NRA National Roads Authority
An tÚdarás um Bóithre Náisiúnta

NDP NATIONAL DEVELOPMENT PLAN

Department of Transport

LAOIS COUNTY COUNCIL

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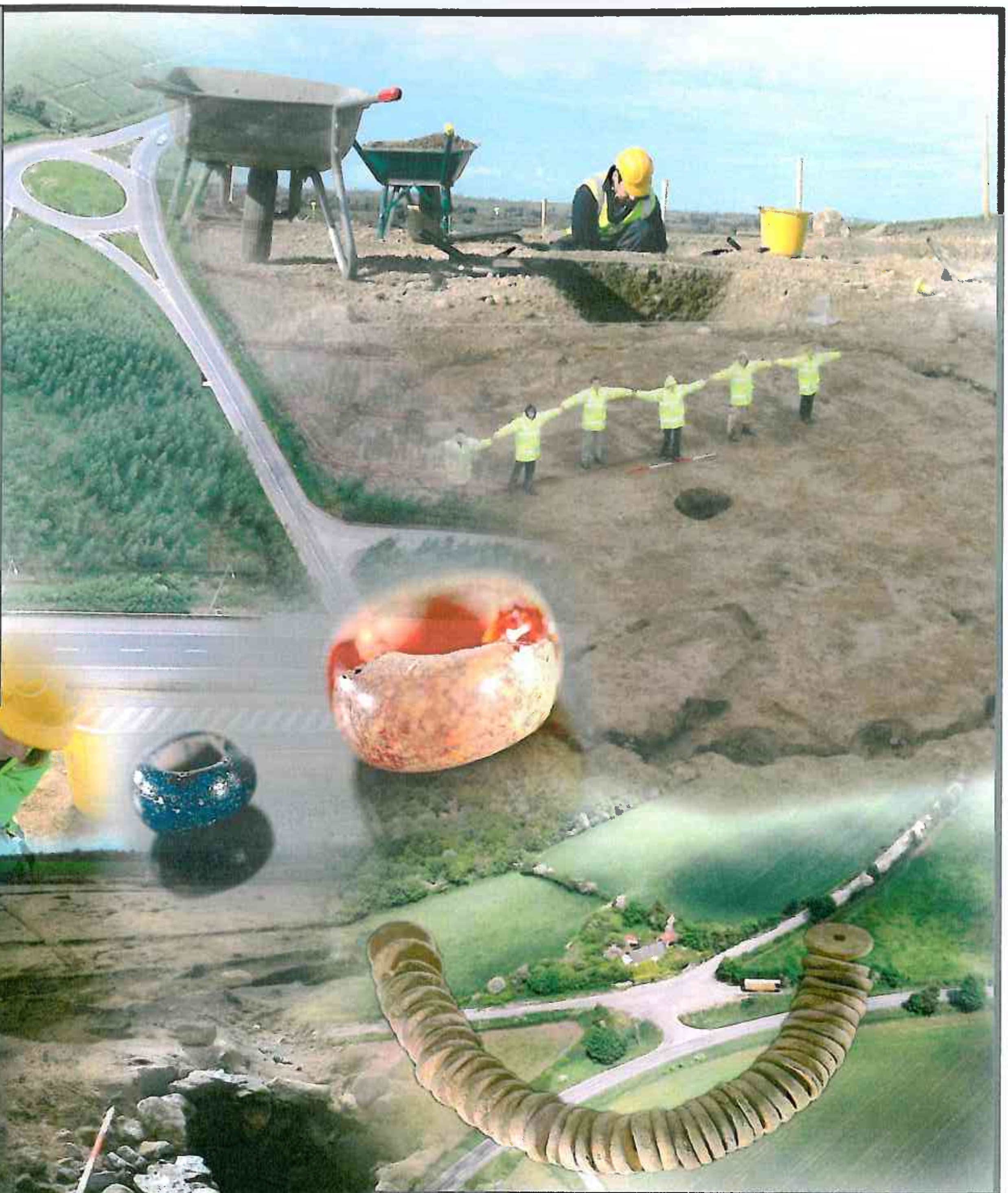

M7 Portlaoise-Castletown/ M8 Portlaoise-Cullahill Motorway Scheme

Contract 2 Coolfin - Derrinsallagh & Townparks Phase 2 - Excavation

Report on the Archaeological Excavation of
Derrinsallagh 4, Co. Laois

Ministerial Directions No.
A015/070
E2180
Anne-Marie Lennon
Report by Lennon with Kane

April 2009
Final
(Senior Archaeologist: Deirdre Murphy)

PROJECT DETAILS

Project	M7 Portlaoise to Castletown/ M8 Portlaoise to Cullahill Motorway Scheme
Client	Laois County Council, County Hall, Portlaoise, County Laois
Contract	Contract 2
Site Name	Derrinsallagh 4
Townland	Derrinsallagh, Co Laois
Nat. Grid Ref	225065, 185647
OD Height	121.091m
OS Map Ref	OS 6 inch sheet 21
Chainage	2590-2680
Ministerial Directions No.	A015/070
Record No.	E2180
Archaeologist	Anne Marie Lennon
Senior Archaeologist	Deirdre Murphy
Report Type	Final
Report Status	Final
Report by	Lennon with Kane
Date of Submission	April 2009
Distribution	Elspeth Logan & Mary Deevy

ACKNOWLEDGEMENTS

This report has been prepared by Archaeological Consultancy Services Ltd on behalf of Laois County Council, Kildare National Roads Design Office (NRDO), and the National Roads Authority (NRA).

The excavation was carried out in accordance with the Directions of the Minister for the Environment, Heritage and Local Government (DOEHLG), in consultation with the National Museum of Ireland (NMI) issued under Section 14 of the National Monuments Acts 1930–2004.

Consulting Engineers – ARUP Consulting Engineers

Project Engineer – Mike Evans

Engineer – Gráinne Wolfe

Kildare County Council, National Roads Design Office

Senior Executive Engineer – Adrian King

Project Archaeologist – Sylvia Desmond

Engineer – Damian McGinnity

Laois County Council

Executive Engineer-Brenda Cuddy

Liaison – Sarah Dunne

National Monuments, Department of the Environment, Heritage and Local Government

Chief Archaeologist – Brian Duffy

Archaeologist – Martin Reid

Irish Antiquities Division, National Museum Of Ireland

Keeper - Nessa O Connor

Assistant Keeper – Isabella Mulhall

NON TECHNICAL SUMMARY

The proposed M7 Portlaoise to Castletown/M8 Portlaoise to Cullahill Motorway Scheme consists of approximately 41km of motorway and 11km of single dual carriageway commencing to the southwest of the existing Portlaoise Bypass and running in a southern direction tying into the existing N8 at Oldtown. A portion of the scheme runs to the west tying into the existing N7 near Borris-in-Ossory. The Archaeological Works contract is subdivided into three separate contracts. Contract 1 consists of approximately 11km of motorway, which extends EW from Aghaboe to west of Borris-in-Ossory through the townlands from Coolfin to Townparks and Derrinsallagh. The works include all associated side roads. There is a partial grade separated junction in the townland of Derrinsallagh, a link road from the partial grade separated junction in a northerly direction, to a tie in with the existing N7, west of Borris in Ossory and associated works. The following report describes the results of archaeological excavation along one section of the planned M8 Portlaoise to Castletown Motorway Scheme, at Derrinsallagh, County Laois, Contract 2.

The site was identified during archaeological testing carried out by Linda Clarke of Archaeological Consultancy Services Ltd in March – May 2005. Seventeen trenches were excavated within this field and a number of potential archaeological features were identified. The site was designated Derrinsallagh 4.

Archaeological resolution of Derrinsallagh 4 was carried out from 28th November 2005 – 10th March 2006 by Anne-Marie Lennon. For recording purposes, the site was designated the scheme no A015/70 and record no E2180. Topsoil stripping on this site revealed a large number of archaeological features dating from the Neolithic Period, to the late Bronze Age and the Iron Age. The Neolithic period was represented by a single pit that contained a bodysherd from an early Neolithic carinated bowl. This pit truncated two shallow curvilinear trenches that were present at the northern end of the site and this may suggest the presence of further Neolithic settlement within the general area. The late Bronze Age settlement consisted of a D-shaped structure and associated pits. One of the pits produced a quantity of pottery that represented five individual vessels (See Appendix 8.6). The Iron Age activity included a sub-circular structure formed by three slot trenches, 46 bowl furnaces, four charcoal production pits, one hearth, a linear ditch towards the south of the site and an assortment of associated pits and postholes. The late Bronze Age and Iron Age settlement evidence was located at the driest area of the site to the northeast.

The bowl furnaces at Derrinsallagh 4, all date from the first century BC to first century AD, well within the Iron Age and were grouped into single, paired or multiple pits for the purpose of iron working. A total sampling strategy was adopted for the excavation at Derrinsallagh 4, and a full detailed analysis of the bowl furnaces and associated features was undertaken.

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1. INTRODUCTION

1.1 Site Location

This report details the results of the archaeological excavation of a site on the M7 Portlaoise–Castletown/M8 Portlaoise–Cullahill Motorway Scheme at Derrinsallagh 4, Contract 2, County Laois (Ordnance Survey six-inch sheet 21; National Grid Co-ordinates 225065, 185647; Figures 1–6). The site at Derrinsallagh 4 was situated south of Borris in Ossory village, west of the R435 Borris in Ossory to Rathdowney road (Figs 1-6). It was located between Chainage 2590-2680 of the proposed scheme, in the townlands of Derrinsallagh and within the Parish of Aghaboe.

1.2 Scope of the Project

The purpose of the Archaeological Services Project was to conduct Archaeological Site Investigations within the lands made available for the scheme and to assess the nature and extent of any new potential archaeological sites uncovered (Phase 1). This phase of the project was carried out in March-June 2005 and throughout 2006 when access to land became available. The principal aim of this phase of the project was to test the known sites, including sites of potential identified in the EIS and through aerial photography. It sought to test for any previously unknown sites that may by virtue of their size or complexity lead to significant delays and costs if revealed during construction works. This phase of the project also tried to assess the archaeological risk across the scheme by examining the volume, range, complexity and distribution of archaeology identified during testing.

The second phase of the project involved the resolution of all archaeological sites identified within the proposed road corridor prior to commencement of the construction of the motorway (Phase 2). The aim of this phase of works was to clear the entire route of archaeology in order to avoid delays and costs during construction works. This phase of the project was carried out from July 2005-October 2006 and excavations were conducted by seven licensed directors under the management of a Senior Archaeologist, Deirdre Murphy. In total ninety-two sites were excavated during this phase of works and all excavations were given separate record numbers issued by The Department of the Environment, Heritage and Local Government.

Following completion of fieldwork a programme of post-excavation analysis was necessary as reports on the archaeological findings must be published. A dissemination strategy also forms a crucial part of this phase of the project. It is proposed that all final reports will be submitted to the relevant authorities by March 2009 and that publication and public lectures/seminars will follow thereafter. Both the format and timescale for publication and seminars will be decided in consultation with the Project Archaeologist.

1.3 Circumstances of Discovery

An archaeological assessment of this site was carried out in advance of the construction of the M7 Portlaoise to Castletown/M8 Portlaoise to Cullahill Motorway Scheme, on behalf of Laois County Council by Anne Marie Lennon. The site was identified during archaeological testing carried out by Linda Clarke of Archaeological Consultancy Services Ltd in March – May 2005. Seventeen trenches were excavated within this field and a number of potential archaeological features were identified. The site was designated Derrinsallagh 4.

1.4 Date and Duration of Excavation Works

Excavation of this site was carried out from the 28^{th} November 2005 – 10^{th} March 2006.

1.5 Size and Composition of the Excavation Team

The excavation team was composed of:

One director
Two supervisors
Nine archaeological assistants
Nine general operatives

2. RECEIVING ENVIRONMENT

2.1 Detailed Overview of the receiving environment (Information was provided by Niall Kenny on behalf of Anne Marie Lennon)

2.1.1 Topographic

The sites at Derrinsallagh (1-5) are located in an area in Co. Laois where grey-brown podzolic (medium textured, moderately deep) soils are prevalent (Feehan 1983, 90-3). The grey-brown podzolic soils are among the best soils in Ireland. The soils in this area are medium textured, well-drained, friable podzolics and are especially good for tillage farming, although these soils are also highly suitable for grass production and grazing (Feehan 1983, 92). However, there are frequent pockets of rough and unproductive gley soils in the areas around Derrinsallagh and Derryvorrigan especially to the south and south-west of Derrinsallagh 4 and the low-lying area to the north of Derryvorrigan 1 and 2. These less fertile soils are much wetter and are not good for tillage and crop husbandry and at best are only suitable for rough summer grazing (Feehan 1983, 93-4). We know from the 1st and 3rd Edition OS Maps that this rough and unproductive boggy land was much more prevalent in the past and that the boggy areas to the south-west of Derrinsallagh 4 and north of Derryvorrigan 1 and 2 were more extensive in the past.

The location of the site of Derrinsallagh 4 in particular, but also the other recently discovered sites associated with metal-working and iron production (Derrinsallagh 1, 5 and Derryvorrigan 1 East), in close proximity to patches of bogland with free-flowing streams and oak abundant woodlands is quite significant. The integral use of oak wood in charcoal production and the important exploitation of locally available bog-iron ores will be discussed in detail later on in the report, but these factors would no doubt have had a major influence in the siting of these iron-producing sites.

2.1.2 Archaeological

Five areas or sites of archaeological activity were uncovered in Derrinsallagh as a result of the archaeological investigations along the proposed route of the M7 Portlaoise to Castletown/M8 Portlaoise to Cullahill Motorway Scheme in this townland. The five sites have been termed Derrinsallagh 1, Derrinsallagh 2, Derrinsallagh 3, Derrinsallagh 4 and Derrinsallagh 5. At Derrinsallagh 1, four pits associated with iron working along with two accompanying postholes were uncovered at this site. It seems to represent medieval iron-production/working activity, possibly smelting or smithing (or even both), however the full extent of the site is not known, as it appears to extend outside of the road-take. At Derrinsallagh 2, a stone lined keyhole-shaped corn-drying kiln with charred plant remains was uncovered and excavated at this site. Forty-four pits associated with metal-working (bowl/or low shaft furnaces) were uncovered at this site (Lennon 2007b). Five possible charcoal producing kilns were also found at Derrinsallagh 4. At Derrinsallagh 5, one bowl furnace, ten pits and ten postholes/stake-holes as well as a curvilinear feature were uncovered.

The main of activity identified at Derrinsallagh 3 undoubtedly represents the remains of an early medieval ringfort site. The morphology, size, characteristic features (Ditch dimensions, entrance towards the east, occurrence of rotary quern etc), landscape and topographical setting all seem to indicate that this was in fact an early medieval enclosure site more commonly known as a ringfort (Stout 1997). There is not a very high density of ringforts or enclosures in the immediate area around Derrinsallagh and quite notably not one ringfort/enclosure or circular earthwork occurs within 2.3km of the Derrinsallagh 3 complex. Within the c.3km study area taken around Derrinsallagh 3, there were three monuments that have been classified as ‘ringforts’ and five monuments that have been classified as ‘enclosures’. Three of the five enclosure sites could quite possibly be ringforts. The three enclosure sites of interest (LA021-022----; LA021-025----; LA022-015----) and the three ringfort sites are all very similar in nature; they are circular or sub-circular in shape and tend to be defined by banks with external fosses. The average diameter of these monuments is between 35-40m with some variation. One ringfort (LA021-024----) has evidence of an original entrance at the southeast while another ringfort (LA021-030001-) has evidence for a possible original entrance at the east. This is reminiscent of the entranceway occurring in the E at the site of Derrinsallagh 3. Including the recently uncovered site of Derrinsallagh 3 and the possible ringfort in the townland of Clonagooden, there is a total of eight ringforts within the 3km study area taken around the site of Derrinsallagh 3.

These eight ‘enclosure-like’ circular and sub-circular sites c.40m in diameter seem to represent what was the secular early medieval settlement of the surrounding landscape. These sites primarily functioned as domestic settlements and farms and so tend to be located in more fertile and arable land (Edwards 1990, 19), perhaps this can possibly explain their distribution in the surrounding areas around Derrinsallagh. The secular settlement in the surrounding areas appears to be scattered although more densely concentrated c.2km to the southwest of Derrinsallagh in the Killasmeestia, Clonlahy and Newtown or Skirk areas. However, we do know that there is a history of a ringfort in the townland to the west of Derrinsallagh and also that according to the folklore evidence, there is a history of local interference and removals of ringfort bushes and features in the area. This raises the question of whether the current distribution pattern is anything like what the original picture would have been. The hills in other parts of Co. Laois have numbers of ringforts scattered on their lower slopes (i.e. in the Ballyquaid Glebe/ Newtown or Skirk area to the west of Derrinsallagh). Perhaps the absence of any surviving ringforts on the lower slopes of Knockseera and Sentryhill can be explained by the fact that these areas were likely to have been more intensively farmed over the years owing to the soils being better drained and that the destruction of monuments was more widespread in this area. Another factor, which may help explain the more slightly concentrated distribution of ringforts to the southwest of the Derrinsallagh area, is that the hill of Knockseera was the site of a possible early ecclesiastical foundation. This foundation spread across parts of Knockseera hill and consisted of a church, graveyard, holy well, holy bush and altar site. The foundation was associated with St. Kieran and may also have been associated with the pilgrims' route, which traversed the landscape and ran eastwards to the sites of Lismore and Aghaboe.

2.1.3 Historic

The prehistoric period is generally under-represented in relation to the later medieval periods, perhaps a reflection on the problems inherent in identifying prehistoric sites in the modern landscape than an actual archaeological truth. It is also an expression of how the physical geography of the region since the last glacial period has affected human settlement within the county when later communities settled and developed sites that may have previously been settled by prehistoric groups with the earlier archaeological sites being effectively removed by later domestic, industrial or agricultural activity, from the medieval period to the present. The Mesolithic period is currently unrecorded in Laois, but it is unlikely that early hunter-gatherers didn't utilise the rich post-glacial environment as they did at Lough Boora, County Offaly. As the transition from a subsistence economy to cereal cultivation and livestock rearing was made during the fourth millennium BC, large tracts of forest cover were cleared, permanent settlements were established, pottery was first used, and elaborate burial rites were developed. The numerous eskers which cross the county provided well drained, easily worked soils for agricultural purposes, however the widespread clearance of the woodland cover, coupled with a climatic deterioration, led to a prolonged period of bog growth that covered much of Slieve Bloom. Neolithic ritual sites and artefacts are known from the county, however settlement sites have yet to be identified. A similar situation exists for the Bronze Age and Iron Age, whereby certain types of sites are known but actual settlement evidence is non-existent or uncommon.

Early Medieval Ireland was divided into five provinces known as *cóiceda* or fifths. In the early medieval period, Laois essentially marked the boundary between the Laigin and the Osraige, in essence the boundary between Leinster and Munster. It was in this region that the greater political manoeuvrings of the seventh and eighth centuries played out, as the opposing dynasties of the Uí Neill and Eóganachta vied for supremacy with terrible consequences for the Laigin. Although they remained locally important, their territory was reduced to a fraction of their former kingdom, comprising a small section of the current county. Archaeologically, this was the period in which ringforts and monasteries were first constructed. Monasteries, such as those at Timahoe and Aghaboe among others, would become important centres of trade and learning taking on the appearance, and performing many of the functions, of towns.

In AD1169, Laois was settled by the Anglo-Normans, led by Maurice de Prendergast, acting in association with the Osraige. During the subsequent colonisation, ringworks, motte and baileys, moated sites and stone castles were constructed; perhaps the most important fortification being the castle atop the Rock of Dunamase. The Anglo-Normans founded at least three boroughs but were rather unsuccessful and never fully developed as urban centres. Indeed, it wasn't until the plantations of the fifteenth century that any attempts at town planning succeeded with the establishment of Portlaoise and Ballinakill. The remaining towns and villages of the county date mainly to the eighteenth century and include Mountrath, Portarlington, Rathdowney, Mountmellick, Abbeyleix and Stradbally.

3. RESEARCH FRAMEWORK

The research framework for Derrinsallagh 4 will address the following topics:

(i) The construction date or date of initial site occupation/use
(ii) The absolute/relative chronology of site use in terms of periods, levels, phases, sequences and events
(iii) The date of site abandonment
(iv) The extent of the archaeological site/activity
(v) The location and distribution of known contemporary sites in the local, regional and national (and international, if appropriate) context.
(vi) The extent of the viable (local/regional) economic catchment area, i.e. the nearest viable contemporary sources of water, food, raw materials, centres of trade, transportation routes, etc.
(vii) The nature and composition of the archaeological finds, features, layers and deposits on site.
(viii) The phases of activity on site
(ix) The nature and phases of construction, use, repair and abandonment of the site.
(x) What cultural group/unit would have occupied the site
(xi) What their material culture would have been
(xii) Why the site location would have been chosen

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4. EXCAVATION RESULTS

4.1 Excavation Methodology

Excavation was carried out between 28th November 2005 and 10th March 2006 under Ministerial Direction Number A015/070. Topsoil stripping on this site was carried out by means of a twenty tonne mechanical excavator equipped with a grading bucket. Spoil was managed by a dumper and was stored on archaeologically sterile areas within the limits of the site. The recording techniques employed were based on a recording system that best suits a rural environment. All potential archaeological features exposed were cleaned, recorded (by plan, photographs, levels, feature sheets etc.) and removed by hand excavation. The site was recorded using multi-context planning of all features exposed. An appropriate sampling strategy was employed. Any finds were washed (where appropriate), treated and catalogued on site and left ready for any further post excavation analysis deemed necessary. They were numbered according to the requirements of the National Museum of Ireland from 1 to 99 according to record number and feature number, i.e. E2180:3:1 represents find number 1 within feature number 3 in Derrinsallagh 4 which was excavated under record number E2180. Unless otherwise stated, the features have been measured length-width-depth. All measurements are in metres. Upon completion of excavation all cuttings were surveyed using GPS equipment and only areas within the CPO were resolved.

4.2 Full Stratigraphic Report

4.2.1 List of features

C001 Topsoil

C002 Ploughsoil

C003 Natural subsoil

C004 Cut of bowl furnace filled with C100, C104, C102, C114, C101, C096

C005 Cut of bowl furnace filled with C395, C394, C382, C381, C055, C054, C056

C006 Cut of stone-filled pit filled with C157, C007

C007 Upper fill of C006

C008 Cut of bowl furnace associated with two other bowl furnaces C009 and C010. Filled with C150, C151, C132, C131, C130, C139, C115

C009 Cut of bowl furnace associated with two other bowl furnaces C008 and C010. Filled with C214, C199, C186, C184, C183, C182, C116

C010 Cut of bowl furnace associated with two other bowl furnaces C008 and C010. Filled with C246, C223, C222, C221, C220, C117

C011 Cut of pit filled with C372

C012 Cut of bowl furnace filled with C109

C013 Non archaeological

C014 Cut of bowl furnace associated with two other bowl furnaces C015 and C016. Filled with C333, C192, C193, C194, C269, C276, C332, C191, C190

C015 Cut of bowl furnace associated with two other bowl furnaces C014 and C016. Filled with C331, C178, C177, C176, C175, C174, C173

C016 Cut of bowl furnace associated with two other bowl furnaces C014 and C016. Filled with C213, C212, C211, C296, C297, C298

C017 Cut of bowl furnace associated with two other bowl furnaces C018 and C019. Filled with C370, C366, C357, C310, C317, C309

C018 Cut of bowl furnace associated with two other bowl furnaces C017 and C019. Filled with C369, C295, C288, C287, C237

C019 Cut of bowl furnace associated with two other bowl furnaces C017 and C018. Filled with C368, C258, C233, C236, C237

C020 Cut of bowl furnace associated with other features C021, C022, C023, C024 and C025. Filled with C260, C259

C021 Cut of bowl furnace associated with other features C020, C022, C023, C024 and C025. Filled with C272 and C273

C022 Cut of bowl furnace associated with other features C020, C021, C023, C024 and C025. Filled with C277, C278, C279, C280 and C283

C023 Cut of bowl furnace associated with other features C020, C021, C022, C024 and C025. Filled with C362, C343, C342, C341, C340, C339 and C338

C024 Cut of pit associated with other features C020, C021, C022, C023 and C025. Filled with C379 and C377

C025 Cut of pit associated with other features C020, C021, C022, C023 and C024

C026 Non archaeological

C027 Non archaeological

C028 Non archaeological

C029 Non archaeological

C030 Non archaeological

C031 Fill of pit C032

C032 Cut of pit filled with C031

C033 Non archaeological

C034 Non archaeological

C035 Non archaeological

C036 Non archaeological

C037 Non archaeological

C038 Non archaeological

C039 Non archaeological

C040 Non archaeological

C041 Non archaeological

C042 Fill of posthole C043

C043 Cut of posthole filled with C042

C044 Non archaeological

C045 Non archaeological

C046 Non archaeological

C047 Non archaeological

C048 Non archaeological

C049 Non archaeological

C050 Non archaeological

C051 Non archaeological

C052 Non archaeological

C053 Cut of pit filled with C111

C054 Sixth fill of C005

C055 Fifth fill of C005

C056 Upper fill of C005

C057 Same as C005

C058 Non archaeological

C059 Fill of C060

C060 Cut of posthole filled with C059

C061 Fill of C062

C062 Cut of posthole filled with C061

C063 Non archaeological

C064 Non archaeological

C065 Non archaeological

C066 Cut of pit filled with C113

C067 Cut of ditch filled with C202

C068 Cut of pit filled with C098 and C097

C069 Cut of pit filled with C108

C070 Cut of ditch filled with C551 and C337

C071 Non archaeological

C072 Cut of pit filled with C167

C073 Non archaeological

C074 Cut of posthole filled with C217

C075 Non archaeological

C076 Non archaeological

C077 Non archaeological

C078 Non archaeological

C079 Non archaeological

C080 Cut of bowl furnace associated with features C081, C082 and C086. Filled with C255 and C249

C081 Cut of bowl furnace associated with features C080, C082 and C086. Filled with C252 and C229

C082 Cut of bowl furnace associated with features C080, C081 and C086. Filled with C251 and C209

C083 Non archaeological

C084 Non archaeological

C085 Non archaeological

C086 Cut of pit associated with features C080, C081 and C082. Filled with C185

C087 Cut of pit filled with C107 and C106

C088 Fill of C089

C089 Cut of posthole filled with C088

C090 Fill of C091

C091 Cut of posthole filled with C090

C092 Non archaeological

C093 Non archaeological

C094 Non archaeological

C095 Non archaeological

C096 Upper fill of C004

C097 Upper fill of C068

C098 Lower fill of C068

C099 Non archaeological

C100 Lower fill of C004

C101 Fifth fill of C004

C102 Fourth fill of C004

C103 Cut of pit filled with C112

C104 Tertiary fill of C004

C105 Non archaeological

C106 Upper fill of C087

C107 Lower fill of C087

C108 Fill of C069

C109 Fill of C012

C110 Non archaeological

C111 Fill of C053

C112 Fill of C103

C113 Fill of C066

C114 Secondary fill of C004

C115 Fifth fill of C008

C116 Upper fill of C009

C117 Upper fill of C010

C118 Cancelled

C119 Cut of bowl furnace associated with bowl furnaces C120 and C121. Filled with C416, C415, C294, C324, C293, C292 and C291

C120 Cut of bowl furnace associated with bowl furnace C119 and C121. Filled with C389, C390, C388 and C387

C121 Cut of bowl furnace associated with bowl furnaces C119 and C120. Filled with C481, C480, C264, C262 and C263

C122 Non archaeological

C123 Cut of charcoal kiln filled with C354, C353, C352, C391, C392 and C380

C124 Cut of pit filled with C256

C125 Cut of bowl furnace associated with other bowl furnaces C126, C127 and C299. Filled with C385, C595, C325, C244, C515, C514, C323, C516 and C517

C126 Cut of bowl furnace associated with other bowl furnaces C125, C127 and C299. Filled with C383 and C326

C127 Cut of bowl furnace associated with other bowl furnaces C125, C126 and C299. Filled with C384, C329, C327 and C328

C128 Non archaeological

C129 Non archaeological

C130 Tertiary fill of C008

C131 Secondary fill of C008

C132 Upper fill of C008

C133 Cut of bowl furnace associated with features C134, C135 and C165. Filled with C206, C560, C537, C524, C536, C207, and C170

C134 Cut of bowl furnace associated with features C133, C135 and C165. Filled with C162

C135 Cut of bowl furnace associated with features C133, C134 and C165. Filled with C318, C253 and C171

C136 Non archaeological

C137 Cut of pit filled with C284

C138 Cut of pit filled with C187

C139 Slag layer within C008

C140 Cut of pit filled with C201 and C198

C141 Cut of pit filled with C205, C216, C164, C163, C156 and C179

C142 Cut of pit filled with C154

C143 Non archaeological

C144 Archaeological spread

C145 Cut of posthole filled with C180

C146 Cut of posthole filled with C181

C147 Non archaeological

C148 Non archaeological

C149 Cut of pit filled with C285

C150 Lower fill of C008

C151 Fourth fill of C008

C152 Cut of pit filled with C153

C153 Fill of C152

C154 Fill of C142

C155 Non archaeological

C156 Upper fill of C141

C157 Lower fill of C006

C158 Non archaeological

C159 Non archaeological

C160 Non archaeological

C161 Non archaeological

C162 Fill of C134

C163 Fifth fill of C141

C164 Tertiary fill of C141

C165 Cut of pit associated with C133, C134 and C135. Filled with C166

C166 Fill of C165

C167 Fill of C072

C168 Cut of bowl furnace associated with C133, C134 and C135. Filled with C542, C541 and C169

C169 Upper fill of C168

C170 Upper fill of C133

C171 Upper fill of C135

C172 Non archaeological

C173 Upper fill of C015

C174 Sixth fill of C015

C175 Fifth fill of C015

C176 Fourth fill of C015

C177 Tertiary fill of C015

C178 Secondary fill of C015

C179 Fourth fill of C141

C180 Fill of C145

C181 Fill of C146

C182 Tertiary fill of C009

C183 Fourth fill of C009

C184 Secondary fill of C009

C185 Fill of C086

C186 Sixth fill of C009

C187 Fill of C138

C188 Cut of posthole filled with C204

C189 Non archaeological

C190 Upper fill of C014

C191 Eighth fill of C014

C192 Secondary fill of C014

C193 Tertiary fill of C014

C194 Fourth fill of C014

C195 Non archaeological

C196 Cut of pit associated with C133. Filled with C197 & C208

C197 Fill of C196

C198 Upper fill of C140

C199 Fifth fill of C009

C200 Non archaeological

C201 Lower fill of C140

C202 Fill of C067

C203 Non archaeological

C204 Fill of C188

C205 Lower fill of C141

C206 Lower fill of C133

C207 Sixth fill of C133

C208 Fill of C196

C209 Upper fill of C082

C210 Cut of pit filled with C218

C211 Tertiary fill of C016

C212 Secondary fill of C016

C213 Lower fill of C016

C214 Lower fill of C009

C215 Non archaeological

C216 Secondary fill of C141

C217 Fill of C074

C218 Fill of C210

C219 Non archaeological

C220 Fifth fill of C010

C221 Fourth fill of C010

C222 Secondary fill of C010

C223 Tertiary fill of C010

C224 Non archaeological

C225 Cut of bowl furnace associated with bowl furnace C226. Filled with C239, C367, C270 and C240

C226 Cut of bowl furnace associated with bowl furnace C225. Filled with C239, C367, C271 and C242

C227 Non archaeological

C228 Cut of pit/stone platform filled with C358

C229 Upper fill of C081

C230 Non archaeological

C231 Non archaeological

C232 Cut of pit associated with C133 and C168

C233 Tertiary fill of C019

C234 Non archaeological

C235 Cut of drain filled with C257

C236 Fourth fill of C019

C237 Upper fill of C018 & C019

C238 Cut of charcoal kiln filled with C254 and C250

C239 Lower fill of C225 & C226

C240 Upper fill of C225

C241 Non archaeological

C242 Upper fill of C226

C243 Non archaeological

C244 Fourth fill of C125

C245 Non archaeological

C246 Lower fill of C010

C247 Non archaeological

C248 Non archaeological

C249 Upper fill of C080

C250 Upper fill of C238

C251 Lower fill of C082

C252 Lower fill of C081

C253 Secondary fill of C135

C254 Lower fill of C238

C255 Lower fill of C080

C256 Fill of C124

C257 Fill of C235

C258 Secondary fill of C019

C259 Secondary fill of C020

C260 Lower fill of C020

C261 Non archaeological

C262 Fourth fill of C121

C263 Upper fill of C121

C264 Tertiary fill of C121

C265 Non archaeological

C266 Cut of bowl furnace filled with C311, C286, C282, C281 and C268

C267 Non archaeological

C268 Upper fill of C266

C269 Fifth fill of C014

C270 Tertiary fill of C225

C271 Tertiary fill of C226

C272 Lower fill of C021

C273 Upper fill of C021

C274 Cut of pit filled with C320

C275 Non archaeological

C276 Sixth fill of C014

C277 Upper fill of C022

C278 Tertiary fill of C022

C279 Secondary fill of C022

C280 Lower fill of C022

C281 Secondary fill of C266

C282 Fourth fill of C266

C283 Fourth fill of C022

C284 Fill of C137

C285 Fill of C149

C286 Tertiary fill of C018

C287 Fourth fill of C018

C288 Tertiary fill of C018

C289 Non archaeological

C290 Non archaeological

C291 Upper fill of C119

C292 Sixth fill of C119

C293 Fifth fill of C119

C294 Tertiary fill of C119

C295 Secondary fill of C018

C296 Fourth fill of C016

C297 Fifth fill of C016

C298 Upper fill of C016

C299 Cut of bowl furnace associated with bowl furnaces C125, C126 and C127. Filled with C386, C314, C330, C313, C312 and C300

C300 Upper fill of C299

C301 Cut of pit filled by C308, C307, C306, C305 and C304

C302 Fill of C303

C303 Cut of pit filled by C302

C304 Fill of C301

C305 Fill of C301

C306 Fill of C301

C307 Fill of C301

C308 Fill of C301

C309 Upper fill of C017

C310 Fourth fill of C017

C311 Lower fill of C266

C312 Fifth fill of C299

C313 Fourth fill of C299

C314 Secondary fill of C299

C315 Cut of pit filled with C316

C316 Fill of C315

C317 Fifth fill of C017

C318 Lower fill of C135

C319 Non archaeological

C320 Upper fill of C335; Fill of C274

C321 Non archaeological

C322 Non archaeological

C323 Seventh fill of C125

C324 Fourth fill of C119

C325 Tertiary fill of C125

C326 Upper fill of C126

C327 Tertiary fill of C127

C328 Upper fill of C127

C329 Secondary fill of C127

C330 Tertiary fill of C299

C331 Lower fill of C015

C332 Seventh fill of C014

C333 Lower fill of C014

C334 Cut of posthole filled with C349, C345, C348, C347 and C346

C335 Cut of ditch filled with C337, C336 and C320

C336 Middle fill of C335; Upper fill of C564

C337 Upper fill of C070; Lower fill of C564 and C335

C338 Upper fill of C023

C339 Sixth fill of C023

C340 Fifth fill of C023

C341 Fourth fill of C023

C342 Tertiary fill of C023

C343 Secondary fill of C023

C344 Non archaeological

C345 Lower fill of C334

C346 Upper fill of C334

C347 Upper fill of C334

C348 Secondary fill of C334

C349 Lower fill of C334

C350 Non archaeological

C351 Non archaeological

C352 Upper fill of C123

C353 Fifth fill of C123

C354 Fourth fill of C123

C355 Non archaeological

C356 Non archaeological

C357 Tertiary fill of C017

C358 Fill of C228

C359 Cut of pit filled with C363

C360 Non archaeological

C361 Non archaeological

C362 Lower fill of C023

C363 Fill of C359

C364 Non archaeological

C365 Non archaeological

C366 Secondary fill of C017

C367 Secondary fill of C225 & C226

C368 Lower fill of C019

C369 Lower fill of C018

C370 Lower fill of C017

C371 Non archaeological

C372 Fill of C011

C373 Non archaeological

C374 Cut of pit associated with features C225 and C226. Filled with C378

C375 Cut of posthole associated with C023. Filled with C376

C376 Fill of C375

C377 Upper fill of C024

C378 Fill of C374

C379 Lower fill of C024

C380 Tertiary fill of C123

C381 Fourth fill of C005

C382 Tertiary fill of C005

C383 Lower fill of C126

C384 Lower fill of C127

C385 Lower fill of C125

C386 Lower fill of C299

C387 Upper fill of C120

C388 Tertiary fill of C120

C389 Lower fill of C120

C390 Secondary fill of C120

C391 Lower fill of C123

C392 Secondary fill of C123

C393 Cut of bowl furnace filled with C556, C555 and C430

C394 Secondary fill of C005

C395 Lower fill of C005

C396 Fill of C017 and C018

C397 Cut of bowl furnace associated with other features C398, C399 and C400. Filled with C404, C405, C451, C452, C450, C403 and C449

C398 Cut of bowl furnace associated with other features C397, C399 and C400. Filled with C407, C576, C575, C574 and C459

C399 Cut of pit associated with features C397, C398, C400. Filled with C408

C400 Cut of bowl furnace associated with features C397, C398 and C399. Filled with C412, C410, C553, C561 and C409

C401 Archaeological spread overlying C397, C398 and C400

C402 Archaeological spread overlying C397, C398 and C400

C403 Sixth fill of C397

C404 Lower fill of C397

C405 Secondary fill of C397

C406 Upper fill of C492 & C506

C407 Lower fill of C398

C408 Fill of C399

C409 Upper fill of C400

C410 Secondary fill of C400

C411 Cut of pit filled with C466, C465 and C413

C412 Lower fill of C400

C413 Upper fill of C411

C414 Non archaeological

C415 Secondary fill of C119

C416 Lower fill of C119

C417 Non archaeological

C418 Cut of posthole filled with C431

C419 Cut of charcoal kiln filled with C587, C586 and C585

C420 Cut of pit filled with C455

C421 Cut of pit filled with C445

C422 Cut of bowl furnace filled with C457 and C453

C423 Cut of pit

C424 Cut of charcoal pit/hearth filled with C522, C523, C525, C526, C528, C568-C573, C490, C489, C488 and C486

C425 Cut of boundary ditch filled with C512, C440 and C439

C426 Cut of charcoal kiln filled with C533 and C502

C427 Cut of bowl furnace filled with C509, C508 and C507

C428 Cut of posthole filled with C461, C442 and C441

C429 Cut of bowl furnace filled with C557, C558, C559, C448 and C447

C430 Upper fill of C393

C431 Fill of C418

C432 Cut of bowl furnace filled with C475, C477, C474, C473, C471 and C444

C433 Cut of pit filled with C443 and C504

C434 Cut of pit filled with C518

C435 Cut of pit filled with C540, C539 and C538

C436 Cut of pit filled with C563 and C562

C437 Cut of bowl furnace filled with C485

C438 Cut of pit filled with C580, C581, C582, C579 and C578

C439 Upper fill of C425

C440 Secondary fill of C425

C441 Upper fill of C428

C442 Secondary fill of C428

C443 Lower fill of C433

C444 Upper fill of C432

C445 Upper fill of C421

C446 Lower fill of C421

C447 Upper fill of C429

C448 Fourth fill of C429

C449 Upper fill of C397

C450 Fourth fill of C397

C451 Tertiary fill of C397

C452 Fifth fill of C397

C453 Upper fill of C422

C454 Non archaeological

C455 Fill of C420

C456 Non archaeological

C457 Lower fill of C422

C458 Non archaeological

C459 Upper fill of C398

C460 Non archaeological

C461 Lower fill of C428

C462 Non archaeological

C463 Non archaeological

C464 Non archaeological

C465 Lower fill of C411

C466 Lower fill of C411

C467 Non archaeological

C468 Cut of pit filled with C495

C469 Cut of pit filled with C549

C470 Non archaeological

C471 Fifth fill of C432

C472 Non archaeological

C473 Fourth fill of C432

C474 Tertiary fill of C432

C475 Lower fill of C432

C476 Non archaeological

C477 Secondary fill of C432

C478 Non archaeological

C479 Non archaeological

C480 Secondary fill of C121

C481 Lower fill of C121

C482 Non archaeological

C483 Non archaeological

C484 Non archaeological

C485 Fill of C437

C486 Upper fill of C424

C487 Non archaeological

C488 Fill of C424

C489 Fourth fill of C424

C490 Fill of C424

C491 Lower fill of C506

C492 Cut of bowl furnace filled with C493, C545, C546, C547, C535, C520, C519, C511, C510 and C494

C493 Lower fill of C492

C494 Upper fill of C492

C495 Fill of C468

C496 Cut of stakehole

C497 Cut of stakehole

C498 Cut of pit filled with C567, C527 and C513

C499 Non archaeological

C500 Non archaeological

C501 Non archaeological

C502 Upper fill of C426

C503 Non archaeological

C504 Upper fill of C443

C505 Non archaeological

C506 Cut of pit filled with C491 and C406

C507 Upper fill of C427

C508 Secondary fill of C427

C509 Lower fill of C427

C510 Ninth fill of C492

C511 Eighth fill of C492

C512 Lower fill of C425

C513 Upper fill of C498

C514 Sixth fill of C125

C515 Fifth fill of C125

C516 Eighth fill of C125

C517 Upper fill of C125

C518 Fill of C434

C519 Seventh fill of C492

C520 Sixth fill of C492

C521 Non archaeological

C522 Lower fill of C424

C523 Fill of C424

C524 Fourth fill of C133

C525 Secondary fill of C424

C526 Fill of C424

C527 Secondary fill of C498

C528 Tertiary fill of C424

C529 Non archaeological

C530 Non archaeological

C531 Non archaeological

C532 Non archaeological

C533 Lower fill of C426

C534 Non archaeological

C535 Fifth fill of C521

C536 Fifth fill of C133

C537 Tertiary fill of C133

C538 Upper fill of C435

C539 Secondary fill of C435

C540 Lower fill of C435

C541 Secondary fill of C168

C542 Lower fill of C168

C543 Non archaeological

C544 Non archaeological

C545 Secondary fill of C492

C546 Tertiary fill of C492

C547 Fourth fill of C492

C548 Non archaeological

C549 Fill of C469

C550 Non archaeological

C551 Lower fill of C070

C552 Non archaeological

C553 Tertiary fill of C400

C554 Non archaeological

C555 Secondary fill of C393

C556 Lower fill of C393

C557 Lower fill of C429

C558 Secondary fill of C429

C559 Tertiary fill of C429

C560 Secondary fill of C133

C561 Fourth fill of C400

C562 Upper fill of C436

C563 Lower fill of C436

C564 Cut of ditch filled with C337 & C336

C565 Cut of pit filled with C566

C566 Fill of C565

C567 Lower fill of C498

C568 Fill of C424

C569 Fill of C424

C570 Upper fill of C424

C571 Upper fill of C424

C572 Upper fill of C424

C573 Oxidised clay fill of C424

C574 Fourth fill of C398

C575 Tertiary fill of C398

C576 Secondary fill of C398

C577 Non archaeological

C578 Upper fill of C438

C579 Tertiary fill of C438

C580 Lower fill of C438

C581 Lower fill of C438

C582 Secondary fill of C438

C583 Cut of pit filled with C594 and C584

C584 Fill of C583

C585 Upper fill of C419

C586 Secondary fill of C419

C587 Lower fill of C419

C588 Non archaeological

C589 Non archaeological

C590 Non archaeological

C591 Non archaeological

C592 Non archaeological

C593 Non archaeological

C594 Fill of C583

C595 Secondary fill of C125

C596 Non archaeological

C597 Non archaeological

C598 Non archaeological

C599 Non archaeological

C600 Non archaeological

C601 Non archaeological

C602 Non archaeological

C603 Cut of circular structure/slot trench filled by C604

C604 Fill of C603

C605 Cut of pit filled with C664, C606

C606 Upper fill of C605

C607 Cut of ditch filled with C608

C608 Fill of C607

C609 Cut of bowl furnace filled with C663, C662, C661, C660 and C659

C610 Cut of pit filled with C612

C611 Non archaeological

C612 Fill of C610

C613 Cut of posthole filled with C614

C614 Fill of C613

C615 Cut of posthole filled with C616

C616 Fill of C615

C617 Cut of stakehole filled with C618

C618 Fill of C617

C619 Non archaeological

C620 Cut of posthole filled with C621

C621 Fill of C620

C622 Cut of posthole filled with C623

C623 Fill of C622

C624 Cut of pit filled with C625

C625 Fill of C624

C626 Cut of posthole filled with C627

C627 Fill of C626

C628 Cut of posthole filled with C629

C629 Fill of C628

C630 Cut of posthole filled with C631

C631 Fill of C630

C632 Cut of posthole filled with C633

C633 Fill of C632

C634 Cut of stakehole filled with C635

C635 Fill of C634

C636 Cut of posthole filled with C637

C637 Fill of C636

C638 Cut of posthole filled with C639

C639 Fill of C638

C640 Cut of posthole filled with C641

C641 Fill of C640

C642 Cut of posthole filled with C643

C643 Fill of C642

C644 Fill of C645

C645 Cut of curvilinear structure/slot trench filled with C644

C646 Fill of C647

C647 Cut of curvilinear structure/slot trench filled by C646

C648 Cut of stakehole filled with C649

C649 Fill of C648

C650 Cut of stakehole filled by C651

C651 Fill of C650

C652 Cut of stakehole filled by C653

C653 Fill of C652

C654 Cut of stakehole filled by C655

C655 Fill of C654

C656 Cut of bowl furnace filled with C663, C662, C666, C665, C661, C660 and C659

C657 Cut of pit filled with C677 and C658

C658 Upper fill of C657

C659 Upper fill of C609 & C656

C660 Fourth fill of C609 & C656

C661 Tertiary fill of C609

C662 Secondary fill of C609

C663 Lower fill of C609 & C656

C664 Lower fill of C605

C665 Middle fill of C656

C666 Lower fill of C656

C667 Cut of pit filled with C668, C676, C675

C668 Upper fill of C667

C669 Cut of posthole filled with C670

C670 Fill of C669

C671 Cut of pit filled by C672

C672 Fill of C671

C673 Cut of pit filled with C674

C674 Fill of C673

C675 Middle fill of C667

C676 Lower fill of C667

C677 Lower fill of C657

4.2.2 Stratigraphic Matrix

Natural Deposit

C003	Natural subsoil: Consisted of yellow to pale-brown sandy-silt-clay. Below C002.

Recent deposit

C001	Topsoil: Consisted of dark brown clay-silt.
C002	Plough-soil: Consisted of mid brown sandy-clayey-silt. Above C003, below C001. Included a flint core (Plate 32).

Period II, Phase 1

Early Neolithic pit

C274	Cut of sub-rectangular pit, with rounded corners. Had a sharp break of slope at top, steeply sloping sides, and a sharp break leading to a highly disturbed uneven base. Measured 2.40m EW x 1.85m NS x 0.17m. Filled with C320. Located at the point where C335 and C565/C607, two linear ditches intersected, and truncated both of these ditches. Above C003, below C320.
C320	Fill of C274, with loosely compacted, rich brownish black silt. Frequent charcoal and fractured limestone included. Measured 2.40m EW x 1.85m NS x 0.17m. Contained a single sherd of early Neolithic pottery E2180:320:001 and a flint scraper E2180:320:002 (See Appendices 8.4 & 8.6; Plate 33). Above C003, under C002.

Curvilinear ditches

Curvilinear ditch 1

C070	Southwest segment of ditch, curvilinear in plan with a rounded terminal at its northeast extent, at its southwest extent C070 continued outside limit of excavation. Measured 23m NE/SW x 1.10m EW x 0.45m. Had a sharp break of slope at top, concave-sloping sides with many small stones pressed against the sides and a gradual break leading to an uneven base. Same as C564, northwest segment of linear ditch with similar orientation, and separated from C070 by 4m of undisturbed ground, most likely an entrance. Filled with C551 and C337. Above C003, below C551.
C551	Lower fill of C070, with loosely compacted pale orange-yellow light brown sandy clay. A moderate-frequent amount of boulders and pebbles included. Measured 23m NE/SW x 0.65m EW x 0.23m. Above C070, below C337.
C337	Upper fill of C070, with moderately compact, mid-brown fine grain powdery silt. Occasional cobbles and pebbles included. Measured 23m x 0.85m x 0.30m-0.45m. Above C551, below C002.

Curvilinear ditch 2

C564	Cut of curvilinear ditch, with a rounded terminal at its south end. C564 had two distinct sections; the southern 15m in length and mostly linear and the northern section was 15m in length and curvilinear. C564 continued outside the limit of excavation to the northeast. C564 met C335; a curvilinear ditch of similar dimensions but different orientation. It was unclear whether C564 was contemporary, preceded or post-dated C335, as the interface where both features met was truncated by C274, a later pit. However, the absence of a continuation of a similar ditch on the same axis as C335 after it interfaced with C564 suggests that both ditches were contemporary. Both C564 and C335 shared the same deposits which suggest that they were backfilled at the same time. C564 measured 30m x 0.40m-1.30m x 0.20-0.40m. Had a gradual-sharp break of slope at top, evenly sloping-concave sides and a gradual-sharp break leading to an uneven base, stony, and varied in width from 0.10m-0.40m. C070 and C607 are numbers that have been

	assigned to different segments of the same ditch. C564 was orientated northeast-southwest. Filled with C337 and C336. Above C003, below C337
C337	Lower fill of C564, with moderately compact greyish brown sandy-silt. A moderate amount of angular stone included. C337 was a deposit of C564, C335 and C070. Within C564, C337 measured 30m x 0.85m x 0.30m. Above C564, below C336.
C336	Upper fill of C564, with moderately compact light brown to greyish sandy-silt. Occasional angular limestone included. C336 was a deposit of C564, C335 and C070. Within C564, C336 measured 30m x 1m x 0.20m. Above C337, below C002.

Boundary ditch

C335	Cut of probable curvilinear boundary ditch, with a rounded terminal at the southeast end. Measured 38m NW/SW x 1m x 0.50m. At the southeast end, C335 becomes gradually shallower. Had a sharp break of slope at top, evenly sloping-slightly concave sides and a gradual-sharp leading to an uneven base, which was stony throughout. Orientated northwest/southwest. At northwest end, C335 met C564; a similar ditch orientated northeast-southwest. C274; a pit of unknown function truncated the upper edges of C335 and C564 at this point. Filled with C337, C336 and C320. Above C003, below C337.
C337	Lower fill of C335, with medium compact greyish brown stony silty-sand. Measured 38m x 1.20m x 0.40m. C337 abutted C336 within C337. Above C335, below C320.
C336	Middle fill of C335, with medium compact light brownish-grey sandy-silt. Occasional pebbles and stones included. Measured 0.20m in depth x 1m NS x 38m EW. Above C337, below C320.
C320	Upper deposit of C335, with loosely compact brownish black stony-silt. Occasional charcoal flecking included. Measured 1.80m x 1.80m x 0.17m. Above C336, below C002.

Period II, Phase 2: Mid-late Bronze Age activity

Postholes and stakeholes associated with Structure 1

Posthole 1

C613	Cut of circular posthole. Measured 0.15m x 0.15m x 0.20m. Had a sharp break of slope at top, vertical sides and a sharp break leading to a concave base. C613 may have supported a post that was part of a D-shaped structure formed by a series of similar posts and stakes C615, C620, C634, C632, C628, C626, C630 and C617. C613 had the same dimensions as C615. Filled with C614. Above C003, below C614.
C614	Fill of C613, with loosely compacted mid brown silty-clay. Occasional charcoal included. Measured 0.15m x 0.15m x 0.20m. Above C613, below C002.

Posthole 2

C615	Cut of circular posthole. Measured 0.15m x 0.15m x 0.20m. Had a sharp break of slope at top, vertical sides and a sharp break leading to a concave base. C615 may have supported a post that was part of a D-shaped structure formed by a series of similar posts and stakes C613, C620, C634, C632, C628, C626, C630 and C617. C615 had the same dimensions as C613. Filled with C616. Above C003, below C616.
C616	Fill of C615, with loosely compacted mid brown silty-clay. Occasional charcoal included. Measured 0.15m x 0.15m x 0.20m. Above C615, below C002.

Stakehole 1

C617	Cut of sub-oval stakehole. Measured 0.08m EW x 0.08m NS x 0.19m. Had a sharp break of slope at top, steep tapered sides and a sharp break leading to a gradually concave base. C617 may have supported a post that was part of a D-shaped structure formed by a series of similar posts and stakes C615, C620, C634, C632, C628, C626, C630 and C613. Filled with C618. Above C003, below C618.
C618	Fill of C617, with loosely compacted mid-light brown clayey sandy-silt. Occasional decayed sandstones included. Measured 0.08m x 0.08m x 0.19m. Above C617, below C002.

Posthole 3

C620	Cut of sub-oval posthole. Measured 0.20m NS x 0.22m EW x 0.22m. Had a sharp break of slope at top, evenly sloping-almost vertical sides and a gradual break leading to a flat base. C620 may have supported a post that was part of a D-shaped structure formed by a series of similar posts and stakes C615, C613, C634, C632, C628, C626, C630 and C617. Filled with C621. Above C003, below C621.
C621	Fill of C620, with loosely compacted mid brown silty-clay. Occasional charcoal included. Measured 0.20m NS x 0.22m EW x 0.22m. Above C620, below C002.

Posthole 4

C622	Cut of circular posthole. Measured 0.20m x 0.17m x 0.19m. Had a sharp break of slope at top, vertical sides and a gradual break leading to a rounded tapering base. C622 was situated 0.30m from three stakeholes C650, C652, C654, and may have been associated with these features. Filled with C623. Above C003, below C623.
C623	Fill of C622, with moderately compact greyish brown silty-sand. Occasional charcoal and stones included. Measured 0.20m x 0.17m x 0.19m. Above C622, below C002.

Pit 1

C624	Cut of oval pit. Measured 0.28m x 0.26m x 0.25m. Had a sharp break of slope at top, vertical sides and a sharp break leading to an uneven base. C624 was situated close to several postholes and stakeholes, and may have supported a structure. C624 was orientated east-west. Filled with C625. Above C003, below C625.
C625	Fill of C624, with loosely compacted greyish brown sandy-silt. Charcoal and pebbles included. Measured 0.28m x 0.26m x 0.25m. Above C624, below C002.

Posthole 5

C626	Cut of oval posthole. Measured 0.21m NS x 0.17m EW x 0.05m. Had a moderate break of slope at top, quite steep-concave sides, and a gradual break leading to a rounded base. C626 may have supported a post that was part of a D-shaped structure formed by a series of similar posts and stakes C615, C620, C634, C632, C628, C613, C630 and C617. Filled with C627. Above C003, below C627.
C627	Fill of C626, with well compact dark brown silty-sand. Occasional charcoal

	included. Measured 0.21m NS x 0.17m EW x 0.05m. Above C626, below C002.

Posthole 6

C628	Cut of circular posthole. Measured 0.23m x 0.21m x 0.17m. Had a sharp break of slope at top, vertical sides and a gradual break leading to a tapered rounded base. C628 may have supported a post that was part of a D-shaped structure formed by a series of similar posts and stakes C615, C620, C634, C632, C613, C626, C630 and C617. Filled with C629. Above C003, below C629.
C629	Fill of C628, with moderately compact greyish-brown silty-sand. Occasional charcoal and pebble included. Measured 0.23m x 0.21m x 0.17m. Above C628, below C002.

Posthole 7

C630	Cut of circular posthole. Measured 0.17m x 0.17m x 0.26m. Had a sharp break of slope at top, vertical sides and a sharp break leading to a flat base. C630 may have supported a post that was part of a D-shaped structure formed by a series of similar posts and stakes C615, C620, C634, C632, C628, C626, C613 and C617. Filled with C631. Above C003, below C631.
C631	Fill of C630, with loosely compacted black silty clay. Occasional charcoal and fractured sandstone included. Measured 0.17m x 0.17m x 0.26m. Above C630, below C002.

Posthole 8

C632	Cut of oval posthole. Measured 0.25m x 0.22m x 0.24m. Had a sharp break of slope at top, vertical sides and a gradual break leading to a tapered descending base to a centre point. C632 may have supported a post that was part of a D-shaped structure formed by a series of similar posts and stakes C615, C620, C634, C613, C628, C626, C630 and C617. Filled with C633. Above C003, below C633.
C633	Fill of C632, with well compact greyish brown sandy-silt. A moderate amount of stones and occasional charcoal included. Measured 0.25m x 0.22m x 0.24m. Above C632, below C002.

Stakehole 2

C634	Cut of circular stakehole. Measured 0.07m x 0.07m x 0.12m. Had a sharp break of slope at top, vertical sides, and a sharp break leading to a pointed base. C634 may have supported a post that was part of a D-shaped structure formed by a series of similar posts and stakes C615, C620, C613, C632, C628, C626, C630 and C617. Filled with C635. Above C003, below C635.
C635	Fill of C634, with loosely compacted mid-brown silty-clay. No other inclusions. Measured 0.07m x 0.07m x 0.12m. Above C634, below C002.

Stakehole 3

C636	Cut of oval posthole. Measured 0.17m x 0.11m x 0.10m. Had a sharp break of slope at top, vertical sides and a gradual break leading to a flat base. C636 was one of a group of three stakeholes that included C638 and C642, and may have functioned together as a wind-break or screen. Filled with C637. Above C003, below C637.
C637	Fill of C636, with moderately compact yellowish-brown sandy-silt. No other inclusions. Measured 0.17m x 0.11m x 0.10m. Above C636, below C002.

Posthole 9

C638	Cut of circular posthole. Measured 0.08m x 0.08m x 0.10m. Had a sharp break of slope at top, evenly sloping sides and a sharp break leading to a tapered pointed base. C638 was 0.25m east of C636 and 0.25m west of C642. These three stakeholes may have acted as a screen or wind-break. Filled with C639. Above C003, below C639.
C639	Fill of C638, with loosely compacted greyish-brown sandy-silt. No other inclusions. Measured 0.08m x 0.08m x 0.10m. Above C638, below C002.

Posthole/Pit 10

C640	Cut of sub-oval (figure of 8) posthole/pit. Measured 0.51m x 0.26m (in width at east end)-0.18m (in width at west end) x 0.16m (in depth at east end)-0.12m (in depth at west end). Had a sharp break of slope at top, concave sides and a gradual break leading to an uneven base. Orientated east-west. C640 may have functioned as a refuse pit or a double posthole, possibly associated with the complex of stakeholes (C650, C652 and C654) was 0.30m north of C640. Filled with C641. Above C003,

	below C641.
C641	Fill of C640, with moderately compact yellowish-grey silty-sand. Occasional charcoal and pebble included. Measured 0.51m x 0.26m (in width at east end)-0.18m (in width at west end) x 0.16m (in depth at east end)-0.12m (in depth at west end). Above C640, below C002.

Stakehole 4

C642	Cut of oval stakehole. Measured 0.13m x 0.10m x 0.08m. Had a sharp break of slope at top, vertical sides and a gradual break leading to a flat even base. C642 was one of a group of three stakeholes that included C638 and C636, and may have functioned together as a wind-break or screen. Filled with C643. Above C003, below C643.
C643	Fill of C642, with moderately compact medium brown sandy-silt. No other inclusions. Measured 0.13m x 0.10m x 0.08m. Above C642, below C002.

Stakehole 5

C650	Cut of oval stakehole. Measured 0.15m x 0.10m x 0.05m. Had a sharp break of slope at top, overhanging sides to the north; concave sides to the south; sloped steeply sides elsewhere and a gradual break leading to a rounded base. Inclination of axis was northwest-southeast, with a 30º angle of rise from northwest ascending to southeast. C650 was 0.20m west of C652 and was 0.35m southwest of C654, two similar postholes. These three postholes formed a possible screen or windbreak. Orientated northwest- southeast. Filled with C651. Above C003, below C651.
C651	Fill of C650, with moderately compact brownish yellow silty-sand. A moderate charcoal included. Measured 0.15m x 0.10m x 0.05m. Above C650, below C002.

Stakehole 6

C652	Cut of circular stakehole. Measured 0.10m x 0.10m x 0.05m. Had a sharp break of slope at top, concave sides and a gradual break leading to a rounded base. C652 was 0.20m east of C650 a posthole, and was 0.15m southwest of C654, a similar stakehole. Together these features formed a possible screen or windbreak. Filled with C653. Above C003, below C653.
C653	Fill of C652, with moderately compact brownish yellow silt-sand. No other inclusions. Measured 0.10m x 0.10m x 0.05m. Above C652, below C002.

