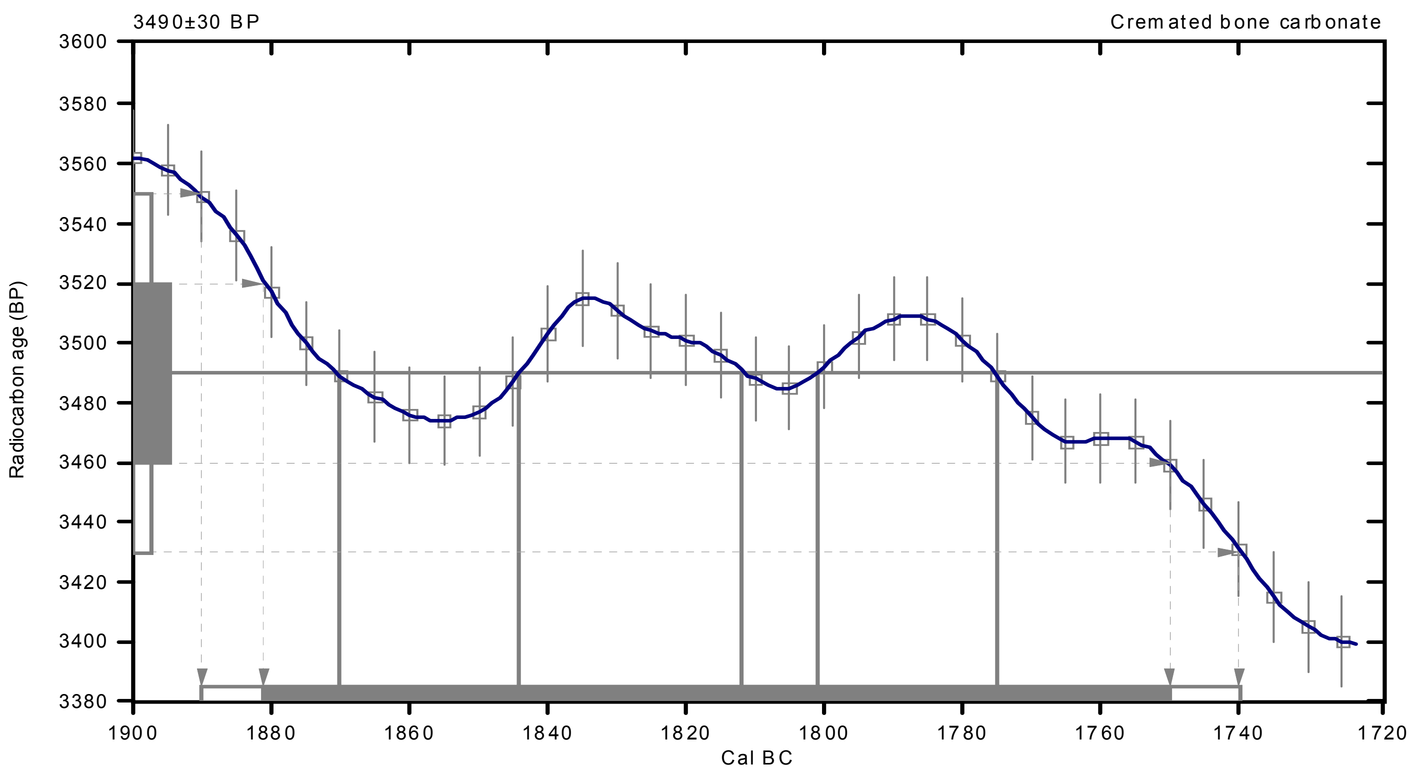
Conventional radiocarbon age: **3490±30 BP**

2 Sigma calibrated result: (95% probability) **Cal BC 1890 to 1740 (Cal BP 3840 to 3690)**

Intercept data

Intercepts of radiocarbon age with calibration curve: Cal BC 1870 (Cal BP 3820) and
Cal BC 1840 (Cal BP 3790) and
Cal BC 1810 (Cal BP 3760) and
Cal BC 1800 (Cal BP 3750) and
Cal BC 1780 (Cal BP 3720)

1 Sigma calibrated result: (68% probability) Cal BC 1880 to 1750 (Cal BP 3830 to 3700)



References:

Database used

INTCAL09

References to INTCAL09 database

Heaton,et.al.,2009, Radiocarbon 51(4):1151-1164, Reimer,et.al, 2009, Radiocarbon 51(4):1111-1150, Stuiver,et.al,1993, Radiocarbon 35(1):137-189, Oeschger,et.al.,1975,Tellus 27:168-192

Mathematics used for calibration scenario

A Simplified Approach to Calibrating C14 Dates

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CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12=-24.2:lab. mult=1)

Laboratory number: **Beta-318515**

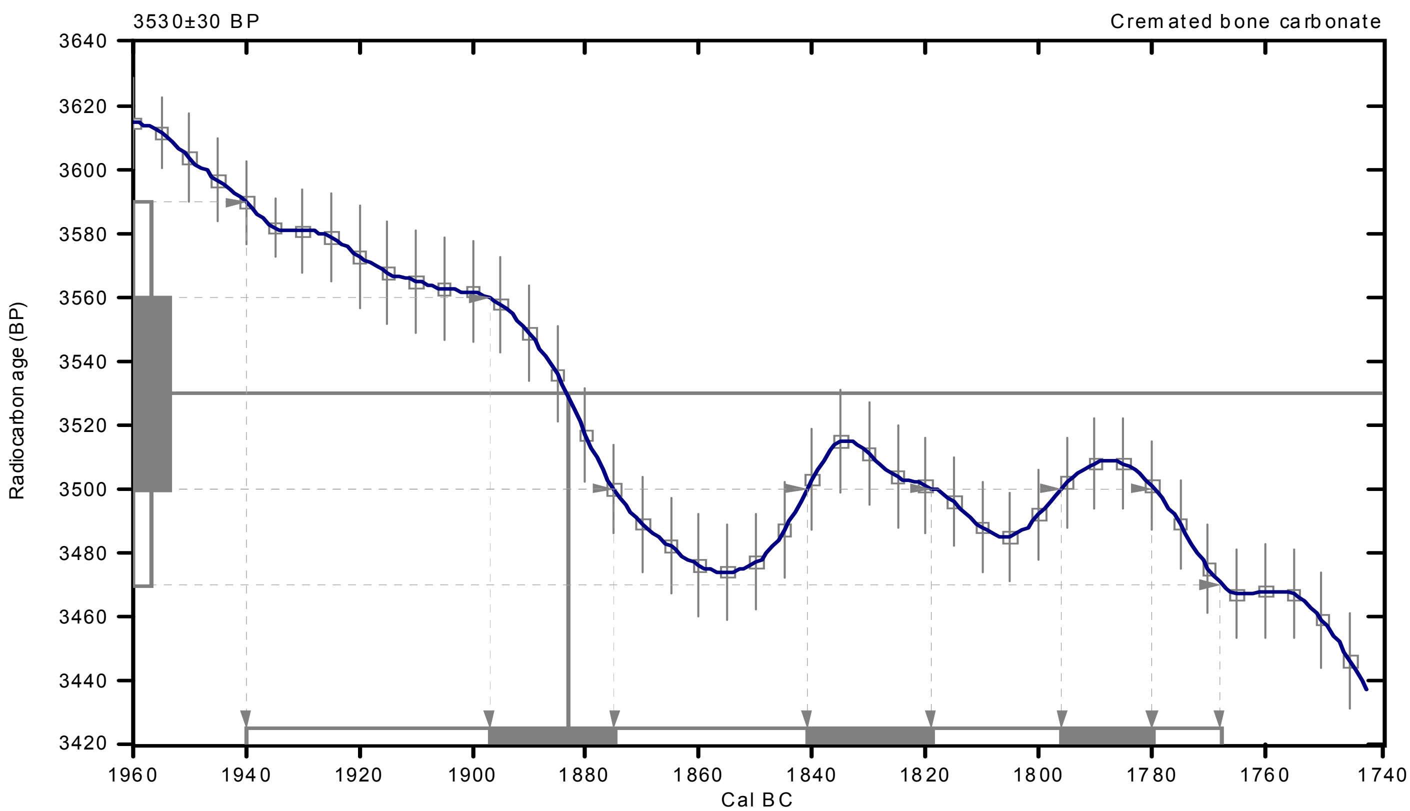
Conventional radiocarbon age: **3530±30 BP**

2 Sigma calibrated result: (95% probability) **Cal BC 1940 to 1770 (Cal BP 3890 to 3720)**

Intercept data

Intercept of radiocarbon age with calibration curve: Cal BC 1880 (Cal BP 3830)

1 Sigma calibrated results: (68% probability) Cal BC 1900 to 1880 (Cal BP 3850 to 3820) and
Cal BC 1840 to 1820 (Cal BP 3790 to 3770) and
Cal BC 1800 to 1780 (Cal BP 3750 to 3730)



References:

Database used

INTCAL09

References to INTCAL09 database

Heaton,et.al.,2009, Radiocarbon 51(4):1151-1164, Reimer,et.al, 2009, Radiocarbon 51(4):1111-1150, Stuiver,et.al,1993, Radiocarbon 35(1):137-189, Oeschger,et.al.,1975,Tellus 27:168-192

Mathematics used for calibration scenario

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GeoArch

Report 2012/18

Archaeometallurgical residues from the Brecon to Tirley gas pipeline

Dr Tim Young
4th July 2012
Revised 4th June 2013

Archaeometallurgical residues from the Brecon to Tirley gas pipeline

Dr T.P. Young

Abstract

This report details the analytical investigation of selected samples of archaeometallurgical residues from plots 331 and 430.Materials from plots 454 and 496 were also examined, but not analysed. Selected materials had been sub-sampled, with cut pieces mounted in resin, ground and polished, for inspection on the analytical scanning electron microscope. Data presented here are mainly backscattered electron photomicrographs (BSEM) and energy dispersive X-Ray spectroscopic (EDS) microanalyses.

The samples from Plot 331 had been taken from whole or fragmented smithing hearth cakes (SHCs). Brief re-examination of the material suggests that the cakes ranged from about 400g to a little over 1000g. The cakes have a high iron content, some contain evidence for formerly having contained metallic iron and many show evidence for 'clasts' of iron oxides, in one case of coarsely dendritic magnetic. These features indicate a high rate of iron loss in the hearth, which suggests that they were generated during bloomsmithing (primary smithing as part of the process of iron production) rather than blacksmithing (the end use of iron).

Samples from Plot 430 are entirely from bloomery iron smelting; they include tapped smelting slags, smelting slags that cooled inside the furnace and a small fragment of bloom. The chemical composition of the slags indicates that they were produced during the smelting of iron ores from the Forest of Dean. The localised distribution of the high-grade ore of Dean meant that smelting took place in locations with woodland resources well outside the area of ore outcrops. This hinterland extends at least 20km from Dean to NW and SE and35Km to SW and NE, in which directions river transport may have had a significant role. Plot 430 is well within this sphere of influence. The tapslag composition compares very closely with previously described from Ariconium *and so, although analyses of ore and furnace ceramic were not available from Plot 430, it is likely that the efficiency and mass balance of the Plot430 smelting would have been similar to that previously described there. The physical evidence from the slags also suggests similar smelting technology to that described from other smaller sites in the hinterland, rather than the different technology that appears to have been employed at the major, possibly military, smelting sites in S Wales and the SW of Dean.*

Contents

Methods

Samples for further investigation had been identified at the assessment stage and a methodology for their investigation on the SEM agreed between Network Archaeology and their specialist for the assessment. The methodology for this project does not follow the usual GeoArch approach and was entirely based around investigation using the analytical SEM.

Electron microscopy was undertaken on the Cambridge Instruments (LEO) S360 analytical electron microscope in the School of Earth and Ocean Sciences, Cardiff University. Microanalysis was undertaken using the system's Oxford Instruments INCA ENERGY energy-dispersive x-ray analysis system (EDX). All petrographic images presented in this report are backscattered electron photomicrographs. The polished blocks for investigation on the SEM were supplied already-prepared.

Locations of analyses are presented as sample-area-analysis (e.g. A2 SOI2 #3), where the samples (up to two) were mounted in resin blocks A to L. The area of the sample in a particular image is referred to as SOIn (SOI = Site Of Interest in the terminology of the INCA microanalysis software) and individual analyses (points or areas) are labelled #m. Images of all SOIs are included in Appendix A, including , where appropriate, details of the analysed points/areas. The scale of the images is mostly indicated by the included scale bar. For samples I,J,K and L, a problem with the instrument meant that the scale bars on the images are given incorrectly. The correct scales are quoted in the figure captions.

All analyses were collected with all elements analysed (including oxygen, but not carbon). Analytical totals were frequently far from 100%, because the analytical system is designed to provide totals of 100% from spot analyses in the centre of the field. The area analyses required for this project are not standardised in the same way and will diverge from a total of 100% (either above or below, depending on the location of the area with respect to the centre of the field).In order to make the microanalytical results simply comparable across materials (and also sites), no attempt has been made to adjust for the oxidation state of elements with variable valency. The figures employed in the report have therefore been constructed with elements expressed as oxides in weight% calculated stoichiometrically, except for mineral structure calculations, where the measured oxygen has been used. Iron is reported in the report expressed as FeO and manganese as MnO.

Throughout this report standard mineral terminology is applied to both natural and anthropogenic materials – although artificial phases are no longer strictly considered to be minerals.

The convention adopted in this report is to describe olivine bearing Fe, Mg, Ca and Mn in terms of an olivine on the forsterite-fayalite join (using the notation for instance of Fa95Fo5 for an olivine that is 95% fayalite and 5% forsterite; where Fe/(Fe+Mg) = 0.95) plus figures for the overall percentage replacement by calcium and manganese.

This project was undertaken for Network Archaeology.

Plot 331

General nature of material

Plot 331 (NGR 336993 236156) was located 1.3km to the south west of Kingstone, in Herefordshire. Most of the assemblage from Plot 331 derives from contexts investigated during initial assessment of the site and not during the subsequent excavation phase; this material does not therefore appear in the assessment catalogue (McKenzie 2008, tables E10.1 and E10.2). The site is of greater significance than might be anticipated from that document alone. The material found is described as occurring in 'dumps', with slag, hearth lining and hammerscale, associated with pottery of the late Iron Age to c. AD70. The 'dumps' lay close to a pit, also containing slag, which was c. 7.5m NE of a late Iron Age/Roman ring ditch, which also contained slag.

The site yielded a moderate number of smithing hearth cakes (SHCs), of which fifteen were either complete or were sufficiently so to be able to have the original weight estimated (230, 264, 270, 298, 310, 336, 386, 557, 606, 636, 786, 890, 920, 944 and 1035g). They thus ranged in weight from 230g up to 1035g, with mean weight of 565g and with seven (47%) weighing less than 500g and one (7%) weighing more than 1000g. Several of the examples have 'exploded' since excavation because of the corrosion of metallic iron within them.

Results

Description of residues

The five mounted samples were derived from four separate SHCs, selected as part of the assessment process.

The four SHCs sampled are all slightly different and provide a spectrum of iron content:

SHC K: this material was very iron rich and contained a zone formed of coarse-grained magnetite overgrown by wustite, several inclusions dominantly of wustite and some unusual lobe-margins comprised of wustite, magnetite and some iscorite. Other parts of the slag showed a slightly lower iron content, with a more conventional texture of wustite dendrites, followed by fayalite, with an interstitial glass.

SHC H/I: this very iron-rich slag was entirely dominated by wustite, ranging from blebby to dendritic forms. There were vesicles, probably tubular and vertical, partially occluded by fayalitic slag. The slag contained possible corroded iron blebs near its base and, less certainly, at its top.

SHC J: was somewhat heterogeneous, with a dense wustite-rich core. Both upper and lower surfaces had a higher content of silicate, with inclusions of melted hearth ceramic present on what was probably the upper surface.

SHC L: was the most silicate-rich of the four samples and therefore more fayalitic with an abundant interstitial leucite-wustite cotectic. It contained some hammerscale inclusions and ceramic influenced zones, around which there were complex intergrowths of calcic olivines and leucite, with a rhönite-bearing interstitial glass.

Details of samples

Sample H & Sample I

Context 3021
(Plates A21, A22, A23, A24)

These two samples are believed to have been taken from the same specimen, with Sample H being from the upper part of the cake and Sample I the lower.

The overall structure shows vesicles near the upper surface (which has a weathered 'crust' lying on in hand specimen, not represented in the polished mounts). The vesicularity decreases rapidly downwards to dense central section. Vesicles are again present near the somewhat lobate base.

Both samples show a texture dominated by wustite, typically in blebby to rounded stubbily dendritic forms. Typical dense parts of the slag shows 80-92% FeO. The dense wustitic slag shows pores, probably mainly vertically tubular, which often are partially filled with a material of lower iron concentration. These fills are glassy or finely crystalline olivine with an FeO content of approximately 50%.

Near the top of the cake (Sample H) the texture is complex, and rather corroded (Plate A22 f-h) Some of the secondary iron oxides have textures similar to that seen in the corroded iron in other specimens and so it is possible that the top of the SHC was originally marked by iron inclusions. Within one of these zones there are rounded areas of slag showing olivines with compositions from F96 with 4% calcium substitution in the core to Fa98 with 7% calcium substitution on the outside. A second generation of olivine is seen in the interstitial spaces, apparently with a higher calcium content.

Olivine-bearing slags are also well seen near the base of the specimen (Sample I; Plate A22, b-c). Again, these areas appear to have contained iron blebs, now entirely oxidised.

Sample J
Context 3021
(Plates A25, A26)

This sample comprised a dense, wustite-rich slag which became increasingly heterogeneous towards one surface (interpreted as the base, since vesicles appear to be generated off the siliceous inclusions, but the way up is not certain). The centre of the piece is dense and wustite-rich. The opposing surface is more siliceous again with large, delicate wustite dendrites.

In a typical, central, heterogeneous area the olivine is elongate, with crystal lengths of several millimetres. The olivine has cores of Fa93 with 4-5%Ca substitution and about 0.4% Mn substitution. These cores grade out to Fa95 with up to 10% Ca substitution and 0.4% Mn, which is then abruptly overlain by calcic olivines of Fa97 with 35% Ca substitution (i.e. 70% kirschsteinite). The interstitial spaces show fine dendrites, probably also of a calcic olivine.

The heterogeneous area show wustite-rich enclaves and zones, typically with fine textures, in associated with more siliceous, coarse grained areas, bearing vesicles with leucite –rich marginal zones.

The contact between the iron-rich slag and the partially melted hearth ceramic includes patches of kirschsteinitic olivine (expressable as Fa98 with 31% calcium substitution, i.e. 62% kirschsteinite) in an apparent cotectic with leucite (or a leucite-wustite cotectic).

Sample K
Context 3050
(Plates A27, A28, A29)

This sample shows a complex texture. The location and orientation of the sample within the SHC is difficult to reconstruct, but may be from its base.

This sample is differentiated from the others from this site by its relatively oxidised nature. Although parts of the slag are fairly conventional, with wustite dendrites, followed by elongate olivines(Fa95-96 with 4-5% Ca substitution and 0.3-0.4% Mn substation) and glass (e.g. Plate A26b), other parts show a strong development of magnetite (as equant euhedral grains and as stocky dendrites, typically with about 12% hercynite). The slag shows a strong differentiation into lobes of different levels of magnetite content, locally bounded by oxide rims, themselves of both magnetite and wustite – and locally iscorite (Plate A27 d,e,f).

The presumed basal layer in the section is dominantly of magnetite – as coarse dendrites (Plate A28). Here, too, the magnetite shows evidence over overgrowth by wustite.

Sample L
Context 3052
(Plates A30, A31)

This sample is rather different from most of the other samples from this site. The slag shows a relatively low wustite content, moderately large elongate olivine and abundant interstitial leucite-wustite cotectic. As with Sample J, where there are inclusions of glass derived from the hearth ceramic, this is associated with the development of complex intergrowths of calcic olivines and leucite, with a rhönite-bearing interstitial glass (Plate A29b).

Dense wustite inclusions occur rarely and are suggestive of flake hammerscale (Plate A29h).

Chemical composition

The overall range of composition within the samples is large, with the analysed areas from Samples H/I, Sample J and Sample L all spanning the FeO-SiO_2-anorthite ternary diagram (Figures 1 and 2) from the wustite to tridymite fields. Sample K shows less variation – possibly as a result of less sampling, but shows a similar range of variation to that of Sample I (the lower part of the section represented by Samples H and I).

The analyses mostly form a tight linear array across the FeO-SiO_2-anorthite ternary diagram, reflecting a narrow range of molar silica to alumina ratio (average of 4.0).

Interpretation

The range of textures and mineralogy demonstrated by these samples is unusual, compared with smithing slags in general, but there is little data available on comparably-dated material. The general chemical composition of the samples is however, broadly in line with other Iron Age and Roman smithing slags from the area.

The weight distribution of the SHC assemblage may be compared with those of just a few other sites. Neither the present assemblage, nor most of the comparative ones, is sufficiently large to be statistically significant, but general comparison may be made.

A compilation of the available data or comparative sites is presented in Table 5. Sample sizes are typically small, so for most sites the statistical parameters are unreliable. Nonetheless it is possible to see two groups of Roman smithing assemblages – one group with SHCs mainly less than 500g and none greater than1000g and a second group with examples of SHCs over 1000g and an average weight of over 500g. The first group is interpreted as the residues from blacksmithing operations (secondary smithing; the end use of iron), whereas the second group is interpreted to include residues from bloomsmithing (primary smithing involved in transforming a raw bloom into usable iron).

The SHC assemblage from Plot 331 fits best with this second group and although the maximum SHC size is less than on the other sites involved in bloomsmithing, the SHCs are larger than those on the middle to late Iron Age iron-production site at Crawcwelt in North Wales (Crew 1998). Other sites in the hinterland of the Forest of Dean where there was iron production also show the presence of large SHCs (e.g. Frocester Court, Thomas 2000). Other such sites in the area may have gone unrecognised; recent attempts by Allen (2009, 2010) to propose non-slag tapping furnaces from the Romano-British period around the Severn Estuary are probably erroneous, for the so-called furnace bottoms of his papers (mainly with weights less than 1kg) are extremely similar to the SHCs from bloomsmithing at Miskin and elsewhere. The site at School Road, Miskin (author's unpublished data) has an assemblage of particularly large SHCs, but this may have been a specialist site, with no secondary smithing.

The only assemblage of material available for direct comparison of the detailed analytical data is that from Coldfurrow, Lyonshall, Herefordshire (approximately 22km NNW of Plot 331). The assemblage (Young 2006b) included a number of large, dense, iron-rich SHCs from deposits associated with a smithy in a small, enclosed, Romano-British farmstead. The assemblage was interpreted as being from bloomsmithing, but there is no identified local source of iron or known smelting sites. Transport of iron ore, or part finished blooms from the Forest of Dean area is possible, but unlikely given the 50km distance. Other, as yet unknown, local sources are more likely. The Milford Haven to Brecon gas pipeline (Young 2011d) produced evidence for Roman smelting in the valley of the Afon Honddu just north of Brecon. This location would suggest a local, probably bog iron ore, source was being exploited. If such sources exist in the river valleys around Brecon, then they may well exist in the Wye valley to the NE too.

The Lyonshall assemblage shows internal structures that are broadly similar to the Plot 331 materials, but the overall chemical compositions appear more iron-rich. It is likely, however, that because investigation of the samples has focused on informative textures and mineral relationships, the large areas of rather simple wustite- and magnetite- dominated textures are possibly somewhat under-represented amongst the area analyses and therefore the calculated averages (Table 2 and Figure 3) are likely to show less iron than is actually the case. The implication of this would be that the Lyonshall smithing slags and those from Plot 331 may be more similar than the average compositions would suggest.

The weight range of the SHCs, together with the high iron contents, therefore suggests that the SHCs from Plot 331 are the residues from the processes broadly known as bloomsmithing or bloom-refining. In detail, these classes of residues are poorly understood at present, for it is clear that not all bloom refining was undertaken purely as a smithing (reheating, working) process. The present material is however suggestive of bloomsmithing in the conventional sense – the samples show oxidised pieces of iron and hammerscale.

Discussion

The subsequent interventions at this site avoided some of the slag-rich deposits located in the evaluation phase, but none-the-less it is clear that this site was of enormous significance. Very few Iron Age bloomsmithing sites have been described; none with both full residue descriptions accompanying physical evidence for the nature of the hearth and process. It is unfortunate that full investigation of the metalworking at Plot 331 was not attempted (macroresidues, microresidues, e.g. hammerscale, and structures).

Iron Age bloomsmithing structures have been described in North Wales (Crew 1987, 1989, 1998), and early to middle Iron Age bloomsmithing residues have been described from southern England from Risely (McDonnell 1984) and from Truro (Young 2008). The occurrence of early Roman (1^{st} century AD) bloomsmithing residues at sites such as Caergwanaf (Young 2010b), and Cardiff Castle (Young & Kearns 2011) is known, but these materials have not yet been analysed in detail. Later Roman bloomsmithing has been identified at Lyonshall (Young 2006b), Dymock (Young & Kearns 2010b) and Caerwent (Young 2006a). At none of these Roman sites is there yet good evidence for the physical nature of the bloomsmithing facility.

The distance of Plot 331 from the Forest of Dean, and its general similarity with the residues from Lyonshall even further away, hints that other sources of iron ore may have supplied so-far unrecognised smelting in this area. One possibility is that there are local bog iron ore resources.

The evidence from Plot 331 therefore falls within a complete gap in existing knowledge, making the site significant on a national basis.

Plot 430

General nature of material

Plot 430 (NGR 35590 22514) was located north of the A49, about 1km northwest of Peterstow.

The site produced archaeometallurgical residues from a wide variety of contexts. The key area was area 430C, a subsection of the site lying at the top of the hill above the two enclosures (area A and B). In Area C metalworking appears to have been undertaken in the 1st-2nd centuries AD.

The current description of the field remains suggests that area C included the remains of two 'bloomeries'. The presented field evidence is insufficiently detailed to comment in detail, but the description resembles to some extent that of two 'furnace settings' – locations in which a furnace may be built and then reconstructed as required over time. The succession, in each setting, of intercutting pits may indicate the changing location of the furnace., but it is unclear what element of the furnaces the 'pits' might represent. Further detailed consideration of (and archaeometallurgical input to?) the interpretation of these structures will be needed before publication, as discussed further below.

Results

Description of residues

The fourteen samples investigated in detail included eight samples of tapped slag, one sample of a slag 'rod', four samples of furnace slags and one fragment of bloom.

The tapped slag (tapslags) showed some textural variability, with some examples with a very fine texture, in small lobes (e.g. sample F1), others with 'classic' textures with chilled lobe margins, sheaf-like bundles of olivine crystals nucleating from the margins and thin 'crusts' on the lobes formed of wustite and/or magnetite (e.g. sample A1) and others still with coarser textures and less well-formed lobe boundaries suggestive of slow cooling (e.g. sample B1).

The tapslags showed elongate olivine, with composition close to fayalite (the total substitution by cations other than iron is almost always less than 10%), with only slightly magnesian cores grading to slightly calcic margins. The interstitial spaces are usually filled by other a glass bearing very fine-grained calcic olivine, or by strongly calcic olivine (70% kirschsteinite) in association with a leucite-wustite cotectic. Such textures were described more generally in the region by Thomas (2000) and it is possible that the origin of the variation lies in a degree of immiscibility within the last fraction to crystallise.

The furnace slags show, as typical, a much less homogeneous texture, with a very variable distribution of primary wustite, forming a network with holes, some of which become occluded by more fayalitic slag, others of which remain open as vesicles. The vesicles, and the margins of charcoal inclusions, often show the development of leucite-rich rims. This is a result of the capture of potassium from the fuel gasses by the adjacent slag. The adjacent olivine is also often moderately to strongly calcic, probably reflecting the addition of calcium from the fuel too. The olivine in the bulk of the slag shows similar low levels of substitution to those in the tapslags.

The bloom fragment was unfortunately too corroded for recovery of any information about the iron. The metal was in contact with a variable, but commonly very wustite-rich slag.

The slag 'rod' (Sample E1) had a structure and mineralogy similar to those of the more iron-rich furnace slags.

Details of samples

Sample A1
Context 86104
(Plates A1, A2, A3)

This sample was taken from a block of fine-grained tap slag in well-formed flow lobes. The flow lobes have smooth, maroon surfaces. In section, the lobe surfaces are seen to be thin horizons of oxides.

The lobes are formed of slag which is variably vesicular. It has fine, sparse, but large dendrites of wustite, forming around 5%. The slag is variably vesicular, both between and within lobes, from just approximately 2% on chilled lobe edges to over 20% in some lobe cores.

The olivine ranges in composition from cores of Fa95 with about 2% of calcium substitution and 0.4% manganese substitution to outer parts of up to Fa98 with 8% Ca and 0.4%Mn. The interstitial glass occasionally bears crystals that are probably a kirschsteinitic olivine.

The olivine crystals form radiating sheaves nucleated on the chilled margins of lobes (Plate A3a, c). The crystals are at least 2mm in length and probably up to 5mm. At their widest individual crystals reach 80µm.

Sample A2
Context 86001
(Plate A4)

Sample A2 resembles A1 in many ways, but the internal lobe surfaces are less well marked, commonly show small protuberances (Plate a3b, d, f) and in some instances (Plate A3d) show continuity of olivine crystals across the boundary. These features suggest that the lobes seen were formed in rapid succession with the earlier (lower) lobe incompletely solidified before imposition of the later (upper) lobe.

The primary wustite is very similar, with sparse, delicate, large dendrites. The olivine is similar in morphology and composition to that in A1 (Fa95 with 2% Ca and 0.4% Mn substitution grading outwards to Fa99 with 0.9% Ca substitution.

Sample B1
Context 86131
(Plate A5)

Sample B1 is a coarser-grained tap slag than samples A1 and A2. The internal lobe boundaries are marked by textural changes in the slightly coarser-grained olivine, with no indication of a wustite/magnetite lobe crust – suggesting that these lobes may have accumulated in the absence of significant oxygen and with a lower cooling rate – so perhaps within the furnace mouth or low in a rapidly accumulating stack of lobes.

The main phase olivine shows a similar range of composition to that in A1 and A2, ranging outwards from Fa93 with 2% Ca and 0.3% Mn substitution to Fa98 with up to 13% Ca substitution and 0.3 Mn substitution.

The interstitial areas are of two distinct varieties. In one there is an interstitial glass bearing fine dendrites of a late-stage calcic olivine. In the other there is a development of a leucite-wustite cotectic in association with a kirschsteinitic overgrowth (Fa100 with 35%Ca substitution) on the main olivine.

Sample B2
Context 86131
(Plates A6, A7)

Sample B2 is porous, charcoal-bearing slag. In section there is very little primary wustite, and the little that is present is concentrated in particular areas. There are some substantial vesicles, with well-developed leucite-rich margins and localised development of grains of metallic iron nearby. The leucite occurs as rounded masses of a leucite-wustite cotectic and also as equant euhedral crystals.

Near to the leucite-rich areas, observed olivine compositions ranged from Fa89 with 1% Ca and 0.4% Mn substitution through to Fa99 with 10% Ca and 0.4%Mn on the margin. In one area the olivine was associated with minor hercynite. The olivine is typically present as 80-300 µm equant, euhedral grains, but in some cases these may possibly be sub-units of larger crystals.

The interstitial areas, as in B1, were variable, with an interstitial glass bearing a calcic olivine being common, but other spaces are filled by a leucite-wustite cotectic. The main phase olivine locally shows a kirschsteinitic overgrowth and in turn locally overgrown rhönite, as small crystals fringing the glassy interstitial areas.

Sample C1
Context 86156
(Plate A8)

This sample shows some similarity to B2, but shows a lower porosity, a more general distribution of stout, small, wustite dendrites and is generally somewhat coarser-grained.

The olivine again forms equant crystals, but of up to about 600 µm; the arrangement of these suggests in some cases they are sub-units of larger complex crystals.

The main olivine grades out from Fa94 with 2% Ca and 0.4%Mn substitution to margins of Fa98 with 6%Ca and 0.4%Mn substitution. Olivine of this composition is then extensively intergrown with the leucite-wustite cotectic, leaving a final interstitial space filled by glass with a fine calcic olivine and rhönite.

Sample C2
Context 86156
(Plate A9)

Sample C2 is a rather coarse-grained tap slag. The primary phase is a small proportion of rather small, delicate, wustite dendrites. These are followed by an olivine, with an elongate form, up to 1mm in length and typically less than 30 µm in width. The olivine is slightly more calcic than in some other tapslags here, with cores of Fa92 with 4% Ca and 0.4%Mn substitution grading to margins of Fa98 with 13% Ca and 0.4% Mn substitution.

The interstitial spaces are filled with a glass rich in very fine grained olivine – apparently of a fairly calcic composition.

The sample is not well preserved, but lobe margins appear to be largely missing any substantial development of iron oxides, although a development of very fine wustite (and magnetite?) dendrites just inside the margin as observed. This may correlate with the observation the piece appears to have been tapped into or through charcoal.

Sample D1
Context 86165
(Plate A10)

Sample D1 is of a fine-grained, slightly vesicular slag, probably a tapslag, with a similar texture to samples A1 and A2, but with a markedly higher proportion of wustite (a reflection of its higher bulk iron content than those samples).

The main phase olivine reaches at least 1mm in length and 60 µm in width. The composition ranges from Fa95 with 3% Ca substitution to Fa98 with 7% Ca substitution on its margins, both with 0.3-0.4% manganese substitution.

The interstitial areas are dominantly glassy with fine olivine dendrites.

Sample D2
Context 86165
(Plates A11, A12)

This sample shows highly corroded iron particles, contained within a very iron-rich slag. The most likely interpretation of this sample is that it represents a small fragment detached from the margin of a bloom.

The iron is entirely corroded and nothing can be said about its former composition. Some relicts of texture are preserved. The broadly concentric structure of the weathering of the main iron particle (approximately 8mm across) probably reflects an original structure, with zones in which the iron appears to include an amalgamation of rounded bodies in close association with an area with rounded slag inclusions, locally up to several hundred microns across.

The associated slag shows a range of textures from areas dominated by coarse, rounded wustite ‘pseudodendrites’, through to glassy (or very finely fayalitic) areas with fine, delicate wustite dendrites. The same range of textures is seen in the external slag as in the probable slag inclusions within the iron.

Sample E1
Context 86174
(Plate A13)

Sample E1 shows considerable similarity to sample C1, although it is somewhat richer in wustite. The wustite forms stout dendrites with rounded arms, reaching up to about 1mm in size.

The main phase of olivine is elongate, reaching 3mm in length and 100 µm in width. The composition varies from Fa94 with 2% Ca and 0.4% Mn substitution in the cores to Fa98 with 6-10% Ca and 0.3%Mn substitution on the margins. The olivine is locally intergrown with a leucite-wustite cotectic. In these areas the olivine approaches Fa99 with 25%Ca and 0.4%Mn substitution (i.e. is approximately 50% kirschsteinite). In other areas the interstitial space is filled with glass bearing parallel late-stage olivine, with a composition up to Fa99 with 17% Ca and 0.6%Mn substitution.

Sample E2
Context 86174
(Plate A14)

Sample E2 is a dense tap slag, broadly comparable with other tap slags in the collection. It does not show clear evidence for well-marked oxide crusts on the flow lobes.

Primary wustite is present as fine delicate dendrites reaching about 500 µm across. The subsequent olivine is elongate, certainly reaching 2mm in length. The olivine composition ranges from Fa93 with 0.7% Ca and 0.6%Mn substitution out to Fa98 with 1.4% Ca and 0.5%Mn substitution. The interstitial areas are of glass with a late, fine, elongate olivine of around Fa98 with 1.8% Ca and 0.5%Mn substitution. The low calcium content of the olivines reflects a lower bulk concentration than in any of the other slags form the site, besides those attached to the bloom fragment (Sample D2).

Sample F1
Context 86196
(Plate A15, A16)

This sample is a somewhat unusual stack of flow lobes. The individual lobes are very thin and fine-textured. They are not typically well-bonded to each other, with significant inter-lobe porosity (possibly indicating they were non-wetting). They are also unusual in showing a relatively high degree of calcium enrichment, but little corresponding potassium enrichment.

Detailed observations of mineralogy were only made in one of the coarser lobes (still one of the finest textures observed from the site) because of the practical problems of obtaining reliable analyses from the finer textures.

Primary wustite was present in delicate dendrites. In some areas (Plate A15g) this showed a variable density on the BSEM image, suggesting that both wustite and possibly magnetite may be present.

The main olivine was very delicate and skeletal. The fine mixture of olivine with the glassy matrix meant that microanalysis of the olivine was not achievable, but it would appear to have been a fayalite with about 10% calcium substitution. The interstitial space is a glass bearing very fine crystals, probably also of olivine.

Sample F2
Context 86196
(Plate A17)

Sample F2 is texturally very similar to sample A2. Parts of the sample are very straightforward, chilled flow lobes (Plate A17c), but away from the most chilled area there appear to breaks in the oxide crusts and the olivine crystals pass through some boundaries (e.g. Plate A17a). Such textures do not necessarily indicate that the growth of the olivine was a continuous process, merely that growth was able to resume into the second lobe.

Analysis of olivine shows a core of Fa95 with 4% Ca and 0.3% Mn substitution grading out to Fa98 with 10-12%Ca and up to 0.4% Mn substitution, with a rather similar composition for late stage olivine within the interstitial spaces.

Sample G1
Context 86225
(Plate A18)

Sample G1 shows similarity with G2 and particularly with sample E1. Compared with E1, it shows a greater, if patchy, development of wustite. The wustite shows a wide distribution of rounded 'gaps' presumably early pores, some now filled by the fayalitic slag, others surviving as open pores. The olivine is typically very large, with dimensions greater than 1mm, and possibly of a relatively equant shape.

Rounded growths of leucite-wustite cotectic are associated with euhedral or subhedral leucite (Plate A18g). The leucite is clearly, at least locally, predating the enclosing olivine.

Remaining interstitial space is filled with complex, probably close to eutectic, growths of feathery dendritic olivine in glass.

The main olivine appears to grade between cores of Fa94 with 2% calcium substitution and margins of Fa98 with about 12% calcium and 0.4%manganese substitution. There seems to be localised late overgrowth of Fa99 with 34%calcium substitution (i.e. 68% kirschsteinite). The kirschsteinite is overlain in turn by a thin overgrowth and also by the late stage interstitial olivine – both with compositions around Fa99 with 17-19% Ca substitution.

Sample G2
Context 86225
(Plates A19, A20)

Sample G2 is a very porous slag, broadly similar to sample G1. The patchy primary wustite varies from agglomerations of large blebs to well-developed dendritic forms. The early gaps in the wustite coverage may be filled by later fayalite – sometimes in the form of otherwise isolated, large bridging crystals.

One margin of the sample (the right hand margin in Plate A19 and Plate A20a) shows indications of being a contact with hearth ceramic – but the orientation of the contact is not known. The contact zone includes localised coarse fayalite (without any wustite), zones of fine-grained iron oxides of uncertain origin, and zones of fine quench-textured fayalitic slag in association with what are probably weathered blebs, formerly of metallic iron.

Within the body of the piece, the voids are generally rimmed with leucite-rich zones, frequently multiple, and thin layers of olivine. The olivine in the body of the slag appears to be mainly somewhat elongate, up to 1mm by 0.5mm. Analyses suggest the cores of the large olivines are as low as Fa91, with under 2% calcium substitution and around 0.3% Mn substitution. The margins of these olivines reach about Fa97 with 5% Ca and 0.3% Mn substitution.

On the margins of the larger pores the leucite-rich zones include, as in G1, both areas of leucite-wustite cotectic and areas with euhedral to subhedral (just possibly resorbed) leucite (Plate A19g). As with other examples from this site, the olivine associated with the leucite is calcic and is mainly Fa99 to Fa100 with 12 to 36% Ca substitution.

Chemical composition of samples

The analyses of selected areas within the samples are presented in Table B2 and the averages of those areas for each sample are given in Table 4.

The general range exhibited by the averaged compositions for the slags is very small, with much of the variation simply be due to the variable levels of iron. Sodium, phosphorus, titanium and manganese are present in very low levels, with manganese rarely exceeding 1 wt% as an oxide. Potassium typically occurs at levels of 1-2% as an oxide; calcium is more variable , ranging from 1.4 to 5.9 wt% oxide. The Si:Al ratio is tightly constrained, with a mean of 4.5.

Various ternary diagrams have been employed to display, and to assist with the interpretation of, relationships in iron slag assemblages. The FeO-SiO_2-Al_2O_3 diagram is commonly employed, as is the CaO-FeO-SiO_2 diagram, but for the present material, in which the levels of CaO and Al_2O_3 are similar, the FeO-SiO_2- $CaAl_2Si_2O_8$ (anorthite) diagram (Levin *et al.* 1964, p. 288, fig. 869) is more appropriate. This diagram was first used for iron slags in the works of Morton & Wingrove (1969, 1972) in discussion of slags from this region of the UK. Morton & Wingrove appear, however, to have used an unusual methodology for calculating the position of data within this system and a revised methodology is adopted here, which discards excess components from analyses which lie outside the ternary plane.

The same diagram was used extensively to illustrate slag variation by Thomas (2000; with a corrected methodology).

The chemical analyses of individual areas are plotted on the FeO-SiO_2- $CaAl_2Si_2O_8$ (anorthite) diagram in Figures 3 and 4. Here they display a remarkably coherent pattern, which can be taken as indicative of a consistent process and technique.

The samples from tapslags form a very tight cluster of points. The analyses from tapslags D1 and parts of C2 lie at the iron rich end of the cluster; all others cluster below 75%FeO. At the iron-poor end of the spectrum the tapslag field is approximately bounded by the samples interpreted as furnace slags B2 and C1. Small, wustite-free zones with G1 and G2, samples interpreted as coming from the zone between the bloom and furnace wall, also plotted in this area.

The iron-rich tapslags of C2 and D1 plot in the same area of the diagram as the analyses from the slag rod (E1) and the majority of analyses from G1 and G2.

This cluster of analyses coincides with the relatively iron-poor slags associated with the bloom fragment, the more iron-rich of which lie at over 80%FeO within the wustite field. All other analyses plot within the fayalite field.

This distribution, tap slags forming a tight cluster in the centre of the more variable furnace slags, provides some support for the suggestion (Thomas & Young 1999a and 1999b) that tapslags from the moderately large slag-tapping furnaces of this area effectively sample the slags produced in the smelting reaction and may, therefore, be employed in mass balance discussions.

Interpretation

The low levels of abundance of many of the dominant elements in the chemical compositions of the slags are typical of slags generated during the smelting of the high-grade iron oxide ores of the Bristol Channel Orefield (*sensu* Young & Thomas 1998, 1999; Young 2000). Thomas (2000) described many of the features seen in the Plot 430 samples from material from other sites within the orefield.

Several separate databases of chemical analyses of smelting slags from the region exist:-

The first of these derives from work around the Severn Estuary by J.RL. Allen and co-workers from Reading (Allen 1988, 2009, 2010; Allen & Fulford 1986, 1987, 1990a, 1990b, 1992; Fulford & Allen 1992). These data provide a useful dataset, although the interpretation of the data raises some problems and, in particular, the differentiation of smelting and smithing slags is sometimes controversial.

The second database is that of work done in Cardiff, including the analyses made for the PhD thesis of Thomas (2000), together with various GeoArch projects (Young 2006a, 2010c, 2010d, 2012; Young & Thomas 1997) and the author's unpublished research on several sites in South Wales.

The third major source is the data compilation by Paynter (2006, 2007), which draws on both of the first two in part, but also includes other published sources and unpublished material from within English Heritage.

Comparison of these various regional data with the current analyses shows a high degree of coherence between the present suite and those previous analyses interpreted to be from the smelting of Forest of Dean ores.

The FeO-SiO_2- $CaAl_2Si_2O_8$ (anorthite) diagram is used to illustrate selected comparative analyses in Figure 6. The field containing the EDS analyses of samples from Plot 430 is shown in pale grey tone. A high degree of overlap is demonstrated with tapslags from the Severn Vale (Allen 1988), from the Chesters site at Woolaston (Fulford & Allen 1992) and from *Ariconium* (Thomas 2000; Young 2012). A lower degree of overlap is shown with materials from Worcester (McDonnell & Swiss 2004), Usk (Thomas 2000) and Frocester Court (Thomas 2000). Interestingly, it is those sites that are geographically closest to the Forest of Dean that provide the best comparisons, perhaps because of the highest degree of similarity of underlying geology.

The reasons for differences in the chemical compositions of slags from the region have been discussed on numerous occasions (Allen 1988, 2009; Paynter 2006, 2007; Thomas 2000). It seems clear, however, from the mass balance calculations (Thomas & Young 1999 a and b), that given the high-grade of the Forest of Dean ores, the influence of the composition of the furnace ceramic will be dominant on the concentration in the slag of those elements most involved in such discussions (e.g. Si, Al, Na, Mg, Ti; but also K and Ca which may also be strongly influenced by the fuel ash).The furnace ceramic contributes 25% - 30% of the mass of the slag according to the mass balance calculations of Thomas (2000). The clustering of data from this region may well thus be a reflection of the variation in the composition of available clays for furnace construction and therefore be a reflection on the local geology (possibly both bedrock and superficial in different cases).

In particular the data from samples from Plot 430 may be compared with analyses (Thomas 2000) of Roman materials from *Ariconium* – the major Roman smelting centre just 8km east of Plot 430 (Jackson 2012). The *Ariconium* site lies on very similar geology to Plot 430. Differences between the two suites of analyses are mainly seen in sodium and magnesium. Whilst this may be a genuine difference, it must be bore in mind that it is possible that analysing these two light elements at low concentrations may cause problems for the analytical techniques.

Discussion

Analyses of smelting residues from Plot 430 allow the confident provenancing of the ore employed to the Forest of Dean and close comparison may be made with residues from nearby *Ariconium*.

Rapid re-examination of the samples from the site suggests that the materials sampled are representative of the residue assemblage. It also suggests that the assemblage comprises dense tapped slags, porous/charcoal rich furnace slags, some slag 'runners' and rare examples of slag 'rods'. Such an assemblage is typical of many sites in the area. The significance of the 'rods' (= 'slag tubes' of McDonnell & Swiss 2004) is unclear. They occur widely on other sites of Roman age, not only in this area, but also in the Weald (e.g. Young 2011a). They appear distinct from the plano-convex 'runners' – which represent slag chilled in the tapping channels, and have usually been attributed to formation in blowholes or 'spy-holes' in the furnace wall. McDonnell & Swiss (2004) hint at an interpretation associated with a rather more exotic process. However, the abundance of the rods suggest that they are formed during the normal operation of a furnace. In the Weald, they may possibly be associated with dome furnaces (Young 2011a). The runners themselves are interesting, for they indicate the use of a channel to carry the slag through the tap arch area. They have been found at several other sites (e.g Miskin, Frocester, Caerleon) and are a characteristic component of the residue assemblage from these sites.

The assemblage does not include the thick, massive, dense, furnace slags, often with ore and roundwood charcoal inclusions, that are becoming recognised at some locations SW of the Forest of Dean (Caergwanaf, author's unpublished data; Cardiff, Young & Kearns 2011; Woolaston, Fulford & Allen 1992; possibly Alvington, Young 2009b; and within central Dean, Young 2011b). These sites include some that appear to have been 'official', in some cases possibly military, operations (e.g. Cardiff and Caergwanaf; Young forthcoming). These occurrences seem to indicate a significantly different smelting technology on these sites.

Unfortunately, very few furnaces have themselves been investigated in the region. The best known, but still with many questions attached, is the large furnace at the 'Chesters', Woolaston (Fulford & Allen 1992). Furnaces at *Ariconium* were dug by Bridgewater (1965), but appear to have been heavily truncated. Better examples at *Ariconium* were found in the unpublished 1967 excavations by Garrod and Moss. Although these have now been illustrated by Jackson (2012), they have not been described in detail. The evidence for the nature of the furnace structures in Plot 430 is therefore very important. Although simple slag-tapping, relatively low-shaft, furnaces are the most likely class of furnace to produced the observed residue assemblage, other morphologies are possible.

Although not actually in the Forest of Dean, Plot 430 lies well within its hinterland – the area over which smelting sites are distributed with a fairly common occurrence. This hinterland extends at least 20km SE of Dean, into the margins of the Cotswolds, 20 km NW (into SW Herefordshire), but farther to NE and SW (35km NE up to Worcester and 35km SW to Caerleon) in which directions movement of ore may have been facilitated by movement on the Severn. The existence of the hinterland may be a response to the requirements for the production of large quantities of charcoal, which may not have been able to have been satisfied in the core area.

In summary, it appears that Plot 430 shows a similar style of iron smelting to other sites in the hinterland of the Forest of Dean, but a technology distinct from that of major, possibly military, centres of smelting. The ore was from Dean, but provenancing ore to particular sources within Dean requires data for elements not analysable under the SEM.

Plot 454

General nature of material

The residues from Plot 454 were re-examined to determine whether further inspection could clarify their origin and whether they would suitable for further investigation. The following list provides a revised catalogue of materials from this plot:

85000: small fragment of slag or clinker, two further certain clinker fragments, three pieces of sandy lining slags and six dense vesicular slag fragments, strictly indeterminate, but likely to be from smithing.

85029: blebby flow-slag penetrating between large charcoal moulds. Indeterminate as to origin in iron smelting or smithing.

85036: probable smithing slag piece, highly weathered, with adhering hammerscale.

85039: rather weathered probable smithing slag piece – surface accretion includes hammerscale.

85043: vitrified hearth lining, pale fine fabric and planar face very similar to material from 85103.

85082: four pieces of vesicular slag, some in poorly developed lobes -probably smithing slag, 1 tiny fragment of lining slag, 1 large piece(c.480g) probably representing a part of a rather prilly SHC of large size.

85088: bleb of convoluted lining slag (probably from iron working).

85101: three small fragments of iron slag attached to hearth/furnace wall

85103: vitrified hearth lining and several substantial pieces of iron slag. Most of the iron slag is probably from smithing - including one extremely coarse grained piece likely to be from bloomsmithing. Two pieces are indeterminate - either from smithing or from Iron Age style slagpit furnace smelting.

85106: three substantial pieces and one fragment of charcoal-rich flow slag, strictly indeterminate but probably smelting furnace slags (quite similar to Iron Age style slagpit furnace slags). One small fragment is probably tapped smelting slag with well-developed maroon haematised surface (i.e. not a morphological similar Iron Age non-slag tapping flow slag).

In summary, the residues from Plot 454 are probably mainly from smithing, probably particularly bloomsmithing, with just one tiny fragment of typical tapslag to indicate smelting nearby. Some of the charcoal-rich slag could just possibly be from Iron-Age smelting, but their evidence is not conclusive. Detailed analysis would not be capable of distinguish Iron Age furnace slags from their Roman equivalents. The assemblage is typical of a site involved in iron production at the period and further investigation would be unlikely to provide additional useful clarification. No further analysis was therefore pursued on the material from this plot.

Plot 496

General nature of material

The residues from Plot 496 were re-examined to determine whether further inspection could clarify their origin and whether they would suitable for further investigation. The following list provides a revised catalogue of materials from this plot:

90009: extremely dense iron slag, containing a high proportion of metallic iron.

90016: various prills, both horizontal (over charcoal) and vertical of dark surfaced slag. No superficial oxidation. one piece shows a planar non-wetted contact surface - possibly from stone or a tool.

90023: three unusual fragments of copper alloy waste - two are metal fragments that appear to have impregnated adjacent charcoal fragments, 1 is just an equivalent impregnated charcoal piece. The most likely interpretation, given the multiple charcoal fragments involved in the larger piece, is that they are the results of spills into a metalworking hearth.
There are also broken fragments from fine grained weathered slag with dimpled base -probably smithing slag, plus one long prill from slag flow through fuel, possibly associated with tapping.
There is also a large prilly SHC weighing 1080g. For the Roman period, such a large SHC is likely to be the result of bloomsmithing rather than blacksmithing.
There is also a bag of small indeterminate slag scraps of varying composition.

90025: lining slag bleb hanging on reduced fired lining

90029: 2 pieces of indurated material, probably out of a hearth floor, one shows a very dark prilly slag binding clay and stone fragments, the other has clay alone,

90038: 3 small blebs of dense iron slag, 2 small fragments of oxidised fired lining.