Stakehole 7

C654	Cut of circular stakehole. Measured 0.10m x 0.09m x 0.05m. Had a sharp break of slope at top, concave sides and a gradual break leading to a rounded base. C654 was 0.15m northeast of C652, and 0.35m east of C650; both C652 and C650 were similar stakeholes. These three features may have functioned as a screen or windbreak. Filled with C655. Above C003, below C655.
C655	Fill of C654, with moderately compact brownish yellow silty-sand. Occasional charcoal included. Measured 0.10m x 0.09m x 0.05m. Above C654, below C002.

Pit 2

C605	Cut of oval pit. Measured 1.32m EW x 0.90m NS x 0.43m. Had a sharp break of slope at top, steeply sloping sides and a moderately break leading to a slightly uneven undulating base. C605 probably function as a refuse pit, both deposits of C605 contained pottery sherds which suggests a domestic function. Filled with C664, C606. Above C003, below C664.
C664	Lower fill of C605, with compact mid-brown clay-silt. A moderate amount of charcoal, sandstone and limestone included. Measured 0.90m NS x 1.23m EW x 0.25m. C664 contained numerous sherds of pottery from the mid to late Bronze Age. Find numbers: E2180:664:001-046 (See Appendix 8.6; Plate 40). Above C605, below C606.
C606	Upper fill of C605, with moderately compact mottled black/dark brown silty-clay. Frequent charcoal and heat-fractured sandstone included. Measured 1.23m EW x 0.90m NS x 0.23m. C606 contained numerous sherds of pottery from the mid to late Bronze age. Finds number: E2180:606:001-047 (See Appendix 8.6; Plates 36-39). Above C664, below C002.

Pit 3

C657	Cut of sub-rectangular pit, with rounded corners. Measured 2.20m NS x 1.25m EW x 0.40m. Had a sharp break of slope at top, steep sloping sides and a gradual break leading to a mostly flat base. Orientated north-south. C657 was 0.80m south of C564 a curvilinear ditch. Filled with C677, C658. Above C003, below C677.
C677	Lower fill of C657, with firmly compact dark greyish brown stone rich silty-clay. Occasional charcoal included. Measured 2.20m NS x 1.25m EW x 0.23m. Above

	C657, below C658.
C658	Upper fill of C657, with loosely compacted brown stone-rich silty-clay. The stone element of C658 consisted of fractured angular sandstones. Measured 2.20m NS x 1.25m EW x 0.25m. Above C677, below C002.

Pit 4

C673	Cut of circular pit. Measured 0.38m x 0.38m x 0.28m. Had a sharp break of slope at top, steeply sloped sides and a sharp break leading to a flat slightly undulating base. C673 was 3.50m south of C657, and 5.00m east of C564. It was unclear what function C673 had. Several stones lined the edge of C673 which would have supported an upright post. Filled with C674. Above C003, below C674.
C674	Fill of C673, with firmly compact mid greyish brown sandstone rich silty-clay. Measured 0.38m x 0.38m x 0.28m. Several of the larger sandstones within C674 measured up to 0.30m x 0.15m x 0.08m, and lined the edges of C673. Above C673, below C002.

Period II, Phase 3: Iron Age Activity

Isolated Pit C583

C583	Cut of irregular isolated pit within angle of C070 and C335. Measured 0.60 x 0.5 x 0.45m. Had a sharp break of slope and vertical sides with a concave base. Filled with C594 and C584. Small concentration of slag in uppermost fill. Cut C003, below C002.
C594	Primary fill of C583 with compact dark brown clay-silt and frequent charcoal. Measured 0.35 x 0.30 x 0.10m. Above C003, below C584.
C584	Secondary fill of C583 with medium brown silty clay. Contained occasional charcoal and a small concentration of slag. Measured 0.50 x 0.6 x 0.3m. Contained rim fragments of furnace bowl lip (E2180:584:001). Above C594.

Slot Trench of Structure 2

Slot trench 1

C603	Cut of curvilinear slot trench, with rounded terminals. Measured 5.50m x 0.40m x 0.18m. Had a sharp break of slope at top, vertical sides, and a sharp break leading to a flat base. C603 was associated with C645 and C647, two similar slot trenches; all

	three formed an incomplete irregular semi-circular outline of a structure. C603 was orientated northwest-southeast. Filled with C604. Above C003, below C604.
C604	Fill of C603, with loosely compacted greyish brown silty-clay at its outer limits, and more moderately compacted towards the centre. Charcoal and decayed sandstone included. Measured 5.50m x 0.40m x 0.18m. Above C603, below C002.

Slot trench 2

C645	Cut of curvilinear slot trench, with rounded terminals. Measured 4m x 0.26m x 0.15m. Had a sharp break of slope at top, vertical sides and a sharp break leading to a flat even base. C645 together with C603 and C647 formed an incomplete, semi-circular outline of a probable structure. C645 was orientated roughly south-northwest. Filled with C644. Above C003, below C644.
C644	Fill of C645, with well compact dark brown silty-clay. Occasional charcoal and badly decayed sandstone included. Measured 4m x 0.26m x 0.15m. Above C645, below C002.

Slot trench 3

C647	Cut of curvilinear slot trench, with rounded terminals. Measured 1.53m x 0.30m x 0.17m. C647 together with C603 and C645 formed an incomplete, semi-circular outline of a probable structure. C647 was orientated northeast-southwest. Filled with C646. Above C003, below C646.
C646	Fill of C647, with loosely compacted greyish-brown silty-clay towards the outer edges and more compact towards the centre. Frequent charcoal and decayed sandstone included. Measured 1.53m x 0.30m x 0.17m. Above C647, below C002.

Features associated with structure 2

Posthole 1

C669	Cut of sub-circular posthole. Measured 0.20m x 0.20m x 0.20m. Had a sharp break of slope at top, vertical sides and a sharp break leading to a flat base. C669 may have been associated with C671, a pit which was 1.30m west of C669. Filled with C670. Above C003, below C670.
C670	Fill of C669, with loosely compacted mid-brown silty-clay. Occasional flecks of charcoal and pebbles included. Measured 0.20m x 0.20m x 0.20m. Above C669,

	below C002.

Pit 1

C671	Cut of circular pit. Measured 0.60m x 0.60m x 0.19m. Had a sharp break of slope at north end; moderate break of slope at south end, moderately evenly sloping sides, and a gradual break leading to an uneven base. It is unclear whether C671 was within the structure formed by the three slot trenches C647, C645, and C603. C671 was situated 2m southeast of a similar feature C610, and 1m north of C667 a pit. May have been associated with domestic activity. Filled with C672. Above C003, below C672.
C672	Fill of C671, with loosely compacted brown silty-clay. Frequent charcoal flecking and fractured sandstone included. Measured 0.60m x 0.60m x 0.19m. Above C671, below C002.

Pit 2

C610	Cut of circular pit. Measured 0.70m x 0.70m x 0.12m. Had a sharp break of slope at top, evenly sloping sides and a gradual break leading to an even-flat base. C610 was located within the interior of a structure formed by three slot trenches C647, C645, and C603. May have functioned as a storage pit. Filled with C612. Above C003, below C612.
C612	Fill of C610, with moderately compact mid brown silty-clay. A moderate amount of charcoal included. Measured 0.70m x 0.70m x 0.12m. C612 contained a worked flint, find number E2180:612:001 (Plate 34). Above C610, below C002.

Pit 3

C667	Cut of oval pit. Measured 1.20m NS x 1.02m EW x 0.20m. Had a sharp break of slope at top, evenly sloping sides and a gradual-concave slope leading to a mainly flat but slightly rounded base. Orientated north-south. C667 was 1m south of C671; a pit, and 1.30m west of C669; a posthole. It was unclear whether C667 was inside or outside the structure formed by the three slot trenches C647, C645, and C603. C667 may have functioned as a refuse pit for domestic cooking. Filled with C676, C675 and C668. Above C003, below C676.
C676	Lower fill of C667, with firmly compact brown sandy silty-clay. Frequent charcoal

	and fractured sandstone included. Measured 1m NS x 0.80m EW x 0.05m. Above C667, below C675.
C675	Middle fill of C667, with compact yellowish-grey silty-clay. Charcoal and fractured sandstone included. Measured 1m NS x 0.85m EW x 0.10m. Above C676, below C668.
C668	Upper fill of C667, with firmly compact light greyish brown sandy silty-clay. Frequent large pieces of charcoal included. Measured 1.20m NS x 1m EW x 0.20m. Above C675, below C002.

Stakehole 1

C648	Cut of oval stakehole. Measured 0.09m x 0.05m x 0.10m. Had a sharp break of slope at top, steeply sloping sides and a gradual break leading to a rounded base. C648 was situated in the interior of a structure formed by three slot trenches. Filled with C649. Above C003, below C649.
C649	Fill of C648, with loosely compacted mid-brown sandy clay-silt. A moderate amount of charcoal and small pebble included. Measured 0.09m x 0.05m x 0.10m. Above C648, below C002.

Bowl Furnace 1

C004	Cut of ovular bowl furnace, truncated by agricultural activity. Measured 0.75m NS x 0.40m EW x 0.28m. Had a sharp break of slope at top, sub-vertical sides, and a gradual break leading to an uneven base sloping upwards from south to north. Filled with C100, C104, C114, C102, C101 and C096. Above C003, below C100.
C100	Lower fill of C004, with medium compact mid-orangey-red fine grained oxidized silty-clay. Occasional pebble included. Measured 0.40m EW x 0.20m NS x 0.20m. Above C004, below C114.
C114	Secondary fill of C004, with heavily cemented greyish dark-blue-green vitrified clay. C104 lined the north, south and east edges of C004. Measured 0.70m x 0.03-0.05m x 0.12m. Above C100, below C104.
C104	Tertiary fill of C004, with heavily compacted yellowish-red to black-brown pebble rich silty-clay. A moderate of slag included. This deposit occurred sporadically throughout C004, but was concentrated mostly towards the centre, where it measured 0.60m NS x 0.70m EW x 0.15m. Above C114, below C102.

C102	Fourth fill of C004, with loose brownish-black silty-clay. Oxidized clay included. Measured 0.50m NS x 0.35m EW x 0.12m. Above C104, below C101.
C101	Fifth fill of C004, with compact orange-pale-yellow silty-clay. Occasional small pebble included. C101 occurs sporadically in lumps within the other deposits, throughout C004. Above C102, below C096.
C096	Upper fill of C004, with moderately compact mid to dark-brown silty-clay. A moderate amount of charcoal flecking and frequent vitrified clay included. Measured 0.35m EW x 0.40m NS x 0.10m. Above C101, below C002.

Bowl Furnace 2

C005/057	Cut of ovular bowl furnace, partially stone-lined. Had a sharp break of slope at the top, sub-vertical sides and a moderate break leading to a rounded base. Measured 1.21m SW/NE x 0.64m NW/SW x 0.43m. Filled with C395, C394, C382, C381, C055, C054 and C056. Above C003, below C395.
C395	Lower fill of C005, with yellowish-orange oxidized clay. No other inclusions. Measured 1.21m SW/NE x 0.64m NW/SW x 0.43m. Above C005, below C394.
C394	Secondary fill of C005, with bluish-white grey stone. Consisted of individual angular and rectangular stones of quartzite and limestone that measured on average 0.25m x 0.15m x 0.05m. The stones were placed upright and lined the edges of C005. Above C395, below C382.
C382	Tertiary fill of C005, with compact greenish black vitrified clay. This deposit lined the stone edges at the western end of C005, and measured 0.80 SW/NE x 0.15m NW/SW x 0.10m-0.22m. Above C394, below C381.
C381	Fourth fill of C005, with compact light orange to red oxidized clayey-silt. Measured 0.40m west-east x 0.42m NS x 0.04m. C381 was only located at the western end of C005. Above C382, below C055.
C055	Fifth fill of C005, with compact light red oxidized silty-clay. No other inclusions. Measured 1.21m SW/NE x 0.6m NW/SW x 0.08m. Above C381, below C054.
C054	Sixth fill of C005, with friable dark brownish-black charcoal rich silt. Frequent slag included. Measured 0.90m EW x 0.50m NS x 0.36m. Above C055, below C056.
C056	Upper fill of C005, with medium compact dark brownish-black sandy-silt. Frequent slag and occasional charcoal included. Measured 0.40m SW/NE x

	0.35m NW/SW x 0.12m. Above C054, below C002.

Pit 4

C006	Cut of circular pit, containing stone possibly used as a platform or working surface. Measured 2.17m EW x 1.85m NS x 0.20m. A moderate break of slope at top, concave sides and a moderate break leading to a flat base. Filled with C157, C007.
C157	Lower fill of C006, with friable dark brown silty-sand. Frequent charcoal and pebble included. Measured 1.78m EW x 1.65m NS 0.13m. Above C006, below C007.
C007	Upper fill of C006, with compact quartz and limestone cobbles and blocks, angular and sub-angular in shape. These measured individually 0.20m x 0.15m x 0.07m. Collectively C007 measured 2.00m EW x 1.60m NS x 0.10m. Above C157, below C002.

Bowl Furnace 3

C008	Cut of circular bowl furnace. Measured 0.60m NS x 0.62m EW x 0.35m. Had a sharp break of slope at the top to the north; more gradual elsewhere, vertical sides; slightly convex in the west and a flat base. C008 is associated with two bowl furnaces, C009 borders C008 to the northwest, and C010 situated 0.50m north of C008. These three features formed a triangle of bowl furnaces located 1m from C070 a northeast-southwest curvilinear ditch. Filled with C150, C131, C130, C151, C139, C115 and C132. Above C003, below C150.
C150	Lower fill of C008, wit pinkish-red oxidised sandy silt-clay. No other inclusions. This deposit formed a ring around the edge of C005. Measured 0.08m x 0.05m (width x depth). Above C008, below C131.
C131	Secondary fill of C008, with firm reddish-orange oxidised clay. No other inclusions. Measured 0.42m NS x 0.40m EW x 0.08m. Above C150, below C130.
C130	Tertiary fill of C008, with compacted bluish-grey vitrified clay lined the edge of C008. Occasional mica and quartz fragments included. Measured 0.08m x *c*.0.05m (width x depth). Above C131, below C151.
C151	Fourth fill of C008, with loose blackish-grey charcoal rich silty-clay. No other inclusions. Measured 0.40m NS x 0.40m EW x 0.10m. Above C130, below C115 (C139).
C139	Slag layer within C008, with compact broken blackish green slag pieces. Measured

	0.25m EW x 0.30m NS x 0.07m max. Above C151, below C115.
C115	Fifth fill of C008, with loosely compacted blackish dark brown clayish-silt. Occasional charcoal flecks included. Measured 0.34m NS x 0.32m EW x 0.10m. Above C151 (C139), below C132.
C132	Upper fill of C008, with loose blackish-grey slag. Occasional charcoal included. Measured 0.40m NS x 0.40m EW x 0.15m. Above C115, below C002.

Bowl Furnace 4

C009	Cut of sub-circular bowl furnace. Measured 0.70m SE/NW x 0.50m SW/NE x 0.25m. Had a moderate break of slope at top, even sloping sides and a moderate-sharp break leading to an uneven base, pot-marked with stone holes. C009 was associated with two other bowl furnaces, C008 which bordered C009 at the southeast, and C010 which was 0.50m east of C009. Filled with C214, C184, C182, C183, C199, C186 and C116. Above C003, below C214.
C214	Lower fill of C009, with well compacted pinkish-red oxidised clay. No other inclusions. Measured 0.15m SE/NW x 0.12m SW/NE x 0.10m. This deposit lined the cut of C009. Above C009, below C184.
C184	Secondary fill of C009, with moderately compact reddish-orange silty-clay. Frequent well compacted firm red clay included. C184 lined C008. Measured 0.08m x 0.20m (width x depth). Above C214, below C182
C182	Tertiary fill of C009, with heavily compact greyish-blue vitrified clay lining its upper extent. Measured 0.04m x 0.06m-0.10m (width x depth). Above C184, below C183.
C183	Fourth fill of C009, with slag-rich medium-heavily compacted mottled reddish-orange clay. Blackish-green vitrified clay pieces included. Measured 0.45m SE/NW x 0.25m SW/NE x 0.17m. Above C182, below C199.
C199	Fifth fill of C009, loose brownish-black charcoal rich clay-silt that contained occasional slag inclusions. Measured 0.30m SE/NW x 0.25m SW/NE x 0.07m in depth. Above C183, under C186.
C186	Sixth fill of C009, with loose greyish black slag-rich clayey-silt. Occasional charcoal included. Measured 0.35m SE/NW x 0.25m SW/NE x 0.10m. Above C199, below C116.
C116	Upper fill of C009, with loose greyish brown-black clayey silt. Occasional charcoal included. Measured 0.50m SE/NW x 0.30m SW/NE x 0.10m. Above C186, below

	C002.

Bowl furnace 5

C010	Cut of sub-circular bowl furnace. Measured 0.65m NW/SW x 0.55m NE/SW x 0.35m. A moderate break of slope at top, near vertical sides to the northwest, sloping gradually elsewhere; and a moderate break leading to a rounded base. C010 was orientated northwest-southeast. Filled with C246, C222, C223, C221, C220 and C117. Above C003, below C246.
C246	Lower fill of C010, with compact pinkish-red sandy silt-clay. C246 formed an irregular ring around the outer extent of C010. Measured 0.10m-0.12m x 0.25m (width x depth). Above C010, below C222.
C222	Secondary fill of C010, with heavily compact greyish-blue vitrified clay. C222 formed an incomplete ring around the outer extent of C010. Measured 0.02m-0.06m x 0.08m (width x depth). Above C246, below C223.
C223	Tertiary fill of C010, with loosely compacted slag-rich dark grey clayish-silt. Occasional charcoal included. Measured 0.25m NW/SW x 0.18m NE/SW x 0.04m. Above C222, below C221.
C221	Fourth fill of C010, with loosely compacted slag-rich dark-grey clayish silt. Frequent charcoal included. Measured 0.30m NW/SW x 0.25m NE/SW x 0.15m. Above C223, below C220.
C220	Fifth fill of C010, with moderately compact red oxidised clay. Dark grey and black clay included. Measured 0.30m NW/SW x 0.20m NE/SW x 0.05m. C220 may be the remains of a clay covering for C010. Above C221, below C117.
C117	Upper fill of C010, with loosely compacted dark black clayish silt. Light brown clay and occasional charcoal and slag included. Contained 8 sherds of prehistoric pottery (E2180:117:2; Plate 35). Measured 0.40m NW/SW x 0.30m NE/SW x 0.15m. Above C220, below C002.

Pit 5

C011	Cut of oval pit, used for stone clearance or refuse. Measured 1.90m EW x 0.86m NS x 0.10m. Had a gradual break of slope at top and a gradual break leading to an uneven base. Orientated east-west. Filled with C372. Above C003, below C372.
C372	Fill of C011, with loose greyish-brown clayish-silt. Frequent stone included.

	Measured 1.90m EW x 0.86m NS x 0.10m. Above C011, under C002.

Bowl furnace 6

C012	Cut of oval bowl furnace, heavily disturbed by more modern agricultural activity. Measured 0.77m EW x 0.40m NS x 0.15m. A moderate break of slope at top, evenly sloping sides and a gradual break leading to a flat base. Orientated east-west. Filled with C109. Above C003, below C109.
C109	Fill of C012, with loosely compacted dark-greyish-brown clayish-silt. A moderate amount of pebbles and charcoal included. Measured 0.77m EW x 0.40m NS x 0.15m. Above C012, below C002.

Bowl Furnace 7

C014	Cut of circular bowl furnace. Measured 0.75m NW/SW x 0.46m NE/SW x 0.40m. Had a sharp break of slope at top, evenly sloping sides and a gradual break leading to a flat base. Associated with two other bowl furnaces, C015, 0.5m south of C014, and C016, 0.3m east of C014. Filled with C333, C192, C193, C194, C269, C276, C332, C191 and C190.
C333	Lower fill of C014, with compact red oxidised clay. A moderate amount of pebbles included. Measured 0.80m x 0.05m x 0.40m. Above C014, below C192.
C192	Secondary fill of C014, with heavily compact dark greenish-grey vitrified clay. Light red clay, small pebbles and occasional slag included. C192 lines the outer edge of C014 and formed an incomplete ring. Measured *c*.0.40m NS x 0.35m EW x 0.05m. Above C333, below C193.
C193	Tertiary fill of C014, with compact dark reddish-brown clayish-silt. Occasional oxidised clay and pebbles included. Measured 0.60m NS x 0.50m EW x 0.10m. Above C192, below C194.
C194	Fourth fill of C014, with heavily compacted, dark greenish-grey vitrified clay. Occasional slag included. Measured 0.05m x 0.16m (width x depth). Above C193, below C269.
C269	Fifth fill of C014, with mottled mix of loose dark brownish-black clayish-silt and (85%) and heavily compact bluish-black slag. Measured 0.50m NW/SW x 0.30m NE/SW x 0.12m. Above C194, below C276.
C276	Sixth fill of C014, with loosely compacted mix of dark brownish-black clayish silt.

	Dark black charcoal (70%), and occasional slag included. Measured 0.40m NW/SW x 0.32m NE/SW x 0.12m. Above C269, below C332.
C332	Seventh fill of C014, with compact orange-red oxidised clay. Measured 0.53m NS x 0.43m EW x 0.05m. C332 may be the remains of the collapsed superstructure of C014. Above C276, below C191.
C191	Eighth fill of C014, with loose dark brownish-black clayish-silt. Frequent charcoal included. Measured 0.30m EW x 0.30m NS x 0.10m. Above C332, below C190.
C190	Upper fill of C014, with loosely compacted light reddish-brown clayish-silt. Occasional oxidised clay included. Measured 0.30m EW x 0.15m NS x 0.03m. Above C191, below C002.

Bowl Furnace 8

C015	Cut of circular bowl furnace. Measured 0.40m NS x 0.37m EW x 0.20m. Had a sharp break of slope at top, overhanging concave sides and a gradual break leading to a flat even base. Associated with two other bowl furnaces, C014, 0.5m northwest of C015, and C016, 0.5m north of C015. Filled with C331, C178, C177, C176, C175, C174 and C173. Above C003, below C331.
C331	Lower fill of C015, with compact red oxidised clay. Occasional pebble included. Measured 0.36m x 0.03m (width x depth). This deposit lined the base of C015. Above C015, below C178.
C178	Secondary fill of C015, with greyish-green vitrified clay that formed an incomplete ring around the outer extent of C015. Measured 0.05m x 0.11m (width x depth). Above C331, below C177.
C177	Tertiary fill of C015, with loosely compacted, blackish dark-brown clayish silt. Frequent charcoal flake included. Measured 0.25m NS x 0.25m EW x 0.04m. Above C178, below C176.
C176	Fourth fill of C015, with loosely compacted, dark brown clayish silt. Occasional vitrified clay included. Measured 0.30m NS x 0.30m EW x 0.12m. Above C177, below C175.
C175	Fifth fill of C015, with loosely compacted, dark blackish-brown charcoal and slag. Measured 0.30m NS x 0.30m EW x 0.05m. Above C176, below C174.
C174	Sixth fill of C015, with loosely compacted, dark brown clayish silt. Occasional slag included. Measured 0.15m NS x 0.15m EW x 0.02m. Above C175, below C173.

C173	Upper fill of C015, with loosely compacted, light-reddish brown clayish silt. Occasional oxidised clay pieces included. Measured 0.20m NS x 0.15m EW x 0.05m. Above C174, below C002.

Bowl Furnace 9

C016	Cut of circular bowl furnace. Measured 0.55m x 0.55m x 0.20m. Had a moderate break of slope at top, evenly sloping sides and a gradual break leading to a flat base. C016 was associated with two other bowl furnaces, C014, 0.3m west of C016, and C015, 0.5m south of C016. Filled with C213, C212, C211, C296, C297 and C298.
C213	Lower fill of C016, with compact red oxidised clay. A moderate amount of small stone included. Measured 0.67m x 0.67m x 0.08m. C213 lines the extent of C016. Above C016, below C212.
C212	Secondary fill of C016, with heavily compacted dark greenish-grey vitrified clay. Measured 0.43m EW x 0.05m x 0.11m. C212 formed an incomplete irregular ring around the extent of C016. Above C213, below C211.
C211	Tertiary fill of C016, with loosely compacted light reddish-brown clayish silt. Occasional burned clay included. Measured 0.40m NS x 0.36m EW x 0.07m. Above C212, below C296.
C296	Fourth fill of C016, with heavily compacted dark blackish brown slag. A moderate amount of oxidised clay included. Measured 0.40m NS x 0.35m EW x 0.10m. C296 represents a failed attempt at firing C016, forming a PCB. Above C211, below C297.
C297	Fifth fill of C016, with loosely compacted mid-brown clayish-silt. Measured 0.40m NS x 0.35m EW x 0.02m. Above C296, below C298.
C298	Upper fill of C016, with loosely compacted dark reddish-brown clayish-silt. A moderate amount of charcoal and slag included. Measured 0.40m NS x 0.35m EW x 0.08m. Above C297, below C002.

Bowl Furnace 10

C017	Cut of sub-circular bowl furnace. Measured 0.74m NS x 0.66m EW x 0.34m. Had a moderate break of slope at top, concave sides and a gradual break leading to an even base. C017 was associated with two other bowl furnaces; C018 immediately east of C017, and C019 immediately east of C018. Filled with C370, C366, C357, C310, C317 and C309. Above C003, below C370.
C370	Lower fill of C017, with moderately compact reddish orange oxidised clay. Occasional pebbles included. C370 lines the outer extent of C017. Measured 0.10m x 0.02m (width x depth). Above C017, below C366.
C366	Secondary fill of C017, with heavily compacted greenish-grey vitrified clay. Frequent slag included. C366 forms an incomplete irregular ring around the outer extent of C017. Measured 0.12m x 0.02m (width x depth). Above C370, below C357.
C357	Tertiary fill of C017, with loosely compacted greyish black clayish silt. Frequent slag and charcoal included. Measured 0.33m NS x 0.29m EW x 0.16m. Above C366, below C310.
C310	Fourth fill of C017, with compact reddish-orange oxidised clay. Frequent slag and occasional vitrified clay included. Measured 0.35m x 0.35m x 0.22m. Above C357, below C317.
C317	Fifth fill of C017, with compact greyish brown sandy silt. Frequent light yellow clay, charcoal and a moderate amount of slag included. Measured 0.42m NS x 0.30m EW x 0.07m. Above C310, below C309.
C309	Upper fill of C017, with loosely compacted light brown sandy clay. Occasional slag, stone pebbles included. Measured 0.60m x 0.60m x 0.05m. Above C317, below C002.

Bowl Furnace 11

C018	Cut of circular bowl furnace. Measured 0.54m NS x 0.53m EW x 0.19m. Had a moderate break of slope at top, concave sides and a moderate break leading to a rounded base. Associated with two other bowl furnaces C017; immediately west of C018, and C019 immediately east of C018. Filled with C369, C295, C288, C287 and C237. Above C003, below C369.
C369	Lower fill of C018, with medium compact reddish-orange oxidised clay. A moderate amount of stone pebble included. C369 lines the base of C018. Measured 0.50m x 0.50m x 0.10m. Above C003, below C295.
C295	Secondary fill of C018, with compact greenish grey vitrified clay. Occasional pebbles included. C295 formed an irregular incomplete ring around the edge of C018 but was absent on the western edge. Measured 0.10m x 0.50m (width x depth). Above C369, below C288.
C288	Tertiary fill of C018, with moderately compact, dark greyish black clayish silt. Frequent slag and a moderate amount of charcoal included. Measured 0.25m EW x 0.27m NS x 0.05m. Above C295, below C287.
C287	Fourth fill of C018, with loosely compacted, dark greyish-brown sandy-silt. Frequent charcoal and a moderate amount of slag included. Measured 0.40m x 0.40m x 0.10m. Above C288, below C237.
C237	Upper fill of C018, with loosely compacted, light brown sandy clay. Occasional slag included. Measured 0.18m NS x 0.10m EW x 0.08m. Above C287, below C002.

Bowl Furnace 12

C019	Cut of sub-circular bowl furnace. Measured 0.75m NS x 0.70m EW x 0.32m. Had a sharp break of slope at top, concave sides and a gradual break leading to a flat base. C019 was associated with two other bowl furnaces; C018 immediately west of C019, and C017 immediately west of C018. Filled with C368, C258, C233, C236 and C237. Above C003, below C368.
C368	Lower fill of C019, with moderately compact, reddish-orange oxidised clay. Occasional pebble included. C368 lined the extent of C019. Measured 0.10m x 0.05m (width x depth). Above C019, below C258.
C258	Secondary fill of C019, with heavily compact greenish grey vitrified clay. Occasional stone pebble included. C258 formed an incomplete irregular ring around

	the extent of C019. Measured 0.05m x 0.05m (width x depth). Above C368, below C233.
C233	Tertiary fill of C019, with loosely compacted, greyish black clayish-silt. Frequent slag included. Measured 0.55m x 0.55m x 0.26m. Above C258, below C236.
C236	Fourth fill of C019, with loosely compacted, light brownish-red clay. Occasional pebble included. Measured 0.48m NS x 0.23m EW x 0.13m. Above C233, below C237.
C237	Upper fill of C019, with loosely compacted, light brown sandy clay. Occasional slag included. Measured 0.18m NS x 0.10m EW x 0.08m. Above C236, below C002.

Bowl Furnace 13

C020	Cut of ovular bowl furnace. Measured 0.38m NW/SW x 0.32m NE/SW x 0.12m. Had a sharp break of slope at top, near vertical sides and a sharp break leading to a flat base formed by a single large stone. C020 was associated with a complex of features that included C021, C022, C023 and C024. Filled with C260, C259. Above C003, below C260.
C260	Lower fill of C020, with compact light pinkish-red silty-clay. C260 lined the base and sides of C020. Measured 0.03m x 0.06m (width x depth). Above C020, below C259.
C259	Upper fill of C020, with well compact slag-rich dark-brownish dark grey mottled clayish-silt. Occasional charcoal included. Measured 0.35m NW/SW x 0.26m NE/SW x 0.12m. Above C260, below C002.

Bowl Furnace 14

C021	Cut of sub-circular bowl furnace. Measured 0.30m EW x 0.28m NS x 0.15m. Had a sharp break of slope at top, vertical-slightly concave sides and a gradual break leading to an even stony base. C021 was associated with a complex of features that included C020, C022, C023 and C024. Filled with C272 and C273. Above C003, below C272.
C272	Lower fill of C021, with compact dark greyish black clayish silt. A moderate amount of slag and occasional charcoal included. C272 formed an incomplete irregular ring around the extent of C021. Measured 0.07m x 0.15m (width x depth). Above C021, below C273.

C273	Upper fill of C021, with loosely compacted slag-rich sandy-silt. Occasional charcoal included. Measured 0.25m EW x 0.21m NS x 0.12m. Above C272, below C002.

Bowl Furnace 15

C022	Cut of sub-circular bowl furnace. Measured 0.70m NS x 0.63m EW x 0.25m. Had a sharp break of slope at top, near-vertical sides and a gradual break leading to a rounded base. C022 was associated with a complex of features including C020, C021, C023 and C024. Filled with C280, C279, C278, C283 and C277. Above C003, below C280.
C280	Lower fill of C022, with compact, stone rich pinkish-orange red oxidised clay. C280 formed a complete irregular ring around the outer extent of C022. Measured 0.12m x 0.15m (width x depth). Above C022, below C279.
C279	Secondary fill of C022, with heavily compacted bluish-grey vitrified clay. Silt pockets included. C279 formed an irregular incomplete ring around C022, and was wider at the south of C022. Measured 0.05m x 0.10m (width x depth). Above C280, below C278.
C278	Tertiary fill of C022, with compact dark greyish-black clayish silt. A moderate amount of charcoal included. Measured 0.28m x 0.28m x 0.15m. Above C279, below C283.
C283	Fourth fill of C022, with well compact slag rich (35%) dark brown silt. Occasional charcoal rusty-coloured clay included. Measured 0.40m NS x 0.30m EW x 0.30m. Above C278, below C277.
C277	Upper fill of C022, with compact orange oxidised clay. Frequent slag included. Measured 0.50m NS x 0.35m EW x 0.10m. Above C283, below C002.

Bowl Furnace 16

C023	Cut of circular bowl furnace. Measured 0.70m x 0.70m (length x width). Had a sharp break of slope at top, sloping convex sides and a gradual break leading to a rounded base. C023 was associated with other features C020, C021, C022 and C024. Filled with C362, C343, C342, C341, C340, C339 and C338. Above C003, below C362.
C362	Lower fill of C023, with dark rusty-brown oxidised clayish silt. Measured 0.15m x 0.15m x 0.05m. C362 lined the outer extent of C023, and formed an incomplete

	irregular ring. Above C023, below C343.
C343	Secondary fill of C023, with compact, reddish orange oxidised clay that formed an incomplete ring around the extent of C023. Measured 0.15m x 0.32m (width x depth). Above C362, below C342.
C342	Tertiary fill of C023, with heavily compacted bluish-grey vitrified clay that formed an irregular incomplete ring around the extent of C023. Measured 0.10m x 0.20m (width x depth). Above C343, below C341.
C341	Fourth fill of C023, with compact, blackish dark grey clayish silt. Frequent charcoal and a moderate amount of slag included. Measured 0.25m x 0.25m x 0.28m. Above C342, below C340.
C340	Fifth fill of C023, with loosely compacted very dark rusty brown clayish silt. Measured 0.15m x 0.15m x 0.05m. Above C341, below C339.
C339	Sixth of C023, with loosely compacted dark brown silty-sand and slag. Occasional charcoal included. Measured 0.30m x 0.30m x 0.12m. Above C340, below C338.
C338	Upper fill of C023, with loosely compacted light brown silty-sand. Occasional slag included. Measured 0.30m SW/NE x 0.25m SE/NW, x 0.16m. Above C339, below C002.

Pit 6

C024	Cut of ovular pit. Measured 0.42m SE/NW x 0.37m SW/NE x 0.12m. Had an uneven gradual break of slope at top, slightly sloped-stepped sides and a gradual break leading to an uneven pot-marked base. Associated with a complex of features C020, C021, C022 and C023. Filled with C379 and C377. Above C003, below C379.
C379	Lower fill of C024, with loosely compacted light brown silty-sand. Measured 0.42m SE/NW x 0.37m NE/SW x 0.08m. Above C024, below C377.
C377	Upper fill of C024, with loosely compacted light brown charcoal-rich silty-sand. Measured 0.30m NE/SW x 0.20m NW/SW x 0.04m. Above C379, below C002.

Pit 7

C053	Cut of oval pit, with rounded corners. Measured 1.19m NE/SW x 0.85m NW/SW x 0.13m. Had a moderate break of slope at top, concave sides and a gradual break leading to a flat base. Filled with C111. Truncated by C067 at its eastern edge.

	Above C003, below C111.
C111	Fill of C053, with compact dark brownish black clayish-silt. Frequent charcoal and stone included. Measured 1.19m NE/SW x 0.85m NW/SW x 0.13m. Above C053, below C002.

Posthole 2

C060	Cut of sub-rectangular posthole. Measured 0.10m NS x 0.07m EW x 0.13m. Had a sharp break of slope at top, steep near vertical sides and a sharp break leading to a U-shaped base. Filled with C059. Above C003, below C059.
C059	Fill of C060, with loose dark-grey silty-clay. Measured 0.10m NS x 0.07m EW x 0.13m. Above C060, below C002.

Posthole 3

C062	Cut of circular posthole. Measured 0.05m x 0.05m x 0.10m. Had a sharp break of slope at top, vertical sides and a sharp break leading to a V-shaped base. Filled with C061. Above C003, below C061.
C061	Fill of C062, with loosely compacted, grey silty-clay. Some pebble included. Measured 0.05m x 0.05m x 0.10m. Above C062, below C002.

Pit 8

C066	Cut of circular pit. Measured 0.60m x 0.60m x 0.15m. Had a sharp break of slope at top, concave sides and an imperceptible base leading to a rounded base. Filled with C113. Above C003, below C113.
C113	Fill of C066, with compact dark brownish-black sandy-silt. Frequent charcoal included. Measured 0.60m x 0.60m x 0.15m. Above C066, below C002.

Ditch

C067	Cut of linear ditch. Measured 22m NS x 2m EW x 0.20m-0.65m. Had a moderate break of slope at top, sloping-vertical sides and a gradual break leading to a flat base. C067 continued outside the limit of excavation at the north and south. Truncated an earlier pit C053. Filled with C202. Above C003, below C202.
C202	Fill of C067, with loosely compacted light brown sandy clay. Occasional pebbles and cobbles included. Measured 22m NS x 2m EW x 0.20m-0.65m. Above C067,

	below C002.

Pit 9

C068	Cut of oval pit. Measured 0.62m EW x 0.48m NS x 0.23m. Had a steep-moderate break of slope at top, steep sides to the east; more moderate elsewhere and steep-moderate break leading to a rounded base. Filled with C098 and C097. Above C003, below C098.
C098	Lower fill of C068, with compact light yellowish-brown sandy-silt. Occasional charcoal flecks included. Measured 0.20m EW x 0.12m NS x 0.05m. Above C068, below C097.
C097	Upper fill of C068, with medium-loosely compacted mid-brown sandy-silt. Frequent angular stones, pebbles, and charcoal included. Measured 0.63m EW x 0.23m NS x 0.23m. Above C098, below C002.

Pit 10

C069	Cut of oval pit. Measured 0.60m NS x 0.60m EW x 0.15m. Had a gradual break of slope at top, concave sides, and a gradual break leading to a slightly concave base. At its east edge C069 is truncated by C067. Filled with C108. Above C003, below C108.
C108	Fill of C069, with loosely compacted, medium brown sandy-silt. Frequent angular stones and charcoal included. Measured 0.60m NS x 0.60m EW x 0.15m. Above C069, below C002.

Pit 11

C072	Cut of oval pit. Measured 0.55m NS x 0.46m EW x 0.25m. Had a gradual break of slope at top, uneven stony sides and a gradual break leading to an uneven stony base. Orientated north-south. Filled with C167. Above C003, below C167.
C167	Fill of C072, with moderately compact, brownish-black sandy-silt. A moderate amount of charcoal and occasional pebbles included. Measured 0.55m NS x 0.46m EW x 0.25m. Above C072, below C002.

Posthole 4

C074	Cut of circular posthole. Measured 0.20m x 0.20m x 0.29m. Had a sharp break of

	slope at top, vertical sides and a sharp break leading to a flat even base. Filled with C217. Above C003, below C217.
C217	Fill of C074, with moderately compact, blackish-brown charcoal stained silt. Occasional decayed stone included. Measured 0.20m x 0.20m x 0.29m. Above C074, under C002.

Bowl Furnace 17

C080	Cut of circular bowl furnace. Measured 0.25m x 0.25m x 0.07m. Had a moderate break of slope at top, concave sides and a moderate break leading to a flat even base. Associated with a complex of features; C081, 0.30m west of C080, C082, 0.20m east of C080, and C086, 0.20m east of C082. Filled with C255 and C249. Above C003, below C255.
C255	Lower fill of C080, with compact orangey-red oxidised clay. Occasional pebble included. Measured 0.25m x 0.05m x 0.04m. C255 formed an irregular ring around the outer extent of C080. Above C080, below C249.
C249	Upper fill of C080, with moderately compact, light brown evenly mixed charcoal-silt. Occasional pebble included. Measured 0.25m x 0.25m x 0.07m. Above C255, below C002.

Bowl Furnace 18

C081	Cut of sub-circular bowl furnace. Measured 0.16m x 0.16m x 0.13m. Had a sharp break of slope at top, stepped sides to the south; vertical elsewhere and a sharp break leading to a flat even base. Associated with a complex of features; C080 was 0.30m west of C081, C082 was 0.20m east of C081, and C086 was 0.20m east of C082. Filled with C252 and C229. Above C003, below C252.
C252	Lower fill of C081, with compact orangey-red oxidised clay. Occasional pebbles included. C252 formed an irregular incomplete ring around the outer extent of C081. Measured 0.15m x 0.06m x 0.06m. Above C081, below C229.
C229	Upper fill of C081, with moderately compact brownish-black silt. Frequent charcoal and slag included. Measured 0.16m x 0.16m x 0.13m. Above C252, below C002.

Bowl Furnace 19

C082	Cut of ovular bowl furnace. Measured 0.34m NS x 0.28m EW x 0.08m. Had a sharp

	break of slope at top, vertical sides, and a moderate break leading to a mainly flat base, slightly pot-marked. Associated with a complex of features; C086 was 0.20m east of C082, C081 was 0.20m west of C082, and C080 was 0.30m west of C081. Filled with C251, C209. Above C003, below C251.
C251	Lower fill of C082, with compact orangey-red oxidised clay. Occasional pebbles included. C251 forms an irregular incomplete ring around the outer extent of C082. Measured 0.34m x 0.07m x 0.05m. Above C082, below C209.
C209	Upper fill of C082, with compact dark brownish-black silt-charcoal mix. Occasional pebbles included. Measured 0.34m NS x 0.28m EW x 0.08m. Above C251, below C002.

Pit 12

C086	Cut of circular pit. Measured 0.31m x 0.31m x 0.18m. Had a sharp break of slope at top, vertical sides to the east; more gradual elsewhere and a gradual break leading to a rounded concave base. Associated with a complex of features; C082 was 0.20m west of C086, C081 was 0.20m west of C082, and C080 was 0.30m west of C081. Filled with C185. Above C003, below C185.
C185	Fill of C086, with compact dark black charcoal-silt mix. Frequent slag included. Measured 0.31m x 0.31m x 0.18m. Above C086, below C002.

Pit 13

C087	Cut of sub-circular pit, possibly for refuse. Measured 0.99m NS x 0.70m EW x 0.30m. Had a sharp break of slope at top, uneven stony sloping sides and a sharp break leading to an uneven base. Filled with C107 and C106. Above C003, below C107.
C107	Lower fill of C087, with loosely compacted, yellowish light brown sandy silt. Frequent cobbles and occasional charcoal included. Measured 0.65m NS x 0.50m EW x 0.08m. Above C087, below C106.
C106	Upper fill of C087, with loosely compacted, blackish brown sandy silt. Occasional stone included. Measured 0.99m NS x 0.70m EW x 0.13m. Above C107, below C002.

Posthole 5

C089	Cut of circular posthole. Measured 0.08m x 0.08m x 0.10m. Had a sharp break of slope at top, gradual sloping sides and a sharp break leading to a V-shaped base. Filled with C088. Above C003, below C088.
C088	Fill of C089, with loosely compacted, dark grey silty-clay. Occasional pebbles included. Measured 0.08m x 0.08m x 0.10m. Above C089, below C002.

Posthole 6

C091	Cut of circular posthole. Measured 0.13m x 0.13m x 0.10m. Had a gradual break of slope at top, sloping sides and a gradual break leading to a U-shaped base. Filled with C090. Above C003, below C090.
C090	Fill of C091, with loosely compacted, dark grey silty-clay. Occasional stones included. Measured 0.13m x 0.13m x 0.10m. Above C091, below C002.

Pit 14

C103	Cut of sub-rectangular pit, with right-angled corners. Measured 1.56m NS x 0.77m EW x 0.30m. A moderate break of slope at top, stepped sides and a gradual break leading to a pointed base that sloped downwards from north to south. C103 bordered C053 at its eastern extent. Filled with C112. Above C003, below C112.
C112	Fill of C103, with compact, dark brownish black clayish-silt. Frequent stones and charcoal included. Measured 1.50m NS x 0.75m EW x 0.30m in depth. Above C103, below C002.

Bowl Furnace 20

C119	Cut of sub-circular bowl furnace. Measured 0.72m x 0.72m x 0.38m. Had a sharp break of slope at top, concave sides and a sharp break leading to a flat even base. Orientated northwest-southwest. C119 was associated with two other features, C120, 0.65m west of C119, and C121, 0.40m south of C119. Filled with C416, C415, C294, C324, C293, C292 and C291. Above C003, below C416.
C416	Lower fill of C119, with compact red oxidised clay. C416 formed an incomplete irregular ring around the outer extent of C119. Measured 0.60m x 0.10m x 0.08m. Above C119, below C415.
C415	Secondary fill of C119, with compact greenish-grey vitrified clay. C415 occurred in

	separate lumps, formed an incomplete irregular ring around the edge of C119, and measured 0.15m x 0.10m x 0.08m. Above C416, below C294.
C294	Tertiary fill of C119, with loosely compacted dark black sandy silt. Frequent slag and charcoal included. Measured 0.52m NW/SW x 0.40m NE/SW x 0.05m. Above C415, below C324.
C324	Fourth fill of C119, with loosely compacted dark brown sandy-silt. Frequent slag and charcoal included. Measured 0.42m NW/SW x 0.32m NE/SW x 0.06m. Above C294, below C293.
C293	Fifth fill of C119, with compact reddish orange oxidised clay. Dark brown clay and slag included. Measured 0.39m x 0.39m x 0.10m. C293 is possibly the remains of the collapsed superstructure of C119. Above C324, below C292.
C292	Sixth fill of C119, with compact light to pale-brown silty-sand. Occasional oxidised clay included. Measured 0.25m x 0.25m x 0.07m. Above C293, below C291.
C291	Upper fill of C119, with loosely compacted dark brown sandy-silt. A moderate-frequent amount of slag and charcoal included. Measured 0.35m x 0.35m x 0.18m. Above C292, below C002.

Bowl Furnace 21

C120	Cut of circular bowl furnace. Measured 0.67m x 0.67m x 0.24m. Had a sharp break of slope at top, concave sides and a moderate break leading to a rounded base. Associated with a series of bowl furnaces; C119, 0.30m east of C120, and C121, 0.50m south of C120. Filled with C389, C390, C388 and C387. Above C003, below C389.
C389	Lower fill of C120, with compact light reddish oxidised clay. C389 formed an irregular ring around the extent of C120 and also lined the base. Measured 0.67m x 0.67m x 0.05m. Above C120, below C390.
C390	Secondary fill of C120, with compact light blackish green vitrified clay. C390 formed an irregular incomplete ring around the outer extent of C120. Measured 0.60m x 0.07m x 0.05m. Above C389, below C388.
C388	Tertiary fill of C120, with loosely compacted, dark brownish black charcoal-rich sandy-silt. Measured 0.55m x 0.55m x 0.19m. Above C390, below C387.
C387	Upper fill of C120, with loosely compacted, mid orange oxidised clay. Measured 0.37m in NW/SW x 0.33m NE/SW x 0.07m. C387 may represent the collapsed roof

	of C120. Above C388, below C002.

Bowl Furnace 22

C121	Cut of bowl furnace. Measured 0.90m NS x 0.78m EW x 0.37m. Had a sharp break of slope at top, concave sides and a moderate break leading to a flat base. Associated with other bowl furnaces, C119 was 0.40m northeast of C121, and C120 was 0.50m north of C121. Filled with C481, C480, C264, C262 and C263. Above C003, below C481. Contained 12 fragments of bowl furnace lining (E2180:121:001-012).
C481	Lower fill of C121, with compact light red oxidised clay. C481 lined the base and formed an irregular ring around C121, Measured 0.90m NS x 0.12m x 0.07m. Above C121, below C480.
C480	Secondary fill of C121, with loosely compacted, black charcoal-rich silty-sand. Measured 0.42m EW x 0.48m NS x 0.10m. Above C481, below C264.
C264	Tertiary fill of C121, with compact red oxidised clay. Measured 0.29m EW x 0.33m NS x 0.10m. Above C480, below C262.
C262	Fourth fill of C121, with loosely compacted, dark brownish silty-sand. Frequent slag and charcoal included. Measured 0.30m EW x 0.35m NS x 0.05m. Above C264, below C263.
C263	Upper fill of C121, with compact orange oxidised clay. Measured 0.38m EW x 0.36m NS x 0.12m. C263 may represent the collapsed superstructure of C121. Above C262, below C002.

Charcoal Kiln 1

C123	Cut of probable ovular charcoal kiln, with rounded corners. Measured 1.30m NS x 1.00m EW x 0.30m. Had a gradual break of slope at top, overhung sides to the north; sloping to the west and concave elsewhere and an imperceptible break leading to a flat base. Filled with C391, C392, C380, C354, C353 and C352. Above C003, below C391.
C391	Lower fill of C123, with loosely compacted, black silty charcoal. Measured 0.75m x 0.75m x 0.05m. Above C123, below C392.
C392	Secondary fill of C123, with loosely compacted, greyish brown sandy clay. Measured 0.90m x 0.90m x 0.07m. Above C391, below C392.

C380	Tertiary fill of C123, with loosely compacted black charcoal layer. Frequent brownish-black silt included. Measured 0.78m x 0.78m x 0.05m. Above C392, below C354.
C354	Fourth fill of C123, with compact orange oxidised clay. Measured 0.30m x 0.30m x 0.07m. Above C380, below C353.
C353	Fifth fill of C123, with compact light reddish sandy-silt. Measured 0.12m x 0.12m x 0.05m. Above C354, below C352.
C352	Upper fill of C123, with loosely compacted, dark brownish-black sandy-silt. Occasional stone included. Measured 1.20m NS x 1.00m EW x 0.05m. Above C353, below C002.

Pit 15

C124	Cut of ovoid pit, of unknown function. Measured 2.66m SE/NW x 1.64m SW/NE x 0.20m. Had a moderate-gradual break of slope at top, convex sloping sides and a moderate-gradual break leading to a flat base. Filled with C256. Above C003, below C256.
C256	Fill of C124, with loosely compacted, dark brown silty-sand. Occasional charcoal included. Measured 2.66m SE/NW x 1.64m SW/NE x 0.20m. Above C124, below C002.

Bowl Furnace 23

C125	Cut of circular bowl furnace. Measured 0.55m x 0.55m x 0.25m. Had a gradual break of slope at top, gradually sloping sides and a gradual break leading to a V-shaped base. Associated with three other bowl furnaces; C126 was 0.20m west of C125, C127 which borders the west edge of C126, and C299 which borders C126 on its north edge. Filled with C385, C595, C325, C244, C515, C514, C323, C516 and C517. Above C003, below C385. Contained fragments of a probable mould (E2180:125:001-004).
C385	Lower fill of C125, with moderate-firmly compact red oxidised silty-clay. C385 lined the base and formed an irregular incomplete ring around C125. Measured 0.50m x 0.10m x 0.05m. Above C125, below C595.
C595	Secondary fill of C125, with moderately compact mid brownish-yellow silty-clay.

	Measured 0.20m x 0.06m x 0.10m. Above C385, below C325.
C325	Tertiary fill of C125, with compact greenish-grey slag-rich vitrified clay. C325 formed an irregular ring around the outer extent of C125. Measured 0.09m x 0.10m (width x depth). Above C595, below C244.
C244	Fourth fill of C125, with loosely compacted, black charcoal rich silty-clay. Measured 0.48m x 0.48m x 0.07m. Above C325, below C515.
C515	Fifth fill of C125, with loosely compacted, black charcoal rich silty-clay. Measured 0.25m x 0.25m x 0.05m. Above C244, below C514.
C514	Sixth fill of C125, with loosely compacted, brown gritty silt. A moderate slag included. Measured 0.30m x 0.30m x 0.10m. Above C515, below C323.
C323	Seventh fill of C125, with loosely compacted, red oxidised silty-clay. Frequent slag and charcoal included. Measured 0.35m x 0.35m x 0.08m. Above C514, below C516.
C516	Eighth fill of C125, with moderately compact slightly vitrified greyish green silty-clay. Measured 0.12m x 0.10m x 0.05m. Above C323, below C517.
C517	Upper fill of C125, with loosely compacted, grey silty-clay. Occasional pebbles included. Measured 0.08m x 0.08m x 0.04m. Above C516, below C002.

Bowl Furnace 24

C126	Cut of circular bowl furnace. Measured 0.41m x 0.25m (width x depth). Had a gradual break of slope at top, steep-near vertical sides and a gradual break leading to a U-shaped base. Associated with other bowl furnaces; C125 was 0.20m east of C126, C127 borders the west edge of C126, and C299 borders C127 on its north edge. Filled with C383 and C326. Above C003, below C383.
C383	Lower fill of C126, with moderately compact red silty-clay. C383 lined the base and formed an irregular ring around C126. Measured 0.05m x 0.15m (width x depth). Above C126, below C326.
C326	Upper fill of C126, with loosely compacted, creamy-brown to black silty-clay. Frequent charcoal and occasional stone included. Measured 0.38m x 0.26m (width x depth). Above C383, below C002.

Bowl Furnace 25

C127	Cut of sub-circular bowl furnace. Measured 0.63m EW x 0.40m NS x 0.20m. Had a

	gradual break of slope at top, moderate sides and a gradual break leading to a flat base. Associated with other bowl furnaces; C299 bordered C127 at its north edge, C126 bordered C127 at its east edge, and C125 was 0.20m east of C126. Orientated east-west. Filled with C384, C329, C327 and C328. Above C003, below C384.
C384	Lower fill of C127, with compact light red oxidised clay. C389 lined the base and formed an irregular ring around C127. Measured 0.10m x 0.05m (width x depth). Above C127, below C329.
C329	Secondary fill of C127, with compact greenish-grey vitrified clay. Occasional pebbles included. C329 formed an irregular incomplete ring around the upper edge and outer extent of C127. Measured 0.35m x 0.05m x 0.05m. Above C384, below C327.
C327	Tertiary fill of C127, with loosely compacted, black silty-clay. Frequent charcoal and slag included. Measured 0.40m x 0.40m x 0.03m. Above C329, below C328.
C328	Upper fill of C127, with moderately compact dark grey clay. Some charcoal included. Measured 0.40m x 0.18m (width x depth). Above C327, below C002.

Bowl Furnace 26

C133	Cut of circular bowl furnace. Measured 0.70m x 0.70m x 0.15m. Had a sharp break of slope at top, concave sloping sides and a gradual break leading to a mainly even base. Associated with other features; C168 a bowl furnace which abutted C133 at its eastern edge, C134 a bowl furnace was 0.25m north of C133, C135 a bowl furnace was 0.15m west of C133. Filled with C206, C560, C537, C524, C536, C207 and C170. Above C003, below C206.
C206	Lower fill of C133, with compact reddish-orange oxidised clay. Coarse sand included. C206 lined the base and ringed the outer extent of C133. Measured 0.70m x 0.15m x 0.05m. Above C133, below C560.
C560	Secondary fill of C133, with compact greenish-grey vitrified clay that formed an incomplete irregular ring around the extent of C133. Measured 0.15m x 0.08m x 0.06m. Above C206, below C537.
C537	Tertiary fill of C133, with moderately compact mottled dark brown sandy-silt. Frequent charcoal and coarse pebble included. Measured 0.40m x 0.40m x 0.05m. Above C560, below C524.
C524	Fourth fill of C133, with compact mid-brown silty-sand. Occasional charcoal and

	oxidised clay included. Measured 0.20m x 0.13m x 0.07m. Above C560, below C524.
C536	Fifth fill of C133, with compact separate mottled lumps of orangey-yellow brown redeposited clay. Coarse sand, fine pebbles, and charcoal included. Measured 0.06m x 0.06m x 0.08m. Above C524, below C207.
C207	Sixth fill of C133, with medium compact orangey-red oxidised clay. Occasional yellow clay, gritty sand and charcoal included. Measured 0.45m x 0.45m x 0.06m. Possibly the remainder of the collapsed superstructure for C133. Above C536, below C170.
C170	Upper fill of C133, with compact charcoal rich dark brownish-black silt. A moderate amount of slag included. Measured 0.70m EW x 0.66m NS x 0.12m. Above C207, below C002.

Bowl Furnace 27

C134	Cut of sub-circular bowl furnace. Measured 0.74m NS x 0.58m EW x 0.20m. Had a sharp break of slope at top, concave sides and a moderate break leading to a flat base. Orientated north-south. C134 is associated with a complex of features; C165; a possible pit cut into the base of C134, C168; a bowl furnace was 0.25m south of C134, C133; a bowl furnace that abutted C168 on its eastern edge, and C135; a bowl furnace was 0.15m west of C133. Filled with C162. Above C003, below C162.
C162	Fill of C134, with loosely compacted, slag-rich dark-brown silt. A moderate amount of charcoal included. Measured 0.74m NS x 0.58m EW x 0.20m. Above C134, below C002.

Bowl Furnace 28

C135	Cut of circular bowl furnace. Measured 0.40m x 0.40m x 0.34m. Had a sharp break of slope at top, vertical sides and a gradual break leading to a flat base. Associated with a complex of features; C133, a bowl furnace was 0.15m east of C135, C168; a bowl furnace that abutted the eastern edge of C133, and C134; a bowl furnace was 0.25m north of C168. Filled with C318, C253 and C171. Above C003, below C318.
C318	Lower fill of C135, with compact reddish-pink oxidised clay. C318 lined the base and formed an irregular ring around C135. Measured 0.25m x 0.25m x 0.05m. Above C135, below C253.

C253	Secondary fill C135, with compact greenish-grey vitrified clay. C253 formed an incomplete irregular ring around C135. Measured 0.40m x 0.40m x 0.14m. Above C318, below C171.
C171	Upper fill of C135, with loosely compacted, dark brownish-black slag-rich sandy-silt. Occasional charcoal included (See Appendix 8.1). Measured 0.40m x 0.40m x 0.34m. Above C253, below C002.

Pit 16

C137	Cut of sub-circular pit, of unknown function. Measured 1.17m EW x 0.68m NS x 0.10m. Had a moderate break of slope at top, concave sides and a moderate break leading to an uneven base, which slightly inclined descending from east to west. Filled with C284. Above C003, below C284.
C284	Fill of C137, with loosely compacted, greyish-brown stone-rich sandy-silt. Measured 1.17m NW/SW x 0.68m NE/SW x 0.10m. Above C137, below C002.

Pit 17

C138	Cut of circular pit, of unknown function. Measured 2.20m NW/SW x 2.13m NE/SW x 0.30m. Had a gradual break of slope at the top to the south; sharp elsewhere, concave sloping sides and a moderate break leading to a flat base. Filled with C187. Above C003, below C187.
C187	Fill of C138, with loosely compacted, brownish grey-black stone-rich sandy-silt. A moderate amount of charcoal included. Measured 2.20m NW/SW x 2.13m NE/SW x 0.30m. Above C138, below C002.

Pit 18

C140	Cut of sub-oval shallow pit, that contained a metalled surface or layer of stone C201 at the base. Measured 1.70m EW x 0.80m NS x 0.17m. Had a gradual break of slope at top, concave or stepped sides and a gradual break leading to an uneven base that sloped downwards from east to west. Filled with C201, C198. Above C003, below C201.
C201	Lower fill of C140, with well compact browny-grey silty stone layer. Frequent rounded pebbles (0.03m-0.07m in diameter) set closely together with silt included. Measured 1.50m EW x 0.65m NS x 0.08m. Above C140, below C198.

C198	Upper fill of C140, with loosely compacted, dark brown silty-clay. Occasional charcoal and burnt bone included. Measured 1.70m EW x 0.80m NS x 0.12m. Above C201, below C002.

Pit 19

C141	Cut of sub-oval pit, that contained a metalled surface possibly a working surface. Measured 1.95m SW/NE x 0.80m NW/SW x 0.13m. Had a sharp break of slope at top, concave or stepped sides and a sharp break leading to an uneven base. Orientated northeast-southwest. Filled with C205, C216, C164, C179, C163 and C156. Above C003, below C205.
C205	Lower fill of C141, with compact layer of closely set rounded pebbles, each measuring 0.03-0.07m in diameter. In total, C205 measured 1.70m SW/NE x 0.55m NW/SW x 0.05m. Above C141, below C216.
C216	Secondary fill of C141, with moderately compact medium brown sandy-silt. Occasional charcoal included. Measured 0.30m SW/NE x 0.20m NW/SW x 0.03m. Above C205, below C164.
C164	Tertiary fill of C141, with moderately compact black silty-clay. Frequent charcoal included. Measured 0.65m x 0.25m x 0.05m. Above C216, below C179.
C179	Fourth fill of C141, with moderately compact orange-brown sandy-silt. Occasional charcoal included. Measured 0.10m x 0.05m x 0.05m. C179 occurred in a single lump as a deposit of C141. Above C164, below C163.
C163	Fifth fill of C141, with moderately compact medium brown sandy-silt. Occasional charcoal included. Measured 1.75m x 0.60m x 0.07m. Above C179, below C156.
C156	Upper fill of C141, with moderately compact medium dark-brown clay-silt. Frequent charcoal included. Measured 1.75m x 0.80m x 0.03m. Above C163, below C002.