The residues from Plot 496 are somewhat similar to those from Plot 454, including large SHCs suggestive of bloomsmithing and some materials that just possibly might be from Iron Age smelting (although other interpretations are possible). The copper alloy materials are probably casting spills. It was an interesting facet of material from two sites in nearby Dymock (Dungworth 2007; Young & Kearns 2010b) that the residues there including iron smelting, bloomsmithing and copper alloy casting (including, specifically, the manufacture of brooches) along with possible silver reclamation/purifying (possibly for plating the brooches) - a very mixed range of metalworking activities taking place together .

In general, the iron slags are fairly unremarkable. They suggest (albeit on a very small sample) that this site may have been more involved with bloom processing than primary smelting. The well-flowed slags do not show surficial oxidation – and therefore accumulated with a fuel bed. This could happen with a slag-tapping smelting furnace, but in the absence of tapslag from this site it is probably more likely they are a flow slags from a non-slag tapping furnace, or are abnormal flows from within a smithing hearth. The assemblage is very small, as well as mixed, and in the absence of association with metallurgical features, detailed analytical investigation would be unlikely to be able to generate useful additional information or to differentiate between the possibilities suggested by the morphological investigation.

Analysis of the small amount of copper alloy residue would not be likely to generate useful data, since a wide range of copper alloys were used in the Roman period and were widely recycled.

No further analysis on material from this plot was therefore undertaken.

References

ALLEN, J.R.L. 1988. Chemical compositional patterns in Romano-British bloomery slags from the wetlands of the Severn Estuary. *Historical Metallurgy*, **22**, 81-86.

ALLEN, J.R.L. 2009. Romano-British iron-making on the Severn Estuary: towards a metallurgical landscape. *Archaeology in the Severn Estuary*, **19**, 73-79.

ALLEN, J.R.L. 2010. The alkali-metal ratio in Roman British bloomery slags. *Archaeology in Severn Estuary*, **20**, 41-45.

ALLEN, J. R. L. & FULFORD, M. G. 1986. The Wentlooge Level: A Romano-British Saltmarsh Reclamation in Southeast Wales. *Britannia*, **17**, 91-117.

ALLEN, J.R.L. & FULFORD, M.G. 1987. Romano-British settlement and industry on the wetlands of the Severn Estuary. *Antiquaries Journal,* **67**,237 -289.

ALLEN, J.R.L. & FULFORD, M.G. 1990a. Romano-British and later reclamations on the Severn salt marshes in the Elmore area, Gloucestershire. *Transactions of the Bristol and Gloucestershire Archaeological Society*, **108**, 17 -32.

ALLEN, J.R.L. & FULFORD, M.G. 1990b. Romano-British wetland reclamations at Longney, Gloucestershire, and the evidence for the early settlement of the inner Severn Estuary. *Antiquaries Journal*, **10**.288-326.

ALLEN, J.R.L. & FULFORD, M.G. 1992. Romano-British and later geoarchaeology at Oldbury Flats : reclamation and settlement on the changeable coast of the Severn Estuary, southwest Britain. *Archaeological Journal*, **149**, 82-123.

BARFORD, P.M. 1996. The metalworking debris from Bear Barn and the Bear Field. Pp. 205-209 *in:* J. Parkhouse & E. Evans, *Excavations in Cowbridge, South Glamorgan, 1977-88*. BAR, British Series, 245pp.

BRIDGEWATER, N.P. 1965. Romano-British iron working near Ariconium. *Transactions of the Woolhope Naturalists' Field Club*, **38**, 124-135.

CREW, P. 1987. Bryn y Castell Hillfort – a Late Prehistoric Iron Working settlement in north-west Wales. In: SCOTT, B.G. & CLEERE, H. (eds) The Crafts of the Blacksmith. 91-100.

CREW, P. 1989. Crawcwellt West excavations 1986-1989. A late prehistoric ironworking settlement. Archaeology in Wales, 29, 11-16.

CREW, P. 1998. Excavations at Crawcwellt West, Merioneth, 1990-98: A late prehistoric upland ironworking settlement. Archaeology in Wales, 38, 22-35.

CREW, P. 2003. Slags and other iron-working residues. pp. 333-340 *in:* H. James, *Roman Carmarthen: Excavations 1978-1993*. Britannia Monograph Series 20, Society for the Promotion of Roman Studies 2003.

DUNGWORTH, D. 2007. Slags and Moulds. *In: T.* Catchpole, 2007, Excavations at the Sewage Treatment Works, Dymock 1995, *Transactions of the Bristol and Gloucestershire Archaeological Society*, **125**, 183-186.

FULFORD, M.G. & ALLEN, J.R.L. 1992. Iron-making at the Chesters villa, Woolaston, Gloucestershire: survey and excavation 1987-91. *Britannia*, **23**, 159-215.

JACKSON, R. 2012*. Ariconium, Herefordshire: An Iron Age Settlement and Romano-British 'Small Town'*. Oxbow, 304pp.

LEVIN, E.M., ROBBINS, C.R. & McMURDIE, H.F., 1964. *Phase Diagrams for Ceramists*, Columbus, Ohio, American Ceramic Society.

McDONNELL, J.G. 1984. Interim Report. Slags, Risely Farm, Berkshire*. English Heritage Ancient Monuments Laboratory Report 4422*.

McDONNELL, J.G. & SWISS, A. 2004. Ironworking residues. pp. 368-378, in: H. Dalwood & R. Edwards *Excavations at Deansway, Worcester, 1988-89: Romano-British small town to late medieval city*. CBA Research Report 139.

McKENZIE, R. 2008. Appendix 10. Metallurgy Assessment. E77-E93 *In:* Network Archaeology 2010, Brecon To Tirley High Pressure Gas Pipeline, Assessment of Potential For Analysis. *Network Archaeology Report No. 413*.

MORTON, G.R. & WINGROVE, J. 1969. Constitution of bloomery slags: Part 1: Roman. *Journal of the Iron and Steel Institute*, **207**, 1556-1564.

MORTON, G.R. & WINGROVE, J. 1972.Constitution of bloomery slags: Part II: Medieval*. Journal of the Iron and Steel Institute*, **210**, 478–488.

PAYNTER, S., 2006. Regional variation in bloomery smelting slags of the Iron Age and Romano-British periods. *Archaeometry*, **48**, 271-292.

PAYNTER, S., 2007. Innovations in bloomery smelting in Iron Age and Romano-British England, pp. 202–210, *in:* S La Niece, D Hook and P Craddock (eds), *Metals and Mines. Studies in Archaeometallurgy* (London).

STARLEY, D. 2012. Ironworking debris from the Welsh Water pipeline. Pp. 161- 163 *in:* R. Jackson, *Ariconium, Herefordshire: An Iron Age Settlement and Romano-British 'Small Town'*. Oxbow, 304pp.

THOMAS, G., 2000. *A chemical and mineralogical investigation of bloomery iron-making in the Bristol Channel Orefield, UK*. Unpublished PhD thesis, Cardiff University.

THOMAS G.R. & YOUNG, T.P. 1999a. Bloomery furnace mass balance and efficiency. *In:* POLLARD, A.M. (ed) *Geoarchaeology: exploration, environments, resources*, Geological Society of London, Special Publication, 165, 155-164.

THOMAS, G.R. & YOUNG, T.P. 1999b. A graphical method to determine furnace efficiency and lining contribution to Romano-British bloomery iron-making slags (Bristol Channel Orefield, UK). *In:* YOUNG, S.M.M., BUDD, P.D., IXER, R.A. and POLLARD, A.M. (eds). *Metals in Antiquity*, British Archaeological Reports International Series, **792**, 223-226. Archaeopress, Oxford.

YOUNG, T.P. 2000. Chapter 10. The Paviland Ochres: characterisation and sourcing. *In*: Aldhouse- Green, S., *Paviland Cave and the 'Red Lady': a definitive report.* Western Academic and Specialist Press Limited, 205-225.

YOUNG, T.P. 2005. *Evaluation of metallurgical residues from Marsh Leys Farm*. GeoArch Report 2005/07.
YOUNG, T.P. 2006a. *Archaeometallurigcal residues from the Caerwent Forum-Basilica (provisional report).* GeoArch Report 2006/01. 33pp + 8 plates.

YOUNG, T.P. 2006b. *Archaeometallurgical residues from Coldfurrow, Lyonshall, Herefordshire.* GeoArch Report 2006/09. 12pp. & 2 plates.

YOUNG, T.P. 2008. *Archaeometallurgical residues from Richard Lander School (RLS04) and Truro College (TCF05).* GeoArch Report 2007/22. 31pp. & 10 plates

YOUNG T.P. 2009a. *Archaeometallurgical residues from Crickhowell Road, Trowbridge, Cardiff.* GeoArch Report 2009/02. 11pp.

YOUNG, T.P. 2009b. *Evaluation of Archaeometallurgical residues from Alvington, Glos. (RCA08),* GeoArch Report 2009/14, 3 pp.

YOUNG, T.P. 2010a. Archaeometallurgical residues. 155-159. *In:* M. Brett, E. R. McSloy and N. Holbrook. A Roman enclosure at Crickhowell Road, Trowbridge, Cardiff. Evaluation and excavation 2005–06. *Archaeologicia Cambrensis*, **158**, 131-166.

YOUNG, T.P. 2010b. Caergwanaf. Pp. 214-216, *In:* B.C Burnham & J.L. Davies (eds) *The Roman Frontier in Wales and the Marches.* Royal Commission on the Ancient and Historical Monuments of Wales.380pp.

YOUNG, T.P. 2010c. *Analysis of archaeometallurgical residues from Brownslade, Pembrokeshire [NPRN 94225].* GeoArch Report 2010/07, 23 pp.

YOUNG, T.P. 2010d. *Archaeometallurgical residues from Robeston Wathen, Pembrokeshire. GeoArch Report 2010/09*, 13 pp.

YOUNG, T.P., 2011a. *Archaeometallurgical residues from Little Furnace Wood, Mayfield, East Sussex.* GeoArch Report 2011/21. 75 pp.

YOUNG, T.P. 2011b. *Evaluation of archaeometallurgical residues from the Forest of Dean Archaeological Survey, Stage 3B phase 2 (37920/37921/37923/37924).* GeoArch Report 2011/32. 13 pp.

YOUNG, T.P. 2011c. Metallurgical Residues, p. 112-114 and Appendix IV, p. 178-180 in: M. Luke & Preece, T. *Farm and Forge: late Iron Age/Romano-British farmsteads at Marsh Leys, Kempston, Bedfordshire*. East Anglian Archaeology, Report No. 138, 198 pp.

YOUNG, T.P. 2011d. *Assessment of the archaeometallurgical residues from the Milford Haven to Brecon High Pressure Gas Pipeline.* GeoArch Report 2011/40. 9 pp.

YOUNG T.P. 2012. Petrographic and chemical analysis. Pp. 163-164 *in:* R. Jackson, *Ariconium, Herefordshire: An Iron Age Settlement and Romano-British 'Small Town'*. Oxbow, 304pp.

YOUNG, T.P. *forthcoming*. Roman military control on ironmaking in South Wales. *In*: B. Cech, T. Rehren (Editors), *Ferrum Noricum – iron production and distribution 200 BC to AD 400, Proceedings of the conference on "Early Iron" in Hüttenberg, September 8th to 12th, 2008*.

YOUNG, T.P. & KEARNS, T. 2010a. *Evaluation of metallurgical residues from Caerleon Junior School (CA/JS/07)*. GeoArch Report 2010/17, 7pp.

YOUNG, T.P. & KEARNS, T. 2010b. *Evaluation of archaeometallurgical residues from Kyrleside, Dymock, Gloucestershire (32523 & 33787).* GeoArch Report 2010/19, 5pp.

YOUNG, T.P . & KEARNS, T. 2011. *Evaluation of metallurgical residues from the New Interpretation Centre, Cardiff Castle, Cardiff [ST181765]*. GeoArch Report 2011/02, 27 pp.

YOUNG, T.P. & THOMAS, G.R. 1997. *Geochemistry of iron-making slags from Caerleon, Gwent.* Cardiff Earth Sciences Geoarchaeology Report 97/03. 7 pp.

YOUNG, T.P. & THOMAS, G.R. 1998. The cargo: iron ore analysis. pp. 105-111 *In:* Nayling, N. *The Magor Pill Medieval Wreck*, CBA Research Report 115, Council for British Archaeology.

YOUNG, T.P. & THOMAS G.R. 1999. Provenancing iron ore from the Bristol Channel Orefield: the cargo of the Magor Pill Boat. *In:* POLLARD, A.M. (ed) *Geoarchaeology: exploration, environments, resources*, Geological Society of London, Special Publication 165, 103-121.

Glossary

Bleb: a small rounded particle or textural component, often a droplet or prill

Blacksmithing: The working of iron for the creation or repair of artefacts.

Bloom: The raw block of iron produced during smelting in the bloomery process. Blooms require further compaction and reworking (bloomsmithing or bloom-refining) in order to remove voids, charcoal and most of the slag entrained in the raw bloom. The remaining slag forms elongate inclusions in the iron, which gives bloomery iron its toughness. Many of the objects described as blooms have undergone at least some compaction. Fully compacted blooms (but not yet worked down to usable bar iron) are termed billets.

Bloomery: a furnace for smelting iron from ore in which iron is produced as a solid material. The bloomery process was employed mainly prior to the introduction of the later blast furnace from the late 15th century.

Bloom-refining: Usually taken as an alternative term for bloomsmithing, but may encompass techniques other than physical working (such as re-melting).

Bloomsmithing: The process of reworking a raw bloom, through repeated reheating and hammering, to reduce its content of slag, to remove unwanted inclusions and to draw out the remaining slag into elongate inclusions. The end product may be a bar or billet. Usually taken as an alternative term for *bloom-refining.*

Blowhole: A hole through a furnace or hearth wall through which air is blown.

Bog Iron Ore: hydrated iron oxide ores formed in superficial sediments (including, but not limited to bogs) through the oxidation of iron-bearing groundwaters.

Cotectic: crystallisation of a liquid to produce two phases at the same time.

Dendrite: a branched crystal form, often associated with rapid growth.

End-member: The limits of solid solution in a mineral system. Used in cases where all the possible sites which a particular element can occupy in a crystal are occupied by atoms of the element. An example would be fayalite, Fe_2SiO_4 being the iron end-member of the olivine group, whereas forsterite, Mg_2SiO_4 is the magnesium end-member.

Euhedral: a crystal shape in which the crystal has developed its faces, indicating its growth was unobstructed by previously formed phases.

Fayalite: the iron-rich end member of the olivine group, Fe_2SiO_4.

Forging: the process of hot-forming a metal by beating it.

Forsterite: the magnesium-rich end member of the olivine group, Mg_2SiO_4.

Goethite: a hydrated iron III oxide, FeO.OH.

Hematite: an iron III oxide Fe_2O_3

Hercynite: an iron-aluminium member of the spinel group of minerals: $FeAl_2O_4$

Interstitial space or *interstice*: the space between the main generation of crystals in a material. On cooling the main phase of crystals will solidify whilst the interstitial spaces are still occupied by molten material, which will solidify at a lower temperature.

Iscorite: the informal name for a phase (artificial mineral) to date only observed in metallurgical slags. The chemical composition is $Fe^{2+}{}_5Fe^{3+}{}_2SiO_{10}$. The mineral is typically encountered in contexts where wustite is oxidised in the presence of fayalite.

Kaolinite: a hydrous alumina-silicate clay mineral, the major component of china clay, $Al_2Si_2O_5(OH)_4$

Kirschsteinite: the calcium/iron-rich end member of the olivine group, $FeCaSiO_4$.

Leucite: a potassium-bearing mineral $KAlSi_2O_6$

Magnetite: an iron oxide member of the spinel group, Fe_3O_4.

Olivine: a group of silicate minerals of the form $(M^{2+})_2SiO_4$ where M can commonly be iron, magnesium, calcium (up to half the M^{2+} ions) or manganese. Includes the end-members fayalite (Fe_2SiO_4), forsterite (Mg_2SiO_4), tephroite (Mn_2SiO_4), kirschsteinite ($CaFeSiO_4$) and monticellite ($CaMgSiO_4$). The complex substitutions are described in this report by using the convention of describing the Fe-Mg as the fayalite-forsterite proportion (for instance Fa95Fo5, where Mg is 5% of the total of Mg+Fe) and then describing the Ca and Mn concentrations as percentage substitutions of the forsterite-fayalite.

Prill: a small aggregate of a material, either a spheroidal droplet or a runnel, formed from a melted liquid and either occurring as a discrete particle or as an inclusion within another material.

Quench: to cool rapidly from high temperature.

Rhönite: An aenigmatite group mineral with a formula of $Ca_2(Mg,Fe^{2+},Fe^{3+},Ti)_6(Si,Al)_6O_{20}$.

Shaft furnace: A furnace that is taller than wide. The shaft furnace permits the reaction of the charge, which descends as the fuel burns, with rising carbon monoxide. Many bloomery furnaces are shaft furnaces, as are blast furnaces.

SHB: Abbreviation for smithing hearth base. This is a synonym of *smithing hearth cake* (*SHC*), which has more general use because the slag cake does not typically form in the bottom of the hearth.

SHC: Abbreviation for smithing hearth cake. A slag cake, typically plano-convex, that forms just below the air inlet in a smithing hearth.

Slagpit Furnace: a variety of bloomery iron smelting furnace in which much of the slag formed during the smelt drains into a pit below the shaft (rather than being tapped outside the furnace).

Smithing: the activity involved in forming a metal object, including, but not limited to, forging metal and joining metal by welding.

Smithing hearth: a hearth used for the heating of metals for smithing.

Smithing hearth cake: a cake of slag formed in the smithing hearth below the level of the air blast. They typically have a rounded convex base, with an upper surface that may be concave, planar or convex depending on the amount of slag that accumulates (abbreviated to *SHC*).

Spinel: a mineral group with the general formula $X^{2+}Y^{3+}{}_2O_4$, which includes, amongst many others, the minerals hercynite and magnetite.

Subhedral: a form of crystal growth which is impeded by some pre-existing phases to permit only some of a crystals faces to be developed.

Tap slag (or *tapped slag*, sometimes *tapslag*): slag that has been *tapped* from a furnace as a liquid to solidify outside the furnace.

Tapping: the process or act of allowing a liquid to flow from a furnace. In the bloomery process it is the slag that may be tapped; in a blast furnace both slag and iron are tapped.

Valency: a measure of the number of bonds formed by an atom of a given element

Vesicle: a void or pore, usually rounded and formed as a preserved gas bubble in a solidified melt.

Wustite: an iron II oxide FeO.

Illustration Captions

Plate 1:
Backscattered Electron Photomicrographs of selected specimens of smithing slags from Plot 331

a. Sample K: montage of images (SOI8-11) showing a section through the lower (?) part of the SHC. The lower part of the section shows a large inclusion formed of inwardly-growing large magnetite dendrites. The zone above shows dendrites and angular skeletal grains of magnetite (pale grey) overgrown by wustite (bright) and followed by elongate fayalite (mid-grey). This is bounded by a scale-like margin (see (c) for detail), above which magnetite is subordinate to wustite.

Scale bar 1mm.

b. Sample H (SOI 5): typical area of sample showing wustite (pale) in rounded blebs and poorly-developed dendrites. The wustite is followed by fayalite (mid grey), which forms the filling of much of the pore on the upper margin, leaving surviving open vesicles (black).

Scale bar 1mm.

c. Sample K (SOI12): detail of a scale-like inclusion associated with dendrites with cores of magnetite (pale grey), overgrown by wustite (bright, rounded margins) and iscorite (bright elongate, thin). The matrix is formed of very finely grained fayalite (mid grey) in glass (dark grey).

Scale bar 200µm.

d. Sample L (SOI9): partially-reacted flake hammerscale fragment, formed of wustite, overgrown by new-formed wustite (bright). The matrix includes elongate fayalite (mid grey) with interstitial phase mainly a leucite-wustite cotectic (black with white specks).

Scale bar 200µm.

e. Sample L (SOI2): detail of zone around a bleb of glass derived from the hearth lining (mid-grey, lower right). The complex reaction zone is dominated by calcic olivine (pale grey) and leucite (dark). For detail see (f).

Scale bar 200µm.

f. Sample L (SOI3): detail of (e). Calcium poor fayalite is overgrown by intergrowths calcium-rich olivine and leucite. The remaining interstitial space is filled with a glass (mid-dark grey) containing hollow crystals of rhönite (slightly paler).

Scale bar 200µm.

Plate 2:
Backscattered Electron Photomicrographs of selected specimens of smelting slags from Plot 430

a. Sample A1 (SOI2): detail of a typical oxidised flow lobe margin from a tapslag. Pale phase in the margin and as fine dendrites is wustite. The mid-grey crystals are fayalite, which has an interstitial matrix of glass with very fine late-stage olivine (dark).

Scale bar 200µm

b. Sample B1 (SOI1): lobe margin in a tap slag, lacking a oxidised crust. The arcuate margin has acted a point for nucleation of the elongate (pale grey) fayalite, which are secondary to very delicate wustite dendrites (bright).

Scale bar 1mm

c. Sample B1 (SOI7):detail of an interstitial space between wustite dendrites (pale) and olivine crystals (mid grey) filled with glass (dark), bearing very fine dendrites of a secondary olivine.

Scale bar 80µm

d. Sample B1 (SOI 3): detail of an interstitial space between wustite dendrites (pale) and olivine crystals (mid grey) filled with a kirschsteinitic olivine (slightly darker than the main phase fayalite) and rounded mass of a leucite-wustite cotectic (leucite dark, wustite bright).

Scale bar 80µm

e. Sample C2 (SOI4): typical microstructure of a tap slag with a moderate wustite (bright) content. Elongate olivine crystals (mid-grey) with an interstitial space filled by glass (dark) bearing fine-grained dendrites of olivine.

Scale bar 60µm

f. Sample E1 (SOI3): microstructure within the slag 'rod' in which the two interstitial fill types (see (c) and (d)) occur together. The glass occurs on the left, in a quench structure between parallel fine olivine crystals; the calcic olivine plus leucite-wustite cotectic occur to the right.

Scale bar 50µm

g. Sample B2 (SOI4): a pore margin in a wustite-poor furnace slag. Much of the interstitial space between the olivines is here occupied by large leucite-wustite cotectic intergrowths (speckled), and locally leucite (dark) on its own.

Scale bar 600µm

h. Sample G2 (SOI42): detail of a wustite-rich furnace slag, showing the wustite developing a framework around 'pores', some of which are entirely filled by fayalitic slag, some bridge by isolated fayalite crystals and others surviving as open vesicles (with margins rich in leucite).

Scale bar 1mm

Figure 1:
Plots of individual area analyses from samples from Plot 331, plotted on the FeO-SiO_2- $CaAl_2Si_2O_8$ (anorthite) diagram.

Figure 2:
Composite of all area analyses from samples from Plot 331, plotted on the FeO-SiO_2- $CaAl_2Si_2O_8$ (anorthite) diagram.

Figure 3:
Plot of area analyses from Plot 331 averaged for each sample (red points), with the field of all area analyses (grey tone), compared with bulk chemical analyses of

smithing slags from other localities (see text for discussion of the origin of these comparative data).

Figure 4:
Plots of individual area analyses from samples from Plot 430, plotted on the FeO-SiO_2- $CaAl_2Si_2O_8$ (anorthite) diagram.

Figure 5:
Composite of all area analyses from samples from Plot 430, plotted on the FeO-SiO_2- $CaAl_2Si_2O_8$ (anorthite) diagram.

Figure 6:
Plot of the field of all area analyses from Plot 430 (grey tone), compared with bulk chemical analyses of smelting slags from other localities (see text for discussion of the origin of these comparative data).

Table 1: Details of samples from Plot 331.

sample	*context*	*original note from assessment*	*surviving sample*	*mounted sample*
H	3021	classic SHB	small fragment from SHC; dense, rusted top, dished, some vesicles, particularly just above weathered base	probably section from top (vesicular, fayalitic) to middle (wustite-rich) of cake
I	3021	classic SHB	[from same piece as above?]	lobate base of cake, passing up towards dense wustite zone
J	3021	dense slag (poss. SHB or furnace?)	rather strongly-curved fragment - probably pale slag on top - so probably an SHC burr	shows gradation from heterogeneous slag (wustite- and ceramic- rich zones) into more uniformly dense material (below?)
K	3050	dense slag (poss. SHB or furnace?)	only tiny chips remaining from preparation; these are very dense slags with internal lobes picked out by lines of vesicles. Presumed original block 854g remaining in separate box. SHC, dense internally slightly lobate, deep, bun shaped, 110x110x40mm.	Unusual slag, apparent lobe margins or scale with iscorite, and a dense zone with coarse magnetite dendrites
L	3052	Dense SHB slag	tiny fragment remaining - show small and large pores as well as dense area - could be SHC	Vesicular slag with well-developed vesicle margin minerals, including rhönite and leucite. Some included flake hammerscale.

Table 2: average chemical composition of samples from Plot 331. Analyses presented as wt% oxides, calculated stoichiometrically from the average of the normalised EDS analyses of representative areas within each sample.

	Na_2O	MgO	Al_2O_3	SiO_2	P_2O_5	S	Cl	K_2O	CaO	TiO_2	MnO	FeO
H	0.53	0.77	2.86	18.21	0.43	0.08	0.01	1.94	4.32	0.04	0.12	70.69
I	0.34	0.79	5.69	19.18	0.30	0.03	0.00	0.89	2.53	0.19	0.00	70.07
J	0.66	0.75	6.34	28.16	0.29	0.02	0.03	2.75	4.75	0.15	0.03	56.06
K	0.43	0.64	3.95	18.59	0.12	0.00	0.00	1.95	2.90	0.07	0.09	71.27
L	1.76	1.16	7.52	32.06	0.19	0.01	0.00	2.76	2.89	0.23	0.08	51.34

Table 3: Details of samples from Plot 430.

sample	*context*	*original note from assessment*	*surviving sample*	*mounted sample*
A1	86104	tap	dense tap slag in narrow lobes	fine-grained tap slag in lobes
A2	86001	tap	large block of tap slag with sandy base, part of side is raised and may be a down-flow or just possibly (from shape of base) a hot deformed bend	coarse grained tap slag with possible remelted (or not initially solid) internal lobe margins
B1	86131	tap	dense tap slag in broad lobes,	coarse tap slag, no oxide on lobe margins, abundant leucite
B2	86131	furnace	from small broken piece of charcoal rich vesicular slag	coarse charcoal bearing slag with leucite and rhönite
C1	86156	furnace	[none]	coarse slag with irregular voids and leucite
C2	86156	tap	rather porous conventional tap slag as part of small flow on/through charcoal	fine grained tap slag
D1	86165	tap	[none]	fine vesicular slag with abundant wustite
D2	86165	furnace	rusted and accreted fragment with some signs of exploding	bloom fragment
E1	86174	porous tap	20x30mm slag rod	vesicular slag - probably from slag rod fragment, well developed vesicle margins
E2	86174	tap	very dense tap slag with strong radial crystals in upper flow; one piece has 'sandy' base, other very reflective with ore fragments	dense tap slag lobe with more abundant fine vesicles in upper part
F1	86196	dense furnace	[none]	tap slag in very thin lobes
F2	86196	dense furnace	[none]	fine grained tap slag
G1	86225	possible SHC	[none] (possible source – 2 concavo-convex blocks with large pore spaces, and rusty concave surfaces	coarsely vesicular ?burr material from smelting furnace
G2	86225	possible SHC	[none] (as above)	coarsely vesicular ?burr material from smelting furnace

Table 4*: average chemical composition of samples from Plot 430. Analyses presented as wt% oxides, calculated stoichiometrically from the average of the normalised EDS analyses of representative areas within each sample.*

	Na_2O	MgO	Al_2O_3	SiO_2	P_2O_5	S	Cl	K_2O	CaO	TiO_2	MnO	FeO
A1 (tap)	0.41	0.65	4.29	25.83	0.27	0.00	0.00	1.77	3.22	0.05	0.12	63.39
A2 (tap)	0.39	0.71	4.27	24.98	0.13	0.00	0.00	1.70	3.63	0.09	0.24	63.88
B1 (tap)	0.24	0.90	6.17	27.80	0.14	0.00	0.00	2.24	3.12	0.20	0.08	59.11
B2 (furnace)	0.17	1.35	6.38	29.36	0.34	0.02	0.00	1.70	3.20	0.22	0.13	57.12
C1 (furnace)	0.11	0.62	7.31	27.16	0.18	0.03	0.00	1.94	3.73	0.29	0.23	58.42
C2 (tap)	0.06	1.13	4.34	24.94	0.30	0.00	0.00	1.21	3.79	0.15	0.17	63.91
D1 (tap)	0.17	0.79	3.92	20.71	0.26	0.02	0.00	1.40	2.87	0.05	0.04	69.77
D2 (bloom)	0.07	0.89	3.31	15.02	0.19	0.01	0.13	0.90	1.44	0.06	0.20	77.76
E1 (rod)	0.16	0.83	3.92	18.74	0.00	0.02	0.00	1.25	2.36	0.04	0.18	72.50
E2 (tap)	0.37	0.97	6.49	25.26	0.00	0.05	0.00	1.90	1.69	0.12	0.31	62.85
F1 (tap)	0.27	0.85	4.21	24.06	0.11	0.01	0.00	1.57	5.88	0.07	0.08	62.90
F2 (tap)	0.28	0.70	4.66	23.79	0.20	0.01	0.02	1.59	4.64	0.09	0.06	63.96
G1 (furnace)	0.38	0.84	3.27	20.63	0.38	0.03	0.02	1.15	2.58	0.00	0.06	70.65
G2 (furnace)	0.19	0.83	3.95	21.17	0.35	0.00	0.00	1.40	2.41	0.00	0.05	69.65
Average tapslag	0.26	0.84	4.70	24.01	0.16	0.01	0.00	1.63	3.47	0.09	0.14	64.69
Average furnace slag	0.18	0.90	4.85	22.67	0.29	0.02	0.03	1.42	2.67	0.11	0.14	66.72
Overall average	0.23	0.86	4.75	23.53	0.20	0.02	0.01	1.55	3.18	0.10	0.14	65.42

Table 5: Comparison of the weight of SHCs from Plot 331 with those of other comparative sites

Site				Statistics of SHC weight distribution where known					
Name	**Reference**	**Age**	**Comment**	**Number**	**Minimum wt.**	**Maximum wt.**	**Mean wt.**	**% <500g**	**%>1000g**
Carmarthen	Crew 2003	RB		136	100	820	227	94%	0%
Cowbridge	Barford 1996	RB		?	175	700	403	?	0%
Marsh Leys Farm	Young 2005, 2011c	RB		30	?	824	333	77%	0%
Caerleon Endowed Schools Field	Young & Kearns 2010a	RB		6	58	284	172	100%	0%
Trowbridge, Cardiff	Young 2009a, 2010a	RB		3	144	290	225	100%	0%
Lyonshall	Young 2006b	RB		14	176	2077	564	64%	14%
Dymock	Young & Kearns 2010b	RB C2?		10	112	3885	1032	60%	14%
Cardiff Castle	Young & Kearns 2011	RB C2-3		5	193	1090	626	40%	20%
Miskin School Road	Author's unpub data	RB C3-4?	SHCs mainly 1-2kg, some over 2kg			>2000			
Ariconium	Starley 2012	RB	Small SHCs average 200g, one was 2740g	8		2740			13%
Crawcwellt	Crew 1998	M-L IA	SHCs mainly either 100-150g (secondary) or 300-400g (primary)						
Plot 331		LIA - RB		15	230	1035	565	47%	7%

Plate A1

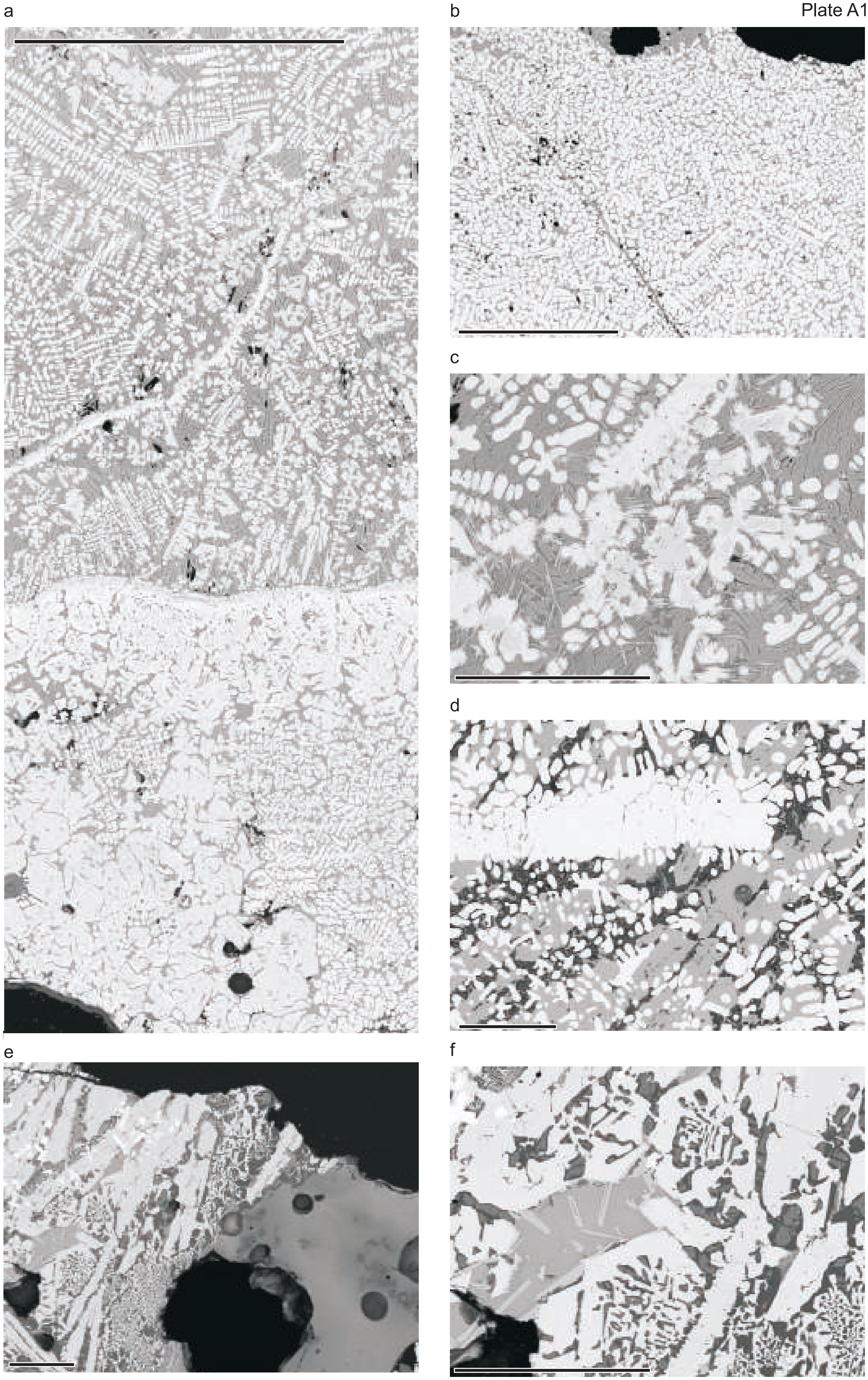
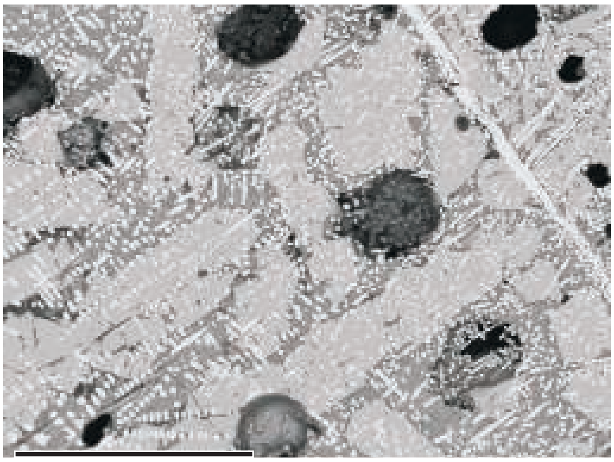
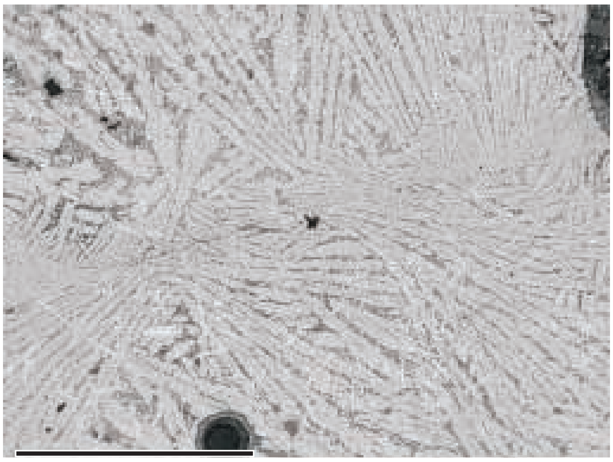


Plate 2

a



b



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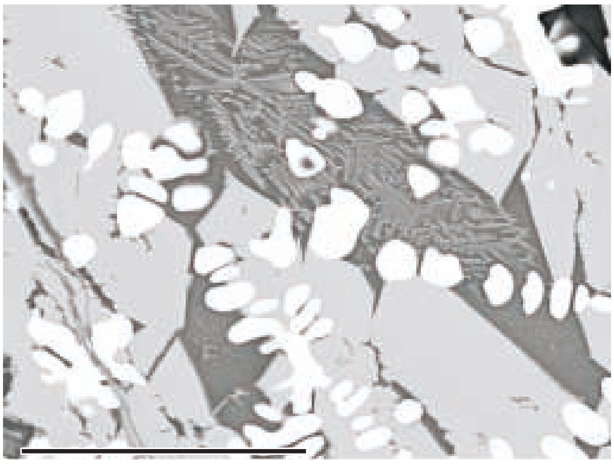

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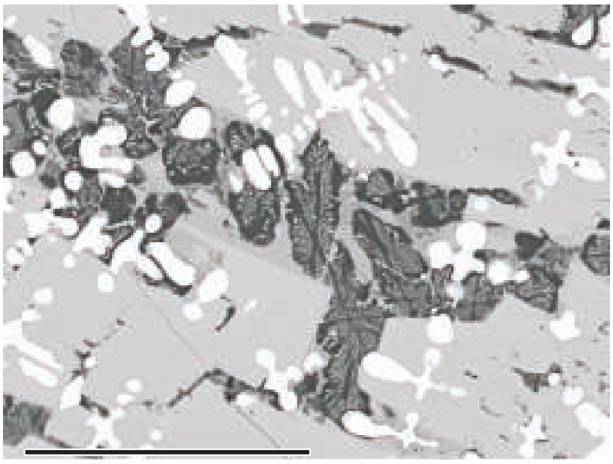

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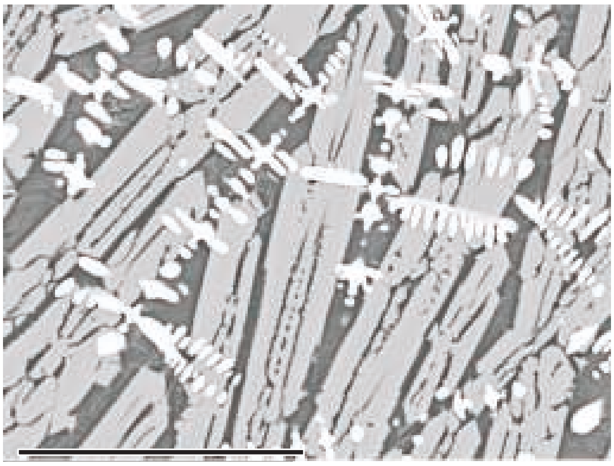
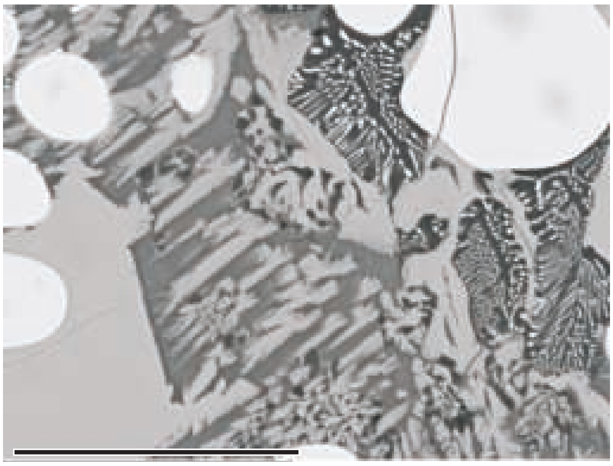


f



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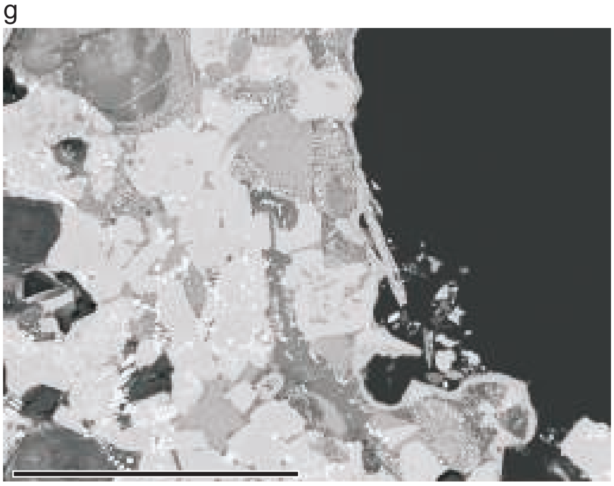


h

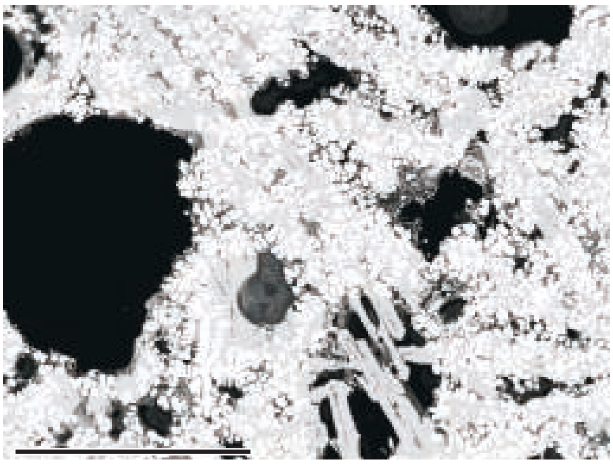


Figure 1

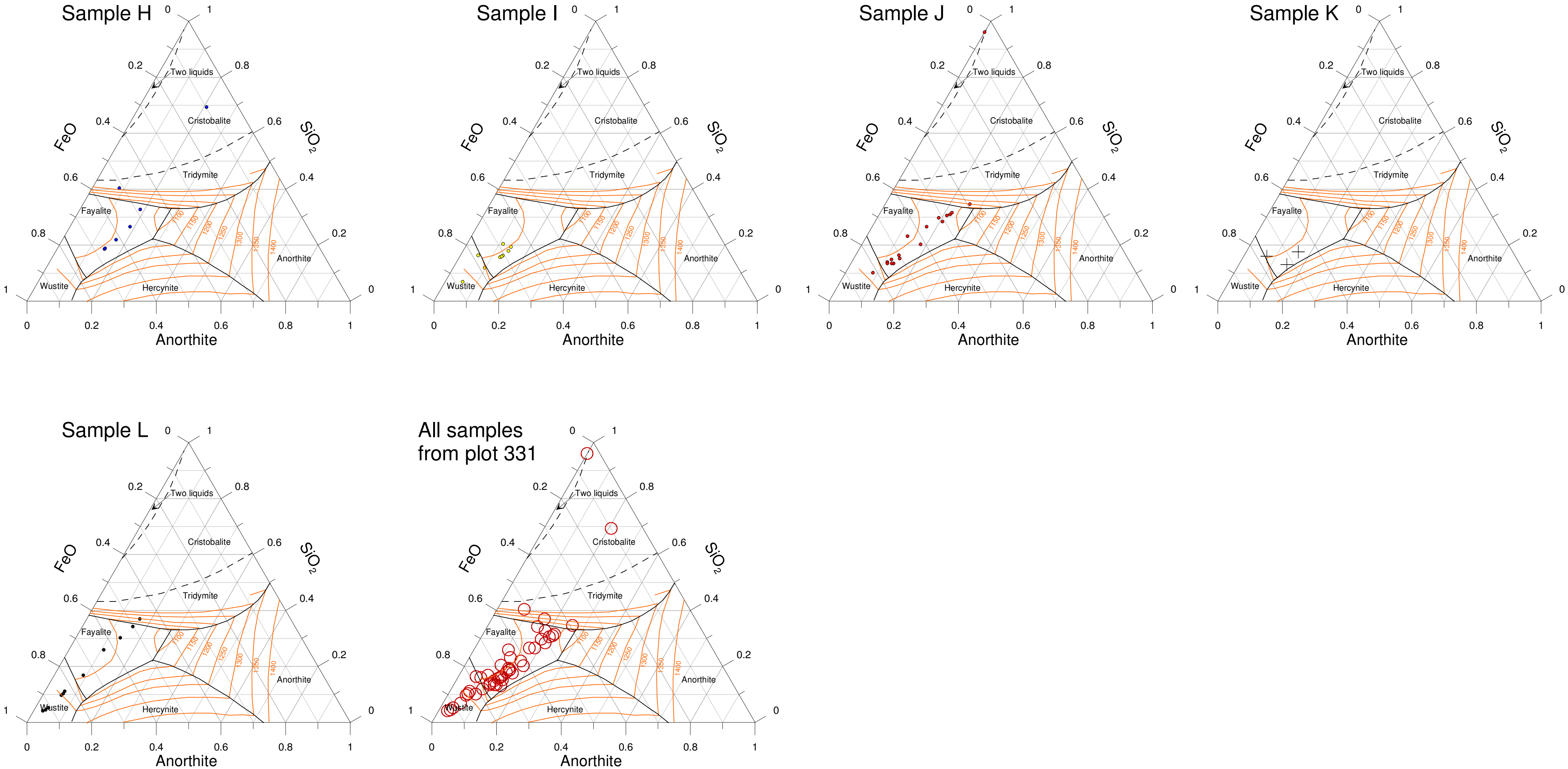
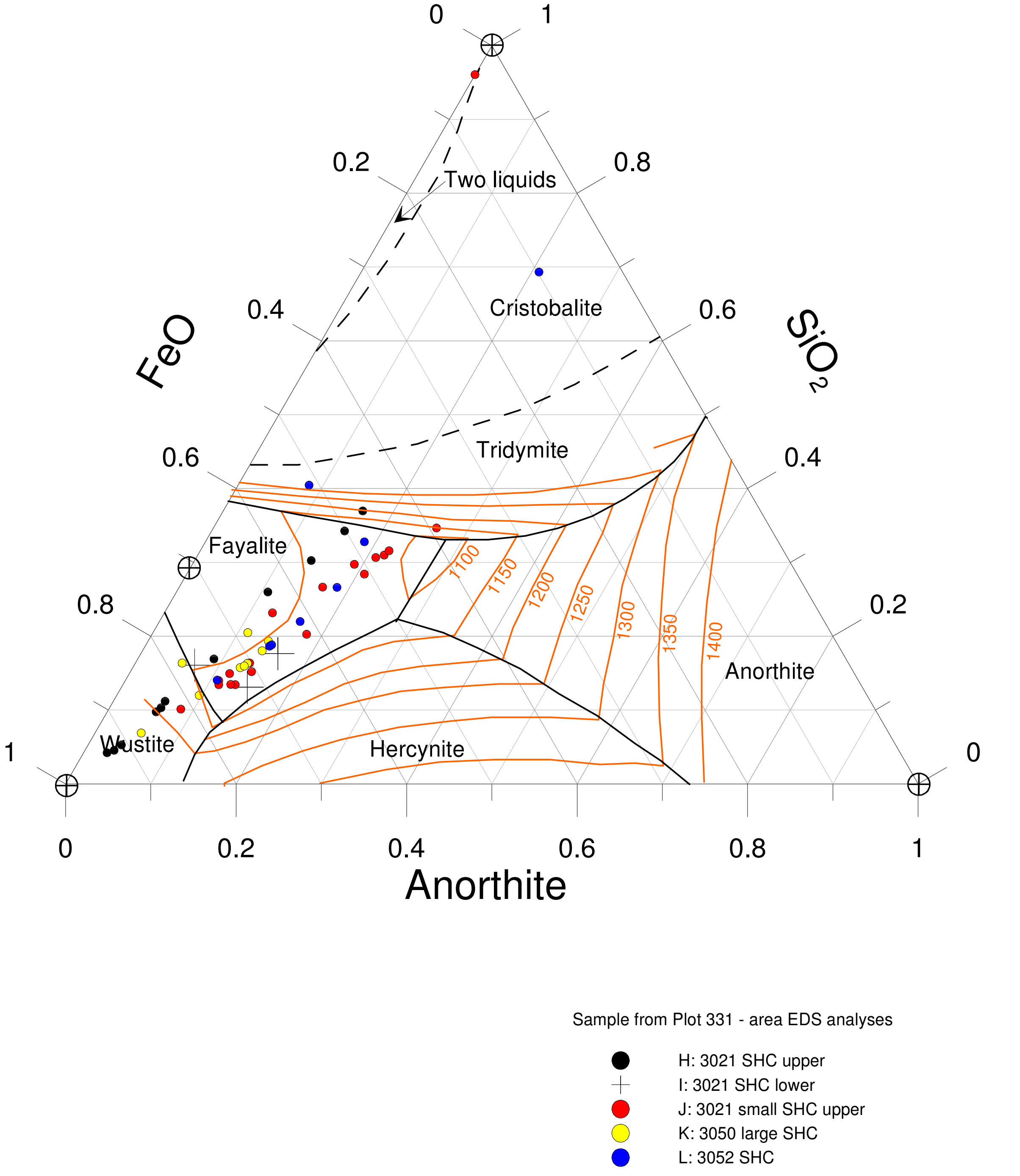
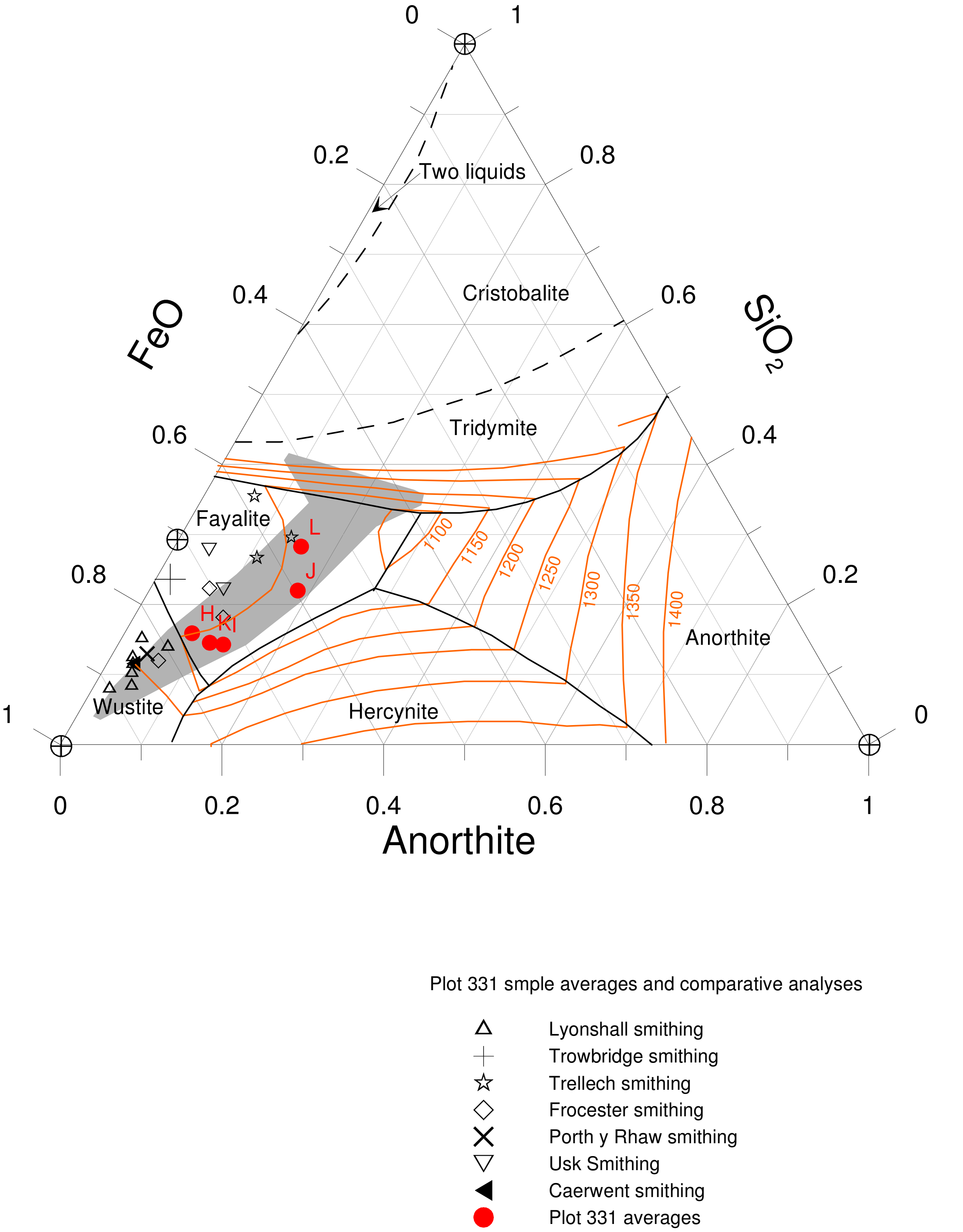

Sample H
Sample I
Sample J
Sample K
Sample L
All samples
from plot 331
FeO
SiO2
Anorthite
Two liquids
Cristobalite
Tridymite
Fayalite
Wustite
Hercynite
Anorthite
1100
1150
1200
1250
1300
1350
1400
0
0.2
0.4
0.6
0.8
1

Figure 2



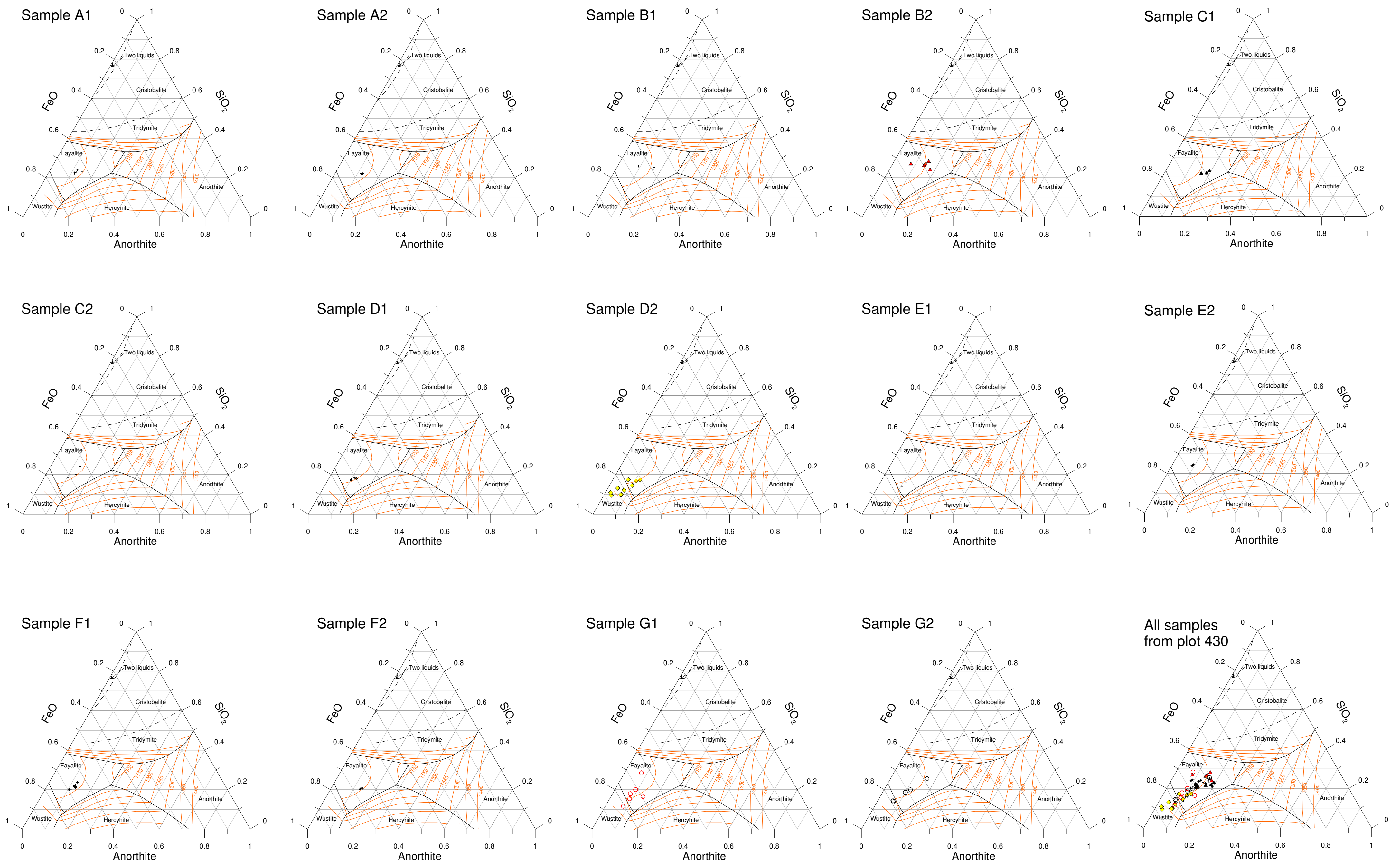
Two liquids
Cristobalite
Tridymite
Fayalite
Wustite
Hercynite
Anorthite
FeO
SiO2
Anorthite
1100
1150
1200
1250
1300
1350
1400
0
0.2
0.4
0.6
0.8
1
Sample from Plot 331 - area EDS analyses
H: 3021 SHC upper
I: 3021 SHC lower
J: 3021 small SHC upper
K: 3050 large SHC
L: 3052 SHC

Figure 3



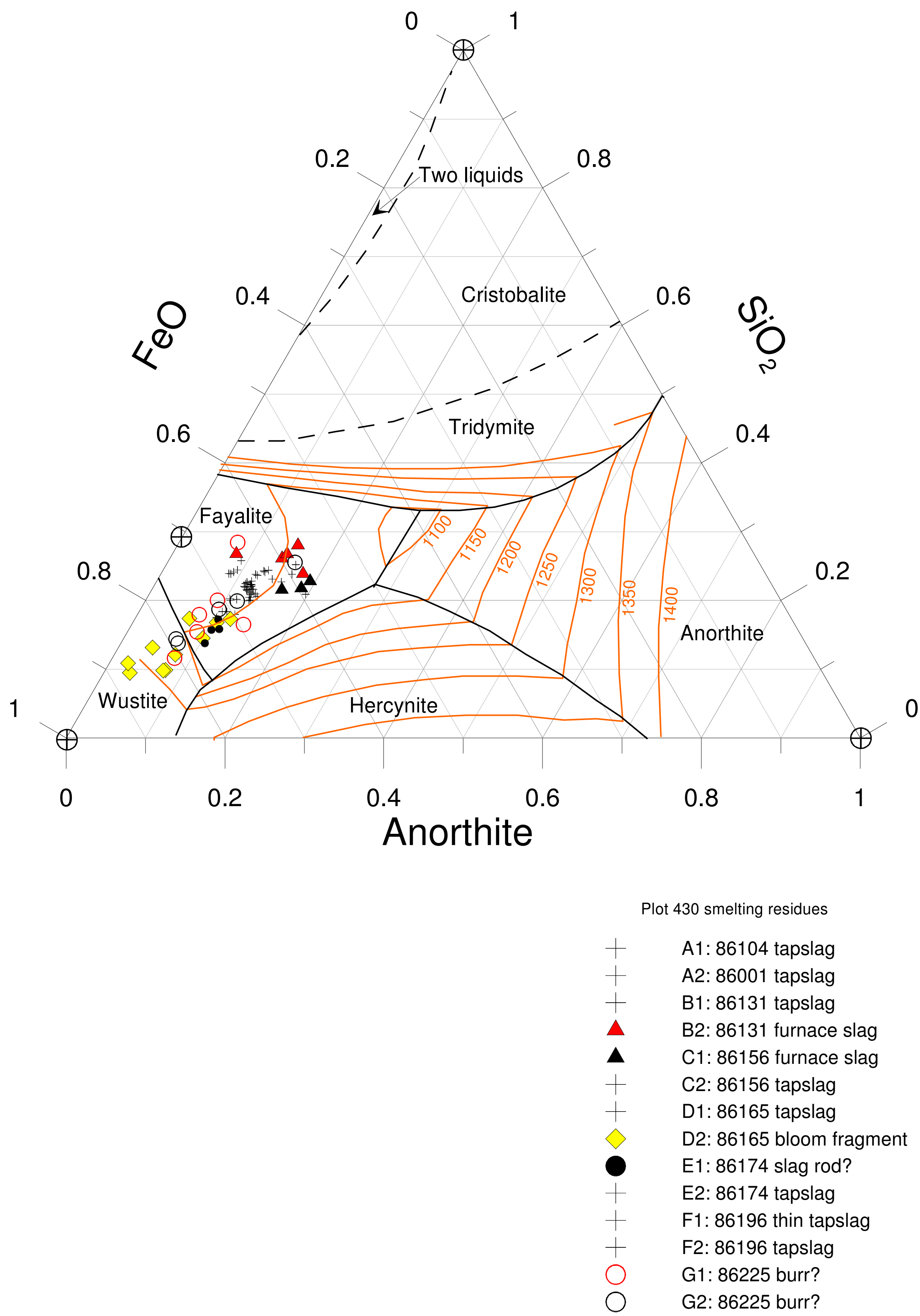
FeO
SiO2
Anorthite
Two liquids
Cristobalite
Tridymite
Fayalite
Wustite
Hercynite
Anorthite
1100
1150
1200
1250
1300
1350
1400
L
J
H
K
I
Plot 331 smple averages and comparative analyses
Lyonshall smithing
Trowbridge smithing
Trellech smithing
Frocester smithing
Porth y Rhaw smithing
Usk Smithing
Caerwent smithing
Plot 331 averages

Figure 4



Sample A1
Sample A2
Sample B1
Sample B2
Sample C1
Sample C2
Sample D1
Sample D2
Sample E1
Sample E2
Sample F1
Sample F2
Sample G1
Sample G2
All samples from plot 430
FeO
SiO2
Anorthite
Two liquids
Cristobalite
Tridymite
Fayalite
Wustite
Hercynite
Anorthite

Figure 5



FeO
SiO2
Anorthite
0
1
0.2
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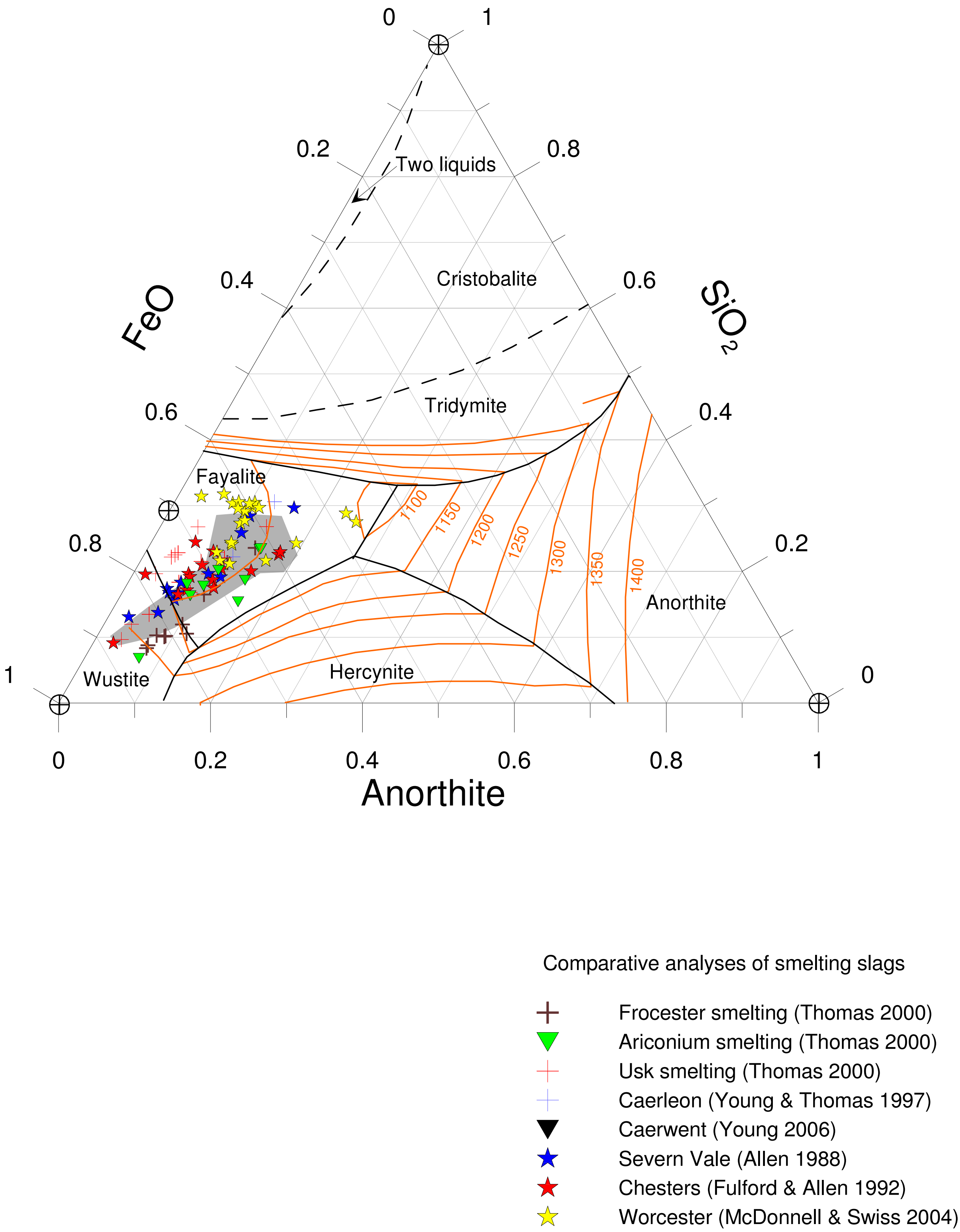
0.4
0.6
0.6
0.4
0.8
0.2
1
0
0
0.2
0.4
0.6
0.8
1
Two liquids
Cristobalite
Tridymite
Fayalite
Wustite
Hercynite
Anorthite
1100
1150
1200
1250
1300
1350
1400
Plot 430 smelting residues
A1: 86104 tapslag
A2: 86001 tapslag
B1: 86131 tapslag
B2: 86131 furnace slag
C1: 86156 furnace slag
C2: 86156 tapslag
D1: 86165 tapslag
D2: 86165 bloom fragment
E1: 86174 slag rod?
E2: 86174 tapslag
F1: 86196 thin tapslag
F2: 86196 tapslag
G1: 86225 burr?
G2: 86225 burr?

Figure 6



0
1
0.2
0.8
0.4
0.6
0.6
0.4
0.8
0.2
1
0
FeO
SiO2
Two liquids
Cristobalite
Tridymite
Fayalite
Wustite
Hercynite
Anorthite
1100
1150
1200
1250
1300
1350
1400
0
0.2
0.4
0.6
0.8
1
Anorthite
Comparative analyses of smelting slags
Frocester smelting (Thomas 2000)
Ariconium smelting (Thomas 2000)
Usk smelting (Thomas 2000)
Caerleon (Young & Thomas 1997)
Caerwent (Young 2006)
Severn Vale (Allen 1988)
Chesters (Fulford & Allen 1992)
Worcester (McDonnell & Swiss 2004)

APPENDIX A
IMAGE ARCHIVE

Archive plates

Plate A1: Sample A1
a) SOI1. Scale bar 2mm .
b) SOI2. Scale bar 200µm.
c) SOI3. Scale bar 1mm.
d) SOI4. Scale bar 1mm.
e) SOI5. Scale bar 1mm.
f) SOI6. Scale bar 1mm.
g) SOI7. Scale bar 1mm.
h) SOI8. Scale bar 70 µm.

Plate A2: Sample A1
a) SOI9. Scale bar 1mm.
b) SOI10. Scale bar 1mm.
c) SOI11. Scale bar 1mm.
d) SOI12. Scale bar 1mm.

Plate A3: Sample A1
Montage of SOI 3 – SOI7 and 9-12. Scale bar 10mm.

Plate A4: Sample A2
a) SOI1. Scale bar 1mm.
b) SOI2. Scale bar 1mm.
c) SOI3. Scale bar 1mm.
d) SOI4. Scale bar 1mm.
e) SOI5. Scale bar 1mm.
f) SOI6. Scale bar 100µm.

Plate A5: Sample B1
a) SOI1. Scale bar 1mm.
b) SOI2. Scale bar 200µm.
c) SOI3. Scale bar 80µm.
d) SOI4. Scale bar 1mm.
e) SOI5. Scale bar 80µm.
f) SOI6. Scale bar 80µm.
g) SOI7. Scale bar 80µm.

Plate A6: Sample B2
a) SOI2. Scale bar 100µm.
b) SOI2. Scale bar 100µm.
c) SOI2. Area as (a). Elemental density map: Al
d) SOI2. Area as (a). Elemental density map: Ca
e) SOI2. Area as (a). Elemental density map: Fe
f) SOI2. Area as (a). Elemental density map: K
g) SOI2. Area as (a). Elemental density map: Si
h) SOI2. Area as (a). Elemental density map: Ti

Plate A7: Sample B2
a) SOI1. Scale bar 200µm.
b) SOI3. Scale bar 600µm.
c) SOI4. Scale bar 600µm.
d) SOI5. Scale bar 100µm.
e) SOI6. Scale bar 600µm.

Plate A8: Sample C1
a) SOI1. Scale bar 2mm.
b) SOI2. Scale bar 600µm.
c) SOI3. Scale bar 600µm.
d) SOI4. Scale bar 200µm..

Plate A9: Sample C2
a) SOI1. Scale bar 600µm.
b) SOI2. Scale bar 600µm.
c) SOI3. Scale bar 600µm.
d) SOI4. Scale bar 60µm.
e) SOI5. Scale bar 600µm.
f) SOI6. Scale bar 600µm.
g) SOI7. Scale bar 600µm.
h) SOI8. Scale bar 60µm.

Plate A10: Sample D1
a) SOI1. Scale bar 600µm.
b) SOI2. Scale bar 600µm.
c) SOI3. Scale bar 60µm.
d) SOI4. Scale bar 600µm.
e) SOI5. Scale bar 600µm.
f) SOI6. Scale bar 60µm.

Plate A11: Sample D2
Montage of SOI 1 – SOI38. Scale bar 5mm.

Plate A12: Sample D2
a) SOI39. Scale bar 600µm..
b) SOI40. Scale bar 70µm.
c) SOI41. Scale bar 400µm.
d) SOI42. Scale bar 100µm.
e) SOI43. Scale bar 1mm.
f) SOI44. Scale bar 600µm.
g) SOI45. Scale bar 800µm.

Plate A13: Sample E1
a) SOI1. Scale bar 1mm.
b) SOI2. Scale bar 100µm.
c) SOI3. Scale bar 50µm.
d) SOI4. Scale bar 600µm.
e) SOI5. Scale bar 600µm.
f) SOI6. Scale bar 600µm.
g) SOI7. Scale bar 100µm.

Plate A14: Sample E2
a) SOI1. Scale bar 1mm.
b) SOI2. Scale bar 1mm.
c) SOI3. Scale bar 70µm.
d) SOI4. Scale bar 1mm.
e) SOI5. Scale bar 1mm.

Plate A15: Sample F1
a) SOI3. Scale bar 1mm.
b) SOI4. Scale bar 1mm.
c) SOI5. Scale bar 1mm.
d) SOI6. Scale bar 1mm.
e) SOI7. Scale bar 1mm.
f) SOI8. Scale bar 1mm.
g) SOI9. Scale bar 60µm.

Plate A16: Sample F1
Montage of SOI3-SOI8
Scale bar 5mm.

Plate A17: Sample F2
a) SOI1. Scale bar 1mm.
b) SOI2. Scale bar 1mm.
c) SOI3. Scale bar 1mm.
d) SOI4. Scale bar 1mm.
e) SOI5. Scale bar 100µm.

Plate A18: Sample G1
a) SOI1. Scale bar 1mm.
b) SOI2. Scale bar 1mm.
c) SOI3. Scale bar 1mm.
d) SOI4. Scale bar 400µm.
e) SOI5. Scale bar 60µm.
f) SOI6. Scale bar 1mm.
g) SOI7. Scale bar 100µm.
h) SOI8. Scale bar 600µm.

Plate A19: Sample G2
Montage of SOI1-SOI65.
Scale bar 5mm.

Plate A20: Sample G2
a) SOI66. Scale bar 1mm.
b) SOI67. Scale bar 400µm.
c) SOI68. Scale bar 200µm.
d) SOI69. Scale bar 1mm.
e) SOI70. Scale bar 500µm.
f) SOI71. Scale bar 1mm.
g) SOI72. Scale bar 300µm.

Plate A21: Sample H
Montage of SOI1-SOI13.
Scale bar 5mm.
Image inverted to correct orientation.

Plate A22: Sample H
a) SOI14. Scale bar 700µm.
b) SOI15. Scale bar 1mm.
c) SOI16. Scale bar 60µm.
d) SOI17. Scale bar 400µm.
e) SOI18. Scale bar 1mm.
f) SOI19. Scale bar 1mm.
g) SOI20. Scale bar 200µm.
h) SOI21. Scale bar 100µm.

Plate A23: Sample I
a) Montage of SOI1-SOI6. Scale bar .
b) SOI7. Scale bar 600µm (not as stated on image).
c) SOI8. Scale bar 120µm (not as stated on image).

Plate A24: Sample I
a) SOI9. Scale bar 600µm (not as stated on image).
b) SOI10. Scale bar 280µm (not as stated on image).
c) SOI12. Scale bar 3mm (not as stated on image).
d) SOI13. Scale bar 600µm (not as stated on image).
e) SOI14. Scale bar 240µm (not as stated on image)..

Plate A25: Sample J
a) SOI1. Scale bar 1.2mm (not as stated on image).
b) SOI2. Scale bar 240µm (not as stated on image).
c) SOI3. Scale bar 1.2mm (not as stated on image).
d) SOI4. Scale bar 600µm (not as stated on image).
e) SOI5. Scale bar 1.2mm (not as stated on image).
f) SOI6. Scale bar 1.2mm (not as stated on image).
g) SOI7. Scale bar 1.2mm (not as stated on image).
h) SOI8. Scale bar 1.2mm (not as stated on image).

Plate A26: Sample J
a) SOI9. Scale bar 4mm.

Plate A27: Sample K
a) SOI1. Scale bar 600µm (not as stated on image).
b) SOI2. Scale bar 600µm (not as stated on image).
c) SOI3. Scale bar 120µm (not as stated on image).
d) SOI4. Scale bar 600µm (not as stated on image).
e) SOI5. Scale bar 600µm (not as stated on image).
f) SOI6. Scale bar 600µm (not as stated on image).
g) SOI7. Scale bar 600µm (not as stated on image).
h) SOI8. Scale bar 600µm (not as stated on image).

Plate A28: Sample K
a) SOI9. Scale bar 600µm (not as stated on image).
b) SOI10. Scale bar 600µm (not as stated on image).
c) SOI11. Scale bar 600µm (not as stated on image).
d) SOI12. Scale bar 200µm (not as stated on image).
e) SOI13. Scale bar 60µm (not as stated on image).
f) SOI14. Scale bar 600µm (not as stated on image).

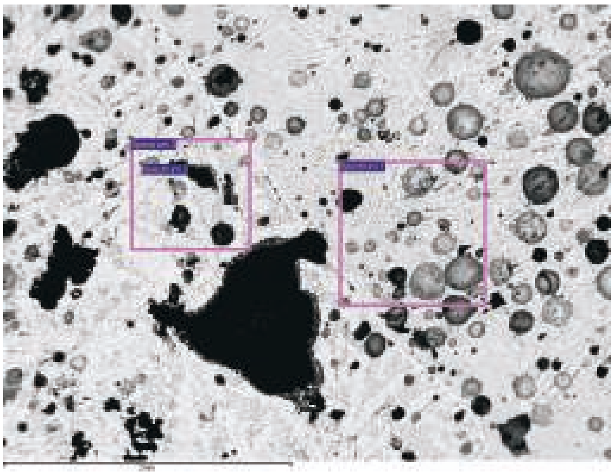
Plate A29: Sample K
Montage of SOI8-SOI11.
Scale bar 1mm.

Plate A30: Sample L
a) SOI2. Scale bar 600µm (not as stated on image).
b) SOI3. Scale bar 200µm (not as stated on image).
c) SOI4. Scale bar 600µm (not as stated on image).
d) SOI5. Scale bar 600µm (not as stated on image).
e) SOI6. Scale bar 600µm (not as stated on image).
f) SOI7. Scale bar 600µm (not as stated on image).
g) SOI8. Scale bar 600µm (not as stated on image).
h) SOI9. Scale bar 400µm (not as stated on image).

Plate A31: Sample L
a) SOI10. Scale bar 200µm (not as stated on image).

Plate A1

a



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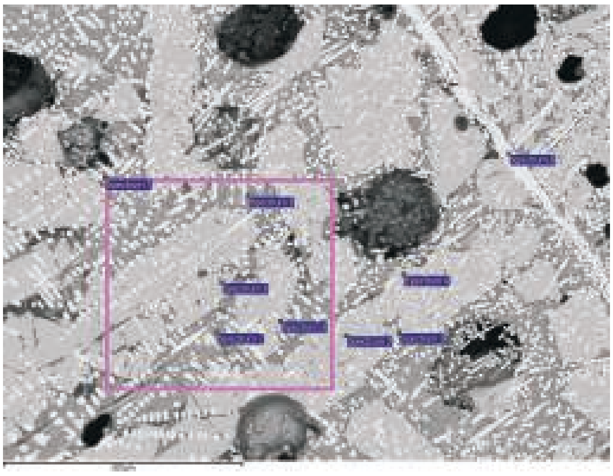

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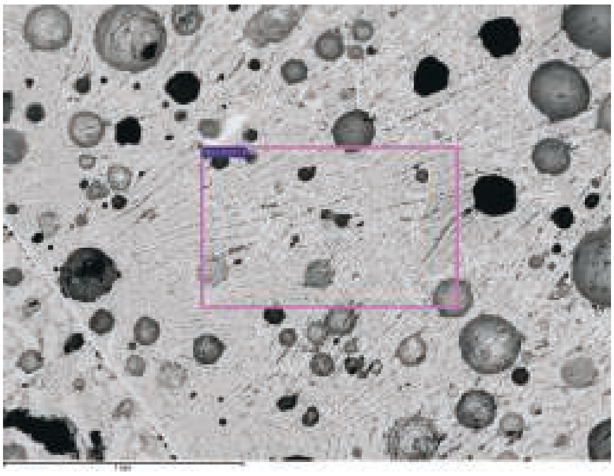

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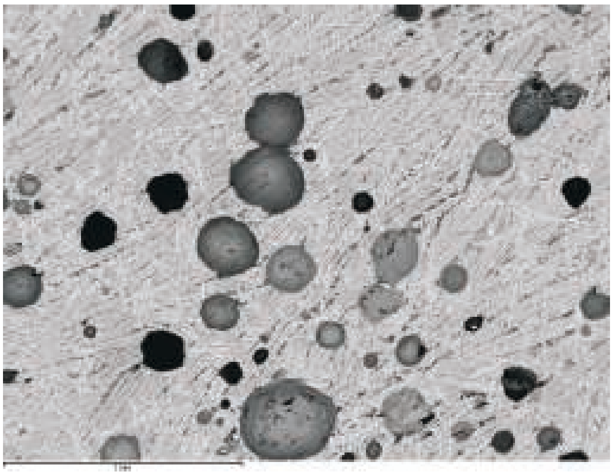

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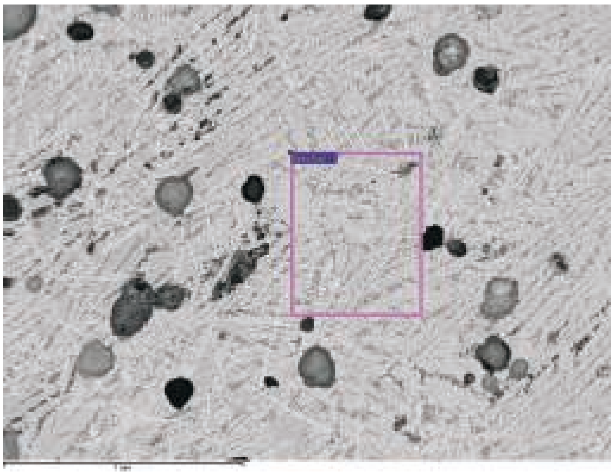

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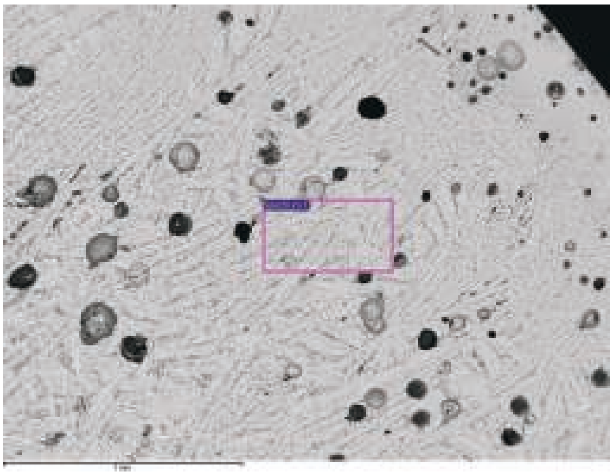

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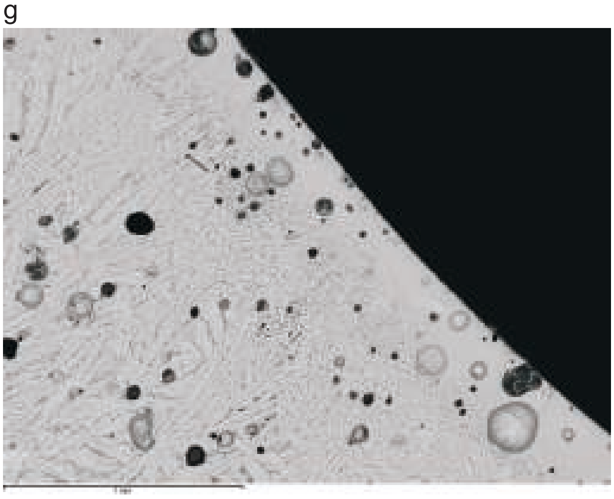

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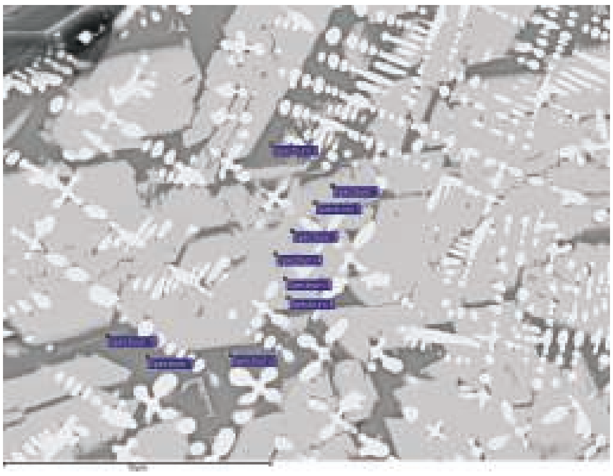

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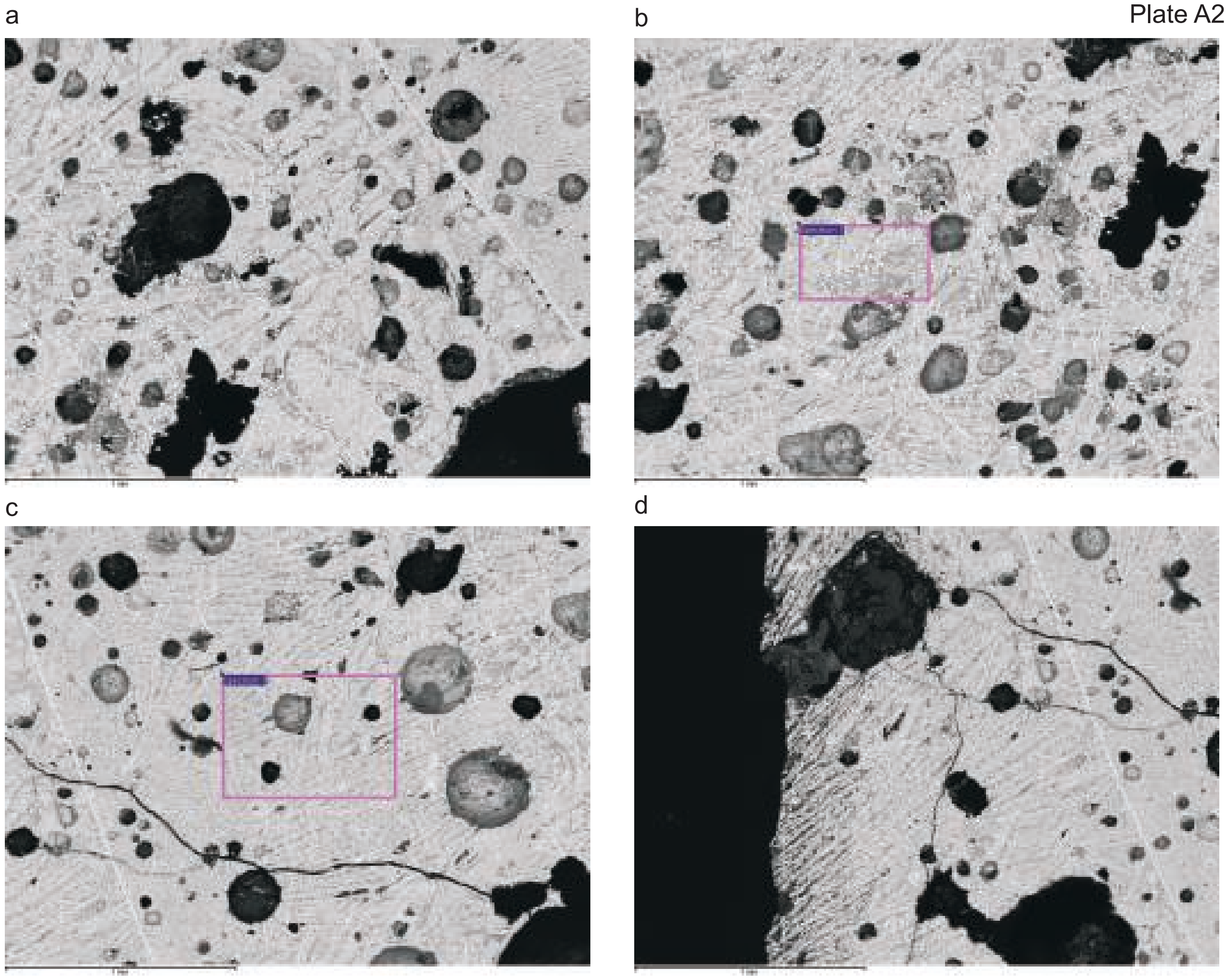

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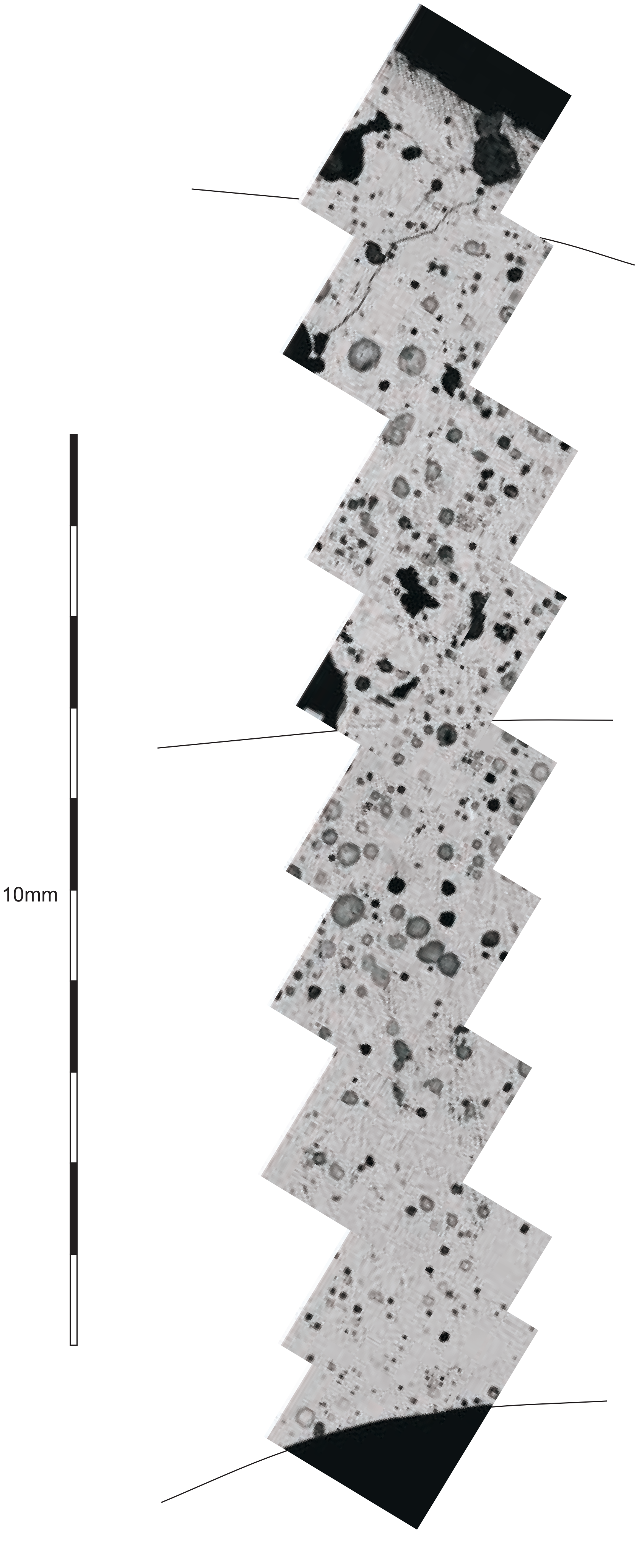

Plate A4

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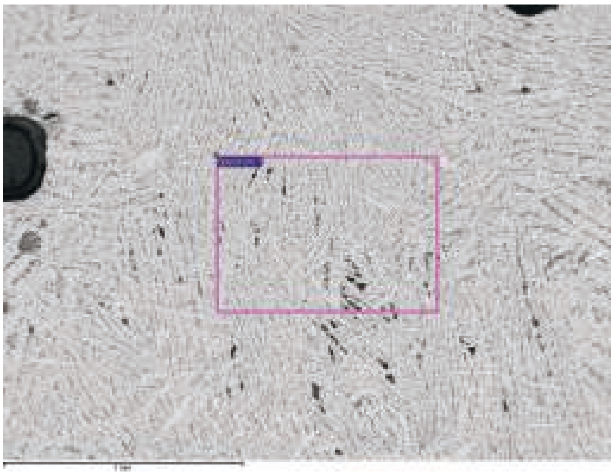

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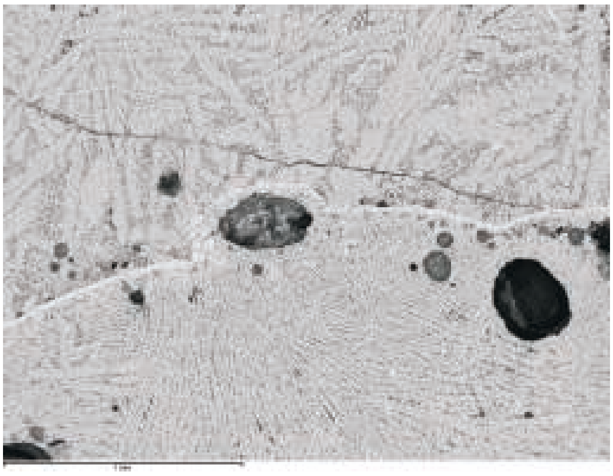

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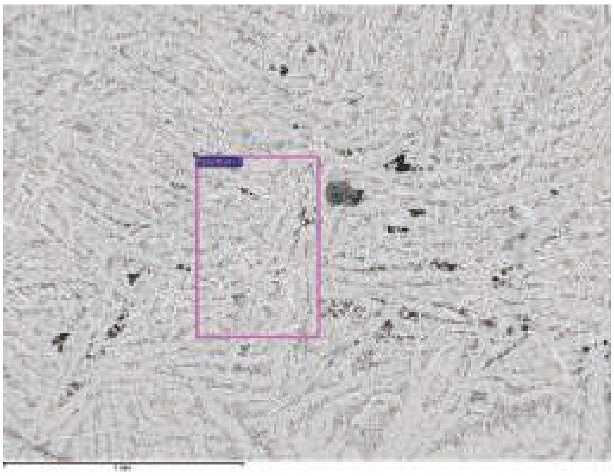

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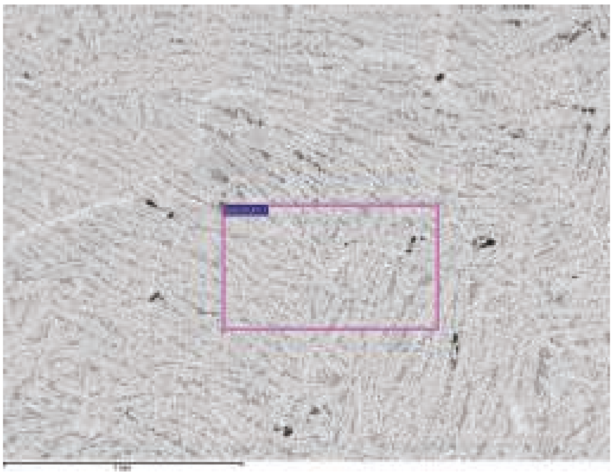

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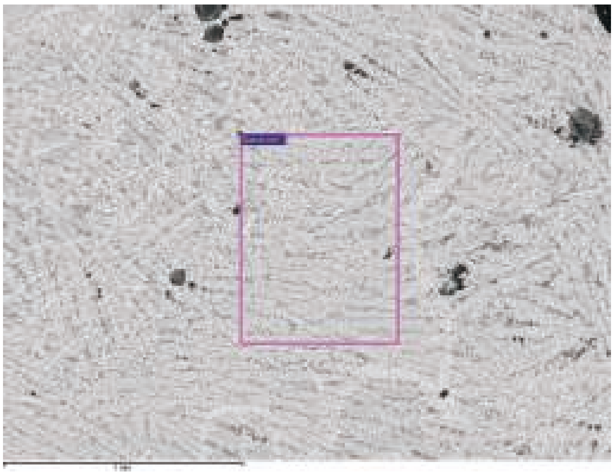

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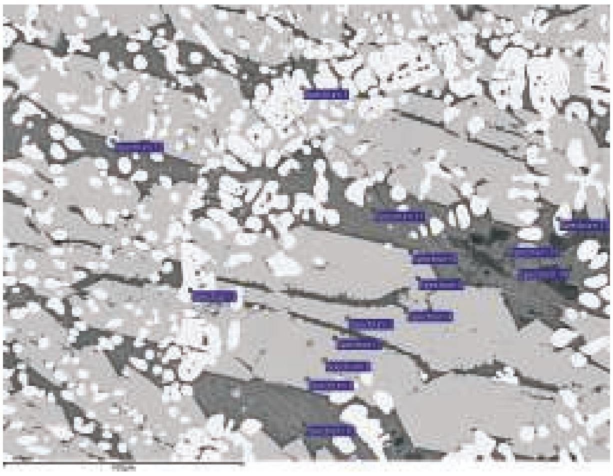

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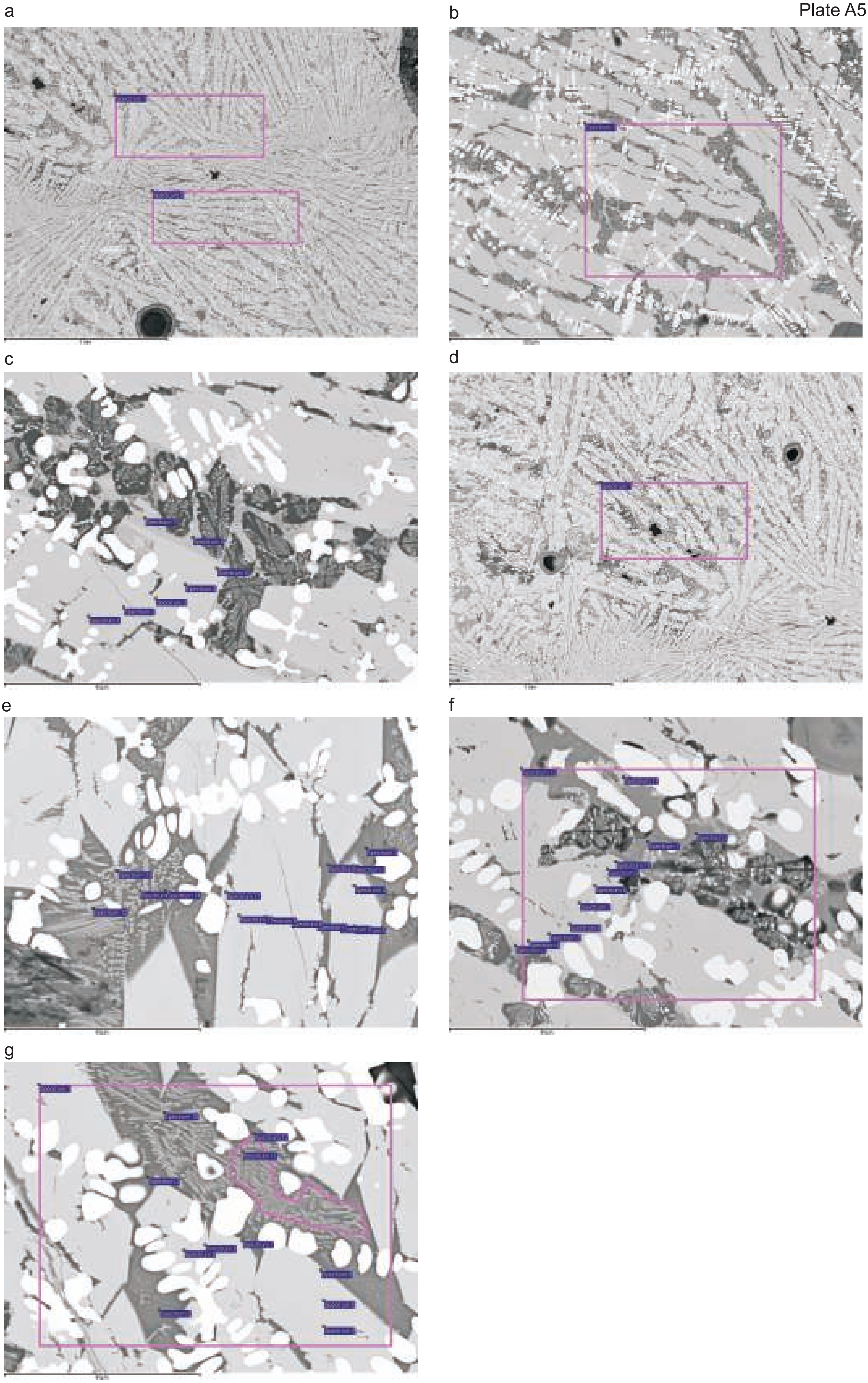
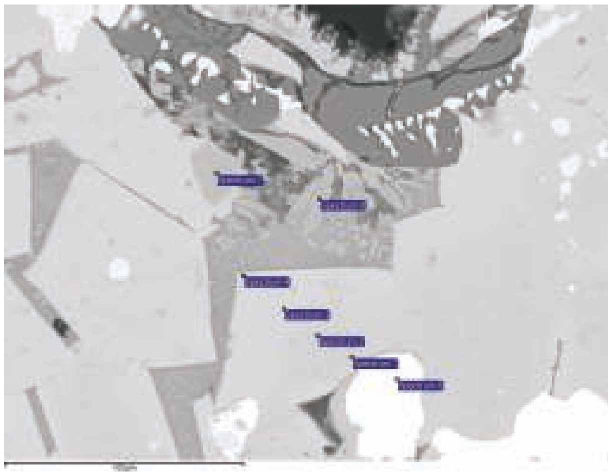


Plate A6

a

b



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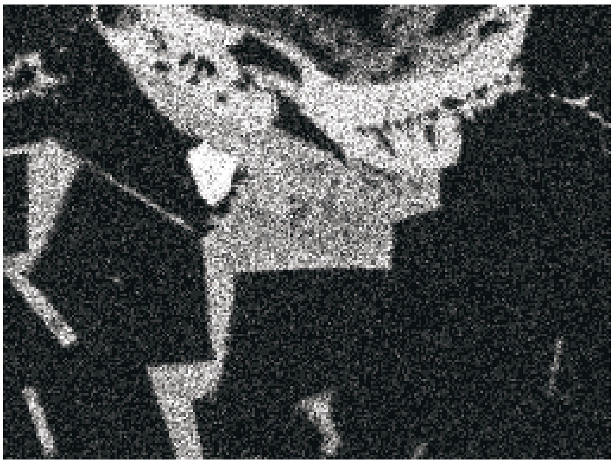

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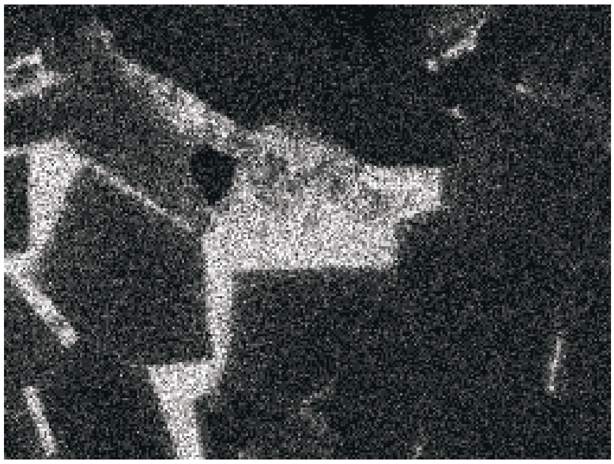

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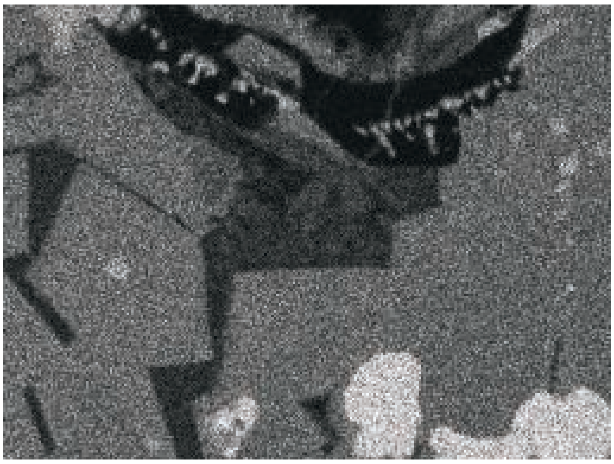