Pit 20

C142	Cut of sub-circular pit. Measured 0.33m NS x 0.26m E x 0.09m. Had a gradual break of slope at top, sloping sides and a sharp break leading to a concave-irregular base. Filled with C154. Above C003, below C154.
C154	Fill of C142, with loosely compacted, black sandy-silt. Frequent charcoal included. Measured 0.30m x 0.22m x 0.09m. Above C142, below C002.

Archaeological Spread 1

C144	Archaeological spread: Consisting of dark blackish-brown silty-clay with frequent charcoal flecks. Measured 0.75m EW x 0.52m NS x 0.13m. Possibly associated with bowl furnace activity of C125, C126, C127, C299 and 6m north of C144. Above C003, below C002.

Posthole 7

C145	Cut of sub-circular posthole. Measured 0.23m x 0.23m x 0.08m. Had a sharp break of slope at top, vertical sides and a moderate break leading to an uneven base that sloped downwards from Northwest-southwest. Filled with C180. Above C003, below C180.
C180	Fill of C145, with compact dark brown clay-silt. A moderate amount of charcoal included. Measured 0.23m x 0.23m x 0.08m. Above C145, below C002.

Posthole 8

C146	Cut of circular posthole. Measured 0.27m x 0.27m x 0.09m. Had a sharp break of slope at top, concave sides and a moderate break leading to a rounded U-shaped base. Filled with C181. Above C003, below C181.
C181	Fill of C146, with compact dark brownish clay. A moderate amount of charcoal included. Measured 0.27m x 0.27m x 0.08m. Above C146, below C002.

Pit 21

C149	Cut of oval pit, with rounded corners. Measured 1m NS x 0.82m EW x 0.16m. Had a gradual break of slope at top, concave sides and a gradual break leading to a flat base that slopes downwards from north to south. Orientated north-south. Filled with C285. Above C003, below C285.
C285	Fill of C149, with loosely compacted, greyish light brown silt. Occasional charcoal included. Measured 1m NS x 0.82m EW x 0.16m. Above C149, below C002.

Pit 22

C152	Cut of sub-circular pit. Measured 0.55m x 0.55m x 0.21m. Had a gradual break of slope at top, gentle sloping sides and a gradual break leading to an uneven base. Filled with C153. Above C003, below C153.

C153	Fill of C152, with loosely compacted, grey silty-clay. Some charcoal and slag included. Measured 0.55m x 0.55m x 0.21m. Above C152, below C002.

Pit 23

C165	Cut of linear pit or channel at the base of bowl furnace C134. Measured 0.12m x 0.05m x 0.04m. Had a sharp break of slope at top, sloping concave sides and a moderate break leading to an even base. Orientated east-west. C165 was situated at the base of bowl furnace C134. Filled with C166. Above C003, below C166.
C166	Fill of C165, with compact dark brownish-black silt. Occasional charcoal included. Measured 0.12m x 0.05m x 0.04m. Above C165, below C002.

Bowl Furnace 29

C168	Cut of sub-circular bowl furnace. Measured 0.58m NS x 0.40m EW x 0.12m. Had a sharp break of slope at top, concave sides and a sharp break leading to an even flat base. C168 was associated with a complex of features; C133, a bowl furnace that abutted C168 on the western edge, C134; a bowl furnace was 0.25m north of C168, and C135; a bowl furnace was 0.15m west of C133. Filled with C542, C541 and C169. Above C003, below C542.
C542	Lower fill of C168, with compact mid reddish-brown mottled oxidised silt. Frequent charcoal, coarse sand, and fine pebbles included. C542 lined parts of the base and sides of C168. Measured 0.58m x 0.35m EW x 0.04m. Above C168, below C541.
C541	Secondary fill of C168, with loosely compacted mid-brown silty-clay. Mottled lumps of oxidised clay and occasional charcoal included. Measured 0.30m x 0.30m x 0.06m. Above C542, below C169.
C169	Upper fill of C168, with moderately compact charcoal-rich dark brownish black silt. Measured 0.58m NS x 0.40m EW x 0.07m. Above C541, below C002.

Posthole 9

C188	Cut of oval posthole. Measured 0.30m NE/SW x 0.14m NW/SW x 0.06m. Had a sharp break of slope at top, vertical sides to north; concave elsewhere and a sharp break leading to a rounded base sloping downwards from south to north. C188 was orientated northeast-southwest. Cut into the base of C141; a possible working

	platform. Filled with C204. Above C003, below C204.
C204	Fill of C188, with loosely compacted dark brownish-black silty-clay. Frequent charcoal included. Measured 0.30m NE/SW x 0.14m NW/SW x 0.06m. Above C188, below C002.

Pit 24

C210	Cut of sub-circular pit. Measured 0.45m EW x 0.38m NS x 0.19m. Had a sharp break of slope at top, overhanging sides to the south; more vertical elsewhere and a sharp break leading to a flat base. Filled with C218. Above c003, below C218.
C218	Fill of C210, with compact light greyish-brown silt. Charcoal flecking included. Measured 0.45m EW x 0.38m NS x 0.19m. Above C210, below C002.

Bowl Furnace 30

C225	Cut of sub-oval bowl furnace. Measured 0.65m NS x 0.60m EW x 0.45m. Had a sharp break of slope at top, near vertical sides and a gradual break leading to an even base sloping downwards from northwest to southeast that included two closely set flat angular quartz blocks. On its eastern edge, C225 abutted C226, a similar bowl furnace. Both C225 and C226 were covered by a spread C374. Filled with C239, C367, C270 and C240. Above C003, below C239.
C239	Lower fill of C225, with medium compact reddish-orange fine grain oxidised clay silt. Occasional charcoal and rounded pebble included. C239 lined the base and the sides of C225. Measured 0.15m x 0.07m x 0.25m. Above C225, below C367.
C367	Secondary fill of C225, with heavily cemented orangey-red brown to greyish-blue black slag rich vitrified clay. C367 partially lined the upper extent of C225, and occurred in irregular separate lumps that measured from 0.10m-0.30m x 0.10m-0.20m x 0.15m-0.20m. Above C239, below C270.
C270	Tertiary fill of C225, with loosely compacted, dark brownish-black very fine charcoal rich silt. Frequent slag included. Measured 0.45m EW x 0.38m NS x 0.22m. Above C367, below C240.
C240	Upper fill of C225, with loosely compacted, greyish brown fine silt. Occasional charcoal and pebble included. Measured 0.35m EW x 0.25m NS x 0.18m. Above C270, below C002.

Bowl Furnace 31

C226	Cut of sub-circular bowl furnace. Measured 0.55m EW x 0.50m NS x 0.32m. Had a sharp break of slope at top, vertical sides and a sharp break leading to an even base tapering to the centre point. On its western edge, C226 abutted C225; a similar bowl furnace. Both C225 and C226 were covered by an archaeological spread C374. Filled with C239, C367, C271 and C242. Above C003, below C239.
C239	Lower fill of C226, moderately compact pale orange to vibrant red fine grained oxidised clay, with moderate charcoal and pebble and frequent vitrified clay inclusions. C239 lined the base and sides of C226 and measured 0.55m in diameter x 0.07m in depth. Above C003, under C367.
C367	Secondary fill of C226, heavily compact orangey reddish-brown to greyish blue-black vitrified clay. C367 occurred in separate lumps and partially lined the upper extent of C226, and measured from 0.10m in length x 0.10m in width x 0.15m in depth, to 0.30m in length x 0.20m in width x 0.20m in depth. Above C239, under C271.
C271	Tertiary fill of C226, loosely compacted, dark brownish-black fine grain charcoal rich silt, with frequent slag inclusions. Measured 0.34m EW x 0.25m NS x 0.20m in depth. Above C367, under C242.
C242	Upper fill of C226, loosely compacted, fine grain greyish-brown silt with occasional charcoal, pebble and oxidised clay inclusions. Measured 0.35m EW x 0.25m NS x 0.18m in depth. Above C271, under C002.

Pit/Stone Platform

C228	Cut of oval pit or possible stone platform/working surface. Measured 2.10m NW/SW x 1.82m NE/SW x 0.15m. Had a gradual break of slope at top, concave sloping sides and a gradual break leading to an uneven base that sloped downwards from northwest to southeast. Orientated northwest-southwest. Filled with C358. Above C003, below C358.
C358	Fill of C228, with loosely compacted, light brown stony-sand. Measured 2.10m NW/SW x 1.82m NE/SW x 0.18m. C358 consisted of coarse sand surrounding numerous small, medium and large pebbles and cobbles that were set closely together. Above C228, below C002.

Drain

C235	Cut of linear field drain, with an irregular rounded terminal at the southeast, and continued outside the limit of excavation at the northwest end. Had a sharp break of slope at top, concave sides and a gradual break leading to a stony mainly uneven base. Measured 5.20m x 0.75m x 0.34m. Orientated northwest-southwest. Filled with C257. Above C003, below C257.
C257	Fill of C235, with loosely compacted stony dark brown sandy-clay. Measured 5.20m NW/SW x 0.75m NE/SW x 0.34m. Above C235, below C002.

Charcoal Kiln 2

C238	Cut of possible small sub-rectangular charcoal kiln, with rounded corners. Measured 0.70m NE/SW x 0.40m SE/NW x 0.20m. Had a moderate break of slope to the west; sharp elsewhere, sloping sides to the east; vertical to the north and south and concave to west and a moderate break of slope to the west; sharp to the north and south and imperceptible to the east leading to a flat even base. Orientated northeast-southwest. Probably associated with bowl furnace activity. Filled with C254 and C250. Above C003, below C254.
C254	Lower fill of C238, with compact mid orangey-red oxidised silt. Occasional pebbles and charcoal included. C254 partially lined the base and edges of C238. Measured 0.70m NE/SW x 0.40m SE/NW x 0.04m. Above C238, below C250.
C250	Upper fill of C238, with compact light brown silt. Occasional charcoal included. Measured 0.58m NE/SW x 0.42m SE/NW x 0.08m. Above C254, below C002.

Bowl Furnace 32

C266	Cut of circular bowl furnace. Measured 0.40m x 0.40m x 0.27m. Had a sharp break of slope at top, concave sides and a moderate break leading to a flat even base. Filled with C311, C281, C286, C282 and C268. Above C003, below C311.
C311	Lower fill of C266, with compact reddish-pink oxidised clay. C311 lined the edge of C266. Measured 0.07m x 0.04m (width x depth). Above C266, below C286.
C281	Secondary fill of C266, with compact dark greenish-grey vitrified clay. C281 formed an irregular incomplete ring around the edge of C266. Measured 0.04m x 0.12m (width x depth). Above C311, below C286.

C286	Tertiary fill of C266, with loosely compacted, dark brownish-black slag-rich sandy-silt. Frequent charcoal included. Measured 0.30m x 0.30m x 0.15m. Above C281, below C282.
C282	Fourth fill of C266, with compact light yellowish-mid orange oxidised clay. Occasional charcoal included. Measured 0.30m x 0.30m x 0.05m. C282 was possibly the remains of the collapsed clay superstructure for the bowl furnace. Above C286, below C268.
C268	Upper fill of C266, with loosely compacted, brown silt. Charcoal included. C268 continued outside C266, and appeared to have been deposited over and around C266 to covering any trace of the bowl furnace. Measured 0.80m x 0.80m x 0.10m. Above C282, below C002.

Bowl Furnace 33

C299	Cut of circular bowl furnace. Measured 0.50m x 0.50m x 0.30m. Had a gradual break of slope at top, sloping sides and a gradual break leading to a U-shaped base. C299 was one of a complex of bowl furnaces; C127 abutted C299 at SE edge, C126 was immediately east of C127 and 0.40m SE of C299, and C125 was 0.30m east of C126. Filled with C386, C314, C330, C313, C312 and C300. Above C003, below C386.
C386	Lower fill of C299, with compact red oxidised silty-clay. C386 lined the base, sides and formed a ring around the outer extent of C299. Measured 0.10m x 0.08m (width x depth). Above C299, below C314.
C314	Secondary fill of C299, with compact greenish-grey vitrified slag. C314 formed an incomplete irregular ring around the outer extent of C299. Measured 0.10m x 0.16m (width x depth). Above C386, below C330.
C330	Tertiary fill of C299, with loosely compacted, light greyish sandy-silt. Occasional slag and pebble included. Measured 0.06m x 0.22m (width x depth). C330 was located on eastern side of C299. Above C314, below C313.
C313	Fourth fill of C299, with loosely compacted, black silty-clay. Frequent charcoal and slag included. Measured 0.33m x 0.33m x 0.10m. Above C330, below C312.
C312	Fifth fill of C299, with loosely compacted, red oxidised clay. Measured 0.32m x 0.32m x 0.10m. C312 may have represented the remains of the collapsed superstructure. Above C313, below C300.

C300	Upper fill of C299, with loosely compacted, black silty-clay. Frequent charcoal included. Measured 0.57m x 0.07m-0.15m (width x depth). Above C312, below C002.

Pit 25

C315	Cut of sub-circular refuse pit. Measured 0.64m EW x 0.70m NS x 0.18m. Had a sharp break of slope at top, steeply evenly sloping sides and a gradual break leading to an even base. Orientated north-south. Filled with C316. Above C003, below C316.
C316	Fill of C315, with moderately compact mid-brown silty-sand. Occasional pebbles included. Measured 0.64m EW x 0.70m NS x 0.18m. Above C315, below C002.

Posthole 10

C334	Cut of circular posthole. Measured 0.22m x 0.22m x 0.17m. Had a sharp break of slope at top, steep-slightly convex sides and a sharp break leading to a slightly concave base. Filled with C349, C345, C348, C347 and C346. Above C003, below C349.
C349	Lower fill of C334, with loosely compacted, medium brown silty-sand. Occasional charcoal flecks included. Measured 0.10m x 0.04m x 0.13m. C349 was situated solely on the eastern side of C334, and was very similar to C345 which was located solely on the western side of C334. C348 separated C349 and C345. Above C345, below C348.
C345	Lower fill of C334, with moderately compact medium brown silty-sand. Occasional charcoal included. Measured 0.24m x 0.05m x 0.14m. C345 was situated only on the western side of C334, and was very similar to C349 which was located solely on the eastern side of C334, and was separated from C345 by C348. Above C345, below C348.
C348	Secondary fill of C334, with loosely compacted, mid-dark brown sandy-silt. Frequent charcoal included. Measured 0.28m x 0.12m x 0.17m. Above C345 and C349, below C347 and C346.
C347	Upper fill of C334, with moderately compact medium to dark brown silty-sand. Occasional charcoal included. Measured 0.24m x 0.04m x 0.08m. C347 was solely located in east side of C334, with only C348 separating C347 and C346. Above

	C348, below C002.
C346	Upper fill of C334, with moderately compact medium brown sandy-silt. A moderate amount of charcoal included. Measured 0.27m x 0.06m x 0.05m. C346 was situated solely on the west side of C334. Above C348, below C002.

Pit 26

C374	Cut of sub oval pit, with, no corners. Measured 1.80m NW/SW x 1.60m EW x 0.08m. Had an imperceptible break of slope at top, even sloping sides at a 10º angle and an imperceptible break leading to an uneven base. C374 truncated the upper edges of two bowl furnaces C225 and C226. Filled with C378. Above C003, below C378.
C378	Fill of C374, with medium compact greyish mid brown fine grain silty-clay. A moderate amount of angular and sub-angular sandstone and limestone cobbles, and occasional charcoal flecking included. Measured 1.80m NW/SW x 1.60m EW x 0.08m. Above C374, below C002.

Posthole 11

C375	Cut of sub-angular posthole, with sharp corners throughout. Measured 0.26m EW x 0.21m NS x 0.15m. Had a sharp break of slope at top, vertical sides and a sharp break leading to a flat base. C375 was situated in the base of C023; a bowl furnace. It was unclear whether C375 predated or was contemporary with C023. Filled with C376. Above C003, below C376.
C376	Fill of C375, with loosely compacted, greyish brown silty-sand. Measured 0.26m EW x 0.21m NS x 0.15m. Above C375, below C002.

Bowl Furnace 34

C393	Cut of oval bowl furnace. Measured 0.50m NS x 0.44m EW x 0.17m. Had a sharp break of slope at top, concave sides and a moderate break leading to an uneven base. Orientated north-south. Filled with C556, C555 and C430. Above C003, below C556.
C556	Lower fill of C393, with compact light brownish red oxidised clay. Measured 0.45m NS x 0.34m EW x 0.15m. C556 formed an irregular incomplete ring around the outer extent of C393. Above C393, below C555.
C555	Secondary fill of C393, with heavily compacted, dark greenish-grey vitrified clay. Occasional small pebbles included. Measured 0.30m NS x 0.20m EW x 0.04m. C555 formed an irregular incomplete ring around the outer extent of C393. Above C556, below C430.
C430	Upper fill of C393, with moderately compact greyish-black slag-rich sandy-silt. Occasional charcoal flecks included. Measured 0.41m NS x 0.30m EW x 0.10m. Above C555, below C002.

Bowl Furnace 35

C397	Cut of sub-circular bowl furnace. Measured 0.40m EW x 0.32m NS x 0.35m. Had a sharp break of slope at top, concave sides and a moderate break leading to a slightly concave base. C397 was one of a complex of features that included C398, C399, and C400. Filled with C404, C405, C451, C450, C452, C403 and C449. Above C003, below C404.
C404	Lower fill of C397, with compact orangey-red oxidised clay. Measured 0.10m-0.15m x 0.05m (width x depth). C404 formed an incomplete ring around the outer extent of C397. Above C397, below C405.
C405	Secondary fill of C397, with heavily compacted, green-brown vitrified clay. Slag included. C405 formed an irregular incomplete ring around the outer extent of C397, and was larger in its east end where it measured 0.08m-0.10m in width. Measured 0.18m x 0.18m x 0.12m. Above C404, below C451.
C451	Tertiary fill of C397, with loosely compacted, black charcoal-rich silt. Measured 0.36m x 0.40m x 0.12m. Above C405, below C452.
C450	Fourth fill of C397, with loosely compacted, black very coarse mixed slag-rich silt. Measured 0.34m x 0.40m x 0.10m. Above C451, below C452.

C452	Fifth fill of C397, with compact deposit of very coarse greyish-black slag. Measured 0.15m x 0.10m x 0.10m. Situated on the north side of C397. Above C450, below C403.
C403	Sixth fill of C397, with compact orange oxidised sandy-clay. Frequent red oxidised clay lumps included. Measured 0.36m EW x 0.40m NS x 0.10m. C403 may have been the remains of the collapsed superstructure for C397. Above C452, below C449.
C449	Upper fill of C397, with compact medium brown clay. Occasional charcoal flecking included. Measured 0.22m x 0.28m x 0.03m. Above C403, below C002.

Bowl Furnace 36

C398	Cut of sub-circular bowl furnace, with rounded corners. Measured 0.54m x 0.50m x 0.44m. Had a gradual break of slope at top, concave sides and a gradual break leading to a rounded base. Orientated east-west. C398 was one of a complex of features that included C397, C399, and C400. Filled with C407, C576, C575, C574 and C459. Above C003, below C407.
C407	Lower fill of C398, with compact orangey-red oxidised silty-clay. C407 lined the sides and formed an incomplete ring around the extent of C398. Measured 0.10m x 0.40m (width x depth). Above C398, below C576.
C576	Secondary fill of C398, with moderately compact orange-pink oxidised silty-clay. Occasional charcoal flecks included. Measured 0.33m x 0.10m x 0.10m. Above C407, below C575.
C575	Tertiary fill of C398, with loosely compacted, black sandy-silt. Frequent charcoal included. Measured 0.40m x 0.30m x 0.08m. Above C576, below C574.
C574	Fourth fill of C398, with compact orange oxidised clay. Occasional charcoal and slag included. Measured 0.47m x 0.45m x 0.32m. Above C575, below C459.
C459	Upper fill of C398, with moderately compact mid brownish-black clay-silt. A moderate amount of charcoal included. Measured 0.70m x 0.50m x 0.10m. Above C574, below C002.

Pit 27

C399	Cut of ovoid pit, with an angled corner in the southwest. Measured 0.43m x 0.35m x 0.08m. Had a sharp-moderate break of slope at top, concave sides and a gradual-

	imperceptible break leading to an uneven base. Orientated north-south. C399 was one of a complex of features that included C397, C398 and C400. Filled with C408. Above C003, below C408.
C408	Fill of C399, with compact dark greyish-brown silty-sand. Frequent slag and occasional charcoal included Measured 0.43m x 0.35m x 0.08m. Above C399, below C002.

Bowl Furnace 37

C400	Cut of sub-oval bowl furnace, with rounded corners. Measured 0.50m x 0.40m x 0.30m. Had a gentle break of slope at top to the east; sharp elsewhere, slightly concave sides and a gradual break leading to a rounded base. Orientated east-west. C400 was one of a complex of features that included C397, C398, and C399. Filled with C412, C410, C553, C561 and C409. Above C003, below C412.
C412	Lower fill of C400, with moderately compact orange-red oxidised clay. C412 lined the sides and formed an incomplete ring around the edge of C400. Measured 0.45m x 0.28m x 0.10m. Above C400, below C410.
C410	Secondary fill of C400, with heavily compacted, greenish-grey vitrified clay. C410 occurred in separate pieces, and formed a highly irregular incomplete ring around the outer extent of C400. Measured 0.50m x 0.10m x 0.13m. Above C412, below C553.
C553	Tertiary fill of C400, with moderately compact dark black sandy-silt. Frequent small slag and charcoal, and occasional larger slag included. Measured 0.50m x 0.20m x 0.20m. Above C410, below C561.
C561	Fourth fill of C400, with compact grey-orange silty-slag. Measured 0.42m x 0.25m x 0.16m. Above C553, below C409.
C409	Upper fill of C400, with compact orange oxidised silty-sand. A moderate amount of oxidised clay lumps included. Measured 0.50m x 0.35m x 0.11m. C409 may have been the remnants of the collapsed superstructure of C400. Above C561, below C002.

Archaeological Spread 2

C401	Sub-angular archaeological spread with rounded corners: Consisted of light-medium

	brownish-grey silty-clay with occasional charcoal inclusions. Measured 0.43m x 0.28m x 0.06m. Orientated north-south. C401 was probably waste material from the bowl furnaces nearby (C397, C398 and C400). Above C003, below C002.

Archaeological Spread 3

C402	Trapezoidal archaeological spread: Consisted of moderately compact dark brown-black silty-sand with frequent charcoal and slag inclusions. Measured 0.55m x 0.28m x 0.07m. Orientated east-west. C402 was probably waste material from the bowl furnaces nearby (C397, C398 and C400). Above C003, below C002.

Pit 28

C411	Cut of sub-oval pit, with rounded corners. Measured 0.34m x 0.26m x 0.10m. Had a gradual break of slope top, concave sides and a gradual break to the east; sharper elsewhere leading to an irregular rounded base with a slightly raised east-west ridge in the centre. Orientated east-west. C411 was situated close to a series of bowl furnaces C397, C398, and C400. Probably associated with the metal working process. Filled with C466, C465 and C413. Above C003, below C466, C465.
C466	Lower fill of C411, with moderately compact medium-light brown sandy-silt. Occasional charcoal included. Measured 0.20m x 0.08m x 0.04m. Above C411, below C413.
C465	Lower fill of C411, with moderately compact medium-dark brown sandy-silt. Occasional charcoal included. Measured 0.15m x 0.23m x 0.08m. Above C411, below C413.
C413	Upper fill of C411, with moderately compact brown-black clay-silt. Frequent charcoal included. Measured 0.33m x 0.24m x 0.10m. Above C465, below C002.

Pit 29

C418	Cut of trapezoidal pit, of unknown function with rounded corners. Measured 0.45m EW x 0.40m NS x 0.12m. Had a moderate break of slope at top, concave sides and a moderate break leading to a flat base. Orientated east-west. Filled with C431. Above C003, below C431.
C431	Fill of C418, with compact dark grey silt. Occasional small stone and charcoal included. Measured 0.45m EW x 0.40m NS x 0.12m. Above C418, below C002.

Charcoal Kiln 3

C419	Cut of oval charcoal kiln. Measured 1.20m EW x 0.90m NW/SW x 0.30m. Had a sharp break of slope at the top to the southwest; gradual elsewhere, concave-evenly sloping sides and an imperceptible break of slope leading to a mainly flat base. Orientated east-west. Filled with C587, C586 and C585. Above C003, below C587.
C587	Lower fill of C419, with loosely compacted, dark brown-bluish black charcoal rich silty-clay and very fine sand grain particles. A moderate amount of cobbles and pebbles included. Measured 0.90m EW x 0.80m NW/SW x 0.10m. Above C419, below C586.
C586	Secondary fill of C419, with loosely compacted, medium bluish grey-brown fine sandy silt. A moderate-frequent amount of charcoal, cobbles and pebbles included. Measured 1.15m EW x 0.90m SE/NW x 0.18m. Above C587, below C585.
C585	Upper fill of C419, with moderately compact mid to dull brown fine grained sandy silt. Occasional pebbles and cobbles included. Measured 1.00m NW/SW x 0.80m EW x 0.07m. Above C586, below C002.

Pit 30

C420	Cut of circular pit. Measured 0.27m x 0.27m x 0.05m. Had a sharp break of slope at top, concave sides and a gentler break leading to a mainly even base. C420 appeared to have been truncated by later activity. C420 was one of a complex of features that included C421 and C422. Filled with C455. Above C003, below C455.
C455	Fill of C420, with moderately compact brownish-black silty-clay. Frequent charcoal included. Measured 0.27m x 0.27m x 0.05m. Above C420, below C002.

Bowl Furnace 38

C421	Cut of sub-circular bowl furnace. Measured 0.27m NS x 0.23m EW x 0.07m. Had a sharp break of slope at top, uneven sloping sides and a gradual break leading to an uneven stony base. C421 appeared to have been truncated by later activity. C421 was one of a complex of features that included C420, and C422. Filled with C446 and C445. Above C003, below C446.
C446	Lower fill of C421, with moderately compact orangey-red oxidised clay. C446 formed an incomplete ring around the outer extent of C421. Measured 0.20m x 0.07m x 0.03m. Above C421, below C445.

C445	Upper fill of C421, with loosely compacted, reddish brown-black silty-clay. Frequent charcoal and occasional slag pieces included. Measured 0.27m NS x 0.23m EW x 0.07m. Above C446, below C002.

Bowl Furnace 39

C422	Cut of sub-circular bowl furnace, with irregular-rounded corners. Measured 0.48m NS x 0.45m EW x 0.10m. Had a gradual break of slope at top, uneven sides to the east; gently sloping elsewhere and a gradual break leading to an uneven base with two slight depressions. Orientated slightly north-south. C422 was truncated at its upper edge by later activity. C422 was one of a complex of features that included C420, and C421. Filled with C457 and C453. Above C003, below C457.
C457	Lower fill of C422, with compact orangey-red oxidised clay. Small pebbles included. C457 formed an incomplete ring around the outer extent of C422. Measured 0.40m x 0.07m x 0.03m. Above C422, below C453.
C453	Upper fill of C422, with loosely compacted, brownish black clay. A moderate amount of slag and charcoal included. Measured 0.48m N x 0.45m EW x 0.09m. Above C457, below C002.

Charcoal Kiln/Hearth 4

C424	Cut of sub-circular charcoal kiln/hearth, with rounded corners. Measured 2.60m NS x 2.20m EW x 0.30m. Had a moderate break of slope at top, concave sides and a moderate break leading to a rounded base. Orientated north-south. C424 partly truncated a linear ditch C425, and cut into one of its fills C440. Filled with C522, C523, C525, C526, C528, C568-C573, C490, C489, C488 and C486. Above C440, below C522.
C522	Lower fill of C424, with loosely compacted, brown sandy-silt. Occasional stones and pebbles included. Measured 1.20m N x, 1.00m EW x 0.10m. C522 was situated mainly in the NW of C424. Above C424, below C525.
C525	Secondary fill of C424, with loosely compacted, greyish silt. A moderate amount of charcoal and stone pebbles included. Measured 0.70m EW x 1.20m NS x 0.30m. Above C522, below C528.
C528	Tertiary fill of C424, with firmly compacted, dark grey clayish-slit. A moderate amount of pebbles and charcoal included. Measured 0.80m NS x 0.70m EW x

	0.25m. Above C525, below C489.
C489	Fourth fill of C424, with firmly compacted, dark grey clayish-silt. Frequent charcoal and a moderate amount of pebbles included. Measured 1.10m NS x 0.70m EW x 0.25m. C489 was situated mainly in the south of C424. Above C528, below C486.
C486	Upper fill of C424, with firmly compacted clayish-silt. Occasional quartz pebbles included. Measured 0.70m NS x 0.40m EW x 0.10m. C486 was situated mostly in the west of C424. Above C489, below C002.

Boundary ditch

C425	Cut of linear boundary ditch. C425 continued outside the limit of excavation. Within the limit of excavation, measured 35m EW x 1.30m NS x 0.65m. Had a sharp break of slope at top, concave or evenly sloping sides and a gradual break leading to an uneven stony base. Orientated east-west. C425 was partially truncated by a charcoal kiln C424. Filled with C512, C440, C439 and C438. Above C003, below C512.
C512	Lower fill of C425, with moderately compact light to pale brownish-grey sandy-silt. A moderate amount of pebbles and very occasional charcoal included. Measured 35m EW x 0.70m NS x 0.25m. Above C425, below C440.
C440	Secondary fill of C425, with moderately compact mid brown very fine powdery silt. Occasional pebbles and charcoal flecking included. Measured 35m EW x 1m NS x 0.30m. Above C512, below C439 & C438 (C424).
C439	Upper fill of C425, with moderately compact blackish dark brown fine grained silt. Frequent charcoal and occasional slag pieces included. Measured 35m EW x 1.30m NS x 0.25m. Above C440, below C002.
C438	Upper fill of C425, with moderately compact blackish dark brown fine grained silt. Frequent charcoal and occasional slag and stones included. Measured 15m EW x 1.30m NS x 0.25m. C438 did not extend the entirety of C425, but continued outside the limit of excavation to the west. Above C440, below C002.

Charcoal Kiln 5

C426	Cut of oval and very regular charcoal kiln. Measured 1.24m NS x 1.10m EW x 0.36m. Had a sharp break of slope at top, vertical sides and a sharp-moderate break leading to a flat rounded base. Orientated north-south. C426 was situated 2m northeast of C393 a bowl furnace associated with metalworking, and 5m from the southern limit of excavation. C426 may have been associated with this metalworking. Filled with C533, C502. Above C003, below C003, below C533.
C533	Lower fill of C426, with compact orangey-red oxidised clay. Some charcoal included. C533 lined parts of the sides and base of C426. Measured 0.80m NS x 0.60m EW x 0.05m. Above C426, below C502.
C502	Upper fill of C426, with compact light greyish brown sand. Occasional charcoal included. Measured 1.11m x 0.97m x 0.28m. Above C533, below C002.

Bowl Furnace 40

C427	Cut of circular bowl furnace. Measured 0.30m x 0.30m x 0.10m. Had a sharp break of slope at top, concave-sloping sides and a gradual leading to a flat even base. C427 was one of a complex of features that included C428, C429, C432, C433, C434, C435, C436 and C438, which were situated at the southeast end of the site. C427 appeared to have been truncated at its upper level. Filled with C509, C508 and C507. Above C003, below C509.
C509	Lower fill of C427, with firmly compact reddish pink oxidised silt. Measured 0.30m EW x 0.20m NS x 0.05m. C509 lined the sides and formed an irregular ring around the extent of C427. Above C427, below C508.
C508	Secondary fill of C427, with compact red oxidised-vitrified silt-clay. Measured 0.30m x 0.30m x 0.02m. C508 lined the sides and part of the base of C427. Above C509, below C507.
C507	Upper fill of C427, with compact dark brownish black silt. Frequent pieces of vitrified clay included. Measured 0.30m x 0.30m x 0.05m. Above C508, below C002.

Posthole 12

C428	Cut of circular posthole. Measured 0.35m x 0.35m x 0.10m. Had a moderate break of slope at top, sloping sides and a moderate break leading to a flat even base. C428 was associated with a complex of features C427, C429, C432, C433, C434, C435, C436 and C438 that were situated at the southeast end of the site. C428 appeared to have been truncated at its upper edge by later activity. Filled with C461, C442, and C441. Above C003, below C461.
C461	Lower fill of C428, with loosely compacted, orange oxidised clay. Measured 0.10m NS x 0.06m EW x 0.04m. C461 occurred on the east side of C428. Above C428, below C442.
C442	Secondary fill of C428, with compact dark brown silt. Occasional slag included. Measured 0.30m x 0.30m x 0.05m. Above C461, below C441.
C441	Upper fill of C428, with loosely compacted, dark black silty-charcoal layer. Measured 0.35m x 0.35m x 0.02m. Above C442, below C002.

Bowl Furnace 41

C429	Cut of circular bowl furnace. Measured 0.46m NS x 0.43m EW x 0.16m. Had a moderate break of slope at top, moderately sloping sides and a gradual break leading to a flat even base. C429 was one of a complex of features that included C427, C428, C432, C433, C434, C435, C436, and C438 were located at the southeast end of the site. C429 may have been truncated by later activity at its upper edge. Filled with C557, C558, C559, C448 and C447. Above C003, below C557.
C557	Lower fill of C429, with compact red oxidised clay. C557 lined the sides and base of C429, and measured 0.47m NS x 0.40m EW x 0.05m in depth. Above C429, below C558.
C558	Secondary fill of C429, with compact greyish-green vitrified clay. Measured 0.33m NS x 0.29m EW x 0.04m. C558 formed an irregular incomplete ring around the outer extent of C429. Above C557, below C559.
C559	Tertiary fill of C429, with compact greyish green vitrified clay. Frequent slag included. Measured 0.24m NS x 0.21m EW x 0.03m. C559 occurred as a mottled deposit of broken pieces of vitrified clay and slag within C429. Above C558, below C448.

C448	Fourth fill of C429, with loosely compacted, dark black sandy-silt. A moderate amount of charcoal included. Measured 0.26m x 0.26m x 0.03m. Above C559, below C447.
C447	Upper fill of C429, with loosely compacted, dark brown silty-sand. A moderate amount of charcoal included. Measured 0.20m NS x 0.29m EW x 0.06m. Above C448, below C002.

Bowl Furnace 42

C432	Cut of circular bowl furnace. Measured 0.50m x 0.50m x 0.10m. Had a moderate break of slope at top, evenly sloping sides and a gradual break leading to a flat even base. C432 was truncated by a linear ditch C425, on its northern edge. C432 was one of a complex of features that included C427, C428, C429, C433, C434, C435, C436 and C438, that were situated at the southeast end of the site. Filled with C475, C477, C474, C473, C471 and C444. Above C003, below C475.
C475	Lower fill of C432, with compact dark orangey-red oxidised silt. C475 lined the sides and formed an incomplete ring around the outer extent of C432. Measured 0.50m EW x 0.43m NS x 0.10m. Above C432, below C477.
C477	Secondary fill of C432, with compact dark red oxidised clay. Occasional pebbles included. Measured 0.46m EW x 0.40m NS x 0.05m. C477 lined the edge of C432, but was absent on the north edge where C432 was truncated by C425. Above C475, below C474.
C474	Tertiary fill of C432, with compact dark greenish-grey vitrified clay. Occasional pebbles included. Measured 0.30m x 0.30m x 0.05m. C474 lined the edges and formed an irregular incomplete ring around C432. Above C477, below C473.
C473	Fourth fill of C432, with compact dark brown silt. Occasional slag included. Measured 0.25m x 0.25m x 0.02m. Above C474, below C471.
C471	Fifth fill of C432, with compact dark brown-grey slag. C471 consisted of a single irregular slag deposit. Measured 0.30m x 0.30m x 0.05m. C471 may represent a failed attempt at firing the bowl furnace C432. Above C473, below C444.
C444	Upper fill of C432, with compact dark brown silt. Occasional slag included. Measured 0.25m x 0.25m x 0.05m. Above C471, below C002.

Pit 31

C433	Cut of irregular pit or depression, with rounded corners. Measured 0.85m EW x 0.55m NS x 0.25m. Had a sharp break of slope at top, concave sides and a sharp break leading to a mainly flat even base. Orientated east-west. C433 was located to the southeast end of the site in close proximity to a series of bowl furnaces. Filled with C443 and C504. Above C003, below C443.
C443	Lower fill of C433, with compact light-grey silt. Occasional stones included. Measured 0.80m EW x 0.55m NS x 0.20m. Above C433, below C504.
C504	Upper fill of C433, with compact dark greyish black stone-silt mix. A moderate amount of charcoal flecking included. Contained within the fill was *c.*10% stone, mainly pebbles of limestone, fractured angular sandstone, and some quartz. Measured 0.35m EW x 0.30m NS x and 0.06m. Above C443, below C002.

Pit 32

C434	Cut of irregular pit or depression, with rounded corners at its west end. At its east end C434 continued outside the limit of excavation. Measured 2.90m NS x 0.80m EW x 0.10m. Had an imperceptible break of slope at top, sloping sides and an imperceptible break except at the western base where break of slope was sharp leading to an uneven base. Orientated north-south. C434 was located to the southeast end of the site and in close proximity to bowl furnaces. Filled with C518. Above C003, below C518.
C518	Fill of C434, with compact dark greyish black stone-silt mix. Frequent slag, charcoal and small stones included. The stones were mostly angular fractured sandstones. Measured 2.90m NS x 0.80m EW x 0.10m. Above C433, below C002.

Pit 33

C435	Cut of very irregular pit. Measured 2.90m EW x 1.50m NS x 0.30m. Had a sharp break of slope at top, varying sides from near vertical-concave-convex and an imperceptible-sharp break leading to a sloped base downwards unevenly from west to east. Orientated east-west. C435 was located to the southeast end of the site in close proximity to bowl furnace activity. Filled with C540, C539 and C538. Above C003, below C540.
C540	Lower fill of C435, with compact light grey sand. Measured 2.60m EW x 1.20m NS x 0.04m. Above C435, below C539.
C539	Secondary fill of C435, with compact dark yellowish-grey silt. Occasional pebbles included. Measured 2.80m EW x 1.30m NS x 0.05m. Above C540, below C538.
C538	Upper fill of C435, with compact dark greyish black-brown stone-rich silt. Frequent stones and occasional charcoal flecking included. The stones were mostly fractured angular sandstone. Measured 2.70m EW x 1.50m NS x 0.18m. Above C539, below C002.

Pit 34

C436	Cut of irregular pit, with sub-circular corners. Measured 3.00m NE/SW x 1.20m NW/SW x 0.30m. Had an imperceptible break of slope at top, sloped uneven sides and an imperceptible-gradual break leading to an uneven base. Orientated northeast-southwest. C436 was located in the southeast corner of the site in proximity to an area of bowl furnace activity. Filled with C563, C562. Above C003, below C563.
C563	Lower fill of C436, with compact dark yellowish-grey silt. Occasional fragmented angular sandstones and limestones included. Measured 3.00m NE/SW x 1.20m NW/SW x 0.06m. Above C436, below C562.
C562	Upper fill of C536, with compact dark grey blackish-brown silt-stone mix. A moderate amount of angular and sub-angular sandstone, and occasional charcoal flecking included. Measured 3.00m NE/SW x 2.20m NW/SW x 0.20m. Above C563, below C002.

Bowl Furnace 43

C437	Cut of irregular bowl furnace, with rounded corners where apparent. Measured 1.15m EW x 0.60m NS x 0.18m. Had a sharp break of slope at top, vertical sides except to the east where it sloped gently and a sharp break except to the east where it was more gradual leading to an uneven base, stony in places. C437 appeared badly truncated at its western edge. C437 was 0.50m northeast of features C420, C421 and C422, all associated with metal working. Filled with C485. Above C003, below C485.
C485	Fill of C437, with loosely compacted, blackish brown silty-sand. A moderate amount of charcoal flecking, slag and decayed stone included Measured 1.15m EW x 0.60m NS x 0.18m. C485 appeared dragged westwards from later activity. Above C437, below C002.

Pit 35

C438	Cut of sub-oval pit. Measured 1.50m NS x 1.00m EW x 0.25m. Had a moderate break of slope at top, sloping sides and a gradual break leading to a flat mainly even base. C438 was located at the southeast end of the site, in proximity to several bowl furnaces, and may have been associated with this metal working activity. C438 was truncated by C425 at its northern edge. Filled with C580, C581, C582, C579 and C578. Above C003, below C580 & F581.
C580	Lower fill of C438, with loosely compacted, dark greyish-black sand. Frequent charcoal included. Measured 1.11m EW x 1.35m NS x 0.12m. Above C438, below C582.
C581	Lower fill of C438, with moderately compact light brown sand. Measured 0.26m NS x 0.35m EW x 0.20m. Above C438, below C582.
C582	Secondary fill of C438, with loosely compacted, dark black sandy-silt. Frequent charcoal flecking included. Measured 0.95m NS x 0.74m EW x 0.06m. Above C580 & C581, below C579.
C579	Tertiary fill of C438, with moderately compact dark grey sand. Frequent charcoal included. Measured 0.95m NS x 0.53m EW x 0.09m. Above C582, below C578.
C578	Upper fill of C438, with moderately compact yellow sand. Occasional charcoal included. Measured 0.75m EW x 0.98m NS x 0.11m. Above C579, below C002.

Pit 36

C468	Cut of oval pit. Measured 1.60m NS x 0.60m EW x 0.30m. Had a sharp break of slope at top, sharply sloping sides and a gentler break leading to an even base. Orientated north-south. C468 was located at the south end of the site, and may have been associated with metal working activity at the nearby bowl furnaces. Filled with C495. Above C003, below C495.
C495	Fill of C468, with compact dark brown dark brown sandy silt. Occasional stone, slag and charcoal included. Measured 1.60m NS x 0.60m EW x 0.30m. Above C468, below C002.

Pit 37

C469	Cut of irregular pear-shaped pit. Measured 0.68m NE/SW x 0.60m NW/SW x 0.20m. Had a sharp break of slope at top to the east; more gradual elsewhere, vertical sides to the west; evenly sharply sloped elsewhere and a gradual break of slope leading to an even flat base. Orientated northeast-southwest. Filled with C549. Above C003, below C549.
C549	Fill of C469, with loosely compacted, greyish medium brown very fine powdery silt. Occasional angular limestone pebble included. Measured 0.68m NE/SW x 0.60m NW/SW x 0.20m. Above C003, below C002.

Bowl Furnace 44

C492	Cut of sub-circular bowl furnace. Measured 0.70m x 0.65m x 0.52m. Had a sharp break of slope at top, slightly concave sides, stepped inwards 0.40m from the base; from where the sides were vertical and a gradual break leading to a slightly rounded base. Orientated slightly north-south. C492 was covered by an archaeological spread C406, and was associated with a complex of features C397, C398, C399, C400, all associated with metal working. Filled with C493, C545, C546, C547, C535, C520, C519, C511, C510 and C494. Above C003, below C493.
C493	Lower fill of C492, with moderately compact red oxidised silty-sand. C493 lined the sides and formed an incomplete ring around the outer extent of C492. Measured 0.06m in width x 0.30m. Above C492, below C545.

C545	Secondary fill of C492, with very compact orange oxidised sand. Measured 0.44m in length x 0.05m in width x 0.20m. Above C493, below C546.
C546	Tertiary fill of C492, with compact green-grey vitrified clay. C546 occurred in separate pieces which formed a very irregular incomplete ring around the outer extent of C492, and was largest on the north edge of C492. Measured 0.20m x 0.10m x 0.05m. Above C545, below C547.
C547	Fourth fill of C492, with moderately compact medium brown sandy-silt with a green hue, possibly slightly vitrified. Very occasional charcoal included. C547 was located solely on the south edge of C492. Measured 0.15m x 0.06m x 0.08m. Above C546, below C535.
C535	Fifth fill of C492, with loosely compacted, dark brown-black slightly sandy-silt. A moderate-frequent amount of charcoal and slag included. Measured 0.28m x 0.29m x 0.02m. Above C547, below C520.
C520	Sixth fill of C492, with loosely compacted medium brown-orange slightly sandy-silt. Occasional charcoal included. Measured 0.18m x 0.25m x 0.03m. Above C535, below C519.
C519	Seventh fill of C492, with compact orange-yellow sand. Frequent lumps of oxidised compact sand included. Measured 0.33m x 0.30m x 0.20m. C519 was the largest deposit within C492. Above C520, below C511.
C511	Eighth fill of C492, with moderately compact dark brown-black very sandy-silt,. Frequent charcoal and occasional slag included. Measured 0.30m x 0.35m x 0.03m. Above C519, below C510.
C510	Ninth fill of C492, with moderately compact light brown sandy-silt. Occasional charcoal included. Measured 0.30m x 0.37m x 0.03m. Above C511, below C494.
C494	Upper fill of C492, with moderately compact medium dark brown silty-sand. A moderate amount of charcoal flecking included. Measured 0.45m x 0.44m x 0.04m. Above C510, below C002.

Pit 38

C498	Cut of very irregular pit. Measured 1.80m EW x 1.60m NS x 0.60m. Had a sharp break of slope at top, almost vertical sides to the east; sloped elsewhere and a sharp break leading to a mainly flat base, which was stony in places. Orientated northwest-southwest. C498 may have functioned as a dumping hole for stone clearance from the surrounding field. Filled with C567, C527 and C513. Above C003, below C567.
C567	Lower fill of C498, with loosely compacted, dark brown stone-rich sandy-silt. Measured 1.10m x 1.10m x 0.30m. Above C498, below C527.
C527	Secondary fill of C498, with moderately compact yellowish-brown silty-clay. Frequent pebbles and charcoal flecking included. Measured 0.80m NS x 1.00m EW x 0.10m. Above C567, below C513.
C513	Upper fill of C498, with loosely compacted, dark brownish-black silt. Some large cobbles and flat angular stones included. Measured 1.80m EW x 1.60m NS x 0.30m. Above C527, below C002.

Pit 39

C506	Cut of sub-oval pit, with rounded corners. Measured 0.90m x 0.48m x 0.25m. Had a gradual break of slope at top, concave sides and a gradual break leading to a rounded base; slightly stepped towards the centre and a rise to the west end. Orientated east-west. C506 bordered C492 and C397 two bowl furnaces, and was likely associated with this metal working process. Filled with C491, C406. Above C003, below C491.
C491	Lower fill of C506, with moderately compact medium brown sandy-silt. Occasional charcoal included. Measured 0.60m x 0.48m x 0.11m. Above C506, below C406.
C406	Upper fill of C506/Archaeological spread, with moderately compact dark brown-black sandy-silt. A moderate-frequent amount of charcoal flecking and occasional slag pieces included. Measured 1.50m x 1.30m x 0.14m. C406 was a deposit within C506 and C492. Above C491, below C002.

Pit 40

C565	Cut of sub oval pit. Measured 1.30m x 1.15m x 0.20m.Had a sharp break of slope at top, sloped evenly sides and a gradual break leading to an uneven base. Orientated north-south. C565 may have functioned as a dumping hole for stones cleared from the field to allow for tillage. Filled with C566. Above C003, below C566.
C566	Fill of C565, with loosely compacted, dark brown stony silt. The stones were mostly angular and sub-angular limestone cobbles. Measured 1.30m x 1.15m x 0.20m. Above C565, below C002.

Bowl Furnace 45

C609	Cut of oval bowl furnace, with rounded corners. Measured 0.80m NS x 0.60m EW x 0.33m. Had a sharp break of slope at top to the north, east, and west; gradual to the south, sloped evenly sides; concave to the south and a gradual break leading to a slightly U-shaped and mainly even base. On its southwest edge, C609 bordered C656 a second bowl furnace. The continuation of oxidised clay and vitrified material suggests that C609 and C656 were used contemporarily. Filled with C663, C662, C661, C660 and C659. Above C003, below C663.
C663	Lower fill of C609, with compact red oxidised clay that formed a ring around the outer extent of C609, and also lined its sides. Measured 0.80m x 0.09m x 0.20m. Above C609, below C662.
C662	Secondary fill of C609, with compact greenish-grey vitrified clay. C662 formed a very irregular incomplete fractured ring around the upper edge of C609. Measured 0.62m x 0.05m x 0.07m. Above C663, below C661.
C661	Tertiary fill of C609, with loosely compacted, mottled yellow-grey ash silt. Occasional charcoal, coarse gritty sand and lumps of oxidised clay included. Measured 0.25m x 0.25m x 0.05m. Above C662, below C660.
C660	Fourth fill of C609, with loosely compacted, charcoal rich black silt. Occasional slag and coarse sand included. Measured 0.65m NS x 0.45m EW x 0.20m. C660 was the largest deposit of C609. Above C661, below C659.
C659	Upper fill of C609, with moderately compact brown-grey silty sand. Charcoal, coarse sand, and small pebbles included. Measured 0.70m NS x 0.60m EW x 0.08m. Above C660, below C002.

Bowl Furnace 46

C656	Cut of oval bowl furnace, with a rounded corner to the southeast. Measured 0.95m x 0.50m x 0.30m. Had a sharp break of slope at top, slightly concave sides and a gradual break leading to a rounded base. Orientated northwest-southwest. On its northeast edge C656 abutted C609; a second bowl furnace. The oxidised clay and vitrified material around both features was linked, which suggests that both of these features were used contemporarily. Filled with C666, C663, C665, C660 and C659. Above C003, below C666.
C666	Lower fill of C656, with compact red oxidised clay. C666 formed an irregular ring around the outer extent of C656 and also lined its sides. Measured 0.95m x 0.20m x 0.28m. Above C656, below C663.
C663	Secondary fill of C656, with compact dark red oxidised silty-clay. C663 lined the outer edge of C666. Measured 0.60m x 0.03m x 0.06m. Above C666, below C665.
C665	Tertiary fill of C656, with compact greyish-green vitrified clay. C665 formed an incomplete irregular ring around the outer extent of C656, but was located mostly on its southeast edge. Measured 0.80m x 0.12m x 0.14m. Above C656, below C660.
C660	Forth fill of C656, with loosely compacted, black silt. Frequent charcoal and occasional slag and coarse sand included. Measured 0.60m x 0.20m x 0.09m. Above C665, below C659.
C659	Upper fill of C656, with firmly compacted, brownish grey silty-sand. Occasional pebble included. C659 was the largest deposit of C656. Measured 0.60m x 0.35m x 0.20m. Above C656 and C660, below C002.

4.2.3 Stratigraphic Sequencing

Table … Stratigraphic Groups		
Site Name: Derrinsallagh 4		**Record No.: E2180 – Scheme No.: A015/070**
Period	**Phase**	**Composition**
I	1	Natural subsoil (post-glacial geological depositions)
II	1	Initial clearance of site and cutting of Neolithic pit
	2	Late Bronze Age structure and associated features
	3A	Iron Age structure and associated features
	3B	Iron Age bowl furnaces
	4	Post Medieval ditches/drains
III	1	Formation of topsoil

Period I

Phase 1

The natural subsoil consisted of compact yellowish pale-brown sandy/clayey silt, which all archaeological features at Derrinsallagh 4 truncated.

Period II

Archaeological occupation

Phase 1

The initial site clearance and the presence of the Early Neolithic pit

Phase 2

Mid to late Bronze Age occupation

Phase 3 A & B

Occupation from the Iron Age period: Industrial activity in the form of bowl furnaces, charcoal production pit, structural and other associated features

Phase 4

Post Medieval Period field boundaries, ditches and drains

Period III Phase 1

The topsoil C001 consisted of dark brown clayey-silt. This topsoil was formed as a result of natural decomposition of plant and animal material. During the Medieval Period, new agricultural practices were introduced which resulted in more intensive crop cultivation. The rate of decomposition increased, and topsoil formation increased as a result.

4.2.4 Stratigraphic Discussion

The earliest evidence for occupation on site was a single bodysherd from an early Neolithic carinated bowl that came from the fill of an earth cut pit. The evidence for habitation settlement on the site was located in the northeast, an area of high dry ground and the two structures uncovered here, date from the late Bronze Age and Iron Age respectively (See Appendices 8.5 & 8.6). The siting of the structures at this location may have provided shelter from the prevailing south-westerly winds and they reflect the continuity of settlement from the late Bronze Age to the Iron Age. The main phase of activity uncovered at the site consisted of numerous iron working bowl furnaces and associated pits dating from the mid Iron Age period (See Appendix 8.9 A & B). The following text outlines the stratigraphic sequence for the site and extent of the excavated features as shown on Fig. 8.

Period II Phase 1: Early Neolithic pit

C274 was a sub-rectangular and measured 2.40m EW x 1.85m NS x 0.17m in depth. It was filled by a single deposit C320; loosely compacted, brownish black, silt, with frequent charcoal inclusions. Two finds were recovered from the fill, a sherd of carinated Neolithic pottery E2180:320:001 (Appendix 8.6) and a flint scraper E2180:320:002 (Appendix 8.4). The pottery recovered was similar to that uncovered at nearby site of Derrinsallagh 3. The exact function of the pit was not clear. The pit (C274) truncated the edges of two shallow curvilinear ditches, C335 and C564/070/607 at the point at where they met (Fig. 8, Plates 6, 30). As a result of this, it was not possible to establish the stratigraphic relationship between these two ditches but it was likely that C335 and C564/C070 were contemporary in date. The ditch C564/070/607 was divided into two segments separated by a 4m wide entrance or break (Plate 31). Context 070 was the number given to the southwest ditch segment. It was curvilinear in plan with a sub-rounded terminal at its northeast extent, at its southwest extent, it exited beyond the limit of the excavation. It measured 23m NE/SW x 1.1m EW x 0.45m in depth. The second northeast segment (C564/C607) measured 23m in length x 0.85m in width x 0.30m-0.45m in depth. The slope of the sides varied from concave to a gradual slope, and the base was uneven. C070/564/607 was filled by two sterile silt deposits C551, and C337. The second ditch C335 was curvilinear with a rounded terminal at the southeast end. It measured 38m NW/SW x 1m wide x 0.50m in depth and at the southeast end, it became shallower. The sides had a gradual slope and uneven base. It was filled by three different sterile silt deposits C337, C336 and C320. It was not possible to obtain a radiocarbon date from the sterile ditch fills. The finds recovered was a quartzite grindstone E2180:608:001(Appendix 8.3) from the fill of C607, the northeasterly section of the ditch C070/C564/C607 and a flake was recovered from C320 (E2180:320:002; Appendix 8.4).

Period II Phase 2: Mid–Late Bronze Age

Late Bronze Age settlement was identified at the northeast area of the site and consisted of the outline of a roughly D-shaped structure (Structure 1) and associated pits (Figs. 9 & 22). The structure was approximately 6m long x 3m wide and consisted of a series of postholes C613, C615, C620, C632, C628, C626, and C630, and stakeholes C634, and C617. The following is a description of the postholes/stakeholes forming the outline of the D-shaped structure (Plate 1). C613 was a circular posthole, measuring 0.15m in diameter x 0.20m in depth with vertical sides and a concave base. It was filled with a single deposit C614; loosely compacted, mid brown, silty-clay with occasional charcoal flecks as inclusions. C615 was a circular posthole, measuring 0.15m in diameter x 0.20m in depth with vertical sides and a concave base. It was filled with a single deposit C616; loosely compacted, mid brown, silty-clay that contained occasional charcoal flecking as inclusions. C616 returned a date of 2900±35 BP, Calibration Sigma 1, (1130-1010 BC), Sigma 2, (1260-1230 BC to 1220-970 BC), from elm charcoal (Appendix 8.5). C620 was a sub-oval posthole, measuring 0.20m NS x 0.22m EW x 0.22m in depth with almost vertical sides and a flat base. It was filled with a single deposit C621; loosely compacted, mid brown, silty-clay that contained occasional charcoal flecking. C626 was an oval shaped posthole measuring 0.21m NS x 0.17m EW x 0.05m in depth with steep sides and a concave base. It filled with a single deposit C627; compact, dark brown, silty-sand with occasional charcoal. C628 was a circular posthole, measuring 0.23m in length x 0.21m in width x 0.17m in depth with vertical sides and a rounded base. It was filled with a single deposit C629; moderately compact, greyish-brown, silty-sand with occasional charcoal flecking and pebbles. C630 was a circular posthole, measuring 0.17m in diameter x 0.26m in depth with vertical sides and a flat base. It filled with a single deposit C631; loosely compacted, black, silty clay that contained occasional charcoal flecking. Context 632 was a circular posthole, measuring 0.17m in diameter x 0.26m in depth with vertical sides and a flat base. It was filled with a single deposit C633; compact, greyish brown, sandy-silt, that included a moderate amount of stones and occasional charcoal flecking. C617 was an oval shaped stakehole, measuring 0.08m EW x 0.08m NS x 0.19m in depth. It had steep tapering sides, and a concave base. It was filled with a single deposit C618; loosely compacted, mid-light brown, clayey sandy-silt. C634 was a circular stakehole, measuring 0.07m in diameter x 0.12m in depth with vertical sides and a pointed base. It was filled with a single deposit C635; loosely compacted, mid-brown, silty-clay. All of the postholes were similar in size, earth cut with no evidence for the use of packing stones to hold the upright posts in positions. Structure 1, was roughly D-shaped in outline with no indication for an associated hearth or occupation layers. The structure may have functioned as a simple shelter.

A second group of post/stakes was located at the south of Structure 1. These were most likely associated with the activity being undertaken in the structure and consisted of the following extending in an east west direction. C640 was a sub-oval posthole/pit, measuring 0.51m in length x 0.26m in width at east end x 0.18m in width at west end x 0.16m in depth at east end x 0.12m in depth at west end. It had concave sides and an uneven base and was filled with a single deposit C641; moderately compact, yellowish-grey, silty-sand that contained occasional charcoal flecking and pebbles. This may have been a re-cut posthole. To the east of C640 was C622 was a circular posthole, measuring, 0.20m in length x 0.17m in width x 0.19m in depth with vertical sides and a tapered base. It was filled with a single deposit C623; moderately compact, greyish brown, silty-sand that contained occasional charcoal and small stone. Located between C640 and C622 at a distance of 1m from Structure 1 were three stakeholes (C650, C652 and C654) and these may have functioned as a wind break. C650 was an oval shaped stakehole, measuring 0.15m in length, 0.10m in breath x 0.05m in depth with steep sloping sides and a concave base. It was filled with a single deposit C651; moderately compact, brownish yellow, silty-sand with charcoal. C652 was a circular stakehole, measuring 0.10m in diameter x 0.05m in depth with sloping sides and a rounded base. It was filled with a single deposit C653; moderately compact, brownish yellow, silt-sand. C654 was a circular stakehole, measuring 0.10m in length x 0.09m in width x 0.05m in depth with sloping sides and a round base. It was filled with a single deposit C655; moderately compact, brownish yellow, silty-sand with occasional charcoal. C624 oval shaped posthole/pit measuring 0.28m in length x 0.26m in width x 0.25m in depth with vertical sides and an uneven base. It was filled with a single deposit C625: loosely compacted, greyish brown, sandy-silt that contained occasional charcoal flecking and pebbles. A quartzite grinding stone was recovered from the fill (E2180:625:001) (See Appendix 8.3). C636 was an oval shaped posthole measuring 0.17m in length x 0.11m in width x 0.10m in depth with vertical sides and a flat base. It was filled with a single deposit C637; moderately compact, yellowish-brown, sandy-silt. C638 was a circular stakehole, measuring 0.08m in diameter x 0.10m in depth with sloping sides and a pointed base. It was filled with a single deposit C639; loosely compacted, greyish-brown, sandy-silt. C642 was an oval shaped stakehole, measuring 0.13m in length x 0.10m in width x 0.08m in depth with vertical sides and a flat base. It was filled with a single deposit C643; moderately compact, medium brown, sandy-silt. These post/stakeholes may have functioned together as a wind-break or screen.

C605 was an oval shaped pit measuring 1.32m EW x 0.90m NS x 0.43m in depth with steeply sloping sides and an uneven base (Fig. 22, Plate 2). It was filled with C664 (lower deposit); compact, mid-brown, clay-silt that contained a moderate amount of charcoal flecking. C606 was moderately compact, mottled black/dark brown, silty-clay that contained frequent charcoal flecking and heat-fractured sandstone. C606 and C664 contained 82 sherds of pottery representing five vessels; E2180:606:001-047, E2180:664:001-046. The lack of care in the quality and finish of these vessels and the presence of soot reflects their intended use in a domestic context. Plain, coarse, domestic pottery of the type represented at Derrinsallagh 4 developed towards the end of the middle Bronze Age and probably out of domestic cordoned urns, a coarse domestic type dating from the late Bronze Age (Appendix 8.6). C606 returned a date of 2900± BP, Calibration Sigma 1, (1130-1010 BC), Sigma 2 (1260-1230 BC to 1220-970 BC) was obtained from Pomoideae/Hazel/Ash/Alder charcoal (Appendix 8.5).