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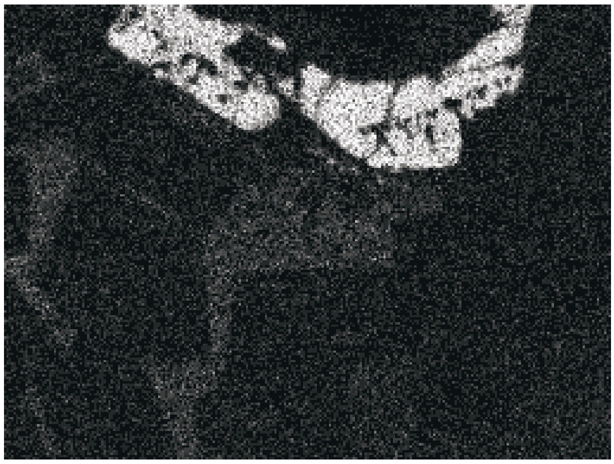

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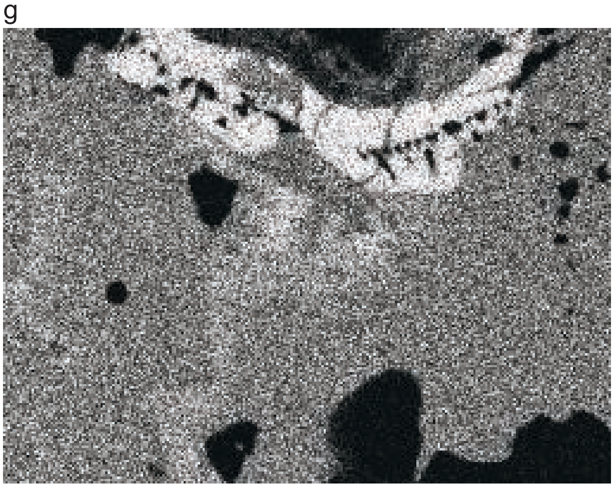

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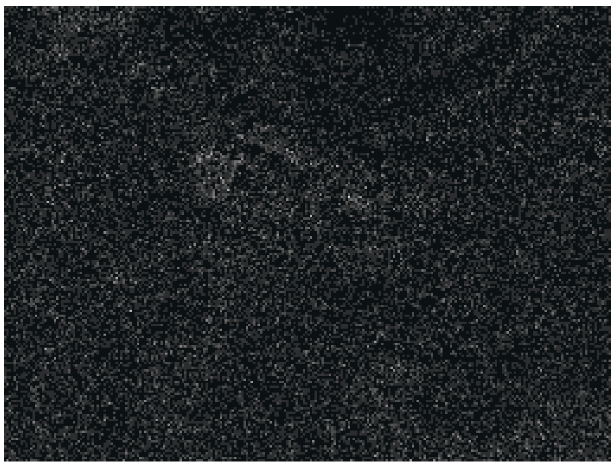

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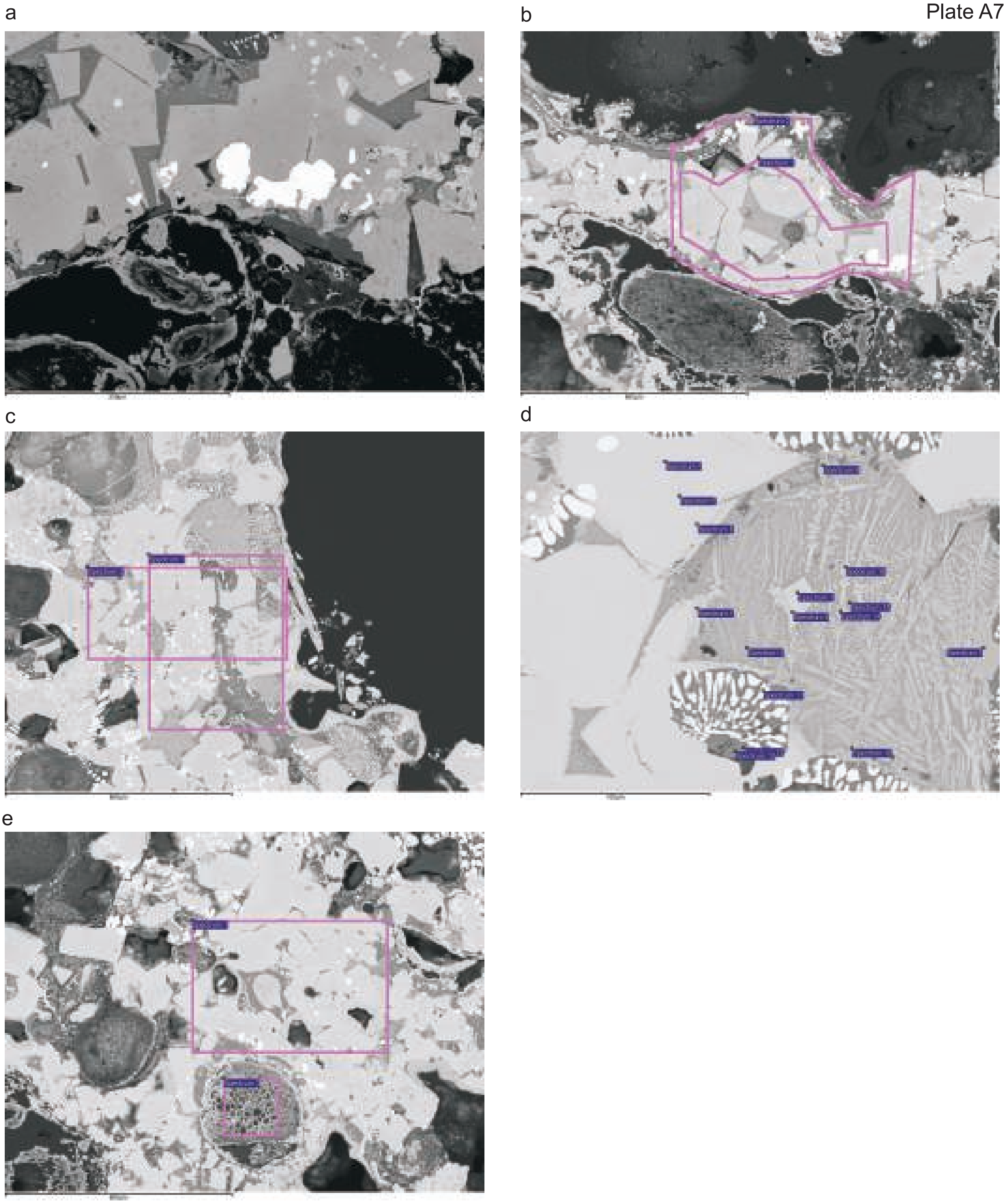

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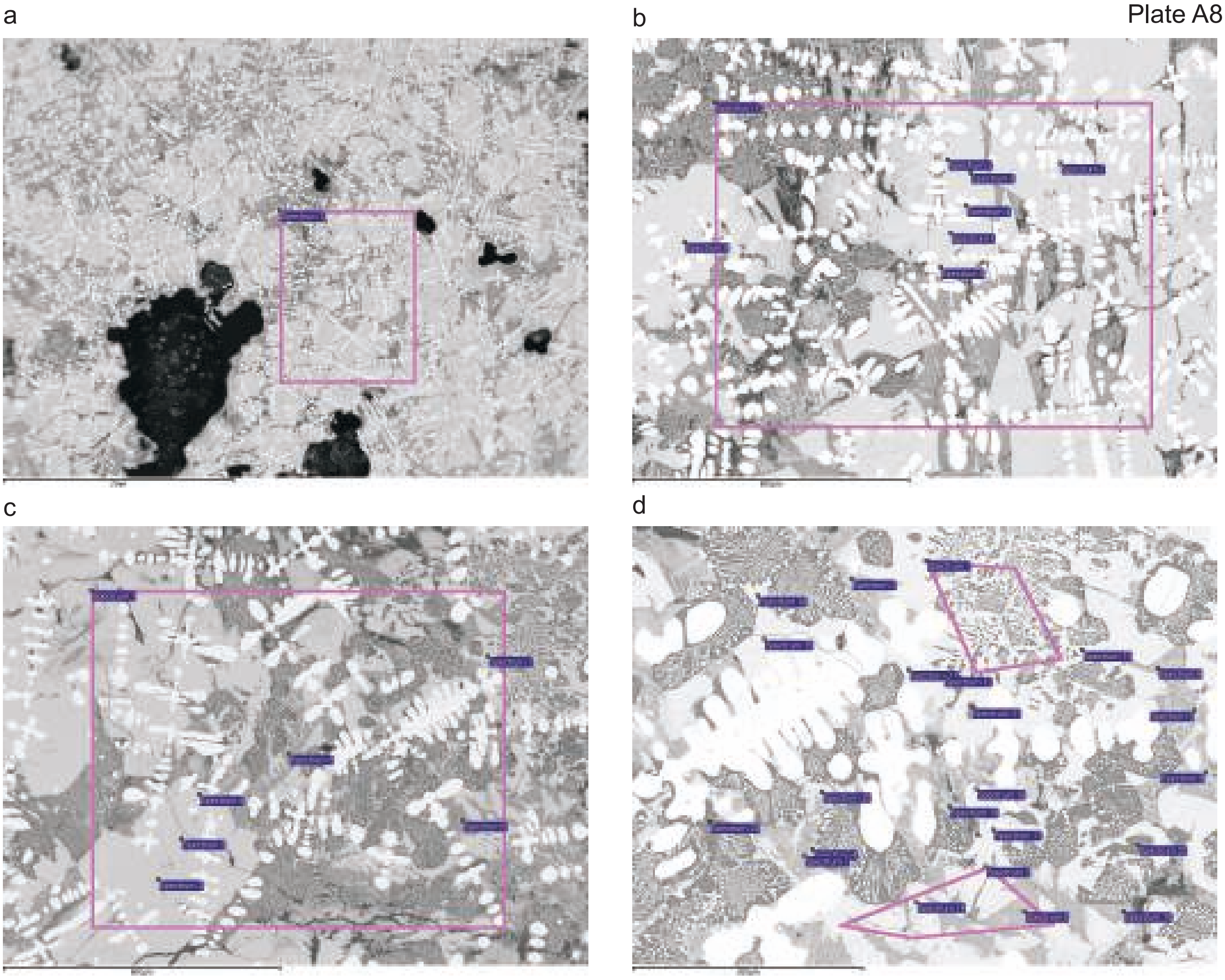

Plate A9

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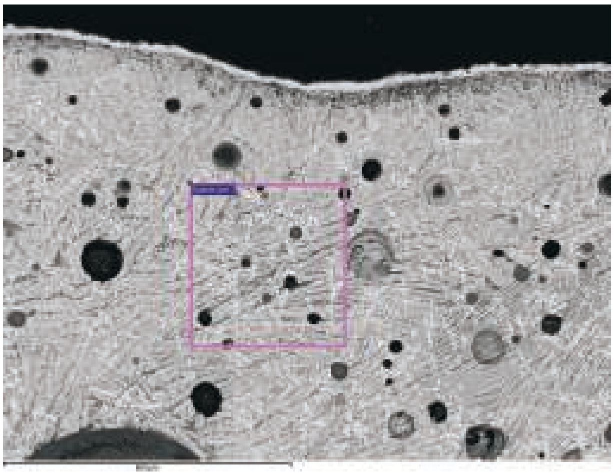

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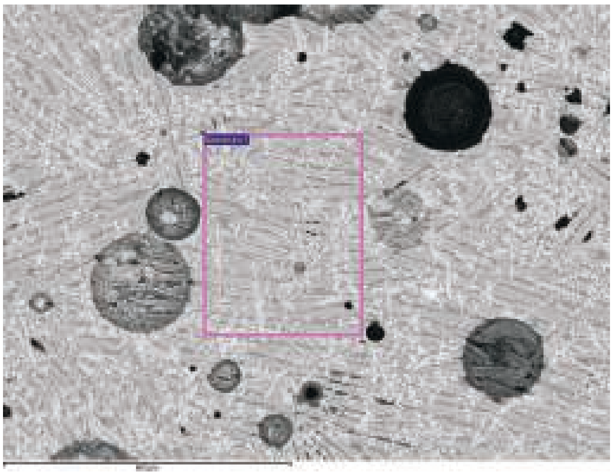

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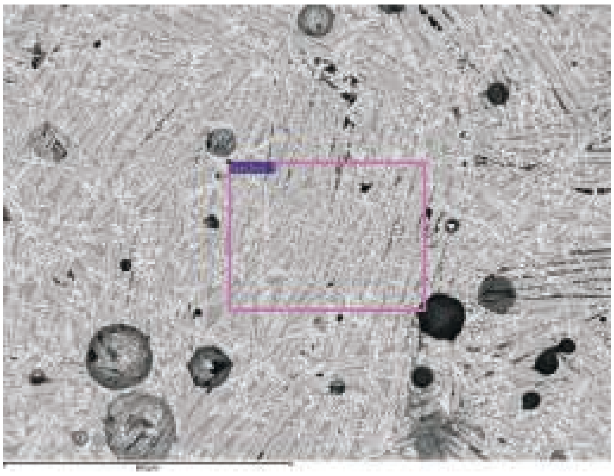

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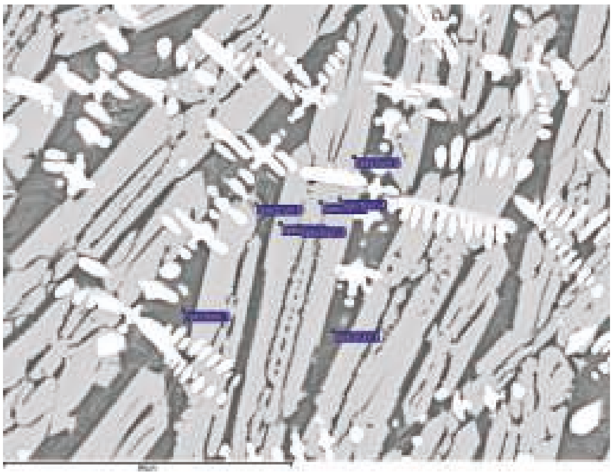

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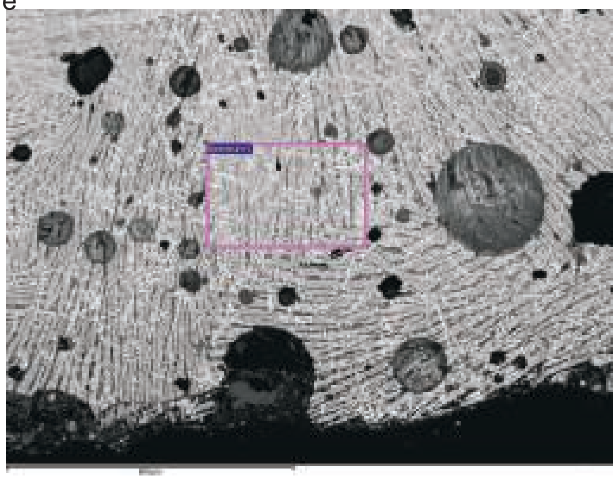

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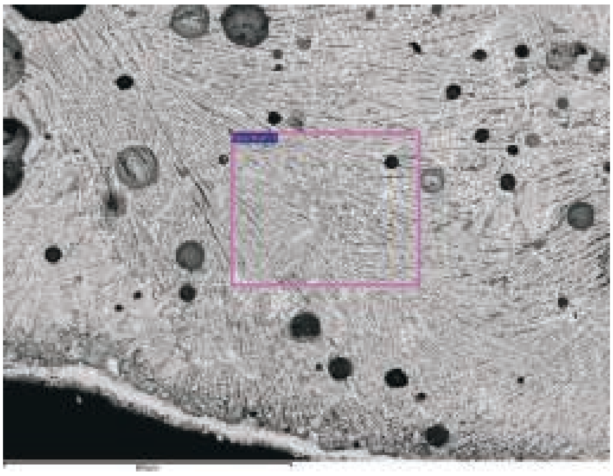

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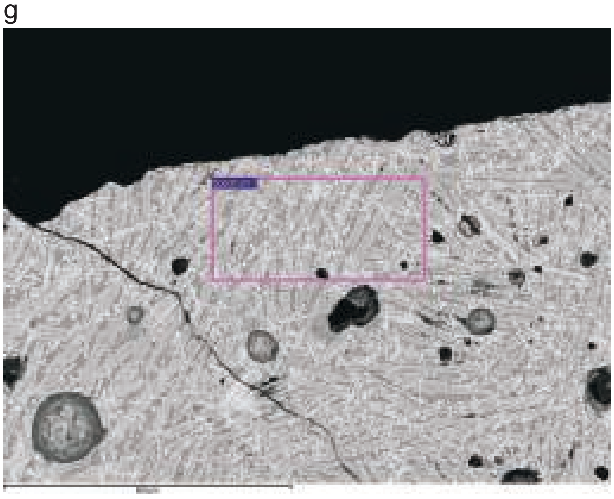

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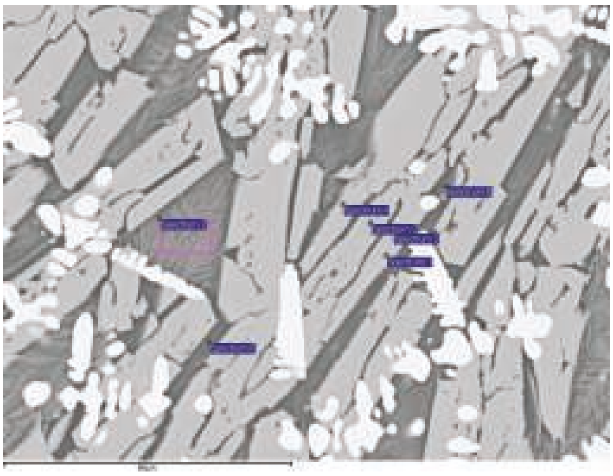

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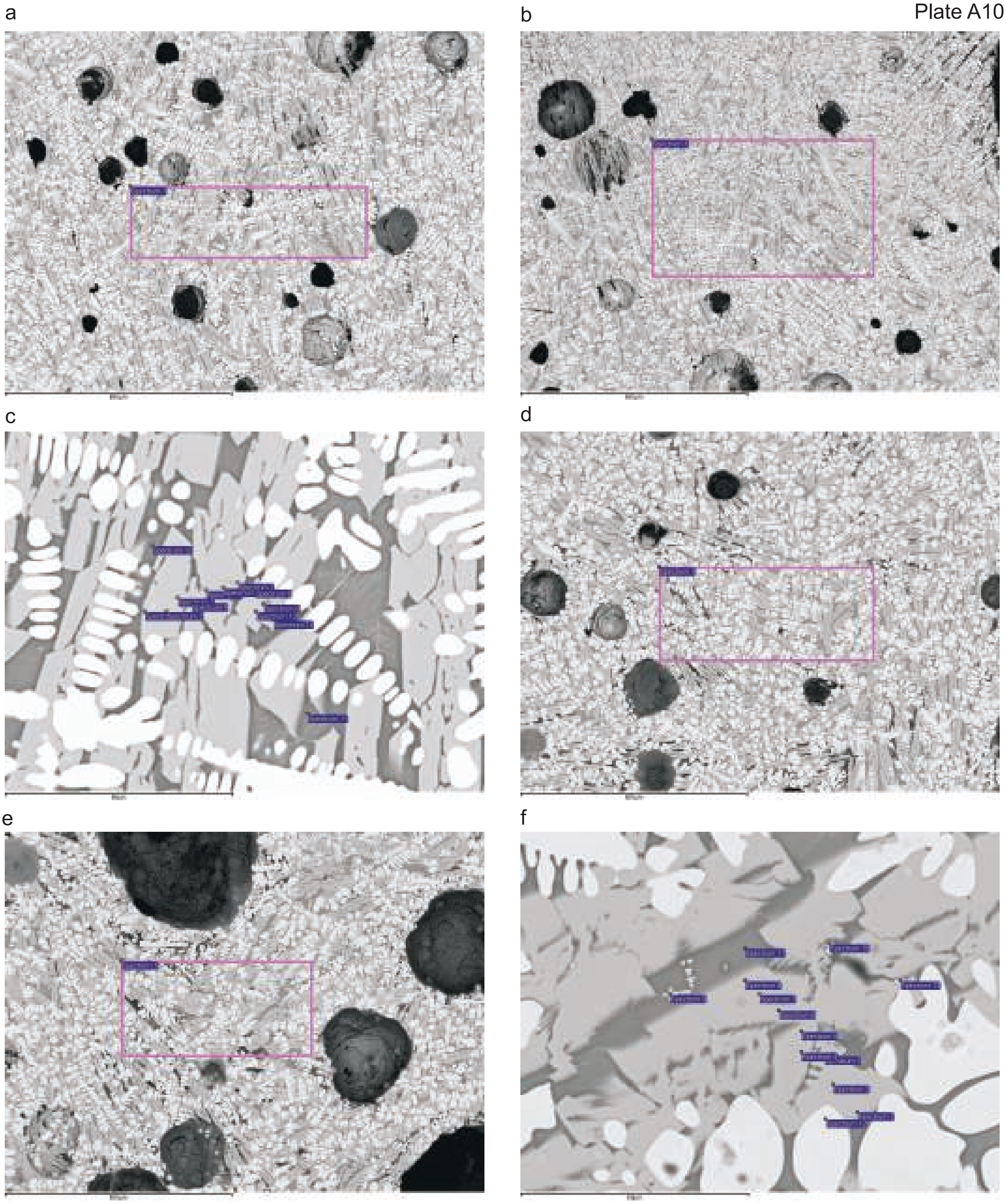

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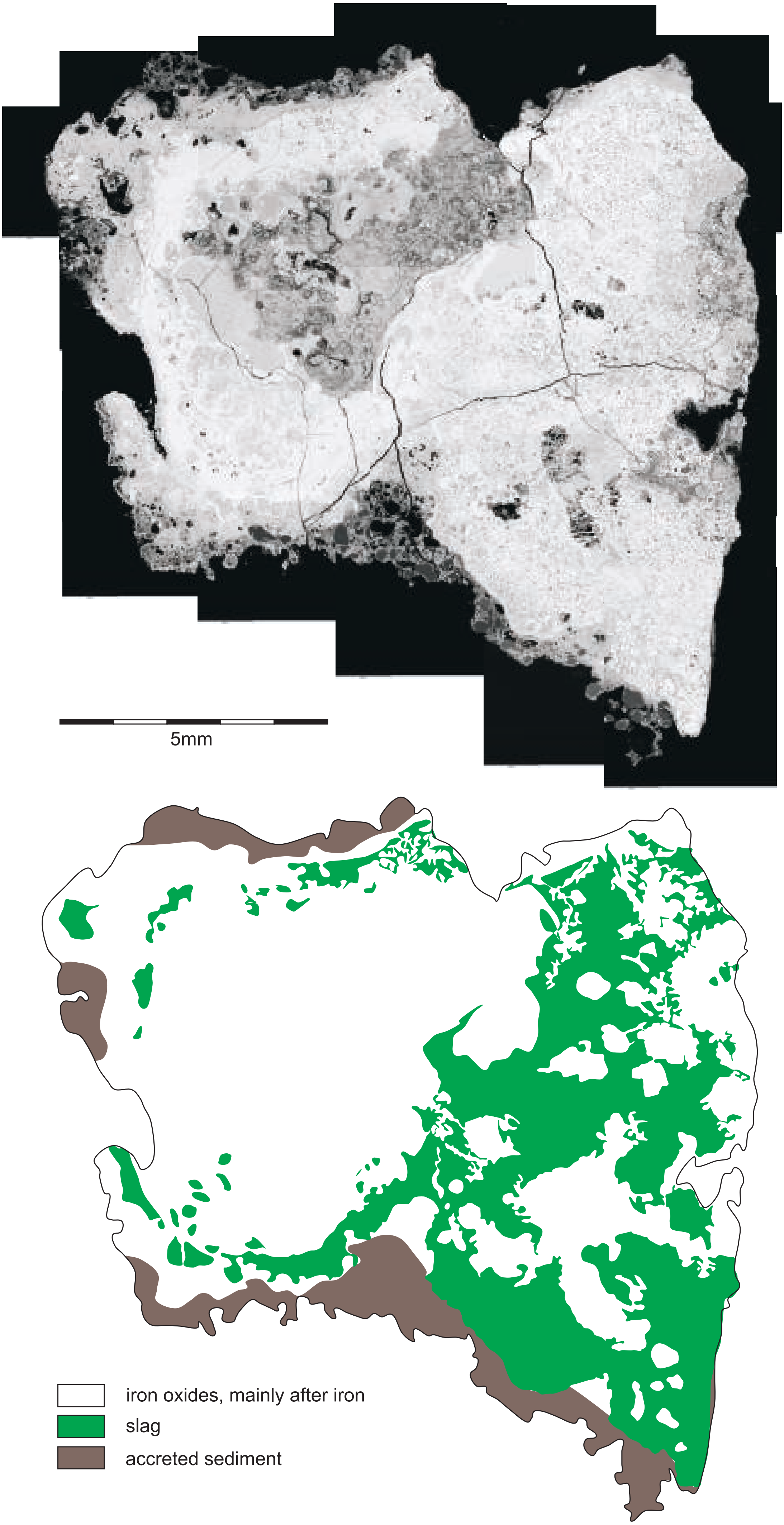

Plate A12

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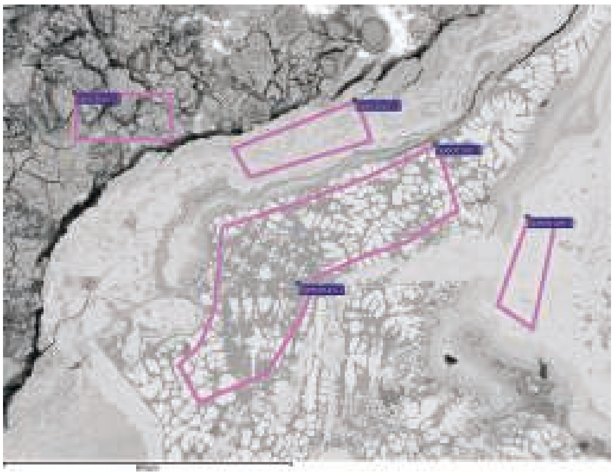

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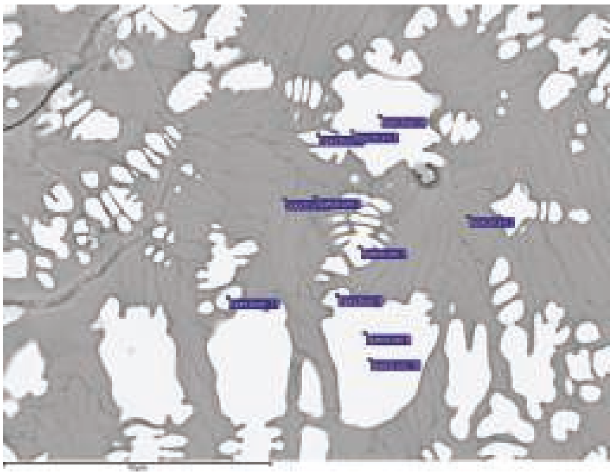

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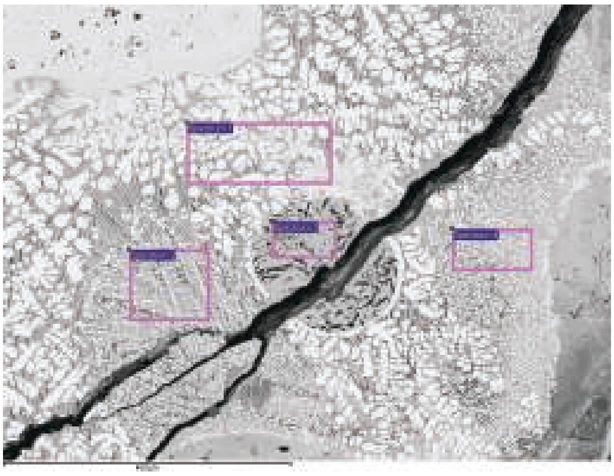

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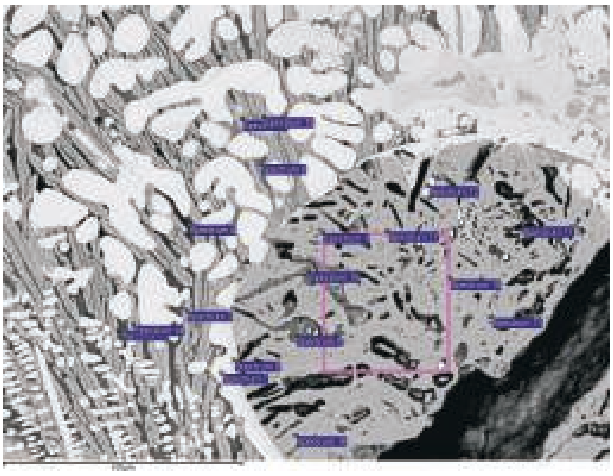

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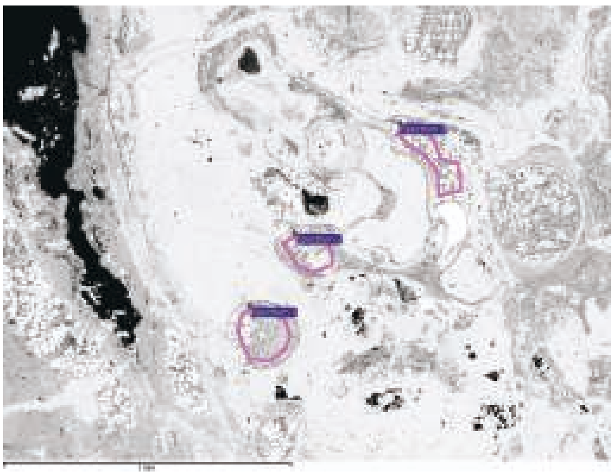

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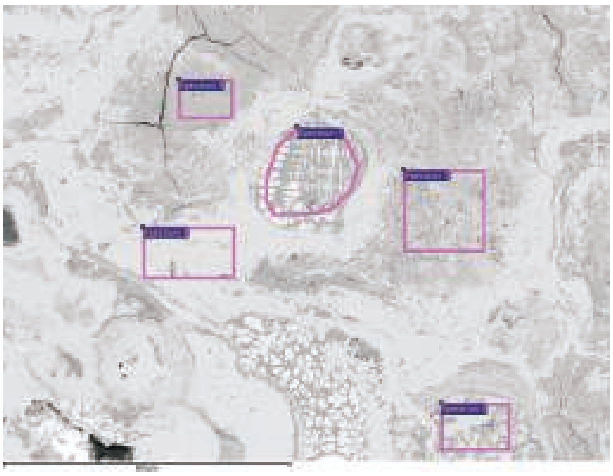

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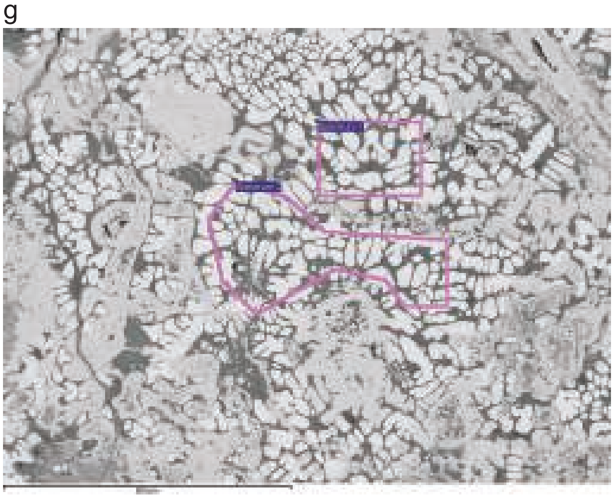

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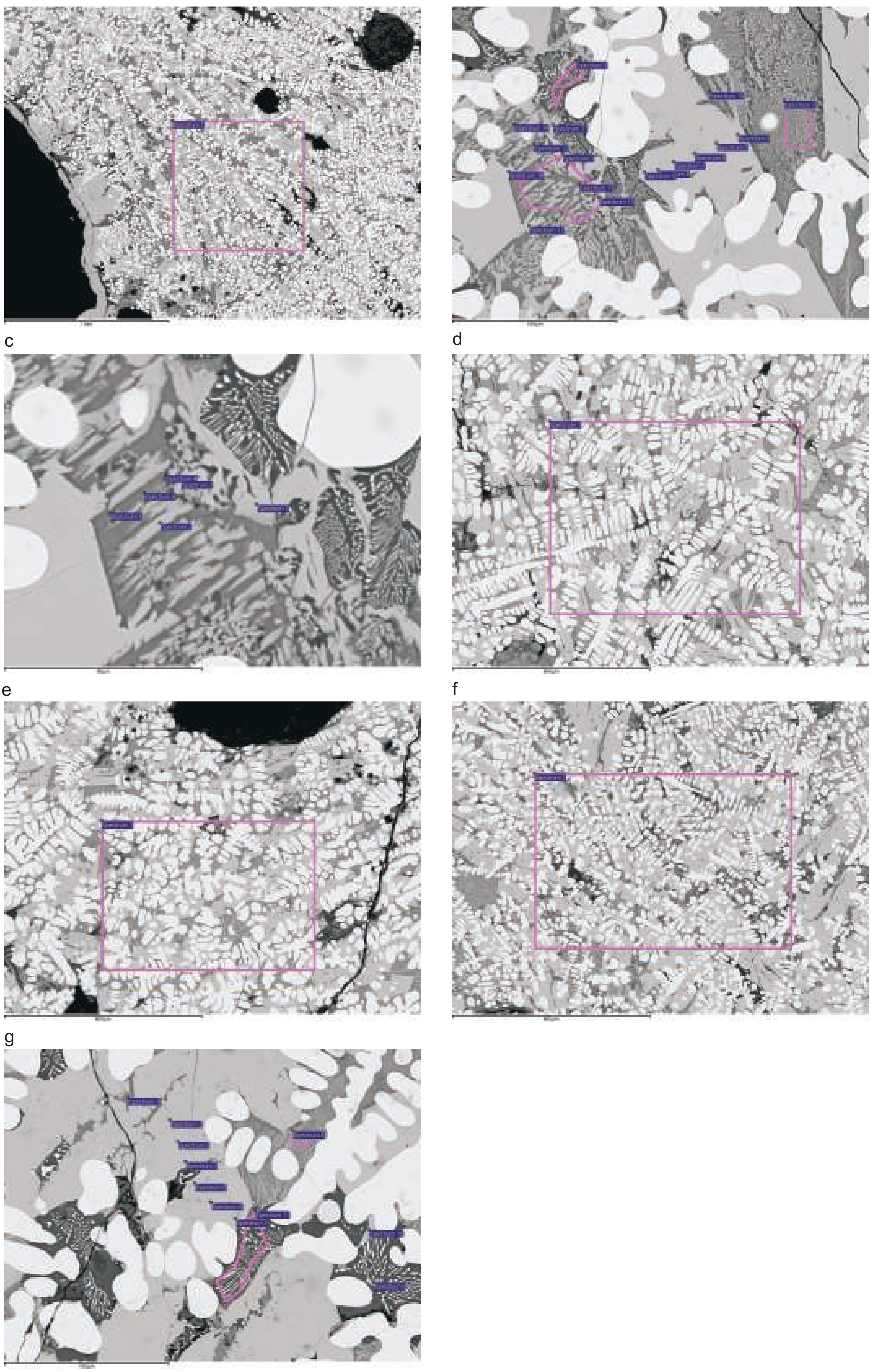

Plate A14

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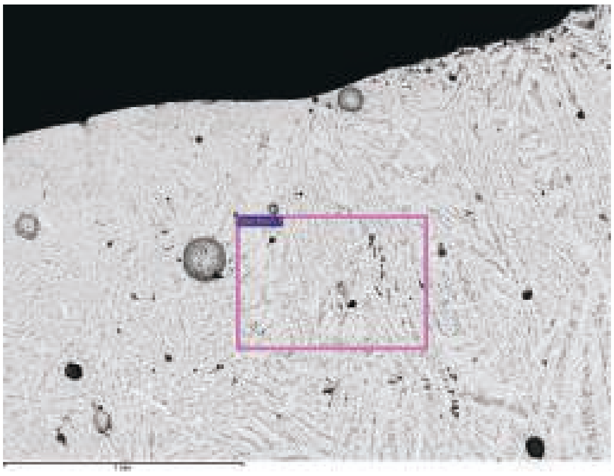

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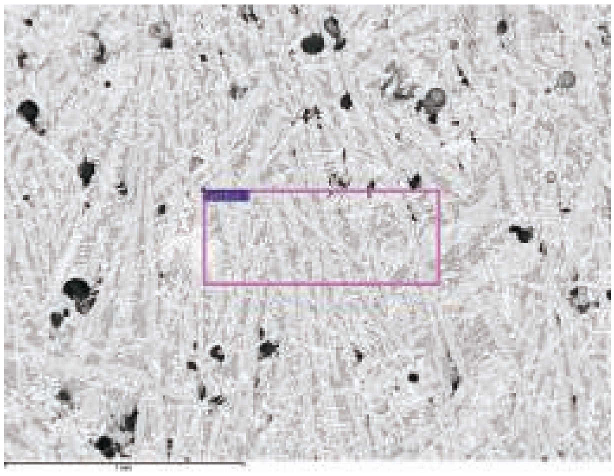

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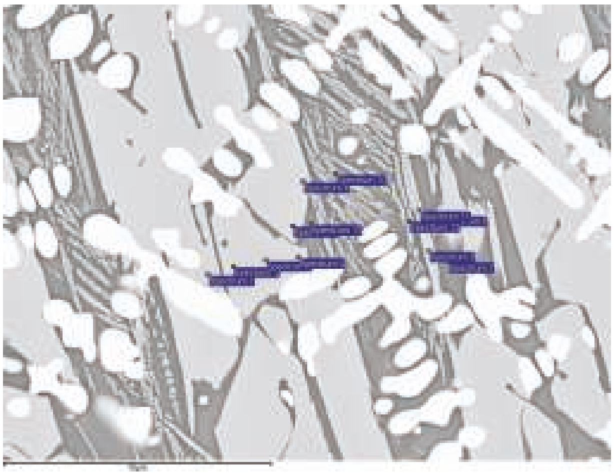

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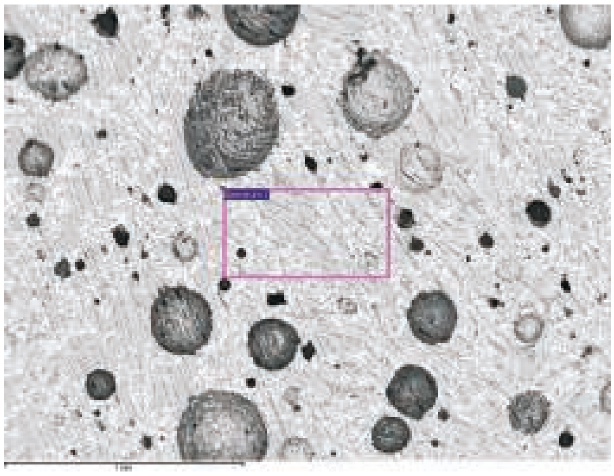

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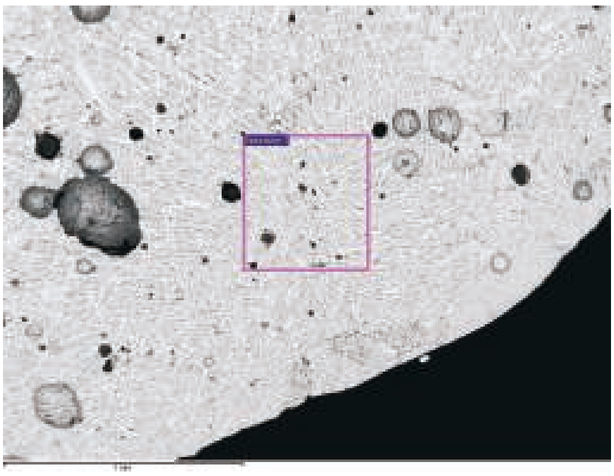

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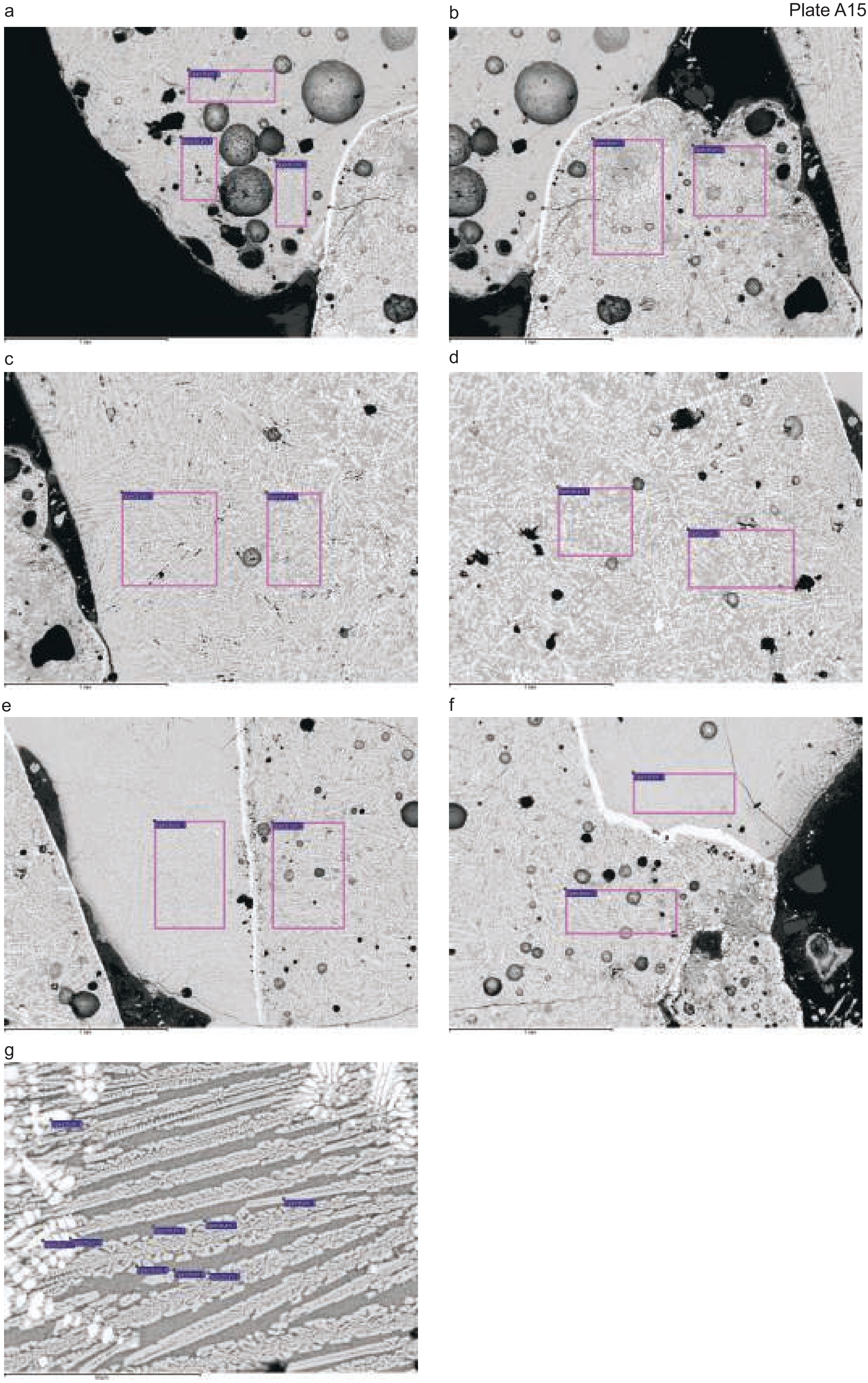

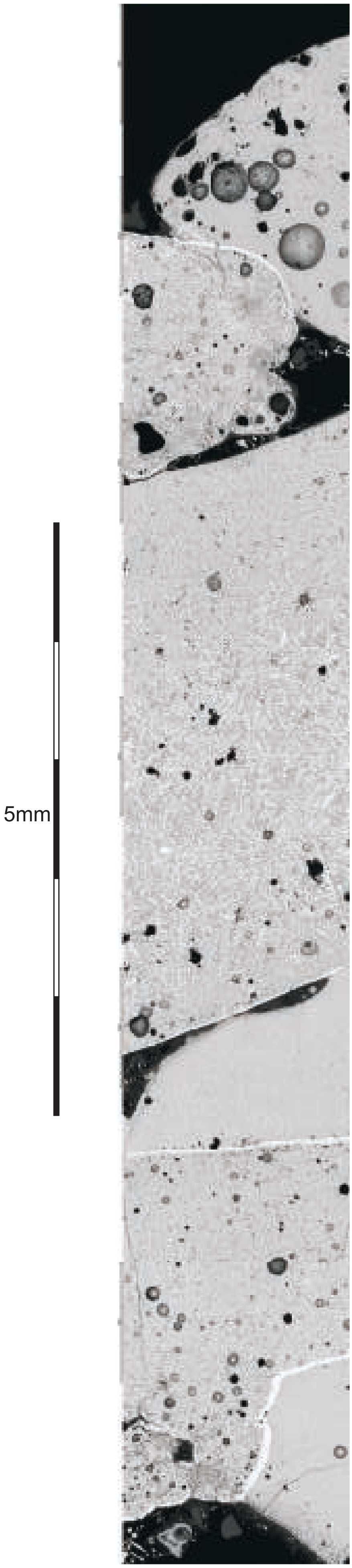
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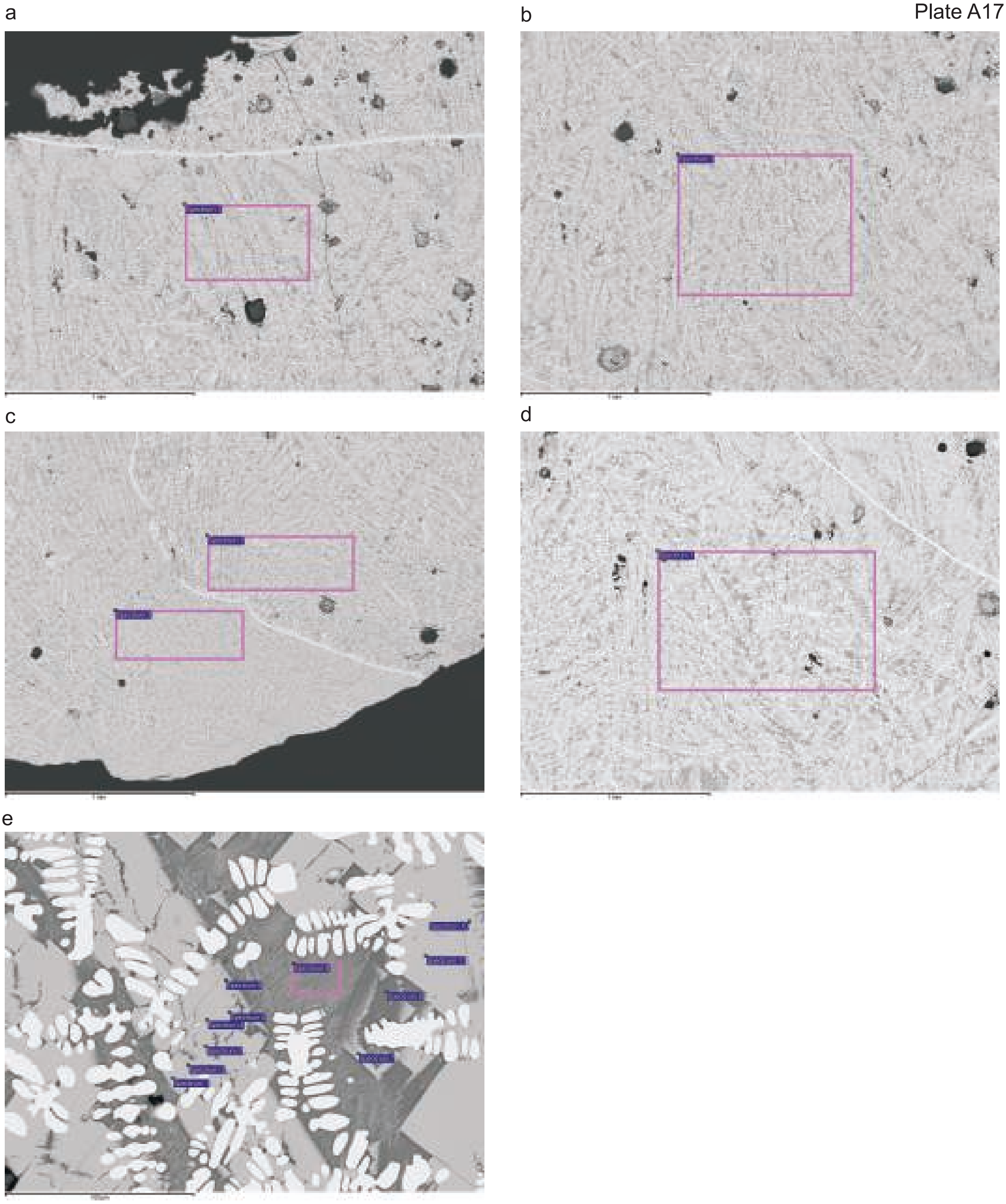
Plate A17



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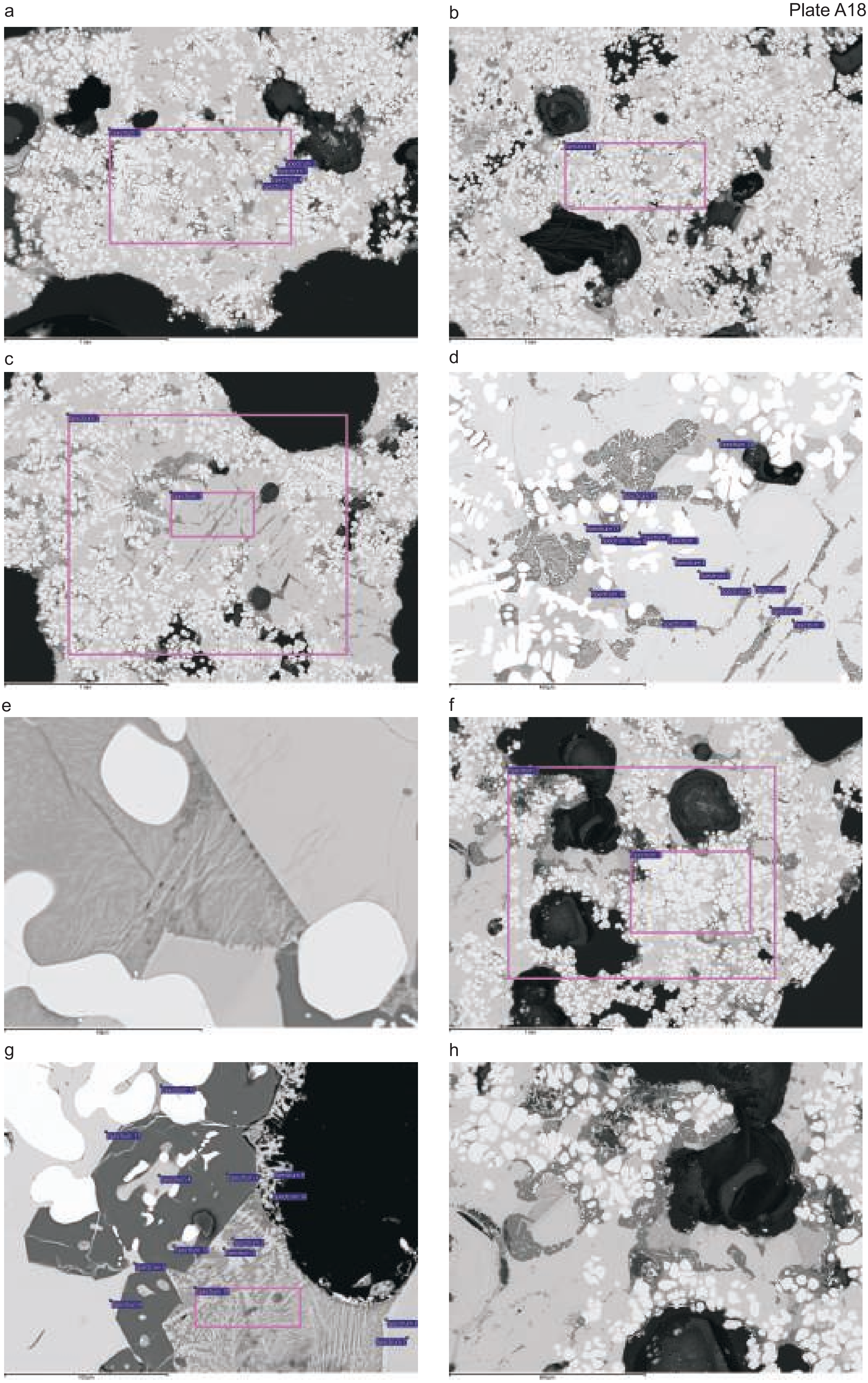