C657 was of a sub-rectangular pit, measuring 2.20m N x 1.25m in width EW x 0.40m in depth with steep sloping sides and a flat base. It was filled with C677 (lower fill); firmly compacted, dark greyish brown, silty-clay with frequent small stones and occasional charcoal flecking, C658 (upper fill); loosely compacted, brown, silty-clay with a high stone content (Plate 3). A quartzite grinding stone (E2180:658:001) was recovered from the fill (Appendix 8.3).

Period II Phase 3A: Iron Age Structure

Structure 2 was located to the northeast of the site and consisted of three curvilinear slot trenches C647, C645, and C603. The slot trenches formed an incomplete semi-circle that measured *c.*7.5m (Fig. 10, Plates 4, 5). Three postholes/pits C610, C669, C671 and a stakehole C648 may also have been associated with the structure. The slot trenches were of varying lengths but were similar in width and depth. C647 was the smallest of the three slot trenches. It was curvilinear in plan and had rounded terminals at both ends. It measured 1.53m x 0.30m x 0.17m with vertical sides and a flat base. C647 was orientated northeast-southwest and filled with a single deposit C646; loosely compacted, greyish-brown, silty-clay that contained frequent charcoal. The second slot trench was C645 which was curvilinear in plan and had rounded terminals at both ends. It measured 4m in length x 0.26m in width x 0.15m in depth with vertical and a flat base. C645 was orientated roughly south-northwest, and filled with a single deposit C644; compact, dark brown, silty-clay with occasional charcoal. A radiocarbon of 2255±35 BP, Calibration Sigma 1 (390-350 BC to 290-230 BC), Sigma 2 (400-340 BC to 330-200 BC) was obtained from this fill (Appendix 8.5). The largest slot trench C603 was curvilinear in plan with rounded terminals at both ends. It measured 5.50m in length x 0.40m in width x 0.18m in depth with vertical sides and a flat base. C603 was orientated northwest-southeast and filled with a single deposit C604. Within this deposit, a quartzite grinding stone was recovered (E2180:604:001- Appendix 8.3). Structure 2, consisted of earth-cut slot trenches with no stake/postholes cut into the base, nor was there an associated hearth or any indication of what type of roofing method was used if indeed this structure was roofed.

C610 was a circular pit, measuring 0.70m in diameter x 0.12m in depth with sloping sides and a flat base. It was filled with a single deposit C612; moderately compact, mid brown, silty-clay with a moderate amount charcoal. A flint pointed blade (E2180:612:001 – Appendix 8.4). C610 was located within the interior of a Structure 2, and may have functioned as a storage pit. C671 was a circular pit/posthole, measuring 0.60m in diameter x 0.19m in depth with sloping sides and an uneven base. It was filled with a single deposit C672; loosely compacted, brown, silty-clay that contained frequent charcoal and small pieces of fractured sandstone. C667 was an oval shaped pit, measuring 1.20m NS x 1.02m EW x 0.20m in depth with sloping sides and a flat base. C667 was situated 1m south of C671, (pit) and 1.3m west of C669 a posthole. It was filled with three deposits C676, C675, and C668. The base deposit C676; firmly compacted, brown, sandy silty-clay that contained frequent charcoal and fractured stone. The second deposit was C675; compact, yellowish-grey, silty-clay that contained charcoal and fractured stone. The third and uppermost deposit, C668 was firmly compact, light greyish brown, sandy silty-clay that contained frequent large pieces of charcoal. C669 was a sub-circular posthole, measuring 0.20m in diameter x 0.20m in depth with vertical sides and a flat base. It had a sharp break of slope at top and base, vertical sides and a flat even base. C648 was an oval shaped stakehole, measuring 0.09m in length x 0.05m in width x 0.10m in depth with steeply sloping sides and a concave base. It was filled with a single deposit C649; loosely compacted, mid-brown, sandy clay-silt, that included a moderate amount charcoal and small pebbles.

The exact association between these features, and Structure 2, is not clear. As structure 2 was an incomplete semi-circle, it is not clear whether C610, C671, C667, C669 and stakehole C648 were located inside or outside the structure. The presence of high quantities of charcoal and fractured stone within the fills of the pits may suggest that they were used for refuse or other domestic activity.

Period II Phase 3B: Iron Age Industrial Activity

The term 'bowl furnace' or 'furnace pit' is used throughout this report, and represents a collectivisation of archaeological features of a similar shape and design. These features show evidence of oxidisation, and the presence of slag as a deposit within the fill or fills of each archaeological features. Bowl furnaces functioned as a sealed reduced oxygen environment, where the amount of oxygen present can be regulated by the individual working the bowl furnace. The presence of a *tuyere* or some other bellows mechanism can be used to introduce oxygen into the bowl furnace to help achieve the high temperatures necessary to aid the smelting process. The extent of Iron Age activity on the site is indicated in Figs. 11-21 and sections on Figs 22-29.

Bowl furnaces and associated pits

Detailed examination of the bowl furnaces was undertaken and the detailed results are available in Appendices 8.9A and 8.9B. A partially excavated bowl furnace (C397) was removed off site for detailed examination and the detailed analysis is contained in Appendix 8.9A.

C004 was the most westerly bowl furnace at Derrinsallagh 4, and was partially destroyed by later activity (Fig.15, Plate 11). It was sub-oval, measured 0.75m NS x 0.40m EW x 0.28m in depth, and had six separate deposits. The base deposit C100 had moderately compact, mid-orangey-red, fine grained oxidized silty-clay with occasional pebbles. The second deposit C114 had compact cemented greyish dark-blue-green vitrified clay. C114 lined the north, south and east edges of C004. The third deposit C104; compact, yellowish-red to black-brown, pebble rich silty-clay contained a moderate amount of slag. This deposit occurred sporadically throughout C004, but was concentrated mostly towards the centre of the bowl furnace. The fourth deposit, C102; loose, brownish-black, silty-clay had oxidized clay. The fifth deposit C101 had compact, orange-pale-yellow, silty-clay with occasional small pebbles. C101 occurred sporadically in lumps within the other deposits, throughout C004. The sixth and uppermost deposit was C096; compact, mid to dark-brown, silty-clay with a moderate amount of charcoal flaking and frequent vitrified clay.

C005/C057 bowl furnace was *c.*20m southeast of C004 (Fig.15, Plate 10). It was partially stone-lined, ovular in plan with vertical sides and a rounded base. C005 measured 1.21m SW/NE x 0.64m NW/SW x was 0.43m in depth. This may have been originally two bowl furnaces modified into one. C005 contained eight separate deposits C395, C394, C382, C381, C055, C054 and C056. The base deposit was C395; yellowish/orange oxidized clay. The second deposit was C394; stone lining that measured on average 0.25m in height x 0.15m in length x 0.05m in width. The stones were set on edge and pressed against the sides of C005. The intense heat of the furnace had fractured the stone. The third deposit was C382; compact, greenish black, vitrified clay. This deposit lined the edges of the stone at the western end of C005. The fourth deposit was C381; compact, light orange to red, oxidized clay-silt. The fifth deposit was C381; compact, light orange to red, oxidized clay-silt and was only present at the western end of C005. The sixth deposit was C055; compact, light red, oxidized silty-clay. The seventh deposit was C054; friable, dark brownish-black, charcoal rich silt, and contained frequent slag. The eight and uppermost deposit was C056; moderately compact, dark brownish-black, sandy-silt, with frequent slag and occasional charcoal. This bowl furnaces had a stone lining and this lining would not allowed temperatures exceeding 700°-800°C be achieved. Slag was present adhering to the stone lining

Three bowl furnaces C008, C009 and C010 formed a triangle of bowl furnaces (Fig. 17), Plate 12). C008 bordered C009 to the northwest and C010 was situated 0.50m north of C008. Context 8 was circular in plan and measured 0.60m NS x 0.62m EW x 0.35m in depth with vertical sides and a flat base. It was filled with seven deposits C150, C131, C130, C151, C139, C115, and C132. The base deposit C150 was a pinkish-red, oxidized sandy silt-clay. This deposit formed a ring around the edge of C008. The second deposit was C131; compact, reddish-orange, oxidized clay. The third deposit was C130; compact, bluish-grey, vitrified clay that lined the edge of C008. The fourth deposit was C151; loose, blackish-grey, charcoal rich silty-clay. The fifth deposit was

C139; compact layer of broken blackish green slag pieces. The sixth deposit was C115; loosely compacted, blackish dark brown, clayish-silt with occasional charcoal flakes. The seventh and uppermost deposit was C132; loose, blackish-grey, silty-clay-slag mix that included occasional charcoal. C009 was a sub-circular bowl furnace, measuring 0.70m SE/NW x 0.50m SW/NE x 0.25m in depth with sloping sides and an uneven base. It was filled with seven deposits C214, C184, C182, C183, C199, C186, and C116. The base deposit was C214; compact, pinkish-red, oxidized clay that formed around the cut of C009. The second deposit was C184; moderately compact, reddish-orange silty-clay that included frequent compact firm red clay. The third deposit was C182; compact, greyish-blue, vitrified clay which lined the upper extent of C009. The fourth deposit was C183; slag rich, compact, mottled reddish-orange clay and blackish-green vitrified clay pieces. The fifth deposit was C199; loose, brownish-black, charcoal rich clay-silt that included occasional slag inclusions. A radiocarbon date of 1920±70 BP Calibration Sigma 2(50BC-240AD) was obtained from the fill (Appendix 8.5). The sixth deposit C186 was a loose, greyish black, slag rich clayey-silt with occasional charcoal. The seventh and uppermost deposit of C009 was C116; loose, greyish brown-black, silty clay that included occasional charcoal. C010 was a sub-circular bowl furnace measuring 0.65m NW/SW x 0.55m NE/SW x 0.35m in depth with vertical sides and a rounded base. It was filled with six deposits C246, C222, C223, C221, C220 and C117. The base deposit was C246; compact, pinkish-red, sandy silt-clay and formed an irregular ring around the outer extent of C010. The second deposit was C222; compact, greyish-blue, vitrified clay and formed an incomplete ring around the outer extent of C010. The third deposit was C223; loosely compacted, slag rich, dark grey, clayish-silt that contained occasional charcoal flecking. The fourth deposit was C221; loosely compacted, slag rich, dark-grey clayish silt that contained frequent charcoal flecking. The fifth deposit was C220; compact, red oxidized clay with dark grey and black clay. C220 may have been the remains of the collapsed superstructure over the furnace C010. The sixth and uppermost deposit of C010 was C117; loosely compacted, dark black clayish silt with light brown clay, charcoal flecking and slag pieces.

C014, C015 and C016 were associated bowl furnaces, C015 was 0.5m south of C014, and C016 was 0.3m east (Fig. 16). C014 was circular in plan and measured 0.75m NW/SW x 0.46m NE/SW x 0.40m in depth with sloping sides and a flat even base. It was filled with nine deposits C333, C192, C193, C194, C269, C276, C332, C191, and C190. The base deposit was C333; compact, red oxidized clay that formed around the outer extent of C014. The second deposit was C192; compact, dark greenish-grey vitrified clay that contained occasional pockets of light red clay small pebbles, and slag pieces. C192 lined the outer edge of C014 and formed an incomplete ring. The third deposit was C193; compact, dark reddish-brown clayish-silt with occasional oxidized clay flecks and pebbles. The fourth deposit was C194; compact, dark greenish-grey vitrified clay with occasional slag fragments. C194 occurred in pockets within C014. The fifth deposit was C269; a mottled mix of loose dark brownish-black clayish-silt and (85%) heavily compact bluish-black slag. C269 may be the result of a failed attempt at firing, the slag choking the bowl furnace and forming a plano-convex bottom (PCB). The sixth deposit was C276; loosely compacted, mix of dark brownish-black, clayish silt and dark black charcoal (70%), with occasional slag. The seventh deposit was C332; compact, orange-red oxidized clay that may be the remains of the collapsed superstructure of C014. The eight deposit was C191; loose, dark brownish-black, clayish-silt with frequent charcoal. The ninth and uppermost deposit was C190; loose, light reddish-brown, clayish-silt with occasional oxidized clay. C015 was a circular in plan and measured 0.40m NS x 0.37m EW x 0.20m in depth with sloping sides and a flat base. It was filled with seven deposits C331, C178, C177, C176, C175, C174, and C173. The base deposit was C331; compact, red oxidized clay with occasional pebbles. This deposit formed along the base of C015. The second deposit was C178; greyish-green vitrified clay that formed an incomplete ring around the outer extent of C015. The third deposit was C177; loosely compacted, blackish dark-brown, clayish silt with frequent charcoal flecking. The fourth deposit was C176; loosely compacted, dark brown, clayish silt with occasional vitrified clay. The fifth deposit was C175; loosely compacted, dark blackish-brown with frequent charcoal and slag. The sixth deposit was C174; loosely compacted, dark brown, clayish silt with occasional slag. The seventh and uppermost deposit was C173; loosely compacted, light-reddish brown, clayish silt with occasional oxidized clay pieces. C016 was circular in plan and measured 0.55m in diameter x 0.20m in depth with sloping sides and a flat base. It was filled with six deposits C213, C212, C211, C296, C297, and C298. The base deposit was C213; compact, red oxidized clay with a moderate amount of stone. The second deposit was C212; compact, dark greenish-grey, vitrified clay. C212 formed an incomplete irregular ring around the extent of C016. The third deposit was C211; loosely compacted, light reddish-brown, clayish silt with occasional burned clay. The fourth deposit was C296; compact, dark brown, slag with a moderate amount of oxidized clay. C296 represents a failed attempt at firing in the bowl furnace, forming a PCB at the base. The fifth deposit was C297; loosely compacted, mid-brown clayish-silt. The sixth and uppermost deposit was C298; loosely compacted, dark reddish-brown, clayish-silt with a moderate amount of charcoal flecks and slag pieces.

C017, C018 and C019 was a group of three associated bowl furnaces, C018 was immediately east of C017, and C019 immediately east of C018 (Fig. 18). Context 017 was sub-circular in plan and measured 0.74m NS x 0.66m EW x 0.34m in depth with concave sides and a flat base. It was filled with six deposits C370, C366, C357, C310, C317, and C309. The base deposit was C370; compact, reddish orange oxidized clay with occasional pebble that formed around the edge of the cut. The second deposit was C366; compact, greenish-grey vitrified clay with frequent slag that formed an incomplete irregular ring around the outer extent of C017. The third deposit was C357; loosely compacted, greyish black, clayish silt that contained frequent slag and charcoal. A radiocarbon date of 1920±60BP Calibration Sigma 2(10BC-250AD) was obtained from this fill (Appendix 8.5). The fourth deposit was C310; compact, reddish-orange, oxidized clay with frequent slag and occasional vitrified clay. C310 may have represented the collapsed superstructure for C017. The fifth deposit was C317; compact, greyish brown, sandy silt that contained frequent of light yellow clay, charcoal flecking and a moderate amount of slag. The sixth and uppermost deposit was C309; loosely compacted, light brown, sandy clay that contained occasional slag, stone pebbles. C018 was circular in plan and measured 0.54m NS x 0.53m EW x 0.19m in depth with concave sides and rounded base. It was filled with five deposits C369, C295, C288, C287, and C237. The base deposit was C369; compact, reddish-orange oxidized clay with moderate amount of pebbles. The second deposit was C295; compact, greenish grey vitrified clay with occasional pebbles that formed an irregular incomplete ring around the edge of C018 but was absent on the western edge. The third deposit was C288; compact, dark greyish black clayish silt that contained frequent slag and a moderate amount of charcoal. The fourth deposit was C287; loosely compacted, dark greyish-brown, sandy-silt that contained frequent charcoal and a moderate amount of slag. The fifth and uppermost deposit was C237; loosely compacted, light brown, sandy clay with occasional slag pieces. C019 was sub-circular in plan and measured 0.75m NS x 0.70m EW x 0.32m in depth with concave sides and a flat base. It was filled with five deposits C368, C258, C233, C236, and C237. The base deposit was C368; compact, reddish-orange oxidized clay with occasional pebble. The second deposit was C258; compact, greenish grey, vitrified clay with occasional pebbles that formed an incomplete irregular ring around the extent of C019. The third deposit C233 was loosely compacted, greyish black, clayish-silt with frequent slag. The fourth deposit was C236; loosely compacted, light brownish-red, clay with occasional pebble. The fifth and uppermost deposit C237 was loosely compacted, light brown, sandy clay with occasional slag.

C020, C021, C022, and C023 formed a complex of small furnaces set in an east-west line, located towards the centre of the site (Fig. 19, Plate 16). Associated with these furnaces was pit C024. Context 020 was oval in plan and measured 0.38m NW/SW x 0.32m NE/SW x 0.12m in depth vertical sides and a flat base formed by a single large stone. It was filled with two deposits C260, and C259. The base deposit was C260; compacted, light pinkish-red, silty-clay that formed around the base and sides of C020. The second and upper deposit was compact slag rich, dark-brownish/grey mottled clayish-silt with occasional charcoal flecking. C021 was sub-circular in plan and measured 0.30m EW x 0.28m NS x 0.15m in depth with steep sloping sides and an even stony base. It was filled with two deposits C272 and C273. The base deposit was C272; compacted, black clayish, silt that contained a moderate of slag and occasional charcoal flecking and formed an incomplete ring around the extent of C021. The second and upper deposit was C273; loosely compacted, slag rich sandy-silt with occasional charcoal flecking.

C022 was sub-circular in plan and measured 0.70m NS x 0.63m EW x 0.25m in depth with vertical sides and a concave base. It was filled with five deposits C280, C279, C278, C283, and C277. The base deposit was C280; compact, stone rich, pinkish-orange red oxidized clay that formed a complete irregular ring around the outer extent of C022. The second deposit was C279; compact, bluish-grey, vitrified clay with frequent silt that formed an irregular, incomplete ring around C022. The third deposit was C278; moderately compact, dark greyish-black, clayish silt with moderate amount of charcoal flecking. The fourth deposit was C283; compact slag rich (35%) dark brown silt that contained occasional charcoal and rusty-coloured clay. The fifth and uppermost deposit was C277; compact, orange oxidized clay with frequent slag. C023 was circular in plan and measured 0.70m in diameter x 0.55m in depth sloping sides and a concave base. It was filled with seven deposits C362, C343, C342, C341, C340, C339, and C338. The base deposit was C362; dark rusty-brown oxidized clayish silt that formed the outer extent of C023, an incomplete, irregular ring. The second deposit was C343; compact, reddish orange oxidized clay that formed an incomplete ring around the extent of C023. The third deposit was C342; compact, bluish-grey, vitrified clay that formed an irregular, incomplete ring around the extent of C023. The fourth deposit was C341; compact, blackish dark grey, clayish silt that contained frequent charcoal flecking and moderate amount of slag. The fifth deposit was C340; loosely compacted, dark rusty brown, clayish silt. The sixth deposit was C339; a mix of loosely compacted, dark brown, silty-sand and heavily compacted, slag with occasional charcoal flecking. The seventh and uppermost deposit was C338; loosely compacted, light brown, silty-sand with occasional slag. C375 was sub-angular stakehole, measuring 0.26m EW x 0.21m NS x

0.15m in depth with vertical sides and a flat base. It was filled with a single deposit C376; loosely compacted, greyish brown, silty-sand. C375 was situated in the base of C023; a bowl furnace. It was unclear whether C375 predated or was contemporary with C023. Context 024 was the cut of a pit, ovular in plan and measured 0.42m SE/NW, 0.37m SW/NE and 0.12m in depth. It had uneven gradual break of slope at top and base, sloping slightly stepped sides, and an uneven pot-marked base. C024 a pit was associated with this complex of features. It was circular in plan measuring 0.42m SE/NW x 0.37m SW/NE x 0.12m in depth. It was filled with two deposits C379 and C377. The base deposit was C379; loosely compacted, light brown, silty-sand. The second and uppermost deposit was C377; loosely compacted, light brown, charcoal rich silty-sand.

C080, C081 and C082 were a complex of three bowl furnace; C081 was 0.30m west of C080, C082 was 0.20m east of C080, and an associated pit C086 was 0.20m east of C082 (Fig. 17). Context 080 was circular in plan, measuring 0.25m in diameter x 0.07m in depth with concave sides and a flat base. It was filled with two deposits C255, and C249. The base deposit was C255; compact, orangey-red, oxidized clay with occasional pebble that formed an irregular ring around the outer extent of C080. The second and upper deposit was C249; compact, light brown evenly mixed charcoal-silt, with occasional pebble. C081 was sub-circular in plan, measuring 0.16m in diameter x 0.13m in depth with vertical sides and a flat base. It was filled with two deposits C252 and C229. The base deposit was C252; compact, orangey-red, oxidized clay that formed an irregular incomplete ring around the outer edge of C081. The second and upper deposit was C229; compact, charcoal and slag rich brownish-black silt. C082 was oval in plan, and measured 0.34m NS x 0.28m EW x 0.08m in depth with vertical sides and flat base. It was filled with two deposits C251, and C209. The base deposit was C251; compact, orangey-red, oxidized clay that formed an irregular incomplete ring around the outer extent of C082. The second and upper deposit was C209; compact, dark brownish-black, silt-charcoal mix with occasional pebbles. C086 was an associated pit located 0.2m east of C082. The pit was circular in plan, and measured 0.31m in diameter x 0.18m in depth with sloping sides and rounded base. It was filled with a single deposit C185; compact, dark black, charcoal-silt mix, with frequent slag.

C119, C120 and C121 formed a complex of three bowl furnaces; C120 was 0.65m west of C119, and C121 was 0.40m south of C119 (Fig.17, Plate 14). Context 119 was sub-circular in plan, and measured 0.72m in diameter x 0.38m in depth with concave side and a flat base. It was filled with seven deposits C416, C415, C294, C324, C293, C292, and C291. The base deposit was C416; compact, red, oxidized clay that formed an incomplete irregular ring around the outer extent of C119. The second deposit was C415; compact, greenish-grey, vitrified clay. C415 occurred in separate pockets, and formed an incomplete irregular ring around the edge of C119. The third deposit was C294; loosely compacted, dark black, sandy silt that contained frequent slag and charcoal. The fourth deposit was C324; loosely compacted, dark brown, sandy-silt with frequent slag and charcoal. The fifth deposit was C293; compact, reddish orange, oxidized clay that contained pockets of dark brown clay and slag and may be the remains of the collapsed superstructure of C119. The sixth deposit was C292; compact, light to pale-brown, silty-sand that contained occasional oxidized clay. The sixth deposit was C292; compact, light to pale-brown, silty-sand, with occasional oxidized clay. The seventh and uppermost deposit was C291; loosely compacted, dark brown, sandy-silt that contained moderate-frequent slag and charcoal. C120 was circular in plan, measuring 0.67m in diameter x 0.24m in depth with concave sides and a rounded base. It was filled with four deposits C389, C390, C388, and C387. The base deposit was C389; compact, light reddish, oxidized clay that formed an irregular ring around the extent and base of C120. The second deposit was C390; compact, light blackish green, vitrified clay that formed an irregular incomplete ring around the outer extent of C120. The third deposit was C388; loosely compacted, dark brownish black, charcoal rich sandy-silt. The fourth and uppermost deposit was C387; loosely compacted, mid orange, oxidized clay that may represent the collapsed superstructure of C120. Context 121 was circular bowl furnace that measured 0.90m NS x 0.78m EW x 0.37m in depth with concave side and a flat base. It was filled with five deposits C481, C480, C264, C262, and C263. The base deposit was C481; compact, light red, oxidized clay that formed an irregular ring on the sides and base. The second deposit was C480; loosely compacted, black, charcoal-rich silty-sand. The third deposit was C264; compact, red, oxidized clay. The fourth deposit was C262; loosely compacted, dark brownish, silty-sand with frequent slag and charcoal. The fifth and uppermost deposit was C263; compact, orange, oxidized clay and represent the collapsed superstructure of C121.

C125, C126, C127 and C299 formed a complex; C126 was 0.20m west of C125, C127 bordered the western edge of C126, and C299 bordered C126 on its northern edge (Fig. 19, Plate 13). C125 was circular in plan and measured 0.55m in diameter x 0.25m in depth with sloping sides and a v-shaped base. It was filled with nine deposits C385, C595, C325, C244, C515, C514, C323, C516, and C517. The base deposit C385 was a compact, red, oxidized silty-clay that formed an irregular incomplete ring around C125. The second deposit was C595; moderately compact, mid brownish-yellow, silty-clay. The third deposit was C325; compact, greenish-grey, slag-rich, vitrified clay that formed an irregular ring around the outer extent of C125. The fourth deposit was C244;

loosely compacted, black, charcoal rich silty-clay. The fifth deposit was C515; loosely compacted, black, charcoal rich silty-clay. The sixth deposit was C514; loosely compacted, brown, gritty silt with a moderate amount of slag. The seventh deposit was C323; loosely compacted, red, oxidized silty-clay, with frequent slag and charcoal. The eighth deposit was C516; moderately compact, slightly vitrified, greyish green, silty-clay. The ninth and uppermost deposit C517 was loosely compacted, grey silty-clay with occasional pebble. C126 was circular in plan and measured 0.41m in width x 0.25m in depth with vertical sides, and a U-shaped base. It was filled with two deposits C383 and C326. The base deposit C383 was moderately compact, red, silty-clay that formed an irregular ring around the extent of C126. The second and upper deposit was C326; loosely compacted, creamy-brown to black, silty-clay that contained frequent charcoal flecking and occasional small stones. C127 was sub-circular in plan, and measured 0.63m EW x 0.40m NS x 0.20m in depth with sloping sides and a flat base. It was filled with four deposits C389, C329, C327, and C328. The base deposit was C389; compact, light red, oxidized clay formed an irregular ring around C127. The second deposit was C329; compact, greenish-grey, vitrified clay with occasional pebbles that formed an irregular, incomplete ring around the upper edge and outer extent of C127. The third deposit was C327; loosely compacted, black, silty-clay with frequent charcoal and slag. The fourth and uppermost deposit was C328; moderately compact, dark grey, clay with some charcoal. C299 was circular in plan and measured 0.50m in diameter x 0.30m in depth with sloping sides and U-shaped base. It was filled with six deposits C386, C314, C330, C313, C312, and C300. The base deposit was C386; compact, red, oxidized silty-clay that formed around the base, sides and formed a ring around the outer extent of C299. The second deposit was C314; compact, greenish-grey, vitrified slag that formed an incomplete irregular ring around the outer extent of C299. The third deposit was C330; loosely compacted, light grayish, sandy-silt, located on eastern side that contained occasional slag and pebble. The fourth deposit was C313; loosely compacted, black, silty-clay with frequent charcoal and slag. The fifth deposit was C312; loosely compacted, red, oxidized clay and may have represented the remains of the collapsed superstructure of C299. The sixth and uppermost deposit C300 was loosely compacted, black silty-clay with frequent charcoal.

C133, C134, C135 and C168 were part of a complex of bowl furnaces at the eastern edge of the site (Fig. 20). C168 abutted C133 at its eastern edge, C134 was 0.25m north of C133 and C135 was 0.15m west of C133. Associated with C134 was C165; a pit or channel at the base of a bowl furnace. Context 133 circular in plan, and measured 0.70m in diameter x 0.15m in depth with concave sides and a flat base. It was with filled by seven deposits C206, C560, C537, C524, C536, C207, and C170. The base deposit C206 was compact, reddish-orange, oxidized clay with inclusions of coarse sand. It formed the base and ringed the outer extent of C133. The second deposit was C560; compact, greenish-grey, vitrified clay that formed an incomplete irregular ring around the extent of C133. The third deposit was C537; moderately compact, mottled dark brown, sandy-silt that contained frequent charcoal and coarse pebbles. The fourth deposit was C524; compact, mid-brown, silty-sand, with occasional flecks of charcoal and oxidized clay. The fifth deposit was C536; compact mottled lumps of orangey-yellow brown, redeposited clay that contained inclusions of coarse sand, fine pebbles and charcoal. The sixth deposit was C207; compact, orangey-red, oxidized clay that contained occasional yellow clay, gritty sand and charcoal and may possibly be the remains of the collapsed superstructure. The seventh and uppermost deposit was C170; charcoal rich, dark brownish-black, silt with a moderate amount of slag. C134 was sub-circular in plan, and measured 0.74m NS x 0.58m EW x 0.20m in depth with concave sides and a flat base. It was filled with a single deposit, C162; loosely compacted, slag-rich, dark-brown silt with a moderate amount of charcoal. C135 was circular in plan, and measured 0.40m in diameter x 0.34m in depth with vertical sides and a flat base. It was filled with three deposits C318, C253, and C171. The base deposit was C318; well compact, reddish-pink, oxidized clay that formed an irregular ring around C135. The second deposit was C253; compact, greenish-grey, vitrified clay that formed an incomplete irregular ring around C135. The third and uppermost deposit was C171; loosely compacted, dark brownish-black, slag-rich sandy-silt, with occasional charcoal flecking (See Appendix 8.1). C168 was sub-circular in plan, and measured 0.58m NS x 0.40m EW x 0.12m in depth with concave sides and a flat base. It was filled with three deposits C542, C541, and C169. The base deposit was C542; compact, mid reddish-brown mottled oxidized silt that contained frequent charcoal, coarse sand, and fine pebbles. The second deposit was C541; loosely compacted, mid-brown, silty-clay with mottled lumps of oxidized clay and occasional charcoal flecks. The third and uppermost deposit was C169; compact, charcoal-rich, dark brownish black silt. C165 was a pit or channel at the base of bowl furnace C134. It was linear in plan, and measured 0.12m in length x 0.05m in width x 0.04m in depth with sloping concave sides, and an even base. It was filled with a single deposit, C166; compact, dark brownish-black silt, with occasional charcoal.

C225 and C256, a pair of abutting bowl furnaces (Fig. 17, Plate 15). The bowl furnaces were truncated by a later shallow pit C374. Context 225 was sub-oval in plan, and measured 0.65m NS x 0.60m EW x 0.45m in depth with vertical sides and the base sloped downwards evenly from northwest-southeast and included two closely set flat angular quartz blocks. On its eastern edge

C225 abutted C226, both C225 and C226 were covered by a spread C374. C225 was filled with four deposits C239, C367, C270, and C240. The base deposit was C239; compact, reddish-orange, fine grained oxidized clay silt that contained occasional charcoal flecking and rounded pebbles. This deposit formed on the base and the sides of the furnace pit. The second deposit was C367; compact, orangey-red brown to greyish-blue black, slag rich vitrified clay that partially lined the upper extent of C225. The third deposit was C270; loosely compacted, dark brownish-black fine charcoal rich silt, with frequent slag. The fourth and uppermost deposit was C240; loosely compacted, greyish brown, fine silt with occasional charcoal and pebbles. C226 was sub-circular in plan, and measured 0.55m EW x 0.50m NS x 0.32m in depth with vertical sides and a flat base. It was filled with four deposits C239, C367, C271, and C242. The base deposit was C239; moderately compact, pale orange to vibrant red, fine grained oxidized clay that contained frequent lumps of vitrified clay, a moderate amount of charcoal and pebbles that lined the base and sides of C226. The second deposit was C367; compact, orangey reddish-brown to greyish blue-black vitrified clay. C367 occurred in separate lumps and partially lined the upper extent of the bowl furnace. The third deposit was C271; loosely compacted, dark brownish-black, fine grained charcoal rich silt, with frequent slag. The fourth and uppermost deposit was C242; loosely compacted, fine grained greyish-brown silt with occasional charcoal, pebbles and oxidized clay. C374 was oval in plan, and measured 1.80m NW/SW x 1.60m EW x 0.08m in depth with sloping sides and uneven base. C374 truncated the upper edges of two bowl furnaces C225 and C226. It was filled with a single deposit C378; compact, greyish brown, fine grained silty-clay, with moderate angular and sub-angular stone and occasional charcoal.

C266 a single bowl furnace was circular in shape, and measured 0.40m in diameter x 0.27m in depth with concave sides and a flat base (Fig. 20). It was filled with five deposits C311, C281, C286, C282, and C268. The base deposit was C311; compact, reddish-pink, oxidized clay that formed around the edges. The second deposit was C281; compact, dark greenish-grey, vitrified clay and formed an irregular, incomplete ring around the edge of C266. The third deposit was C286; loosely compacted, dark brownish-black slag-rich, sandy-silt with frequent charcoal. The fourth deposit was C282; compact, light yellowish-mid orange, oxidized clay with occasional charcoal and may be the remains of the collapsed clay superstructure of the bowl furnace. The fifth and uppermost deposit was C268; loosely compacted, brown silt with charcoal.

C393 was a single bowl furnace, oval in outline, and measured 0.50m NS x 0.44m EW x 0.17m in depth with concave sides and an uneven base (Fig. 21). It was filled with three deposits C556, C555, and C430. The base deposit was C556; compact, light brownish red, oxidized clay that formed an irregular, incomplete ring around the outer extent of C393. The second deposit was C555; compact dark greenish-grey, vitrified clay with occasional small pebble and formed an irregular, incomplete ring around the outer extent of C393. The third and uppermost deposit was C430; moderately compact, greyish-black, slag-rich, sandy-silt, with occasional charcoal flecks.

C397, C398, C399, C400, C492 bowl furnace complex and associated pits C399, C411 and C506 were located at the southeast area of the site (Fig. 21, Plate 17). C397 was sub-circular in plan, and measured 0.40m EW x 0.32m NS x 0.35m in depth with concave sides and a base. It was filled with seven deposits C404, C405, C451, C450, C452, C403, and C449 (Plate 18). The base deposit C404 compact, orangey-red, oxidized clay that formed an incomplete ring around the outer extent of C397. The second deposit was C405; compact, green-brown, vitrified clay, with slag that formed an irregular, incomplete, ring around the outer extent of C397. The third deposit was C451; loosely compacted, black, charcoal-rich silt. The fourth deposit was C450; loosely compact, black, slag-rich silt. The fifth deposit was C452; compact, deposit of coarse greyish-black slag situated on the north side of C397. The sixth deposit was C403; compact, orange, oxidized sandy-clay, with frequent red oxidized clay lumps that may have been the remains of the collapsed roof/superstructure of C397. The seventh and uppermost deposit was C449; compact, medium brown clay with occasional charcoal. This bowl furnace was removed off site, partially excavated for further analysis (Appendix 9A). C398 was sub-circular in plan and measured 0.54m in length x 0.50m in width x 0.44m in depth with concave sides and base. It was filled with five deposits C407, C576, C575, C574, and C459. The base deposit was C407: compact, orangey-red, oxidized silty-clay that formed an incomplete ring around the extent of C398. The second deposit C576 was moderately compact, orange-pink, oxidized silty-clay, with occasional charcoal flecks. The third deposit was C575; loosely compacted, black, sandy-silt, with frequent charcoal. The fourth deposit was C574; compact, orange, oxidized clay with occasional charcoal and slag. The fifth and uppermost deposit was C459; moderately compact, mid brownish-black, clay-silt with moderate inclusions of charcoal. C400 was sub-oval in plan and measured 0.50m in length x 0.40m in width x 0.30m in depth with concave sides and base (Plate 20). It was filled with five deposits C412, C410, C553, C561, and C409. The base deposit was C412; moderately compact, orange-red, oxidized clay that formed an incomplete ring around the edge of C400. The second deposit was C410; heavily compact greenish-grey vitrified clay. C410 occurred in separate pieces, and formed an irregular, incomplete ring around the outer extent of C400. The third deposit was C553; moderately compact, dark black, sandy-silt with frequent slag and charcoal.

The fourth deposit was C561; compact, grey-orange, silty-sand. The fifth and uppermost deposit was C409; compact, orange, oxidized silty-sand, with a moderate amount of oxidized clay lumps that may have been the remnants of the collapsed roof/cover for C400. C492 was sub-circular in plan, and measured 0.70m in length x 0.65m in width x 0.52m in depth with vertical sides and a concave base. It was covered by an archaeological spread C406, and filled with ten deposits C493, C545, C546, C547, C535, C520, C519, C511, C510, and C494. The base deposit C493 was moderately compact, red, oxidized silty-sand that formed an incomplete ring around the outer extent of C492. The second deposit was C545; compact, orange, oxidized sand. The third deposit was C546; compact, green-grey, vitrified clay and occurred in separate areas that formed an irregular, incomplete, ring around the outer extent of C492, and was the largest deposit on the north edge of C492. The fourth deposit was C547; moderately compact, brown, sandy-silt with a green hue, possibly slightly vitrified and contained occasional charcoal flecking. C547 was located solely on the south edge of C492. The fifth deposit was C535; loosely compacted, dark brown-black, slightly sandy-silt with moderate-frequent amount of charcoal and slag. C520 was loosely compacted, medium brown-orange, slightly sandy-silt with occasional charcoal. The seventh deposit was C519; compact, orange-yellow, sand that contained frequent lumps of oxidized clay and was the largest single deposit within C492. The eight deposit was C511; moderately compact, dark brown-black, very sandy-silt, with frequent charcoal and occasional slag. The ninth deposit was C510; moderately compact, light brown, sandy-silt with occasional charcoal. The tenth and uppermost deposit was C494; moderately compact, medium dark brown, silty-sand, with moderate-frequent charcoal inclusions. The following pits were associated with the bowl furnaces: C399 was ovoid in plan and measured 0.43m in length x 0.35m in width x and 0.08m in depth with sloping sides and an uneven base. It was filled with a single deposit, C408; compact, dark greyish-brown, silty-sand with frequent slag and occasional charcoal. C411 was sub-oval and measured 0.34m in length x 0.26m in width x 0.10m in depth with sloping sides and uneven base. It was filled with three deposits C466, C465, and C413. The base deposit was C466; moderately compact, medium-light brown, sandy-silt with occasional charcoal. The second deposit C465 was moderately compact, medium-dark brown, sandy-silt with occasional charcoal. The third and uppermost deposit was C413; moderately compact, brown-black, clay-silt with frequent charcoal. C506 was sub-oval in plan and measured 0.90m in length x 0.48m in width x 0.25m in depth with sloping sides and a concave base. It was filled with two deposits C491 and C406. The base deposit was C491; moderately compact, medium brown, sandy-silt with occasional charcoal. The second and upper deposit was C406; moderately compact, dark brown-black, sandy-silt with a moderate-frequent amount of charcoal and occasional slag pieces.

C420, C421, C422 and C437 were part of a complex of small bowl furnaces located to the south of the site that had been truncated by later activity (Fig. 21, Plate 21). C421 sub-circular in plan and measured 0.27m NS x 0.23m EW x 0.07m in depth with sloping sides and an uneven base. It was filled with two deposits C446 and C445. The base deposit was C446; moderately compact, orangey-red, oxidized clay and formed an incomplete ring around the outer extent of C421. The second and upper deposit was C445; loosely compacted, reddish brown-black, silty-clay with frequent charcoal and occasional slag. C422 was sub-circular in plan and measured 0.48m NS x 0.45m EW x 0.10m in depth with sloping sides and an uneven base. It was filled with two deposits C457 and C453. The base deposit was C457; compact, orangey-red, oxidized clay with small pebbles that formed an incomplete ring around the outer extent of C422. The second and upper deposit was C453; loosely compacted, brownish black, clay with a moderate amount of slag and charcoal. C437 was the cut of a bowl furnace that irregular in plan. It measured 1.15m EW x 0.60m NS x 0.18m in depth with vertical sides and uneven base. It had been truncated at its western edge and was filled with a single deposit, C485; loosely compacted, blackish brown, silty-sand that contained a moderate amount of charcoal flecking, slag and decayed stones. C428 was the cut of a posthole/pit that was circular in plan and measured 0.35m in diameter, and 0.10m in depth. It had a moderate break of slope at top and base, sloping sides, and a flat even base

C427, C429, and C432 formed a complex of bowl furnaces that were situated at the southeast end of the site (Fig. 21, Plate 22). Associated with these bowl furnaces were a series of pits C428, C433, C434, C435, C436 and C438. Context 427 was circular in plan and measured 0.30m in diameter x 0.10m in depth with sloping sides and a flat base. It was filled with three deposits C509, C508, and C507. The base deposit was C509; compact, reddish pink, oxidized silt that formed an irregular ring around the sides of C427. The second deposit was C508; compact, red, oxidized-vitrified silt-clay that was present on the base and sides of the cut. The third and uppermost deposit was C507; compact, dark brownish black, silt with frequent vitrified clay. C429 was circular in plan, and measured 0.46m NS x 0.43m EW x 0.16m in depth with sloping sides and a flat base. It had been truncated by later activity and was filled with five deposits C557, C558, C559, C448, and C447. The base deposit was C557; compact, red oxidized clay that formed on the sides and base of C429. The second deposit was C558; compact, greyish-green, vitrified clay. C558 formed an irregular, incomplete ring around the outer extent of C429. The third deposit was C559; compact, greyish green, vitrified clay with frequent slag. The fourth deposit was C448; loosely compacted, dark black, sandy-silt with a moderate amount of charcoal. The fifth and uppermost deposit was C447; loosely compacted, dark brown, silty-sand with a moderate amount of charcoal. C432 was circular in plan and measured 0.50m in diameter x 0.10m in depth with sloping sides and a flat base. It was filled with six deposits C475, C477, C474, C473, C471, and C444. The base deposit was C475; compact, dark orangey-red, oxidized silt that formed an incomplete ring around the outer extent of C432. The second deposit was C477; compact, dark red, oxidized clay with occasional pebbles. C477 lined the edge of C432, but was absent on the north edge where C432 was truncated by C425. The third deposit was C474; compact, dark greenish-grey, vitrified clay that lined the edges to form an irregular incomplete ring around C432. The fourth deposit was C473; compact, dark brown, silt with occasional slag. The fifth deposit was C471; a single deposit of dark brown-grey slag (0.30m in diameter x 0.05m in depth). This deposit may represent a failed attempt at firing the bowl furnace C432. The sixth and uppermost deposit C444 was compact, dark brow, silt with occasional slag. C437 was irregular in plan and measured 1.15m EW x 0.60m NS x 0.18m in depth with vertical sides and uneven base. C437 was truncated at its western edge. It was filled with a single deposit C485; loosely compacted, blackish brown, silty-sand with moderate charcoal, slag and decayed stone. The following pits were associated with the iron working in this area. C428 had been truncated at its upper edge by later activity and was filled with three deposits C461, C442, and C441. The base deposit was C461; loosely compacted, orange, oxidized clay, located on the east side. The second deposit was C442; compact dark brown silt with occasional slag. The third and uppermost deposit was C441; loosely compacted, dark black, silty-charcoal layer. C433 was irregular in plan and measured 0.85m EW x 0.55m NS x 0.25m in depth with sloping sides and a flat base. It was filled with two deposits C443 and C504. The base deposit was C443; compact, light-grey, silt with occasional stones. The second and upper deposit was C504; compact, dark greyish black, stone-silt mix, with moderate charcoal inclusions. The stones were mostly pebbles of limestone, fractured angular sandstone, and some quartz. C434 was irregular in plan and measured 2.90m NS x 0.80m EW x 0.10m in depth with sloping sides and an uneven base. It was filled with a single deposit, C518; compact, dark greyish black, stone-silt mix, with frequent slag and charcoal. The stones were mostly angular fractured sandstones. C435 was irregular in plan and measured 2.90m EW x 1.50m NS x 0.30m in depth with steep sloping sides and a sloping base. It was filled with three deposits C540, C539, and C538. The base deposit was C540; compact, light grey sand. The second deposit was C539; compact, dark yellowish-grey, silt with occasional pebble. The third and uppermost deposit was C538; compact, dark greyish black-brown, stone-rich silt. The stones were mostly fractured angular sandstone. It contained occasional charcoal flecking. C436 was irregular in plan and measured 3.00m NE/SW x 1.20m NW/SW x 0.30m in depth with sloping sides and an uneven base. It was filled with two deposits

C563 and C562. C563 contained compact, dark yellowish-grey, silt with occasional fragmented angular sandstone and limestone. The second and uppermost deposit was C562; compact, dark grey blackish-brown, silt-stone mix that contained frequent fractured, angular and sub-angular stones, and occasional charcoal flecking. C438 was sub-oval in plan and measured 1.50m NS x 1.00m EW x 0.25m in depth with sloping sides and a flat base. It was filled with five deposits C580, C581, C582, C579, and C578. The base deposit was C580; loosely compacted, dark greyish-black, sand with frequent charcoal. The second deposit was C581; moderately compact, light brown, sand. The third deposit was C582; loosely compacted, dark black, sandy-silt with frequent charcoal. The fourth deposit was C579; moderately compact, dark grey, sand with frequent charcoal. The fifth and uppermost deposit was C578; moderately compact, yellow sand with occasional charcoal. The irregular outline of these pits was the result of truncation that occurred in this area of the site.

A pair of bowl furnaces C609 and C656 was located to the northeast end of the excavation (Fig. 14, Plates 7-9). C609 bordered C656 and the continuation of oxidized clay and vitrified material suggests that both were contemporary in use. C609 was oval and measured 0.80m NS x 0.60m EW x 0.33m in depth with concave sides and a U-shaped base. It was filled with five deposits C663, C662, C661, C660, and C659. The base deposit was C663; compact, red, oxidized clay that formed a ring around the outer extent and sides of C609. The second deposit was C662; compact, greenish-grey, vitrified clay that formed a very irregular, incomplete, fractured ring around the upper edge of C609. The third deposit was C661; loosely compacted, mottled yellow-grey, ash silt that contained occasional charcoal, coarse gritty sand, and lumps of oxidized clay. The fourth deposit was C660; loosely compacted, charcoal rich black, silt with occasional slag and coarse sand. The fifth and uppermost deposit was C659; moderately compact, brown-grey silty sand, with charcoal, coarse sand and small pebbles. A radiocarbon date of 2005±35 BP, Calibration Sigma 1 (45BC-30AD to 35-50AD), Sigma 2 (100BC-80AD) was obtained from the fill (Appendix 8.5). C656 was oval in plan and measured 0.95m in length, 0.50m in width x 0.30m in depth with concave sides and base. It was filled with five deposits C666, C663, C665, C660, and C659. The base deposit was C666; compact, red, oxidized clay that formed an irregular ring around the outer extent and sides of C656. The second deposit was C663; compact, dark red, oxidized silty-clay, located on the outer edge of C666. The third deposit was C665; compact, greyish-green, vitrified clay that formed an incomplete, irregular, ring around the outer extent of C656 and was located mostly on its southeast edge. The fourth deposit was C660; loosely compacted, black, silt with frequent charcoal and infrequent slag and coarse sand. The fifth and uppermost deposit was C659; firmly compact, brownish grey, silty-sand with occasional pebbles. C659 was the single largest deposit within C656.

Pits, Postholes and Stakeholes

Numerous pits and post/stakeholes of varying size and shape of unknown function were uncovered at this site. It is most likely that these features were associated with the activity above (Figs. 12 -21)

Pits

C583 was an irregular shaped isolated pit at the north of the site. It measured 0.60 x 0.50 x 0.40m with vertical sides and a concave base. It was filled with C594 and C584. The primary deposit C594 was dark brown clay silt with frequent charcoal. The secondary fill C584 was light brown silty clay with charcoal and a small concentration of slag. It contained a rim fragment of a furnace bowl lip (E2180:584:001). C006 was circular in plan and measured 2.17m EW x 1.85m NS x 0.20m in depth with concave sides and a flat base. It was filled with two deposits C157 and C007. The base deposit was C157; friable, dark brown, silty-sand with frequent charcoal and pebbles. The second and uppermost deposit was C007; layer of quartz and limestone cobbles and blocks, angular and sub-angular in shape. The stone measured individually 0.20m in length x 0.15m in width x 0.07m in depth. The exact function of the pit was unclear but as the stone was set flat, it may suggest a working surface. C011 was oval in shape and measured 1.90m EW x 0.86m NS x 0.10m in depth with sloping sides and an uneven base. It was filled with a single deposit C372; loose, greyish-brown, clayish-silt with frequent stones. C053 was oval in shape and measured 1.19m NE/SW x 0.85m NW/SW x 0.13m in depth with concave sides and a flat base. It was truncated by C067 on the eastern side. It was filled with a single deposit C111; compact, dark brownish black, clayish-silt with frequent charcoal and stones. C066 was circular in plan, and measured 0.60m in diameter x 0.15m in depth with concave sides and base. It was filled with a single deposit C113; compact, dark brownish-black, sandy-silt, with frequent charcoal. C068 was oval in shape, and measured 0.62m EW x 0.48m NS x 0.23m in depth with steep sides and concave base. It was filled with two deposits C098, and C097. The base deposit was C098; compact, light yellowish-brown, sandy-silt with occasional charcoal flecks. The second and upper deposit was C097; medium-loosely compacted, mid-brown, sandy-silt with frequent angular stone cobbles, and charcoal. C069 was oval in plan, and measured 0.60m NS x 0.60m EW x 0.15m in depth with concave sides and base. It was filled with a single deposit C108; loosely compacted, medium brown, sandy-silt, with frequent inclusions of angular stones and charcoal. C072 was oval in plan, and measured 0.55m NS x 0.46m EW x 0.25m in depth with sloping sides and an uneven base. It was filled with a single deposit C167; medium compact, brownish-black, sandy-silt with a moderate amount of charcoal and occasional pebbles. C087 was sub-circular in plan, and measured 0.99m NS x 0.70m EW x 0.30m in depth with sloping sides and an uneven base. It was filled with two deposits C107, and C106. The base deposit was C107; loosely compacted, yellowish light brown, sandy silt with frequent small stones and occasional charcoal. C107 contained three quartzite grinding stones (E2180:107:001-003) (See Appendix 8.3). C106 was the second and upper deposit which contained loosely compacted, blackish brown, sandy silt with occasional stones. C103 was a sub-rectangular in plan, and measured 1.56m NS x 0.77m EW x 0.30m in depth with stepped sides and a sloping base. It was filled with a single deposit C111; compact stone and charcoal rich, dark brownish black clayish-silt. C124 was ovoid in plan, and measured 2.66m SE/NW x 1.64m SW/NE x 0.20m in depth with sloping sides and a flat base. It was filled with a single deposit C256; loosely compacted, dark brown, silty-sand with occasional charcoal.

C137 was sub-circular in plan, and measured 1.17m EW x 0.68m NS x 0.10m in depth with concave sides and an uneven base. It was filled with a single deposit C284; loosely compacted, greyish-brown stone-rich sandy-silt. C138 was circular in plan and measured 2.20m NW/SW x 2.13m NE/SW x 0.30m in depth with sloping sides and a flat base (Plate 23). It was filled with a single deposit C187; loosely compacted, brownish grey-black, stone-rich sandy-silt, with moderate charcoal inclusions. C140 a shallow sub-oval pit, measuring 1.70m EW x 0.80m NS x 0.17m in depth with concave sides and an uneven base (Plate 24). It was filled with two deposits C201 and C198. The base deposit was C201; compact, brown-grey, that contained numerous rounded pebbles (0.03m-0.07m in diameter) set closely together with silt around the pebbles. It measured 1.50m EW, 0.65m NS, and 0.08m in depth. The second and upper deposit was C198; loosely compacted, dark brown, silty-clay, with occasional charcoal and burnt bone. C141 was a shallow, sub-oval pit, and measured 1.95m SW/NE x 0.80m NW/SW x 0.13m in depth with sloping sides and an uneven base. It was filled with six deposits C205, C216, C164, C179, C163, and C156. The base deposit was C205; well compact layer of closely set rounded pebbles, each measuring 0.03-0.07m in diameter. The stone layer measured 1.70m SW/NE x 0.55m NW/SW x 0.05m in depth. The second deposit was C216; moderately compact, medium brown, sandy-silt with occasional charcoal. The third deposit was C164; moderately compact, black silty-clay with frequent charcoal. The fourth deposit was C179; moderately compact pocket of re-deposited orange-brown, sandy-silt, with occasional charcoal. The fifth deposit was C163; moderately compact, medium brown, sandy-silt with occasional charcoal. The sixth and uppermost deposit was C156; moderately compact, medium dark-brown, clay-silt with frequent charcoal. The function of these two pits C140 and C141 is not clear. They may have had an association with iron working on the site. C142 was sub-circular in plan, and measured 0.33m NS x 0.26m EW x 0.09m in depth with sloping sides and an uneven base. It was filled with a single deposit C154; loosely compacted, black, sandy-silt with frequent charcoal. C149 was oval in shape and measured 1.00m NS x 0.82m EW x 0.16m in depth with sloping sides and a flat base. It was filled with a single deposit C285; loosely compacted, greyish light brown, silt with occasional charcoal. C152 was sub-circular in plan, and measured 0.55m in diameter x 0.21m in depth with sloping sides and an uneven base. It was filled with a single deposit C153; loosely compacted, grey silty-clay with some charcoal and slag. C210 was sub-circular in plan, and measured 0.45m EW x 0.38m NS x 0.19m in depth with vertical sides and a flat base. It was filled with a single deposit C218; compact, light greyish-brown, silt with charcoal. C228 was the cut of a pit that was oval in shape and measured 2.10m NW/SW x 1.82m NE/SW x 0.15m in depth with sloping sides and a flat base (Plate 24). It was filled with a single deposit C358; loosely compacted, light brown, sand that contained numerous small, medium and large pebbles and cobbles that were set closely together. This pit was similar to C006 and may have has the same function as a working surface. C315 was sub-circular in plan and measured 0.64m EW x 0.70m NS x 0.18m in depth with steep sloping sides and an even base. It was filled with a single deposit C316; compact, mid-brown, silty-sand with occasional pebbles.

C418 was irregular in plan and measured 0.45m EW x 0.40m NS x 0.12m in depth with concave sides and a flat base. It was filled with a single deposit C431; compact dark grey silt with occasional small stones and charcoal. Contained within the fill was a quartzite grinding stone (E2180:418:001) (See Appendix 8.3). C420 was circular in plan, and measured 0.27m in diameter x 0.05m in depth with concave sides and a flat base. It was filled with a single deposit C455; moderately compact, brownish-black, silty-clay with frequent charcoal. The pit was truncated by later activity. C468 was oval in plan and measured 1.60m NS x 0.60m EW x 0.30m in depth with steep sloping sides and a flat base. It was filled with a single deposit C495; compact, dark brown, sandy silt with occasional stones, slag and charcoal. C469 was irregular-pear-shaped in plan and measured 0.68m NE/SW x 0.60m NW/SW x 0.20m in depth with vertical sides and a flat base. It was filled with a single deposit C549; loosely compacted, greyish, medium brown very fine powdery silt with occasional angular limestone pebbles. C498 was irregular in plan and measured 1.80m EW x 1.60m NS x 0.60m in depth with steep sloping sides and a flat base. It was filled with three deposits C567, C527, and C513. The base deposit was C567; loosely compacted, dark brown, stone-rich sandy-silt. The second deposit was C527; moderately compact yellowish-brown silty-clay with frequent pebbles and charcoal. The third and uppermost deposit was C513; loosely compacted, dark brownish-black, silt with flat angular stone. C565 was sub oval in plan and measured 1.30m in length x 1.15m in width x 0.20m in depth with sloping sides and an uneven base. It was filled with a single deposit C566; loosely compacted, dark brown, stony silt. The stones were mostly angular and sub-angular limestone blocks and cobbles, with no particular order of noticeable design.

Postholes

C334 was a circular posthole, measuring 0.22m in diameter x 0.17m in depth with sloping sides and a concave base. It was filled with five deposits C349, C345, C348, C347, and C346. The base deposit was C349; loosely compacted, medium brown, silty-sand with occasional charcoal and was situated solely on the eastern side of C334. It was very similar to C345 which was located solely on the western side of C334. The second deposit was C345; moderately compact, medium brown, silty-sand with occasional charcoal. The third deposit was C348; loosely compacted, mid-dark brown, sandy-silt with frequent charcoal. The fourth deposit was C347; moderately compact medium to dark brown, silty-sand with occasional charcoal. C347 was solely located in east side of C334, with only C348 separating C347 and C346. The fifth and uppermost deposit was C346; moderately compact, medium brown, sandy-silt with moderate charcoal inclusions. C346 was situated solely on the west side of C334. C060 was a sub-rectangular posthole measuring 0.07m EW x 0.10m NS x 0.13m in depth with steep sloping side and a U-shaped base. It was filled with a single deposit C059; loose dark-grey silty-clay. C062 was a circular posthole, measuring 0.05m in diameter x 0.10m in depth with vertical sides and a V-shaped base. It was filled with a single deposit C061; loosely compacted, grey silty-clay with some pebbles. C074 was a circular posthole, measuring 0.20m in diameter x 0.29m in depth with vertical sides and a flat base. It was filled with a single deposit C217; moderately compact, blackish-brown, charcoal stained silt, with occasional decayed stones. C089 was a circular posthole, measuring 0.08m in diameter x 0.10m in depth with sloping sides and a V-shaped base. It was filled with a single deposit C088; loosely compacted, dark grey, silty-clay with occasional pebbles. C091 was a circular posthole, measuring 0.13m in diameter x 0.10m in depth with sloping sides and a U-shaped base. It was filled with a single deposit C090; loosely compacted, dark grey, silty-clay with occasional stones. C145 was a circular posthole, measuring 0.23m in diameter, and 0.08m in depth with vertical sides and an uneven base. It was filled with a single deposit C180; compact, dark brown, clay-silt with moderate charcoal inclusions. C146 was a circular posthole, measuring 0.27m in diameter x 0.09m in depth with sloping sides and a U-shaped base. It was filled with a single deposit C181; compact, dark brownish, clay, with a moderate amount of charcoal. C188 was an oval shaped posthole, measuring 0.30m NE/SW x 0.14m NW/SW x 0.06m in depth with vertical sides and a rounded base. It was filled with a single deposit C204; loosely compacted, dark brownish-black, silty-clay with frequent charcoal.

Charcoal production pits

Four possible charcoal pits were uncovered at Derrinsallagh 4. These pits were used for the production of charcoal to be used as a fuel for the metal working that took place in the bowl furnaces. Wood was placed in a charcoal kiln and the heat from the fire caused the wood to partly carbonize. This process removed sap, impurities, water, and oxygen from the wood. The wood could then be placed in a bowl furnace, where the oxygen was controlled through a form of artificial pumping.

C123 was oval in shape and measured 1.30m NS x 1.00m EW x 0.30m in depth with sloping sides and a flat base. It was filled with six deposits C391, C392, C380, C354, C353, and C352. The base deposit was C391; loosely compacted, black, silty charcoal. The second deposit was C392; loosely compacted, greyish brown, sandy clay. The third deposit was C380; loosely compacted, black, charcoal layer with frequent brownish-black silt. The fourth deposit was C354; compact, orange, oxidized clay. The fifth deposit was C353; compact light reddish, sandy-silt. The sixth and uppermost deposit was C352; loosely compacted, dark brownish-black, sandy-silt, with occasional stones. C238 was sub-rectangular in plan and measured 0.70m NE/SW x 0.40m SE/NW x 0.20m in depth with sloping sides and a flat base. It was filled with two deposits C254, and C250. The base deposit was C254; compact, mid orangey-red, oxidized silt with occasional pebbles and charcoal. C254 was partially formed on the base and edges of the pit. The second and upper deposit was C250; compact, light brown, silt with occasional charcoal. C238 was situated *c*.5m northwest of a series of bowl furnaces and pits C080, C081, C082, C083, C084, and C085, and was 3m southeast of C123; a charcoal pit. C238 was probably associated with the nearby bowl furnaces, and the metal working activity that took place therein. There was evidence that C238 was partially truncated, and the edge of the cut appeared dragged both to the south and north which may have been the result of agricultural ploughing. C419 was oval shaped charcoal production pit and measured 1.20m EW x 0.90m NW/SW x 0.30m in depth with sloping sides and a flat base (Plate 26). It was filled with three deposits C587, C586, and C585. The base deposit was C587; loosely compacted, dark brown-bluish black, charcoal rich silty-clay of very fine grain particles that contained a moderate amount of pebbles. The second deposit was C586; loosely compacted, medium bluish grey-brown, fined grain silt that contained a moderate amount of charcoal flecking, and pebbles. The third and uppermost deposit was C585; compact, mid to dull brown, fine grained silt with occasional pebbles. C419 did not contain much oxidized clay; it may have been cleaned after use. C419 was located *c.*8m from the western limit of excavation (CPO line), and 7m southwest of a series of bowl furnaces C017, C018, and C019. C419 may have been associated with these features, providing the essential fuel for the metal working taking place within C017, C018, and C019.

C426 was an oval charcoal production pit, and measured 1.24m NS x 1.10m EW x 0.36m in depth with vertical sides and a rounded base. It was filled with two deposits C533, and C502. The base deposit was C533; compact, orangey-red, oxidized clay with some charcoal. C533 lined parts of the sides and base of C426. The second and uppermost deposit was C502; compact, light greyish brown, sand with occasional charcoal. C426 was orientated north-south and was situated 2m northeast of C393; a bowl furnace associated with metalworking, and 5m from the southern limit of excavation. C426 may have been associated with the metalworking that took place within C393.

Hearth

C424 was a sub-circular charcoal production/hearth pit measured 2.60m NS x 2.20m EW x 0.30m in depth with sloping sides and a rounded base (Plate 27). C424 was filled with five deposits C522, C525, C528, C489, and C486. The base deposit was C522; loosely compacted, reddish brown, oxidized sandy-silt with occasional stone pebbles. The second deposit was C525; loosely compacted, greyish silt, with a moderate amount of charcoal and stone pebbles. The third deposit was C528; compact, dark grey, clayish-slit, with a moderate amount of pebbles and charcoal. The fourth deposit was C489: compacted, dark grey, clayish-silt that contained frequent charcoal flecking and a moderate amount of pebbles. C489 was situated mainly in the south of C424. The fifth and uppermost deposit was a firmly compacted, clayish-silt with occasional pebbles. C486 was situated mostly in the west of C424. C424 was orientated north-south, and partly truncated a linear ditch C425. It cut into one of its fills C440. C424 was located 10m from the southern limit of excavation and *c.*6m southwest of a series of bowl furnaces C397, C400, and C492. It may have provided fuel for the metal working process that took place in these features.

Archaeological Spreads

C144 was an archaeological spread of dark blackish-brown silty-clay with frequent charcoal flecks. C144 was possibly associated with the series of bowl furnaces C125, C126, C127, and C299, which were 6m north of C144. C144 was probably waste material removed from the environs of these bowl furnaces to allow for their further use. C401 was an archaeological spread that consisted of a light-medium brownish-grey, silty-clay with occasional charcoal. It was sub-angular in plan and had rounded corners. C401 was orientated north-south, and was probably waste material from the bowl furnaces nearby (C397, C400, and C492). C402 was an archaeological spread that consisted of moderately compact dark brown-black silty-sand with frequent charcoal and slag. C402 was orientated east-west and was probably waste material from the bowl furnaces nearby (C397, C398, and C400).

Ditch

C425 was the cut of a linear ditch, measuring 35m EW x 1.30m NS x 0.65m in depth (Plates 28-29). C425 continued outside the limit of excavation to the east and west. It had sloping sides and an uneven base and was filled with four deposits C512, C440, C439, and C438. The base deposit was C512; compact, light to pale brownish-grey, sandy-silt, with a moderate amount of pebbles and occasional charcoal. The second deposit was C440; compact, mid brown, very fine powdery silt with occasional pebbles, and charcoal. The third deposit was C439; compact, blackish dark brown, fine grained silt with frequent charcoal flecking and occasional slag pieces. The fourth and uppermost deposit was C438; compact, blackish dark brown, fine grained silt that contained frequent charcoal flecking, occasional slag and stones. C438 did not extend along the entirety of C425, but continued outside the limit of excavation within C425 to the west. C425 was located at the southern end of the site, *c.*10m from the southern limit of excavation. C425 was orientated east-west and was partially truncated by a charcoal kiln C424.

Period II Phase 4: Post Medieval Ditches and Drains

C067 was a linear ditch that measured 22m NS x 2m EW x 0.20m-0.65m. The sides sloped and the base was flat. C067 continued outside the limit of excavation at the north and south. C067 truncated an earlier pit C053, and was cut into the subsoil. It was filled with a single deposit C202; loosely compacted, light brown, sandy clay with occasional pebbles and cobbles.

C235 was the cut of linear field drain, orientated northwest-southwest with an irregular rounded terminal at the southeast, and continued outside the limit of excavation at the northwest end. It measured 5.20m in length x 0.75m in width x 0.34m in depth. It had sloping sides and uneven base. It was filled with a single deposit C257; loosely compacted, stony dark brown sandy-clay.

4.2.5. Stratigraphic Conclusion

The earliest evidence of occupation on the site was from **Period II, phase 1** a single sherd of carinated Neolithic pottery from a pit that truncates two linear ditches. The finds recovered from the ditches include the following; a quartzite grindstone E2180:608:001 (Appendix 8.3), lithics E2180:002:001, flint core and E2180:320:002, flint scraper (Appendix 8.4). These finds are representative of the later Irish prehistoric tradition, therefore it cannot be discounted that the sherd of carinated Neolithic pottery was not in a primary deposition and may have been intrusive in a later Bronze Age or Iron Age feature. If this was the case, the ditches would have contemporary with the general Bronze Age/Iron Age occupation of the site.

Period II, phase 2 was late Bronze Age settlement located at the northeast of the site and consisted of the rough outline of a D-shaped structure (Structure 1) and associated pits. This structure was *c*.6m long x 3m wide and consisted of a series of postholes C613, C615, C620, C632, C628, C626, and C630, and stakeholes C634, and C617. To the south of the Structure 1, was a second group of postholes and associated stakeholes; C640, C622 (postholes), C650, C652, C654 (stakeholes) and C624, C636 (postholes), C638, C642 (stakeholes). This group of post/stakeholes may have functioned together as wind-breaks or screens. Two pits, C605 and C657 were found in association. One of the pits, C605, contained numerous sherds of late Bronze Age cooking ware and a grindstone was recovered from the fill of the second pit. The D-shaped structure may have functioned as a basic shelter and the finds indicate that domestic activity was being carried out on site. The two radiocarbon dates were obtained from this period were taken from the D-shaped structure and from the refuse pit that produced a large quantity of pottery. The dates returned were identical 2900±35 BP and 2900±35 BP (Appendix 8.5).

The Iron Age activity on this site has been divided into two phases, reflecting the radiocarbon dates obtained. **Period II, phase 3A** consisted of curvilinear slot trenches C647, C645, and C603 that formed an incomplete semi-circle, measuring *c.*7.5m (Structure 2). Three postholes/pits C610, C669, C671 and a stakehole C648 may also have been associated with the structure. A radiocarbon date was obtained from Structure 2 and returned a middle Iron Age date of 2255±35 BP. **Period 2, phase 3B,** identifies and describes features associated with iron working. The term "bowl furnace" is used throughout this report, and represents a collectivization of archaeological features of a similar shape and design, and with evidence of oxidisation and the presence of slag as a deposit within the fill or fills of each archaeological feature. Bowl furnaces functioned as a sealed reduced oxygen environment, where the amount of oxygen present can be regulated by the individual working the bowl furnace. The presence of a *tuyere* or some other bellows mechanism can be used to introduce oxygen into the bowl furnace. At Derrinsallagh 4, 46 archaeological features were identified as bowl furnaces. Radiocarbon dates obtained from three of these furnaces place their construction and use within 2005±35 BP to 1920±60BP (Appendix 8.5). Associated with the bowl furnaces were four possible charcoal production pits, a hearth, pits, postholes and stakeholes.

A Post Medieval field boundary and drain were uncovered but for the most part the site was relatively undisturbed. In recent years, the field had been ploughed and re-seeded but was not used for arable farming.

4.3 Artefactual Material

4.3.1 Pottery

See Appendix 8.6

Pottery Archive					
Record: Context: Find number	**Period**	**Completeness**	**Artefact type**	**Condition**	**Comments (decoration etc)**
E2180:001:002	Iron Age	Fragment	Mould or crucible	Fair	
E2180:117:001-003	Middle-Late Bronze Age	Rim Sherds	Coarse Pottery	Poor	
E2180:117:004-009	Middle-Late Bronze Age	Fragments	Coarse Pottery	Poor	
E2180:117:010-014	Middle-Late Bronze Age	Body Sherds	Coarse Pottery	Poor	
E2180:121:001-010	Iron Age	Fragments	Furnace bowl lining	Poor	
E2180:121:011-012	Iron Age	Fragment	Furnace bowl lining	Poor	
E2180:125:001-004	Iron Age	Fragments	Probable mould	Poor	
E2180:320:001	Neolithic	Body sherd	Carinated Bowl	Fair	
E2180:584:001	Iron Age	Rim fragment	Lip of a furnace bowl	Poor	
E2180:606:001	Middle-Late Bronze Age	Body sherd	Coarse Pottery	Poor	
E2180:606:002	Middle-Late Bronze Age	Rim sherd	Coarse Pottery	Poor	
E2180:606:003	Middle-Late Bronze Age	Body sherd	Coarse Pottery	Poor	
E2180:606:004-006	Middle-Late Bronze Age	Rim sherds	Coarse Pottery	Poor	
E2180:606:007	Middle-Late Bronze Age	Rim sherd	Coarse Pottery	Poor	
E2180:606:008-009	Middle-Late Bronze Age	Body sherds	Coarse Pottery	Poor	
E2180:606:010	Middle-Late Bronze Age	Two fragments	Coarse Pottery	Poor	
E2180:606:011	Middle-Late Bronze Age	Rim sherd	Coarse Pottery	Poor	
E2180:606:012	Middle-Late Bronze Age	Four fragments	Coarse Pottery	Poor	
E2180:606:013-019	Middle-Late Bronze Age	Body sherds	Coarse Pottery	Poor	

E2180:606:020	Middle-Late Bronze Age	Fragment	Coarse Pottery	Poor	
E2180:606:021	Middle-Late Bronze Age	Rim sherd	Coarse Pottery	Poor	
E2180:606:022	Middle-Late Bronze Age	Body sherd	Coarse Pottery	Poor	
E2180:606:023	Middle-Late Bronze Age	Rim sherd	Coarse Pottery	Poor	
E2180:606:024-026	Middle-Late Bronze Age	Body sherds	Coarse Pottery	Poor	
E2180:606:027	Middle-Late Bronze Age	Body sherd	Coarse Pottery	Poor	
E2180:606:028	Middle-Late Bronze Age	Rim sherd	Coarse Pottery	Poor	
E2180:606:029-031	Middle-Late Bronze Age	Body sherds	Coarse Pottery	Poor	
E2180:606:032-035	Middle-Late Bronze Age	Rim sherds	Coarse Pottery	Poor	
E2180:606:036-042	Middle-Late Bronze Age	Body sherds	Coarse Pottery	Poor	
E2180:606:043	Middle-Late Bronze Age	Rim sherd	Coarse Pottery	Poor	
E2180:606:044-046	Middle-Late Bronze Age	Body sherds	Coarse Pottery	Poor	
E2180:606:047	Middle-Late Bronze Age	Four fragments	Coarse Pottery	Poor	
E2180:664:001-002	Middle-Late Bronze Age	Body sherds	Coarse Pottery	Poor	
E2180:664:003-004	Middle-Late Bronze Age	Fragments	Coarse Pottery	Poor	
E2180:664:005	Middle-Late Bronze Age	Body sherd	Coarse Pottery	Poor	
E2180:664:006-007	Middle-Late Bronze Age	Fragments	Coarse Pottery	Poor	
E2180:664:008-013	Middle-Late Bronze Age	Body sherds	Coarse Pottery	Poor	
E2180:664:014	Middle-Late Bronze Age	Fragment	Coarse Pottery	Poor	
E2180:664:015	Middle-Late Bronze Age	Body sherd	Coarse Pottery	Poor	
E2180:664:016-017	Middle-Late Bronze Age	Fragments	Coarse Pottery	Poor	
E2180:664:018	Middle-Late	Body sherd	Coarse Pottery	Poor	

	Bronze Age				
E2180:664:019	Middle-Late Bronze Age	Fragment	Coarse Pottery	Poor	
E2180:664:020-021	Middle-Late Bronze Age	Body sherds	Coarse Pottery	Poor	
E2180:664:022	Middle-Late Bronze Age	Fragment	Coarse Pottery	Poor	
E2180:664:023	Middle-Late Bronze Age	Body sherd	Coarse Pottery	Poor	
E2180:664:024	Middle-Late Bronze Age	Fragment	Coarse Pottery	Poor	
E2180:664:025-026	Middle-Late Bronze Age	Body sherds	Coarse Pottery	Poor	
E2180:664:027	Middle-Late Bronze Age	Fragment	Coarse Pottery	Poor	
E2180:664:028-029	Middle-Late Bronze Age	Body sherds	Coarse Pottery	Poor	
E2180:664:030-031	Middle-Late Bronze Age	Fragments	Coarse Pottery	Poor	
E2180:664:032	Middle-Late Bronze Age	Body sherd	Coarse Pottery	Poor	
E2180:664:033-034	Middle-Late Bronze Age	Fragments	Coarse Pottery	Poor	
E2180:664:035	Middle-Late Bronze Age	Body sherd	Coarse Pottery	Poor	
E2180:664:036	Middle-Late Bronze Age	Rim sherd	Coarse Pottery	Poor	
E2180:664:037-039	Middle-Late Bronze Age	Body sherds	Coarse Pottery	Poor	
E2180:664:040	Middle-Late Bronze Age	Base angle sherd	Coarse pottery	Poor	
E2180:664:041-043	Middle-Late Bronze Age	Body sherds	Coarse Pottery	Poor	
E2180:664:044	Middle-Late Bronze Age	Base angle sherd	Very worn pottery	Poor	
E2180:664:045	Middle-Late Bronze Age	Shoulder sherd	Coarse pottery	Poor	
E2180:664:046	Middle-Late Bronze Age	Base angle sherd	Coarse pottery	Poor	

4.3.2 Lithics

See Appendix 8.4

Lithics archive					
Record: Context: Find number	**Period**	**Completeness**	**Condition**	**Artefact Type**	**Comments**
E2180:002:001	Prehistoric	Fragment	Fair	Flint core	Bi-polar core
E2180:320:002	Prehistoric	Fragment	Fair	Flint scraper	Scraper
E2180:612:001	Prehistoric	Fragment	Fair	Flint Blade	Pointed blade

4.3.3 Stone objects

See Appendix 8.3

Stone materials archive					
Record: Context: Find number	**Period**	**Completeness**	**Condition**	**Artefact Type**	**Comments**
E2180:107:001	Prehistoric	Complete	Fair	Grinding stone	Quartzite
E2180:107:002	Prehistoric	Complete	Fair	Grinding stone	Quartzite
E2180:107:003	Prehistoric	Complete	Fair	Grinding stone	Quartzite
E2180:418:001	Prehistoric	Complete	Fair	Grinding Stone	Quartzite
E2180:604:001	Prehistoric	Complete	Fair	Grinding stone	Quartzite
E2180:608:001	Prehistoric	Complete	Fair	Grinding Stone	Quartzite
E2180:625:001	Prehistoric	Complete	Fair	Grinding Stone	Quartzite
E2180:658:001	Prehistoric	Complete	Fair	Grinding Stone	Quartzite

4.3.4 Metal objects

See Appendix 8.7

4.4 Environmental Evidence

4.4.1 Cremated bone

See Appendix 8.2

Table 1: Summary of cremated remains

Context	Context Detail	Bone Colour	Species	Weight (g)
163	Fill of pit (141)	White	Unknown	1.8
198	Upper deposit of pit (140)	White	Unknown	3.7
219	Fill of pit	White	Unknown	1.0

Table 2: Fraction weights and fragment size

Context	Total Weight	Fraction Weights						Max. Frag Size
		>10mm		5-10mm		2-5mm		
	g	g	%	g	%	g	%	mm
163	1.8	1.8	100.0	0.0	0.0	0.0	0.0	27.9
198	3.7	1.5	40.5	0.7	18.9	1.5	40.5	43.9
219	1.0	0.0	0.0	1.0	100.0	0.0	0.0	20.1

4.4.2 Botanic

Soil Flotation Results			
Context No.	**Sample No.**	**Weight prior to flotation**	**Quantities of material recovered**
C606	532	8.000kg	0.012kg
C606	534	0.060kg	0.007kg
C633	505	6.000kg	0.026kg
C659	524	0.1220kg	0.030kg
C664	533	7.500kg	0.017kg
C674	544	8.000kg	0.017kg
C607	522	2.500kg	0.151kg
C603	546	0.881kg	0.001kg

C604	506	0.111kg	0.016kg
C606	532	7.500kg	0.029kg
C607	507	8.000kg	0.044kg
C607	520	1.430kg	0.000kg
C607	521	3.000kg	0.080kg
C612	513	42.000kg	0.051kg
C614	495	3.000kg	0.002kg
C616	496	2.800kg	0.008kg
C618	497	0.333kg	0.001kg
C621	501	3.000kg	0.009kg
C623	498	1.121kg	0.006kg
C624	499	0.829kg	0.006kg
C625	500	0.042kg	0.004kg
C627	502	0.320kg	0.002kg
C629	504	1.308kg	0.004kg
C631	503	3.900kg	0.021kg
C637	508	0.908kg	0.004kg
C639	509	0.312kg	0.002kg
C641	511	1.813kg	0.006kg
C643	510	0.611kg	0.004kg
C644	514	8.000kg	0.012kg
C646	515	7.500kg	0.020kg
C649	512	0.227kg	0.002kg
C651	517	0.334kg	0.004kg
C653	516	0.010kg	0.003kg
C655	518	0.054kg	0.00kg
C658	519	0.180kg	<0.001kg
C658	540	0.020kg	0.006kg
C658	541	3.500kg	0.017kg
C667	545	9.00kg	0.006kg
C668	538	2.50kg	0.014kg

C669	529	0.855kg	0.006kg
C672	536	7.000kg	0.041kg
C675	537	3.00kg	0.009kg
C676	539	3.00kg	0.011kg
C676	527	0.053kg	0.008kg

4.5 Dating Evidence

See Appendix 8.5

A series of radiocarbon dates were obtained from various archaeological features on the site. The earliest dates obtained were from a D-shaped structure and a pit that contained numerous sherds of pottery. C616 (Structure 1) returned a date of 2900±35 BP, Calibration Sigma 1, (1130-1010 BC), Sigma 2, (1260-1230 BC to 1220-970 BC), from elm charcoal. Pit C606, had a date of 2900± BP, Calibration Sigma 1, (1130-1010 BC), Sigma 2 (1260-1230 BC to 1220-970 BC) was obtained from Pomoideae/Hazel/Ash/Alder charcoal. A mid Iron Age date was obtained from charcoal (ash species) in C644, a segmented circular structure of 2255±35 BP, Calibration Sigma 1 (390-350 BC to 290-230 BC), Sigma 2 (400-340 BC to 330-200 BC). The dates were obtained from the charcoal fills of three iron working bowl furnaces that include the following; C199, fill of bowl furnace C009, 1920±70 BP Calibration Sigma 2(50BC-240AD), C357 fill of bowl furnace C017, 1920±60BP Calibration Sigma 2(10BC-250AD), and C659 fill of C656, 2005±35 BP, Calibration Sigma 1 (45BC-30AD to 35-50AD), Sigma 2 (100BC-80AD).

The radiocarbon dates show that the site was occupied from the mid to late Bronze Age, the fifth to fourth centuries BC and the late Iron Age, first century BC to first century AD. Bronze Age settlement was uncovered in the nearby site of Derrinsallagh 3, and the sites of Derryvorrigan 1 and 2. Iron Age activity was uncovered at the site closest; Derrinsallagh 5, and again at Derryvorrigan 1.

5. DISCUSSION

The excavations at Derrinsallagh 4 has uncovered evidence of human occupation dating from the Neolithic, mid to late Bronze Age, mid to late Iron Age and Post Medieval periods, indicating that this location was used during several periods in the past. Although, the site may not have been in continuous use, the gentle ridge of ground that encompasses the townland of Derrinsallagh was favoured for settlement and maybe part of a larger pattern of settlement within the area. The earliest recorded activity on the site was a pit that contained a single sherd of carinated Neolithic pottery. To date, the evidence for Neolithic settlement in County Laois has been scant but recent excavations on the M7 Portlaoise to Castletown/M8 Portlaoise to Cullahill Motorway Scheme have uncovered evidence from the same time period on three other sites Cuffsborough 2, Tintore 2, and Derrinsallagh 3. The sherd of pottery uncovered at Derrinsallagh 4 was similar to those recovered from the nearby site of Derrinsallagh 3, located within the same townland at a distance of 500m. The pottery recovered from Derrinsallagh 3 consisted of six Neolithic carinated bowls with a distribution 4000–3600BC. However, at Derrinsallagh 4, it must be borne in mind that the pit from which the sherd of pottery was recovered, truncated two linear ditches and the finds (flint core and scraper) recovered from the ditches are representative of the later Irish prehistoric tradition. It cannot be discounted that the sherd of carinated Neolithic pottery may not have been a primary deposit and could have been an intrusive redeposit in later Bronze Age or Iron Age.

The mid to late Bronze Age settlement on the site was located on a well-drained soil suitable for arable farming. The presence of a simple D-shaped structure, pits containing cooking ware and a grindstone, together with a scatter of post/stakes possibly serving as windbreaks would suggest that domestic activity was being carried out at this site. There was no evidence for an associated hearth. There were no occupation layers associated nor was there any indication as to the roofing methods employed in the structure. The entrance to the structure was most likely located to the southeast or east, facing away from the prevailing winds. Bronze Age settlement takes many forms, from open to enclosed settlements, from isolated houses to clustered settlements. It is not known whether the structure at Derrinsallagh 4 was an isolated house as the area of excavation was restricted to that of the roadtake. It is possible that the structure may lie at the edge of a larger settlement. Other Bronze Age settlement was uncovered within the same townland of Derrinsallagh and the nearby townland of Derryvorrigan. At Derrinsallagh 3, a mid to late Bronze Age house and cremation pits from the late Bronze Age were uncovered. Further east on the lower slope of Lough Knockseera, a complex of mid to late Bronze Age houses was uncovered at Derryvorrigan 1 and a single late Bronze Age house at Derryvorrigan 2.

The earliest Iron occupation on site consists of a semi-circular structure and associated pits. This occupation is earlier than the iron working pits and indicates that the site was in use at an earlier period in the Iron Age. This structure returned a date similar to the date obtained for a small bowl furnace at the nearby site of Derrinsallagh 5 (See Appendix 8.5). Iron working activity on site has been dated from the mid to late Iron Age period and consisted of bowl furnaces, pits, charcoal production pits and ancillary features. The site produced a total of 46 bowl furnaces. These bowl furnaces were used in the production of iron, and occurred individually or in groups of two, three, or four. The bowl furnaces were dispersed throughout the site, and it is likely further features are present outside the limit of the CPO. Individual bowl furnaces differed in dimensions and depth, but all were circular, sub-circular, oval or sub-oval in plan. All of the bowl furnaces were partially or fully surrounded by a ring or 'halo' of oxidised clay, and contained at least one deposit of dark brown/black charcoal rich silt with some slag. The larger bowl furnaces had varying amounts of vitrified clay which either lined the edges of the bowl furnace or were loose inclusions within the deposits. Some of the smaller bowl furnaces contained no vitrified clay. In a small number of the larger bowl furnaces, the vitrified clay continued higher than the upper extent of the sides of the feature, and may represent the remains of the superstructure for the furnace. All of the bowl furnaces were cut into the sub-soil. A number of the larger bowl furnaces had a substantial amount of slag as a deposit within the feature. This slag may represent a failed attempt at firing, resulting in it becoming choked up with slag and yielding little or no iron. Two separate analyses were undertaken on the contents of different bowl furnaces yielding the following information. A total of 296kg chunky, drippy, amorphous slag was examined under the following headings; Material Analysis, Feature Analysis and Spatial Analysis (See Appendix 9). The slags are of fayalitic composition and are bloomery smelting slags. The presence of fayalitic slags suggest that the furnaces were not sufficiently reducing and that only 20% of iron present reduced to wustite prior to reacting with the silica present and converting to slag. Inefficient smelting conditions such as bowls too small, not adequately insulated with lining, not sufficient space between the tuyeré and the furnace bottom for the bloom to grow. Very little bloom was produced, the slag appeared as furnace fill or post smelt but the slag was the smelt itself. No evidence was found for smithing slags. In the first analysis, no evidence for tuyeré was found. The vitrified interior was not evidence of a lining but material of the furnace melting. The nearest section to the heat when cooled has the glossy effect. Only one bowl furnace produced evidence for a lining; a clay enriched quartz. No direct evidence for a superstructure was noted but a raised lip of between 0.04-0.05m was found at the upper edge of bowl to hold the charcoal. It is unlikely that a superstructure would have survived centuries of ploughing and in recent times, modern ploughing and re-seeding. Most of the bowl furnaces operated at a low temperature between 400°-600°C, this was not a sufficiently high temperature for smelting. One of the bowl furnaces had a stone lining; this lining would not allow temperatures exceeding 700°-800°C be achieved and slag even adhered to the stone lining. One bowl furnace located between two other furnaces did achieve a sufficiently high temperature of between 600°-1200°C and would have allowed smelting to take place. Apart from this one example, no difference in the heat was achieved between the individual furnaces within clusters that might indicate specific use in the smelting process. One bowl furnace or non-slag tapping slag pit furnace was removed off site for detailed analysis. The analysis revealed that the presence of an arch, two successive blowing orientations; the final use left 22kg of slag attached to the furnace walls, and the presence of compact fired clay in the upper fill indicates the presence of a furnace superstructure. Analysis of the slag composition would indicate the use of a locally sourced ‘bog ore’, still present today within the immediate vicinity of the site. The soil chemistry analysis carried out in conjunction with the analysis of the slag suggested that there may have been domestic activity to the north and northwest of the site. No evidence of domestic activity was found within the immediate vicinity of the furnace areas (The late Bronze Age and Iron Age structures were located to the north and northeast area of the site outside the area where the soil analysis was undertaken). Several charcoal production pits, and ancillary pits were found in association with the iron working bowl furnaces. The bowl furnaces were located on level ground up-slope from the lower wetter ground to the south and west which in pre-historic times was likely to have been the source of the ‘bog ore’. The siting of Derrinsallagh 4 was deliberately located close to a natural and regenerative source of iron ore. Bog iron ore would have been collected within the fields surrounding the site in what was bogland and a plentiful supply of oak wood would have been available. These resources could be continually exploited for use in the iron production process. Parallels for this type of furnace can be found in the nearby site of Derrinsallagh 3.

The range of finds recovered from the different phases of activity on this site was poor and most likely represent domestic activity. Only three pieces of flint were recovered, a pointed blade, a scraper and a bi-polar core, all of which are prehistoric in date with the pointed blade representative of earlier activity. Eight grinding stones were found in association with the pits (See Appendices 8.3 & 8.4). No finds were recovered in association with any of the bowl furnaces. The pottery recovered included a single sherd of Neolithic pottery and numerous sherds of middle to late Bronze Age cooking ware (See Appendix 8.6).

6. CONCLUSION

This site has been adequately archaeologically assessed and resolved. There are no other archaeological features within the limits of the roadtake.

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Record of Monuments and Places (RMP), The Department of the Environment, Heritage and Local Government, 7 Ely Place Upper, Dublin 2.

Topographical Files of the National Museum of Ireland, Kildare Street, Dublin 2

7.3 Cartographic Sources

1839 1st edition Ordnance Survey Map

1891 2nd edition Ordnance Survey Map

1909 Ordnance Survey Revision edition RMP map

Signed:

Anne-Marie Lennon
Licensed Archaeologist

April 2009

8. APPENDICES

8.1 Appendix 1: Wood Identification analysis report

Derrinsallagh 4, M7 Portlaoise to Castletown/M8 Portlaoise to Cullahill Motorway Scheme, Co Laois, Ireland

Species identification of charcoal samples

September 2008

Ellen OCarroll MA DIP. EIA MGT

Archaeological Consultancy & Wood Specialist

8 Cumberland Street, Dun Laoghaire, Co. Dublin

Contents

1. Introduction

Three thousand eight hundred and ninety seven charcoal fragments from one hundred and four contexts relating to twenty seven archaeological sites were analyzed from excavations along the M7 Portlaoise to Castletown/M8 Portlaoise to Cullahill motorway scheme, contract 2. Thirty four wood samples from Middle and Late Bronze Age *fulacht* sites and wooden troughs were also analyzed within the framework of these studies. Contract 2 covers a length of approx 13 km and includes numerous *fulacht fiadh* sites, charcoal production pits, bowl furnaces, cremation pit, linear feature, hearths, burnt spread, wells, kilns, pits, postholes and one ring gully.

In recent years, a considerable amount of structural as well as non-structural wood and charcoal has been recovered from archaeological deposits in Ireland. Wood was a vital and widely used raw material from prehistoric to medieval times although its importance is rarely reflected in the analysis of archaeological assemblages mainly due to its perishable nature. It is important to note that people in prehistoric, Early Christian and medieval communities were mainly dependant on woodland resources for the construction of buildings, for the manufacture of most implements and for fuel for wood-burning activities. The woods in a surrounding catchment area were exploited and often managed to provide an essential raw material for the community. A study of the range of species on an archaeological site offers an indication of the composition of local woodland in its period of use and any selection policies for particular species at any given time and place.

Large assemblages of wood and charcoal from the numerous road schemes currently under excavation, and subsequent analysis of the sampled wood and charcoal is currently on-going in Ireland. Although relatively little of the charcoal and wood analysis carried out from these analyses has been published, one recent publication includes the gas-pipe line to the west which is used for comparative purposed in this report (Grogan *et al*. 2007).

Analysis of timbers can provide information on two different levels. These can be seen as the structural and constructional aspects gained from studying the timbers as ‘timber’ and also the environmental and dendrochronological aspects gained from a study of the timber as ‘wood’. From preliminary analysis of some of the work in progress on the wood assemblages it is clear that oak was the most common species used for wall-posts and planks, hazel was preferred for wattle structures and species such as pomoideae, ash, willow, alder, birch and holly were utilised for a variety of other structural requirements. Alder, ash and oak are the most frequent species used in the construction of plank-lined troughs while hazel and ash are selected for wattle posts also used in the construction of wattle troughs.

The analysis completed from the wood and charcoal excavated along the M7 Portlaoise to Castletown/M8 Portlaoise to Cullahill Motorway Scheme will add important information to the rapidly expanding database of environmental indicators particularly in relation to the Neolithic, Bronze Age and Medieval periods in the area. This area of work is especially important in Ireland where there are no written records up to the 18th century relating to the amount and type of woodland in Ireland (McCracken 1971, 15).

The analysis of charcoal can also provide information on two different levels. Charcoal analysis is an important component of any post-excavation environmental work as it can help in re-constructing an environment hitherto lost, although this must be done with caution as sufficient sample numbers and fragments counts are required for a complete and full understanding of the immediate environment. Keepax suggests 50 samples in a European temperate climate. Charcoal is also analyzed and identified to determine what species are used and selected for particular functions on site i.e. post-holes, wall posts, burnt remains of wattle and so forth. In summary, charcoals are excellent indicators of exploited environments and the vegetation that developed within them.

Results from the hundreds of *fulacht fiadh* which have been analyzed throughout Ireland with regard to species selection for fuel have shown that a wide variety of taxa are identified from these assemblages, which may suggest that the inhabitants were selecting firewood from whatever trees and branches were closest to hand. Alder charcoal does sometimes dominate the *fulacht* assemblages but this is generally confined to the wetter areas of Ireland such as Mayo (O'Carroll, N5, 2007) and the midlands area of Ireland (O'Carroll, N6 KTK, 2008) highlighting the wetter environments in these particular areas of Ireland particularly during the Bronze Age. Oak and hazel was shown to be more frequently used at *fulacht* sites in Tipperary possibly highlighting the different terrain of more dryland areas and scrubland in the south of Ireland in the Bronze Age (O'Donnell, N8 2008).

The wood and charcoal assemblage analysed in this report covers both the Prehistoric and Medieval periods. Charcoal was analysed from a Neolithic pit at Derrinsallagh 3, numerous Bronze Age *fulacht* sites, early and Late Medieval charcoal production pits, a Late Bronze Age cremation pit from Derrinsallagh 3, the fill of an Iron Age well excavated at Bushfield 4, a Bronze Age fire hearth from Boherard 2, early medieval and high medieval kilns from Derrinsallagh 3, several un-diagnostic pits dating to the Bronze Age, Iron Age and Medieval periods, Middle and Late Bronze Age postholes and an early Medieval ring gully from Lismore/Bushfield 1.

The analysis presented here concentrates on species identification, species selection and the composition of the local woodland during the Neolithic, Bronze Age, Iron Age and Medieval periods along the route of Contract 2, M7 Portlaoise to Castletown/M8 Portlaoise to Cullahill Motorway Scheme. Woodworking analysis was completed on timbers that contained evidence of tooling, which includes recording facets and jam curves and is sometimes a useful indicator of tool types being used on a given site at a given period. Split timber types, preserved point types, annual tree-ring counts and average growth rates of the trees that the wood was felled from was also noted and recorded. Each piece of wood was also examined for blade signatures.

2. Methods

The process for identifying wood, whether it is charred, dried or waterlogged is carried out by comparing the anatomical structure of wood samples with known comparative material or keys (Schweingruber 1990). A wood reference collection from the Botanical Gardens in Glasnevin, Dublin was also used.

Wood

Thin slices were taken from the transversal, tangential and longitudinal sections of each piece of wood and sampled using a razor blade. These slices were then mounted on a slide and glycerine was painted onto the wood to aid identification and stop the wood section from drying out. Each slide was then examined under an E200 Nikon microscope at magnifications of 10x to 500x. By close examination of the microanatomical features of the samples the species were determined. The diagnostic features used for the identification of wood are micro-structural characteristics such as the vessels and their arrangement, the size and arrangement of rays, vessel pit arrangement and also the type of perforation plates.

All of the wood excavated on each site was sampled for identification and further analysis. The wood samples were firstly washed and recorded on wood working sheets and were then identified as to species. Where appropriate, the samples were measured and described in terms of their function and wood technology. This included point types, split types and individual toolmarks such as facets and tool signatures.

The annual tree rings were counted partially under a microscope and partially by eye therefore it is only an approximate age. The annual tree ring counts for the split timbers do not give a real estimate of the age of the parent tree when it was cut down as splitting implies division and therefore only partial remains of the parent tree will survive. Average growth rates were also established. A fast growth rate is around 4mm per year. As different factors (weather and soil conditions) determine growth rates of trees and growth rates vary across each sample average growth rates were calculated for each sample.

Charcoal

The soil samples were processed on-site. The flots were sieved through a 250 micron or a 1mm sieve, while the retent was put through a 2mm or 4mm sieve. All of the charcoal remains from the soil samples were then bagged and labeled.

The identification of charcoal material involves breaking the charcoal piece along its three sections (transverse, tangential and radial) so clean sections of the wood pieces can be obtained. This charcoal is then identified to species under a universal compound microscope reflected and transmitted light sources at magnifications x 10 - 400. By close examination of the microanatomical features of the samples the charcoal species are determined.

The purpose of the charcoal identifications was two-fold. In some cases the identifications were carried out prior to C14 dating in order to select specific species for dating and in other cases the charcoal was analyzed for fuel selection policies and selection of wood types for structural use. Each species was identified, bagged together and then weighed. Insect channels were noted on the charcoal fragments identified as this may indicate the use of dead or rotting wood used for fuel or other such functions. The distinction can sometimes be made between trunks, branches and twigs if the charcoal samples are large enough. This was noted where possible. When charcoal samples showed indications of fast or slow growth this was also recorded. The samples identified for environmental reconstruction and wood usage were counted per fragment and then weighed. The smaller sample amounts with less than 50 fragments were all identified while 50 fragments were identified from the larger samples.

There are inherent problems in re-constructing the environment at the time of use of the site due to the low quantity of samples and charcoal fragments identified from the assemblages. Keepax concludes that, when working in a temperate climate, at least fifty samples should be identified from an archaeological site, to make it a viable charcoal study, with a minimum of 25 samples (Keepax 1988). Notwithstanding the charcoal sample numbers, it is clear that the charcoal results coupled with the wood analysis throw up some interesting results and trends in relation to wood selection and use and woodland cover in the Neolithic, Bronze, Iron and Medieval periods in Co. Laois.

A number of wood taxa cannot be identified to species or sub-species level anatomically. Sessile oak *(Quercus petraea)* and pedunculate oak *(Quercus robur)* are both native and common in Ireland and the wood of these species cannot be differentiated on the basis of their anatomic characteristics. English elm *(Ulmus procera)* and wych elm *(Ulmus glabra)* cannot be separated by their wood structure and identifications of elm are shown as *Ulmus* spp. There are also two species of birch (*Betula pendula* and *Betula pubescens*) and several species of willow therefore the identifications are given as *Betula* spp and *Salix* spp respectively. Within the family of Pomoideae it is impossible to distinguish between crab apple (*Malus sylvestris*), pear (*Pyrus communis*), hawthorn (*Crataegus* spp.) and mountain ash/rowan (*Sorbus aucuparia*).

3. Definitions of Element Types and woodworking terminology

Dates and timeframes

Neolithic	*4000-2500BC*
Early Bronze Age (EBA)	*c. 2500-1800BC*
Middle Bronze Age (MBA)	*1800-1000BC*
Late Bronze Age (LBA)	*1000-500BC*
Iron Age	*500BC-400AD*
Early Medieval	*400AD-1200AD*
High Medieval	*1200AD-1400AD*
Late Medieval	*1400AD-1600AD*
Post Medieval	*1600AD – 1900AD*

Constructional Elements

Brushwood: Stems or rods measuring 6 cm or less in diameter.

Roundwood: A piece of worked or unworked wood in the round and over 6 cm in diameter.

Vertical Stake/Post: Upright brushwood or roundwood driven vertically or at an angle into the ground. Sometimes but not always used for stabilization.

Horizontal: Brushwood, plank or roundwood laid flat on the ground.

Twigs: Small shoots or branches measuring around 1 cm in diameter.

Split timber: Wood converted from the round including planks, half splits and split pegs.

Woodworking terms and definitions

Chisel point: The end of a piece of wood cut to a point on one single face.

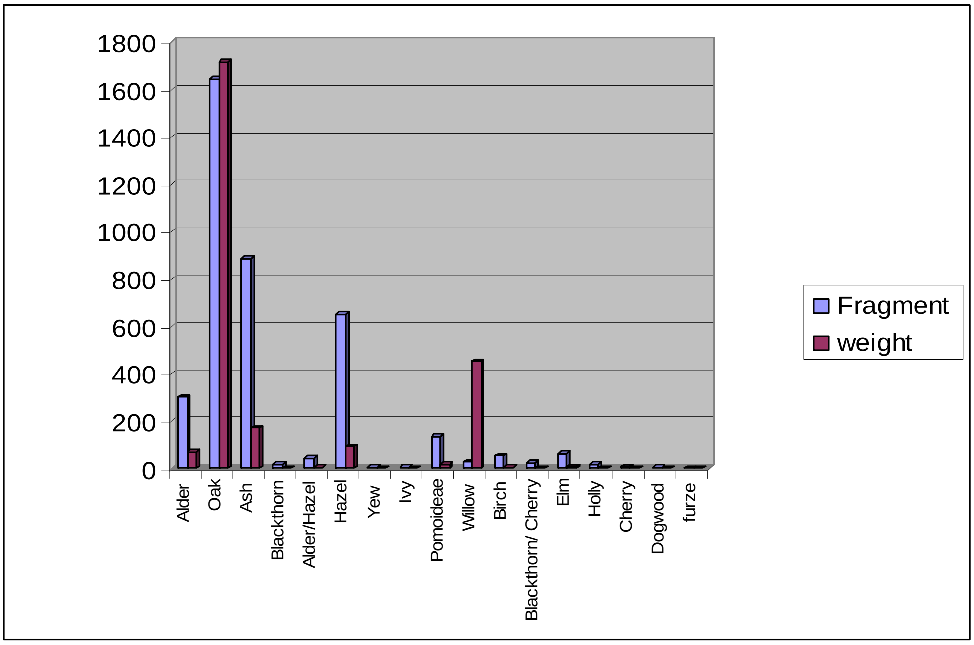
Conversion: The way in which the primary trunk has been split into smaller elements.

Facet:	The cut surface produced on a piece of wood by a tool blow. The blow can leave behind a particular signature if the cutting edge of the tool is flawed.
Facet junction:	The nature of the junctions between each facet was also assessed as to whether they were clean, ragged or stepped
Jam curves:	A complete toolmark on wood retaining the impression of the complete width of the blade used
Pencil point:	The end of a piece of wood cut to a point on multiple faces.
Signature:	A signature is an imperfection in a woodcutter's blade which is transferred onto the timber when the wood is cut. A negative impression or a groove is created where a flange of metal extends beyond the axe blade where as a positive or raised signature is created by a gap in the blade edge.
Wedge point:	The end of a piece of wood cut to a point on two faces.

4. Results & Analysis

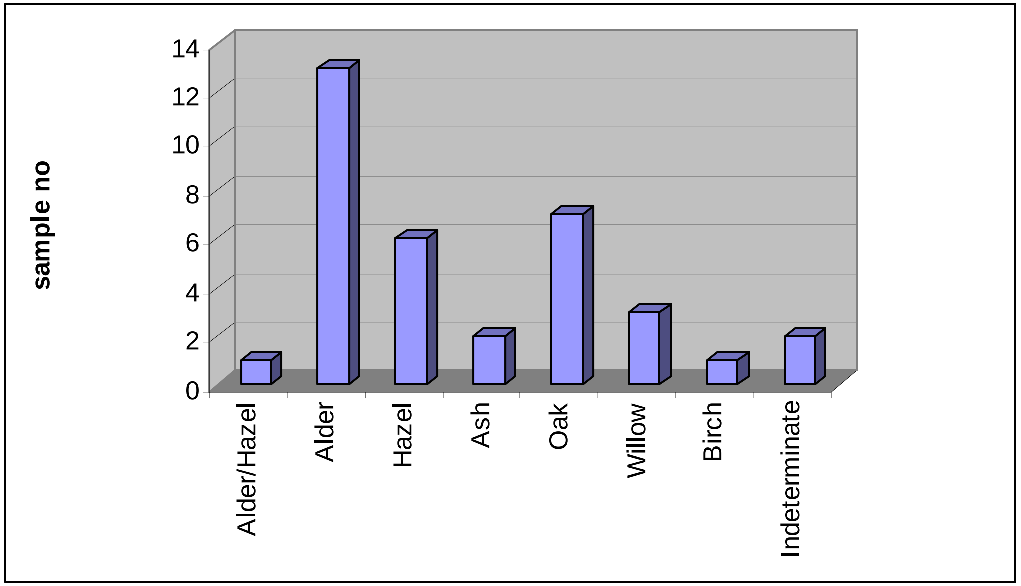
<u>Charcoal assemblage, all sites</u>

Figure 1: All taxa identified from sites analyzed. Weight in grams



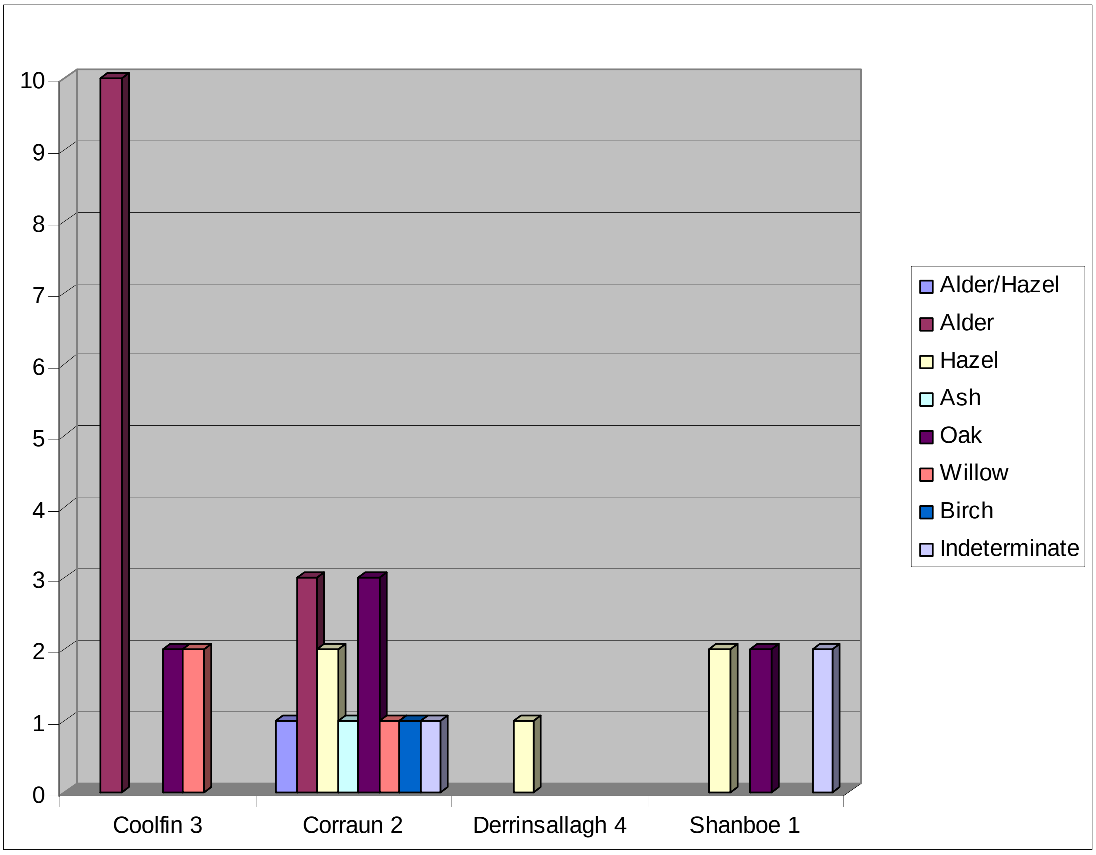
Site	Site type	Sample type	Sample number	Context	Date	Identifications	Comment	Length	Width x Depth/ Diameter	Age	Woodworking evidence	Recommendations
E2180 Derrinsallagh 4	Bowl furnace	Post	1	C171 (C135)		*Corylus avellana*	Charred & in 5 pieces		1.5cm	7yrs	Chisel pointed & torn	Discard

Figure 2: All wood taxa identified from sites that produced wood along Contract 2



One charred chisel pointed post was analysed from Derrinsallagh 4. It was chisel pointed and had a tear along its length. Coolfin 3 is dated to the middle Bronze Age while the remaining three sites (Corraun 2, Derrinsallagh 4 & Shanboe 1) are dated to the Later Bronze Age.

The wood varied in preservation qualities where some displayed evidence of tooling and other samples contained much degraded wood which was mushy and very difficult to identify or analyze.



5. Discussion of Charcoal and wood assemblage

Aims of the study

1. To determine the types of wood selected for use either as fuel or as structural wood.
2. To re-construct the environment that the charcoal and wood was selected from and the possible changes and differences in different time periods between woodland present in the areas during the Neolithic, Early, Middle and Late Bronze Age, Iron Age and Medieval periods.
3. To determine use and function of particular features and their associated charcoal through the identification of taxa types

Wood types identified from charcoal and wood assemblages

Table 2: Taxa types identified from the charcoal and wood assemblage along Contract 2

Botanical name	**Species**
Corylus avellana	Hazel
Prunus spinosa	Blackthorn
Prunus avium/padus	Bird/Wild Cherry
Ulmus sp.	Elm
Pomoideae	Apple type
Quercus spp	Oak
Alnus glutinosa	Alder
Salix sp	Willow
Fraxinus excelsior	Ash
Cornus sanguinea	Dogwood
Betula sp	Birch
Taxus Baccata	Yew
Ulex europeas	Furze
Ilex acquilofium	Holly
Hedera helix	Ivy

Three thousand eight hundred and ninety seven charcoal fragments from one hundred and four contexts relating to twenty seven archaeological sites were analysed from excavations along the M7 Portlaoise to Castletown/M8 Portlaoise to Cullahill road scheme, contract 2. Thirty four wood samples from a Middle Bronze Age walkway and Late Bronze Age *fulacht* sites were also analysed within the framework of these studies. Contract 2 covers a length of approx 13 km and includes numerous *fulacht fiadh* sites, charcoal production pits, cremation pit, a well, kilns, bowl furnaces, a linear feature, pits, postholes and one ring gully.

Charcoal was identified from the fill of various troughs, the fill of pits, from burnt mound spreads and hearths associated with excavated *fulachta fiadh*. These were from Boherard 1, 2 and 3, Coolfin 1, 3 and 4, Shanboe 1 and 4, Corraun 2 and Bushfield/Lismore 1. Charcoal analysed from charcoal production pits dated mainly to the Medieval periods and bowl furnaces dating to the Iron Age and related to metalworking activities were identified from Derrinsallagh 5, Derryvorrigan 1, Bushfield/Lismore 1, Barnasallagh 1, Kilcotton 1 and Delligabaun 1. Charcoal analysed from kilns dating to the Medieval periods were sampled from Derrinsallagh 3. Charcoal from pits excavated at Palmershill 1, Derrinsallagh 1, 2, 3 and 4, Derryvorrigan 1, Barnasallagh 1, Bushfield/Lismore 1, Bushfield 5 and Shanboe 5 were also identified to determine possible function and fuel type used at the pits. Possible structural wood used at the site were analysed from charcoal associated with postholes/stakeholes at Derrinsallagh 2, Derryvorrigan 2, Lismore 2 and Palmershill 1. One sample from a cremation pit at Derrinsallagh 3 and a sample from the fill of wells at Bushfield 4 and Coolfin 1 were also identified. Finally charcoal from a linear feature at Coolfin 3 and a ring gully at Bushfield/Lismore 1 was also analysed. Wood timbers were identified from a walkway at Coolfin 3, and the remains of wooden troughs at Corraun 2, Derrinsallagh 4 and Shanboe 1.

There were fifteen taxa present in the charcoal and wood remains. Taxa identified from the assemblage were oak (*Quercus* sp), hazel (*Corylus avellana*), ash (*Fraxinus excelsior),* alder (*Alnus glutinosa),* Pomoideae (apple type), elm (*Ulmus* sp), birch (*Betula* sp), blackthorn/cherry (*Prunus* spp), holly *(Ilex acquilofium*), willow *(Salix* spp), yew (*Taxus baccata*), ivy *(Hedera helix),* dogwood *(Cornus sanguinea)* and *Ulex europeas* (Furze) in order of representation. The range of taxa identified from the features analysed includes large trees (elm, ash, yew and oak), medium sized trees (alder and birch) and smaller scrub or hedgerow trees like blackthorn, blackthorn/cherry, willow, dogwood, hazel, holly, furze, and pomoideae. Ivy is classed as a woody stem creeper and was very abundant on trees, walls and rocks (Webb 1953, 73).

The results from the wood analysis reflect to a certain extent surrounding treeland cover and selection of such trees for use at the Bronze Age sites. The identifications show that alder and oak wood were the main taxa used for planks and horizontals at these sites. Hazel appears to have been used as post and wattle lining in Shanboe 2 and was also selected for posts at

Corraun 2 and Derrinsallagh 4. One fragment of ash may have been used to line the trough at F025, Corraun 2. Willow was also present at Coolfin 3 and natural birch wood was identified from Shanboe 1 F009.

6. Woodworking evidence

Analysis of wood was carried out from 4 wooden troughs excavated at Shanboe 1, Derrinsallagh 4 and Corraun 2 all dated to the Late Bronze Age. A wooden walkway excavated at Coolfin 3 and dated to the Middle Bronze Age was also analysed within the framework of this study. The alder planks or horizontal timbers mainly associated with the walkway at Coolfin 3 were constructed of tangentially and half split timbers while the oak planks/horizontal timbers were manufactured from radial splits. Tangential splits are split against the line of the rays and as a consequence are not as strong as timbers split along the rays (radial splits).

The analysed posts were pencil and wedge pointed from Coolfin 3 and chisel pointed from Derrinsallagh 4. Chisel points are very basic worked points where only one side is cut and may be related to the felling of the branch or coppiced stool from the main tree trunk. Wedge points are cut on two sides and may highlight a higher degree of woodworking efficiency while pencil points are worked on all sides and may have been worked in this fashion for use as posts or as stabilisation posts within a feature.

Some facets or tool marks were noted on some of the pointed posts at Coolfin 3 and these measured between 2.5 and 3.5 cm in width and between 3.1 and 7 cm in length. The facets were slightly concave in profile. Two jam curves were also noted on these posts and these were between 3.1 and 3.5 cm in width (plate 2). The jam curves and associated facets suggest that a narrow long blade with a slightly splayed edge was used at Coolfin 3. There was no tooling recognised on the timbers from Corraun 2, Derrinsallagh 4 and Shanboe 1.

7. Conclusions on Wood and charcoal Assemblage

Three thousand eight hundred and ninety seven charcoal fragments from one hundred and four contexts relating to twenty seven archaeological sites were analyzed from excavations along the M7 Portlaoise to Castletown/M8 Portlaoise to Cullahill Motorway scheme, contract 2. Thirty four wood samples from a Middle Bronze Age walkway and Late Bronze Age *fulacht* sites were also analyzed within the framework of these studies. Contract 2 covers a length of approx 13 km and includes numerous *fulacht fiadh* sites, charcoal production pits, cremation pit, wells, kilns, bowl furnaces, a linear feature, pits, postholes/stakeholes and one ring gully.

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Oak along with ash, hazel and alder dominate the charcoal assemblage while alder, oak, hazel, willow and ash in that order are present in the wood assemblage.

Oak may have been used as post material at Derrinsallagh 3 and was the preferred taxon for use at metalworking activities including Medieval charcoal production pits and Iron age dated bowl furnaces. Ash stakes may have been used at Lismore 2 and ash was also quite prevalent at the features analysed from Boherard and the fill of a well at Bushfield 4.

Alder brushwood was also identified from a Medieval kiln at Derrinsallagh 3 and a possible cremation pit from the same townland. Here again the higher quantities of alder is more representative of wetland environments rather than dryland forested areas. Chaff was also present in one of the samples from the kilns at Derrinsallagh which may indicate that remains from the wheat and barley grasses were being used as firewood within the kilns.

Other trends recorded from the analysis shows that yew was identified in more frequent amounts from the townland areas of Derrinsallagh and Derryvorrigan.

All of the wood taxa identified from the excavations were of native origin. The inhabitants of the sites along the route of Contract 2 had access to a mosaic of environment types which included oak in the Neolithic periods, primary woodland trees and many varieties of smaller and scrubland trees in the Bronze Age and Iron Age and then larger fragment counts of oak in the Medieval periods. Alder plays a more significant role in the sites analysed along this stretch of the routeway.

It would be of great benefit to the project if the results were compared and contrasted with local and regional pollen cores from the areas that underwent excavation.

Appendix 1:

Description of wood types

Alnus glutinosa (Alder)

Alder is a widespread native tree and occupies wet habitats along stream and river banks. It is an easily worked and split timber and therefore quite commonly manufactured into planks.

Betula sp (Birch)

Hairy birch (*Betula pubescens Ehrh*) and silver birch (*Betula pendula Roth*) cannot be distinguished microscopically. Silver birch requires light and dry soil while hairy birch grows on wet-marginal areas. Birch more often occurs on wet marginal areas and is one of the first trees to establish itself on raised bogs. The wood from birch trees is strong but it rots quickly when exposed to outdoor conditions.

Corylus avellana (Hazel)

Hazel is a native species and was very common up to the end of the 17th century. McCracken (1971, 19) points out that “it was once widespread to a degree that is hard to imagine today”. With the introduction of brick, steel and slate the crafts associated with hazel became obsolete, and today the woods that supplied hazel have diminished rapidly.

Hazel is normally about 3-5m in height and is often found as an understory tree in broadleaf woods dominated by oak. It also occurs as pure copses on shallow soils over limestone as seen today in The Burren in Co. Clare and survives for 30 to 50 years. Its main advantage is seen in the production of long flexible straight rods through the process known as coppicing. Hazel also makes good fuel.

Fraxinus excelsior (Ash)

Ash is a native species to Ireland preferring lime rich freely draining soils. It is not a very durable timber in waterlogged conditions but has a strong elastic nature and is easily worked. Ash appears to have colonised the open land after the first farmers removed much of the native woodland therefore it is frequently used as structural timber in the Later Bronze Age periods as seen at Clonfinlough in Co. Offaly. Ash is also abundant in native hedgerows and was quite common in the later historic period.

Ilex aquifolium (Holly),

Holly is a shrub found quite commonly in hedgerows alongside blackthorn and furze and in the understory of oak woods. The *Bretha Comaithchesa* (Laws of neighbourhood) which are listed in the ancient Irish law tracts records holly as one of the five nobles of the wood namely for its use in the construction of cart-shafts and its leaves were valuable as cattle fodder during the winter months (Nelson 1993, 43).

Pomoideae, (Apple type)

Pomoideae includes apple, pear, hawthorn and mountain ash. It is impossible to distinguish these wood species anatomically but as wild pear is not native and crab apple is a rare native species in Ireland it is likely that the species identified from the site along the N5 are hawthorn or mountain ash (rowan) (Nelson 194-200, 1993). Hawthorn (*Crataegus monogyna*) is a native species, and is found in many hedgerows throughout Ireland. Mountain ash (*Sorbus aucuparia*) is also a common tree in Ireland growing particularly well in rocky and hilly mountainous places.

Prunus spinosa (Blackthorn)

It is difficult to differentiate between cherry and blackthorn particularly in relation to charcoal therefore the identified charcoal has been classified as *Prunus* spp which could be either blackthorn or cherry.

The sloe bush, as blackthorn is commonly referred to, is a very durable wood and is as strong as oak. It is a thorny shrub found in woods and scrubs on all soil types. In a woodland situation it is more likely to occur in clearings and at the woodland edges.

Prunus padus/Prunus avium (Bird /Wild cherry)

The genus *Prunus spp.* includes *Prunus spinosa* (Blackthorn), *Prunus avium* (Wild cherry) and *Prunus padus* (Bird cherry). Wood of the genus *Prunus* can be difficult to differentiate microscopically. Wild cherry and blackthorn are more common in Ireland than bird cherry. There is very little archaeological evidence for the use of cherry wood in Ireland although the wild cherry tree is commonly found in many hedgerows (Nelson 1993, 167). It is a very durable wood and is as strong as oak.

Quercus spp (Oak)

Sessile oak *(Quercus petraea)* and pedunculate oak *(Quercus robur)* are both native and common in Ireland and the wood of these species can not be differentiated on the basis of their anatomic characteristics. Pedunculate oak is found growing in areas of heavy clays and loams, particularly where the soil is alkaline. Sessile oak is found on acid soils and often in pure stands. Unlike pedunculate oak, it thrives on well-drained soils but is tolerant of flooding (Beckett 1979, 40-41). Both species of oak grow to be very large trees (30-40m high).

Oak was one of the most prevalent trees growing in Ireland throughout the medieval period. The anglicised form of the Irish name for oak (derry) is included in many townland names today. Out of 62,000 townlands in Ireland about 1,600 contain the word “derry” in one form or another, either as a prefix or suffix (McCracken 1971, 23).

Oak is a dense wood and is very suitable for charcoal production. It also makes good firewood when dried and will grow in wetland areas when conditions are dry. Charcoal was important in pre-historic and Medieval Ireland as it burned hotter and cleaner than wood and was considered superior to wood in that respect. We know from historical sources that the charcoal maker, or collier, was an important figure in Early Medieval Ireland.

Oak also has unique properties of great durability and strength and was frequently used in the manufacture of posts and wooden plank.

Salix sp (Willow),

Willow is a very strong wood in tree form and is excellent for the use as posts. It is also a very flexible wood and was commonly used for the construction and weaving of baskets. It is a native species in Ireland and can be found in a tree and shrub form. According to Webb (1971, 160-2) thirteen species of willow are found growing wild in Ireland, of which eight are certainly native. The wood of *salix* trees and shrubs cannot be differentiated to species on the basis of anatomical features.

Taxus Bacatta (Yew)

The yew *(Taxus bacatta L.)* is a slow-growing conifer, living as long as 1000 years and reaching 65 feet, they are known for their strength and resistance to the cold. *Taxus bacatta* has a preference for well-drained lime rich soils. It is much less common in recent times because of over harvesting (its hard, springy wood was the source of English longbows). The evergreen needles are very broad, and the seeds are produced in red, berry-like cones. Yews are toxic; one of the toxic compounds, taxol, is an effective treatment for some cancers. Yew is used for the manufacture of wooden bows, spears and many staves were constructed from yew in the Early Medieval periods.

Ulmus spp (Elm)

A few fragments of elm charcoal were identified from the trough fill, the early burnt spreads and the early Neolithic hut sites.

English elm *(Ulmus procera)* and wych elm *(Ulmus glabra)* cannot be separated by their wood structure. As suggested by Mitchell (1986) elm declined (although would not have completely died out) with the advent of farming and possibly elm disease epidemic around 3700BC. It generally prefers damp woods particularly on limestone.