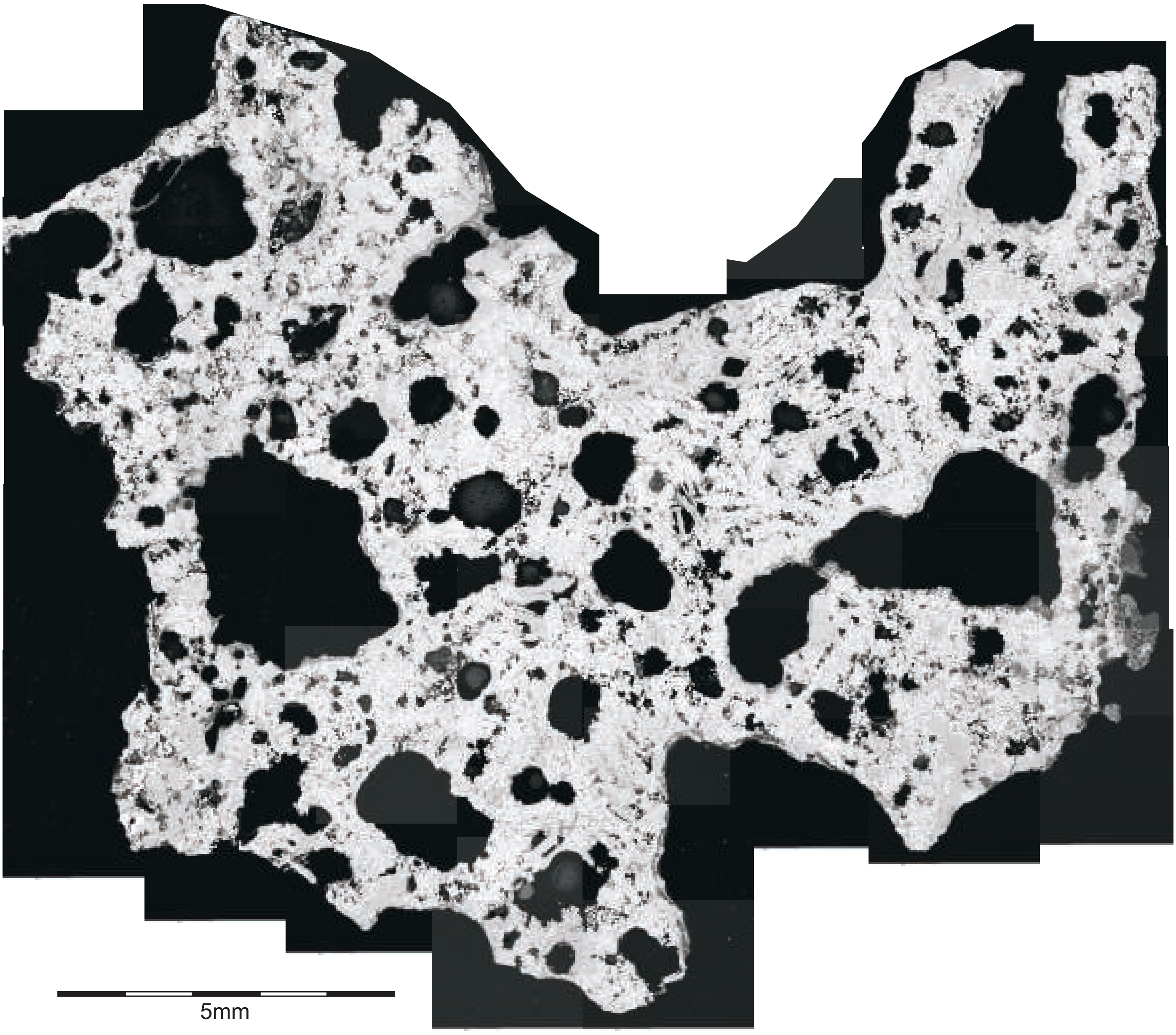
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Plate A20

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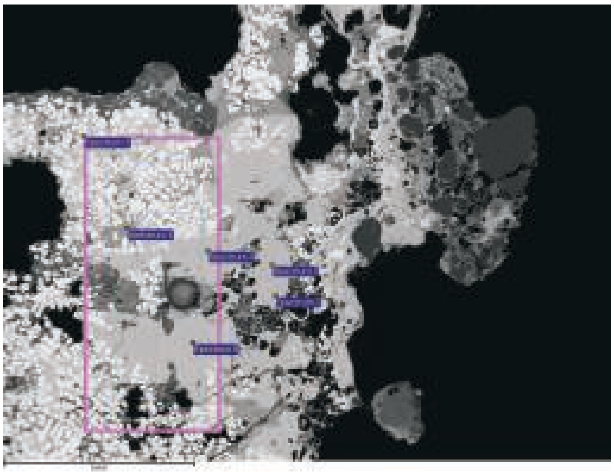

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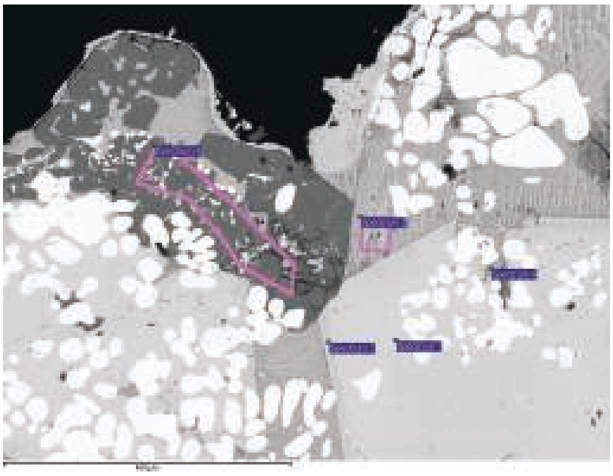

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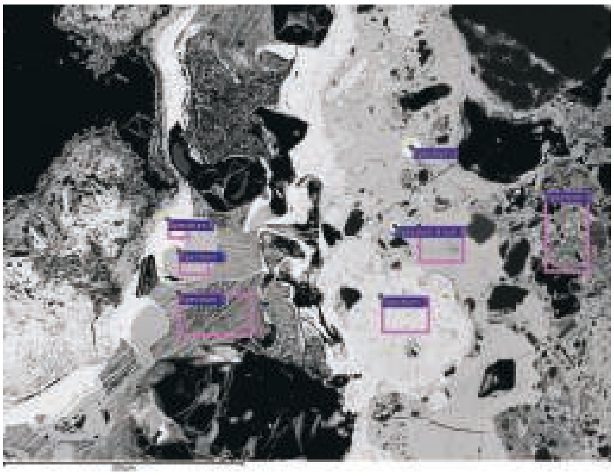

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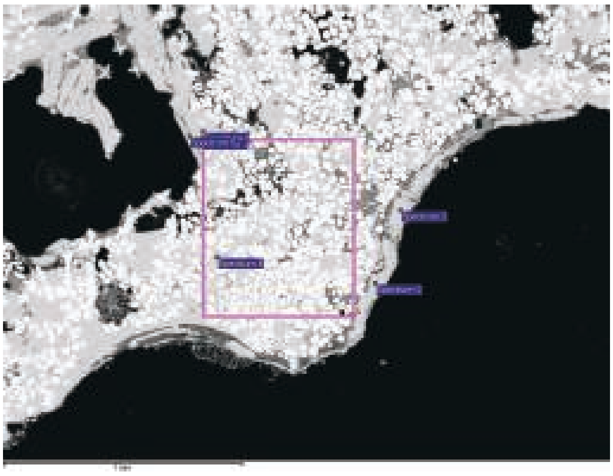

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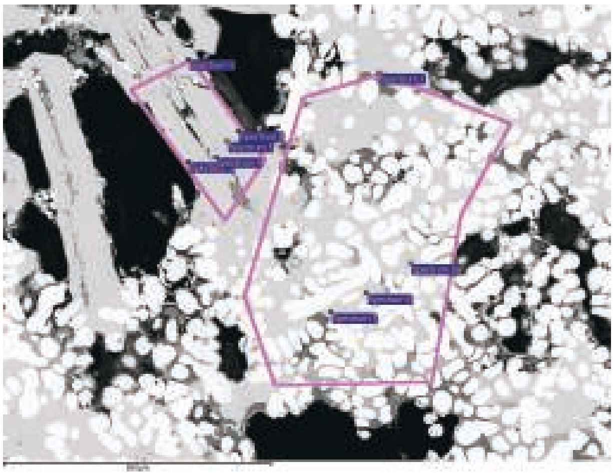

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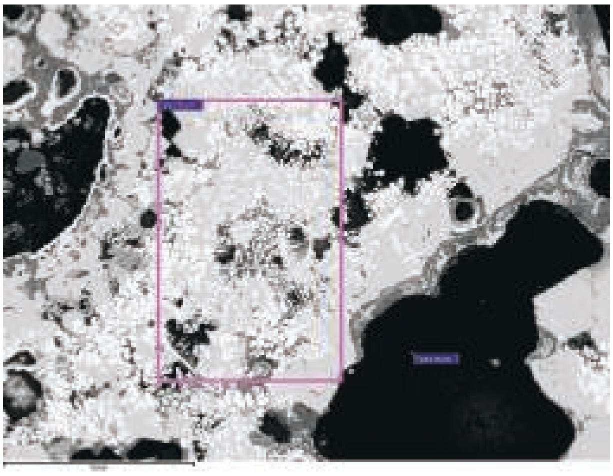

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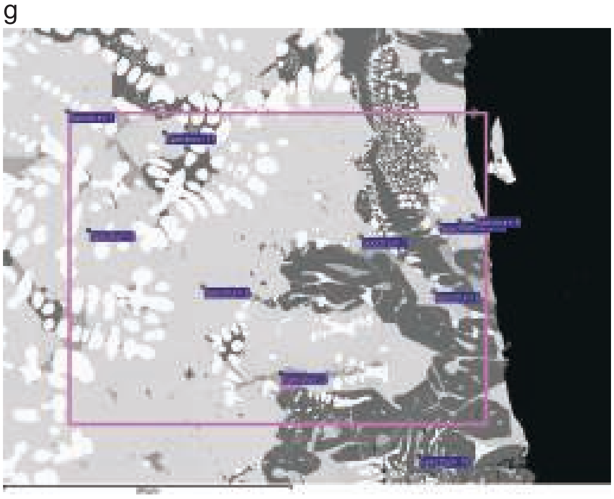


Plate A21

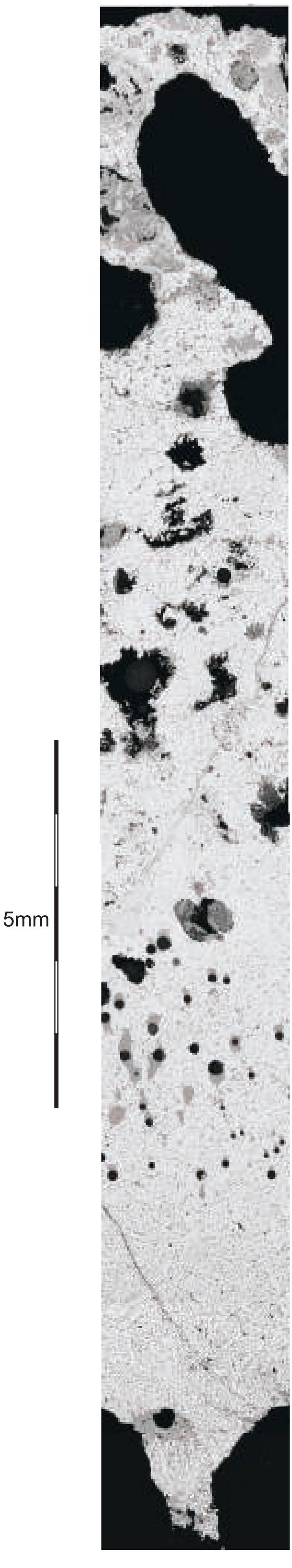
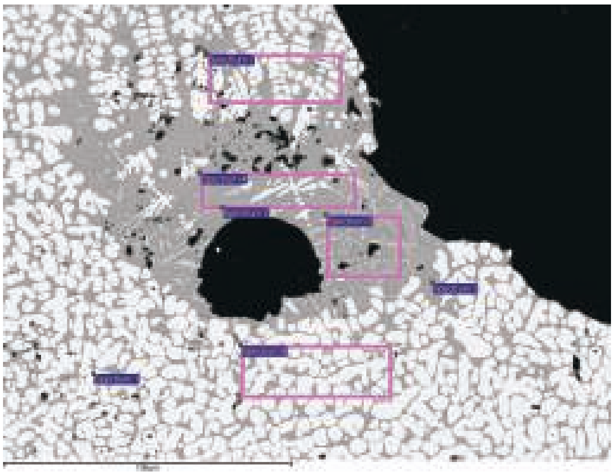


Plate A22

a



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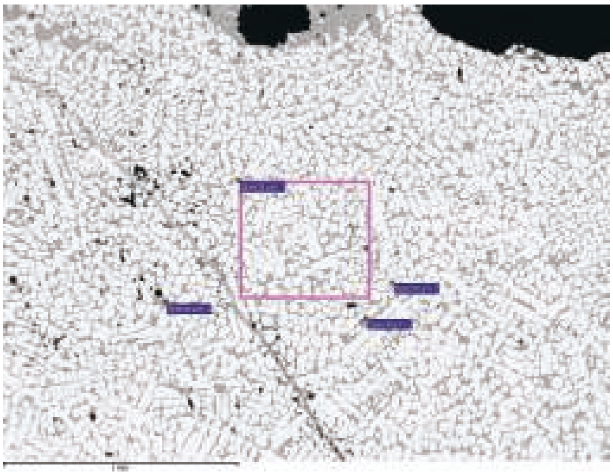

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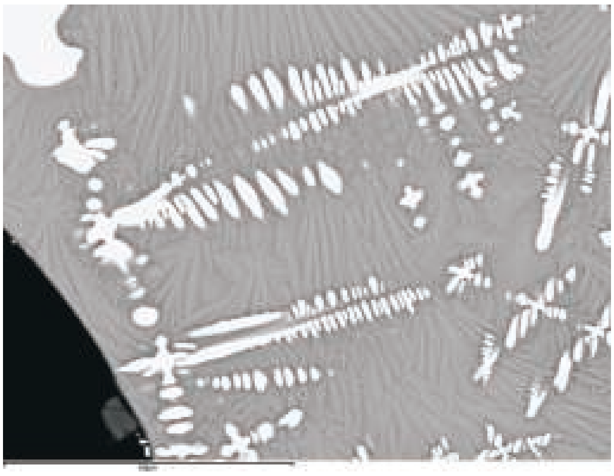

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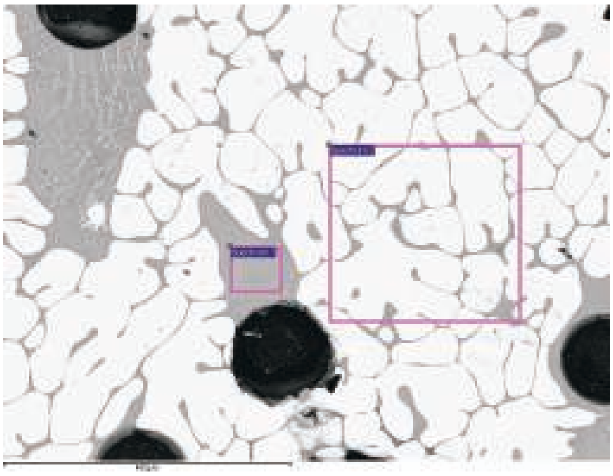

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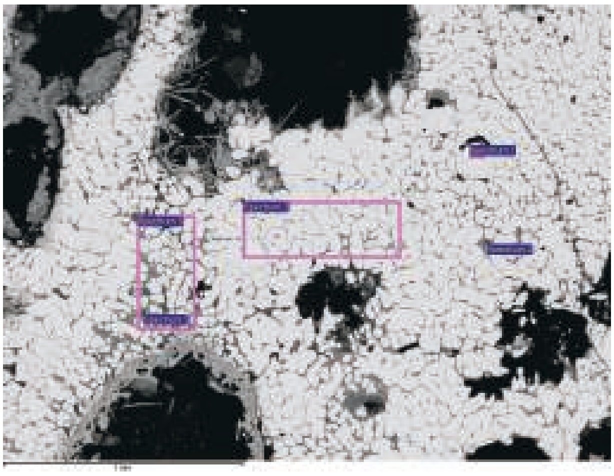

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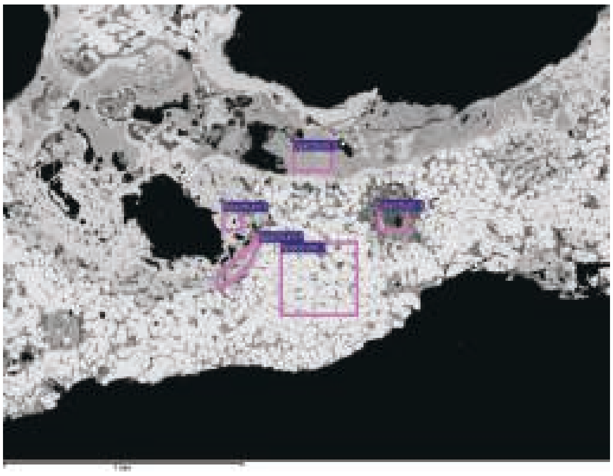

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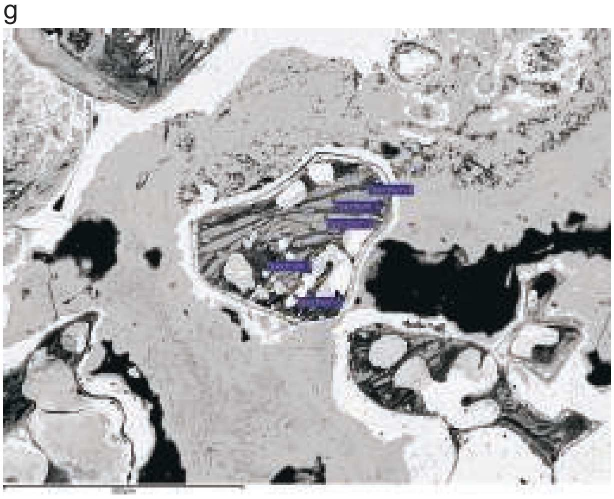

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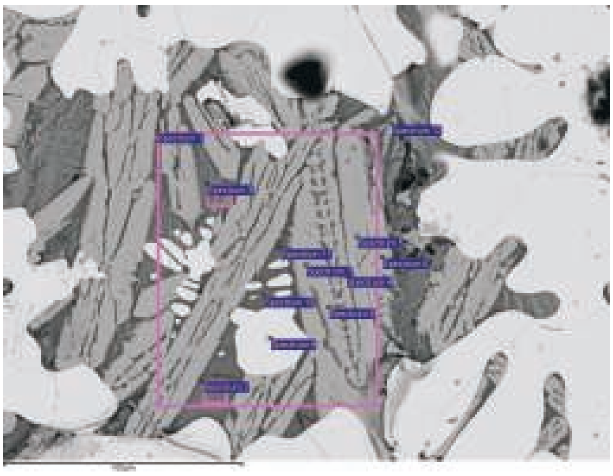

Plate A23

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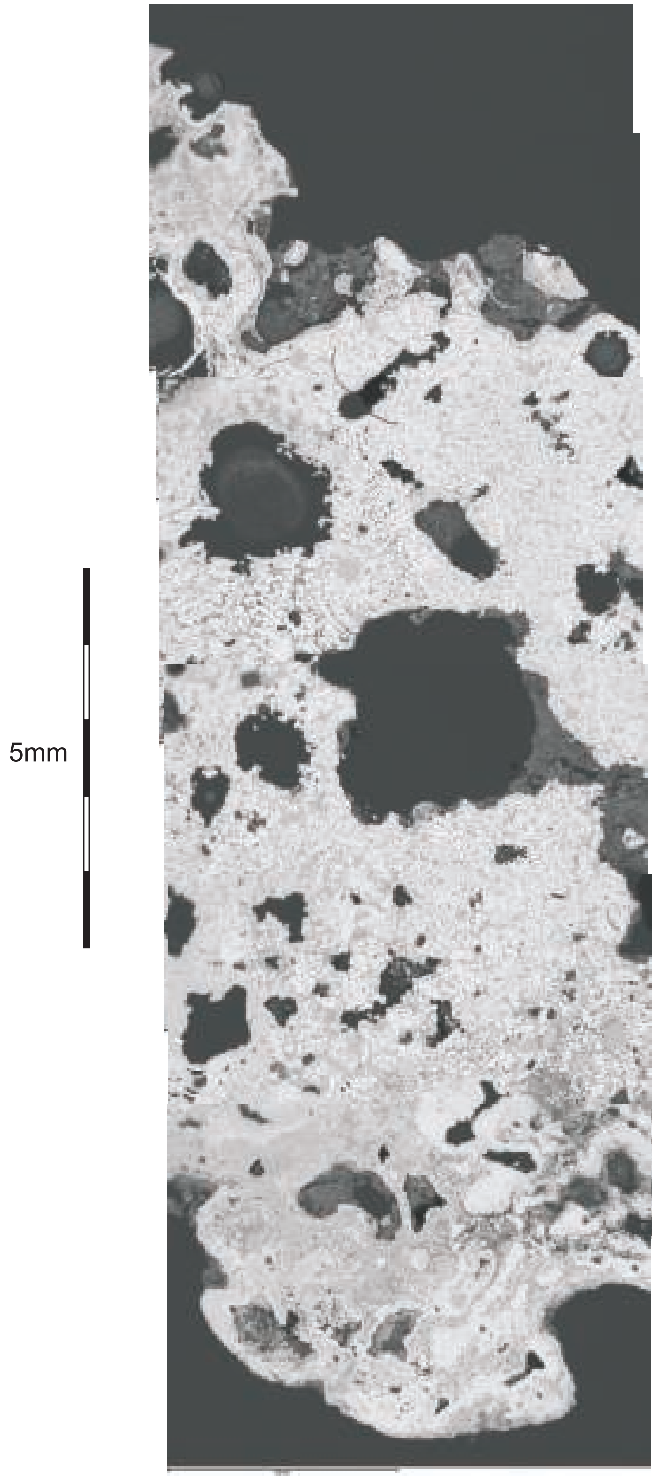

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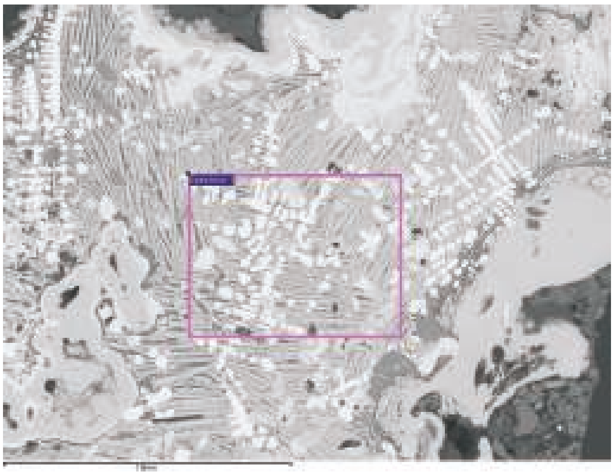

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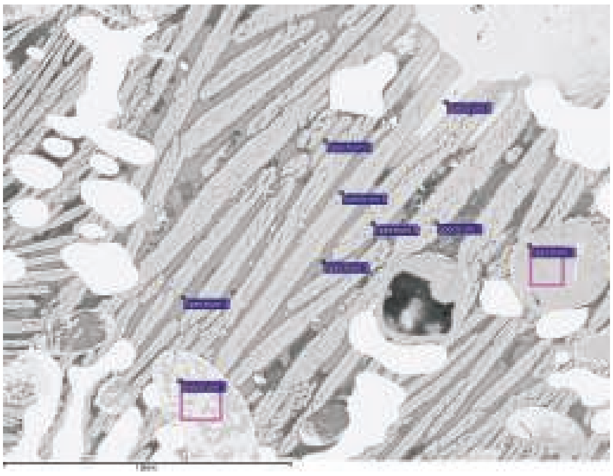

Plate A24

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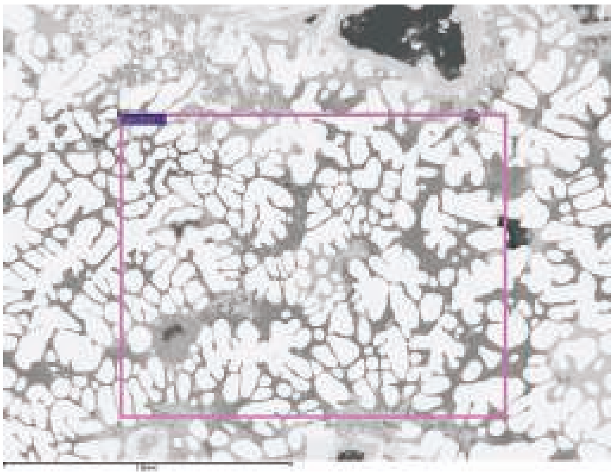

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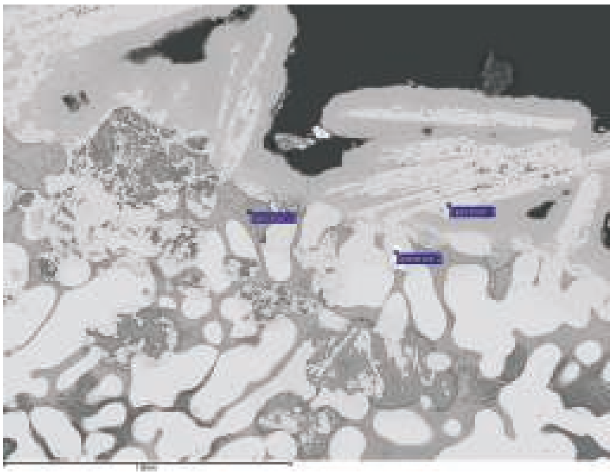

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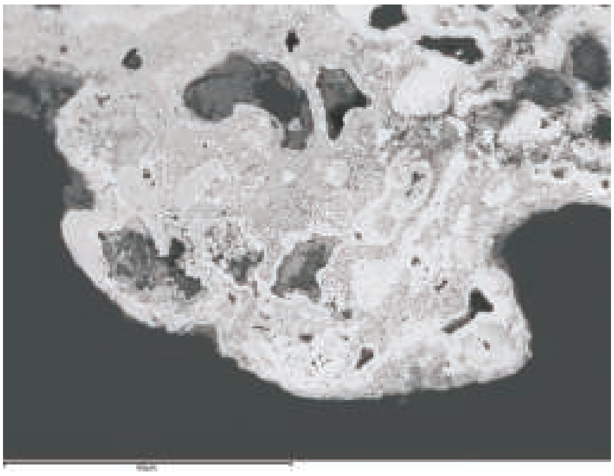

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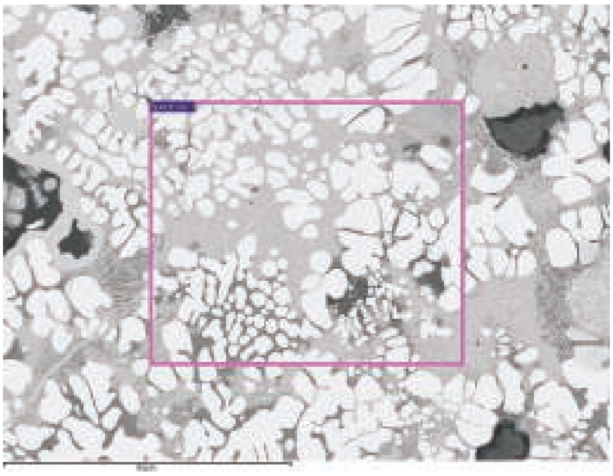

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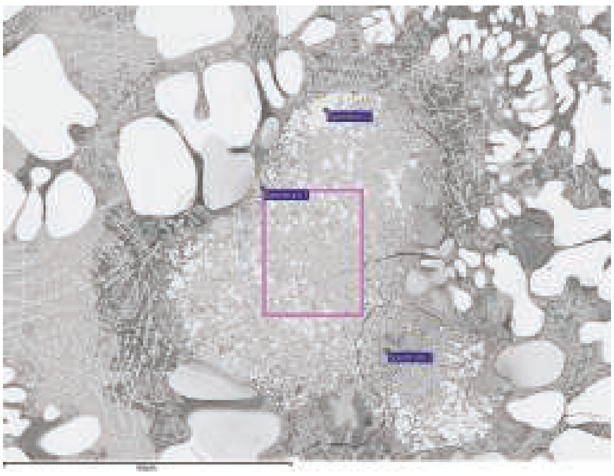

Plate A25

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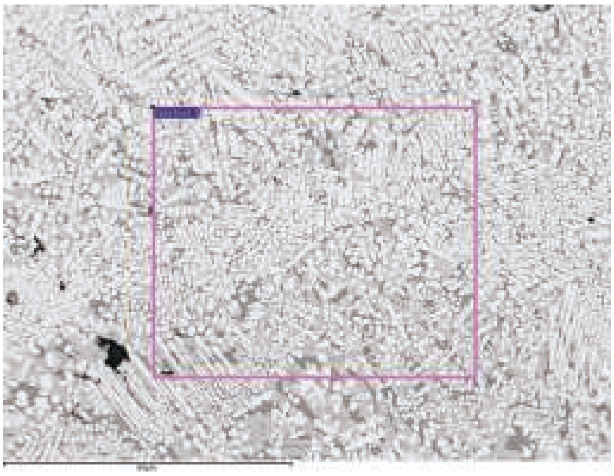

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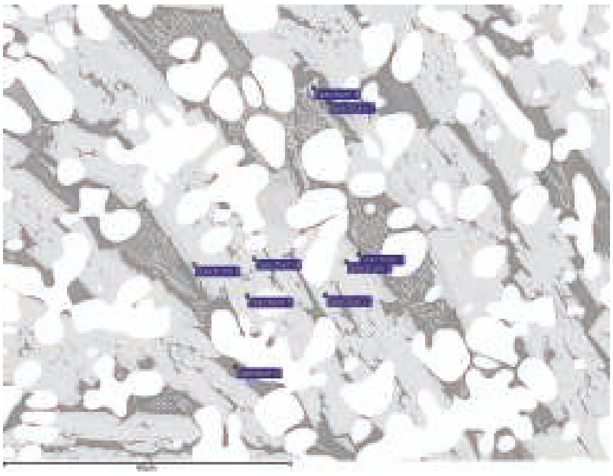

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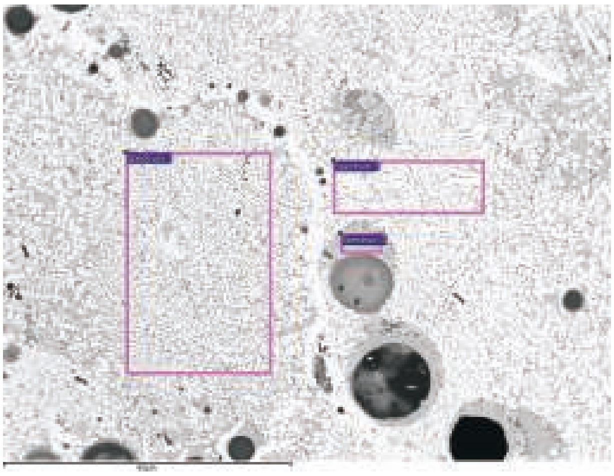

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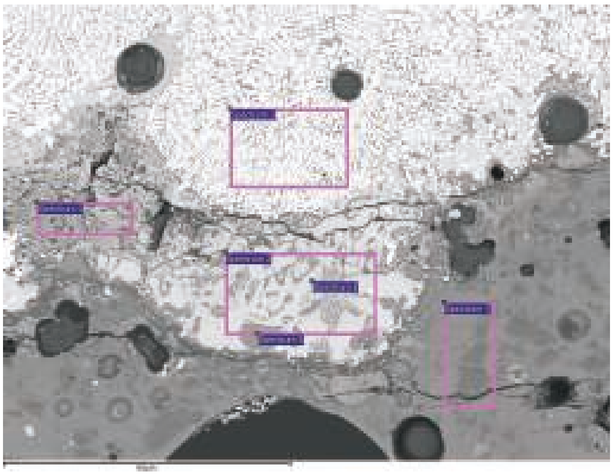

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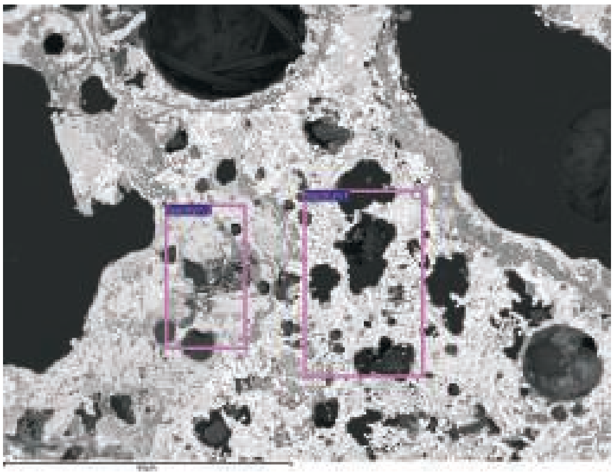

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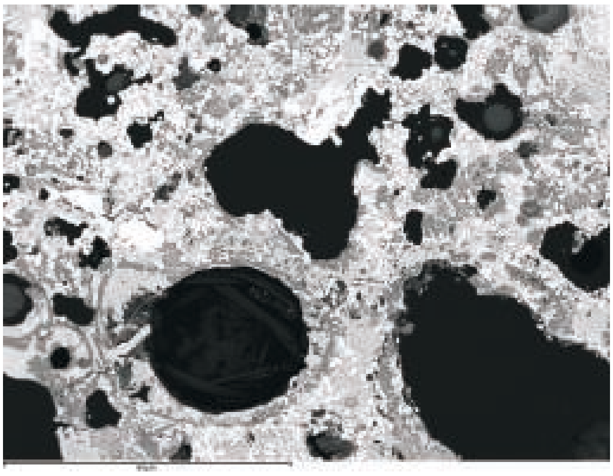

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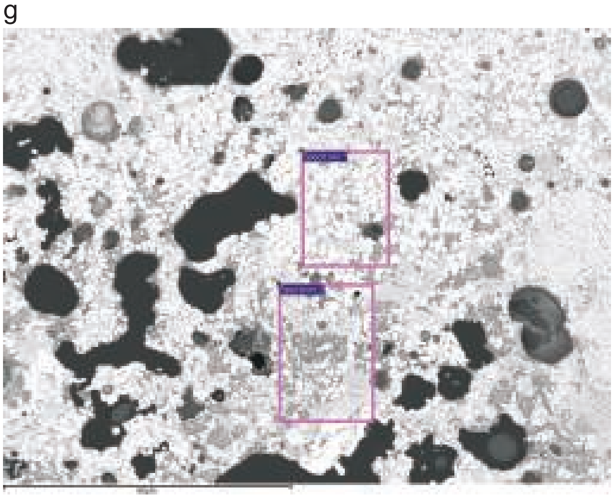

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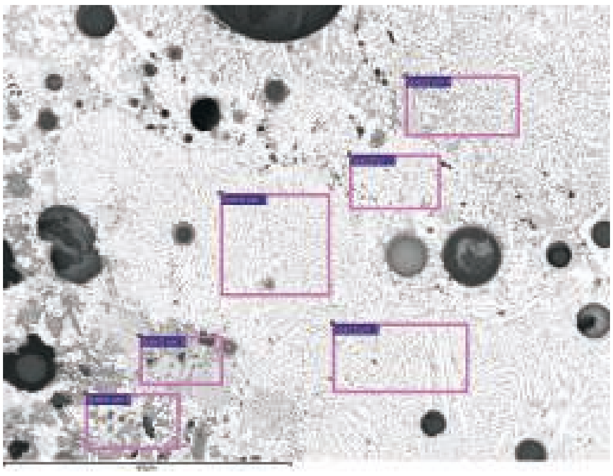

Plate A26

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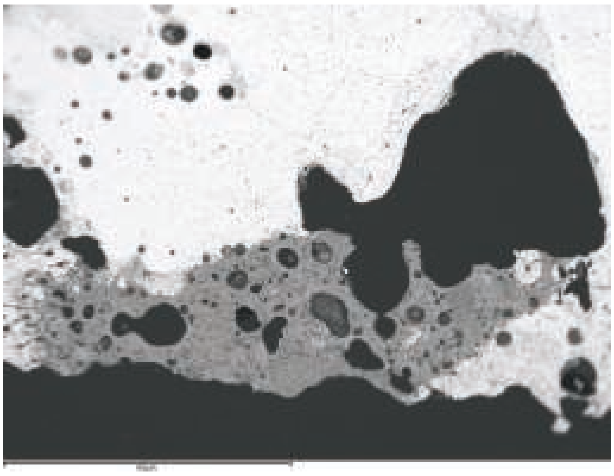

Plate A27

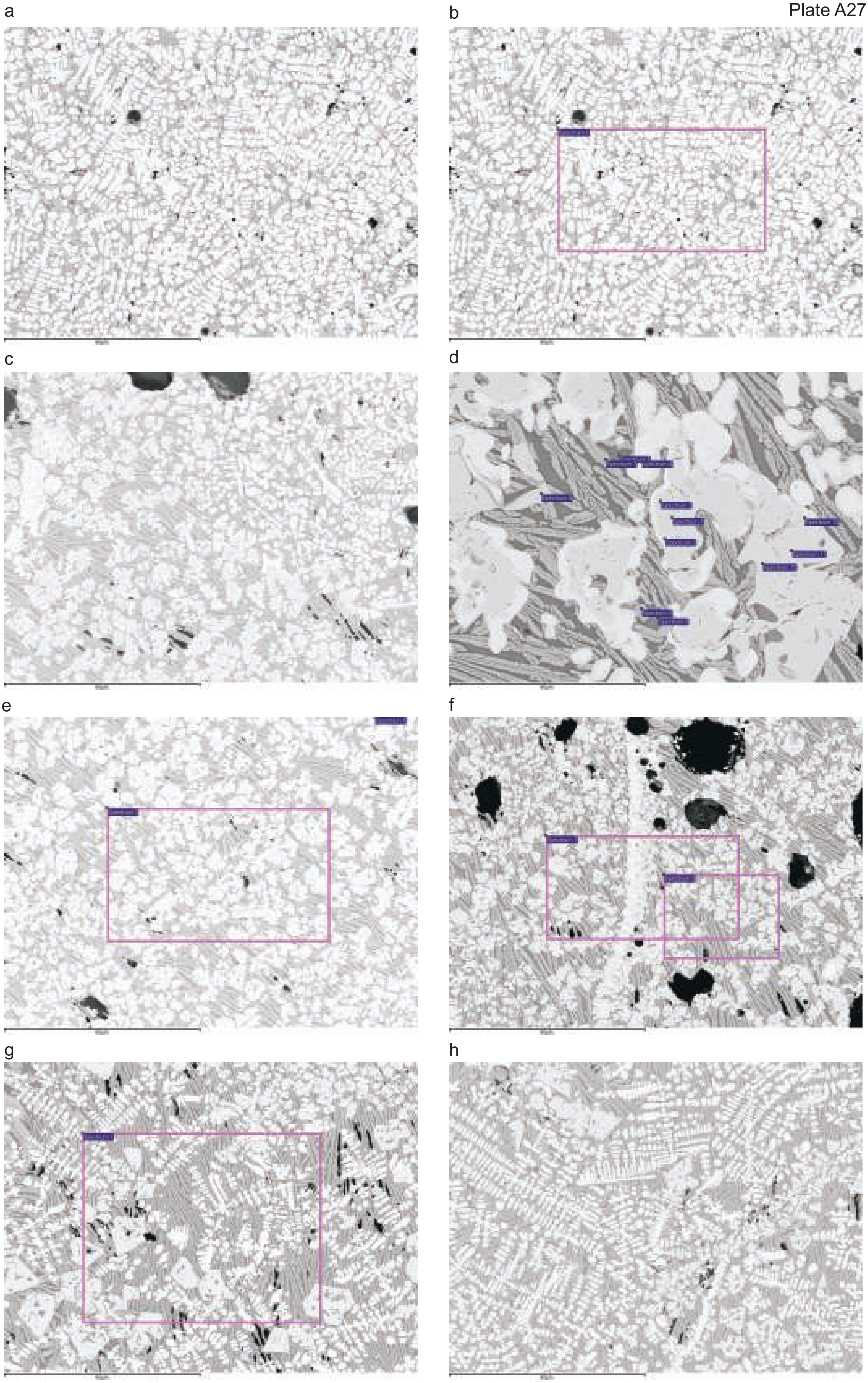

Plate A28

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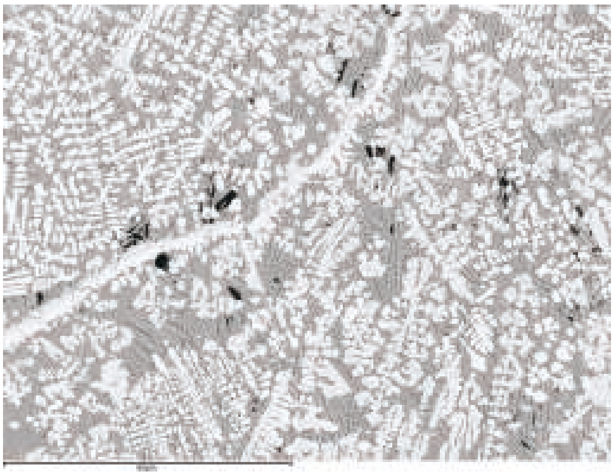

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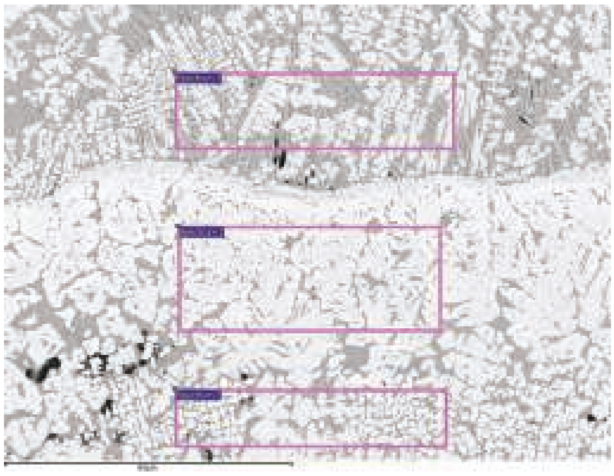

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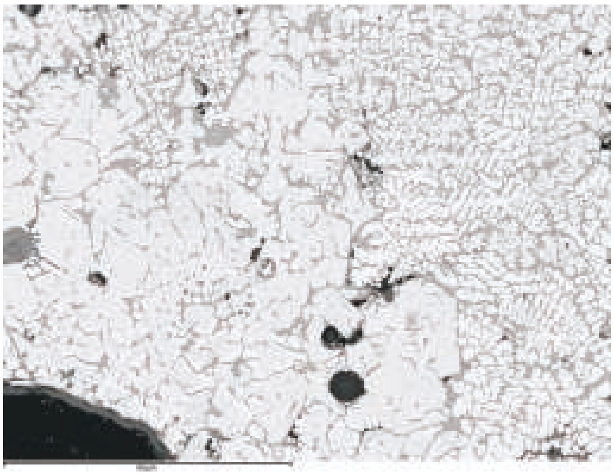

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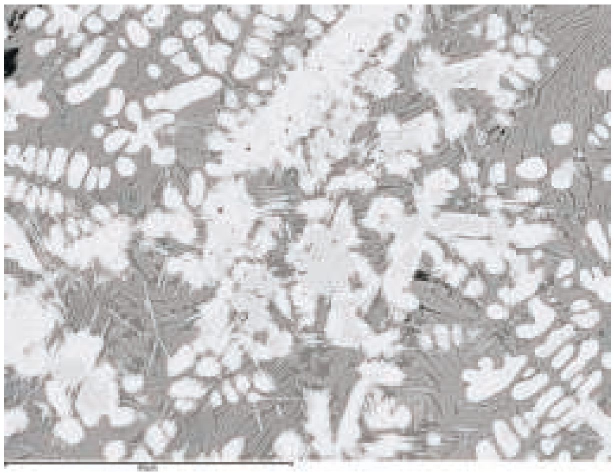

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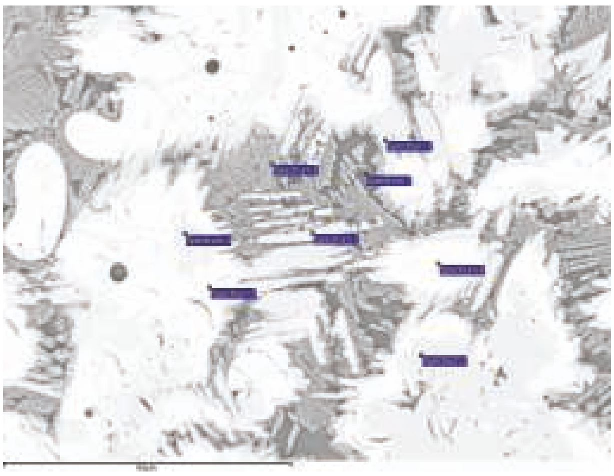

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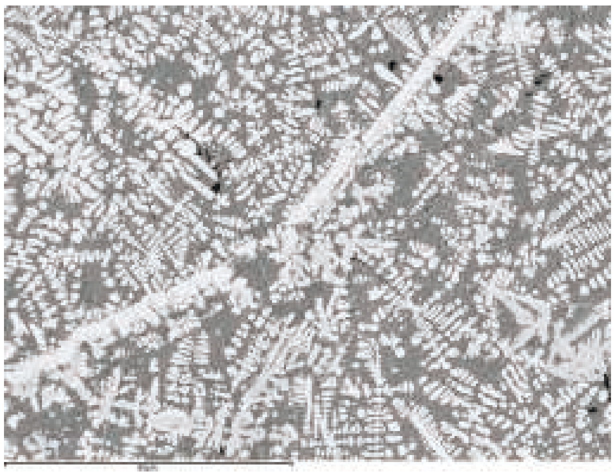


Plate A29

1mm

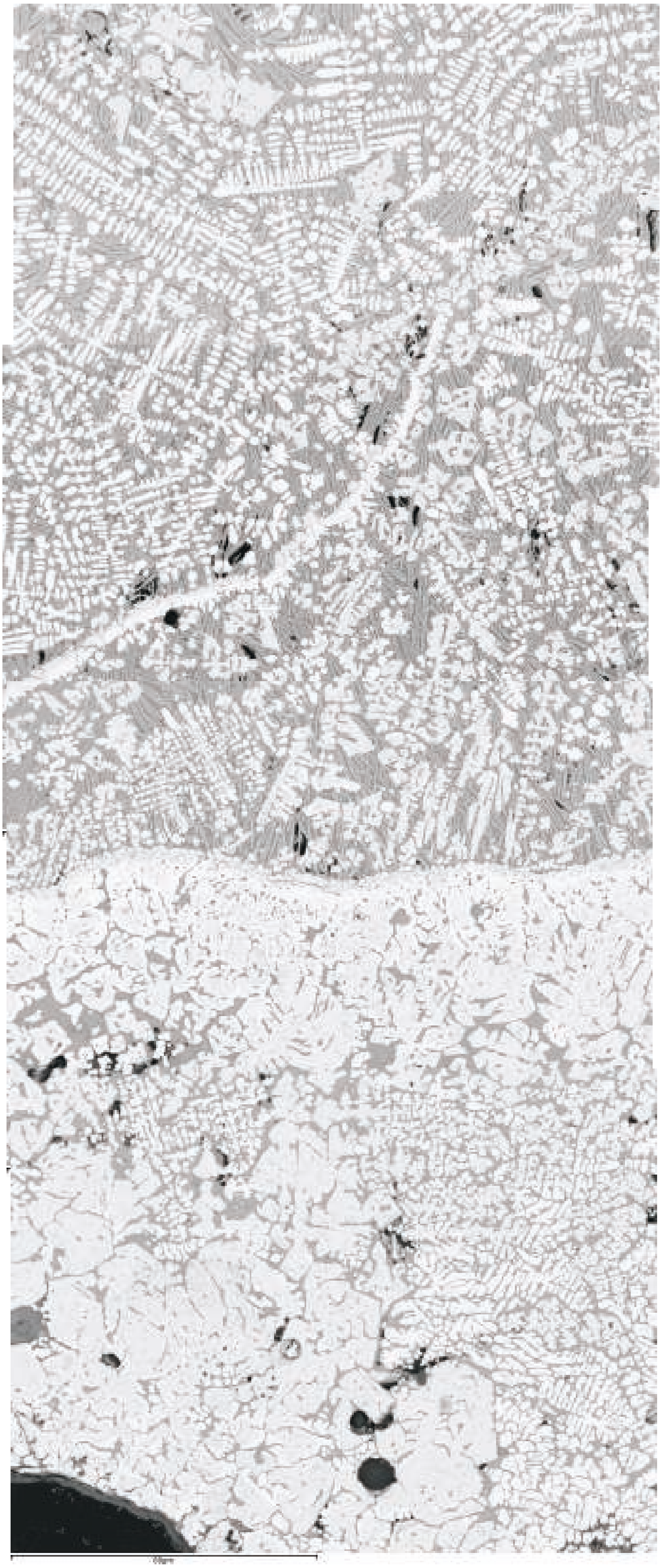
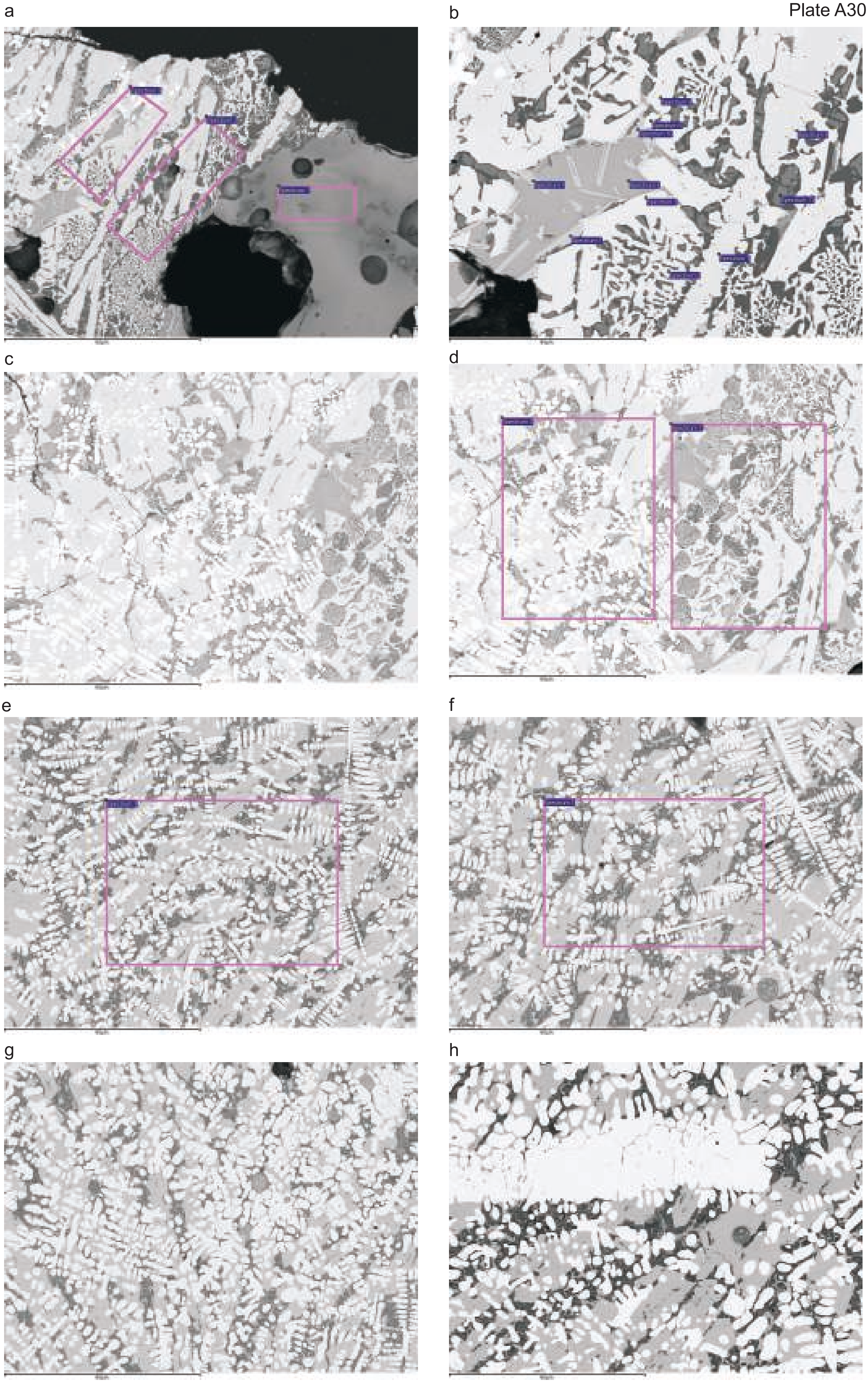