Cornus Sanguinea (Dogwood)

A medium sized shrub with reddish twigs. It is found in thickets and rocky places and is more commonly found along the western seaboards and parts of central Ireland.

Ulex europeas (Furze, Gorse or Whin)

A bushy shrub with green thorny branchlets. The furze shrub reaches a height of 2-5 feet and contains bright yellow flowers. Furze or gorse is commonly found on heaths, pastures and stony places.

Hedera Ilex (Ivy)

Ivy is a woody creeper and climbs by clinging roots. It is a native taxa and is abundantly found on trees, walls and rocks.

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8.2 Appendix 2: Environmental analysis report

Derrinsallagh 4, M7 Portlaoise to Castletown/M8 Portlaoise to Cullahill Motorway Scheme, Co Laois, Ireland

Cremated bone analysis

on behalf of

Archaeological Consultancy Services Ltd

Report 1886
April 2008

archaeological.services@durham.ac.uk

www.durham.ac.uk/archaeological.services

Contents

1. Summary

The project

1.1 An excavation was undertaken by Archaeological Consultancy Services Ltd at Derrinsallagh 4, Co Laois, Ireland. This report presents the results of cremated bone analysis of the fills of three pits.

Results

1.2 The amount of cremated bone present was small, at 6.5g in total. All bone had been burnt at high temperatures and was fully oxidised. Unfortunately, none of the fragments could be identified, and it was not possible to tell if the bone was human or animal.

2. Project background

Location and background

2.1 An excavation was undertaken by Archaeological Consultancy Services Ltd at Derrinsallagh 4, Co Laois, Ireland, during which a large number of archaeological features were revealed. These included a D-shaped structure, 46 bowl furnaces used in iron production and dating to the Iron Age, charcoal kilns, pits and ditches. This report presents the results of analysis of cremated bone recovered from three pits at this site.

Objective

2.2 The objective was to analyse the cremated bone recovered from three pit fills (contexts 163, 198 and 219) in order to further our understanding of burial practices in Co Laois.

Dates

2.3 Samples were received by Archaeological Services Durham University in October 2007. Analysis and report preparation was conducted between October 2007 - April 2008.

Personnel

2.4 Sample processing was undertaken by Archaeological Consultancy Services Ltd. The cremated bone analysis and report preparation was carried out by Dr Anwen Caffell.

Archive

2.5 The record number is A015/070 (E2180). The bone samples are currently at the Environmental Laboratory at Archaeological Services Durham University awaiting collection or return.

3. Methods

3.1 Cremated bone from three contexts was presented for analysis, weighing 6.5g in total. Each sample of cremated remains was passed through a nest of sieves, with mesh sizes of 10mm, 5mm, and 2mm (McKinley 2004). Each fraction was weighed and the largest fragment of bone was measured.

4. Results and interpretation

4.1 Summary data for each context is presented in Table 1, and the fraction weights and fragment size data are given in Table 2.

Table 1: Summary of cremated remains

Context	Context Detail	Bone Colour	Species	Weight (g)
163	Fill of pit (141)	White	Unknown	1.8
198	Upper deposit of pit (140)	White	Unknown	3.7
219	Fill of pit	White	Unknown	1.0

Table 2: Fraction weights and fragment size

Context	Total Weight	Fraction Weights						Max. Frag Size
		>10mm		5-10mm		2-5mm		
	g	g	%	g	%	g	%	mm
163	1.8	1.8	100.0	0.0	0.0	0.0	0.0	27.9
198	3.7	1.5	40.5	0.7	18.9	1.5	40.5	43.9
219	1.0	0.0	0.0	1.0	100.0	0.0	0.0	20.1

4.2 The amount of cremated bone recovered from each context was extremely small, all weighing <5g and with the heaviest context (198) weighing only 3.7g (Table 1). This latter context had the largest fragment, measuring 43.9mm, and the smallest fragment was found in context (219), measuring 20.1mm. The degree of fragmentation varied: all material from context (163) was in the largest fraction, and all material from context (219) was in the middle fraction; most of the material in context (198) was split evenly between the largest and smallest fractions, with a small percentage of bone in the middle fraction (Table 2).

4.3 The bone in all contexts was white in colour (Table 1), suggesting that it had been exposed to temperatures in excess of *c*. 600ºC and had achieved full oxidation (McKinley 2004).

4.4 All fragments were examined with a view to identification, but unfortunately the bone was too small and lacking in distinctive features for identification of fragments to be possible. It was not possible to determine whether the bone was human or animal.

5. Sources

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8.3 Appendix 3: Petrographical analysis report

Petrographical report on stone objects from Archaeological Excavations

in advance of the

Derrinsallagh 4, M7 Portlaoise to Castletown/M8 Portlaoise to Cullahill Motorway Scheme, Contract 2

Record Number E2180

on behalf of ACS Ltd.

by
EurGeol Dr Stephen Mandal MIAI PGeo

May 08
CRDS Ltd Ref: 1020P8

1. Introduction

This report is based on the macroscopic (hand specimen) examination of 14 stone objects found as a result of archaeological excavations carried out at Derrinsallagh 4 in advance of the construction of the M7 Portlaoise to Castletown/M8 Portlaoise to Cullahill Motorway Scheme (Record No. E2180). The objects consist of: eight Grinding stones; and six natural unworked pebbles/ cobbles/ blocks.

The purpose of the study was to identify the rock types from which the stone objects were made, to highlight potential sources for them, and to comment on their possible function. It is important to note that macroscopic petrographical studies have been considered of limited value in comparison to microscopic (thin section and geochemical analysis) studies. On the other hand, macroscopic studies provide an excellent preliminary assessment tool and have proven to be of considerable value in petrographical studies (e.g. see Mandal 1997; Cooney and Mandal 1998).

2. Solid Geology and Soils of the Site

(See Figure 1 for a site location and geology (after Archer et al. 1996; Gatley et al. 2005))

The geology of the area is dominated by Carboniferous sediments, predominantly limestone, which form a stratigraphical succession generally younging to the southeast.

However, the oldest rocks in the area occur in the northwest of the area and are of Devonian Age, comprising the Cadamstown Formation (CW) of pale and red sandstone, grit and claystone and include the Clonaslee Member (CWcl), which consists of thick flaggy sandstone and thin siltstone.

The oldest rocks of the Carboniferous Period in the area belong to the Lower Limestone Shale (LLS), consisting of sandstone, limestone and mudstone. These unconformably overlie the Ballysteen Formation (BA); Courceyan Age fossiliferous dark grey muddy limestones which make up the majority of the area. Included in the Ballysteen Formation is the Lisduff Oolite Member (BAld) of oolitic limestone. Overlying this is the Waulsortion Limestones, massive bedded limestones of Upper Courceyan Age.

Another unconformity separates the Waulsortion Limestones from the conformable Urlingford Succession of the Crosspatrick Formation (CS), pale-grey cherty crinoidal limestone; the Aghmacart Formation (AG), dark shaly micrite / peloidal limestone; the Durrow Formation (DW), shaly fossiliferous and oolitic limestone; and the Clogrenan Formation (CL), cherty bluish crinoidal limestone.

A further substantial unconformity separates this succession from the Killeshin Siltstone Formation (KN), Upper Namurian muddy siltstone and silty mudstone, in turn unconformably overlain by the Moyadd Coal Formation (MC), Lower Westphalian shale, siltstone and minor sandstone.

The bedrock at the site consists of the Ballysteen Formation (BA) of fossiliferous dark grey muddy limestones.

The geology of the area represents the period from the Devonian (*c*. 410 – 355 million years ago), when this part of Ireland was on the edge of a huge continent called Laurussia, formed by the collision of Laurentia and Avalonia – South America at the end of the Silurian. The rocks were derived from the Caledonian mountain uplift which occurred at e start of the Devonian, representing the final erosion of the mountain range prior to the inundation of the early Carboniferous sea. The Carboniferous sequence of rocks in the area is a result of shallow (sandstones and limestones) and deeper (shales and mudstones) period of deposition on the sea floor.

The area is part of a physical geographical region known as the Southern Hill and Vale Area (part of the Central Lowlands). The soil types are predominantly grey brown podzolics (see Aalen *et al*. 1997, ch. 1).

3. Results

The results of the macroscopic identification of the finds are given in Table 1 and are discussed below. Based on a preliminary assessment of the material, the assemblage includes eight artefacts, all of which are grinding stones and are sedimentary (quartzite).

Grinding stones

The assemblage includes eight grinding stones, all of which are made from quartzite, four very coarse to coarse grained, two medium grained and two fine grained. All are made from water rolled secondary sources; six from cobbles, two from blocks. All exhibit clear evidence of working, in the form of grinding and / or pecking of the faces and or circumference.

Other Stones

The six remaining stones in the assemblage are all natural and unworked. These include water rolled cobbles and pebbles. In terms of rock types, all are sedimentary (two quartzite; one vein quartz; one sandstone; one limestone; and one shale).

4. Potential Sources

It is likely that the sources for all of these objects are local. There are abundant sources for rocks of these types in the area (see Figure 1). It is, however, important to note that these objects did not arrive on site from bedrock, but from secondary sources, such as a water-rolled river cobbles / pebbles, or in the till.

5. Conclusions

It is not possible to determine a definitive source for these objects based on macroscopic examination alone. Furthermore detailed microscopic analysis would also be unlikely to identify exact sources. On the other hand, it can be stated that the materials from which these objects were manufactured are available locally in outcrop and within the glacial tills. Thus it is probable that these objects were derived from local sources.

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8.4 Appendix 4: Lithics report

Preliminary analysis of the lithic pieces from Derrinsallagh 4, M7 Portlaoise to Castletown/M8 Portlaoise to Cullahill Motorway Scheme, Co. Laois

Archaeological Record No: E2180

Ministerial scheme No: A015/070

by

Dr. MARIA B. O'HARE

Statement of Significance

Three lithic pieces were recovered from the excavations at Derrinsallagh 4, Co. Laois from as many features. These include a pointed blade, a bipolar core and a split pebble expedient type scraper; these latter two pieces in particular are fairly characteristic of later prehistoric type material.

Introduction

There were three lithics derived from the Portlaoise to Castletown/Culahil, contract 2 of the M7 Portlaoise to Castletown/M8 Portlaoise to Cullahill Motorway Scheme at Derrinsallagh 4, Co. Laois under excavation record number E2180, scheme A015/70. These lithic pieces have an individual entry and is listed within the database (Microsoft excel) for Contract 2, report number two and is accompanied by a glossary of terms corresponding to this database.

Description of artefacts

A flint scraper (E2180:320:002) measuring 42.6x27.8x12mm was recovered from feature (F302). It is fully patinated and slightly broken made on a cortical split pebble flake. It appears that the natural edge of this pebble has been employed as a scraper. A fully patinated flint bipolar core (E2180: 002:001) was recovered from feature (F2). It has maximum dimensions of <40mm (these cannot be orientated like platform produced pieces and therefore are measured at 10mm intervals). A pointed blade (E2180:612:001) was recovered from feature (F612) and is a semi-translucent, dark grey flint which is relatively fresh and has no cortex remaining. The dimensions are as follows: 40x17.2x3.7mm.

Discussion

All that can be established from this small collection of artefacts is that the cortical split-pebble scraper along with the bipolar piece is typically found within later Irish prehistoric contexts (O’ Hare 2005 and O’ Hare forthcoming) and the semi-translucent blade is more typically found within earlier contexts. Therefore, as each of these artefacts was derived from different features, either they may represent multi-period prehistoric activity or simply represent a diversity of types from a fairly broad prehistoric tradition. In the absence of more contextually meaningful information and the limitation of only three lithic pieces, a specific prehistoric date is fairly difficult to establish. Hopefully future excavations of this site may reveal more contextually meaningful range of lithic material to establish the date and nature of the activity from the Derrinsallagh 4 site.

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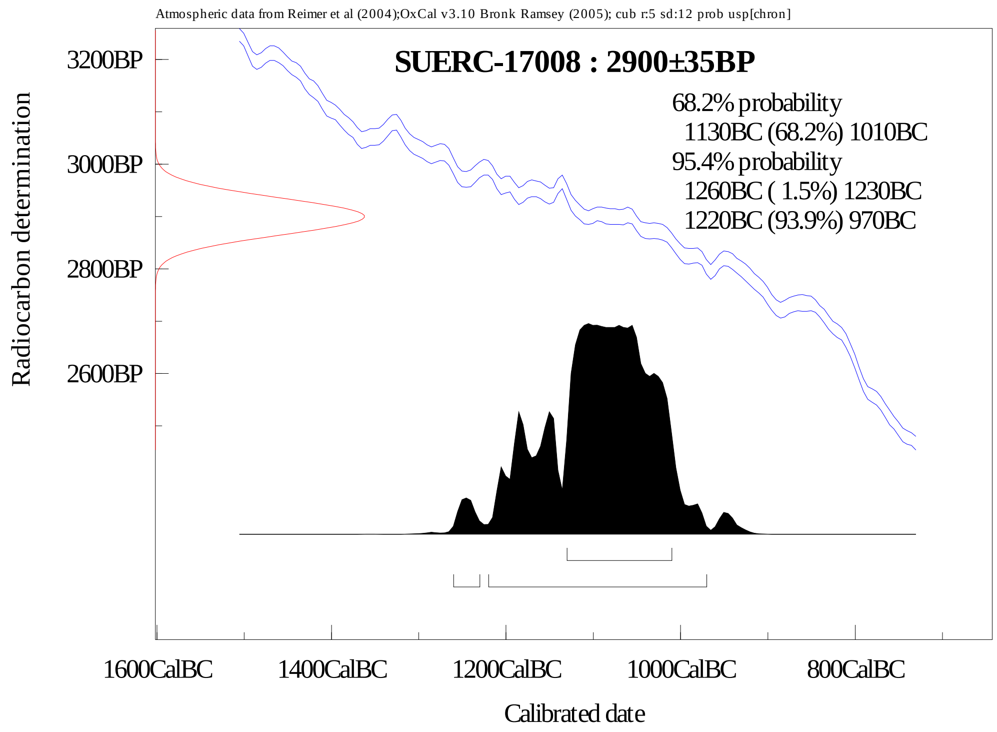
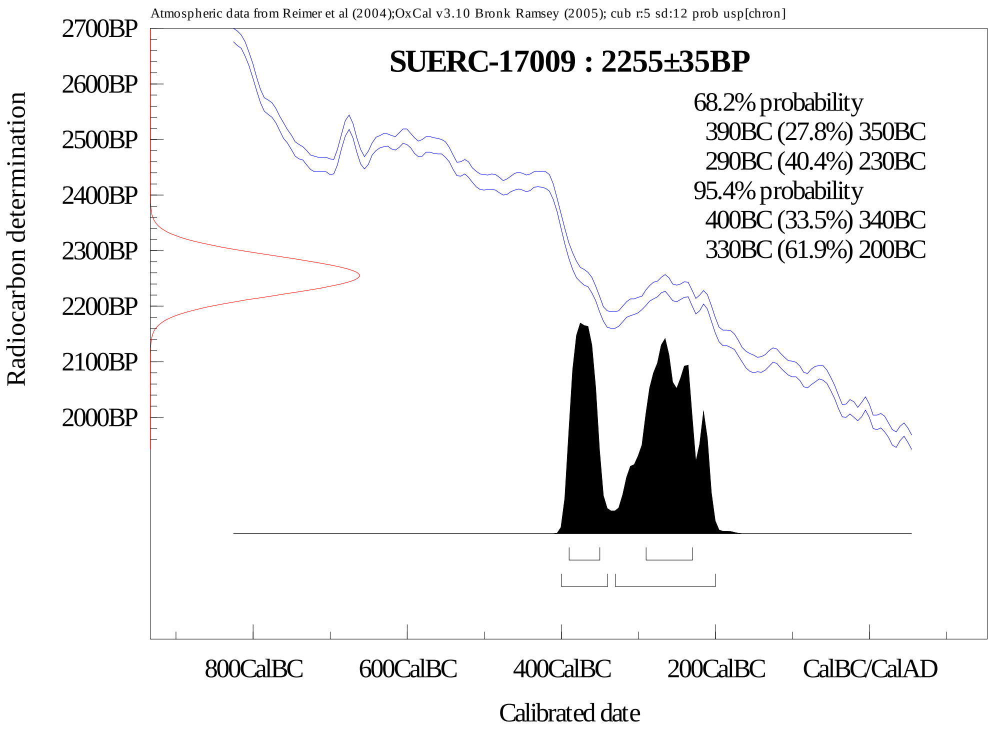
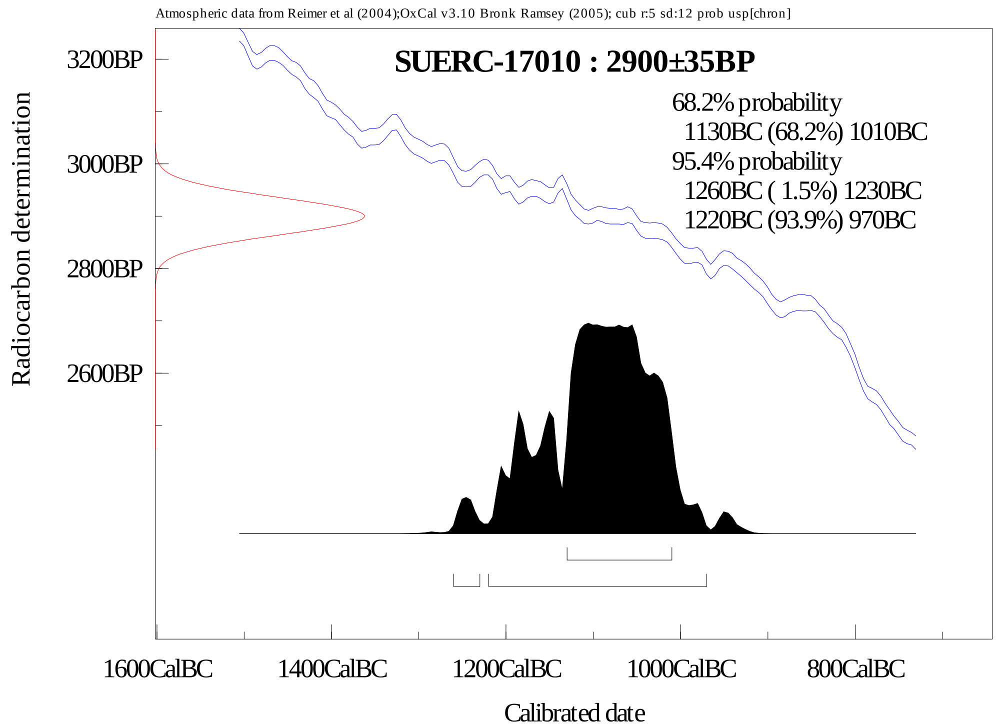
8.5 Appendix 5: Radiocarbon dating results



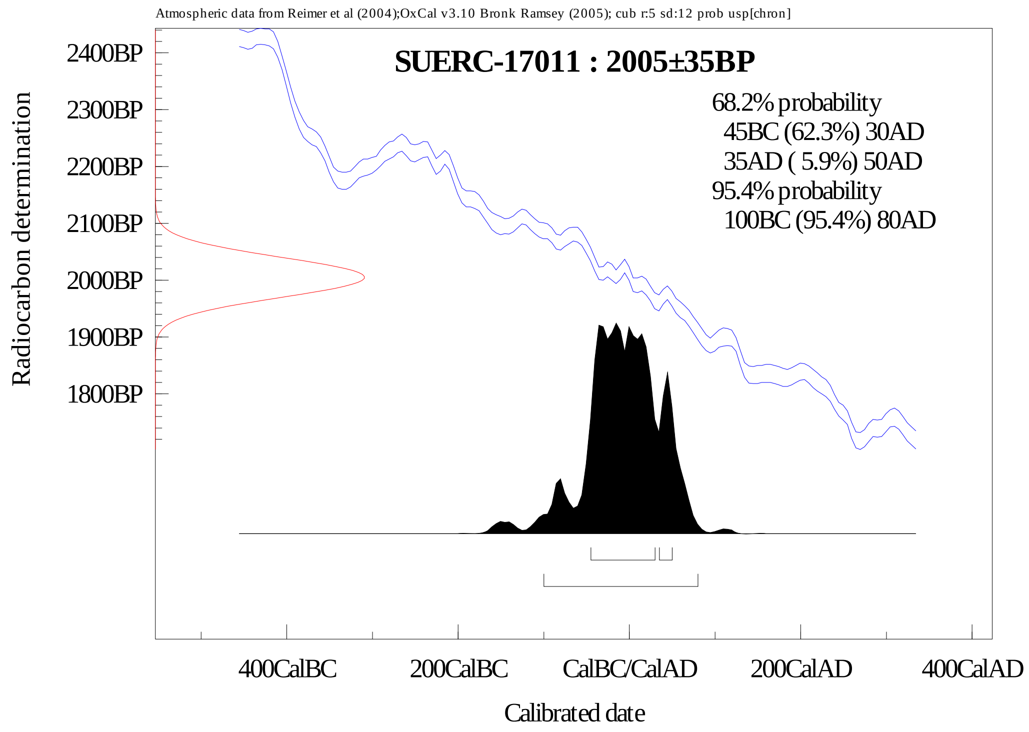
GU No.	Reporting Number	Sample Type	Site	Sample Id	Species Dated	d13C	Age % Modern	Ageerror 1 sigma
16360	SUERC-17008	Charcoal	Derrinsallagh 4	05_09:E2180:F606:S534	Pomoideae/Hazel/Ash/Alder	-24.5	2900	35



GU No.	Reporting Number	Sample Type	Site	Sample Id	Species Dated	d13C	Age % Modern	Ageerror 1 sigma
16361	SUERC-17009	Charcoal	Derrinsallagh 4	05_09:E2180:F644:S514	Ash	-25.2	2255	35



GU No.	Reporting Number	Sample Type	Site	Sample Id	Species Dated	d13C	Age % Modern	Ageerror 1 sigma
16362	SUERC-17010	Charcoal	Derrinsallagh 4	05_09:E2180:F616:S496	Elm	-23.4	2900	35



GU No.	Reporting Number	Sample Type	Site	Sample Id	Species Dated	d13C	Age % Modern	Ageerror 1 sigma
16363	SUERC-17011	Charcoal	Derrinsallagh 4	05_09:E2180:F659:S524	Ash	-26.8	2005	35

Ms. Rachel Sloane Report Date: 8/17/2006

Archaeological Consultancy Services, Ltd. Material Received: 7/12/2006

Sample Data	Measured Radiocarbon Age	13C/12C Ratio	Conventional Radiocarbon Age (*)
Beta - 218645	1940 +/- 70 BP	-26.3 o/oo	1920 +/- 70 BP

SAMPLE: A015/70:C199:S101
ANALYSIS: Radiometric-Standard delivery
MATERIAL/PRETREATMENT: (charred material): acid/alkali/acid
2 SIGMA CALIBRATION: Cal BC 50 to Cal AD 240 (Cal BP 2000 to 1710)

CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12=-26.3:lab. mult=1)

Laboratory number: **Beta-218645**

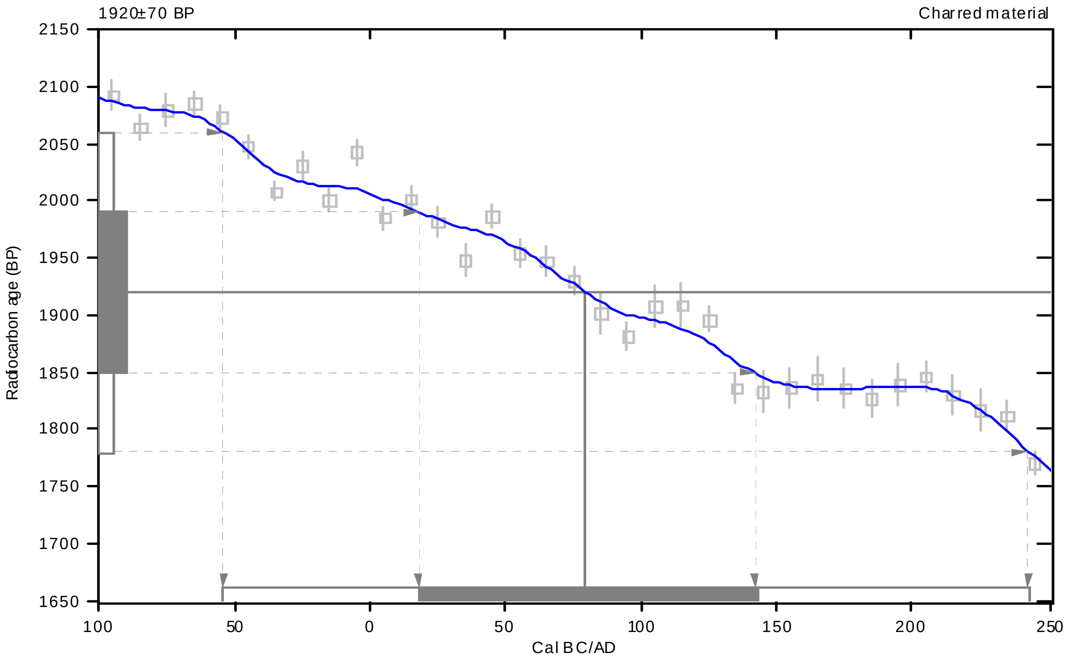
Conventional radiocarbon age: **1920±70 BP**

2 Sigma calibrated result: (95% probability) **Cal BC 50 to Cal AD 240 (Cal BP 2000 to 1710)**

Intercept data

Intercept of radiocarbon age with calibration curve: Cal AD 80 (Cal BP 1870)

1 Sigma calibrated result: (68% probability) Cal AD 20 to 140 (Cal BP 1930 to 1810)



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Calibration Database
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Stuiver, M., van der Plicht, H., 1998, Radiocarbon 40(3), pxii-xiii
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Mathematics
A Simplified Approach to Calibrating C14 Dates
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Beta Analytic Radiocarbon Dating Laboratory

4985 S.W. 74th Court, Miami, Florida 33155 • Tel: (305)667-5167 • Fax: (305)663-0964 • E-Mail: beta@radiocarbon.com

Ms. Rachel Sloane Report Date: 8/17/2006

Archaeological Consultancy Services, Ltd. Material Received: 7/12/2006

Sample Data	Measured Radiocarbon Age	13C/12C Ratio	Conventional Radiocarbon Age (*)
Beta - 218649	1920 +/- 60 BP	-27.0 o/oo	1890 +/- 60 BP

SAMPLE: A015/70:C357:S259
ANALYSIS: Radiometric-Standard delivery
MATERIAL/PRETREATMENT: (charred material): acid/alkali/acid
2 SIGMA CALIBRATION: Cal BC 10 to Cal AD 250 (Cal BP 1960 to 1700)

CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12=-27:lab. mult=1)

Laboratory number: **Beta-218649**

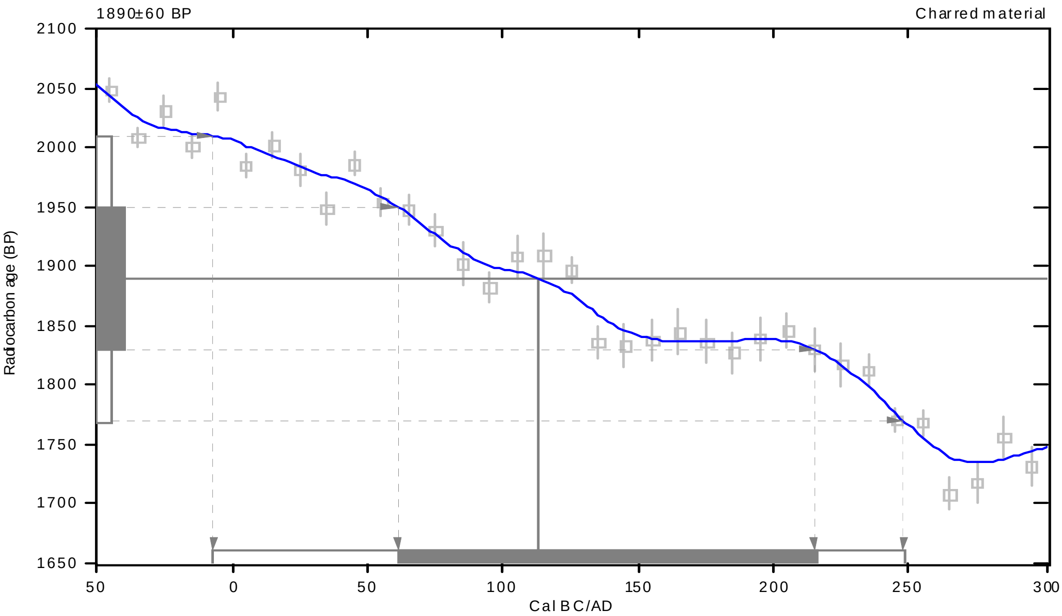
Conventional radiocarbon age: **1890±60 BP**

2 Sigma calibrated result: (95% probability) **Cal BC 10 to Cal AD 250 (Cal BP 1960 to 1700)**

Intercept data

Intercept of radiocarbon age with calibration curve: Cal AD 110 (Cal BP 1840)

1 Sigma calibrated result: (68% probability) Cal AD 60 to 220 (Cal BP 1890 to 1740)



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Beta Analytic Radiocarbon Dating Laboratory

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8.6 Appendix 6: Prehistoric pottery report

Prehistoric pottery report from Derrinsallagh 4, M7 Portlaoise to Castletown/M8 Portlaoise to Cullahill Motorway Scheme from Co. Laois

Archaeological record No: E2180

by

Eoin Grogan and Helen Roche

Summary

The site at Derrinsallagh 4 produced 83 sherds of prehistoric pottery (plus 32 fragments) representing an early Neolithic carinated bowl and five middle to late Bronze Age domestic vessels (Nos 1–5). Other material representing moulds and furnace lining came from middle Iron Age bowl furnaces.

Residual early prehistoric material

A bodysherd from an early Neolithic carinated bowl came from the fill [**320**] of a possible refuse pit [**274**]. This material may represent short term activity on the site. There is very little identified archaeology of this period from Co. Laois although there is a portal tomb at Ballynaslee, Co. Offaly, *c*. 22km to the southeast but also situated on the Nore Valley. Another early Neolithic site, with a pottery assemblage representing at least five carinated bowls, occurred in the same townland of Derrinsallagh (Grogan and Roche 2008a) while small quantities of this pottery also came from Tintore 2 and Cuffsborough 2 on the M7 Portlaoise to Castletown/M8 Portlaoise to Cullahill Motorway Scheme (Grogan and Roche 2008b; 2008c).

The middle to late Bronze Age pottery

The site produced 82 sherds (19 rim-, 3 base-angle-, 61 bodysherds, plus 32 fragments) from at least five vessels. Most of this pottery came from the fills [**606**, **664**] of pit [**605**] but Vessel 1 came from a disturbed context in the upper fill [**117**] of a later bowl furnace [**010**]. The pottery consists of flat based vessels with bucket or slightly biconical profiles and generally inturned rims. Vessels 1 and 5 have simple rims while Nos 2–4 have inturned expanded rims with flat to slightly concave internal bevels and short, constricted, necks. The fabric is of medium quality with a low to medium content of mainly dolerite inclusions (generally ≤ 4.9 x 4.8mm, but occasionally up to 10.7 x 6.7mm); Vessel 2 also contained coarse granite and quartzite. Generally the pot walls are relatively thin (*c*. 9–11mm) but tended to be thicker (up to 17mm) in the lower body while the rounded shoulders of Nos 3 and 4 were also thicker and may have been strengthened to support the inturned rims during manufacture. The pottery has some wear to both surfaces and edges and there is only a small number of refitting sherds; Vessel 2 has more extensive wear and the outer surfaces are abraded. Where preserved it is evident that the exterior of the pots were finished with a fine slurry which masked most of the surface inclusions. The general lack of care in the quality and finish of these vessels reflects their intended use in domestic contexts: evidence for domestic use, in the form of sooting or a thick blackened accretion, occurs on Nos 2–4.

Plain, coarse, domestic pottery of the type represented at Derrinsallagh developed towards the end of the middle Bronze Age probably out of domestic cordoned urns. The inturned rims, giving the vessels a closed profile, occur principally in funerary contexts as at Priestsnewtown, Co. Wicklow (Tobin *et al*. 2004; Grogan and Roche 2004a), and Ask, Co. Wexford (Stevens 2007; Grogan and Roche 2008b). Very similar profiles, with inturned bevelled rims and short constricted necks, occurred in a domestic context at Ballylegan, Co. Tipperary (McQuade 2006; Grogan and Roche 2007a), and from the ring ditch cemetery at Darcytown, Co. Dublin (Carroll 2004; Grogan and Roche 2007b).

Both the fabric type and the vessel forms can be most closely paralleled at Rathgall, Co. Wicklow (Raftery 1976; 1993; see Grogan 2005, fig. 6). The bevelled rims and overall pot profile also feature at Lough Gur (Ó Ríordáin 1954; Grogan and Eogan 1987). The Derrinsallagh pottery is from small to medium-sized pots *c*. 16.6–21cm in external rim diameter; similar vessels are comparatively rare but have been recorded at, for example, Carrig, Co. Wicklow, Kilbane, Co. Limerick, and Stamullen, Co. Meath (Grogan 1990; O'Callaghan 2006; Grogan and Roche 2004b; Grogan and Roche 2007c). Very similar material to the Derrinsallagh pottery was dated to *c*. 1100–900 BC at Ballylegan and Darcytown but the emergence of this form by 1300–1200 BC is suggested by dates from the burials at Priestsnewtown.

Regional Context

The Derrinsallagh pottery, and that from Lismore 2 (Grogan and Roche 2008c) on the M7 Portlaoise to Castletown/M8 Portlaoise to Cullahill Motorway Scheme, is the first reported example of middle or late Bronze Age pottery from the area. The closest site is at Ballydavid, Co. Tipperary (Roche and Grogan 2008), although there are Bronze Age settlement indicators, including *fulachta fiadh* and barrows, as well as the hillfort at Boley Upper, along the Nore Valley.

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CATALOGUE

The excavation number E2180 is omitted throughout; only the context number followed by the find number is included.

Where the pottery is listed in the catalogue the context numbers are in bold: *e.g.*: **606**:35. Numbers in square brackets (*e.g.* **606**:[34, 43]indicate that the sherds are conjoined. The thickness refers to an average dimension; where relevant a thickness range is indicated. Vessel numbers have been allocated to pottery where some estimation of the form of the pot is possible, or where the detailed evidence of featured sherds (*e.g.* rims, shoulders), decoration or fabric indicates separate vessels.

R = rimsherd N = necksherd

The early Neolithic

A single bodysherd (**320**:1) of very smooth dark red-brown fabric with a red-brown inner surface and a dark grey core came from a possible refuse pit [**274**]. The outer surface appears to have been burnished. There is a medium content of quartzite inclusions (≤ 2 x 1mm). Body thickness: 7mm; weight: 6g.

The middle to late Bronze Age domestic pottery

The site produced 82 sherds (19 rim-, 3 base-angle-, 61 bodysherds, plus 32 fragments) from at least five vessels. Most of this pottery came from the fills [**606**, **664**] of pit [**605**] but Vessel 1 came from the upper fill [**117**] of a later bowl furnace [**010**].

Vessel 1. This is represented by 8 sherds (3 rimsherds: **117**:1.1, 2.1, 3.1; 5 bodysherds: **117**:1.2, [2.2, 3.2], 2.3, 3.3; 6 fragments: **117**:3.4–9) from a vessel with a flat, slightly inturned expanded rim, a gently rounded neck and a probable bucket-shaped profile. The fabric has a grey-buff exterior, a grey brown interior and a dark grey core. There is a low to medium content of dolerite inclusions (≤ 4.9 x 4.8mm, up to 10.7 x 6.7mm). Neck thickness: 9.2–10.9mm, body: 11.5mm; weight: 61g.

Vessel 2. This is represented by 7 sherds (2 rimsherds: **606**: [34, 43]; 5 bodysherds: **606**:36, 42, 44–46; 4 fragments: **606**:47) from a vessel with a rounded, outwardly expanded rim and a flat internal bevel; the rim is inturned giving the vessel a slightly closed profile. There is a slight constricted neck and the upper body is rounded. The fabric has a much worn or abraded buff exterior; the grey-brown to grey-buff interior is smooth but uneven with protruding but largely masked surface inclusions. The core is dark grey. Where preserved (*e.g.* **606**:34) the external surface has a smooth slurry finish. There is sooting on the internal surface and on the inner side of the rim top. There is a medium to high content of dolerite, coarse granite and quartzite inclusions (up to 6.8 x 5.2mm). Neck thickness: 9.47mm, body: 17.5mm; weight: 260g.
Maximum external rim diameter: *c*. 16.6cm.

Vessel 3. This is represented by 25 sherds (8 rimsherds: **606**:2, [4, 6], 5, 11, 21, 23, 33; 17 bodysherds: **606**:1, 3, 8–9, 13–19, 22, 24–26, 31, 40; 7 fragments: **606**:10 (2), 12 (4), 20) from a vessel with a rounded, outwardly expanded rim and a concave internal bevel; the rim is inturned giving the vessel a slightly closed profile. The upper body is rounded. Where preserved (*e.g.* **606**:2) the exterior has a smooth buff slurry finish but this has broken off much of the upper surface (*e.g.* **606**:5, 11, 33). The grey-brown to dark grey-brown inner surface is smooth and there is a dark grey core. There is sooting on the internal surface from below the rim and on the outer half of the rim bevel. There is a low to medium content of dolerite inclusions (≤ 5 x 4mm, up to 10.8 x 6mm). Neck thickness: 19.4mm, body: 9.45mm; weight: 257g.
Maximum external rim diameter: *c*. 19cm.

Other sherds
There are 2 further bodysherds (**664**:2, 43) that are probably from Vessel 2 or 3; weight: 25g.

Vessel 4. This is represented by 20 sherds (4 rimsherds: **606**:7, 28, 32, 35; 1 base-/base-anglesherd: **664**:46; 1 shouldersherd: **664**:45; 14 bodysherds: **606**:27, 29–30, 37–39, 41, **664**:8, 11, 15, 35, 37, 41–42) from a vessel with a rounded rim and a concave internal bevel, a slight constricted neck and a rounded upper body. The buff fabric has a grey-buff inner surface and a dark grey core. Where preserved (*e.g.* **606**:30, 35, 41) the exterior has a

smooth, thick, buff slurry finish but, despite this, there are exposed inclusions on the surface. The slurry finish has flaked off much of the surface (*e.g.* **606**:7, 28, 32). There is sooting on the internal surface and on the outer two-thirds of the rim bevel. There is a low to medium content of dolerite inclusions (≤ 5 x 4mm, up to 10.8 x 6mm). Neck thickness: 13.6mm, body: 16–18mm; weight: 676g.
Maximum external rim diameter: *c*. 21cm.

Vessel 5. This is represented by 7 sherds (1 rimsherd: **664**:36; 1 much worn base-/base-anglesherd: **664**:44; 5 bodysherds: **664**:1, 23, 25, 38–39) from a small vessel with a rounded rim and gently rounded internal bevel, and a gently curved upper body. The generally worn buff fabric has a grey-brown inner surface and a dark grey core. There is a medium content of dolerite inclusions (≤ 5.5 x 4mm). Neck thickness: 10mm, body: 8.7mm; weight: 67g.

Other sherds
A further 13 sherds (1 base-anglesherd: **664**:40; 12 bodysherds: **664**:5, 9–10, 12–13, 18, 20–21, 26, 28–29, 32; 15 fragments: **664**:3–4, 6–7, 14, 16–17, 19, 22, 24, 27, 30, 33–34, 31) are probably from the pots described above but cannot be assigned to any particular vessel; weight: 135g.

Other material: probable mould fragments
*Bowl furnace [**125**]*
There are four pieces (**125**:[1, 4], 2–3) of very compact red-buff fabric with a distinctive smooth inner brown-buff surface. There is a very low content of mainly sandgrade inclusions with occasionally larger fragments of sandstone (≤ 3.4 x 2mm). These appear to be from a wide flat mould; thickness: 10.63–11.2, weight: 19g.

1:2 is a small *unstratified* fragment from a mould or crucible of red-buff fabric with a smooth, curved, inner surface and some blackening, possibly residue, on the outer surface. There is a very low content of mainly sandgrade inclusions with occasionally larger fragments of sandstone (≤ 2 x 1mm). Weight: 2g.

Probable furnace bowl lining

*Bowl furnace [**121**]*

121:1, 10–12 are of compact light buff fabric (plus fragments: **121**:2–9) with a very low content of mainly sandgrade inclusions with occasionally larger fragments of sandstone (≤ 2.7 x 2mm). Thickness: 15.62–28.3, weight: 88g.

*Context [**584**]*[1]

584:1 is a rim with a rounded top that thickens quickly into the body (thickness: 24.18mm). This much worn piece has an orange-buff top with the remainder grey-brown. The surfaces are even but abrasive and there is a low content of quartzite and sandstone inclusions (≤ 2 x 1mm, up to 3.83 x 3.39mm). This appears to be from the lip of a furnace bowl, weight: 35g.

Vessel No.	**Context/feature**	**Number of sherds**	**Rimsherds**	**Base-, base angle**	**Bodysherds**	**Fragments**	**Inclusions**	**Vessel size**	**Weight (g)**	**Pottery type**
	320	1	0	0	1	0	Q		6	ENCB
1	**117**	8	3	0	5	6	D	S	61	M–LBA
2	**606**	7	3	0	5	4	D G Q	16.6	260	M–LBA
3	**606/664**	25	8	0	17	7	D		257	M–LBA
4	**606/664**	20	4	1	15	0	D		676	M–LBA
5	**664**	7	1	1	5	0	D		667	M–LBA
Other	**664**	2	0	0	2	0	D		25	M–LBA
Other	**664**	13	0	1	12	15	D		135	M–LBA
		82	19	3	61	32			2081	M–LBA

[1] This context is not listed in the accompanying text.

Table 1: Details of pottery including individual vessels from Derrinsallagh 4, Co. Laois

Vessel	**Context**	**Sherds to draw**	**Section only**	**Photograph**
1	**117**	R. **117**.2.1		
2	**606**	R. **606**:[34, 43]		
3	**606**	R. **606**:2		
4	**606/664**	R. **606**:35		
5	**664**	R. **664**:36		

Table 2: Suggestions for illustration

8.7 Appendix 7: Metal objects report

Report on the Metal Artefacts from the M7 Portlaoise to Castletown/M8 Portlaoise to Cullahill Motorway Scheme, Co. Laois, Contract 2

For Archaeological Consultancy Services

by

Órla Scully, MA MIAI

Introduction

There were metal finds from seven excavations in contract 2. The sites are: Derrinsallagh 3 (E2179), Derrinsallagh 4 (E2180), Derrinsallagh 5 (E2181), Derryvorrigan 1 (E2193), Lismore/Bushfield 1 (E2220), Bushfield 3 (E2224) and Bushfield 6 (E2457). In total there were 50 metal artefacts from contract 2.

The results of the examination are given in the catalogue. The finds are listed according to their National Museum of Ireland registration no. The next listing is the site name, followed the feature from which the artefact was recovered, the finds no; what the object is, what metal type it is, its description; the dimensions and under what category it functioned as.

The measurements are all given as millimetres. The format of measurement is length by breadth by width. In the case of circular objects, the letter 'd' preceding a measurement indicates a diameter. When giving measurements of nails, the first measurement gives length, followed by the max width of the head, followed by the max width of the shaft. If an object is fragmented, the dimensions of the largest piece are given, with the prefix 'max'.

The objects are assigned a function to facilitate discussion. The details of each artefact are given in the catalogue which follows the discussion. The finds from contract 2 fall under several functional categories; coinage, domestic, dress, horse equipment, keys and locks, knives, miscellaneous, structural and tools. Where possible, a type and date range for an artefact is given. Where comparative material from other site can be found it is also given, with full bibliographical references.

Coinage

There were two coins from the Contract 2 assemblage. That from Derryvorrigan 1 (E2193:1:1) is a King George half penny. The date is not visible, but would be one of three possible reigns, spanning a date range from 1714 to 1830. The second coin from Bushfield 6 (E2457:6:15), is an 'old' penny. The surface detail is obscured, but the vague outline of a head would indicate an English penny, probably late 19th or early 20th century.

Domestic

This bowl approximates to a modern 'tablespoon' size. Medieval spoons tend to be spatulate in shape. The later medieval spoons have characteristic fig-shaped bowls.[2] The two spoons from Bushfield 6 (E2457:6:3 & 5) are early modern.

A copper alloy strip from Derrinsallagh 3 (E2179:279:1), with one of the long sides smooth, the other showing signs of being ripped from the original object may represent the rim of a platter or bowl. Both terminals have rivet holes at the point of the break. The strip may alternatively have formed the rim of a cauldron. The 'bronze' tripod cauldron seems 'first to have appeared on the Continent towards the end of the twelfth century and was used in England in the thirteenth and increasingly in the fourteenth an fifteenth centuries'. [3] Earlier vessels of course exist, such as the hanging lamp from Ballinderry Crannóg 1, believed to date to the 10th century. This had a strip of flat bronze, riveted onto the upper edge of the bowl to give additional strength to the bowl. It was secured by twelve rivets set at rather unequal intervals.' [4]

Dress

A button from Bushfield is a mass produced copper variety (E2457:6:1). Flat copper-alloy disks predominated in the second half of the eighteenth century[5] and continued in use especially in shirts, right through to the early 20th century.

Of greater antiquity is the shank of a ringed pin found in Lismore/Bushfield 1 (E2220: 148:1). A ringed pin consists of a pin with a loose swivel ring inserted through the head of the pin. Sometimes the head has faceted sides to accommodate the terminals of the pin, in other cases, such as the example from Lismore/Bushfield 1; the head is perforated to accept the ring. The ring in this case did not survive. The hole, (post conservation) is only 3mm. These functioned as dress or cloak fasteners and are Viking Age/Early Medieval in date. They are the forerunners of the medieval stick pin, which are plentiful in the Irish urban medieval record. The ringed pin form appears to 'have originated in Ireland sometime during the late fourth of early fifth century A.D.'[6] The type continued in use in Dublin until the end of the 11th century. A shank fragment from Derrinsallagh (E2179:450:3) may be part of a ringed pin.

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2 Brisbane, (1990) 832

3 Biddle (1990)947

4 O Neill Hencken (1936) 193

5 Noël-Hume, I (1991) 88

6 Fanning, (1994) 52

Two buckles, form Lismore/Bushfield 1 (E2220:820:1) and Derrinsallagh 3 (E2179:449:1) are made of iron. They both have plates attached. The latter is an oval shape with the plate passing through the buckle and folded over and a gap at the point of the fold allowed the pin, or tongue to protrude. The Lismore/Bushfield buckle is a small D-shaped buckle with a little copper alloy detail riveted to one side. The plate is rolled over the straight side of the buckle. The leather or fabric would have been sandwiched between the plates. Small buckles like these could have had multiple uses. In London 'the relatively small number of iron frames [of buckles] from the earlier part of the sequence is striking'.[7] Buckles with plates attached enter the developmental sequence in London in the mid 14th century. Iron appears as a material for strap ends in the late 13th/early 14th century, (ibid).'The various D-shaped iron buckles are the most common individual form of buckle from Winchester, as from medieval contexts nationally, and their different shapes and sizes, many plain but some decorated, indicated that they were an all-purpose type'. [8] Medieval iron buckles from Winchester date from the 11th century. Larger iron buckles are usually associated with horse tack. These small buckles from Contract 2 are items of personal dress, most probably from belts.

Horse Equipment

The only artefact from this category is a horseshoe nail. The rectangular head is an expansion of the shaft. This type postdates the larger headed nails which were countersunk into the shoe. The new type of shoe which was characterised by nails tapering in profile appeared in England before the middle of the 14th century. [9]

Keys and Locks

A barrel padlock key from Derrinsallagh 3 is the only item in this functional group. The long narrow shank has a closed looped bow. The bit is simple; a curved terminal at right angles to the shank and may have suffered some damage. An example with a bifurcated bit from Anglo-Scandinavian levels at York 'would have released the lock springs with a levering, rather than sliding, motion.[10] 'Box padlocks with internal mechanisms incorporating leaf springs were in use until the eleventh century and barrel padlocks with

[7] Egan & Pritchard (1991)21
[8] Goodall, (1990) 526
[9] Clark, (1986) 3
[10] Ottaway, (1992) 675
[1]0 Goodall, (1990) a, 1001

similar mechanisms were in use at the same time and continued in use throughout and beyond the medieval period'.[11]

Knives

There were four knives from Contract 2. Two from Derrinsallagh 3 most closely approximate to Goodall's Type B. (E2179:448:2 & 449:2). Type B is characterised by a flat blade-back, which angles down to the tip, with a straight or curved cutting edge. In the case of the Derrinsallagh artefacts, the blade back is straight, and the cutting edge slopes to meet it. This type is dated by Goodall from the ninth century to not later than the fourteenth century. The other knives from the assemblage (E2220:1:11 & 244:1) are Type C This type is recorded prior to the tenth century and is found in limited numbers in late medieval contexts. Type C has the cutting edge and the flat back parallel before both taper to the tip.

Miscellaneous

This encompasses all scrap and various bars, rings and straps which do not readily reveal their function, or indeed may be multifunctional. Included here is an early modern vessel (E2224:304:1 & 2) of unknown alloy. The flattened spherical vessel has an elongated neck, complete with screw cap. A piece of the same metal may be a stand. The spiral wound stopper is a modern invention and perhaps the object functioned as a bed warmer.

Structural

The majority of the artefacts in this section were nails and rivets. The nails were all rectangular sectioned with round heads where they survived. These nails are ubiquitous on medieval and earlier sites when nails were hand wrought. There is little difference between the medieval examples from Contract 2 and those recovered from the Iron Age site at Freestone Hill Co. Kilkenny. It was not until 'about 1790 the first cut nails were produced…sliced by machine from sheet iron'[12], though that did not preclude the continuing production by hand. Four rivets were identified. This distinction was really a matter of size and solidity. These objects could be called large nails but they were heavier and more bulky. Rivets are used to fit heavy timbers together- also known as clench bolts- they are often found in association with boats in Viking and medieval contexts. In essence a rivet 'consisted of a nail which, once passed through the timbers to be joined, had a

[12] Noël Hume (1991), 253

small pierced plate, the rove, set over its tip. The tip was then burred or hammered over [clenched] to hold the bolt in position'[13]. Other structural artefacts include several examples of strap hinges, none complete. These would have attached to wooden doors, or large chests, and are eyed hinges are 'known from contexts of the tenth to fourteenth century.'[14] Several pieces of building ironwork were recovered from the vernacular house in Bushfield 6. These quaint latches and window clasps are fast fading from memory. The acorn-shaped knob of the window latch (E2457:6:9) is in perfect condition. These can date from the late 18th century.

Tools

Finally, a bill hook or sickle from Bushfield 6 is a well preserved iron tool. This is a reaping tool, with a long tradition in the folk history of Ireland. 'The scythe and the iron hook have their origin in the Early Iron Age, and some methods of securing the crop can have changed little in two thousand years.[15]'

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[13] Ottaway, (1992), 615
[14] Goodall, (1990) b 331
[15] Evans (1958)95

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8.8. Appendix 8: Site archive

Table …. Site Archive (Basic) Summary			
Site Name: Derrinsallagh 4		Record No.: E2180 – Scheme no.: A015/070	
Type	Description	Quantity	Notes
Contexts	Validated contexts from excavation	110	All contexts sheets have been checked and cross-referenced.
Plans	'A2' 1:50 (no. of sheets)	25	Field drawings
Sections	'A2' 1:10 (no. of sheets)	25	Sections and profiles
Photographs		48 rolls	Colour prints & CDs
Registers	Plan Register Photographic Register Finds Register Sample Register	1 1 1 1	All Registers have been checked and cross-referenced.
Diaries	Director's Diary	1	All Diaries have been checked and cross-referenced.
	Flots	44	

8.9 Appendix 9A: Metallurgical report

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Report 2008/23

Evaluation of Archaeometallurgical residues from the M7 Portlaoise to Castletown/M8 Portlaoise to Cullahill Motorway Scheme Contract 2: Derrinsallagh 4 (E2180)

Dr Tim Young
12th December 2008

Abstract

The Derrinsallagh 4 extension yielded approximately 3.3kg of residues from iron smelting. These were mainly within a furnace (believed to be C656 and C609), but some also occurred in pit C667.

The residues from within the furnace may have been dumped there, rather than being in situ. They include pieces of vitrified furnace wall suggestive of a furnace wall with a protruding or overhanging blowhole, similar to that postulated for furnace C397.

Contents

Methods

All investigated materials were examined visually, using a low-powered binocular microscope where necessary. All significant materials were summarily described and recorded to a database (Table 1). As an evaluation, the materials were not subjected to any high-magnification optical inspection, nor to any other form of instrumental analysis. The identifications of materials in this report are therefore necessarily limited and must be regarded as provisional.

Results

The residues are all either certainly iron smelting residues or are compatible with that origin. C660 contains a variety of residues, mainly associated with the blowing wall of the furnace (four pieces of vitrified wall from close to the blowhole) and slag formation near to that wall. The assemblage does not include the small scale slag pieces so typical of the lower parts of the pits of slagpit iron smelting furnaces (compare the assemblage from Derrinsallagh 5; Young 2008b). This could be due to a sampling bias, with a lack of collection of the smaller residue fragments from C660, but is perhaps more likely to be a genuine difference, perhaps suggesting the furnace was emptied, before large waste pieces were dumped into it.

The material from C660 includes what is probably the region of wall from close to an overhanging blowhole (as probably occurred in the late stage use of C397 and may have occurred in the earlier use too), together with some slags from the wall below.

The material from C659 includes “sinter” (a granular residue from the slagpit floor formed from ore dust and other materials falling through the charge), together with other blebby slags normally found on the slagpit floor, as well as flow slags which would have solidified within the fuel bed. This material is much more like a normal base-of-pit assemblage than that from the stratigraphically lower C660. This supports the idea that the residues were dumped into this furnace, rather than being in situ from its last smelt.

Pit fill C676 (Pit C667) yielded a sparse assemblage of smelting residues, all fine materials likely to have formed low in a slag pit furnace.

Interpretation

The interpretation of these deposits assumes contexts C659 and C660 are fills of both furnaces C656 and C609. In the context listing they are given as fills of C656 and C609.

These two furnaces are adjoining and have rather similar morphologies and the context descriptions of the fills are similar (despite the numbering).

Context 659 has a 14C date to the first centuries BC/AD, on ash charcoal. This appears to be a period of diversity in furnace construction, and the site records should be examined carefully to determine whether they reveal more about these furnaces than is currently apparent.

Both furnaces C656 and C609 are described as being rather elongate, which raises the possibility that they may have been furnaces with an arch, comparable to furnace C397 which was examined in detail (Young 2008b). In particular C659 is described as being “0.95m in length, 0.50m in width, and 0.30m in depth”, dimensions not too dissimilar to those of the furnace C397 excavated in detail.

The description of furnaces C609, C659 and C656 are described as brown fill. In both descriptions C660 is a lower dark, charcoal and slag-rich deposit.
The residue assemblage from C659 is mixture of various, possibly redeposit smelting residues. This is in agreement with the possibility of C659 as an upper, post-abandonment fill of the slagpit. C660 does not contain an assemblage typical of the lower fills of slagpits, and may indicate dumping of slag into the furnace on its abandonment.

Evaluation of potential

The residues from Derrinsallagh 4 as a whole represent a very important collection that is worthy of full retention and much detailed study. The material from the extension should be viewed as a small component of the whole. Further analysis would be best directed at good complete suites of slags left in situ in furnaces; this material may have been redeposited, and is therefore a much lower priority for further investigation.

It should be retained in full along with the remainder of the material from the site.

It is likely that these residues come from an arched furnace similar to C397.

References

YOUNG, T.P. 2008a. Evaluation of Archaeometallurgical residues from the M7/M8 Contract 2: Derrinsallagh 5 (E2181). *GeoArch Report 2008/24.*

YOUNG, T.P. 2008b. M7/M8 Contract 2. Detailed recording of furnace C397, Derrinsallagh 4 (E2180), *GeoArch Report 2008/34.*

F	sample	context wt	Wt	no	Notes
1	547	44	44	2	single piece of dense, probably flow-, slag, broken in 2
659	525	1400	422	48	flow slag, mainly in small blebby prills with small charcoal moulds
659	525		216	9	lining slags, gravelly
659	525		414	32	rusty sinter
659	525		84	9	dull blebs associated with sinter
659	525		82	18	fragments of clay and stones, many glazed and/or vesicular
659	525		60	1	slag formed of small prills with small charcoal moulds
659	525		116		bits and dust
660	535	1800	340	26	flow slag, blebby, small charcoal moulds
660	535		424	15	fragments of massive to prilly slag blocks - some with faces suggesting they originated adjacent to the wall
660	535		608	1	Block of lining 170 wide, 100 wide incurved densely vitrified pad, attached to small prilly slag cake extending 60 into hearth, curve suggests that the blowhole area was overhanging and curved – possible to interpret this as the base of a dome.
660	535		118	3	fired wall
660	535		306		dust and small bits
676	528	120	52	5	sintery material
676	528		44	5	well developed flow slag prills
676	528		24	1	dull flows on sintery material

Table 1: Summary catalogue of residues by context and sample

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54 Heol y Cadno,
Thornhill,
Cardiff,
CF14 9DY.

Mobile: 07802 413704
Fax: 08700 547366
E-Mail: Tim.Young@GeoArch.co.uk
Web: www.GeoArch.co.uk

REPORT 2:

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Report 2008/34

Detailed recording of furnace C397, Derrinsallagh 4 (E2180), M7 Portlaoise to Castletown/M8 Portlaoise to Cullahill Motorway Scheme Contract 2, Co. Laois

Dr Tim Young
20th December 2008

Abstract

Furnace C397 was lifted as a block with its underlying subsoil, following its partial excavation in the field. Detailed excavation of the block off-site has revealed new details of the construction of the furnace. It is not a simple "bowl furnace", but rather an evolved variety of the non-slag tapping slagpit furnace, featuring a furnace arch mainly or entirely below original ground level, connecting the furnace pit with an external working hollow. The base of the pit is below the level of the base of the arch, so it is clear the furnace was not designed to be able to tap slag, despite a similarity in design with slag-tapping furnaces. The sides of the arch and pit were formed of very carefully smoothed clay, but it is not clear if this was an applied lining, or made by wetting and smoothing the face of the original cut. The smooth face was very well preserved, showing use of the arch had been very careful.

The natural substrate was fired for some variable, but locally considerable, distance behind the face, and was deeply vitrified on the south side, with lines of vitrification and slagging developing in a concave manner, suggestive of a "burr" below a blowhole. Blowing at right angles to the arch is the most common configuration, and this probably indicates the manner in which the furnace was blown initially. However, later use of the furnace involved blowing from the side opposite the arch. The location of the blowhole on this wall was preserved as was the large slag cake in front of it. The final use of the furnace had developed a rather atypical slag block, which appears to have resulted from constriction and eventual occlusion of the blast by development of a slag "hood".

The total slag remaining in the furnace (some had been previously removed during its initial partial excavation) amounted to some 20.7kg relating to its late use and the early "burr" weighed 6.8kg. The rather complicated history of this furnace means that it is not the ideal furnace from which to calculate the amount of slag produced during a single smelt. However, a figure of 20kg is not too dissimilar to the few examples of complete slag productions that have been measured from broadly similar furnaces in Ireland.

Parallels for the style of furnace can be sought locally, with possibly similar furnaces at Derrinsallagh 3 (Furnace C819 and working hollow C640) and maybe at other sites on this scheme. Further east of the M7/N7 scheme other examples may occur. Outside the area, very close parallels can be drawn with the furnaces

from the Iron Age of N. Wales described, and reconstructed by Crew. The only major difference with Crew's reconstruction is that the Derrinsallagh example may have had overhanging wall, giving the furnace a domed or bottle shape.

Contents

Methods

This furnace had been approximately half-sectioned during its original excavation in the field, and a description based on this appears in the Prelim Report. In the prelim report the orientation of the furnace was wrongly recorded, with the cardinal points rotated by 90°, because the field plan was oriented with North to the right, not to the top as assumed.

The furnace had then been lifted from the site (on the advice of the archaeometallurgical specialist), supported by plastic wrapping and resting on a palette. The block had been in storage for some considerable time before examination, so was extremely dry, requiring extensive wetting in order to excavate further.