Plate A30



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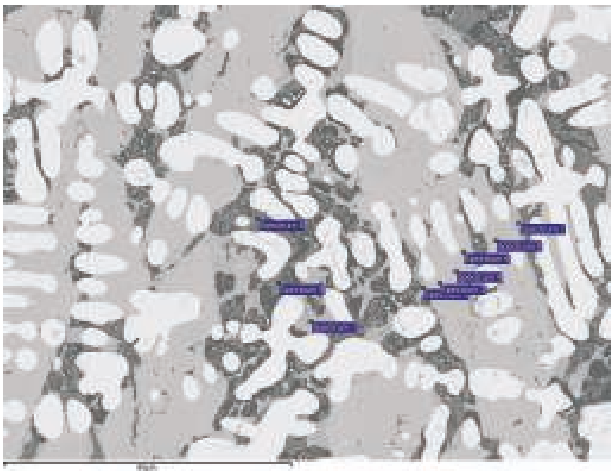

APPENDIX B
EDS ANALYSIS ARCHIVE

EDS data archive

					Atom%																		Wt%																		
					O	Na	Mg	Al	Si	P	S	Cl	K	Ca	Ti	V	Cr	Mn	Fe	Ni	Cu	Ba	O	Na	Mg	Al	Si	P	S	Cl	K	Ca	Ti	V	Cr	Mn	Fe	Ni	Cu	Ba	total
A1	SOI 1	#1	area	typical	59.00	0.29	0.45	2.21	11.24	0.12			0.82	1.30	0.00			0.15	24.44				22.17	0.15	0.26	1.40	7.41	0.08			0.75	1.22	0.00			0.19	32.07				65.71
A1	SOI 1	#2	area	error	58.57		0.52	1.52	11.85				0.62	1.06					25.85				39.64		0.53	1.74	14.08				1.03	1.80					61.08				119.91
A1	SOI 1	#3	area	typical	59.12	0.40	0.44	2.15	11.43	0.11	0.00		0.91	1.48	0.00				23.96				34.37	0.33	0.39	2.11	11.67	0.13	0.00		1.29	2.15	0.00				48.63				101.08
A1	SOI 2	#1	area	small typical	58.52	0.42	0.39	2.22	11.71	0.12	0.00		1.09	1.67	0.07				23.80				36.24	0.37	0.36	2.32	12.73	0.14	0.00		1.65	2.58	0.12				51.44				107.95
A1	SOI 2	#2	point	ol core	59.02		1.28	0.13	13.34					0.50				0.12	25.60				35.36		1.17	0.13	14.03					0.75				0.25	53.54				105.23
A1	SOI 2	#3	point	ol inner	59.07		1.13	0.19	13.38					0.60				0.08	25.54				34.95		1.02	0.19	13.89					0.89				0.17	52.74				103.85
A1	SOI 2	#4	point	ol outer	59.74		0.67	0.00	13.39					0.85				0.09	25.25				35.29		0.60	0.00	13.89					1.26				0.17	52.07				103.29
A1	SOI 2	#5	point	ol outer	58.81		0.82	0.11	13.38					0.79				0.14	25.96				35.19		0.74	0.11	14.05					1.19				0.28	54.21				105.76
A1	SOI 2	#6	point	ol outer	58.44		1.00	0.10	13.71					0.62	0.00			0.00	26.12				34.96		0.91	0.10	14.40					0.93	0.00			0.00	54.54				105.84
A1	SOI 2	#7	point	i/s ol + glass	60.88	0.45	0.00	4.38	15.20	0.27	0.10		2.94	4.75	0.00			0.00	11.03				41.64	0.44	0.00	5.05	18.25	0.36	0.14		4.91	8.14	0.00			0.00	26.33				105.26
A1	SOI 2	#8	point	i/s ol + glass	57.47	0.65	0.00	4.47	13.96	0.22	0.15		2.30	4.13	0.06			0.00	16.59				37.11	0.60	0.00	4.86	15.83	0.27	0.19		3.62	6.68	0.12			0.00	37.40				106.69
A1	SOI 2	#9	point	oxide of lobe margin	54.91			0.56	0.84				0.11	0.36	0.11				43.12				24.85			0.43	0.66				0.12	0.41	0.15				68.12				94.74
A1	SOI 3	#1	area	typical	58.63	0.28	0.51	2.16	11.50	0.11	0.00		0.93	1.45	0.00				24.43				31.84	0.22	0.42	1.98	10.96	0.11	0.00		1.23	1.97	0.00				46.31				95.04
A1	SOI 5	#1	area	typical	57.82	0.38	0.44	2.29	11.84	0.16			1.05	1.57	0.06			0.10	24.28				31.07	0.29	0.36	2.08	11.17	0.17			1.38	2.12	0.10			0.18	45.56				94.48
A1	SOI 6	#1	area	typical	57.71	0.34	0.39	2.22	11.75	0.10	0.00		1.08	1.58	0.06			0.08	24.69				32.30	0.28	0.33	2.09	11.55	0.11	0.00		1.47	2.21	0.10			0.15	48.24				98.84
A1	SOI 8	#1	point	ol outer	60.78		0.43	0.75	13.24				0.64	1.95				0.08	22.12				37.22		0.40	0.77	14.23				0.96	2.99				0.18	47.29				104.04
A1	SOI 8	#2	point	to inner	59.13		0.98	0.17	13.44					0.71				0.12	25.46				34.39		0.86	0.16	13.73					1.04				0.23	51.69				102.11
A1	SOI 8	#3	point	to inner	59.41		1.10	0.41	13.28				0.20	0.88				0.11	24.61				35.27		0.99	0.41	13.85				0.29	1.31				0.22	51.00				103.34
A1	SOI 8	#4	point	to core	58.91		1.18	0.23	13.36					0.67				0.10	25.55				34.38		1.05	0.22	13.69					0.97				0.20	52.05				102.56
A1	SOI 8	#5	point	to core	58.65		1.19	0.15	13.46					0.57				0.10	25.87				34.52		1.07	0.15	13.91					0.85				0.19	53.15				103.84
A1	SOI 8	#6	point	to inner = 3	57.85		0.87	0.21	12.38					0.68				0.08	27.92				33.09		0.76	0.20	12.43					0.98				0.15	55.76				103.38
A1	SOI 8	#7	point	glass	61.05	0.81	0.00	7.90	15.57	0.37	0.16		4.29	3.48	0.06				6.31				43.67	0.84	0.00	9.53	19.56	0.51	0.23		7.50	6.24	0.12				15.77				103.97
A1	SOI 8	#8	point	glass	60.45	0.82		7.69	15.87	0.40	0.17		4.51	3.40	0.08				6.60				41.67	0.81		8.94	19.21	0.53	0.24		7.61	5.87	0.17				15.89				100.93
A1	SOI 8	#9	point	K	60.15	0.42	0.13	1.92	13.22	0.22			0.71	7.97					15.26				40.99	0.41	0.13	2.20	15.82	0.29			1.18	13.61					36.30				110.93
A1	SOI 8	#10	point	glass?	60.14	0.75		7.52	15.90	0.37	0.10		4.19	2.91	0.07				8.05				41.93	0.75		8.84	19.45	0.50	0.14		7.15	5.08	0.14				19.60				103.58
A1	SOI 10	#1	area	typical	58.56	0.42	0.35	2.70	11.99		0.00		1.35	1.98	0.00				22.65				37.44	0.39	0.34	2.91	13.46		0.00		2.11	3.17	0.00				50.55				110.37
A1	SOI 11	#1	area	typical	58.70	0.38	0.48	2.26	12.04	0.11	0.00		1.04	1.57					23.42				31.85	0.30	0.40	2.06	11.47	0.12	0.00		1.38	2.13					44.36				94.06
A2	SOI 1	#1	area	typical	56.56	0.36	0.40	2.41	11.72	0.10	0.00		0.99	1.79	0.06			0.08	25.54				30.32	0.28	0.32	2.18	11.03	0.10	0.00	1.29	2.40	0.10	0.14			47.80	95.98				
A2	SOI 3	#1	area	typical	57.12	0.36	0.50	2.24	11.67	0.00			0.97	1.77	0.00			0.09	25.29				33.88	0.30	0.45	2.24	12.16	0.00			1.41	2.62	0.00			0.19	52.37				105.61
A2	SOI 4	#1	area	typical	56.70	0.27	0.62	2.42	11.81	0.11	0.00		1.07	1.90	0.00			0.14	24.98				31.58	0.21	0.52	2.27	11.54	0.11	0.00		1.45	2.65	0.00			0.27	48.55				99.16
A2	SOI 5	#1	area	typical	56.81	0.43	0.50	2.41	11.90				1.05	1.87	0.06			0.07	24.90				30.93	0.34	0.41	2.21	11.37				1.40	2.55	0.10			0.13	47.31				96.76
A2	SOI 6	#1	point	altered M	53.00			0.57	0.25				0.00	0.00	0.08				46.11				23.81			0.43	0.19				0.00	0.00	0.11				72.30				96.84
A2	SOI 6	#2	point	altered M	52.72			0.65	0.33						0.10				46.19				24.58			0.51	0.27						0.15				75.18				100.70
A2	SOI 6	#3	point	ol core	58.17		1.39	0.20	13.65					0.69				0.12	25.78				32.88		1.20	0.19	13.54					0.98				0.24	50.87				99.89
A2	SOI 6	#4	point	ol inner	57.67		0.67	0.36	14.31				0.14	1.51				0.10	25.23				32.73		0.58	0.34	14.26				0.20	2.15				0.20	49.98				100.45
A2	SOI 6	#5	point	ol outer	58.08		0.96	0.15	13.78					0.90				0.16	25.98				32.00		0.80	0.13	13.33					1.24				0.31	49.96				97.78
A2	SOI 6	#6	point	ol margin	58.37		0.34	0.74	13.98				0.24	2.39				0.00	23.95				33.22		0.29	0.71	13.96				0.34	3.41				0.00	47.58				99.51
A2	SOI 6	#7	point	ol core	58.41		1.46	0.17	13.63					0.76				0.14	25.44				33.31		1.27	0.16	13.64					1.08				0.28	50.63				100.37
A2	SOI 6	#8	point	ol inner	58.12		1.45	0.12	13.65					0.69				0.16	25.81				33.09		1.25	0.12	13.64					0.99				0.31	51.28				100.68
A2	SOI 6	#9	point	ol outer	58.06		0.53	0.12	13.75					1.32				0.12	26.10				32.90		0.46	0.11	13.67					1.87				0.23	51.63				100.88
A2	SOI 6	#10	point	glass/late ol	59.37	0.60	0.00	5.06	15.81	0.27			3.18	5.30				0.07	10.32				38.66	0.56	0.00	5.56	18.08	0.34			5.07	8.65				0.16	23.47				100.55
A2	SOI 6	#11	point	glass/late ol	60.32	0.41	0.15	4.79	15.91	0.28			2.89	5.22					10.02				38.42	0.38	0.14	5.15	17.79	0.35			4.49	8.34					22.29				97.35
A2	SOI 6	#12	point	w?	52.33			0.47	0.38				0.00	0.10	0.12				46.59				24.11			0.36	0.31				0.00	0.12	0.17				74.93				100.00
A2	SOI 6	#13	point	w?	51.63			0.46	0.30					0.13	0.17			0.10	47.21				22.10			0.33	0.23					0.14	0.22			0.14	70.53				93.69
A2	SOI 6	#14	point	weathering?	60.52	0.49		5.61	16.27	0.32			3.12	5.21	0.07				8.39				38.53	0.45		6.02	18.18	0.39			4.85	8.31	0.13				18.65				95.51
A2	SOI 6	#15	point	weathering?	64.56	0.37	0.11	6.36	17.51	0.25	0.00	0.09	2.36	1.62	0.08				6.70				41.56	0.34	0.11	6.90	19.79	0.31	0.00	0.13	3.71	2.61	0.14				15.05				90.65
					O	Na	Mg	Al	Si	P	S	Cl	K	Ca	Ti	V	Cr	Mn	Fe	Ni	Cu	Ba	O	Na	Mg	Al	Si	P	S	Cl	K	Ca	Ti	V	Cr	Mn	Fe	Ni	Cu	Ba	total
B1	SOI 1	#1	area	typical	58.45		0.53	3.00	12.23				1.35	1.58	0.08			0.09	22.69				32.27		0.45	2.79	11.85				1.82	2.18	0.13			0.17	43.73				95.38
B1	SOI 1	#2	area	typical	58.85	0.33	0.60	3.26	12.56				1.23	1.54	0.07				21.56				36.35	0.29	0.56	3.39	13.62				1.85	2.39	0.14				46.49				105.09
B1	SOI 2	#1	area	typical	58.93		0.57	3.35	13.02				1.65	1.51	0.00				20.97				35.62		0.52	3.42	13.82				2.43	2.29	0.00				44.25				102.34
B1	SOI 3	#1	point	ol core	58.50		1.51	0.15	13.51					0.60				0.10	25.63				34.57		1.36	0.15	14.02					0.88				0.21	52.87				104.05
B1	SOI 3	#2	point	ol inner	58.42		1.22	0.15	13.56					0.68				0.08	25.89				34.38		1.09	0.14	14.01					1.00				0.17	53.18				103.97
B1	SOI 3	#3	point	ol outer	58.73		0.72	0.20	13.57					0.92				0.13	25.73				34.64		0.65	0.20	14.04					1.36				0.27	52.96				104.12
B1	SOI 3	#4	point	ol outer	58.22		0.73	0.15	13.65					0.88	0.00			0.12	26.25				33.87		0.65	0.14	13.93					1.29	0.00			0.24	53.30				103.42
B1	SOI 3	#5	point	main ol margin	58.05		0.52	0.17	13.72					1.46				0.13	25.95				33.03		0.45	0.16	13.70					2.09				0.25	51.53				101.22
B1	SOI 3	#6	point	K og	59.35		0.00	0.11	13.31	0.15				9.20				0.08	17.79				36.23		0.00	0.12	14.27	0.18				14.07				0.18	37.91				102.95
B1	SOI 3	#7	point	K og	59.57		0.20	0.12	13.13	0.19				9.29					17.51				36.63		0.18	0.13	14.17	0.23				14.31					37.58				103.24
B1	SOI 4	#1	area	typical	59.93	0.22	0.75	2.79	11.97	0.09	0.00		0.67	0.82	0.09			0.00	22.66				32.94	0.17	0.63	2.58	11.55	0.09	0.00		0.90	1.13	0.16			0.00	43.48				93.64
B1	SOI 5	#1	point	glass	60.71	0.48		9.86	15.16	0.47	0.09		4.66	3.63	0.13				4.80				42.19	0.48		11.55	18.50	0.63	0.13		7.92	6.32	0.28				11.64				99.65
B1	SOI 5	#2	point	glass	60.90	0.44		9.33	15.84	0.38	0.08		4.66	3.54	0.06				4.76				41.25	0.43		10.66	18.83	0.50	0.11		7.72	6.01	0.12				11.24				96.88
B1	SOI 5	#3	point	ol margin	58.61		0.62	0.19	13.70					0.78				0.10	26.00				33.11		0.53	0.18	13.59					1.10				0.20	51.26				99.98
B1	SOI 5	#4	point	ol outer	58.78		1.75		13.43					0.49				0.09	25.46				33.36		1.51		13.38					0.70				0.17	50.44				99.55
B1	SOI 5	#5	point	ol inner	58.46		1.99		13.45					0.53				0.13	25.44				33.43		1.73		13.50					0.76				0.25	50.79				100.47

B1	SOI 5	#6	point	ol inner	58.76		1.96	0.21	13.37					0.48				0.12	25.10				33.69		1.71	0.20	13.46					0.69				0.24	50.24				100.23
B1	SOI 5	#7	point	ol inner	58.76		0.98	0.18	13.42		0.00			0.83				0.10	25.74				33.89		0.86	0.18	13.59		0.00			1.20				0.19	51.82				101.72
B1	SOI 5	#8	point	ol inner	58.97		1.76	0.21	13.48					0.47				0.10	25.01				34.14		1.55	0.20	13.70					0.68				0.21	50.54				101.01
B1	SOI 5	#9	point	ol inner	58.42		1.96	0.15	13.45					0.45				0.11	25.46				33.75		1.72	0.15	13.64					0.66				0.22	51.33				101.46
B1	SOI 5	#10	point	ol outer	58.63		1.75		13.50		0.00			0.46				0.10	25.57				33.98		1.54		13.74		0.00			0.67				0.19	51.74				101.86
B1	SOI 5	#11	point	ol margin	59.41		0.56	0.12	13.28			0.13		1.21				0.11	25.18				34.65		0.50	0.12	13.60			0.17		1.77				0.22	51.27				102.29
B1	SOI 5	#12	point	glass/late ol	60.68	0.28	0.00	5.11	14.69	0.27	0.00		3.21	5.93	0.00				9.83				40.76	0.27	0.00	5.79	17.32	0.36	0.00		5.27	9.99	0.00				23.04				102.80
B1	SOI 5	#13	point	glass/late ol	60.07	0.20	0.12	4.53	14.51	0.23			2.51	6.62					11.20				40.63	0.19	0.13	5.17	17.23	0.30			4.16	11.21					26.43				105.45
B1	SOI 5	#14	point	glass/late ol	60.84	0.42		9.21	15.94	0.38	0.14		5.24	2.88	0.08				4.88				43.01	0.42		10.98	19.78	0.52	0.20		9.05	5.10	0.17				12.03				101.26
B1	SOI 5	#15	point	glass/late ol	59.90	0.23		3.38	14.19	0.19	0.00		1.96	7.18				0.00	12.97				38.61	0.21		3.67	16.05	0.24	0.00		3.09	11.60				0.00	29.17				102.65
B1	SOI 6	#1	point	glass	69.73	0.00	0.00	3.75	12.13	0.30	0.15	0.12	0.07	0.11					13.63				47.68	0.00	0.00	4.33	14.57	0.40	0.21	0.18	0.12	0.19					32.53				100.21
B1	SOI 6	#2	point	glass	67.35			3.64	12.68	0.30	0.18	0.08	0.10	0.11					15.56				39.88			3.64	13.18	0.34	0.22	0.11	0.14	0.16					32.16				89.83
B1	SOI 6	#3	point	K og	59.35	0.00	0.16	1.22	12.99	0.46	0.00		0.20	9.48	0.00				16.14				36.18	0.00	0.15	1.26	13.91	0.54	0.00		0.29	14.48	0.00				34.34				101.15
B1	SOI 6	#4	point	ol margin	58.42		0.44	0.16	13.68					2.24				0.08	24.97				34.09		0.39	0.16	14.01					3.27				0.17	50.87				102.96
B1	SOI 6	#5	point	ol inner	57.93		1.72	0.15	13.73					0.60				0.13	25.74				33.66		1.51	0.15	14.01					0.87				0.26	52.21				102.66
B1	SOI 6	#6	point	ol inner	57.18		1.22	0.00	14.25		0.00			1.79				0.00	25.56				32.30		1.04	0.00	14.13		0.00			2.53				0.00	50.39				100.40
B1	SOI 6	#7	point	ol inner	58.06		1.85	0.23	13.83					0.52				0.11	25.40				33.71		1.63	0.23	14.09					0.75				0.21	51.47				102.10
B1	SOI 6	#8	point	ol inner	58.50		1.12		13.48					0.85	0.06				25.99				33.68		0.98		13.62					1.23	0.10				52.23				101.85
B1	SOI 6	#9	point	ol outer	58.06		0.58	0.15	13.78		0.00	0.00		2.13	0.07			0.11	25.12				33.28		0.50	0.14	13.87		0.00	0.00		3.06	0.12			0.22	50.27				101.47
B1	SOI 6	#10	point	ol margin	59.62		0.39	0.15	13.50					2.99				0.11	23.26				35.62		0.35	0.15	14.16					4.47				0.22	48.51				103.48
B1	SOI 6	#11	point	late ol??	61.45	0.00	0.21	0.31	13.21	0.15				2.64					22.04				34.57	0.00	0.18	0.29	13.05	0.16				3.73					43.27				95.24
B1	SOI 6	#12	area	small	59.53	0.00	0.59	2.89	10.85	0.14	0.00	0.00	0.26	0.81	0.09			0.00	24.84				33.38	0.00	0.50	2.73	10.68	0.15	0.00	0.00	0.35	1.14	0.15			0.00	48.63				97.73
B1	SOI 7	#1	area	typical	56.99	0.52	0.52	3.80	12.12	0.17			1.49	2.03	0.09			0.07	22.19				34.06	0.45	0.47	3.83	12.71	0.20			2.18	3.04	0.17			0.14	46.30				103.55
B1	SOI 7	#2	point	glass	60.65	0.96		8.81	15.86	0.37	0.10		4.18	4.01	0.05				5.00				42.61	0.97		10.44	19.57	0.50	0.15		7.18	7.06	0.11				12.27				100.85
B1	SOI 7	#3	point	glass	60.82	0.98	0.00	9.15	15.93	0.35	0.07		4.71	3.09	0.10				4.80				42.27	0.98	0.00	10.73	19.43	0.47	0.09		8.00	5.38	0.21				11.65				99.22
B1	SOI 7	#4	point	ol inner	57.64		1.34	0.19	13.87					0.75				0.12	26.10				32.14		1.13	0.18	13.57					1.04				0.24	50.79				99.10
B1	SOI 7	#5	point	ol inner	58.04		1.01		13.75					0.91				0.12	26.17				32.33		0.86		13.45					1.27				0.23	50.89				99.03
B1	SOI 7	#6	point	ol margin	56.78	0.00	0.35	0.76	14.37				0.17	2.43				0.10	25.03				31.51	0.00	0.30	0.71	14.00				0.23	3.38				0.20	48.50				98.84
B1	SOI 7	#7	point	ol margin	57.41	0.44	0.31	2.74	14.99	0.19			0.98	3.15				0.07	19.72				35.27	0.39	0.29	2.84	16.17	0.23			1.46	4.84				0.15	42.28				103.93
B1	SOI 7	#8	point	ol outer	57.71		0.69	0.17	13.92					1.07				0.08	26.36				32.44		0.59	0.16	13.74					1.51				0.16	51.73				100.33
B1	SOI 7	#9	point	ol inner	57.68		1.72	0.16	13.78					0.58	0.00			0.08	25.98				32.77		1.49	0.15	13.74					0.83	0.00			0.17	51.53				100.68
B1	SOI 7	#10	point	glass/late ol	59.77	0.67		4.39	14.45	0.29			2.35	6.88	0.00				11.20				38.93	0.63		4.82	16.52	0.37			3.74	11.23	0.00				25.47				101.70
B1	SOI 7	#11	point	glass/late ol	59.44	0.86		6.70	15.62	0.28	0.06		3.51	5.06	0.00				8.45				39.45	0.82		7.51	18.20	0.36	0.08		5.70	8.42	0.00				19.58				100.13
B1	SOI 7	#12	area	interstitial	59.75	0.77	0.00	6.94	15.49	0.35	0.09		4.03	4.71	0.06				7.80				39.08	0.73	0.00	7.66	17.79	0.45	0.11		6.44	7.72	0.12				17.81				97.90
					O	Na	Mg	Al	Si	P	S	Cl	K	Ca	Ti	V	Cr	Mn	Fe	Ni	Cu	Ba	O	Na	Mg	Al	Si	P	S	Cl	K	Ca	Ti	V	Cr	Mn	Fe	Ni	Cu	Ba	total
B2	SOI 2	#1	point	ol inner	56.46		2.75		14.24					0.40				0.11	26.04				31.46		2.33		13.93					0.56				0.21	50.66				99.14
B2	SOI 2	#2	point	ol inner	56.99		3.03		14.16					0.40				0.13	25.28				32.36		2.62		14.12					0.57				0.26	50.10				100.03
B2	SOI 2	#3	point	ol outer	55.78		0.99		14.60					0.69				0.09	27.85				29.99		0.81		13.78					0.93				0.16	52.27				97.94
B2	SOI 2	#4	point	ol margin	57.27			0.59	13.97	0.27				2.70				0.11	25.09				32.67			0.56	13.99	0.30				3.86				0.22	49.97				101.59
B2	SOI 2	#5	point	iron															100.00																		97.72				97.72
B2	SOI 2	#6	point	rhönite	59.37			8.53	11.35	0.13			0.00	5.88	0.75			0.00	14.00				37.12			9.00	12.46	0.16			0.00	9.21	1.40			0.00	30.55				99.89
B2	SOI 2	#7	point	hercynite	57.33			23.40	0.24					0.08	0.93			0.07	17.95				35.50			24.44	0.26					0.13	1.73			0.15	38.79				101.00
B2	SOI 3	#1	area	typical	57.42		1.08	2.70	13.51	0.24	0.11		0.25	2.42	0.09			0.11	22.07				32.14		0.92	2.55	13.28	0.26	0.12		0.34	3.40	0.16			0.21	43.12				96.48
B2	SOI 3	#2	area	typ with margins	58.34		0.91	3.41	13.03	0.16			0.70	1.88	0.09				21.48				32.23		0.76	3.18	12.64	0.17			0.94	2.60	0.15				41.42				94.09
B2	SOI 4	#1	area	typical	58.29	0.38	0.57	4.62	13.37	0.15	0.00		1.78	1.33	0.11			0.07	19.34				35.54	0.33	0.53	4.75	14.31	0.18	0.00		2.65	2.04	0.19			0.14	41.16				101.82
B3	SOI 4	#2	area	typical	57.13	0.38	0.71	3.61	13.71	0.11	0.00		1.32	1.36	0.08			0.07	21.51				34.00	0.33	0.64	3.63	14.32	0.13	0.00		1.92	2.04	0.14			0.15	44.70				101.99
B2	SOI 5	#1	point	K rich ol	57.92			0.14	13.63	0.16				5.73					22.42				32.04			0.13	13.23	0.17				7.94					43.29				96.81
B2	SOI 5	#2	point	glass/late ol	58.76	1.04		5.94	14.16	0.70	0.20		0.86	7.98	0.17				10.21				37.55	0.95		6.41	15.88	0.86	0.26		1.34	12.77	0.32				22.77				99.10
B2	SOI 5	#3	point	hercynite	56.77		0.00	23.91	0.25					0.07	0.73				18.27				32.66		0.00	23.20	0.25					0.10	1.26				36.68				94.15
B2	SOI 5	#4	point	ol core	57.32		1.34	0.14	13.90					0.53				0.16	26.61				30.99		1.10	0.13	13.20					0.72				0.30	50.21				96.64
B2	SOI 5	#5	point	ol inner	56.56		0.49	0.19	14.15					1.01				0.14	27.46				29.85		0.40	0.17	13.11					1.33				0.25	50.57				95.68
B2	SOI 5	#6	point	ol outer	56.33		0.20	0.15	14.27					2.53	0.00			0.00	26.54				29.76		0.16	0.13	13.23					3.34	0.00			0.00	48.93				95.55
B2	SOI 5	#7	point	K og	58.35			0.15	13.57	0.19				9.99					17.76				34.47			0.15	14.07	0.21				14.78					36.62				100.30
B2	SOI 5	#8	point	rhönite	59.77			8.65	11.20	0.16				5.66	0.49				14.07				36.05			8.80	11.86	0.19				8.55	0.89				29.62				95.94
B2	SOI 5	#9	point	K og	58.45			0.19	13.40	0.20				8.88					18.88				33.13			0.18	13.33	0.22				12.61					37.36				96.82
B2	SOI 5	#10	point	rhönite	59.78			8.55	11.46	0.18			0.05	5.75	0.51				13.73				38.12			9.20	12.83	0.22			0.07	9.18	0.97				30.58				101.18
B2	SOI 5	#11	point	W	52.13			0.39	0.28				0.14	0.15	0.32				46.59				23.58			0.30	0.22				0.16	0.17	0.43				73.57				98.43
B2	SOI 5	#12	point	leucite	60.03	0.24		9.25	18.25				7.03						5.21				40.31	0.23		10.48	21.51				11.54						12.21				96.28
B2	SOI 5	#13	point	leucite	60.70	0.20		9.90	19.92				8.88						0.39				44.05	0.21		12.12	25.39				15.75						1.00				98.52
B2	SOI 5	#14	point	glass/late ol	59.58			2.02	13.14	0.44			0.33	7.30	0.15				17.05				34.70			1.98	13.43	0.50			0.47	10.66	0.25				34.66				96.65
B2	SOI 5	#15	point	glass	59.94	0.75		7.96	13.96	0.55	0.17		0.77	7.60	0.30				7.99				37.99	0.68		8.51	15.53	0.67	0.22		1.20	12.07	0.57				17.68				95.13
B2	SOI 5	#16	point	glass/late ol	57.63	0.30	0.00	1.25	13.45	0.43			0.17	6.89	0.07			0.09	19.72				32.10	0.24	0.00	1.18	13.15	0.47			0.22	9.61	0.12			0.17	38.35				95.62
B2	SOI 6	#1	area	typical	59.48		1.25	2.52	12.32				0.81	0.73					22.88				30.58		0.98	2.19	11.12				1.02	0.94					41.07				87.90
B2	SOI 6	#2	area	charcoal	63.60		0.00	1.40	3.77	0.25	0.00	0.16		0.52					30.30				19.09		0.00	0.71	1.98	0.14	0.00	0.10		0.39					31.74				54.16
					O	Na	Mg	Al	Si	P	S	Cl	K	Ca	Ti	V	Cr	Mn	Fe	Ni	Cu	Ba	O	Na	Mg	Al	Si	P	S	Cl	K	Ca	Ti	V	Cr	Mn	Fe	Ni	Cu	Ba	total
C1	SOI 1	#1	area	typical	58.66	0.00	0.59	3.14	11.85	0.09	0.07		0.64	1.80	0.10			0.08	22.98				32.21	0.00	0.49	2.90	11.43	0.10	0.07		0.87	2.47	0.16			0.16	44.06				94.92
C1	SOI 2	#1	area	typical	58.60	0.27	0.38	3.88	12.08	0.11	0.00	0.00	1.06	1.76	0.09			0.09	21.68				35.14	0.23	0.34	3.92	12.72	0.13	0.00	0.00	1.55	2.65	0.16			0.19	45.37				102.40
C1	SOI 2	#2	point	ol inner	58.28		1.03	0.14	13.67					0.78				0.09	26.02				30.80		0.83	0.12	12.68					1.04				0.16	47.99				93.61
C1	SOI 2	#3	point	ol inner	58.91		1.29	0.18	13.56					0.77				0.13	25.17				31.17		1.04	0.16	12.60					1.02				0.23	46.49				92.70
C1	SOI 2	#4	point	ol inner	58.31		1.41	0.16	13.71					0.74				0.08	25.60				31.52		1.16	0.14	13.01					1.00				0.15	48.30				95.28
C1	SOI 2	#5	point	ol inner	58.24		1.24	0.16	13.74					0.73				0.11	25.78				31.97		1.03	0.15	13.24					1.01				0.20	49.39				96.99
C1	SOI 2	#6	point	ol outer	58.48		0.88		13.77					0.91				0.16	25.80				33.43		0.76		13.82					1.31				0.31	51.49				101.13
C1	SOI 2	#7	point	ol inner	58.47		2.00		13.63					0.58				0.15	25.16				28.79		1.50		11.78					0.72				0.26	43.25				86.30

C1	SOI 2	#8	point	ol inner	58.83		1.20	0.11	13.67					0.77	0.00			0.12	25.29				38.39		1.19	0.12	15.66					1.26	0.00			0.27	57.59				114.48
C1	SOI 3	#1	area	typical	58.66		0.27	4.49	12.36				1.59	1.78	0.11			0.09	20.66				35.64		0.25	4.60	13.18				2.37	2.71	0.19			0.19	43.81				102.94
C1	SOI 3	#2	point	ol core	58.24		1.71	0.16	13.93					0.62				0.15	25.19				38.95		1.73	0.19	16.36					1.04				0.35	58.81				117.42
C1	SOI 3	#3	point	ol core	57.97		1.66	0.18	13.82					0.66				0.12	25.58				37.22		1.62	0.20	15.57					1.06				0.27	57.33				113.27
C1	SOI 3	#4	point	ol outer	58.32		0.59	0.11	14.01					1.17				0.16	25.64				36.03		0.55	0.12	15.20					1.82				0.34	55.29				109.34
C1	SOI 3	#5	point	glass	61.69	0.80		8.08	13.36	0.41	0.13		0.84	7.04	0.09				7.57				43.23	0.81		9.54	16.44	0.55	0.18		1.44	12.36	0.18				18.52				103.25
C1	SOI 3	#6	point	glass	60.88	0.79	0.00	8.68	13.23	0.48	0.16		0.88	7.03	0.13				7.74				38.65	0.72	0.00	9.30	14.74	0.59	0.20		1.37	11.18	0.25				17.16				94.15
C1	SOI 3	#7	point	ol 2	58.42		0.61	0.15	13.77					1.55				0.00	25.49				26.81		0.43	0.12	11.09					1.78				0.00	40.83				81.05
C1	SOI 4	#1	area	OL2/LW	58.93		0.28	4.57	14.94				3.10	0.93				0.00	17.25				33.94		0.25	4.44	15.10				4.36	1.34				0.00	34.67				94.09
C1	SOI 4	#2	area	OL3/Glass	59.93	0.43	0.00	4.29	13.68	0.21			0.63	5.30	0.07			0.00	15.46				38.89	0.40	0.00	4.70	15.59	0.27			0.99	8.61	0.13			0.00	35.03				104.61
C1	SOI 4	#3	point	rhönite	60.71			10.02	10.45	0.15				5.60	0.26				12.83				38.58			10.74	11.66	0.18				8.91	0.49				28.45				99.01
C1	SOI 4	#4	point	rhönite	61.28			10.13	10.54	0.10				5.36	0.30				12.28				43.38			12.10	13.10	0.13				9.51	0.63				30.35				109.20
C1	SOI 4	#5	point	rhönite	60.68			10.51	10.75	0.16			0.10	5.66	0.16				11.96				37.41			10.93	11.64	0.20			0.15	8.75	0.30				25.74				95.11
C1	SOI 4	#6	point	glass	61.23	0.66		8.20	14.20	0.49			0.82	7.80					6.61				37.94	0.59		8.57	15.44	0.58			1.24	12.10					14.29				90.76
C1	SOI 4	#7	point	glass	62.09	0.84		8.42	13.41	0.43	0.18		0.75	7.26	0.09				6.53				45.99	0.90		10.51	17.43	0.61	0.27		1.36	13.47	0.21				16.88				107.65
C1	SOI 4	#8	point	glass	60.59	0.77		8.50	13.75	0.36	0.14		0.93	7.22	0.11				7.63				41.29	0.75		9.76	16.45	0.48	0.19		1.55	12.32	0.23				18.15				101.17
C1	SOI 4	#9	point	glass	60.72	0.46		6.91	12.01	0.53	0.13		0.28	7.29	0.08				11.60				36.64	0.40		7.04	12.72	0.62	0.15		0.41	11.02	0.15				24.42				93.56
C1	SOI 4	#10	point	glass	61.30	0.76		9.08	13.68	0.29	0.16		0.89	7.34	0.10				6.41				40.75	0.72		10.18	15.96	0.38	0.21		1.44	12.22	0.20				14.86				96.93
C1	SOI 4	#11	point	ol 2	57.94		0.58	0.15	13.96					1.59				0.11	25.68				31.61		0.48	0.13	13.37					2.17				0.20	48.91				96.87
C1	SOI 4	#12	point	ol 2	58.12		0.69	0.18	13.73					1.45				0.11	25.71				31.84		0.58	0.17	13.21					1.99				0.21	49.17				97.16
C1	SOI 4	#13	point	ol 2	58.53		0.63	0.18	13.62				0.05	1.42				0.13	25.43				31.02		0.51	0.16	12.67				0.07	1.89				0.24	47.04				93.60
C1	SOI 4	#14	point	ol2?	57.55		0.40	0.12	14.24		0.00		0.10	1.79				0.00	25.79				31.79		0.34	0.12	13.81		0.00		0.14	2.48				0.00	49.73				98.39
C1	SOI 4	#15	point	ol2?	58.65		0.47	0.18	13.72					1.72				0.10	25.17				33.76		0.41	0.17	13.86					2.47				0.21	50.57				101.46
C1	SOI 4	#16	point	ol 3	58.81		0.23	0.22	13.68					3.71				0.11	23.22				35.27		0.21	0.22	14.40					5.58				0.23	48.61				104.54
C1	SOI 4	#17	point	ol2-3	57.88		0.43	0.12	13.96					1.87				0.11	25.62				32.48		0.36	0.12	13.76					2.63				0.22	50.19				99.76
C1	SOI 4	#18	point	ol2-3	58.77		0.27	0.18	13.65					2.70				0.08	24.34				33.33		0.24	0.17	13.59					3.84				0.16	48.19				99.54
C1	SOI 4	#19	point	rhönite	60.73			10.47	10.21	0.15				5.57	0.43				12.45				40.18			11.69	11.86	0.19				9.23	0.85				28.74				102.74
C1	SOI 4	#20	point	ol2-3	59.75			0.18	13.35					6.89				0.10	19.73				36.96			0.18	14.50					10.68				0.22	42.61				105.14
C1	SOI 4	#21	point	leucite	61.67	0.21		9.81	19.54				7.79						0.99				44.28	0.21		11.87	24.62				13.67						2.47				97.13
C1	SOI 4	#22	point	leucite	61.45	0.26		9.82	19.42				8.54						0.51				42.50	0.26		11.46	23.58				14.43						1.22				93.45
C1	SOI 4	#23	point	leucite	61.84	0.35		9.65	19.56				7.88						0.72				49.99	0.40		13.16	27.76				15.58						2.04				108.93
					O	Na	Mg	Al	Si	P	S	Cl	K	Ca	Ti	V	Cr	Mn	Fe	Ni	Cu	Ba	O	Na	Mg	Al	Si	P	S	Cl	K	Ca	Ti	V	Cr	Mn	Fe	Ni	Cu	Ba	total
C2	SOI 1	#1	area	typical	57.12	0.00	0.85	2.11	11.00	0.16			0.18	1.45	0.00			0.09	27.04				30.67	0.00	0.69	1.91	10.37	0.17			0.23	1.96	0.00			0.16	50.67				96.83
C2	SOI 2	#1	area	typical	55.31	0.36	0.76	2.56	12.94	0.15			1.25	2.40	0.08			0.10	24.08				31.64	0.30	0.66	2.47	12.99	0.17			1.75	3.44	0.14			0.19	48.08				101.84
C2	SOI 3	#1	area	typical	55.89	0.00	0.73	2.63	13.08	0.11			1.16	2.50	0.08			0.00	23.82				31.09	0.00	0.62	2.46	12.78	0.12			1.58	3.48	0.13			0.00	46.26				98.52
C2	SOI 4	#1	point	ol outer	55.99		1.26	0.26	14.71					1.68				0.12	25.97				30.97		1.06	0.24	14.28					2.33				0.23	50.15				99.27
C2	SOI 4	#2	point	ol inner	56.52		1.84	0.37	14.35				0.16	1.28				0.10	25.37				31.67		1.57	0.35	14.12				0.22	1.79				0.20	49.62				99.54
C2	SOI 4	#3	point	ol inner	56.59		1.73	0.37	14.34				0.20	1.31				0.12	25.34				31.76		1.48	0.35	14.13				0.27	1.84				0.23	49.64				99.70
C2	SOI 4	#4	point	ol inner	56.47		2.13	0.22	14.31				0.12	1.17				0.14	25.44				31.50		1.80	0.21	14.02				0.16	1.64				0.28	49.55				99.16
C2	SOI 4	#5	point	ol outer	56.62		1.35	0.19	14.41		0.00			1.55				0.12	25.76				31.27		1.13	0.17	13.97		0.00			2.14				0.23	49.65				98.56
C2	SOI 4	#6	point	ol margin	58.32		0.48	1.46	14.21	0.21	0.00		1.06	3.23				0.11	20.92				34.70		0.43	1.47	14.84	0.24	0.00		1.53	4.82				0.22	43.45				101.71
C2	SOI 4	#7	point	glass	59.17	0.39	0.00	5.39	15.82	0.31	0.11		3.52	5.44	0.12				9.74				38.36	0.36	0.00	5.90	18.00	0.39	0.14		5.57	8.84	0.22				22.04				99.82
C2	SOI 4	#8	point	glass	58.14	0.46		6.32	15.92	0.33	0.10	0.00	3.52	5.45	0.15			0.07	9.55				37.14	0.42		6.81	17.86	0.41	0.13	0.00	5.49	8.72	0.28			0.15	21.31				98.72
C2	SOI 5	#1	area	typical	55.92		0.80	2.67	11.44	0.17			0.59	1.83	0.07			0.11	26.40				29.09		0.64	2.35	10.45	0.17			0.75	2.39	0.10			0.20	47.93				94.05
C2	SOI 6	#1	area	typical	58.12		0.88	2.17	10.03	0.14	0.00			1.05	0.11			0.00	27.51				29.74		0.68	1.87	9.01	0.14	0.00			1.34	0.16			0.00	49.15				92.11
C2	SOI 7	#1	area	typical	55.71	0.00	0.79	2.53	13.01				1.25	2.42	0.00		0.00	0.11	24.17				30.10	0.00	0.65	2.30	12.34				1.66	3.27	0.00		0.00	0.21	45.59				96.13
C2	SOI 8	#1	point	ol outer	57.22		1.11	0.31	14.11				0.12	1.79				0.09	25.25				32.22		0.95	0.30	13.95				0.16	2.53				0.18	49.62				99.90
C2	SOI 8	#2	point	ol inner	55.94		2.19	0.36	14.66				0.10	1.01				0.14	25.60				30.98		1.84	0.34	14.26				0.13	1.40				0.27	49.50				98.73
C2	SOI 8	#3	point	ol inner	56.40		2.09	0.21	14.39					1.01				0.09	25.80				31.38		1.77	0.20	14.06					1.41				0.18	50.12				99.11
C2	SOI 8	#4	point	ol outer	55.98		1.33	0.28	14.96		0.00		0.00	1.25				0.10	26.11				30.84		1.11	0.26	14.47		0.00		0.00	1.72				0.18	50.22				98.81
C2	SOI 8	#5	point	glass	58.07	0.46	0.00	6.98	16.10	0.37	0.09		3.73	4.25	0.10			0.00	9.86				36.23	0.41	0.00	7.34	17.63	0.44	0.12		5.68	6.65	0.18			0.00	21.47				96.16
C2	SOI 8	#6	point	glass	59.30	0.34	0.00	6.96	15.51	0.36	0.06		3.20	5.39	0.13			0.00	8.75				38.20	0.31	0.00	7.56	17.54	0.45	0.08		5.04	8.70	0.26			0.00	19.67				97.79
C2	SOI 8	#7	area	glass/late ol	58.37	0.43		4.68	15.66	0.26	0.00		3.08	5.66	0.10			0.00	11.76				37.00	0.39		5.01	17.43	0.32	0.00		4.77	8.98	0.20			0.00	26.01				100.11
					O	Na	Mg	Al	Si	P	S	Cl	K	Ca	Ti	V	Cr	Mn	Fe	Ni	Cu	Ba	O	Na	Mg	Al	Si	P	S	Cl	K	Ca	Ti	V	Cr	Mn	Fe	Ni	Cu	Ba	total
D1	SOI 2	#1	area	typical	54.88	0.35	0.49	2.57	10.60	0.14	0.00		1.02	1.65	0.00		0.00	0.00	28.30				29.60	0.27	0.40	2.34	10.04	0.15	0.00		1.34	2.23	0.00		0.00	0.00	53.28				99.64
D1	SOI 3	#1	area	typical	55.01	0.32	0.54	2.30	10.52	0.15	0.00		1.04	1.67	0.07		0.00	0.00	28.38				29.35	0.24	0.44	2.07	9.86	0.15	0.00		1.36	2.23	0.11		0.00	0.00	52.86				98.68
D1	SOI 4	#1	point	ol outer	56.26	0.00	0.56	0.90	15.03				0.23	1.93				0.12	24.97				31.80	0.00	0.49	0.86	14.91				0.32	2.74				0.23	49.26				100.59
D1	SOI 4	#2	point	ol inner	57.04		1.34	0.14	13.90					0.75				0.11	26.72				31.66		1.13	0.13	13.54					1.04				0.21	51.76				99.48
D1	SOI 4	#3	point	ol inner	57.45		1.41	0.24	13.82					0.75				0.11	26.23				31.96		1.19	0.22	13.50					1.05				0.20	50.93				99.05
D1	SOI 4	#4	point	ol inner	57.78		1.32	0.73	13.99	0.17			0.37	1.21				0.10	24.32				33.07		1.15	0.70	14.06	0.19			0.52	1.73				0.21	48.58				100.22
D1	SOI 4	#5	point	ol inner	54.74		1.17	0.43	10.39				0.08	0.66				0.08	32.45				29.76		0.97	0.40	9.91				0.11	0.90				0.15	61.57				103.76
D1	SOI 4	#6	point	ol inner	56.81		1.27	0.19	14.15				0.15	0.93				0.07	26.43				31.10		1.05	0.18	13.60				0.21	1.27				0.14	50.51				98.06
D1	SOI 4	#7	point	ol inner	57.69		0.81	0.51	13.74	0.10	0.00		0.22	1.48				0.09	25.35				32.44		0.70	0.48	13.56	0.11	0.00		0.31	2.08				0.17	49.76				99.60
D1	SOI 4	#8	point	ol inner	57.32		0.72	0.28	14.06				0.12	1.46				0.12	25.91				31.93		0.61	0.26	13.75				0.17	2.03				0.23	50.39				99.38
D1	SOI 4	#9	point	ol outer	56.91	0.27	0.58	1.83	14.20	0.11			0.89	1.88				0.14	23.20				31.45	0.21	0.49	1.70	13.77	0.12			1.21	2.61				0.26	44.75				96.58
D1	SOI 4	#10	point	ol outer	57.73		0.62	0.60	13.86	0.18			0.25	1.74				0.13	24.90				32.46		0.53	0.57	13.68	0.19			0.34	2.45				0.25	48.87				99.33
D1	SOI 4	#11	point	glass	59.58	0.50	0.00	6.31	15.65	0.45	0.12		3.71	4.96	0.05			0.00	8.67				38.61	0.46	0.00	6.90	17.80	0.57	0.15		5.88	8.05	0.10			0.00	19.62				98.13
D1	SOI 4	#12	point	glass	59.28	0.50	0.00	7.18	15.53	0.48	0.15		3.46	4.69	0.00				8.72				38.25	0.47	0.00	7.82	17.59	0.59	0.20		5.46	7.58	0.00				19.63				97.60
D1	SOI 4	#13	point	ol outer	57.33		0.98	0.11	13.99					1.19				0.08	26.32				31.49		0.82	0.11	13.48					1.64				0.15	50.46				98.15

D1	SOI 5	#1	area	typical	55.32	0.00	0.64	2.17	9.89				0.78	1.42	0.00			0.07	29.72				29.20	0.00	0.51	1.93	9.16				1.01	1.87	0.00			0.13	54.75				98.56
D1	SOI 6	#1	area	typical	55.24	0.00	0.67	2.15	10.13	0.15	0.07		0.70	1.37	0.00			0.00	29.52				29.22	0.00	0.54	1.91	9.41	0.15	0.08		0.91	1.82	0.00			0.00	54.52				98.56
D1	SOI 7	#1	point	ol outer	60.48		0.80	1.05	13.15	0.15			1.10	2.67				0.09	20.51				35.87		0.72	1.05	13.69	0.17			1.59	3.97				0.19	42.46				99.71
D1	SOI 7	#2	point	ol inner	57.53		1.48	0.24	13.65					0.80				0.12	26.18				31.96		1.25	0.22	13.31					1.12				0.23	50.77				98.86
D1	SOI 7	#3	point	ol inner	57.30		1.29	0.45	13.94				0.16	0.86				0.12	25.88				31.55		1.08	0.42	13.48				0.21	1.18				0.23	49.75				97.90
D1	SOI 7	#4	point	ol inner	57.31		1.31	0.24	13.79				0.08	0.88				0.09	26.29				31.45		1.09	0.22	13.29				0.11	1.21				0.16	50.36				97.90
D1	SOI 7	#5	point	ol inner	56.06		1.46	0.26	14.30	0.15				0.86	0.00			0.10	26.81				30.23		1.19	0.23	13.54	0.16				1.16	0.00			0.18	50.47				97.18
D1	SOI 7	#6	point	ol inner	58.40		1.24	0.39	13.39				0.35	1.26					24.97				32.76		1.06	0.37	13.18				0.47	1.77					48.89				98.51
D1	SOI 7	#7	point	ol inner	57.85		1.20	0.32	13.72				0.15	0.96				0.00	25.80				32.22		1.02	0.30	13.41				0.21	1.34				0.00	50.16				98.67
D1	SOI 7	#8	point	ol outer	55.99		0.52	0.19	14.70					1.58				0.13	26.89				29.97		0.42	0.18	13.82					2.12				0.24	50.25				96.99
D1	SOI 7	#9	point	oxide dendrite in glass	55.69	0.28	0.00	4.29	7.08	0.16			2.02	1.03	0.21				29.24				31.14	0.22	0.00	4.05	6.95	0.17			2.76	1.45	0.35				57.07				104.16
D1	SOI 7	#10	point	small oxide	55.55	0.32	0.19	3.68	6.26	0.15	0.00		1.66	0.97	0.23				30.97				30.36	0.25	0.16	3.40	6.01	0.16	0.00		2.22	1.33	0.38				59.07				103.33
D1	SOI 7	#11	point	glass	59.35	0.58		8.08	14.08	0.52	0.23		3.31	5.17	0.12				8.56				38.06	0.54		8.74	15.85	0.64	0.30		5.19	8.31	0.24				19.16				97.03
D1	SOI 7	#12	point	W	52.14			0.48	0.12						0.11				47.15				23.70			0.37	0.10						0.15				74.83				99.14
D1	SOI 7	#13	point	small oxide	54.42		0.33	1.53	4.94				0.53	0.59	0.13				37.52				27.01		0.25	1.28	4.31				0.64	0.73	0.19				65.01				99.43
					O	Na	Mg	Al	Si	P	S	Cl	K	Ca	Ti	V	Cr	Mn	Fe	Ni	Cu	Ba	O	Na	Mg	Al	Si	P	S	Cl	K	Ca	Ti	V	Cr	Mn	Fe	Ni	Cu	Ba	total
D2	SOI 39	#1	area	slag by iron	57.16	0.36	0.57	2.38	9.66	0.16	0.00		1.35	1.29	0.00			0.00	27.06				34.71	0.31	0.53	2.44	10.30	0.19	0.00		2.01	1.97	0.00			0.00	57.35				109.81
D2	SOI 39	#2	point	glass	60.45	0.27	0.53	3.33	14.98	0.23	0.09		2.27	2.69	0.00			0.07	15.10				42.44	0.27	0.57	3.95	18.46	0.31	0.12		3.89	4.73	0.00			0.18	37.00				111.92
D2	SOI 39	#3	area	crust on iron	64.10			0.00	0.00		0.14	0.00							35.75				33.62			0.00	0.00		0.15	0.00							65.45				99.21
D2	SOI 39	#4	area	bright oxide	59.96			0.00			0.00	0.07							39.96				28.11			0.00			0.00	0.08							65.39				93.58
D2	SOI 39	#5	area	soft rust	51.67							0.56							47.77				16.77							0.40							54.11				71.29
D2	SOI 40	#1	point	etched i/s	60.50	0.32	0.73	3.03	14.70	0.29	0.08		2.06	1.85	0.00			0.12	16.32				40.25	0.31	0.74	3.40	17.17	0.37	0.10		3.35	3.08	0.00			0.28	37.89				106.92
D2	SOI 40	#2	point	etched i/s	60.50	0.31	0.76	3.10	14.90	0.25	0.00		2.08	1.58	0.00			0.07	16.46				39.52	0.29	0.75	3.42	17.08	0.32	0.00		3.33	2.58	0.00			0.15	37.54				104.96
D2	SOI 40	#3	point	etched i/s	61.01	0.27	0.62	3.27	15.15	0.24	0.00		2.38	1.98	0.00			0.08	15.00				40.93	0.26	0.64	3.70	17.85	0.31	0.00		3.90	3.34	0.00			0.17	35.13				106.22
D2	SOI 40	#4	point	ang W og	54.20		0.43	0.41	0.43				0.09	0.07	0.10			0.00	44.28				27.08		0.32	0.35	0.37				0.11	0.09	0.14			0.00	77.22				105.69
D2	SOI 40	#5	point	ang W marg	53.89		0.33	0.36	0.00				0.00		0.10				45.32				26.42		0.25	0.29	0.00				0.00		0.15				77.56				104.67
D2	SOI 40	#6	point	ang W core	53.92		0.43	0.32	0.00						0.08				45.25				26.29		0.32	0.27	0.00						0.11				76.99				103.98
D2	SOI 40	#7	point	W dendrite	53.85		0.33	0.26	0.16				0.08	0.07	0.00			0.10	45.15				26.34		0.24	0.21	0.14				0.09	0.09	0.00			0.16	77.09				104.37
D2	SOI 40	#8	point	large W marg	54.27		0.39	0.28	0.25				0.08	0.00	0.07				44.65				26.98		0.30	0.23	0.22				0.10	0.00	0.11				77.49				105.43
D2	SOI 40	#9	point	large W core	54.00		0.41	0.27	0.14						0.08				45.09				26.93		0.31	0.23	0.12						0.12				78.49				106.20
D2	SOI 40	#10	point	large W core	53.56		0.47	0.29	0.13						0.00			0.00	45.55				26.45		0.35	0.24	0.11						0.00			0.00	78.54				105.70
D2	SOI 40	#11	point	small W	53.75		0.36	0.39	0.25				0.00	0.07	0.00			0.13	45.05				26.89		0.27	0.33	0.22				0.00	0.09	0.00			0.23	78.67				106.70
D2	SOI 41	#1	area	slag by iron	59.24		0.63	1.35	4.81	0.00	0.00	0.00	0.18	0.33	0.00			0.08	33.38				32.99	0.53	1.27	4.70	0.00	0.00	0.00		0.24	0.45	0.00			0.16	64.89				105.23
D2	SOI 41	#2	area	slag by iron	59.55		0.75	2.29	8.52	0.11		0.36		0.64				0.13	27.65				37.59	0.72	2.44	9.45	0.13		0.50			1.02				0.28	60.94				113.06
D2	SOI 41	#3	area	iron bleb?	68.80			0.34	0.69	0.09	0.00	0.14		0.59					29.35				38.17		0.32	0.68	0.09	0.00	0.17			0.83					56.84				97.09
D2	SOI 41	#4	area	slag by iron	60.95		0.64	1.34	6.32			0.32		0.41	0.00			0.00	30.02				32.29	0.52	1.20	5.87			0.37			0.54	0.00			0.00	55.51				96.29
D2	SOI 42	#1	area	iron bleb?	69.01		0.00	0.25	0.74			0.17		0.69					29.14				37.76		0.00	0.23	0.71			0.21		0.94					55.66				95.52
D2	SOI 42	#2	point	ol mixed	60.68		1.54	0.83	11.90	0.12		0.16		0.73				0.18	23.85				37.24		1.44	0.86	12.82	0.14		0.22		1.12				0.39	51.11				105.35
D2	SOI 42	#3	point	ol mixed	60.49		1.51	0.64	12.98	0.12		0.09		0.74				0.16	23.26				39.78		1.51	0.71	14.98	0.16		0.14		1.22				0.36	53.40				112.26
D2	SOI 42	#4	point	glass	60.56		0.30	10.01	8.60	0.49	0.00	1.77		1.68	0.00			0.11	16.48				37.32		0.28	10.40	9.30	0.58	0.00	2.42		2.60	0.00			0.23	35.45				98.59
D2	SOI 42	#5	point	glass	67.23		0.21	8.09	7.12	0.42	0.08	1.45		0.89					14.51				47.17		0.22	9.57	8.76	0.57	0.12	2.25		1.57					35.53				105.77
D2	SOI 42	#6	point	glass	66.38	0.00	0.14	5.69	4.93	0.17	0.00	0.74		0.75					21.21				41.35	0.00	0.13	5.98	5.39	0.21	0.00	1.02		1.17					46.12				101.37
D2	SOI 42	#7	point	o/g on bleb	53.97		0.38	0.26											45.39				27.71		0.30	0.22											81.35				109.59
D2	SOI 42	#8	point	inner crust on bleb	57.00		0.27	0.72						0.08	0.12				41.81				29.48		0.22	0.63						0.11	0.18				75.48				106.10
D2	SOI 42	#9	point	weathered in bleb	55.01		0.00	0.30	0.65		0.00	0.38		3.17					40.49				22.72		0.00	0.21	0.47		0.00	0.35		3.28					58.37				85.40
D2	SOI 42	#10	point	weathered in bleb	60.58		0.33	0.56	0.88		0.00	0.74		3.37				0.00	33.53				27.53		0.23	0.43	0.70		0.00	0.75		3.84				0.00	53.18				86.67
D2	SOI 42	#11	point	hole in bleb	57.14				0.44		0.36	0.44		9.42					32.20				13.30				0.18		0.17	0.23		5.49					26.17				45.54
D2	SOI 42	#12	point	iron in bleb															100.00																		93.25				93.25
D2	SOI 42	#13	point	iron in bleb	22.53			0.00	0.21		0.00	0.00		0.19					77.07				7.63			0.00	0.13		0.00	0.00		0.16					91.17				99.09
D2	SOI 42	#14	point	mixed ol	60.05		1.61	0.83	12.64	0.15		0.16		0.75				0.13	23.68				39.25		1.60	0.91	14.51	0.19		0.23		1.24				0.29	54.02				112.22
D2	SOI 42	#15	point	mixed ol	60.16		1.67	0.95	11.54			0.10		0.65				0.17	24.76				37.01		1.56	0.98	12.46			0.14		1.00				0.37	53.18				106.70
D2	SOI 42	#16	point	iron bleb matrix	70.12		0.00	0.23	0.65			0.10		0.07					28.83				42.42		0.00	0.24	0.69			0.13		0.11					60.88				104.47
D2	SOI 42	#17	point	iron bleb matrix	69.52			0.26	0.86			0.16		0.12	0.00				29.09				41.33			0.26	0.89			0.21		0.18	0.00				60.38				103.24
D2	SOI 42	#18	point	iron bleb matrix	70.78			0.00	1.21			0.07		0.10					27.84				45.49			0.00	1.36			0.10		0.16					62.46				109.56
D2	SOI 43	#1	area	SI	59.48		0.28	1.67	5.26	0.00		0.22		0.23	0.08			0.00	32.80				37.03		0.26	1.75	5.74	0.00		0.30		0.36	0.14			0.00	71.30				116.89
D2	SOI 43	#2	area	SI	56.59	0.31	0.65	2.02	8.32	0.14			1.06	1.01	0.00			0.14	29.75				32.62	0.26	0.57	1.97	8.42	0.15			1.50	1.47	0.00			0.27	59.88				107.10
D2	SOI 43	#3	area	SI	56.18	0.00	0.76	2.05	6.99	0.11			0.82	0.80	0.00			0.11	32.20				24.91	0.00	0.51	1.53	5.44	0.09			0.88	0.88	0.00			0.17	49.84				84.26
D2	SOI 44	#1	area	SI	57.77	0.00	0.75	2.23	9.17	0.16	0.08	0.00	0.90	1.04	0.06			0.18	27.65				32.52	0.00	0.64	2.12	9.06	0.17	0.09	0.00	1.23	1.47	0.11			0.36	54.33				102.09
D2	SOI 44	#2	area	weathered iron	66.25			0.00	0.10	0.00	0.24	0.08							33.34				32.41			0.00	0.08	0.00	0.23	0.08							56.94				89.75
D2	SOI 44	#3	area	weathered iron	60.60			0.00	0.13		0.23								39.04				34.29			0.00	0.13		0.26								77.12				111.80
D2	SOI 44	#4	area	weathered iron	64.62			0.44	0.27	0.08	0.17	0.06							34.35				35.03			0.40	0.26	0.09	0.18	0.08							65.00				101.04
D2	SOI 44	#5	area	weathered iron	70.04						0.28	0.10							29.58				38.89						0.31	0.13							57.35				96.68
D2	SOI 45	#1	area	slag nr iron	56.88	0.00	0.65	1.57	5.92	0.12	0.00	0.00	0.60	0.80	0.08			0.10	33.28				27.28	0.00	0.47	1.27	4.99	0.11	0.00	0.00	0.70	0.96	0.12			0.16	55.70				91.76
D2	SOI 45	#2	area	slag nr iron	56.49	0.00	0.59	1.54	5.92		0.00	0.08	0.64	0.80	0.00			0.08	33.85				30.59	0.00	0.48	1.41	5.63		0.00	0.10	0.85	1.09	0.00			0.15	64.00				104.30
					O	Na	Mg	Al	Si	P	S	Cl	K	Ca	Ti	V	Cr	Mn	Fe	Ni	Cu	Ba	O	Na	Mg	Al	Si	P	S	Cl	K	Ca	Ti	V	Cr	Mn	Fe	Ni	Cu	Ba	total
E1	SOI 1	#1	area	typical	57.61	0.00	0.54	2.11	9.54		0.08		0.73	1.29	0.06			0.00	28.04				32.01	0.00	0.45	1.98	9.31		0.09		0.99	1.79	0.10			0.00	54.39				101.11
E1	SOI 2	#1	area	late ol-glass	60.36	1.08	0.00	4.33	13.85	0.29	0.15		1.11	5.58	0.00			0.10	13.15				39.87	1.02	0.00	4.82	16.07	0.37	0.20		1.79	9.23	0.00			0.23	30.31				103.92
E1	SOI 2	#2	area	late ol/W-glass	60.81	0.24	0.15	4.87	14.56	0.22	0.00		3.69	2.66	0.00				12.79				38.17	0.22	0.14	5.16	16.04	0.27	0.00		5.67	4.19	0.00				28.02				97.87
E1	SOI 2	#3	area	L-W	59.59	0.32	0.00	8.23	15.77				6.36						9.73				39.39	0.30	0.00	9.18	18.30				10.28						22.45				99.90
E1	SOI 2	#4	point	ol outer	59.58		0.80	0.13	13.25					1.07				0.16	25.00				33.88		0.69	0.13	13.23					1.53				0.31	49.64				99.42

E1	SOI 2	#5	point	ol inner	59.07		1.33	0.15	13.38					0.68				0.12	25.26				33.56		1.15	0.14	13.35					0.97				0.24	50.09				99.51
E1	SOI 2	#6	point	ol core	57.43		1.42	0.18	13.96					0.68				0.14	26.19				31.34		1.18	0.16	13.38					0.93				0.26	49.90				97.14
E1	SOI 2	#7	point	ol core	59.42		1.44	0.16	13.15					0.67				0.14	25.01				34.79		1.28	0.15	13.51					0.99				0.29	51.11				102.13
E1	SOI 2	#8	point	ol inner	59.97		1.17	0.20	12.99					0.70				0.13	24.84				35.09		1.04	0.20	13.34					1.03				0.27	50.72				101.69
E1	SOI 2	#9	point	ol outer	59.04		0.92	0.12	13.43					1.02				0.17	25.31				34.01		0.81	0.11	13.59					1.47				0.33	50.89				101.22
E1	SOI 2	#10	point	late ol	60.06	0.21	0.43	0.76	12.94	0.17			0.19	3.20				0.11	21.93				36.74	0.19	0.40	0.79	13.90	0.20			0.28	4.90				0.23	46.82				104.44
E1	SOI 2	#11	point	late ol	59.45		0.26	0.19	13.29	0.16				4.56				0.16	21.92				35.49		0.24	0.19	13.92	0.19				6.83				0.33	45.67				102.86
E1	SOI 2	#12	point	glass	61.66	1.94		7.42	13.68	0.49	0.40	0.13	1.08	6.24	0.14				6.82				43.50	1.97		8.82	16.94	0.68	0.56	0.20	1.87	11.02	0.30				16.79				102.65
E1	SOI 2	#13	point	glass	61.28	1.90		7.53	13.48	0.55	0.33	0.09	0.95	6.55	0.17				7.16				42.86	1.91		8.88	16.56	0.74	0.46	0.14	1.63	11.48	0.35				17.49				102.50
E1	SOI 2	#14	point	glass	60.05	1.96		7.03	13.73	0.41	0.24	0.11	1.39	6.15	0.07				8.87				40.69	1.91		8.04	16.33	0.54	0.32	0.17	2.29	10.44	0.13				20.97				101.83
E1	SOI 2	#15	point	glass	61.20	2.43		7.48	14.98	0.33	0.11		1.64	5.14	0.00				6.68				41.21	2.35		8.49	17.71	0.44	0.14		2.70	8.67	0.00				15.71				97.42
E1	SOI 2	#16	point	ol margin	60.03	0.00	0.42	0.16	13.02	0.14			0.00	2.42				0.09	23.73				36.52	0.00	0.39	0.16	13.91	0.17			0.00	3.69				0.18	50.39				105.41
E1	SOI 2	#17	point	ol margin	60.57	0.00	0.36	0.46	13.00		0.00		0.12	3.16			0.00	0.11	22.22				37.51	0.00	0.34	0.48	14.13		0.00		0.18	4.91			0.00	0.24	48.04				105.82
E1	SOI 3	#1	point	late ol	59.75	0.00	0.42	0.23	13.15	0.15			0.16	4.07				0.13	21.95				34.89	0.00	0.38	0.22	13.48	0.16			0.23	5.96				0.25	44.73				100.30
E1	SOI 3	#2	point	late ol	60.70	0.29	0.20	0.63	12.90	0.19			0.13	6.17				0.10	18.68				37.92	0.26	0.19	0.66	14.15	0.23			0.20	9.66				0.21	40.75				104.24
E1	SOI 3	#3	point	late ol	60.32		0.21	1.05	13.75	0.24			0.68	5.43				0.09	18.23				38.07		0.20	1.12	15.23	0.30			1.05	8.58				0.19	40.15				104.89
E1	SOI 3	#4	point	L mixed	60.46	0.60	0.00	7.33	15.85	0.28	0.14	0.00	3.70	4.39	0.13				7.12				37.10	0.53	0.00	7.58	17.07	0.33	0.17	0.00	5.55	6.75	0.23				15.24				90.57
E1	SOI 3	#5	point	L mixed	63.50	0.93		7.34	14.78	0.23	0.13		4.00	3.33	0.13				5.62				41.80	0.88		8.15	17.08	0.29	0.17		6.44	5.49	0.25				12.91				93.47
E1	SOI 3	#6	point	glass	61.03	1.86		7.17	13.72	0.39	0.31	0.10	1.00	6.35	0.15				7.92				41.12	1.80		8.14	16.23	0.51	0.42	0.15	1.64	10.72	0.30				18.63				99.67
E1	SOI 4	#1	area	typical	57.20	0.00	0.59	2.13	8.96				0.77	1.14	0.00			0.11	29.10				31.34	0.00	0.49	1.96	8.62				1.03	1.56	0.00			0.21	55.65				100.87
E1	SOI 5	#1	area	typical	56.58	0.25	0.66	2.17	8.16				0.74	1.25				0.10	30.09				31.69	0.20	0.57	2.05	8.02				1.01	1.76				0.19	58.85				104.34
E1	SOI 6	#1	area	typical	57.51	0.34	0.56	2.39	8.99		0.00		0.80	1.14				0.08	28.20				31.85	0.27	0.47	2.24	8.74		0.00		1.08	1.58				0.14	54.51				100.88
E1	SOI 7	#1	point	glass	61.34	1.47	0.00	8.06	13.00	0.63	0.28	0.11	1.46	6.09	0.09			0.00	7.48				41.77	1.44	0.00	9.26	15.54	0.83	0.38	0.16	2.42	10.39	0.18			0.00	17.77				100.14
E1	SOI 7	#2	point	ol inner	60.19		1.56	0.30	13.00					0.75				0.13	24.08				35.02		1.38	0.29	13.28					1.09				0.27	48.91				100.24
E1	SOI 7	#3	point	ol inner	59.73		1.50	0.00	13.08					0.56				0.11	25.02				34.23		1.31	0.00	13.16					0.80				0.22	50.05				99.77
E1	SOI 7	#4	point	ol inner	59.92		1.14	0.14	13.08					0.80				0.12	24.80				34.53		1.00	0.13	13.24					1.16				0.24	49.89				100.18
E1	SOI 7	#5	point	ol inner	57.76		1.50	0.13	13.94					0.62				0.15	25.91				31.66		1.25	0.12	13.41					0.85				0.28	49.59				97.16
E1	SOI 7	#6	point	ol inner	56.38		1.70	0.19	14.14					0.65				0.18	26.78				29.94		1.37	0.17	13.18					0.86				0.33	49.65				95.50
E1	SOI 7	#7	point	ol margin	59.98		0.68	0.19	13.12					1.67				0.12	24.23				34.67		0.60	0.18	13.31					2.42				0.25	48.88				100.31
E1	SOI 7	#8	area	ol-rich i/s	58.59	1.26	0.17	4.56	13.73	0.29	0.12		1.32	5.25	0.08			0.06	14.57				35.30	1.09	0.16	4.63	14.53	0.34	0.15		1.94	7.93	0.14			0.13	30.65				96.98
E1	SOI 7	#9	point	ol margin	53.45	0.00	1.21	0.67	15.82		0.09		0.19	0.98				0.18	27.41				25.50	0.00	0.88	0.54	13.25		0.09		0.22	1.17				0.29	45.64				87.58
E1	SOI 7	#10	point	ol margin	58.94		0.47	0.43	13.79				0.21	2.91				0.15	23.09				32.65		0.40	0.40	13.41				0.28	4.04				0.28	44.64				96.11
E1	SOI 7	#11	area	L-W rich i/s	60.01	0.29		7.84	14.75				6.16						10.94				38.53	0.27		8.49	16.62				9.66						24.53				98.11
					O	Na	Mg	Al	Si	P	S	Cl	K	Ca	Ti	V	Cr	Mn	Fe	Ni	Cu	Ba	O	Na	Mg	Al	Si	P	S	Cl	K	Ca	Ti	V	Cr	Mn	Fe	Ni	Cu	Ba	total
E2	SOI 1	#1	area	typical	56.96	0.25	0.75	3.38	11.73		0.00	0.00	1.09	0.81	0.09			0.07	24.87				33.55	0.21	0.67	3.36	12.13		0.00	0.00	1.56	1.20	0.15			0.14	51.13				104.10
E2	SOI 2	#1	area	typical	56.19	0.41	0.62	3.88	12.11		0.08		1.22	0.89	0.00			0.13	24.47				31.71	0.33	0.53	3.69	12.00		0.09		1.68	1.26	0.00			0.24	48.21				99.76
E2	SOI 3	#1	point	ol inner	57.63		1.86	0.23	13.84					0.27				0.17	26.01				33.29		1.63	0.22	14.03					0.39				0.33	52.44				102.32
E2	SOI 3	#2	point	ol inner	57.12		1.94	0.17	14.13					0.20				0.18	26.25				32.63		1.69	0.17	14.17					0.28				0.35	52.35				101.64
E2	SOI 3	#3	point	ol inner	57.38		1.73	0.21	13.98					0.23				0.12	26.35				32.70		1.50	0.21	13.99					0.33				0.23	52.42				101.37
E2	SOI 3	#4	point	ol outer	57.57		0.67	0.30	13.89					0.36				0.08	27.14				32.51		0.57	0.29	13.77					0.51				0.15	53.50				101.30
E2	SOI 3	#5	point	ol outer	57.44		0.53	0.20	13.93				0.00	0.37				0.17	27.37				32.14		0.45	0.19	13.68				0.00	0.52				0.32	53.44				100.74
E2	SOI 3	#6	point	ol outer	57.65	0.00	0.67	0.42	13.66				0.00	0.40				0.14	27.06				32.39	0.00	0.57	0.40	13.47				0.00	0.57				0.26	53.07				100.74
E2	SOI 3	#7	point	glass	58.79	0.71		9.89	15.94	0.16	0.06	0.00	3.80	2.63	0.09			0.00	7.93				38.90	0.67		11.04	18.52	0.20	0.08	0.00	6.14	4.36	0.17			0.00	18.32				98.41
E2	SOI 3	#8	point	late ol	57.81		0.48	0.34	13.89					0.39				0.14	26.96				32.12		0.40	0.32	13.54					0.54				0.26	52.28				99.46
E2	SOI 3	#9	point	late ol	57.40		0.47	0.89	14.03				0.25	0.50	0.00			0.13	26.33				32.28		0.40	0.84	13.85				0.35	0.71	0.00			0.26	51.69				100.37
E2	SOI 3	#10	point	glass/late ol	58.13	0.57	0.00	5.37	14.90	0.12	0.07		2.15	1.73				0.08	16.88				36.37	0.51	0.00	5.67	16.37	0.15	0.08		3.28	2.71				0.18	36.86				102.18
E2	SOI 3	#11	point	glass/late ol	57.59	0.31	0.27	2.48	14.02				0.70	0.74	0.00			0.13	23.75				34.13	0.26	0.25	2.48	14.58				1.02	1.10	0.00			0.27	49.13				103.23
E2	SOI 3	#12	point	glass/late ol	58.44	0.27	0.23	3.54	14.50	0.09			1.30	0.91	0.00		0.05	0.00	20.66				35.89	0.24	0.22	3.67	15.63	0.11			1.96	1.40	0.00		0.10	0.00	44.28				103.48
E2	SOI 3	#13	point	glass	59.93	0.68	0.00	9.64	15.32	0.15	0.00		3.76	2.94	0.07			0.00	7.50				39.98	0.65	0.00	10.84	17.94	0.20	0.00		6.14	4.92	0.14			0.00	17.47				98.28
E2	SOI 4	#1	area	typical	55.70	0.35	0.66	3.70	12.16	0.00	0.00		1.20	0.88	0.00			0.15	25.20				31.03	0.28	0.56	3.47	11.89	0.00	0.00		1.64	1.23	0.00			0.29	49.01				99.41
E2	SOI 5	#1	area	typical	55.12	0.39	0.71	3.63	12.17		0.09		1.11	0.87	0.08			0.15	25.69				28.98	0.29	0.57	3.22	11.23		0.10		1.42	1.14	0.13			0.27	47.14				94.48
					O	Na	Mg	Al	Si	P	S	Cl	K	Ca	Ti	V	Cr	Mn	Fe	Ni	Cu	Ba	O	Na	Mg	Al	Si	P	S	Cl	K	Ca	Ti	V	Cr	Mn	Fe	Ni	Cu	Ba	total
F1	SOI 3	#1	area	typical	56.84	0.37	0.64	2.42	11.38		0.07		0.96	2.91	0.00			0.08	24.33				31.31	0.29	0.53	2.25	11.01		0.08		1.29	4.02	0.00			0.15	46.78				97.71
F1	SOI 3	#2	area	typical	57.04	0.00	0.62	2.39	11.22	0.00	0.07		0.89	2.91	0.08			0.11	24.67				28.45	0.00	0.47	2.01	9.82	0.00	0.07		1.09	3.64	0.11			0.19	42.96				88.82
F1	SOI 3	#3	area	typical	57.17	0.26	0.56	2.45	11.36	0.10	0.00		0.81	2.93	0.00			0.00	24.35				25.07	0.17	0.37	1.81	8.74	0.08	0.00		0.87	3.22	0.00			0.00	37.28				77.62
F1	SOI 4	#1	area	typical	57.25	0.34	0.54	2.23	11.30	0.00	0.00		0.99	2.94	0.09			0.00	24.31				34.80	0.30	0.50	2.28	12.06	0.00	0.00		1.48	4.47	0.16			0.00	51.58				107.62
F1	SOI 4	#2	area	typical	57.03	0.53	0.56	2.31	12.02		0.00		1.07	3.09	0.00			0.00	23.40				28.13	0.38	0.42	1.92	10.41		0.00		1.28	3.82	0.00			0.00	40.29				86.66
F1	SOI 5	#1	area	typical	57.26	0.26	0.53	2.43	10.92	0.13	0.00		0.90	3.15	0.07				24.34				35.38	0.23	0.50	2.53	11.85	0.16	0.00		1.36	4.87	0.14				52.50				109.52
F1	SOI 5	#2	area	typical	57.46	0.00	0.60	2.42	11.02	0.11			0.96	3.18	0.00				24.25				28.67	0.00	0.45	2.04	9.66	0.11			1.17	3.97	0.00				42.24				88.30
F1	SOI 6	#1	area	typical	56.63	0.00	0.60	2.31	11.36				0.93	3.17	0.00			0.09	24.91				34.31	0.00	0.55	2.36	12.08				1.37	4.82	0.00			0.18	52.70				108.38
F1	SOI 6	#2	area	typical	56.15	0.25	0.64	2.33	11.74				1.00	3.15	0.00			0.07	24.68				28.38	0.18	0.49	1.98	10.41				1.23	3.98	0.00			0.13	43.53				90.32
F1	SOI 7	#1	area	typical	56.61	0.24	0.66	2.22	10.74	0.12			0.88	2.63	0.06			0.00	25.83				32.56	0.20	0.58	2.15	10.84	0.14			1.23	3.80	0.11			0.00	51.86				103.46
F1	SOI 7	#2	area	typical	57.29	0.33	0.58	2.30	11.19				0.94	2.75	0.00				24.62				26.75	0.22	0.41	1.81	9.17				1.07	3.22	0.00				40.12				82.77
F1	SOI 8	#1	area	typical	56.98	0.26	0.54	2.08	10.55	0.00	0.00		0.83	2.64	0.00				26.13				25.37	0.17	0.36	1.56	8.24	0.00	0.00		0.90	2.94	0.00				40.61				80.15
F1	SOI 8	#2	area	typical	56.45	0.28	0.61	2.34	11.70	0.10	0.00		1.06	2.88	0.00			0.08	24.50				34.79	0.25	0.57	2.43	12.66	0.12	0.00		1.60	4.45	0.00			0.17	52.71				109.74

F1	SOI 9	#1	point	ol/glass	58.34		0.72	1.30	15.02				0.78	3.33				0.09	20.42				36.87		0.69	1.38	16.66				1.20	5.28				0.20	45.05				107.34
F1	SOI 9	#2	point	ol/glass	58.52	0.32	0.73	0.95	14.42				0.34	2.93				0.12	21.66				34.93	0.27	0.66	0.96	15.11				0.50	4.38				0.25	45.12				102.19
F1	SOI 9	#3	point	ol/glass	58.04		0.81	0.58	14.48				0.40	2.86				0.13	22.71				35.03		0.74	0.59	15.35				0.58	4.32				0.27	47.84				104.72
F1	SOI 9	#4	point	ol/glass	58.73	0.00	0.88	1.27	14.48				0.70	2.74				0.10	21.10				36.54	0.00	0.83	1.33	15.81				1.07	4.27				0.21	45.83				105.88
F1	SOI 9	#5	point	glass	61.65	0.00	0.11	4.65	16.34	0.20	0.11		2.46	6.40					8.07				42.53	0.00	0.11	5.41	19.79	0.27	0.15		4.15	11.07					19.43				102.91
F1	SOI 9	#6	point	ol/glass	60.20	0.00	0.35	2.81	15.36	0.15			1.99	5.82					13.31				40.70	0.00	0.36	3.21	18.23	0.19			3.28	9.86					31.42				107.26
F1	SOI 9	#7	point	ol/W	58.57			2.17	1.51				0.13	0.75	0.29				36.58				31.16			1.95	1.41				0.17	1.00	0.46				67.93				104.08
F1	SOI 9	#8	point	ol/W	53.73			0.27	0.87					0.34					44.79				26.01			0.22	0.74					0.41					75.69				103.07
F1	SOI 9	#9	point	ol/W	59.50		0.16	1.88	5.09	0.00		0.00	0.11	2.09	0.14				31.03				32.22		0.13	1.71	4.84	0.00		0.00	0.15	2.84	0.23				58.66				100.78
					O	Na	Mg	Al	Si	P	S	Cl	K	Ca	Ti	V	Cr	Mn	Fe	Ni	Cu	Ba	O	Na	Mg	Al	Si	P	S	Cl	K	Ca	Ti	V	Cr	Mn	Fe	Ni	Cu	Ba	total
F2	SOI 1	#1	area	typical	55.91	0.00	0.54	2.67	11.65	0.13			1.02	2.51	0.00			0.11	25.44				32.45	0.00	0.48	2.61	11.87	0.14			1.45	3.66	0.00			0.23	51.55				104.44
F2	SOI 2	#1	area	typical	55.70	0.42	0.47	2.63	11.23	0.08	0.00	0.06	0.92	2.29	0.08				26.13				31.54	0.34	0.41	2.51	11.16	0.09	0.00	0.08	1.27	3.24	0.14				51.64				102.42
F2	SOI 3	#1	area	typical	55.66	0.33	0.46	2.59	11.45	0.09	0.00		1.00	2.38	0.00			0.00	26.04				26.38	0.23	0.33	2.07	9.53	0.08	0.00		1.15	2.82	0.00			0.00	43.09				85.68
F2	SOI 3	#2	area	typical	55.99	0.25	0.54	2.75	11.56	0.00	0.07		1.02	2.43	0.00			0.00	25.39				35.03	0.22	0.51	2.90	12.69	0.00	0.08		1.56	3.81	0.00			0.00	55.45				112.26
F2	SOI 4	#1	area	typical	55.67	0.34	0.51	2.62	11.44	0.10	0.00		0.94	2.38	0.07			0.00	25.92				31.11	0.27	0.43	2.47	11.22	0.11	0.00		1.29	3.33	0.12			0.00	50.56				100.91
F2	SOI 5	#1	point	ol outer	58.17		0.73	0.24	13.69				0.18	2.74				0.00	24.26				34.70		0.66	0.24	14.33				0.26	4.10				0.00	50.51				104.79
F2	SOI 5	#2	point	ol inner	57.08	0.00	1.44	0.19	14.01					1.04				0.12	26.11				32.77	0.00	1.26	0.18	14.12					1.50				0.24	52.32				102.39
F2	SOI 5	#3	point	ol inner	56.84		1.36	0.23	14.04		0.00			1.15				0.10	26.29				32.41		1.18	0.22	14.05		0.00			1.64				0.19	52.33				102.01
F2	SOI 5	#4	point	ol inner	56.90		1.48	0.20	13.98					1.16				0.09	26.19				32.29		1.27	0.19	13.93					1.65				0.18	51.89				101.41
F2	SOI 5	#5	point	ol outer	56.46		0.60	0.16	14.27					1.90				0.07	26.53				31.37		0.51	0.15	13.92					2.65				0.14	51.46				100.20
F2	SOI 5	#6	point	ol margin	56.12		0.40	0.13	14.56					3.39				0.00	25.40				30.65		0.33	0.12	13.96					4.64				0.00	48.41				98.11
F2	SOI 5	#7	point	late ol	55.68		0.40	0.14	14.76					2.98				0.11	25.92				30.34		0.33	0.13	14.12					4.07				0.21	49.31				98.51
F2	SOI 5	#8	point	glass	59.47	0.59	0.00	8.03	15.59	0.29	0.11		3.38	4.76	0.06				7.71				40.02	0.57	0.00	9.12	18.41	0.38	0.15		5.56	8.02	0.13				18.12				100.48
F2	SOI 5	#9	area	typical i/s	59.21	0.53	0.00	5.80	15.33	0.27	0.06		2.97	5.61	0.05				10.18				37.97	0.49	0.00	6.27	17.26	0.33	0.07		4.65	9.02	0.10				22.78				98.94
F2	SOI 5	#10	point	ol	58.65		0.95	0.30	13.54				0.25	1.92				0.10	24.30				32.47		0.80	0.28	13.16				0.34	2.66				0.18	46.95				96.84
F2	SOI 5	#11	point	ol inner	56.92	0.00	1.43	0.20	13.93	0.12				1.12				0.11	26.17				30.77	0.00	1.17	0.18	13.22	0.12				1.52				0.21	49.37				96.56
					O	Na	Mg	Al	Si	P	S	Cl	K	Ca	Ti	V	Cr	Mn	Fe	Ni	Cu	Ba	O	Na	Mg	Al	Si	P	S	Cl	K	Ca	Ti	V	Cr	Mn	Fe	Ni	Cu	Ba	total
G1	SOI 1	#1	area	typical	55.17	0.32	0.67	1.63	9.87	0.18			0.60	1.48				0.00	30.06				30.33	0.25	0.56	1.52	9.52	0.19			0.80	2.04				0.00	57.68				102.90
G1	SOI 1	#2	point	large ol	56.92		1.20	0.14	14.04					1.45				0.11	26.13				26.19		0.84	0.11	11.34					1.68				0.17	41.97				82.30
G1	SOI 1	#3	point	large ol	57.28		1.65	0.17	13.88					0.58				0.00	26.44				27.52		1.21	0.14	11.71					0.69				0.00	44.35				85.62
G1	SOI 1	#4	point	large ol	56.29		1.67	0.18	14.22					0.85				0.00	26.79				27.46		1.24	0.15	12.18					1.04				0.00	45.62				87.69
G1	SOI 1	#5	point	ol mixed	58.96		0.93	2.34	12.99					2.87				0.15	21.75				32.73		0.79	2.19	12.66					4.00				0.29	42.14				94.79
G1	SOI 2	#1	area	typical	54.33	0.33	0.55	1.90	9.14	0.10	0.00	0.00	0.84	0.99	0.00			0.00	31.82				28.69	0.25	0.44	1.70	8.47	0.10	0.00	0.00	1.09	1.31	0.00			0.00	58.67				100.72
G1	SOI 3	#1	area	W free	57.55	0.39	0.98	1.42	13.69	0.16	0.00		0.61	1.24				0.08	23.88				32.20	0.31	0.84	1.34	13.45	0.18	0.00		0.83	1.73				0.15	46.65				97.67
G1	SOI 3	#2	area	typical	56.39	0.26	0.68	1.84	10.73	0.11	0.09		0.72	1.26				0.08	27.84				29.95	0.20	0.55	1.65	10.01	0.11	0.09		0.94	1.68				0.15	51.60				96.92
G1	SOI 4	#1	point	ol	57.90		1.39		13.93					0.57					26.21				31.97		1.16		13.50					0.79					50.51				97.94
G1	SOI 4	#2	point	ol	57.03		1.75	0.15	14.02					0.52				0.00	26.52				31.21		1.45	0.14	13.47					0.72				0.00	50.66				97.65
G1	SOI 4	#3	point	ol	57.48		1.42	0.13	13.96	0.13				1.19				0.09	25.61				31.93		1.20	0.12	13.61	0.14				1.65				0.17	49.66				98.47
G1	SOI 4	#4	point	ol	57.15		1.20	0.14	14.12					0.93				0.08	26.39				32.13		1.02	0.13	13.93					1.30				0.16	51.78				100.47
G1	SOI 4	#5	point	ol	57.52		1.50	0.11	13.87					0.58				0.11	26.31				32.58		1.29	0.11	13.79					0.82				0.22	52.02				100.82
G1	SOI 4	#6	point	ol	57.61		1.17		14.17					0.85				0.00	26.20				32.81		1.01		14.17					1.21				0.00	52.08				101.27
G1	SOI 4	#7	point	ol	57.66	0.00	0.84	0.00	14.09					2.04				0.00	25.37				32.44	0.00	0.71	0.00	13.92					2.88				0.00	49.81				99.76
G1	SOI 4	#8	point	ol	57.48		0.70	0.00	14.14					1.78				0.00	25.90				32.71		0.60	0.00	14.13					2.54				0.00	51.45				101.44
G1	SOI 4	#9	point	ol outer	57.42		0.52	0.00	13.97					3.38				0.11	24.59				33.59		0.46	0.00	14.35					4.96				0.22	50.20				103.79
G1	SOI 4	#10	point	ol outer	58.40		0.22	0.10	13.61	0.11				9.41				0.00	18.15				36.38		0.20	0.11	14.89	0.13				14.68				0.00	39.47				105.87
G1	SOI 4	#11	point	ol outer	57.81	0.00	0.52	0.15	13.90	0.15				2.53				0.11	24.83				34.24	0.00	0.47	0.15	14.46	0.17				3.76				0.23	51.34				104.81
G1	SOI 4	#12	point	ol/glass	59.21	2.15	0.00	4.63	13.00	1.39	0.26		0.56	7.64	0.00				11.04	0.13			38.28	2.00	0.00	5.05	14.76	1.74	0.33		0.88	12.37	0.00				24.92			0.72	101.03
G1	SOI 4	#13	point	ol/glass	59.17	1.65	0.00	4.43	13.22	1.15	0.37		0.73	6.68	0.00				12.50	0.10			34.56	1.38	0.00	4.37	13.56	1.30	0.43		1.04	9.77	0.00				25.49			0.49	92.39
G1	SOI 4	#14	point	ol/glass	59.63	1.97	0.00	4.81	14.03	1.24	0.38		1.10	6.64	0.09				10.10				42.03	2.00	0.00	5.72	17.36	1.70	0.54		1.90	11.73	0.19				24.84				107.99
G1	SOI 4	#15	point	ol/glass	64.01	1.64	0.00	5.81	12.27	1.61	0.54		0.73	5.80	0.13				7.46				48.85	1.80	0.00	7.48	16.44	2.39	0.83		1.35	11.09	0.29				19.88				110.41
G1	SOI 6	#1	area	W-rich	54.59	0.32	0.27	1.71	7.10	0.18	0.00		0.51	1.43	0.00			0.00	33.89	0.00			27.66	0.24	0.21	1.46	6.31	0.18	0.00		0.64	1.81	0.00			0.00	59.92			0.00	98.42
G1	SOI 6	#2	area	typical	57.00	0.52	0.46	2.79	9.59	0.21	0.10	0.08	0.99	1.68	0.00				26.57				25.03	0.33	0.31	2.07	7.40	0.18	0.09	0.08	1.06	1.85	0.00				40.73				79.12
G1	SOI 7	#1	point	leucite	60.50	0.25		10.05	20.18				8.75						0.28				42.93	0.25		12.03	25.13				15.17						0.69				96.19
G1	SOI 7	#2	point	late ol	56.82	0.00	0.21	0.26	14.02	0.50	0.00			5.44					22.74				31.90	0.00	0.18	0.25	13.82	0.54	0.00			7.65					44.57				98.90
G1	SOI 7	#3	point	glass	58.33	1.94		6.22	13.58	1.45	0.38		0.97	7.36	0.24				9.53				37.22	1.77		6.70	15.21	1.79	0.49		1.51	11.77	0.46				21.24				98.17
G1	SOI 7	#4	point	K?	58.14	0.25	0.29	0.10	13.61	0.19			0.08	8.70				0.09	18.54				34.81	0.22	0.27	0.11	14.30	0.21			0.12	13.04				0.19	38.74				102.02
G1	SOI 7	#5	point	ol margin	58.73	0.45	0.49	0.00	13.55				0.08	2.59					24.12				33.95	0.37	0.43	0.00	13.75				0.11	3.75					48.66				101.02
G1	SOI 7	#6	point	ol margin	57.77		0.70		14.05					1.58				0.07	25.83				33.97		0.63		14.51					2.32				0.14	53.01				104.57
G1	SOI 7	#7	point	K?	58.92		0.25	0.00	13.47					9.38					17.98				35.64		0.23	0.00	14.30					14.21					37.97				102.36
G1	SOI 7	#8	point	K margin	59.76	0.00	0.17	0.24	13.03	0.56				4.47					21.76				36.20	0.00	0.15	0.24	13.86	0.66				6.79					46.02				103.92
G1	SOI 7	#9	point	secondary Feox	68.28		0.00	0.21	1.32	0.14				0.12					29.94				36.04		0.00	0.19	1.23	0.14				0.15					55.16				92.91
G1	SOI 7	#10	area	i/s	59.14	1.49	0.15	4.09	13.20	1.03	0.27		0.58	6.62	0.12				13.31				37.95	1.37	0.14	4.43	14.87	1.28	0.34		0.91	10.64	0.24				29.81				101.99
G1	SOI 7	#11	point	ol margin	57.75		0.68	0.00	13.96					1.92				0.00	25.68				32.99		0.59	0.00	14.00					2.75				0.00	51.21				101.55
G1	SOI 7	#12	point	glass?	59.37	1.35	0.15	4.11	13.31	1.42	0.31		0.84	8.08	0.00				10.96	0.10			38.70	1.26	0.15	4.52	15.23	1.79	0.40		1.34	13.19	0.00				24.94			0.54	102.07
G1	SOI 7	#13	point	glass	59.24	1.27	0.00	3.48	12.49	1.17	0.10		0.48	8.57	0.05				13.15				38.73	1.19	0.00	3.83	14.33	1.48	0.13		0.76	14.04	0.11				30.01				104.61
G1	SOI 7	#14	point	secondary Feox	67.41			0.27	1.22	0.15			0.08	0.11					30.76				34.38			0.23	1.09	0.15			0.09	0.15					54.76				90.84
					O	Na	Mg	Al	Si	P	S	Cl	K	Ca	Ti	V	Cr	Mn	Fe	Ni	Cu	Ba	O	Na	Mg	Al	Si	P	S	Cl	K	Ca	Ti	V	Cr	Mn	Fe	Ni	Cu	Ba	total
G2	SOI 66	#1	area	typical	56.46	0.27	0.58	2.33	10.99	0.20			0.81	1.56	0.00			0.09	26.70				37.20	0.26	0.58	2.59	12.71	0.26			1.31	2.57	0.00			0.21	61.41				119.09
G2	SOI 66	#2	point	large ol	56.92		1.83	0.00	14.30					0.51				0.10	26.34				35.94		1.76	0.00	15.85					0.81				0.21	58.05				112.62

G2	SOI 66	#3	point	large ol	56.83		2.51	0.00	14.36					0.45				0.00	25.84				34.63		2.33	0.00	15.37					0.69				0.00	54.97				107.99
G2	SOI 66	#4	point	large ol	57.10		2.22	0.13	14.05					0.48				0.08	25.95				37.48		2.22	0.15	16.18					0.79				0.17	59.44				116.43
G2	SOI 66	#5	point	glass/late ol	58.99	1.30	0.11	3.25	13.66	0.91	0.11		0.77	6.95				0.07	13.88				44.47	1.40	0.12	4.13	18.07	1.33	0.16		1.43	13.13				0.18	36.51				120.94
G2	SOI 66	#6	point	large ol	57.63	0.21	1.95	0.13	14.06					0.44				0.11	25.47				42.03	0.22	2.16	0.16	18.00					0.80				0.28	64.84				128.50
G2	SOI 67	#1	point	large ol inner	57.50		1.81	0.16	13.76	0.17				0.59				0.00	26.01				32.89		1.58	0.16	13.81	0.19				0.85				0.00	51.94				101.42
G2	SOI 67	#2	point	large ol margin	57.88	0.21	0.24	0.00	13.81					8.71				0.10	19.05				35.47	0.19	0.22	0.00	14.86					13.36				0.21	40.74				105.04
G2	SOI 67	#3	area	fine i/s	59.80	1.05	0.14	3.59	13.17	0.88	0.14		0.58	6.46	0.12				14.05				36.30	0.92	0.13	3.68	14.04	1.04	0.17		0.86	9.82	0.22				29.78				96.95
G2	SOI 67	#4	point	glass	58.86	1.23		5.34	14.05	1.20	0.32		1.30	6.86	0.17				10.66				34.39	1.04		5.26	14.41	1.35	0.38		1.86	10.05	0.30				21.75				90.79
G2	SOI 67	#5	area	leucite +	60.82	0.67		9.19	17.63		0.00		6.50	0.45					4.73				43.81	0.70		11.16	22.29		0.00		11.45	0.82					11.89				102.11
G2	SOI 68	#1	area	fine i/s	61.98	0.29	0.20	4.01	8.59	3.20		0.00	0.10	4.72	0.13				16.78				35.58	0.24	0.18	3.88	8.65	3.56	0.00		0.14	6.79	0.23				33.63				92.86
G2	SOI 68	#2	area	bright Fe crust	61.88	0.52	0.00	0.30	0.59	0.33		0.00		0.27					36.11				30.93	0.38	0.00	0.25	0.52	0.31	0.00			0.34					63.00				95.74
G2	SOI 68	#3	area	outer Fe crust	67.77		0.22	1.26	1.87	0.56				0.18					28.14				35.70		0.17	1.12	1.73	0.57				0.24					51.74				91.29
G2	SOI 68	#4	area	ceramic	65.92	0.00	0.50	4.05	8.12	0.56			0.61	0.24	0.08				19.93				33.33	0.00	0.38	3.45	7.21	0.55			0.76	0.30	0.12				35.18				81.28
G2	SOI 68	#5	point	ex Fe droplet	57.86			0.15	0.00										41.99				26.70			0.12	0.00										67.65				94.47
G2	SOI 68	#6	point	ex Fe droplet	58.40				0.00				0.00						41.60				27.41				0.00				0.00						68.15				95.56
G2	SOI 68	#7	area	inner droplets?	67.98			0.12	0.56	0.14				0.13					31.07				36.96			0.11	0.53	0.15				0.17					58.96				96.89
G2	SOI 68	#8	area	inner bright	56.35			0.18											43.47				27.15			0.15											73.09				100.39
G2	SOI 69	#1	area	typical	54.54	0.33	0.63	1.56	8.08	0.09			0.52	1.05	0.00			0.00	33.21				28.45	0.25	0.50	1.37	7.40	0.09			0.66	1.37	0.00			0.00	60.48				100.57
G2	SOI 69	#2	point	ol in pore rind	56.97		0.69	0.00	14.09					1.43				0.08	26.74				30.01		0.56	0.00	13.03					1.89				0.15	49.17				94.80
G2	SOI 69	#3	point	ol in pore rind	57.25		0.70	0.00	14.00					1.54				0.13	26.39				26.63		0.49	0.00	11.43					1.80				0.20	42.85				83.41
G2	SOI 69	#4	point	ol	58.30		1.42	0.28	13.71					0.73				0.07	25.49	0.00			33.10		1.22	0.27	13.66					1.04				0.14	50.52	0.00			99.95
G2	SOI 69	#5	point	ol pore edge	58.46		1.00	0.16	13.81					2.35				0.07	24.16				33.96		0.89	0.15	14.08					3.41				0.14	48.99				101.63
G2	SOI 69	#6	point	ol	57.96		1.67	0.11	13.83					0.66				0.00	25.76				36.62		1.60	0.12	15.34					1.05				0.00	56.82				111.54
G2	SOI 70	#1	area	typical	54.74	0.00	0.62	1.45	8.31	0.14			0.37	1.10				0.00	33.26				27.36	0.00	0.47	1.22	7.29	0.14			0.45	1.38				0.00	58.02				96.33
G2	SOI 70	#2	area	ol in pore	58.24	0.26	0.99	0.90	13.62				0.42	1.11					24.46				32.49	0.21	0.84	0.85	13.34				0.57	1.55					47.63				97.47
G2	SOI 70	#3	point	ol margin	57.60		1.28	0.16	14.12					0.65				0.00	26.19				33.50		1.13	0.15	14.41					0.94				0.00	53.17				103.31
G2	SOI 70	#4	point	ol inner	57.88		1.20	0.13	13.82					1.40				0.00	25.59				33.14		1.04	0.12	13.89					2.00				0.00	51.14				101.33
G2	SOI 70	#5	point	ol inner	57.43		1.50	0.00	14.04					0.53				0.09	26.41				32.22		1.28	0.00	13.83					0.75				0.17	51.73				99.98
G2	SOI 70	#6	point	ol outer	56.95	0.00	1.12	0.00	14.19					0.79				0.00	26.95				30.65	0.00	0.92	0.00	13.40					1.07				0.00	50.63				96.67
G2	SOI 70	#7	point	ol outer	57.67		0.88	0.15	13.94					1.32				0.00	26.04				33.71		0.78	0.15	14.30					1.94				0.00	53.13				104.00
G2	SOI 70	#8	point	ol inner	57.55		1.29	0.15	13.94					0.82				0.08	26.16				32.37		1.10	0.14	13.77					1.16				0.15	51.36				100.06
G2	SOI 70	#9	point	ol inner	57.62		1.39	0.12	13.77					0.82				0.12	26.16				31.14		1.14	0.11	13.07					1.11				0.22	49.35				96.14
G2	SOI 71	#1		error	91.30							8.70											2.86							0.60											3.47
G2	SOI 71	#2	area	typical	56.26	0.30	0.69	2.08	10.41	0.13			0.61	1.02					28.49				31.16	0.24	0.58	1.95	10.12	0.14			0.82	1.42					55.08				101.51
G2	SOI 72	#1	area	typical	57.08	0.00	0.51	3.77	13.45	0.15			1.96	1.52					21.45	0.11	0.00		33.79	0.00	0.46	3.77	13.98	0.17			2.83	2.26					44.33	0.23	0.00		101.81
G2	SOI 72	#2	area	fine i/s	59.82	1.35	0.11	5.85	12.30	1.74	0.45		0.83	7.63					9.74			0.17	40.78	1.32	0.12	6.73	14.72	2.30	0.62		1.38	13.04					23.18			0.98	105.15
G2	SOI 72	#3	point	late ol margin	58.86	0.00	0.00	0.12	13.31	0.16				9.95					17.60				33.05	0.00	0.00	0.11	13.12	0.18				14.00					34.49				94.95
G2	SOI 72	#4	point	late ol inner	57.47		0.17	0.13	13.94					4.08				0.00	24.20				29.93		0.14	0.12	12.74					5.32				0.00	43.99				92.23
G2	SOI 72	#5	point	late ol inner	58.24	0.00	0.22	0.18	13.62					3.95					23.79				30.67	0.00	0.18	0.16	12.59					5.21					43.74				92.54
G2	SOI 72	#6	point	ol assoc L	56.90	0.00	0.26	0.00	14.13	0.15				6.78				0.00	21.78				30.70	0.00	0.21	0.00	13.38	0.15				9.17				0.00	41.03				94.64
G2	SOI 72	#7	point	ol margin	60.22	0.76	0.15	0.12	10.75					3.45					24.55				33.70	0.61	0.13	0.11	10.57					4.84					47.95				97.91
G2	SOI 72	#8	point	ol	57.11		1.85	0.00	14.19					0.48				0.00	26.37				32.98		1.62	0.00	14.38					0.70				0.00	53.17				102.85
G2	SOI 72	#9	point	ol	57.27		1.37	0.00	14.05					0.66				0.09	26.57				33.57		1.22	0.00	14.46					0.97				0.17	54.36				104.75
G2	SOI 72	#10	point	fine i/s	59.63			3.71	13.32	1.50	0.34		0.29	8.20	0.15			0.00	12.87				37.71			3.95	14.79	1.83	0.43		0.44	12.99	0.29			0.00	28.41				100.84
G2	SOI 72	#11	point	ol	57.48		0.97	0.21	14.05			0.00		0.83				0.00	26.46				32.19		0.83	0.20	13.81			0.00		1.17				0.00	51.73				99.92
					O	Na	Mg	Al	Si	P	S	Cl	K	Ca	Ti	V	Cr	Mn	Fe	Ni	Cu	Ba	O	Na	Mg	Al	Si	P	S	Cl	K	Ca	Ti	V	Cr	Mn	Fe	Ni	Cu	Ba	total
H	SOI 14	#1	point	iron															99.30	0.70																	120.34	0.90			121.24
H	SOI 14	#2	point	glass	58.85	0.77	0.80	2.57	15.43	0.43	0.10		2.18	4.24	0.00			0.09	14.53				38.80	0.73	0.80	2.86	17.86	0.55	0.14		3.51	7.01	0.00			0.20	33.43				105.89
H	SOI 14	#3	point	glass	59.10	0.75	0.66	2.54	15.91	0.42	0.15		2.22	4.69	0.00			0.10	13.46				35.04	0.64	0.60	2.54	16.56	0.49	0.17		3.22	6.97	0.00			0.20	27.85				94.27
H	SOI 14	#4	area	in pore	56.99	0.86	0.54	2.35	13.76	0.40	0.16		2.25	3.83	0.08			0.11	18.65				33.64	0.73	0.49	2.34	14.26	0.46	0.19		3.24	5.66	0.14			0.23	38.41				99.81
H	SOI 14	#5	area	in pore	56.84	0.97	0.61	2.61	15.17	0.33	0.17		2.57	4.35	0.00			0.16	16.23				32.27	0.79	0.53	2.50	15.12	0.36	0.19		3.57	6.18	0.00			0.30	32.17				94.00
H	SOI 14	#6	area	typical	53.45	0.38	0.61	1.33	6.20	0.18	0.00		0.90	1.49	0.00				35.48				29.67	0.30	0.51	1.24	6.04	0.19	0.00		1.22	2.07	0.00				68.74				109.97
H	SOI 14	#7	area	typical	54.23	0.72	0.72	1.81	9.25	0.19	0.10	0.00	1.41	2.39				0.11	29.07				26.91	0.51	0.54	1.51	8.06	0.18	0.10	0.00	1.71	2.97				0.19	50.36				93.05
H	SOI 15	#1	area	typical	53.37	0.50	0.46	1.27	5.89	0.13	0.09		0.76	1.49	0.07				35.99				27.75	0.37	0.36	1.11	5.37	0.13	0.09		0.96	1.94	0.11				65.31				103.51
H	SOI 15	#2	point	iron															99.33	0.67																	93.05	0.66			93.71
H	SOI 15	#3	point	glass	59.39	0.81	0.51	2.88	16.67	0.40	0.14		2.61	5.14				0.00	11.44				39.51	0.77	0.52	3.23	19.47	0.52	0.19		4.24	8.56				0.00	26.57				103.57
H	SOI 15	#4	point	glass	60.25	0.88	0.51	2.61	15.64	0.46	0.16		2.34	5.03	0.00				12.13				48.85	1.02	0.63	3.56	22.25	0.72	0.26		4.64	10.22	0.00				34.33				126.48
H	SOI 17	#1	area	in pore	59.23	0.62	0.60	2.57	15.34	0.34	0.13		2.04	4.85				0.07	14.21				39.43	0.60	0.60	2.89	17.93	0.44	0.17		3.31	8.08				0.17	33.03				106.65
H	SOI 17	#2	area	typical	52.36	0.00	0.64	0.81	3.06				0.43	0.70	0.00			0.09	41.91				24.49	0.00	0.45	0.64	2.52				0.49	0.82	0.00			0.14	68.44				98.01
H	SOI 18	#1	point	iron															99.45	0.55																	66.89	0.39			67.28
H	SOI 18	#2	area	typical	52.55	0.41	0.58	0.65	2.76				0.25	0.60					42.20				25.94	0.29	0.43	0.54	2.39				0.30	0.74					72.72				103.36
H	SOI 18	#3	area	typical	54.84	0.00	0.48	1.31	6.53	0.18	0.00	0.09	0.60	1.46					34.52				34.99	0.00	0.46	1.41	7.32	0.22	0.00	0.13	0.94	2.33					76.87				124.65
H	SOI 18	#4	point	glass	59.72	0.57	0.41	2.43	16.00	0.32	0.09		2.05	5.45	0.00				12.95				29.98	0.41	0.32	2.06	14.10	0.31	0.09		2.51	6.86	0.00				22.69				79.32
H	SOI 18	#5	point	glass	60.42	0.53	0.55	2.34	15.54	0.33	0.11		1.99	5.07	0.00				13.13				51.35	0.64	0.71	3.35	23.18	0.55	0.19		4.14	10.78	0.00				38.94				133.83
H	SOI 19	#1	area	typical	53.66	0.32	0.46	0.90	3.47			0.00	0.32	0.46					40.41				28.69	0.24	0.38	0.81	3.26			0.00	0.42	0.61					75.42				109.84
H	SOI 19	#2	area	dull pore lining	68.04				0.15		0.14	0.75		0.20					30.73				34.70				0.13		0.14	0.84		0.26					54.70				90.76
H	SOI 19	#3	area	corroded pore	58.71		0.00	0.38	2.24	0.00	0.30	3.01	0.00	0.31					35.04				21.82		0.00	0.24	1.46	0.00	0.22	2.48	0.00	0.29					45.45				71.96
H	SOI 19	#4	area	altered slag	60.83	0.00	0.30	0.87	3.73		0.09	0.86	0.18	0.43					32.73				35.72	0.00	0.26	0.86	3.84		0.11	1.12	0.26	0.63					67.09				109.89
H	SOI 19	#5	area	bright pore fill	58.59		0.00	0.00	0.12		0.11	0.29							40.89				30.38		0.00	0.00	0.11		0.12	0.33							74.00				104.94
H	SOI 20	#1	point	late ol	59.80	0.21	0.78	1.40	13.73	0.18			0.98	2.21					20.71				36.39	0.18	0.72	1.44	14.66	0.21			1.46	3.38					44.00				102.45
H	SOI 20	#2	point	late ol	60.06	0.00	0.86	0.39	13.22	0.08	0.00		0.29	2.47	0.00				22.64				36.28	0.00	0.79	0.40	14.02	0.10	0.00		0.43	3.73	0.00				47.73				103.48