The stored block measured approximately 500mm N-S and 540mm E-W. Some subsidence had occurred during lifting, so that the originally horizontal top surface of the block was tilted towards the original South by about 10°. Drawings made of the furnace during examination are drawn to a "best fit" horizontal, for the original horizontal was not recorded on the block.

During examination, the lifted furnace was first thoroughly cleaned, before the remaining infill of the furnace was removed. The furnace structure, which had considerable adhering slag, was then sampled.

Results

The furnace cut was not located during the examination. The inner face of the pit was carefully smoothed, suggesting that the wall of the pit was formed of reworked or emplaced clay, but no certain differentiation of a cut was made, with the heavy overprinting of the thermal alteration precluding recognition of subtle changes in the clay. Stone clasts from the natural boulder clay protruded slightly into the base of the pit, indicating that this at least was not lined. On balance of probabilities it is felt that the cut was probably very close to the final pit form, with the cut surface carefully smoothed, rather than there being any considerable thickness of lining, but this point is uncertain.

The basal pit was shown to be not a circular structure as originally described, but a “figure of eight” shape, with the truncation produced by the lifting cutting the structure across the “waist”. The main section of the pit had a gently concave base (modified slightly by the stones protruding from the natural boulder clay below), with slightly angular breaks of slope at the foot of the walls. The lowest point on the base, offset towards the North side, lies at about 340mm below the level of truncation. Where the walls had not reacted, or become coated in slag, they were carefully formed, with a smooth surface formed of clay slurry, and with a slightly overhanging orientation.

The lower section of the pit appears to have sub-circular, with a diameter of approximately 360mm. The level of truncation was probably close to the original ground level, at which the furnace appears to have been approximately 320mm diameter. The overhang on the sides was particularly marked to North and East, that to south being altered by a slag-filled embayment (see below).

To the west side of the preserved pit, the “waist” area had a floor at about 200mm below truncation, with markedly angular breaks of slope at the bottom of the overhanging walls. The waist was about 260mm wide on the floor at its narrowest and 220mm wide at the level of truncation.

Heat-produced alteration of the silty clay surrounding the pit (as mentioned above, the equation of the furnace pit with the original cut is not quite certain, so these altered clays probably include mainly natural, with a superficial skim of reworked clay) was quite complex. At the level of truncation a marked oxidised halo extended about 30mm from the pit margin, although on the eastern side of the furnace this was truncated by the cutting of the lifted block. The oxidised halo was fairly superficial, and thinned rapidly with depth, with the lower walls of the pit showing little alteration apart from mild baking. The base of the pit had a variable reddened skim, which seemed particularly marked near the natural stones in the pit floor.

On the south side of the furnace there was a strong and wide reduced-fired alteration in an arcuate form around the early burr. Elsewhere a zone of reduced-firing extends beneath those sections of pit wall with adhering slag.

The margins of the late blowhole were fired to a strongly oxidised red-orange as would be expected in this location.

The observed infill of the furnace comprised five main components:

1. The basal section of the pit was filled by a poorly-compacted charcoal-rich dark deposit. This is equivalent to c451 of the site records. This deposit was probably up to about 120mm thick in the furnace pit, extending and thinning into the "waist", where it was approximately 70mm thick.

2. A second charcoal-rich deposit overlay c451. This was equivalent to c450 of the site records. This material was very rich in slag fragments. Most of the deposit had been removed in the original excavation. The western edge of the deposit was a line forming the continuation of the sub-circular pit margin across the "waist". The slag did not continue into the waist, where the fired clay deposit (c402) lay directly on c451.

3. The uppermost remaining fill of the pit was a well compacted deposit of fired clay, mainly oxidised-fired and often forming large planar slabs. This material was c403 of the site records. Much of this deposit had been removed from the furnace during the initial excavation. The deposit included several large slabs of fired clay, which were inclined into the pit. These would appear to represent fragments of the furnace superstructure which fell internally during degradation. One particularly substantial slab lay across the boundary between the furnace pit and the "waist", in a position corresponding to the limit of c451; it is just conceivable that this was a deliberately-placed slab to block the arch during the last use of the furnace.

4. To the east side of the pit was a major (approximately 15kg) dark-coloured slag mass attached to the wall. Full description of this mass must await its future detailed investigation. The upper, outer, side of the mass contained what appears to be the location of the blowhole. A strongly oxidised lower margin leads to a hole 75mm wide by 30mm high, connected to an internal cavity dipping at 30-40° into the slag mass.

The mass extends 200mm into the furnace (reaching the centre of the sub-circular pit) and extends laterally over a distance of approximately 240mm. The block thus subtends an angle approximately 120° from the centre of the pit. The mass has a fairly smooth planar central upper surface approximately 65mm wide which dips down into the furnace above the central cavity. The lateral faces of the mass dip more steeply and form webs onto the furnace sides in both directions.

On the lateral walls of the pit slag totalling 4.6kg was attached around to an angle of 50° to the blowing axis on either side; the gap without attached slag is centred on, but not quite symmetrical with, the gap into the “waist”. The lower part of the slag layer attached to the walls thickens downwards before terminating abruptly at a level 160-200mm below the truncation surface. This level is probably equivalent to the base of c450.

These slags form part of the material referred to as c452 in the site records.

5. Parts of the southern and eastern sides of the pit show intense vitrification of the pit wall close to the truncation surface. The vitrification appears as a paler grey material than the slag described in (4) above. Distinction between in-situ vitrification of the wall and adhering pale slags is difficult, and should be resolved in future analytical investigations. This vitrification extends to a maximum depth of about 15mm into the wall on the east side of the pit, but to the south of the pit there is a more complex situation where the vitrified material appears to be up to 20mm thick on either side of an embayment in the wall 240mm wide and 80mm deep. The embayment is filled with a dense pale slag, with some concentric featuring on the flat upper surface. The total weight of this slag block is approximately 6.5kg.The precise form of the lower part of the slag here is not known, but would be revealed by sectioning of the sampled material. The embayment represents the zone of strong reaction with the furnace wall seen immediately below the blowhole; a reaction zone which typically generates a dense, coarse-grained slag referred to as the “burr”.

The site records indicate that a further fill (c449) existed, forming a shallow (sag?) fill over the abandoned furnace, but there were no remnants of this in the lifted block.

Interpretation

The furnace was interpreted in the field as a circular “bowl furnace”. Following this examination, that interpretation is no longer tenable. The “circular bowl” has been shown to be approximately half of a figure of eight structure. The “waist” of the structure shows incurving sides, and may be reconstructed as a furnace arch. The arch would have been 240-280mm high and 200mm wide, with its top approximately 40mm above the truncation surface. The finely-preserved smooth internal face of the arch suggests that it received little damage in use (or had been recently repaired). This suggests in turn that any arch-blocking was more external to the furnace and also that this part of the furnace must have remained relatively cold.

The furnace pit can be interpreted as the basal pit of a non-slag tapping furnace, of a kind commonly referred to as a slagpit furnace. The floor of the arch lies at a level 160mm above the base of the slagpit, so tapping the furnace would not have been possible.

The working hollow outside the furnace was not recognised as such during the initial excavation, but is represented by "spread" c402 and possibly also spread c401. The extension of c451 into the furnace arch raises the possibility that it was originally contiguous with, and therefore the external charcoal rich spread c402. The base of c402 should be viewed as part of cut c397. Cut c397 therefore has an overall length (NW-SE) of approximately 1.15m.

The recognition of a slagpit furnace with a furnace arch is highly significant. Such furnaces have been suspected elsewhere previously, but the evidence from Derrinsallagh 3 is unequivocal. The presence of an arch is an indicator that furnace cleaning and repair was not possible through the superstructure. Experimental work has shown the significance of access to the furnace for slag clearance and repair; the interior of the furnace must be reachable, it must all lie within an arm's length. Once the shaft reaches a critical height, approximately 600mm, it becomes impossible to repair the furnace although some repair of the blowhole area is likely to be required after each smelt (Crew 1991). A furnace arch is one solution to this (a removable tuyère block is another). A large furnace arch also facilitates removal of large slag blocks and possibly also removal of the bloom itself.

The reconstruction of the superstructure of this furnace is problematic because of the lack of large sections of fired ceramic. Several other sites have produced sections of vitrified furnace with a convex vitrified face, but particularly in this context the material from the Derrinsallagh 4 extension should be mentioned (Young 2008). The vitrified material from c660 could be interpreted as a blowhole within an overhanging wall, which is very reminiscent of the situation in c397.

The pit of c397 has markedly overhanging sides and the question is to what extent that curve continued above the level of truncation. Without sectioning the blowhole on the east side it is difficult to be certain, but it would appear that the blowhole was on an overhanging section. Continuation of the overhang above the blowhole would be unlikely, since the hot-zone of the furnace would impinge on the wall and be likely to cause extreme damage.

There is little direct evidence for the thickness of the walls of the furnace. The curvature of the walls of the arch suggest, despite being incompletely known, that the wall here was perhaps 100mm in thickness, and a broadly similar thickness is suggested by the width of the zone between the cut of c397 and the limit of spread c406 to the east.

Pleiner (2000) illustrated several examples of slagpit furnaces with overhanging pit sides, but with a straight shaft above. The advantages of such geometry would be likely to include minimising the contact between descending slag and pit wall, to make it easier to clear the pit after use.

The collapsed material in this furnace was mainly on the less altered (unvitrified) side of the furnace and it is unclear whether the planar slabs were originally so, or had been compressed flat. Planar vitrified material was recorded within the present scheme at Clonrud 4 (Young 2008e).

Quite apart from the preservation of the furnace arch, this furnace is remarkable for its evidence of a change in blowing orientation during the lifespan of the furnace. The final use of the furnace entailed blowing through the blowhole on the southeast side of the furnace, opposite to the furnace arch. This final phase of use left 21kg of slag, mainly attached to the furnace walls (plus any slag removed from the furnace during its initial excavation; material which has not yet been traced). The main slag mass in the furnace is of very unusual form. It has neither the form of a typical smelting slag cake (sometimes called a furnace bottom), for which good examples are known from sites such as Tullyallen 6 (Young 2003a) and Adamstown (Young 2006), but is equally not typical smithing slag.

The downward deflection of the air blast into a slag tube is commonly seen (author's personal observation) when a smelt produces too much slag on the blowing wall, which descends over the air inlet and chills against the incoming cool air forming a slag hood. Once the air flow into the furnace is impeded a vicious circle is set up in which the reaction becomes concentrated into a smaller area and the build-up of slag in the blowing area is encouraged.

Once the air supply becomes completely occluded (as probably happened here), the temperature of the furnace will fall rapidly and the reaction halts. In this case, it would appear that the slagging of the furnace was too severe to be deemed worth cleaning and it was abandoned. What is not currently clear (but might be determined with sectioning of the main slag mass), is whether the furnace had ever been worked successfully in this configuration. The accumulation of slag around the pit walls terminated downwards at the top of the charcoal layer c451. This suggests that c451 was a deposit left in the furnace from previous smelting. It is unclear if the wall slags were all from the last smelt, but it is possible that they were.

The late axial blowing of the furnace replaced a more conventional earlier configuration with blowing from the south, at approximately right-angles to the furnace arch. In this configuration a deep burr developed, which was left in place when the furnace was reoriented. The deep vitrification around the burr suggests sustained use, but it is unknown how much use the furnace had before being realigned.

Discussion

The detailed understanding of non-slag tapping furnaces in Ireland is progressing only slowly. It is clear that these slagpit furnaces were really quite diverse in detail, but very few have been examined in sufficient detail to permit either the determination of their morphology or the development of a typology.

Parallels for the style of furnace can be sought locally, with possibly similar furnaces at Derrinsallagh 3 (Furnace C819 and working hollow C640; Young 2008c) and maybe at other sites on this scheme. Further east of the M7 Portlaoise to Castletown/M8 Portlaoise to Cullahill Motorway Scheme other examples may occur (Cappakeel West and Morrett; Young 2005). Outside the area, very close parallels can be drawn with the furnaces from the Iron Age of N. Wales described, and reconstructed by Crew (Crew 1987, 1989, 1991, 1998). The only major difference with Crew's reconstruction is that the Derrinsallagh 4 furnace has overhanging pit sides and may have had an overhanging lower wall, giving the furnace a domed or bottle shape.

Pleiner (2000; p. 149) classed as "small" those slagpit furnaces with slagpit diameters of "35-40cm producing 20-25kg of slag". This weight of slag appears quite typical for early furnaces in Ireland (Derryvorrigan 1 c092 – c21kg, Young 2008d; Tullyallen 6 – 17.5kg, Young 2003a; Adamstown 1 - 18.6kg, Young 2006). However, even if the Irish furnaces in similar in capacity, they appear to be very different in detailed morphology, particularly during the Iron Age. Moderate diameter furnaces with arches appear to be just one variety in use (as Derrinsallagh 4 c397) – with wider furnaces with no arch (Tullyallen 6, Adamstown 1), and paired furnaces (Clonrud 4, Derryvorrigan 1?, Derrinsallagh 4?) of variable diameter also being common.

The large amount of information gained from this furnace, in terms of its morphology , the presence of an arch, and in terms of its reorientation with two successive blowing orientations, is considerable. The results form a stark contrast with the typical field description of such features, which are usually schematic and superficial.

Evaluation of potential

The effort of lifting this furnace and its subsequent detailed examination has paid great dividends and the proposal for lifting the furnace is to be applauded.

This furnace now represents one of the best-documented furnaces known from Ireland and it goes a long way to establishing the morphology of at least one of the furnace types in use in Iron Age. It is clear that multiple variants of the slagpit furnace were employed, and old models of the "bowl furnace" (Scott 1990) can be abandoned as previously proposed (e.g. Young 2003b).

A thorough analytical examination of the slags from this furnace would be highly desirable, given the detailed understanding of furnace morphology. Detailed investigation of multiple slag samples to understand the reactions taking place and their spatial relationships is recommended.

To pursue this level of understanding it is highly desirable that the slags removed from the initial partial clearance of the furnace are located and retrieved to be reunited with the new collections, so that the slag assemblage can be understood in its entirety.

Appendix 1: Description in the style of the stratigraphic report

C397: cut of the basal pit of a complex slagpit furnace. The cut is figure-of-eight in plan, with the eastern section of the pit corresponding to the original field interpretation of C397 (sub-circular, 0.40m diameter), but in addition there was a further, shallower pit to the NW, filled with context C402 as well as C403, and possibly C401. The two pits were connected via a narrow waist 0.2m wide, corresponding to the furnace arch. The precise shape of the NW part of the cut is unknown, but it would appear to have been approximately 0.45m wide (SW-NE). The overall length (NW-SE) of C397 was probably approximately 1.15m. **C397** was one of a complex of features that included **C398, C399**, and **C400**. **C397** was cut into **C003**, and filled by seven deposits **C401, C402**, **C451, C450, C452**, **C403**, and **C449**. The natural was variously altered to **C404**, a well compacted orangey-red oxidised clay or to reduced and variably vitrified material **C405**, which both formed incomplete zones around the outside of **C397** The first deposit was **C451** a loosely compacted black charcoal-rich silt. It measured at least 0.52m in length (extending outside the lifted block and may have been equivalent to **C402**), 0.40m in width, and 0.12m in depth. The second deposit was **C450** loosely compacted black very coarse mixed slag-rich silt. It was restricted to the eastern section of the cut and measured 0.34m in length, 0.40m in width, and 0.10m in thickness. The third deposit **C452** was a mass greyish-black slag attached to the southern and eastern walls of the eastern section of **C397** and extending up to 0.20m into the pit and was up to 0.20m thick. The fourth deposit **C403** was well compacted orange oxidised sandy-clay, with frequent red oxidised clay lumps. It measured 0.60m east-west, 0.32m north-south, and 0.10m in thickness. **C403** may have been the remains of the collapsed superstructure of **C397**. The fifth and uppermost deposit in the eastern section was **C449** a well compacted medium brown clay with occasional charcoal inclusions. It measured 0.22m in length, 0.28m in width, and 0.03m in depth. **C402** was the lower fill of the shallow NW part of the **C397** and was possibly equivalent to **C451**. **C401** was a spread, or fill of C397 lying to the west of **C402**.

C397	Cut of the basal pit of a complex slagpit furnace. The cut is figure-of-eight in plan, with the eastern pit corresponding to the field interpretation of C397, but in addition there was probably a further, shallower pit to the NW, filled with context C402 as well as C403, and possibly C401, linked to the eastern pit via a narrower "waist". The precise shape of the NW part of the cut is unknown but was probably 0.45m wide and extended about 0.70m to the NW of the narrow central section. The narrow waist was 0.20m deep, 0.20m wide and 0.10-0.15m long. The SE pit measured 0.38m east-west, 0.40m north-south, 0.34m in depth. The eastern

	section of the cut has a sharp break of slope at top, more gradual at base, concave sides, locally overhanging, and a slightly concave base. The central waist has steep overhanging sides with an abrupt break of slope onto a sub-horizontal base. C397 was one of a complex of features that included C398, C399, and C400. Cut into C003 (locally oxidised to C404 and vitrified to C405), filled by C451, C450, C452, C403, C449.
C404 (natural)	Oxidised fired clay in surrounds of C397. Probably mainly altered in-situ natural (C003) although some finishing of the cut with soft clay may have been undertaken. Well compacted orangey-red oxidised clay. Measured 0m-0.05m in width, 0.05m in depth. C404 formed an incomplete ring around the outer extent of C397. Particularly prominent on the SE side of the cut. Above C003, under C405.
C405 (natural)	Reduced fired/vitrified clay in surrounds of C397, together with its locally vitrified surface, well-indurated green-brown vitrified clay. C405 formed an irregular incomplete ring around the outer extent of C397, and was widest on its west side where it measured 0.05m - 0.08m in width. The context may be largely altered natural, although it may include some material that was sufficiently molten to have flown down the wall. Above C404, under C451.
C451	Lower deposit of C397, loosely compacted black charcoal-rich silt. Forms the lowest fill in C397 and extends across the eastern pit and the waist. May correspond to C402 in the W pit. Measured at least 0.52m in length, 0.40m in width, 0.12m in depth. Above C405 and C403, under C452.
C450	Deposit of C397, loosely compacted black very coarse mixed slag-rich silt lying in the central part of the eastern pit. Measured 0.34m in length, 0.40m in width, and 0.10m in depth. Above C451, under C403.
C452	Deposit of C397. Slag attached to the eastern and southern walls of the eastern pit. Occupies an irregular area 0.40m long by 0.20m wide and up to 0.20m thick. Above C451, under C403.
C403	Deposit of C397, well compacted orange oxidised sandy-clay, with frequent red oxidised clay lumps. Measured 0.60m NW-SE, 0.32m NE-SW and up to 0.12m in thickness. C403 may have been the part of the collapsed superstructure of C397. Above C452 and C451, under C449.
C449	Upper deposit of C397. Well compacted medium brown clay with occasional charcoal inclusions. Measured 0.22m in length, 0.28m in width, 0.03m in depth. Above C403, under C002.

In addition I would recommend that spread C402, and possibly spread C401, should be considered as fills of the working hollow section of C397.

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Figure Captions

Figure 1: Plan and sections of furnace c397

Figure 2: Plan of furnace c397 superimposed on pre-excavation plan #232, showing the suggested outline of the furnace and its working hollow, as indicated by the adjacent spreads.

Figure 3: Tentative longitudinal (a) and transverse (b) sections of the furnace as it might have been in use. Both successive blowholes are shown – the early one in (b) would not have been open during the later use of the furnace using the axial blast (a).

GeoArch

geoarchaeological, archaeometallurgical & geophysical investigations

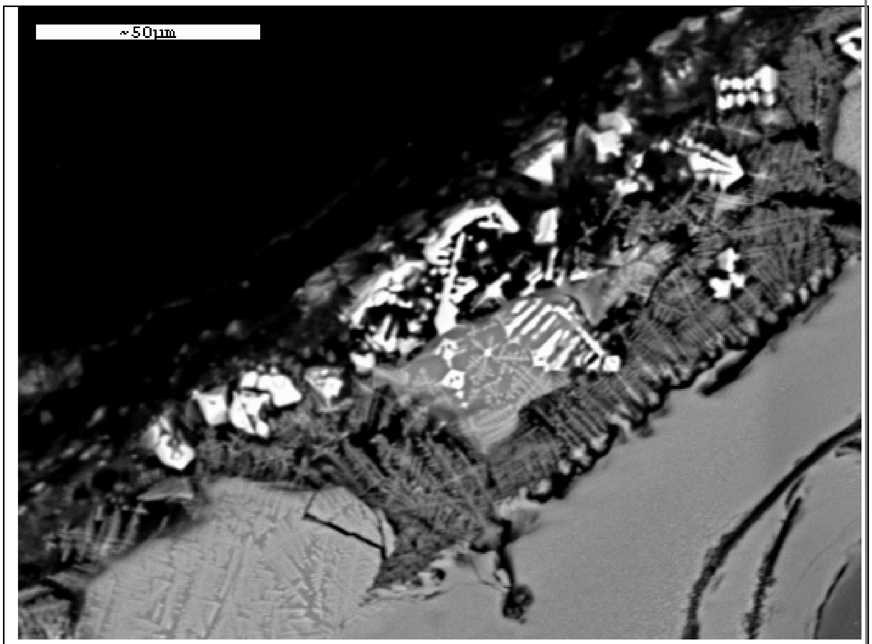
54 Heol y Cadno,
Thornhill,
Cardiff,
CF14 9DY.

Mobile: 07802 413704
Fax: 08700 547366
E-Mail: Tim.Young@GeoArch.co.uk
Web: www.GeoArch.co.uk

SCOTTISH ANALYTICAL SERVICES FOR ART & ARCHAEOLOGY

Derrinsallagh 4, Co. Laois, Eire

'Soft Archaeology' Characterisation



SASAA 204.3

This report has been commissioned by ACS Ltd, Ireland.

Cover photo shows Sample 204.3.201B, vitrified furnace lining (photo by SASAA).

7 Belgrave Terrace,
Glasgow, G12 8JD,
Scotland, UK
Tel/fax: +44(0)141 337 2623
Email: enquiries@sasaa.co.uk
Web: www.sasaa.co.uk

Derrinsallagh 4, Co. Laois, Eire

'Soft Archaeology' Characterisation

Prepared by:
Dr L Wilson and Dr E Photos-Jones, in accordance with SASAA standard procedures.

SASAA 204.3
Scottish Analytical Services for Art & Archaeology
Glasgow, Scotland, UK
June 2006

Derrinsallagh 4, Co. Laois, Eire
'Soft Archaeology' Characterisation

Synopsis

SASAA 204.3 *represents the third in a series of interim reports aimed at the investigation of aspects of industrial and domestic activity within the site based on the technical characterisation of materials and features within. Following the acquisition of C-14 dates by ACS Ltd., the interim reports will be collated to create a coherent story regarding the site and the activities within.*

The interim reports in the series:
204.1 *– Derrinsallagh 4, Co. Laois, Eire. In-Situ Magnetic Susceptibility Data: Preliminary Report*
204.2 - *Derrinsallagh 4, Co. Laois, Eire. Geoarchaeological reconnaissance during a one day visit at the above site and surrounding area , 13th February 2006: Preliminary Report*
204.3 – *Derrinsallagh 4, Co. Laois, Eire. 'Soft Archaeology' Characterisation*
204.4 - *Derrinsallagh 4, Co. Laois, Eire. Iron Ore Sourcing*
204.5 – *Derrinsallagh 4, Co. Laois, Eire. Analysis of Metallurgical Waste*

By ***'Soft archaeology'*** *we refer to the soils and features within as well as the recording, sampling and technical characterisation thereof. Soft archaeology can be examined independently and it compliments data generated by the examination of 'hard archaeology,' which includes buildings, structures and installations. Derrinsallagh 4 is primarily a site with soft archaeology; the furnaces are embedded within the soils and they are constituted from local materials. In this report two samples of furnace walls are appraised, with a fuller report on the furnaces and the metallurgical waste in general to be given in SASAA 204.5. These fragments of furnace walls, provide an insight into how local materials have been adapted/ enhanced to generate 'new' materials able to respond to the tasks required.*

1 Aim and Objectives

Aim

To characterise the 'soft archaeology' of the site at Derrinsallagh 4, Co. Laois (Figure 1), for the purpose of assessing evidence for domestic activity within the site. By 'soft archaeology', we refer to soils and the features within such as the cuts made for the primitive bowl furnaces, as well as their walls and wall linings.

Objectives

- Phosphate and organic matter analysis and pH measurement
- SEM-EDAX examination of furnace walls/wall linings.

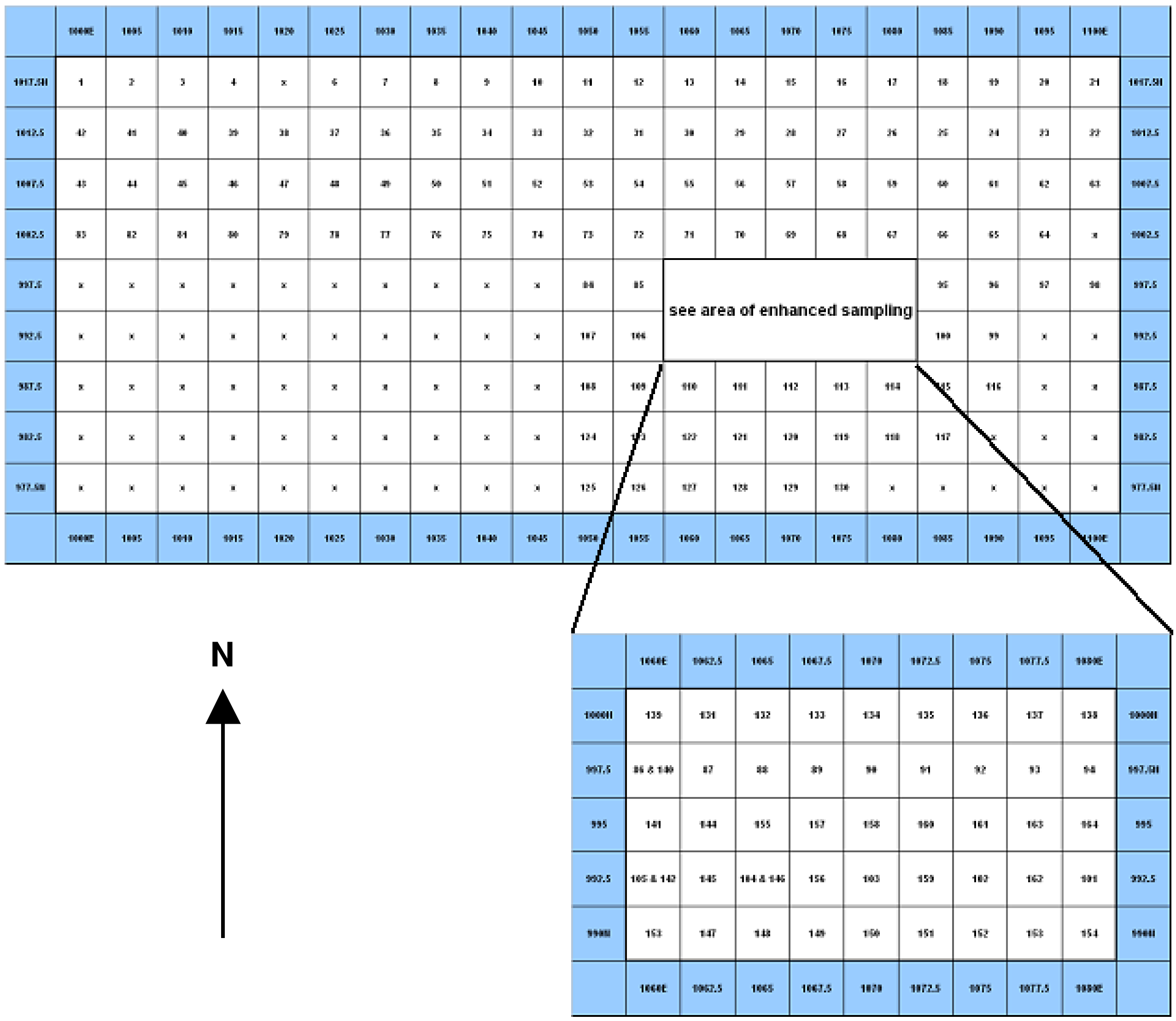


Figure 1. Derrinsallagh 4 site grid plan (based on hand-drawn version provided by ACS Ltd.). "Area of enhanced sampling" corresponds to "pattern of furnaces area" in hand-drawn notes. However, as furnaces are scattered throughout the site, SASAA have amended this accordingly. N.B. Numbers refer to samples taken. x = point not sampled.

2 Methodology

2.0 Sample List

The majority of samples were taken at regular intervals across a site grid, 5m apart by the ACS Ltd. team (Figure 1 and Table 1). A few additional samples were taken by SASAA whilst on site (Table 2).

SASAA received the following samples for analysis:

- 163 soil samples for PO_4, pH and organic content analysis, sampled from regular intervals across the site grid (5m intervals).
- 1 kubiena tin for micromorphological analysis, sampled from a ditch profile.
- 2 'bog' iron ore samples.
- 3 samples of furnace wall/wall lining.
- 6 other soil samples – of notable interest to SASAA (charcoal spreads and furnace material).

Table 1. Sample list and related analyses.

ACS Sample No.	Sample Coordinates	Description	Analysis	SASAA Lab No.
1	1017.5N 1000E	soil	PO_4, pH, organic matter	**204.3.73**
2	1017.5N 1000E	soil	PO_4, pH, organic matter	**204.3.8**
3	1017.5N 1010E	soil	PO_4, pH, organic matter	**204.3.4**
4	1017.5N 1015E	soil	PO_4, pH, organic matter	**204.3.2**
6	1017.5N 1025E	soil	PO_4, pH, organic matter	**204.3.71**
7	1017.5N 1030E	soil	PO_4, pH, organic matter	**204.3.40**
8	1017.5N 1035E	soil	PO_4, pH, organic matter	**204.3.66**
9	1012.5N 1065E	soil	PO_4, pH, organic matter	**204.3.25**
10	1017.5N 1045E	soil	PO_4, pH, organic matter	**204.3.57**
11	1017.5N 1050E	soil	PO_4, pH, organic matter	**204.3.5**
12	1017.5N 1055E	soil	PO_4, pH, organic matter	**204.3.6**
13	1017.5N 1060E	soil	PO_4, pH, organic matter	**204.3.39**
14	1017.5N 1065E	soil	PO_4, pH, organic matter	**204.3.30**
15	1017N 1070E	soil	PO_4, pH, organic matter	**204.3.7**
16	1017.5N 1075E	soil	PO_4, pH, organic matter	**204.3.82**
17	1017N 1080E	soil	PO_4, pH, organic matter	**204.3.1**
18	1017.5N 1085E	soil	PO_4, pH, organic matter	**204.3.37**
19	1017.5N 1090E	soil	PO_4, pH, organic matter	**204.3.3**
20	1017.5N 1095E	soil	PO_4, pH, organic matter	**204.3.36**
21	1017.5N 1100E	soil	PO_4, pH, organic matter	**204.3.10**
22	1012.5N 1100E	soil	PO_4, pH, organic matter	**204.3.59**
23	1012.5N 1095E	soil	PO_4, pH, organic matter	**204.3.11**
24	1012.5N 1090E	soil	PO_4, pH, organic matter	**204.3.14**
25	1012.5N 1085E	soil	PO_4, pH, organic matter	**204.3.106**
26	1012.5N 1080E	soil	PO_4, pH, organic matter	**204.3.15**
27	1012.5N 1075E	soil	PO_4, pH, organic matter	**204.3.12**
28	1012.5N 1070E	soil	PO_4, pH, organic matter	**204.3.13**
29	1012.5N 1065E	soil	PO_4, pH, organic matter	**204.3.9**
30	1012.5 1060E	soil	PO_4, pH, organic matter	**204.3.17**
31	1012.5N 1055E	soil	PO_4, pH, organic matter	**204.3.16**
32	1012.5N 1050E	soil	PO_4, pH, organic matter	**204.3.80**
33	1012.5N 1045E	soil	PO_4, pH, organic matter	**204.3.60**

34	1012.5N 1040E	soil	PO_4, pH, organic matter	**204.3.48**
35	1012.5N 1035E	soil	PO_4, pH, organic matter	**204.3.43**
36	1012.5N 1030E	soil	PO_4, pH, organic matter	**204.3.33**
37	1012.5N 1025E	soil	PO_4, pH, organic matter	**204.3.54**
38	1012.5N 1020E	soil	PO_4, pH, organic matter	**204.3.47**
39	1012.5N 1015E	soil	PO_4, pH, organic matter	**204.3.111**
40	1012.5N 1010E	soil	PO_4, pH, organic matter	**204.3.90**
41	1012.5N 1005E	soil	PO_4, pH, organic matter	**204.3.79**
42	1012.5N 1000E	soil	PO_4, pH, organic matter	**204.3.86**
43	1007.5N 1000E	soil	PO_4, pH, organic matter	**204.3.101**
44	1007.5N 1005E	soil	PO_4, pH, organic matter	**204.3.81**
45	1007.5N 1010E	soil	PO_4, pH, organic matter	**204.3.70**
46	1007.5N 1015E	soil	PO_4, pH, organic matter	**204.3.19**
47	1007.5N 1020E	soil	PO_4, pH, organic matter	**204.3.34**
48	1007.5N 1025E	soil	PO_4, pH, organic matter	**204.3.87**
49	1007.5N 1030E	soil	PO_4, pH, organic matter	**204.3.68**
50	1007.5N 1035E	soil	PO_4, pH, organic matter	**204.3.35**
51	1017.5N 1050E	soil	PO_4, pH, organic matter	**204.3.63**
52	1007.5N 1045E	soil	PO_4, pH, organic matter	**204.3.38**
53	1007.5N 1050E	soil	PO_4, pH, organic matter	**204.3.94**
54	1007.5N 1055E	soil	PO_4, pH, organic matter	**204.3.22**
55	1007.5N 1055E	soil	PO_4, pH, organic matter	**204.3.88**
56	1007.5N 1065E	soil	PO_4, pH, organic matter	**204.3.18**
57	1007.5N 1070E	soil	PO_4, pH, organic matter	**204.3.24**
58	1007.5N 1075E	soil	PO_4, pH, organic matter	**204.3.104**
59	1007.5N 1080E	soil	PO_4, pH, organic matter	**204.3.32**
60	1007.5N 1085E	soil	PO_4, pH, organic matter	**204.3.46**
61	1007.5N 1090E	soil	PO_4, pH, organic matter	**204.3.85**
62	1007.5N 1095E	soil	PO_4, pH, organic matter	**204.3.20**
63	1007.5N 1100E	soil	PO_4, pH, organic matter	**204.3.64**
64	1002.5N 1095E	soil	PO_4, pH, organic matter	**204.3.42**
65	1002.5N 1090E	soil	PO_4, pH, organic matter	**204.3.76**
66	1002.5N 1085E	soil	PO_4, pH, organic matter	**204.3.99**
67	1002.5N 1080E	soil	PO_4, pH, organic matter	**204.3.107**
68	1002.5N 1075E	soil	PO_4, pH, organic matter	**204.3.163**
69	1002.5N 1070E	soil	PO_4, pH, organic matter	**204.3.55**
70	1002.5N 1065E	soil	PO_4, pH, organic matter	**204.3.110**
71	1002.5N 1060E	soil	PO_4, pH, organic matter	**204.3.109**
72	1002.5N 1055E	soil	PO_4, pH, organic matter	**204.3.114**
73	1002.5N 1050E	soil	PO_4, pH, organic matter	**204.3.65**
74	1002.5N 1045E	soil	PO_4, pH, organic matter	**204.3.45**
75	1002.5N 1040E	soil	PO_4, pH, organic matter	**204.3.89**
76	1002.5N 1035E	soil	PO_4, pH, organic matter	**204.3.95**
77	1002.5N 1030E	soil	PO_4, pH, organic matter	**204.3.112**
78	1002.5N 1025E	soil	PO_4, pH, organic matter	**204.3.21**
79	1002.5N 1020E	soil	PO_4, pH, organic matter	**204.3.84**
80	1002.5N 1015E	soil	PO_4, pH, organic matter	**204.3.44**
81	1002.5N 1010E	soil	PO_4, pH, organic matter	**204.3.77**
82	1002.5N 1005E	soil	PO_4, pH, organic matter	**204.3.67**
83	1002.5N 1000E	soil	PO_4, pH, organic matter	**204.3.51**
84	997.5N 1050E	soil	PO_4, pH, organic matter	**204.3.96**
85	997.5N 1050E	soil	PO_4, pH, organic matter	**204.3.98**
86	997.5N 1060E	soil	PO_4, pH, organic matter	**204.3.161**
87	997.5N 1062.5E	soil	PO_4, pH, organic matter	**204.3.137**
88	997.5N 1065E	soil	PO_4, pH, organic matter	**204.3.141**
89	997.5N 1067.5E	soil	PO_4, pH, organic matter	**204.3.152**
90	997.5N 1070E	soil	PO_4, pH, organic matter	**204.3.159**
91	997.5N 1065E	soil	PO_4, pH, organic matter	**204.3.160**

92	997.5N 1075E	soil	PO_4, pH, organic matter	**204.3.153**
93	997.5N 1077E	soil	PO_4, pH, organic matter	**204.3.148**
94	997.5N 1080E	soil	PO_4, pH, organic matter	**204.3.162**
95	997.5N 1085E	soil	PO_4, pH, organic matter	**204.3.72**
96	997.5N 1090E	soil	PO_4, pH, organic matter	**204.3.103**
97	997.5N 1095E	soil	PO_4, pH, organic matter	**204.3.92**
98	997.5N 1065E	soil	PO_4, pH, organic matter	**204.3.113**
99	992.5N 1090E	soil	PO_4, pH, organic matter	**204.3.27**
100	992.5N 108.5E	soil	PO_4, pH, organic matter	**204.3.91**
101	992.5N 1080E	soil	PO_4, pH, organic matter	**204.3.139**
102	992.5N 1075E	soil	PO_4, pH, organic matter	**204.3.135**
103	992.5N 1040E	soil	PO_4, pH, organic matter	**204.3.128**
104	992.5N 1065E	soil	PO_4, pH, organic matter	**204.3.158**
105	992.5N 1060E	soil	PO_4, pH, organic matter	**204.3.143**
106	992.5N 1055E	soil	PO_4, pH, organic matter	**204.3.61**
107	992.5N 1050E	soil	PO_4, pH, organic matter	**204.3.53**
108	987.5N 1050E	soil	PO_4, pH, organic matter	**204.3.62**
109	987.5N 1055E	soil	PO_4, pH, organic matter	**204.3.74**
110	987.5N 1060E	soil	PO_4, pH, organic matter	**204.3.52**
111	987.5N 1065E	soil	PO_4, pH, organic matter	**204.3.31**
112	987.5N 1070E	soil	PO_4, pH, organic matter	**204.3.50**
113	987.5N 1075E	soil	PO_4, pH, organic matter	**204.3.29**
114	1012.5N 1020E	soil	PO_4, pH, organic matter	**204.3.108**
115	987.5N 1085E	soil	PO_4, pH, organic matter	**204.3.69**
116	987.5N 1090E	soil	PO_4, pH, organic matter	**204.3.93**
117	1007.5N 1070E	soil	PO_4, pH, organic matter	**204.3.97**
118	982.5N 1080E	soil	PO_4, pH, organic matter	**204.3.78**
119	982.5N 1075E	soil	PO_4, pH, organic matter	**204.3.56**
120	982.5N 1070E	soil	PO_4, pH, organic matter	**204.3.102**
121	980N 1065E	soil	PO_4, pH, organic matter	**204.3.28**
122	982.5N 1060E	soil	PO_4, pH, organic matter	**204.3.49**
123	982.5N 1055E	soil	PO_4, pH, organic matter	**204.3.23**
124	982.5N 1050E	soil	PO_4, pH, organic matter	**204.3.75**
125	975.5N 1050E	soil	PO_4, pH, organic matter	**204.3.58**
126	977.5N 1055E	soil	PO_4, pH, organic matter	**204.3.26**
127	972.5N 1050E	soil	PO_4, pH, organic matter	**204.3.100**
128	972.5N 1065E	soil	PO_4, pH, organic matter	**204.3.83**
129	972.5N 1070E	soil	PO_4, pH, organic matter	**204.3.105**
130	977.5N 1075E	soil	PO_4, pH, organic matter	**204.3.41**
131	1000N 1062.5E	soil	PO_4, pH, organic matter	**204.3.134**
132	1000N 1062.5E	soil	PO_4, pH, organic matter	**204.3.130**
133	1000N 1067.5E	soil	PO_4, pH, organic matter	**204.3.119**
134	1000N 1070E	soil	PO_4, pH, organic matter	**204.3.125**
135	1000N 1072.5E	soil	PO_4, pH, organic matter	**204.3.145**
136	1000N 1072.5E	soil	PO_4, pH, organic matter	**204.3.146**
137	1000N 1077.5E	soil	PO_4, pH, organic matter	**204.3.154**
138	1000N 1080E	soil	PO_4, pH, organic matter	**204.3.118**
139	1000N 1060E	soil	PO_4, pH, organic matter	**204.3.151**
140	997.5N 1060E	soil	PO_4, pH, organic matter	**204.3.116**
141	995N 1060E	soil	PO_4, pH, organic matter	**204.3.150**
142	992.5N 1060E	soil	PO_4, pH, organic matter	**204.3.121**
143	900N 1060E	soil	PO_4, pH, organic matter	**204.3.127**
144	995N 1062.5E	soil	PO_4, pH, organic matter	**204.3.144**
145	992.5N 1062.5E	soil	PO_4, pH, organic matter	**204.3.157**
146	992.5N 1065E	soil	PO_4, pH, organic matter	**204.3.149**
147	990N 1062E	soil	PO_4, pH, organic matter	**204.3.129**
148	990N 1065E	soil	PO_4, pH, organic matter	**204.3.138**
149	990N 1067.5E	soil	PO_4, pH, organic matter	**204.3.117**

150	990N 1040E	soil	PO_4, pH, organic matter	**204.3.126**
151	990N 1072.5E	soil	PO_4, pH, organic matter	**204.3.140**
152	990N 1075E	soil	PO_4, pH, organic matter	**204.3.124**
153	990N 1077E	soil	PO_4, pH, organic matter	**204.3.147**
154	992.5N 1072.5E	soil	PO_4, pH, organic matter	**204.3.122**
155	995N 1065E	soil	PO_4, pH, organic matter	**204.3.132**
156	992.5N 1067.5E	soil	PO_4, pH, organic matter	**204.3.155**
157	995N 1067.5E	soil	PO_4, pH, organic matter	**204.3.115**
158	995N 1070E	soil	PO_4, pH, organic matter	**204.3.123**
159	992.5N 1072.5E	soil	PO_4, pH, organic matter	**204.3.131**
160	995N 1072.5E	soil	PO_4, pH, organic matter	**204.3.133**
161	995N 1075E	soil	PO_4, pH, organic matter	**204.3.136**
162	992.5N 1077E	soil	PO_4, pH, organic matter	**204.3.142**
163	995N 1077.5E	soil	PO_4, pH, organic matter	**204.3.156**
164	995N 1080E	soil	PO_4, pH, organic matter	**204.3.120**

Table 2. Additional sample list and related analyses.

SASAA Field No	Context	Description	Analysis	SASAA Lab No
1	5	Furnace wall lining	SEM-EDAX	**204.3.200**
2	439	furnace wall lining, N wall of ditch	SEM-EDAX, pH, in situ magnetic susceptibility	**204.3.201a, 204.3.201b**
3	435 W	charcoal spread	pH, in situ magnetic susceptibility	**204.3.202**
4	435 E	charcoal spread	pH, in situ magnetic susceptibility	**204.3.203**
5	436	charcoal spread	pH, in situ magnetic susceptibility	**204.3.204**
6	433	charcoal spread	pH, in situ magnetic susceptibility	**204.3.205**
7	428	furnace contents	pH, in situ magnetic susceptibility	**204.3.206**
8	429	furnace contents: brown/slaggy layer	pH, in situ magnetic susceptibility	**204.3.207**
9	429	furnace contents: black/charcoal layer	pH, in situ magnetic susceptibility	**204.3.208**
10	U/S	water 1, from above bog iron ore*: Gerry's field	pH, conductivity, total dissolved solids	**204.3.209**
11	U/S	water 2 from above bog iron ore*: Gerry's field	pH, conductivity, total dissolved solids	**204.3.210**
12	U/S	bog iron ore* 1: Gerry's field	pH, ICP-MS (forthcoming)	**204.3.211**
13	U/S	bog iron ore* 2: Gerry's field	pH, ICP-MS (forthcoming)	**204.3.212**
15	425	To be confirmed	micromorphology	**204.3.213**

***N.B.** By ‘bog’ iron ore, we refer to the iron-rich encrustations visible in the vicinity of the site and accumulating within ditches and at the boundaries between fields. Such encrustations have been reported elsewhere in the British Isles (Hall and Photos-Jones 1998). It is our working hypothesis that the features sampled in the course of this investigation may represent similar ones to those actually ‘harvested’ as ‘ore’ by the Derrinsallagh inhabitants. This hypothesis remains to be confirmed by further analysis (see SASAA 204.4, forthcoming).

2.1 Phosphate

Samples were prepared using a standard ignition-hydrochloric acid *total* phosphate extraction procedure (SASAA in-house method based on Murphy and Riley 1962). The procedure was repeated without ignition for *inorganic* phosphate determination. Phosphate concentrations were then measured colorimetrically, using a WPA Colorimeter. Quantification was achieved by analysis of a series of standards and construction of a calibration curve, against which unknown samples can be plotted and concentrations derived. *Organic* phosphate concentration was then calculated as the difference between total and inorganic components.

2.2 pH
$pH_{(H2O)}$ and conductivity in a 1:2:5 soil-water slurry were determined following a standard method (McGrath and Loveland 1992 and British Standard 2000b). Meter used: Hanna H1991300 combined pH, conductivity TDS and temperature meter.

2.3 Organic Matter
Organic matter was determined on a loss-on-ignition basis, following a standard method (Bascomb 1982).

2.4 SEM-EDAX
A number of samples have been prepared as polished blocks by grinding with a series of silicon carbide papers and polished with 6- and 3-micron diamond paste. Quantitative SEM-EDAX analyses are undertaken first on the entire surface of the polished block, and subsequently on each of the different mineralogical phases observed. Each phase contains, apart from the main constituent elements, a suite of other minor and trace elements. Two sets of analyses are needed. The first type (taken over a mean of three) is aimed to cover the analysis of the entire surface of the polished block and is considered to be representative of the composition of the sample as a whole. The second type is aimed at establishing the composition of each of the mineralogical phases observed and so at identifying the process that generated the sample under investigation. In both types of analyses only major and minor elements are recorded. The sensitivity of the analysis for most elements is c.0.2%.

2.5 Micromorphology
A sample was taken on site for soil micromorphological analysis using a kubiena tin. The sample was taken vertically through a soil profile of a ditch (context 425). This sample is currently undergoing processing for the preparation of soil slides. These slides will subsequently be examined microscopically to infer details on site formation, industrial/domestic activity and ditch infilling. Sample preparation for soil micromorphology is a lengthy process, and we expect to have results by August 2006. We shall forward micromorphological results as soon as they become available as an Appendix to this report (SASAA 204.3).

3 Results

3.1 Soil Chemistry
Table 3 and Figures 2-5 give the results of soil chemical analysis. In addition, Table 4 gives the results of soil features chemistry.

Table 3. Soil phosphate (total, inorganic, organic and % inorganic), organic content and pH.

ACS Sample No.	Total PO_4 (mg/kg)	Inorganic PO_4 (mg/kg)	Organic PO_4 (mg/kg)	Inorganic PO_4 (%)	Organic matter (% LOI)	pH	SASAA No.
1	51.89	13.57	38.32	26.15	7.43	5.81	204.3.73
2	14.95	4.53	10.41	30.33	4.32	5.72	204.3.8
3	20.11	17.87	2.24	88.87	4.08	5.68	204.3.4
4	29.86	18.56	11.30	62.14	4.32	5.48	204.3.2
6	45.19	4.72	40.47	10.44	3.51	5.64	204.3.71
7	40.80	9.16	31.64	22.44	4.37	5.50	204.3.40
8	22.27	4.57	17.70	20.52	2.88	5.67	204.3.66
9	42.29	4.09	38.20	9.67	7.79	5.74	204.3.25
10	40.25	9.20	31.05	22.86	1.82	5.48	204.3.57
11	46.19	17.80	28.39	38.53	5.83	5.46	204.3.5
12	55.80	13.64	42.16	24.44	6.04	5.58	204.3.6

13	54.43	17.68	36.75	32.48	3.50	5.69	204.3.39
14	30.69	17.57	13.13	57.24	4.29	5.62	204.3.30
15	51.13	8.35	42.78	16.33	6.14	5.47	204.3.7
16	45.14	4.51	40.63	10.00	4.51	5.71	204.3.82
17	35.77	9.11	26.66	25.46	5.90	5.65	204.3.1
18	30.55	8.53	22.02	27.91	5.03	5.57	204.3.37
19	35.33	17.37	17.95	49.18	5.27	5.46	204.3.3
20	30.34	12.94	17.40	42.64	3.91	5.88	204.3.36
21	35.14	8.82	26.32	25.09	3.69	5.64	204.3.10
22	26.33	4.61	21.72	17.51	2.51	5.74	204.3.59
23	35.85	4.24	31.61	11.83	5.91	5.53	204.3.11
24	42.49	8.49	34.01	19.97	8.06	5.60	204.3.14
25	36.47	21.80	14.67	59.77	5.45	5.53	204.3.106
26	30.39	13.76	16.63	45.27	5.71	5.48	204.3.15
27	36.08	13.07	23.01	36.22	5.71	5.60	204.3.12
28	32.15	12.32	19.83	38.31	10.00	5.59	204.3.13
29	56.99	13.67	43.32	23.98	7.05	5.52	204.3.9
30	25.43	8.84	16.59	34.78	5.45	5.19	204.3.17
31	36.13	8.94	27.20	24.73	6.28	5.60	204.3.16
32	22.93	9.05	13.88	39.46	4.58	5.72	204.3.80
33	225.47	8.82	216.66	3.91	3.02	5.60	204.3.60
34	49.99	13.36	36.64	26.71	4.20	5.59	204.3.48
35	36.84	13.34	23.50	36.21	6.06	5.44	204.3.43
36	19.59	13.14	6.46	67.04	2.65	5.71	204.3.33
37	31.98	13.36	18.62	41.79	4.13	5.61	204.3.54
38	35.49	28.57	6.92	80.50	3.54	5.74	204.3.47
39	22.62	22.62	0.00	100.00	5.31	5.42	204.3.111
40	18.43	18.01	0.42	97.71	7.45	5.71	204.3.90
41	18.12	0.00	18.12	0.00	3.03	6.12	204.3.79
42	41.71	13.52	28.19	32.42	4.33	6.32	204.3.86
43	13.49	8.91	4.57	66.09	5.00	5.42	204.3.101
44	8.87	4.78	4.09	53.88	3.63	5.46	204.3.81
45	36.92	8.90	28.02	24.11	4.75	5.40	204.3.70
46	20.41	17.90	2.51	87.70	4.85	5.55	204.3.19
47	25.36	12.95	12.42	51.05	4.21	5.64	204.3.34
48	49.78	43.16	6.62	86.70	1.99	5.97	204.3.87
49	35.38	9.46	25.92	26.73	3.05	5.36	204.3.68
50	15.25	13.01	2.24	85.32	4.31	5.53	204.3.35
51	22.72	13.57	9.16	59.71	2.59	5.64	204.3.63
52	25.58	13.75	11.83	53.74	5.20	5.47	204.3.38
53	32.20	17.77	14.43	55.18	2.62	5.59	204.3.94
54	35.49	8.63	26.86	24.31	4.49	5.83	204.3.22
55	22.77	22.77	0.00	100.00	6.05	6.00	204.3.88
56	35.23	8.95	26.29	25.39	4.60	5.45	204.3.18
57	20.26	4.28	15.97	21.15	5.15	5.46	204.3.24
58	42.88	42.88	0.00	100.00	2.81	5.90	204.3.104
59	10.05	4.47	5.57	44.53	3.83	5.75	204.3.32
60	47.94	24.35	23.59	50.80	1.29	5.44	204.3.46
61	18.42	18.42	0.00	100.00	5.17	5.80	204.3.85
62	40.41	4.39	36.03	10.85	3.57	5.58	204.3.20
63	26.83	14.71	12.12	54.82	4.42	5.55	204.3.64
64	81.17	26.72	54.44	32.92	5.06	5.83	204.3.42
65	44.95	13.30	31.65	29.59	3.87	5.76	204.3.76
66	21.80	21.80	0.00	100.00	2.82	5.67	204.3.99
67	54.20	13.69	40.50	25.27	3.41	5.41	204.3.107
68	13.51	0.00	13.51	0.00	3.88	5.39	204.3.163
69	45.73	13.81	31.92	30.20	4.18	5.66	204.3.55
70	31.11	18.80	12.32	60.41	5.04	5.63	204.3.110

71	30.50	30.50	0.00	100.00	2.57	5.44	204.3.109
72	13.26	13.26	0.00	100.00	3.05	5.42	204.3.114
73	32.03	8.98	23.06	28.02	4.33	5.70	204.3.65
74	31.60	4.43	27.17	14.03	4.03	5.57	204.3.45
75	26.67	26.67	0.00	100.00	1.76	5.72	204.3.89
76	36.19	36.19	0.00	100.00	2.92	5.63	204.3.95
77	17.73	17.73	0.00	100.00	3.25	5.11	204.3.112
78	25.23	13.25	11.98	52.51	4.28	5.66	204.3.21
79	18.28	18.28	0.00	100.00	5.18	5.46	204.3.84
80	32.18	4.40	27.78	13.67	5.35	5.84	204.3.44
81	13.25	9.57	3.68	72.21	2.86	6.11	204.3.77
82	22.40	8.88	13.51	39.67	3.57	6.06	204.3.67
83	45.09	18.16	26.93	40.27	5.21	5.53	204.3.51
84	13.62	13.62	0.00	100.00	2.62	5.84	204.3.96
85	27.23	18.82	8.40	69.14	5.52	5.66	204.3.98
86	21.82	4.88	16.94	22.37	3.62	5.46	204.3.161
87	8.65	4.59	4.07	53.01	1.23	5.23	204.3.137
88	9.37	9.37	0.00	100.00	2.94	5.65	204.3.141
89	13.47	8.81	4.65	65.45	1.57	5.60	204.3.152
90	8.87	0.00	8.87	0.00	3.49	5.29	204.3.159
91	41.27	8.75	32.52	21.19	3.95	5.17	204.3.160
92	22.94	8.86	14.08	38.64	5.29	5.48	204.3.153
93	21.93	9.77	12.17	44.53	3.17	5.25	204.3.148
94	17.94	4.54	13.40	25.31	3.62	5.34	204.3.162
95	22.06	4.66	17.40	21.13	3.33	5.32	204.3.72
96	32.27	12.90	19.37	39.97	5.84	5.61	204.3.103
97	37.94	13.32	24.63	35.10	7.23	5.90	204.3.92
98	27.79	8.53	19.26	30.70	5.05	5.20	204.3.113
99	51.56	20.98	30.58	40.69	5.00	5.60	204.3.27
100	18.08	13.53	4.55	74.82	1.94	5.53	204.3.91
101	8.87	4.71	4.16	53.07	2.29	5.40	204.3.139
102	22.28	4.49	17.79	20.14	1.96	5.64	204.3.135
103	8.83	8.83	0.00	100.00	1.45	6.01	204.3.128
104	36.11	8.94	27.18	24.75	4.41	5.29	204.3.158
105	27.53	8.64	18.89	31.39	3.90	5.99	204.3.143
106	22.07	9.81	12.26	44.44	2.86	5.64	204.3.61
107	27.25	9.38	17.87	34.43	4.44	5.52	204.3.53
108	37.05	17.61	19.44	47.53	4.96	5.83	204.3.62
109	22.01	9.34	12.67	42.43	3.56	5.35	204.3.74
110	46.10	8.88	37.21	19.27	5.41	5.71	204.3.52
111	20.24	14.04	6.20	69.38	4.44	5.82	204.3.31
112	32.12	8.80	23.31	27.41	3.61	5.80	204.3.50
113	45.11	8.75	36.36	19.40	2.86	5.59	204.3.29
114	26.99	26.99	0.00	100.00	3.08	5.33	204.3.108
115	30.86	14.25	16.61	46.19	3.33	5.57	204.3.69
116	37.76	22.22	15.54	58.84	6.35	5.70	204.3.93
117	40.44	40.44	0.00	100.00	4.44	5.20	204.3.97
118	26.89	13.65	13.24	50.77	3.81	5.93	204.3.78
119	36.53	17.99	18.54	49.24	6.43	5.80	204.3.56
120	34.90	34.90	0.00	100.00	5.35	5.30	204.3.102
121	25.47	12.61	12.86	49.50	4.99	5.71	204.3.28
122	22.70	13.65	9.05	60.13	5.05	5.69	204.3.49
123	15.08	15.08	0.00	100.00	4.74	5.73	204.3.23
124	26.96	9.00	17.96	33.37	3.05	5.90	204.3.75
125	42.18	8.70	33.48	20.63	4.08	5.76	204.3.58
126	20.58	13.58	7.00	66.00	6.36	5.53	204.3.26
127	36.23	13.51	22.72	37.30	3.03	5.53	204.3.100
128	18.01	8.84	9.17	49.07	4.78	5.58	204.3.83

129	31.98	18.05	13.93	56.44	3.15	5.77	204.3.105
130	24.95	9.13	15.82	36.59	3.76	5.60	204.3.41
131	9.80	9.80	0.00	100.00	1.34	5.61	204.3.134
132	8.80	8.80	0.00	100.00	1.84	5.57	204.3.130
133	27.93	27.93	0.00	100.00	2.82	5.80	204.3.119
134	35.78	9.53	26.25	26.64	2.21	5.70	204.3.125
135	9.00	4.71	4.29	52.35	2.81	5.47	204.3.145
136	8.93	8.93	0.00	100.00	4.41	5.63	204.3.146
137	23.66	4.41	19.25	18.63	5.98	5.36	204.3.154
138	22.54	22.54	0.00	100.00	5.83	5.90	204.3.118
139	13.47	4.60	8.87	34.15	3.96	5.60	204.3.151
140	39.20	39.20	0.00	100.00	6.54	5.70	204.3.116
141	35.60	4.65	30.95	13.06	3.46	5.61	204.3.150
142	26.81	18.70	8.11	69.76	2.31	5.14	204.3.121
143	13.36	9.59	3.77	71.76	1.21	5.48	204.3.127
144	13.25	4.73	8.52	35.71	3.76	5.82	204.3.144
145	22.64	8.90	13.74	39.31	4.99	5.49	204.3.157
146	13.59	13.59	0.00	100.00	2.93	5.37	204.3.149
147	30.22	4.70	25.52	15.55	2.56	5.92	204.3.129
148	17.96	17.96	0.00	100.00	2.52	5.63	204.3.138
149	31.35	18.30	13.05	58.37	3.86	6.00	204.3.117
150	22.12	9.44	12.68	42.68	1.85	5.56	204.3.126
151	13.05	4.90	8.14	37.59	1.28	5.55	204.3.140
152	21.74	18.86	2.88	86.75	0.60	5.42	204.3.124
153	13.38	4.43	8.94	33.14	1.66	5.61	204.3.147
154	28.45	28.45	0.00	100.00	2.02	5.37	204.3.122
155	17.37	9.60	7.77	55.26	2.48	5.74	204.3.132
156	32.42	8.80	23.63	27.13	5.48	5.67	204.3.155
157	28.48	28.48	0.00	100.00	4.03	5.39	204.3.115
158	30.49	23.38	7.11	76.69	1.33	5.56	204.3.123
159	4.38	4.38	0.00	100.00	0.65	5.70	204.3.131
160	22.24	13.84	8.40	62.24	1.61	5.80	204.3.133
161	22.37	13.99	8.38	62.53	2.16	5.07	204.3.136
162	18.19	4.68	13.51	25.72	4.16	6.10	204.3.142
163	27.66	4.54	23.12	16.41	5.22	5.30	204.3.156
164	19.32	19.32	0.00	100.00	1.14	5.61	204.3.120

Table 4. Additional samples chemistry.