					O	Na	Mg	Al	Si	P	S	Cl	K	Ca	Ti	V	Cr	Mn	Fe	Ni	Cu	Ba	O	Na	Mg	Al	Si	P	S	Cl	K	Ca	Ti	V	Cr	Mn	Fe	Ni	Cu	Ba	total
H	SOI 20	#3	point	glass/hole	64.35	0.94	0.00	5.55	17.44	0.35	0.25	0.13	4.20	1.29	0.09				5.42				49.17	1.03	0.00	7.15	23.40	0.52	0.38	0.22	7.84	2.47	0.20				14.45				106.83
H	SOI 20	#4	point	glass	65.25	1.09		4.17	17.18	0.28	0.11	0.24	3.00	1.17					7.43			0.08	48.83	1.17		5.26	22.57	0.41	0.17	0.40	5.50	2.19					19.40			0.49	106.39
H	SOI 20	#5	point	altered iron?	52.29			0.16	0.32			0.00			0.08				47.14				24.61			0.13	0.27			0.00			0.12				77.43				102.55
H	SOI 21	#1	area	pore fill	58.18	0.55	0.50	1.99	12.59	0.11	0.07		1.22	2.11				0.00	22.68				35.86	0.49	0.47	2.06	13.62	0.14	0.09		1.83	3.25				0.00	48.79				106.60
H	SOI 21	#2	area	fine i/s	60.62	1.04	0.00	5.39	15.07	0.30	0.16	0.00	4.10	3.84	0.08				9.41				43.47	1.07	0.00	6.52	18.96	0.41	0.23	0.00	7.18	6.89	0.18				23.55				108.46
H	SOI 21	#3	area	fine i/s	60.52	1.11		4.45	14.98	0.24	0.16		3.37	4.12	0.05				11.01				41.97	1.10		5.20	18.24	0.33	0.22		5.70	7.16	0.10				26.66				106.70
H	SOI 21	#4	point	ol inner	59.41		0.95	0.33	13.25				0.06	1.22					24.78				35.74		0.87	0.34	13.99				0.09	1.83					52.03				104.89
H	SOI 21	#5	point	ol inner	56.28		0.78	0.18	13.41			0.07		1.12					28.16				29.53		0.62	0.16	12.35			0.08		1.47					51.57				95.79
H	SOI 21	#6	point	ol outer	59.69		0.54	0.13	13.26					1.83					24.55				35.81		0.50	0.13	13.97					2.75					51.42				104.58
H	SOI 21	#7	point	ol inner	59.32		0.73	0.13	13.26				0.00	1.46					25.10				35.79		0.67	0.13	14.04				0.00	2.20					52.85				105.68
H	SOI 21	#8	point	ol inner	59.09	0.00	0.86	0.21	13.15	0.09	0.00		0.09	1.20				0.00	25.31				35.10	0.00	0.77	0.21	13.72	0.11	0.00		0.14	1.79				0.00	52.49				104.32
H	SOI 21	#9	point	W	53.09		0.00	0.27	0.00						0.00				46.64				25.70		0.00	0.22	0.00						0.00				78.82				104.73
H	SOI 21	#10	point	glass?	59.61	1.19	0.00	5.47	15.86	0.29	0.24		4.11	3.18					9.98			0.07	41.49	1.19	0.00	6.42	19.38	0.40	0.33		6.99	5.55					24.24			0.42	106.41
H	SOI 21	#11	point	glass?	59.91	1.61		6.74	16.24	0.38	0.21		4.75	2.76	0.08				7.33				42.45	1.64		8.05	20.20	0.52	0.30		8.23	4.90	0.17				18.13				104.57
H	SOI 21	#12	point	late ol	59.35	0.22	0.51	0.23	13.47	0.00			0.11	3.83					22.27				35.61	0.19	0.47	0.23	14.19	0.00			0.17	5.76					46.64				103.26
					O	Na	Mg	Al	Si	P	S	Cl	K	Ca	Ti	V	Cr	Mn	Fe	Ni	Cu	Ba	O	Na	Mg	Al	Si	P	S	Cl	K	Ca	Ti	V	Cr	Mn	Fe	Ni	Cu	Ba	total
I	SOI 7	#1	area	fine ols	58.13	0.49	0.60	3.13	10.24	0.17	0.07	0.00	0.55	1.60	0.08			0.00	24.95				33.02	0.40	0.52	2.99	10.21	0.18	0.08	0.00	0.77	2.28	0.13			0.00	49.46				100.05
I	SOI 8	#1	area	ex Fe drop?	60.76			0.16	2.51		0.08			0.14					36.34				31.58			0.14	2.29		0.09			0.18					65.94				100.22
I	SOI 8	#2	area	ex Fe drop?	67.92			0.49	4.29					0.17					27.12				36.42			0.45	4.04					0.23					50.75				91.88
I	SOI 8	#3	point	glass	59.10	1.09		8.40	14.35	0.34	0.20		3.02	5.18	0.20				8.11				38.21	1.01		9.16	16.29	0.42	0.26		4.78	8.39	0.39				18.31				97.21
I	SOI 8	#4	point	glass	59.50	1.15		8.22	13.90	0.32	0.20		2.79	4.59	0.15				9.18				39.35	1.09		9.18	16.14	0.41	0.27		4.51	7.60	0.30				21.19				100.04
I	SOI 8	#5	point	ol	56.39	0.00	1.51	0.65	14.38				0.14	1.70				0.08	25.15				31.68	0.00	1.29	0.61	14.18				0.19	2.39				0.16	49.32				99.83
I	SOI 8	#6	point	ol	56.77		1.30	1.57	14.23				0.62	2.22				0.14	23.15				31.66		1.10	1.48	13.94				0.85	3.11				0.26	45.06				97.46
I	SOI 8	#7	point	ol	56.22		1.57	0.34	14.18				0.07	1.33				0.14	26.13				30.70		1.31	0.31	13.59				0.09	1.82				0.27	49.81				97.91
I	SOI 8	#8	point	bright oxide	58.39				0.34					0.00					41.11				27.19				0.28					0.00					66.82				94.25
I	SOI 8	#9	point	weathering?	68.00			0.62	5.86	0.19	0.00			0.28					25.06				38.22			0.59	5.78	0.20	0.00			0.39					49.15				94.32
I	SOI 9	#1	area	typical	55.09		0.33	3.49	8.87	0.00			0.31	0.75	0.06			0.00	31.11				29.26		0.27	3.13	8.27	0.00			0.40	0.99	0.10			0.00	57.67				100.09
I	SOI 10	#1	point	elongate in pore	57.25						0.18								42.57				26.06						0.16								67.64				93.85
I	SOI 10	#2	point	iron															100.00																		99.70				99.70
I	SOI 10	#3	point	fine i/s	62.24		0.73	2.71	13.41	0.28	0.07			1.33	0.00			0.09	19.13				37.52		0.67	2.76	14.19	0.33	0.09			2.01	0.00			0.19	40.25				98.02
I	SOI 13	#1	area	typical	55.30	0.44	0.76	3.12	8.61	0.20	0.00		0.77	1.54	0.06			0.00	29.20				29.67	0.34	0.62	2.82	8.11	0.20	0.00		1.01	2.08	0.10			0.00	54.69				99.64
I	SOI 14	#1	area	granular ore?	65.93			0.48	6.27	0.16	0.10			0.25					26.80				36.55			0.45	6.11	0.17	0.11			0.35					51.86				95.61
I	SOI 14	#2	point	granular ore?	59.57			0.17	1.83		0.25			0.09					38.09				29.03			0.14	1.56		0.24			0.11					64.79				95.87
I	SOI 14	#3	point	altered?	63.70		0.21	2.77	13.77	0.19			0.00	1.02	0.20			0.07	18.06			0.00	37.85		0.19	2.78	14.36	0.22			0.00	1.51	0.35			0.15	37.47			0.00	94.88
					O	Na	Mg	Al	Si	P	S	Cl	K	Ca	Ti	V	Cr	Mn	Fe	Ni	Cu	Ba	O	Na	Mg	Al	Si	P	S	Cl	K	Ca	Ti	V	Cr	Mn	Fe	Ni	Cu	Ba	total
J	SOI 1	#1	area	typical	55.25	0.40	0.57	2.75	8.51				0.79	2.03	0.08				29.62				30.59	0.32	0.48	2.57	8.27				1.06	2.82	0.13				57.24				103.49
J	SOI 2	#1	point	ol margin	58.38		0.48	0.31	13.68				0.09	9.50				0.00	17.56				35.49		0.44	0.32	14.60				0.13	14.47				0.00	37.27				102.73
J	SOI 2	#2	point	ol outer	57.77		1.33	0.13	13.54					2.12				0.08	25.02				33.15		1.16	0.12	13.64					3.05				0.15	50.12				101.39
J	SOI 2	#3	point	ol inner	57.77		1.91	0.75	14.02				0.17	1.55				0.09	23.74				34.57		1.74	0.76	14.72				0.25	2.32				0.18	49.59				104.13
J	SOI 2	#4	point	ol inner	57.78		1.22	0.14	13.92				0.00	2.93				0.10	23.90				34.27		1.10	0.14	14.50				0.00	4.35				0.21	49.49				104.06
J	SOI 2	#5	point	ol inner	57.36		1.91	0.14	14.47					1.30				0.14	24.69				34.83		1.76	0.14	15.43					1.97				0.29	52.33				106.76
J	SOI 2	#6	point	ol margin	58.27		0.58	0.00	13.84				0.00	9.66				0.06	17.58				36.73		0.56	0.00	15.32				0.00	15.25				0.14	38.69				106.67
J	SOI 2	#7	point	glass	60.47	1.34		10.28	16.14	0.24	0.08		4.60	3.14	0.05				3.66				41.26	1.32		11.83	19.34	0.32	0.10		7.67	5.37	0.11				8.72				96.04
J	SOI 2	#8	point	glass	60.57	1.36	0.00	10.17	16.05	0.30	0.10		4.43	3.33	0.05				3.64				45.72	1.47	0.00	12.94	21.27	0.44	0.15		8.18	6.30	0.11				9.59				106.17
J	SOI 2	#9	point	late ol	59.46		0.53	0.77	13.72	0.13	0.09		0.61	8.55					16.13				35.05		0.47	0.77	14.19	0.15	0.11		0.88	12.63					33.18				97.43
J	SOI 3	#1	area	typical	54.89	0.72	0.60	2.69	9.59	0.12			1.22	2.77	0.08			0.00	27.33				35.23	0.66	0.58	2.92	10.81	0.14			1.92	4.45	0.15			0.00	61.23				118.09
J	SOI 3	#2	area	typical	52.99	0.47	0.55	1.89	6.59				0.70	1.71	0.00			0.00	35.10				22.14	0.28	0.35	1.33	4.84				0.72	1.79	0.00			0.00	51.19				82.63
J	SOI 3	#3	area	ol-L in pore	57.63	0.37	0.84	3.89	15.62				2.49	2.84				0.08	16.24				32.96	0.30	0.73	3.75	15.68				3.48	4.06				0.16	32.43				93.57
J	SOI 4	#1	area	ceramic	64.80	0.39	0.73	4.12	26.99		0.00	0.00	1.89		0.16			0.00	0.93				46.29	0.40	0.79	4.96	33.85		0.00	0.00	3.31		0.33			0.00	2.31				92.24
J	SOI 4	#2	area	marginal slag	58.67	0.79	0.58	3.64	14.67	0.23	0.07	0.12	2.24	4.19	0.08			0.00	14.71				38.77	0.75	0.58	4.06	17.02	0.30	0.09	0.17	3.62	6.94	0.15			0.00	33.94				106.38
J	SOI 4	#3	area	typical	54.18	0.82	0.35	2.64	8.45				1.11	2.44	0.11			0.00	29.90				28.20	0.62	0.27	2.32	7.72				1.41	3.18	0.17			0.00	54.32				98.20
J	SOI 4	#4	area	marginal slag	64.79	1.48	0.11	3.97	15.08	0.67		0.05	0.17	1.99	0.18				11.50				44.40	1.46	0.11	4.59	18.14	0.89		0.08	0.29	3.42	0.37				27.52				101.26
J	SOI 4	#5	point	glass	60.12	0.19		9.94	20.45				9.00						0.30				46.65	0.21		13.01	27.86				17.06						0.81				105.60
J	SOI 4	#6	point	ol with leucite	57.97	0.00	0.36	0.09	13.83					8.60	0.00			0.00	19.14				35.01	0.00	0.33	0.10	14.67					13.01	0.00			0.00	40.36				103.47
J	SOI 5	#1	area	typical - W	57.48	0.73	0.61	2.35	11.67	0.00	0.00	0.17	1.16	2.77	0.00				23.05				22.96	0.42	0.37	1.58	8.18	0.00	0.00	0.15	1.14	2.77	0.00				32.15				69.72
J	SOI 5	#2	area	typical - pore	61.17	0.45	0.53	3.12	13.60	0.15	0.13	0.00	1.57	2.89	0.06				16.31				36.44	0.39	0.48	3.14	14.23	0.18	0.16	0.00	2.29	4.32	0.11				33.92				95.64
J	SOI 7	#1	area	typical - W	54.65	0.80	0.56	2.93	9.39	0.13	0.10		1.09	2.09	0.07				28.17				26.45	0.56	0.41	2.39	7.98	0.13	0.10		1.29	2.53	0.11				47.59				89.54
J	SOI 7	#2	area	typical - pore	56.21	0.77	0.29	5.21	13.32	0.13			2.80	1.52	0.06				19.70				36.01	0.71	0.28	5.62	14.98	0.17			4.38	2.43	0.11				44.05				108.76
J	SOI 8	#1	area	dense W	54.33	0.46	0.47	2.32	8.54				1.02	2.15					30.70				30.15	0.37	0.40	2.17	8.32				1.39	2.99					59.45				105.23
J	SOI 8	#2	area	dense W	53.86	0.40	0.50	2.39	8.38	0.16			1.08	2.21					31.03				28.68	0.30	0.40	2.15	7.83	0.17			1.41	2.95					57.67				101.56
J	SOI 8	#3	area	dense W	54.52	0.00	0.70	2.48	9.10				1.17	2.16					29.87				24.06	0.00	0.47	1.85	7.05				1.27	2.39					46.03				83.11
J	SOI 8	#4	area	typical	56.21	0.00	0.54	3.55	11.81				1.86	2.68					23.36				21.17	0.00	0.31	2.26	7.81				1.71	2.53					30.71				66.49
J	SOI 8	#5	area	F+L	59.63	0.48	0.41	3.51	14.40	0.14	0.00		2.17	3.62				0.06	15.60				44.52	0.51	0.46	4.42	18.87	0.20	0.00		3.95	6.78				0.14	40.65				120.51
J	SOI 8	#6	area	L/W dom	56.23	0.65	0.18	6.15	14.04	0.10	0.06		3.72	1.80	0.00			0.06	17.02				44.78	0.74	0.21	8.26	19.63	0.15	0.10		7.24	3.60	0.00			0.16	47.32				132.19
					O	Na	Mg	Al	Si	P	S	Cl	K	Ca	Ti	V	Cr	Mn	Fe	Ni	Cu	Ba	O	Na	Mg	Al	Si	P	S	Cl	K	Ca	Ti	V	Cr	Mn	Fe	Ni	Cu	Ba	total
K	SOI 2	#1	area	typical	55.54	0.34	0.53	2.06	7.43				0.74	1.05					32.31				29.95	0.26	0.43	1.88	7.03				0.97	1.41					60.81				102.75

K	SOI 3	#1	area	typical	56.39	0.43	0.44	2.79	9.64		0.00	0.00	1.16	1.34	0.00			0.10	27.71				32.35	0.36	0.38	2.70	9.71		0.00	0.00	1.63	1.92	0.00			0.20	55.50				104.75
K	SOI 4	#1	point	M core	57.77		0.31	3.24	0.22						0.19				38.27				29.74		0.24	2.81	0.19						0.30				68.77				102.05
K	SOI 4	#2	point	M outer	57.67		0.00	3.00	0.13						0.16				39.04				29.43		0.00	2.58	0.12						0.24				69.54				101.90
K	SOI 4	#3	point	W rim	52.91		0.23	0.19	0.34										46.33				25.12		0.17	0.15	0.29										76.78				102.50
K	SOI 4	#4	point	W	52.87		0.00	0.43	0.30										46.40				24.61		0.00	0.34	0.24										75.38				100.57
K	SOI 4	#5	point	glass	60.55	0.68	0.00	5.65	16.31	0.35	0.20		3.54	4.80	0.00				7.92				41.56	0.67	0.00	6.54	19.65	0.47	0.27		5.94	8.25	0.00				18.97				102.32
K	SOI 4	#6	point	glass	60.00	0.79	0.00	5.58	16.26	0.33	0.16		3.57	4.85	0.05			0.00	8.40				41.51	0.79	0.00	6.51	19.74	0.44	0.22		6.04	8.40	0.11			0.00	20.28				104.05
K	SOI 4	#7	point	ol	58.59	0.21	1.28	0.47	13.82				0.34	1.04				0.09	24.15				34.46	0.18	1.15	0.47	14.27				0.49	1.54				0.18	49.58				102.31
K	SOI 4	#8	point	ol	57.97	0.00	1.09	0.65	14.07				0.36	1.36				0.11	24.39				34.13	0.00	0.97	0.65	14.54				0.52	2.01				0.23	50.14				103.18
K	SOI 4	#9	point	M outer	57.97			3.61	0.35						0.29				37.78				30.31			3.18	0.32						0.46				68.94				103.21
K	SOI 4	#10	point	M-marg	58.04		0.00	1.24	0.36						0.13				40.23				28.39		0.00	1.02	0.31						0.19				68.70				98.61
K	SOI 4	#11	point	M-core	57.24		0.31	3.48	0.27						0.21			0.00	38.49				28.55		0.24	2.93	0.23						0.31			0.00	67.01				99.27
K	SOI 4	#12	point	M-outer	57.42		0.22	2.89	0.28						0.13				39.07				28.97		0.17	2.46	0.24						0.19				68.81				100.84
K	SOI 5	#1		error	56.16			2.89											40.94				20.05			1.74											51.03				72.83
K	SOI 5	#2	area	typical	57.63	0.39	0.51	2.56	9.05				1.06	1.25	0.07				27.48				32.95	0.32	0.44	2.47	9.08				1.48	1.79	0.12				54.85				103.50
K	SOI 6	#1	area	incl 'scale'	57.32	0.28	0.49	2.59	9.28				1.06	1.34	0.07			0.12	27.44				32.90	0.23	0.43	2.51	9.35				1.48	1.93	0.13			0.24	54.96				104.16
K	SOI 6	#2	area	typical	57.33	0.43	0.39	2.76	10.23	0.09			1.27	1.47	0.07			0.08	25.89				31.90	0.34	0.33	2.59	9.99	0.10			1.72	2.05	0.11			0.16	50.29				99.59
K	SOI 7	#1	area	typical	57.24	0.32	0.51	2.77	10.81	0.08			1.36	1.66				0.00	25.25				33.52	0.27	0.46	2.73	11.11	0.09			1.95	2.43				0.00	51.60				104.16
K	SOI 10	#1	area	typical	57.50	0.57	0.49	2.10	10.50	0.15			1.63	2.05					25.01				30.36	0.43	0.39	1.87	9.73	0.15			2.11	2.72					46.10				93.86
K	SOI 10	#2	area	typical	55.80	0.31	0.30	1.16	4.26				0.82	1.00				0.00	36.35				29.13	0.23	0.24	1.02	3.90				1.04	1.30				0.00	66.24				103.12
K	SOI 10	#3	area	typical	56.65	0.49	0.39	1.06	8.16	0.11			1.56	2.12					29.45				34.14	0.42	0.36	1.08	8.63	0.13			2.29	3.20					61.94				112.21
K	SOI 13	#1	point	iscorite	55.83		0.71	1.28	5.19					0.10	0.10				36.80				28.28		0.55	1.10	4.61					0.12	0.14				65.06				99.87
K	SOI 13	#2	point	iscorite	55.89		0.70	1.47	6.03				0.14	0.31	0.00			0.10	35.37				29.24		0.56	1.29	5.54				0.18	0.41	0.00			0.18	64.60				102.00
K	SOI 13	#3	point	mag	57.42		0.34	3.02	0.31						0.29				38.63				28.96		0.26	2.56	0.28						0.43				68.01				100.51
K	SOI 13	#4	point	mag in scale	57.72		0.27	1.25	0.29						0.17				40.31				28.82		0.21	1.05	0.25						0.25				70.27				100.84
K	SOI 13	#5	point	W in scale	52.60		0.32	0.25	0.28										46.55				24.35		0.23	0.19	0.23										75.23				100.23
K	SOI 13	#6	point	W	52.91		0.28	0.26	0.39										46.17				24.31		0.20	0.20	0.31										74.04				99.06
K	SOI 13	#7	point	glass	59.84	0.69	0.13	4.74	17.64	0.29	0.22		3.06	4.75	0.05				8.59				39.11	0.65	0.13	5.23	20.24	0.37	0.28		4.88	7.78	0.11				19.61				98.39
K	SOI 13	#8	point	glass + ol	58.58	0.35	0.76	2.55	15.65	0.13			1.57	2.67				0.12	17.62				35.91	0.31	0.71	2.63	16.84	0.16			2.36	4.10				0.24	37.71				100.97

					O	Na	Mg	Al	Si	P	S	Cl	K	Ca	Ti	V	Cr	Mn	Fe	Ni	Cu	Ba	O	Na	Mg	Al	Si	P	S	Cl	K	Ca	Ti	V	Cr	Mn	Fe	Ni	Cu	Ba	total
L	SOI 2	#1	area	ceramic glass	62.51	1.74	0.99	4.63	22.75	0.09	0.00		3.22	1.35	0.20			0.06	2.46				41.78	1.67	1.00	5.22	26.69	0.12	0.00		5.26	2.26	0.40			0.14	5.73				90.27
L	SOI 2	#2	area	typical	59.52	3.91	0.87	4.33	15.16				0.42	0.64	0.07				15.08				39.24	3.70	0.87	4.81	17.55				0.68	1.05	0.14				34.70				102.76
L	SOI 2	#3	area	typical	58.24	1.51	0.76	3.42	13.91				0.69	1.72	0.12			0.00	19.63				37.19	1.39	0.73	3.69	15.59				1.08	2.76	0.23			0.00	43.75				106.42
L	SOI 3	#1	point	rhönite	60.62	0.24		7.54	10.28	0.07				5.34	1.72				14.19				40.39	0.23		8.47	12.03	0.09				8.91	3.43				33.00				106.55
L	SOI 3	#2	point	ol + L margin	58.63		0.30	0.13	13.68					2.05				0.08	25.14				34.03		0.26	0.12	13.94					2.98				0.16	50.94				102.44
L	SOI 3	#3	point	ol + L	58.10		1.71	0.17	13.82					0.63				0.10	25.47				33.64		1.50	0.17	14.04					0.92				0.21	51.47				101.94
L	SOI 3	#4	point	rhönite	60.13	0.69		7.14	11.28	0.11			0.19	5.74	1.17				13.55				39.43	0.65		7.90	12.99	0.14			0.30	9.42	2.30				31.01				104.14
L	SOI 3	#5	point	glass	61.31	2.06	0.00	6.30	14.98	0.47	0.14		0.60	6.94	0.19				7.02				42.21	2.04	0.00	7.32	18.10	0.63	0.19		1.01	11.96	0.40				16.87				100.71
L	SOI 3	#6	point	spinel	58.06			7.51	0.51					0.11	3.54	0.15			30.12				30.17			6.58	0.47					0.14	5.51	0.24			54.63				97.73
L	SOI 3	#7	point	long ol	57.79		3.14	0.00	13.80		0.07			0.33				0.12	24.75				33.11		2.73	0.00	13.88		0.08			0.47				0.24	49.51				100.03
L	SOI 3	#8	point	ol+L	57.95		2.29	0.18	13.87		0.00			0.55	0.00			0.08	25.08				30.68		1.84	0.16	12.89		0.00			0.73	0.00			0.15	46.36				92.82
L	SOI 3	#9	point	ol outside L	57.65	0.26	0.79	0.12	13.88					0.75				0.11	26.44				31.35	0.21	0.65	0.11	13.26					1.02				0.20	50.19				96.98
L	SOI 3	#10	point	rhönite	60.59	0.34		7.56	10.63					5.46	1.18				14.23				38.27	0.31		8.06	11.78					8.64	2.22				31.38				100.67
L	SOI 3	#11	point	leucite	61.05	0.39		9.79	19.96				8.40						0.42				42.55	0.39		11.51	24.42				14.31						1.03				94.19
L	SOI 5	#1	area	typical	59.21	1.35	0.45	5.12	14.57	0.13			2.28	1.52	0.06				15.30				34.96	1.15	0.41	5.10	15.10	0.14			3.30	2.24	0.11				31.53				94.03
L	SOI 5	#2	area	typical	56.77	1.06	0.68	3.84	11.88	0.12	0.06		1.37	1.56	0.10			0.07	22.48				35.50	0.96	0.64	4.05	13.05	0.14	0.08		2.09	2.44	0.19			0.15	49.08				108.36
L	SOI 6	#1	area	typical	56.00	0.65	0.75	3.12	10.79	0.00			1.34	1.46					25.90				31.57	0.52	0.64	2.96	10.68	0.00			1.84	2.06					50.95				101.23
L	SOI 7	#1	area	typical	55.44	0.73	0.72	3.28	10.90	0.13	0.00		1.47	1.48	0.00			0.09	25.76				31.18	0.59	0.62	3.11	10.76	0.14	0.00		2.01	2.08	0.00			0.18	50.57				101.24
L	SOI 8	#1	area	typical	53.27	0.43	0.78	2.74	8.77	0.12	0.00	0.00	1.11	1.17	0.00			0.00	31.60				28.39	0.33	0.63	2.47	8.20	0.13	0.00	0.00	1.45	1.56	0.00			0.00	58.79				101.94
L	SOI 10	#1	point	ol with L/W	57.96	0.25	0.63	0.13	13.59	0.27			0.00	9.11					18.06				34.67	0.22	0.58	0.13	14.27	0.32			0.00	13.65					37.72				101.55
L	SOI 10	#2	point	ol margin	59.10	0.23	0.53	0.14	13.33	0.12				9.08					17.46				34.86	0.20	0.48	0.14	13.81	0.14				13.42					35.95				99.00
L	SOI 10	#3	point	ol inner	56.84		2.18	0.18	14.20					0.95				0.11	25.54				30.77		1.79	0.16	13.50					1.29				0.20	48.27				95.98
L	SOI 10	#4	point	ol core	56.90		2.69	0.13	14.25					0.74				0.00	25.29				31.07		2.23	0.12	13.66					1.01				0.00	48.21				96.30
L	SOI 10	#5	point	ol core	56.44		2.82	0.22	14.18					0.69				0.12	25.53				30.21		2.29	0.20	13.32					0.93				0.21	47.70				94.87
L	SOI 10	#6	point	ol inner	56.79		2.89	0.13	14.14					0.65				0.00	25.40				30.01		2.32	0.12	13.12					0.86				0.00	46.85				93.28
L	SOI 10	#7	point	ol margin	58.06		0.60	0.10	13.83	0.09				9.69					17.63				32.45		0.51	0.09	13.56	0.10				13.56					34.40				94.67
L	SOI 10	#8	point	glass?	60.28	3.48	0.13	7.22	14.01	0.88	0.30		0.75	5.18					7.78				40.19	3.33	0.13	8.12	16.40	1.14	0.40		1.22	8.65					18.12				97.69
L	SOI 10	#9	point	glass?	59.01	4.27	0.00	7.48	14.30	0.92	0.28		0.67	5.65					7.41				40.14	4.18	0.00	8.59	17.08	1.21	0.38		1.12	9.62					17.60				99.91

				atom% O	Na	Mg	Al	Si	P	S	Cl	K	Ca	Ti	Mn	Fe
A1	SOI 1	#1	typical	59.00	0.29	0.45	2.21	11.24	0.12			0.82	1.30	0.00	0.15	24.44
A1	SOI 1	#3	typical	59.12	0.40	0.44	2.15	11.43	0.11	0.00		0.91	1.48	0.00		23.96
A1	SOI 3	#1	typical	58.63	0.28	0.51	2.16	11.50	0.11	0.00		0.93	1.45	0.00		24.43
A1	SOI 5	#1	typical	57.82	0.38	0.44	2.29	11.84	0.16			1.05	1.57	0.06	0.10	24.28
A1	SOI 6	#1	typical	57.71	0.34	0.39	2.22	11.75	0.10	0.00		1.08	1.58	0.06	0.08	24.69
A1	SOI 10	#1	typical	58.56	0.42	0.35	2.70	11.99		0.00		1.35	1.98	0.00		22.65
A1	SOI 11	#1	typical	58.70	0.38	0.48	2.26	12.04	0.11	0.00		1.04	1.57			23.42
A2	SOI 1	#1	typical	56.56	0.36	0.40	2.41	11.72	0.10	0.00		0.99	1.79	0.06	0.08	25.54
A2	SOI 3	#1	typical	57.12	0.36	0.50	2.24	11.67	0.00			0.97	1.77	0.00	0.09	25.29
A2	SOI 4	#1	typical	56.70	0.27	0.62	2.42	11.81	0.11	0.00		1.07	1.90	0.00	0.14	24.98
A2	SOI 5	#1	typical	56.81	0.43	0.50	2.41	11.90				1.05	1.87	0.06	0.07	24.90
B1	SOI 1	#1	typical	58.45		0.53	3.00	12.23				1.35	1.58	0.08	0.09	22.69
B1	SOI 1	#2	typical	58.85	0.33	0.60	3.26	12.56				1.23	1.54	0.07		21.56
B1	SOI 2	#1	typical	58.93		0.57	3.35	13.02				1.65	1.51	0.00		20.97
B1	SOI 4	#1	typical	59.93	0.22	0.75	2.79	11.97	0.09	0.00		0.67	0.82	0.09	0.00	22.66
B1	SOI 7	#1	typical	56.99	0.52	0.52	3.80	12.12	0.17			1.49	2.03	0.09	0.07	22.19
B2	SOI 3	#1	typical	57.42		1.08	2.70	13.51	0.24	0.11		0.25	2.42	0.09	0.11	22.07
B2	SOI 3	#2	typ with margins	58.34		0.91	3.41	13.03	0.16			0.70	1.88	0.09		21.48
B2	SOI 4	#1	typical	58.29	0.38	0.57	4.62	13.37	0.15	0.00		1.78	1.33	0.11	0.07	19.34
B3	SOI 4	#2	typical	57.13	0.38	0.71	3.61	13.71	0.11	0.00		1.32	1.36	0.08	0.07	21.51
B2	SOI 6	#1	typical	59.48		1.25	2.52	12.32				0.81	0.73			22.88
C1	SOI 1	#1	typical	58.66	0.00	0.59	3.14	11.85	0.09	0.07		0.64	1.80	0.10	0.08	22.98
C1	SOI 2	#1	typical	58.60	0.27	0.38	3.88	12.08	0.11	0.00	0.00	1.06	1.76	0.09	0.09	21.68
C1	SOI 3	#1	typical	58.66		0.27	4.49	12.36				1.59	1.78	0.11	0.09	20.66
C2	SOI 1	#1	typical	57.12	0.00	0.85	2.11	11.00	0.16			0.18	1.45	0.00	0.09	27.04
C2	SOI 2	#1	typical	55.31	0.36	0.76	2.56	12.94	0.15			1.25	2.40	0.08	0.10	24.08
C2	SOI 3	#1	typical	55.89	0.00	0.73	2.63	13.08	0.11			1.16	2.50	0.08	0.00	23.82
C2	SOI 5	#1	typical	55.92		0.80	2.67	11.44	0.17			0.59	1.83	0.07	0.11	26.40
C2	SOI 6	#1	typical	58.12		0.88	2.17	10.03	0.14	0.00			1.05	0.11	0.00	27.51
C2	SOI 7	#1	typical	55.71	0.00	0.79	2.53	13.01				1.25	2.42	0.00	0.11	24.17
D1	SOI 2	#1	typical	54.88	0.35	0.49	2.57	10.60	0.14	0.00		1.02	1.65	0.00	0.00	28.30
D1	SOI 3	#1	typical	55.01	0.32	0.54	2.30	10.52	0.15	0.00		1.04	1.67	0.07	0.00	28.38
D1	SOI 5	#1	typical	55.32	0.00	0.64	2.17	9.89				0.78	1.42	0.00	0.07	29.72
D1	SOI 6	#1	typical	55.24	0.00	0.67	2.15	10.13	0.15	0.07		0.70	1.37	0.00	0.00	29.52
D2	SOI 39	#1	slag by iron	57.16	0.36	0.57	2.38	9.66	0.16	0.00		1.35	1.29	0.00	0.00	27.06
D2	SOI 41	#1	slag by iron	59.24		0.63	1.35	4.81	0.00	0.00	0.00	0.18	0.33	0.00	0.08	33.38
D2	SOI 41	#2	slag by iron	59.55		0.75	2.29	8.52	0.11		0.36		0.64		0.13	27.65
D2	SOI 41	#4	slag by iron	60.95		0.64	1.34	6.32			0.32		0.41	0.00	0.00	30.02
D2	SOI 45	#1	slag nr iron	56.88	0.00	0.65	1.57	5.92	0.12	0.00	0.00	0.60	0.80	0.08	0.10	33.28
D2	SOI 45	#2	slag nr iron	56.49	0.00	0.59	1.54	5.92		0.00	0.08	0.64	0.80	0.00	0.08	33.85
D2	SOI 43	#1	Sl	59.48		0.28	1.67	5.26	0.00		0.22		0.23	0.08	0.00	32.80
D2	SOI 43	#2	Sl	56.59	0.31	0.65	2.02	8.32	0.14			1.06	1.01	0.00	0.14	29.75
D2	SOI 43	#3	Sl	56.18	0.00	0.76	2.05	6.99	0.11			0.82	0.80	0.00	0.11	32.20
D2	SOI 44	#1	Sl	57.77	0.00	0.75	2.23	9.17	0.16	0.08	0.00	0.90	1.04	0.06	0.18	27.65
E1	SOI 1	#1	typical	57.61	0.00	0.54	2.11	9.54		0.08		0.73	1.29	0.06	0.00	28.04
E1	SOI 4	#1	typical	57.20	0.00	0.59	2.13	8.96				0.77	1.14	0.00	0.11	29.10
E1	SOI 5	#1	typical	56.58	0.25	0.66	2.17	8.16				0.74	1.25		0.10	30.09
E1	SOI 6	#1	typical	57.51	0.34	0.56	2.39	8.99		0.00		0.80	1.14		0.08	28.20
E2	SOI 1	#1	typical	56.96	0.25	0.75	3.38	11.73		0.00	0.00	1.09	0.81	0.09	0.07	24.87
E2	SOI 2	#1	typical	56.19	0.41	0.62	3.88	12.11		0.08		1.22	0.89	0.00	0.13	24.47
E2	SOI 4	#1	typical	55.70	0.35	0.66	3.70	12.16	0.00	0.00		1.20	0.88	0.00	0.15	25.20
E2	SOI 5	#1	typical	55.12	0.39	0.71	3.63	12.17		0.09		1.11	0.87	0.08	0.15	25.69
F1	SOI 3	#1	typical	56.84	0.37	0.64	2.42	11.38		0.07		0.96	2.91	0.00	0.08	24.33
F1	SOI 3	#2	typical	57.04	0.00	0.62	2.39	11.22	0.00	0.07		0.89	2.91	0.08	0.11	24.67
F1	SOI 3	#3	typical	57.17	0.26	0.56	2.45	11.36	0.10	0.00		0.81	2.93	0.00	0.00	24.35
F1	SOI 4	#1	typical	57.25	0.34	0.54	2.23	11.30	0.00	0.00		0.99	2.94	0.09	0.00	24.31
F1	SOI 4	#2	typical	57.03	0.53	0.56	2.31	12.02		0.00		1.07	3.09	0.00	0.00	23.40
F1	SOI 5	#1	typical	57.26	0.26	0.53	2.43	10.92	0.13	0.00		0.90	3.15	0.07		24.34
F1	SOI 5	#2	typical	57.46	0.00	0.60	2.42	11.02	0.11			0.96	3.18	0.00		24.25
F1	SOI 6	#1	typical	56.63	0.00	0.60	2.31	11.36				0.93	3.17	0.00	0.09	24.91
F1	SOI 6	#2	typical	56.15	0.25	0.64	2.33	11.74				1.00	3.15	0.00	0.07	24.68
F1	SOI 7	#1	typical	56.61	0.24	0.66	2.22	10.74	0.12			0.88	2.63	0.06	0.00	25.83
F1	SOI 7	#2	typical	57.29	0.33	0.58	2.30	11.19				0.94	2.75	0.00		24.62
F1	SOI 8	#1	typical	56.98	0.26	0.54	2.08	10.55	0.00	0.00		0.83	2.64	0.00		26.13
F1	SOI 8	#2	typical	56.45	0.28	0.61	2.34	11.70	0.10	0.00		1.06	2.88	0.00	0.08	24.50
F2	SOI 1	#1	typical	55.91	0.00	0.54	2.67	11.65	0.13			1.02	2.51	0.00	0.11	25.44
F2	SOI 2	#1	typical	55.70	0.42	0.47	2.63	11.23	0.08	0.00	0.06	0.92	2.29	0.08		26.13
F2	SOI 3	#1	typical	55.66	0.33	0.46	2.59	11.45	0.09	0.00		1.00	2.38	0.00	0.00	26.04
F2	SOI 3	#2	typical	55.99	0.25	0.54	2.75	11.56	0.00	0.07		1.02	2.43	0.00	0.00	25.39
F2	SOI 4	#1	typical	55.67	0.34	0.51	2.62	11.44	0.10	0.00		0.94	2.38	0.07	0.00	25.92
G1	SOI 1	#1	typical	55.17	0.32	0.67	1.63	9.87	0.18			0.60	1.48		0.00	30.06

G1	SOI 2	#1	typical	54.33	0.33	0.55	1.90	9.14	0.10	0.00	0.00	0.84	0.99	0.00	0.00	31.82
G1	SOI 3	#1	W free	57.55	0.39	0.98	1.42	13.69	0.16	0.00		0.61	1.24		0.08	23.88
G1	SOI 3	#2	typical	56.39	0.26	0.68	1.84	10.73	0.11	0.09		0.72	1.26		0.08	27.84
G1	SOI 6	#1	W-rich	54.59	0.32	0.27	1.71	7.10	0.18	0.00		0.51	1.43	0.00	0.00	33.89
G1	SOI 6	#2	typical	57.00	0.52	0.46	2.79	9.59	0.21	0.10	0.08	0.99	1.68	0.00		26.57
G2	SOI 66	#1	typical	56.46	0.27	0.58	2.33	10.99	0.20			0.81	1.56	0.00	0.09	26.70
G2	SOI 69	#1	typical	54.54	0.33	0.63	1.56	8.08	0.09			0.52	1.05	0.00	0.00	33.21
G2	SOI 70	#1	typical	54.74	0.00	0.62	1.45	8.31	0.14			0.37	1.10		0.00	33.26
G2	SOI 71	#2	typical	56.26	0.30	0.69	2.08	10.41	0.13			0.61	1.02			28.49
G2	SOI 72	#1	typical	57.08	0.00	0.51	3.77	13.45	0.15			1.96	1.52			21.45
H	SOI 14	#4	in pore	56.99	0.86	0.54	2.35	13.76	0.40	0.16		2.25	3.83	0.08	0.11	18.65
H	SOI 14	#5	in pore	56.84	0.97	0.61	2.61	15.17	0.33	0.17		2.57	4.35	0.00	0.16	16.23
H	SOI 14	#6	typical	53.45	0.38	0.61	1.33	6.20	0.18	0.00		0.90	1.49	0.00		35.48
H	SOI 14	#7	typical	54.23	0.72	0.72	1.81	9.25	0.19	0.10	0.00	1.41	2.39		0.11	29.07
H	SOI 15	#1	typical	53.37	0.50	0.46	1.27	5.89	0.13	0.09		0.76	1.49	0.07		35.99
H	SOI 17	#1	in pore	59.23	0.62	0.60	2.57	15.34	0.34	0.13		2.04	4.85		0.07	14.21
H	SOI 17	#2	typical	52.36	0.00	0.64	0.81	3.06				0.43	0.70	0.00	0.09	41.91
H	SOI 18	#2	typical	52.55	0.41	0.58	0.65	2.76				0.25	0.60			42.20
H	SOI 18	#3	typical	54.84	0.00	0.48	1.31	6.53	0.18	0.00	0.09	0.60	1.46			34.52
H	SOI 19	#1	typical	53.66	0.32	0.46	0.90	3.47			0.00	0.32	0.46			40.41
H	SOI 21	#1	pore fill	58.18	0.55	0.50	1.99	12.59	0.11	0.07		1.22	2.11		0.00	22.68
I	SOI 7	#1	fine ols	58.13	0.49	0.60	3.13	10.24	0.17	0.07	0.00	0.55	1.60	0.08	0.00	24.95
I	SOI 9	#1	typical	55.09		0.33	3.49	8.87	0.00			0.31	0.75	0.06	0.00	31.11
I	SOI 13	#1	typical	55.30	0.44	0.76	3.12	8.61	0.20	0.00		0.77	1.54	0.06	0.00	29.20
J	SOI 1	#1	typical	55.25	0.40	0.57	2.75	8.51				0.79	2.03	0.08		29.62
J	SOI 3	#1	typical	54.89	0.72	0.60	2.69	9.59	0.12			1.22	2.77	0.08	0.00	27.33
J	SOI 3	#2	typical	52.99	0.47	0.55	1.89	6.59				0.70	1.71	0.00	0.00	35.10
J	SOI 3	#3	ol-L in pore	57.63	0.37	0.84	3.89	15.62				2.49	2.84		0.08	16.24
J	SOI 4	#1	ceramic	64.80	0.39	0.73	4.12	26.99		0.00	0.00	1.89		0.16	0.00	0.93
J	SOI 4	#2	marginal slag	58.67	0.79	0.58	3.64	14.67	0.23	0.07	0.12	2.24	4.19	0.08	0.00	14.71
J	SOI 4	#3	typical	54.18	0.82	0.35	2.64	8.45				1.11	2.44	0.11	0.00	29.90
J	SOI 4	#4	marginal slag	64.79	1.48	0.11	3.97	15.08	0.67		0.05	0.17	1.99	0.18		11.50
J	SOI 5	#1	typical - W	57.48	0.73	0.61	2.35	11.67	0.00	0.00	0.17	1.16	2.77	0.00		23.05
J	SOI 5	#2	typical - pore	61.17	0.45	0.53	3.12	13.60	0.15	0.13	0.00	1.57	2.89	0.06		16.31
J	SOI 7	#1	typical - W	54.65	0.80	0.56	2.93	9.39	0.13	0.10		1.09	2.09	0.07		28.17
J	SOI 7	#2	typical - pore	56.21	0.77	0.29	5.21	13.32	0.13			2.80	1.52	0.06		19.70
J	SOI 8	#1	dense W	54.33	0.46	0.47	2.32	8.54				1.02	2.15			30.70
J	SOI 8	#2	dense W	53.86	0.40	0.50	2.39	8.38	0.16			1.08	2.21			31.03
J	SOI 8	#3	dense W	54.52	0.00	0.70	2.48	9.10				1.17	2.16			29.87
J	SOI 8	#4	typical	56.21	0.00	0.54	3.55	11.81				1.86	2.68			23.36
J	SOI 8	#5	F+L	59.63	0.48	0.41	3.51	14.40	0.14	0.00		2.17	3.62		0.06	15.60
J	SOI 8	#6	L/W dom	56.23	0.65	0.18	6.15	14.04	0.10	0.06		3.72	1.80	0.00	0.06	17.02
K	SOI 2	#1	typical	55.54	0.34	0.53	2.06	7.43				0.74	1.05			32.31
K	SOI 3	#1	typical	56.39	0.43	0.44	2.79	9.64		0.00	0.00	1.16	1.34	0.00	0.10	27.71
K	SOI 5	#2	typical	57.63	0.39	0.51	2.56	9.05				1.06	1.25	0.07		27.48
K	SOI 6	#1	incl 'scale'	57.32	0.28	0.49	2.59	9.28				1.06	1.34	0.07	0.12	27.44
K	SOI 6	#2	typical	57.33	0.43	0.39	2.76	10.23	0.09			1.27	1.47	0.07	0.08	25.89
K	SOI 7	#1	typical	57.24	0.32	0.51	2.77	10.81	0.08			1.36	1.66		0.00	25.25
K	SOI 10	#1	typical	57.50	0.57	0.49	2.10	10.50	0.15			1.63	2.05			25.01
K	SOI 10	#2	typical	55.80	0.31	0.30	1.16	4.26				0.82	1.00		0.00	36.35
K	SOI 10	#3	typical	56.65	0.49	0.39	1.06	8.16	0.11			1.56	2.12			29.45
L	SOI 2	#1	ceramic glass	62.51	1.74	0.99	4.63	22.75	0.09	0.00		3.22	1.35	0.20	0.06	2.46
L	SOI 2	#2	typical	59.52	3.91	0.87	4.33	15.16				0.42	0.64	0.07		15.08
L	SOI 2	#3	typical	58.24	1.51	0.76	3.42	13.91				0.69	1.72	0.12	0.00	19.63
L	SOI 5	#1	typical	59.21	1.35	0.45	5.12	14.57	0.13			2.28	1.52	0.06		15.30
L	SOI 5	#2	typical	56.77	1.06	0.68	3.84	11.88	0.12	0.06		1.37	1.56	0.10	0.07	22.48
L	SOI 6	#1	typical	56.00	0.65	0.75	3.12	10.79	0.00			1.34	1.46			25.90
L	SOI 7	#1	typical	55.44	0.73	0.72	3.28	10.90	0.13	0.00		1.47	1.48	0.00	0.09	25.76
L	SOI 8	#1	typical	53.27	0.43	0.78	2.74	8.77	0.12	0.00	0.00	1.11	1.17	0.00	0.00	31.60

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