SASAA Field No.	Context	Description	K	pH	Conductivity (μS)	TDS (ppm)	SASAA Lab No.
1	5	furnace wall lining	n.d.	n.d.	n.d.	n.d.	204.3.200
2	439	furnace wall lining, N wall of ditch	Vitrified face: 781, 1156. Red face: 219, 80.	7.82	n.d.	n.d.	204.3.201a, 201b
3	435 W	charcoal spread	52	6.68	n.d.	n.d.	204.3.202
4	435 E	charcoal spread	32	5.87	n.d.	n.d.	204.3.203
5	436	charcoal spread	71	5.7	n.d.	n.d.	204.3.204
6	433	charcoal spread	141	5.78	n.d.	n.d.	204.3.205
7	428	furnace contents	7535	5.89	n.d.	n.d.	204.3.206
8	429	furnace contents: brown/slaggy layer	4920	5.86	n.d.	n.d.	204.3.207
9	429	furnace contents: black/charcoal layer	792	5.84	n.d.	n.d.	204.3.208
10	U/S	water 1, from above bog iron ore: Gerry's field	0	7.18	604	301	204.3.209
11	U/S	water 2 from above bog iron ore: Gerry's field	0	7.23	599	298	204.3.210
12	U/S	bog iron ore 1: Gerry's field	n.d.	7.46	n.d.	n.d.	204.3.211

13	U/S	bog iron ore 2: Gerry's field	n.d.	7.42	n.d.	n.d.	204.3.212
15	425	To be confirmed	n.d.	n.d.	n.d.	n.d.	204.3.213

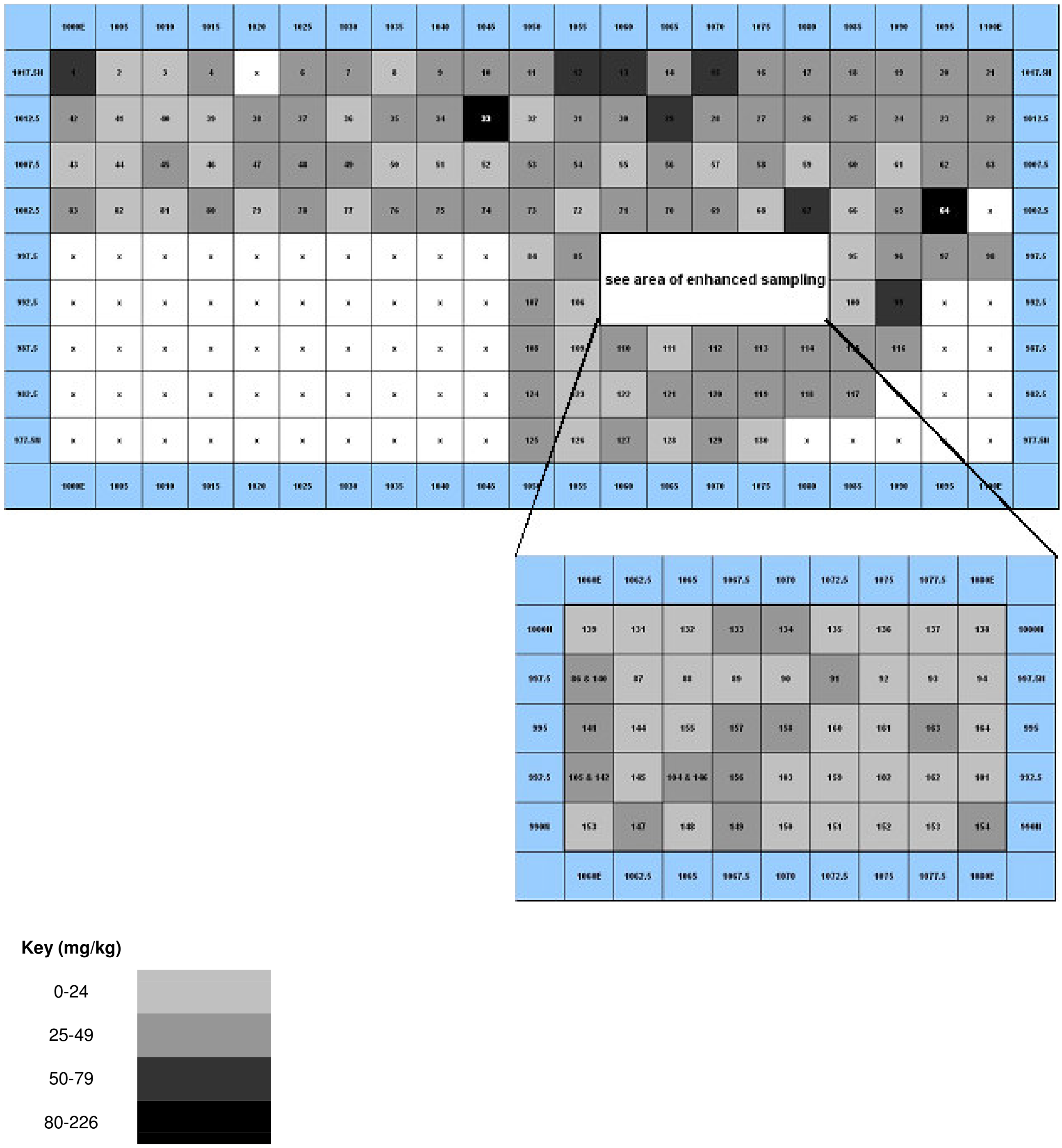


Figure 2. Total phosphate in soil across site at Derrinsallagh 4. N.B. Numbers refer to samples taken. x = point not sampled.

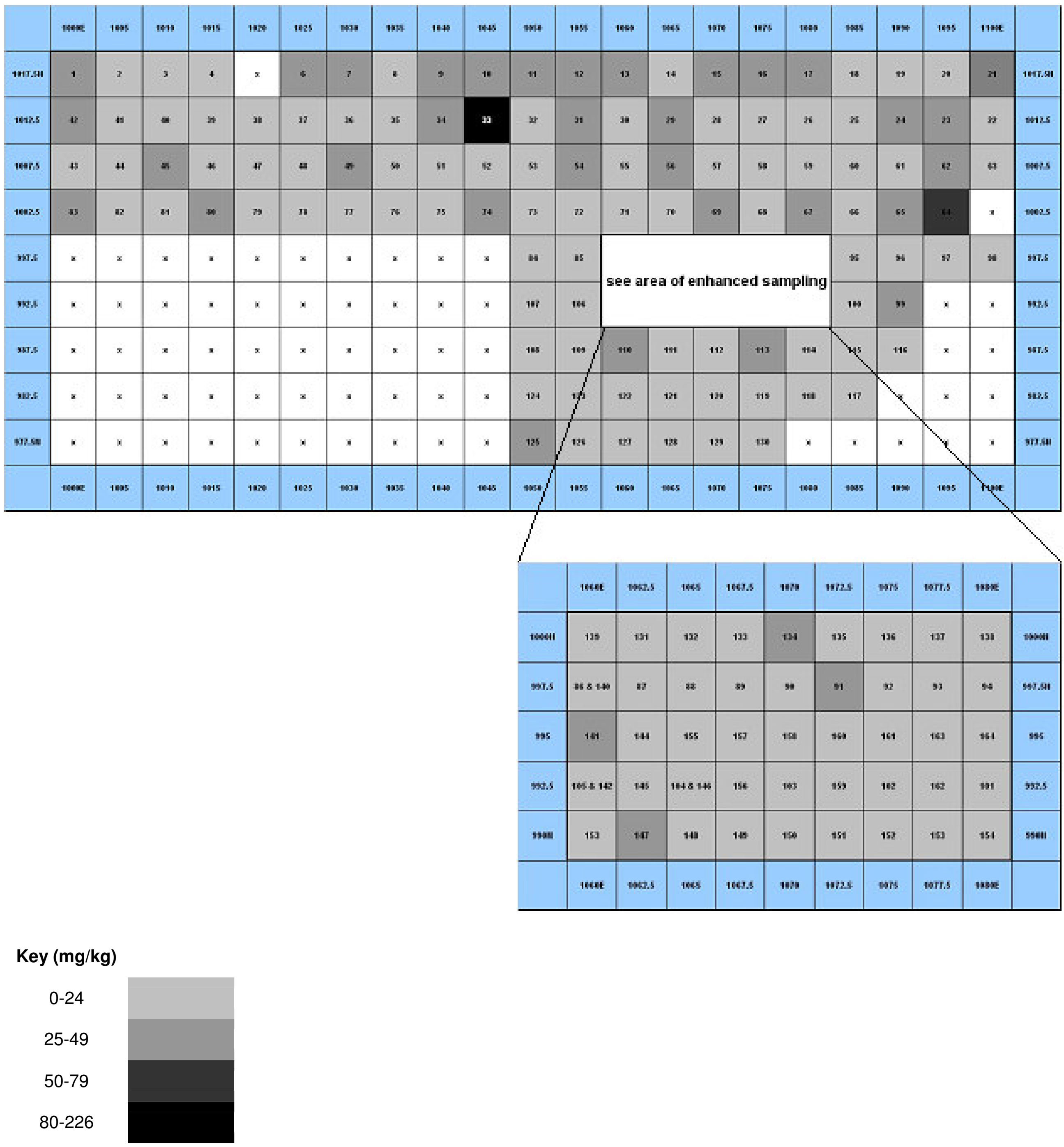


Figure 3. Organic phosphate in soil across site at Derrinsallagh 4. N.B. Numbers refer to samples taken. x = point not sampled.

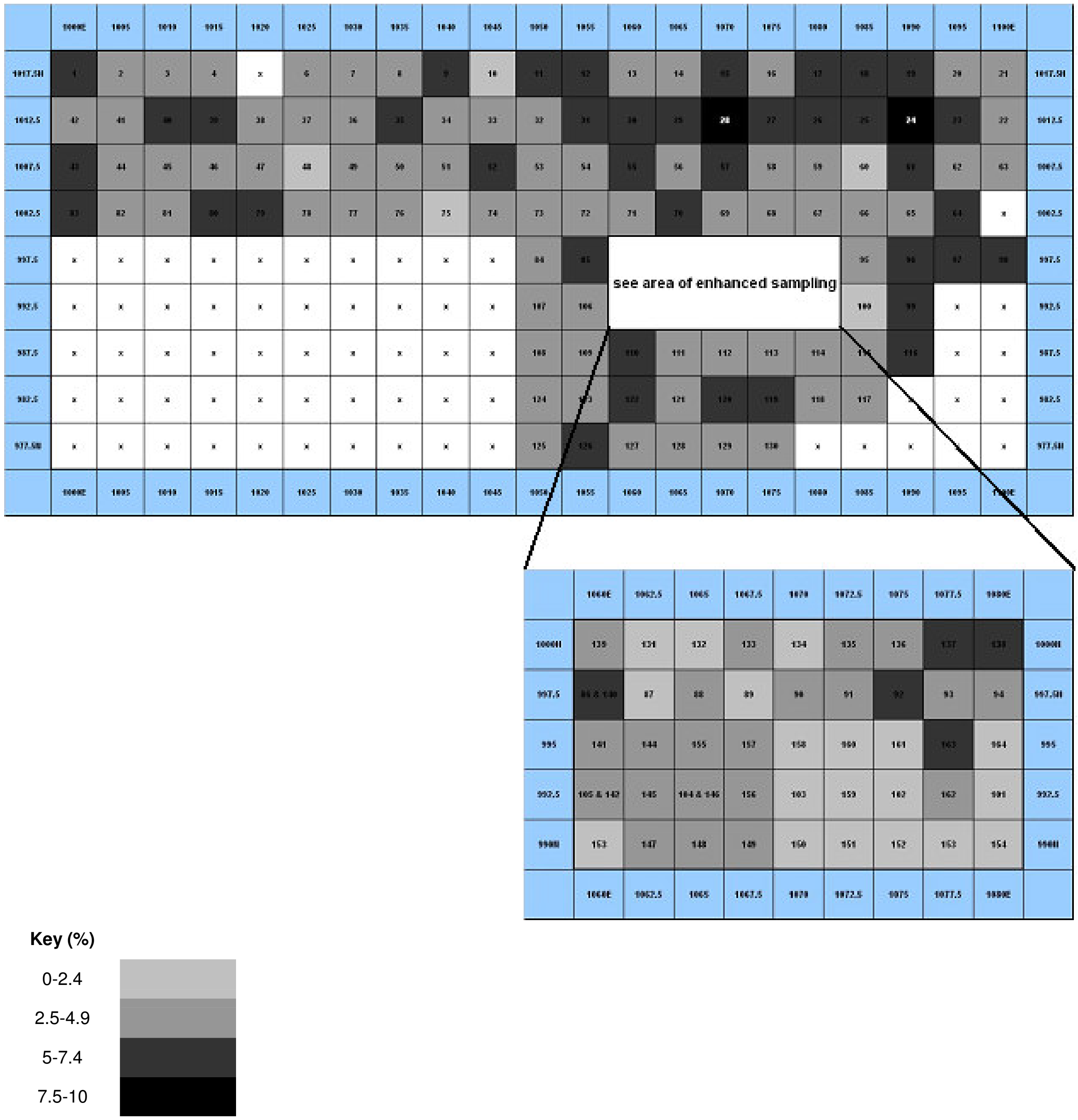


Figure 4. Soil organic content (%LOI) across site at Derrinsallagh 4. N.B. Numbers refer to samples taken. x = point not sampled.

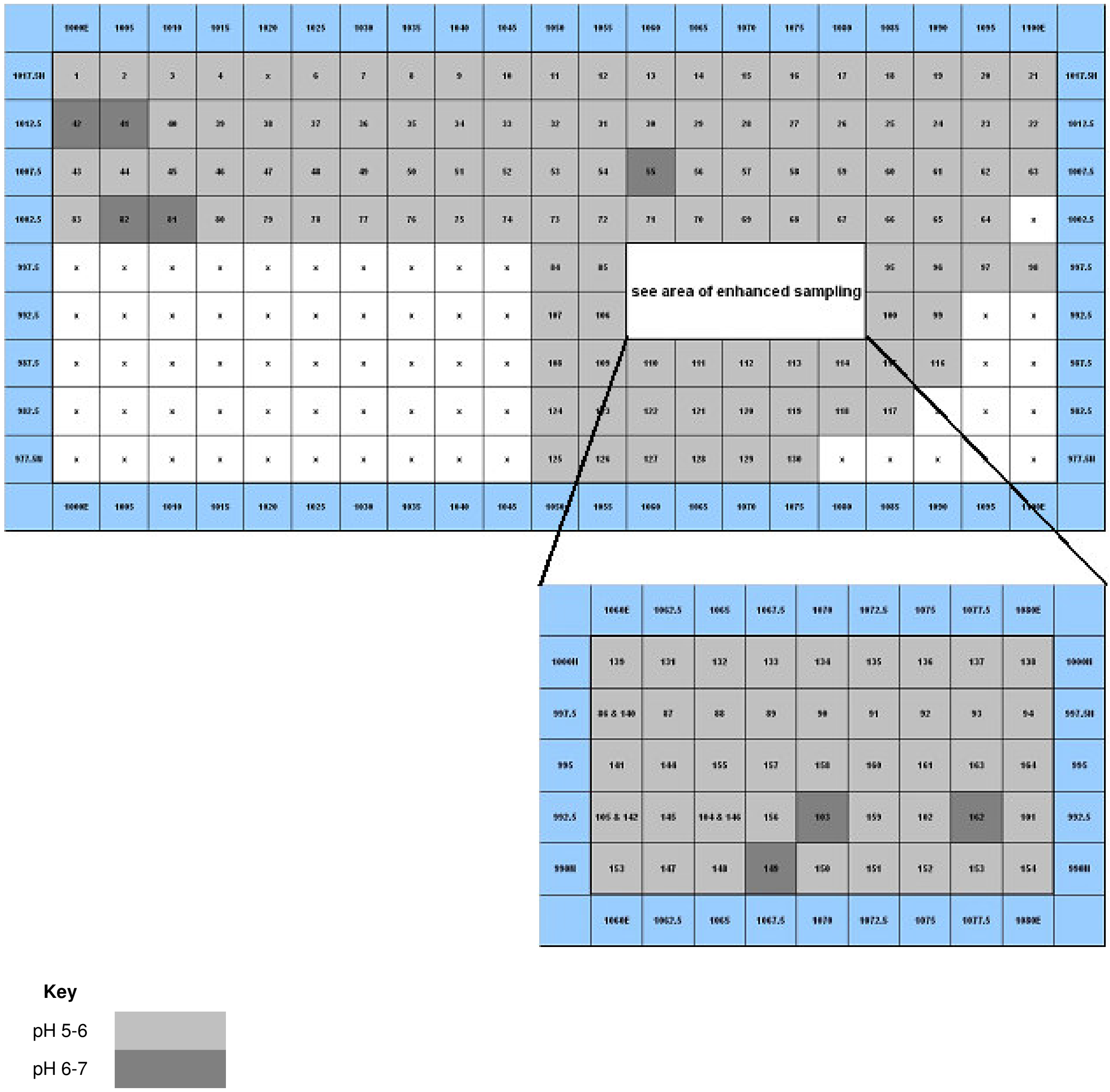


Figure 5. Soil pH across site at Derrinsallagh 4. N.B. Numbers refer to samples taken. x = point not sampled.

3.2 Soil Features (wall lining)

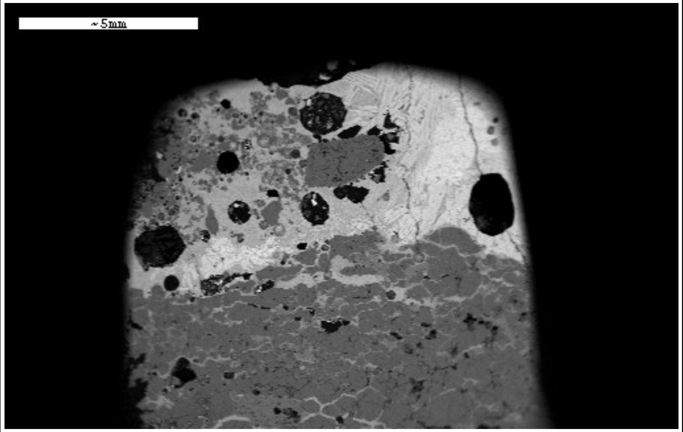
Figure 6 shows the furnace in context 5. Sample 204.3.200 was removed from the protruding wall directly below the stone. The stone must have served as a base for the bellows. There is so far no indication as to the nature/shape of the bellows at Derrinsallagh 4. The purpose of the analysis is to examine the nature of the wall lining and establish the extent to which it may have undergone any special treatment.

Figure 6. Furnace at Derrinsallagh 4 (context 5). Sample 204.3.200 was taken from within this furnace, below the stone resting under the green ruler in the photo.

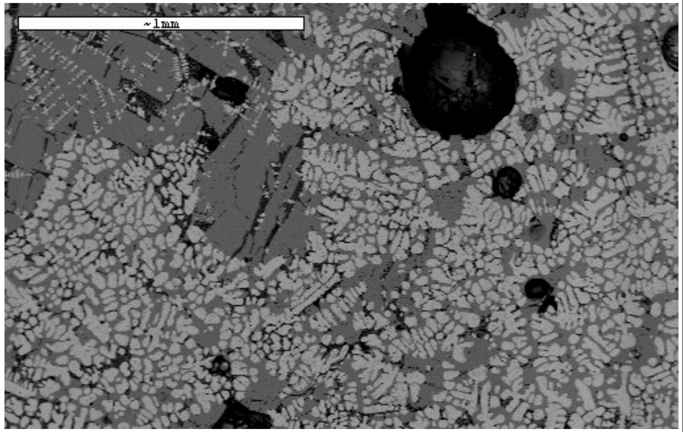
Figure 7. Samples examined by SEM-EDAX.

		
Sample 204.3.200 represents a section of the furnace wall/wall lining of the furnace in Context 5. It was removed by the present investigator from the area just below the stone, presumably the base on which the bellows rested. There was no evidence for bellows.	**Sample 204.3.201A are fragments of furnace wall/wall lining obtained from Context 439. They appear to have been discarded within the ditch.**	**Sample 204.3.201B are fragments of furnace wall/wall lining obtained from Context 439. They appear to have been discarded within the ditch.**

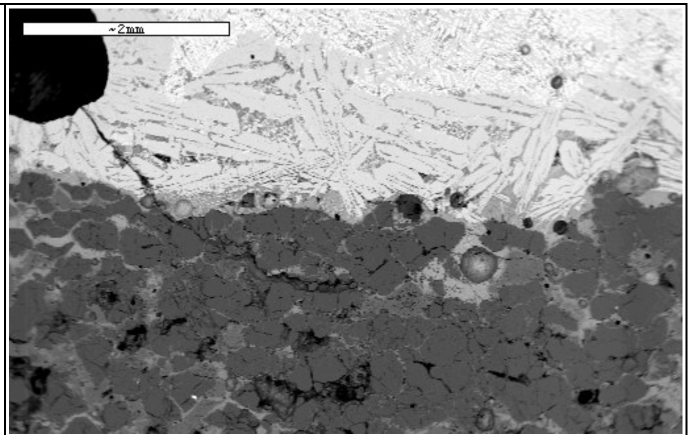
Figure 8. SEM-EDAX images.



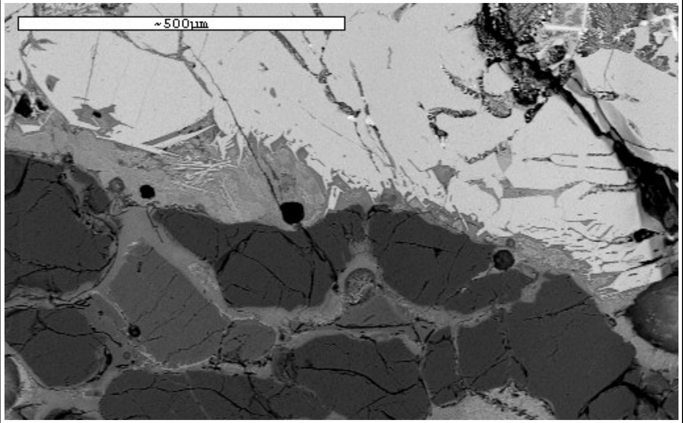
SEM-BS image of sample 204.3.200 shows that it consists of two areas: the furnace wall proper (dark grey and rich in quartz) and the slag which appears to adhere onto the wall



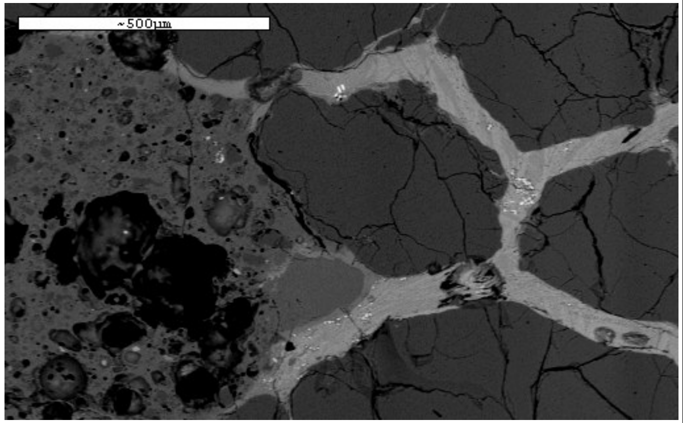
SEM-BS image of sample 204.3.200 showing an area within the slag; dendrites of iron oxides and needles of fayalite with some interstitial glass.



SEM-BS image of sample 204.3.200 showing the ‘interface’ between the two areas. There is no reaction between the two zones, ie the quartz grains appear to have not been heat-affected. The slag simply adheres to the stone surface.

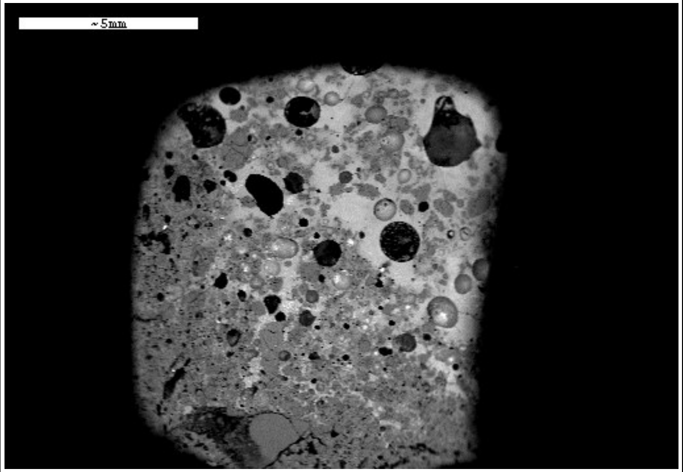


SEM-BS image of sample 204.3.200 showing a close up of the interface between the quartz rich sandstone and the slag.

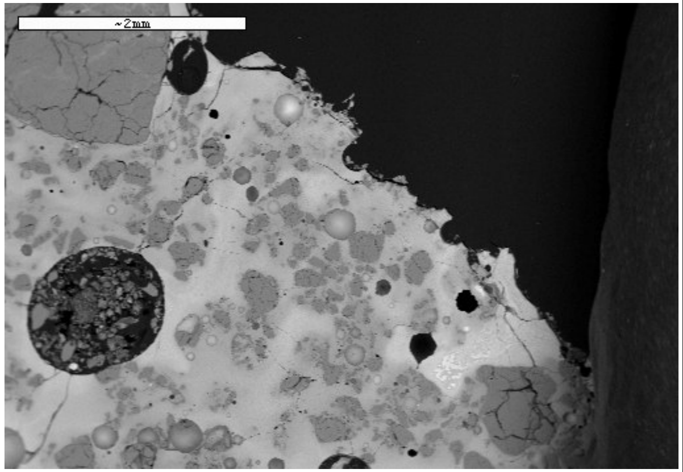


SEM-BS image of sample 204.3.200 showing variety of ‘binders’ holding the quartz grains together. The darker phase to the left consists primarily of K- alumino-silicates; the bright phase to the right consists of a ferrougenous material. Spot analyses on these ‘binders’ are shown in Table 5.

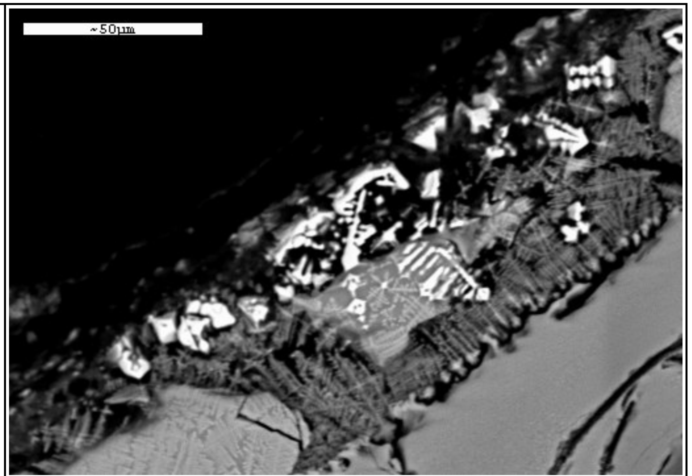
SEM-BS image of sample 204.3.200 showing ferrougenous ‘binder’ within the sandstone having reduced, the result of heating within a reducing environment, to fayalite and iron oxides.



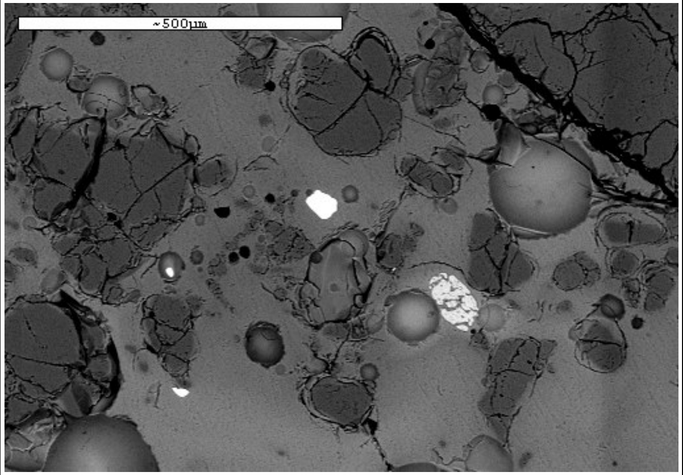
SEM-BS image of sample 204.3.201B showing two sections : a vitrified one(top right) and a low temperature heated one (bottom left) with a gradient of heating in between. This is a ceramic material



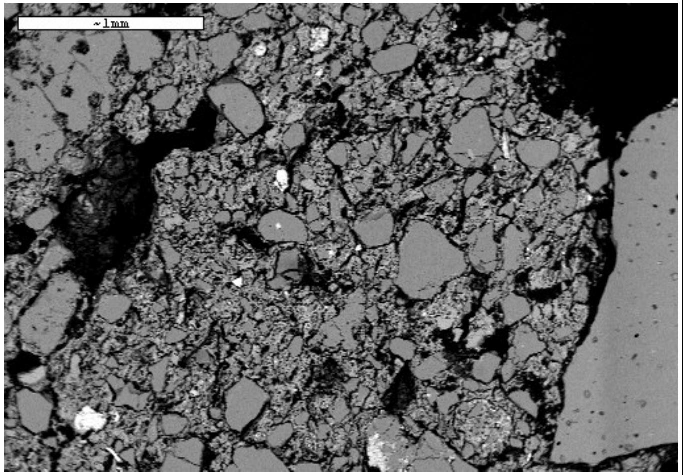
SEM-BS image of a detail within the vitrified area; it consists of partially melted and unaltered grains of quartz within a glassy matrix.



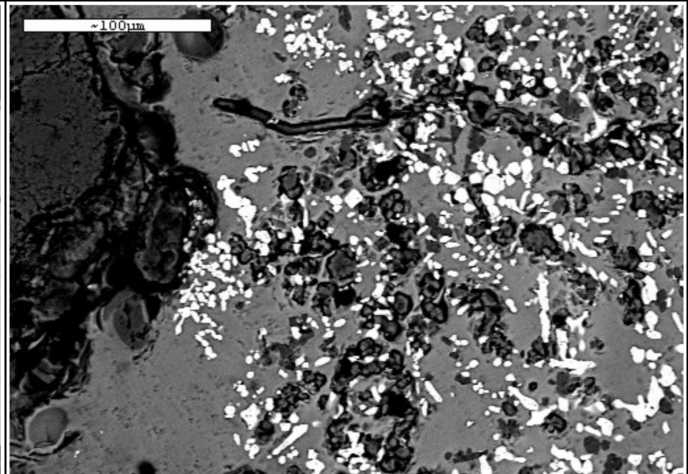
SEM-BS image of a detail within the surface of the vitrified area within sample 204.3.201B, showing the formation of iron oxides.



SEM-BS image of the vitrified section within sample 204.3.201B showing the presence of small inclusions of zircon and titanium iron oxides typical in clays.



SEM_BS image of sample 204.3.201showing the low fired section, with pronounced porosity.



SEM-BS image of the low fired area within sample 204.3.201B showing the formation of iron oxides as a result of localised reducing conditions.

Table 5. SEM-EDAX data (weight %). nd = not detected.

Sample	Description	Na_2O	MgO	Al_2O_3	SiO_2	P_2O_5	SO_3	K_2O	CaO	TiO_2	MnO	FeO	BaO	Total
204.3.200														
204.3.200	mean area analysis on slag section	0.51	0.30	2.83	16.85	0.47	0.31	0.95	1.83	0.44	6.53	69.22	nd	100
204.3.200	mean area analysis on the quartz-rich section	0.47	nd	4.71	87.14	nd	nd	1.88	1.23	0.25	0.39	3.58	nd	100
	slag section													
204.3.200	spot analysis on fayalite within slag section	nd	0.62	nd	29.71	nd	nd	nd	0.51	nd	7.6	61.78	nd	100
204.3.200	spot analysis on wustite within slag section	nd	nd	0.48	0.49	nd	nd	0.27	nd	nd	2.3	95.23	nd	100
204.3.200	spot analysis on interstitial glass within slag section	nd	nd	22.28	49.85	nd	nd	18.58	nd	nd	0.45	5.58	3.58	100
	interface													
204.3.200	infiltration of slag within area of the sandstone section	0.56	0.47	3.50	47.04	nd	nd	2.08	2.18	nd	4.45	39.34	nd	100
	Quartz- rich section													
204.3.200	Spot analysis(1) on the ferrougenous binder or space between the quartz grains	nd	nd	17.88	31.58	2.2	0.44	3.8	2.12	0.28	nd	41.62	0.27	100
204.3.200	Spot analysis (2) on the ferrougenous binder or space between the quartz grains; the ferrougenous material varies in its relative amounts of P and Mn.	nd	nd	1.04	3.5	nd	nd	0.14	0.12	nd	4.22	91.35	nd	100
204.3.200	Spot analysis (3) on the K-aluminosilicate phase; this is not a crystalline phase as can be seen in the SEM images above.	0.86	nd	18.01	64.73	nd	nd	15.73	nd	nd	nd	0.33	nd	100
204.3.200	area analysis of eutectic interstitial material between quartz grains in the sandstone section	0.96	0.36	3.72	49.87	0.45	nd	1.05	12.83	nd	4.03	26.40	nd	100
204.3.200	spot analysis on fayalite within eutectic in sandstone section	0.76	nd	3.71	24.90	nd	nd	1.47	0.49	0.92	0.86	66.73	nd	100
204.3.200	spot analysis on glass within eutectic in sandstone section	1.23	nd	9.08	52.33	0.94	0.63	3.40	6.09	0.73	1.16	24.42	nd	100
204.3.201b														
204.3.201b	mean area analysis on low-fired section	0.58	0.48	8.07	83.72	nd	nd	2.04	0.53	0.64	nd	3.64	nd	100
204.3.201b	mean area analysis on vitrified section	0.84	0.33	6.67	75.24	0.38	nd	2.77	3.24	0.43	0.72	9.53	nd	100
204.3.201b	spot analysis on vitrified section	0.92	0.31	6.74	63.03	nd	nd	2.82	3.97	0.46	1.17	20.30	nd	100

4 Discussion

4.1 Soil Chemistry

4.1.1 Soil phosphate

Phosphate is naturally present in soils, and the aim here is to identify a superimposed anthropogenic phosphate signal above 'background' levels (typically of low magnitude).

Total soil phosphate, assessed on the basis of soil samples taken at regular intervals across a site grid, was generally fairly low at Derrinsallagh 4 (Table 3). To the south of the site and in the area of the furnaces (Figure 2), total phosphate is low and consistent, and not considered anthropogenic. There is however a significant anomalous area to the north of the site between 1012.5-1017.5N and 1045-1070E. Total phosphate values in this area are higher than elsewhere on the site. There are also isolated anomalies at 1002.5N, 1095E and 1017.5N, 1000E.

Total soil phosphate is composed of inorganic and organic fractions. In terms of anthropogenic phosphate, the *inorganic* part generally represents human or animal remains (from inorganic calcium phosphate in bones). *Organic* phosphate signifies anthropogenic waste, refuse and ashes.

At Derrinsallagh 4, inorganic phosphate makes up a varying percentage of the total (Table 3). Inorganic concentrations are too low to suggest the presence of bones on site. The organic phosphate on site (Table 3 and Figure 3) is enhanced in the same areas as mentioned for the total phosphate – to the north of the site and north west.

This suggests there may have been domestic activity outwith the metalworking area, to the north of the site. It is possible the archaeology extends past the field boundary to the north (A-M Lennon pers. comm.) and that domestic activity may be found here, on the basis of the soil phosphate data.

The other anomalies mentioned within the site require further investigation to draw firm conclusions as to the cause of the phosphate enhancement – were there any bone fragments noted in contexts related to these grid squares? Was there an accumulation of ash or organic material?

4.1.2 Soil organic matter

Enhancement of soil organic matter can be indicative of anthropogenic input into soil chemistry. Soil organic matter is not especially high across the site at Derrinsallagh 4 (Table 3 and Figure 4) but there is some enhancement visible to the north of the site again. This again suggests domestic activity may have taken place in and around this area. Little organic material was detected in the region of the furnaces.

4.1.3 Soil pH

Anomalous pH values may be caused by changes in micro-environmental conditions as the result of anthropogenic influence. However, soil pH is fairly acidic and stable throughout the site (Table 3 and Figure 5). There is little variation and pH generally lies between 5-6 across the entire area. In contrast to samples measured away from the field containing the archaeological site (see Section 4.2 – samples 10-13), Derrinsallagh 4 is fairly acidic; possibly the result of archaeological industrial activity or more recent agricultural activity.

4.1.4 Soil magnetic susceptibility (see SASAA 204.1)

Magnetic susceptibility (K) was measured at several points along the same grid as for soil phosphate. Values did not show any considerable enhancement above 'background' and so this approach was abandoned due to time constraints. Instead, we concentrated on the examination of magnetic susceptibility in and around the furnace areas (SASAA 204.1).

4.1.5 Soil summary

An analysis of soil chemistry at Derrinsallagh 4 suggests there may be domestic activity to the north and north west of the site, extending into the field beyond (not excavated). There is no evidence of domestic activity within and in the immediate vicinity of the furnace area.

4.2 Additional Soil Samples Chemistry

The additional soil samples were also subject to an examination of their basic chemistry (Table 4). Magnetic susceptibility has been discussed previously (SASAA 204.1) and is only included here for completeness. *Within* the site boundaries, pH values generally fall within the expected range for the site (pH 5-6). Sample 2 (204.3.201) is slightly higher (pH 7.82) indicating micro-environmental conditions here – this is likely due to the presence of slag minerals within the furnace raising the pH towards alkaline. The samples taken from *outwith* the site boundaries – from uncultivated land (Samples 10-13) exhibit pH c.7. The water samples (Samples 10-11) have fairly high conductivity and total dissolved solids (TDS) indicating they have considerable dissolved salts present. These samples highlight that soils on the site are fairly acidic in contrast to the surrounding uncultivated land.

4.3 Soil Features (Stone and clay-based furnace walls)

Two samples have been examined in this report. Sample 204.3.200 was recovered from within the furnace of context 5; sample 204.3.201 was a ‘stray’ find within context 439.

Sample 204.3.200 is a fragment of the furnace wall (east furnace) of context 5 consisting of a small vertical sandstone slab on which slag has adhered. There is no zone of reaction between slag and sandstone. The sandstone includes a variety of ‘binders’, the material that holds the quartz and other silica rich grains together. Those of a more ferrougenous composition have reduced to iron oxides and fayalite, the result of the stone being exposed to the reducing atmosphere of the furnace.

The slag is a manganese and phosphorus rich iron oxide (wustite) with fayalite (iron silicate) and interstitial glass. Given the lack of a reaction zone between the slag and the stone wall, it is surmised that the temperature prevailing within the furnace could not have exceeded 700º-850º C. In other words the temperature within the furnace would have been that associated with a bon fire, only in the conditions within would have been reducing rather than oxidising. There is no wall lining proper, made of silt or clay and spread over the surface of the stone.

Sample 204.3.201B is a fragment of quartz-enriched and clay-based furnace wall. It is not clear whether this clay-rich material is natural or artificially produced, by mixing locally available clay/silt with crushed-up quartz pebbles. Addition of quartz would have made an otherwise ‘weak’ material more refractory and therefore suitable for use as part of a metallurgical furnace.

The section nearest the source of heat (black) has melted and upon cooling solidified into a glassy surface; there is a temperature gradient between the section exposed to the source of heat and the section least affected by heat. In other words both sections have the same composition, only one has melted.

The two fragments of furnace walls consist of different materials: one is ceramic, the other is stone. The similarity lies in the abundance of quartz particles present within each. It is not certain whether the stone wall constitutes an earlier or a later example of furnace wall construction at Derrinsallagh. There is certainly only one such example of that type of furnace (A-M Lennon, pers. comm). Although stone would have been a readily available local material, when used in the furnace, it would also have been subject to potential fracturing while the smelting was in progress. Quartz enriched clay/silt would have made a better furnace wall material and would have simulated the action of the sandstone encountered in the previous example, without the side effect of potential fracture.

A fuller report on the above will be provided in association with the examination of the rest of the metallurgical waste from the site.

It is important that samples for C-14 dating are obtained from the furnace at Context 5 and others where the furnace wall consisted of clay. It is possible that Derrinsallagh furnaces span a number a periods or that different furnace designs and materials were being tested at the site.

4.4 Forthcoming Analyses

Further interim reports in the Derrinsallagh 4 series will include ***Iron ore sourcing*** (from 'bog' iron ore and slag analyses – SASAA 204.4) and an ***Analysis of metallurgical waste*** (SASAA 204.5). ***Soil micromorphology*** will be given as an Appendix to SASAA 204.3 as soon as data becomes available.

5 References

Wilson L (2006). Derrinsallagh 4, Co. Laois, Eire. In-Situ Magnetic Susceptibility Data Collection: A Preliminary Report. *SASAA Reports* **204.1**. Scottish Analytical Services for Art and Archaeology: Glasgow.

Hall A J and E Photos-Jones 1998, The bloomery mounds of the Scottish Highlands , part 2: a review of iron mineralisation, The Journal of the Historical Metallurgy Society, (32), 2, 54-66.

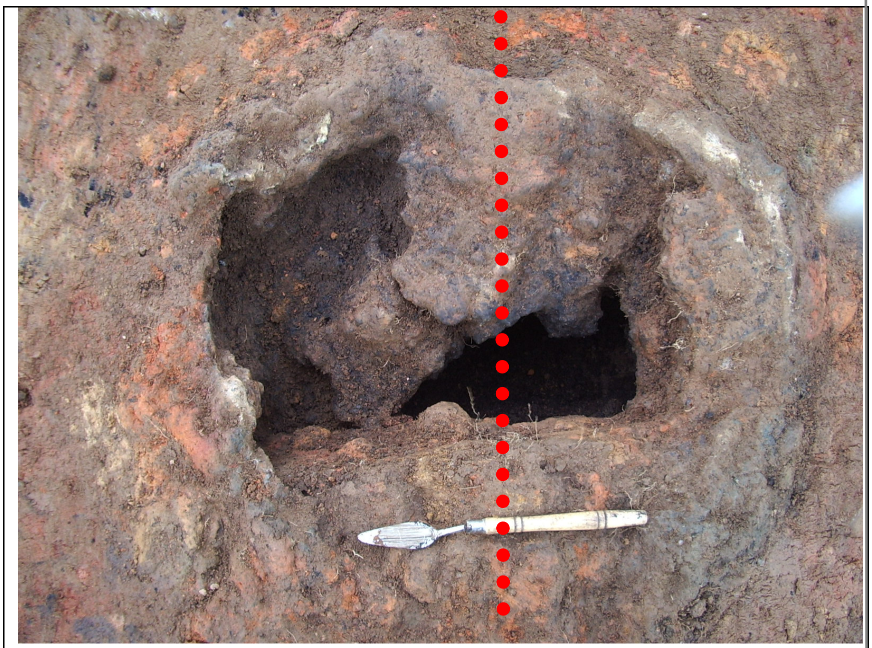
6 Acknowledgements

SASAA would like to thank Laois County Council for providing the funds for this investigation. ACS Ltd. (Madeleine Hill) for making it happen. We would like to acknowledge the assistance of Anne Marie Lennon and her team: Colm Flynn, Bronwen Chapman, Karen, Joanne Jezierska, and Wojciech Koczorowszi. On the analytical side, we would like to thank Gert Petersen, SASAA, Chris Connor, Dept. of Archaeology, University of Glasgow, and Robert MacDonald and Peter Chung, Dept. of Geology, University of Glasgow.

SCOTTISH ANALYTICAL SERVICES FOR ART & ARCHAEOLOGY

Derrinsallagh 4, Co. Laois, Eire

In-Situ
Magnetic Susceptibility Data Collection:
A Preliminary Report



SASAA 204.1

This report has been commissioned by ACS Ltd, Ireland.

Cover photo shows furnace [C397] at Derrinsallagh 4; line shows path of magnetic susceptibility measurements (photo by SASAA).

7 Belgrave Terrace,
Glasgow, G12 8JD,
Scotland, UK
Tel/fax: +44(0)141 337 2623
Email: enquiries@sasaa.co.uk
Web: www.sasaa.co.uk

Derrinsallagh 4, Co. Laois, Eire

In-Situ
Magnetic Susceptibility Data Collection:
A Preliminary Report

Prepared by:
Dr L Wilson, in accordance with SASAA standard procedures.

SASAA 204.1
Scottish Analytical Services
for Art & Archaeology
Glasgow,
Scotland, UK
February 2006

Derrinsallagh 4, Co. Laois, Eire

In-Situ Magnetic Susceptibility Data Collection:
A Preliminary Report

Aim

In situ magnetic susceptibility data collection was carried out at targeted locations across the site at Derrinsallagh 4, Co. Lois, Ireland (Figure 1), comprising of a cluster of bowl furnaces; the aim was to characterise heating patterns within furnace areas and charcoal spreads, pre and post excavation.

Novelty of the technique

In situ magnetic susceptibility data collection is an ideal method of analytical investigation on sites with evidence of metalworking, such as Derrinsallagh 4. The field probe allows quick and accurate measurement of magnetic susceptibility at a large number of sample points. In the 1.5 days SASAA were on site, we took over 650 measurements. Data can be rapidly collected, assimilated and interpreted back in the office, allowing reports to be delivered promptly, and **while** the excavation is still in progress. The results are aimed to guide the process of excavation and aid interpretation during and at the post-excavation phases.

Summary

This preliminary report examines 4 case studies, each targeting a specific question arising from the field evidence and which in situ magnetic susceptibility measurements can potentially clarify.

Case Study 1

This case study examines ***patterns of heating in double furnaces***. The function of the double furnace was not clear, but the question can be clarified by examining the range of heating in and across each furnace (manifest as enhanced magnetic susceptibility measurements).

Case Study 2

This case study aims to locate the ***position of the tuyere in a furnace***. Again, furnace morphology may be able to suggest where the tuyere may have been positioned, but magnetic susceptibility enhancement can provide firm evidence to that effect because the area around the tuyere is normally the hottest part of the furnace.

Case Study 3

This case study examines ***charcoal spreads*** around the site, and aims to differentiate them from other areas/features that have undergone heating.

Case Study 4

This case study entails a ***comparison of pre- and post-excavation magnetic susceptibility data as a means of predicting the location of metalworking features.*** .

Aim

In situ magnetic susceptibility data collection was carried out at targeted locations across the site at Derrinsallagh 4, Co. Lois, Ireland (Figure 1), comprising of a cluster of bowl furnaces; the aim was to characterise heating patterns within furnace areas and charcoal spreads, pre and post excavation.

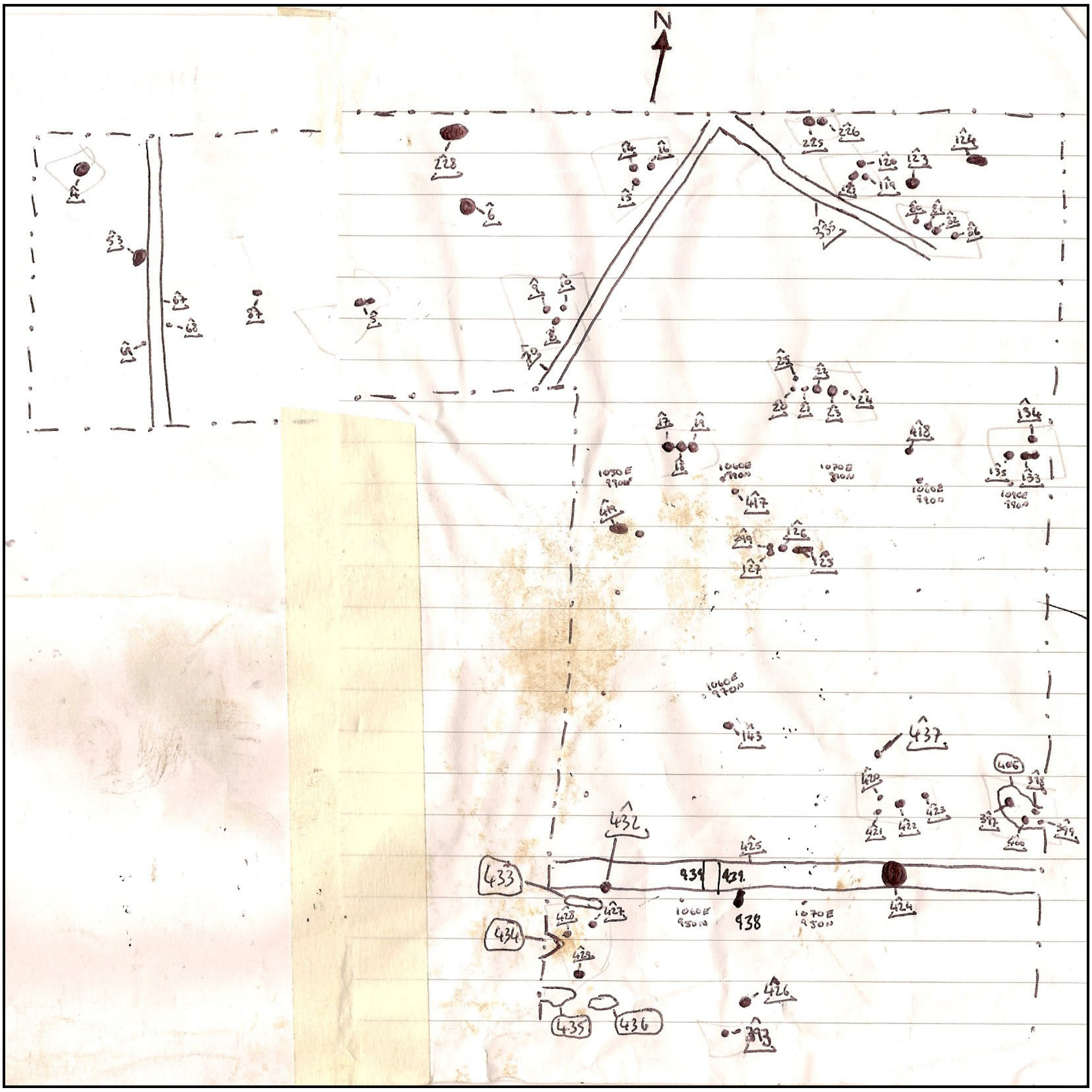


Figure 1. Preliminary site map of Derrinsallagh 4, Co. Lois, Ireland (ACS Ltd.).

Methodology

SASAA used a Bartington MS2 magnetic susceptibility system, with an MS2F probe to measure in situ magnetic susceptibility (www.bartington.com). Volume specific magnetic susceptibility was measured (***K***), which is a dimensionless value. Background measurements were taken at various points off-site to monitor data quality (Background ***K*** = 11, 16, 21). Magnetic susceptibility values are enhanced above background when an area has been exposed to heating (i.e., heated soils in a furnace, vitrified clay, charcoal), and enhanced further where there are ferrous minerals present (i.e. in the form of metal itself or slag).

Novelty of the technique

In situ magnetic susceptibility data collection is an ideal method of analytical investigation on sites with evidence of metalworking, such as Derrinsallagh 4. The field probe allows quick and accurate measurement of magnetic susceptibility at a large number of sample points. In the 1.5 days SASAA were on site, we took over 650 measurements. Data can be rapidly collected, assimilated and interpreted back in the office, allowing reports to be delivered promptly, and **while** the excavation is still in progress. The results are aimed to guide the process of excavation and aid interpretation during and at the post-excavation phases.

Case Studies

Case Study 1

This case study examines ***patterns of heating in double furnaces***. The function of the double furnace was not clear, e.g. in Context 5 (Figure 2), but the question can be clarified by examining the range of heating in and across each furnace (manifested as enhanced magnetic susceptibility measurements).

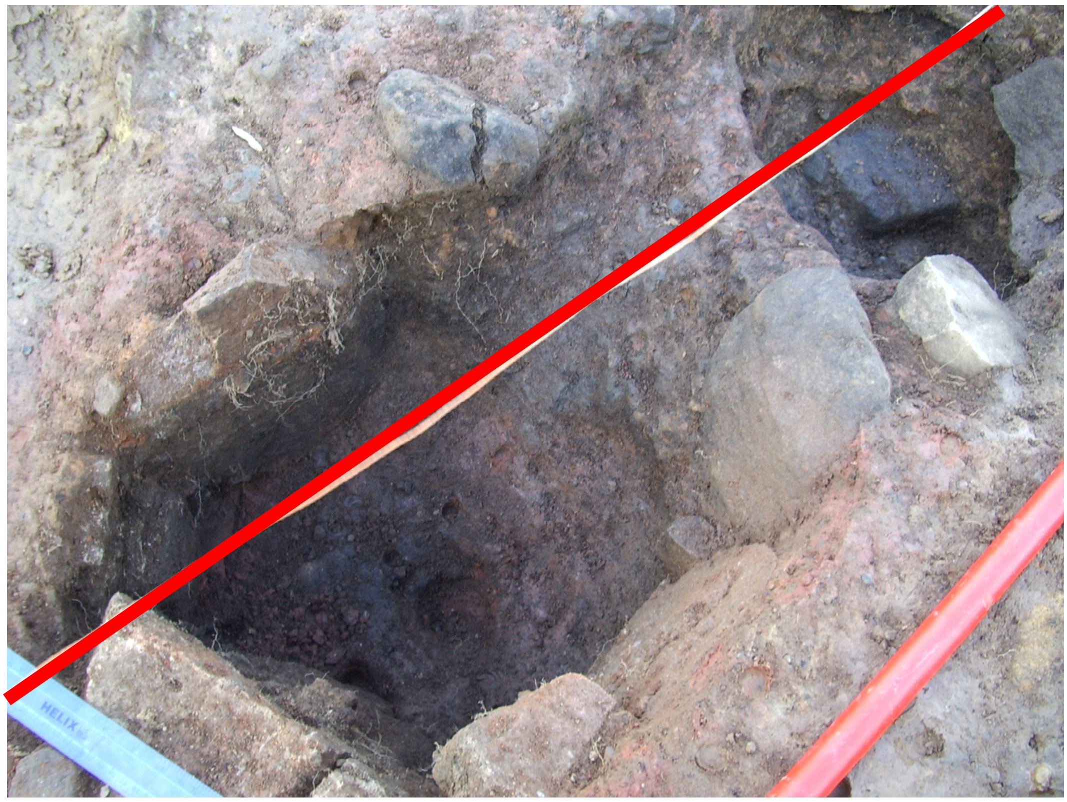


Figure 2. Context 5. Double furnaces. Red line shows approximate path of magnetic susceptibility sampling points from SW-NE (SASAA image).

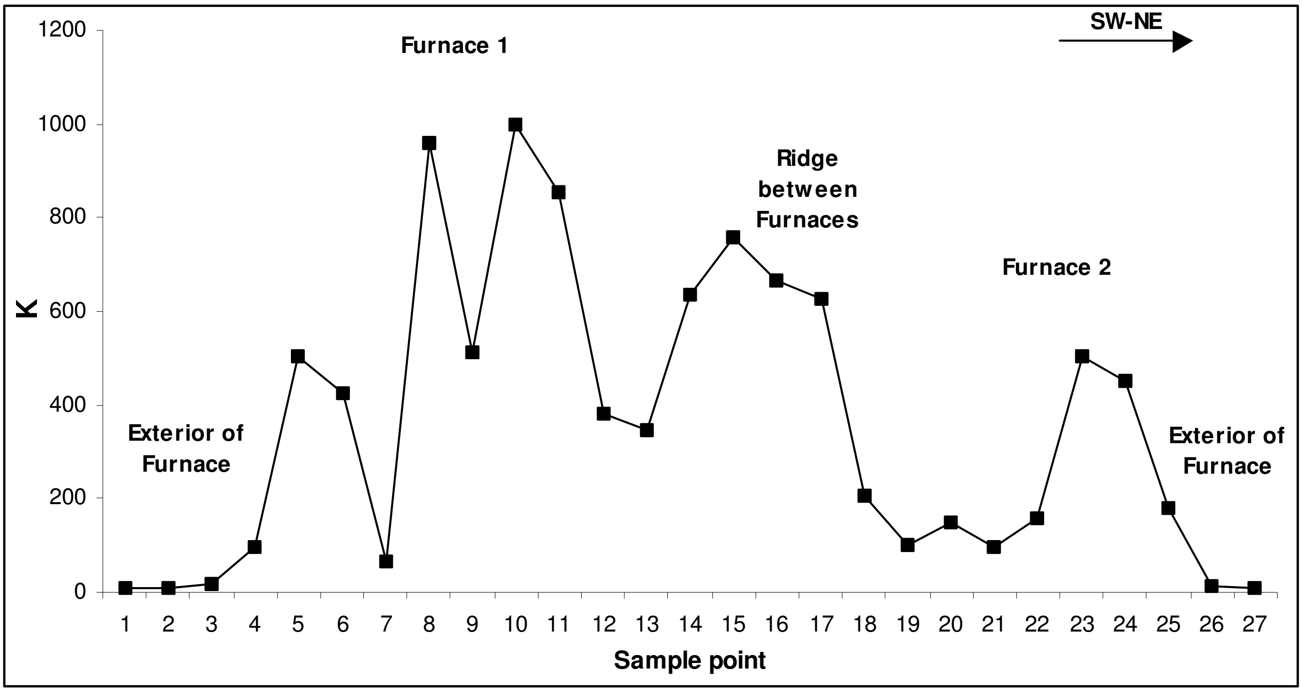


Figure 3. Context 5. Magnetic susceptibility measurements (***K***) across the double furnaces from SW-NE.

Figure 3 clearly demonstrates enhancement of magnetic susceptibility within the furnace regions above background values. As enhanced magnetic susceptibility is an indicator of the extent to which the soil has been heated, there is firm evidence that Furnace bowl 1 has been exposed to a higher degree of heating than Furnace bowl 2. These bowls are therefore likely to have served different functions.

Case Study 2

This case study aims to locate the ***position of the tuyere in a furnace***. Furnace morphology may be able to suggest where the tuyere may have been positioned (e.g. Context 121, Figure 4), but magnetic susceptibility enhancement can provide firm evidence to that effect because the area around the tuyere is normally the hottest part of the furnace.

Figure 4. Context 121. Furnace. Red line shows approximate path of magnetic susceptibility sampling points from W-E (SASAA image).

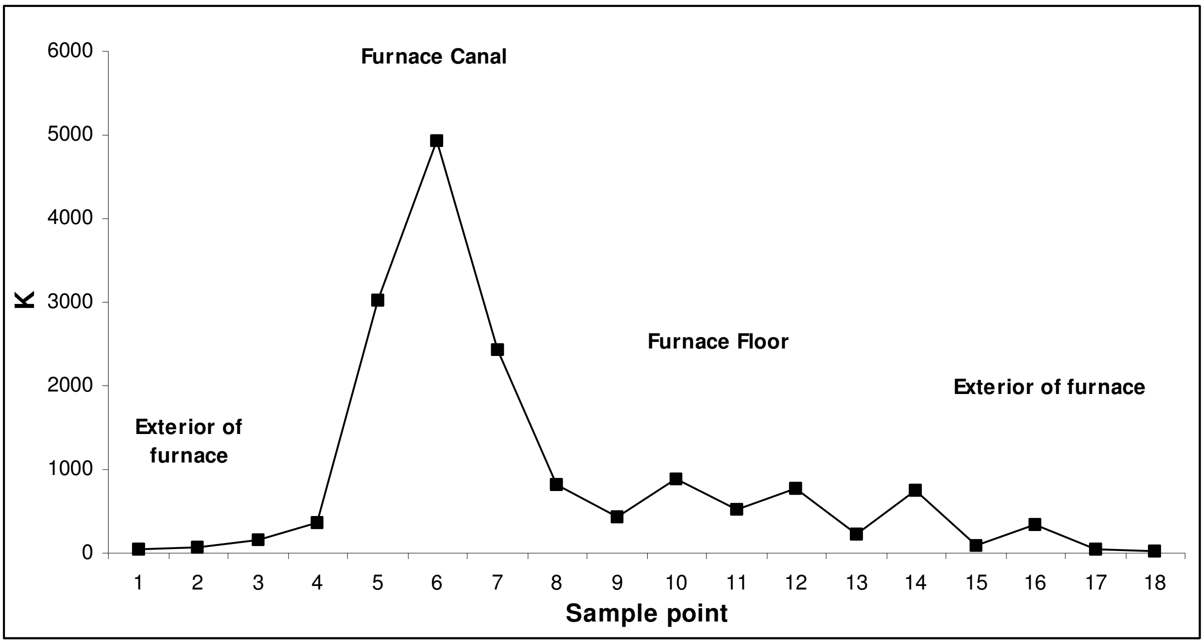


Figure 5. Context 121. Magnetic susceptibility (***K***) measurements across the furnace from W-E.

The extreme enhancement of ***K*** values in and around the region of the furnace canal at the W end of the feature (Figure 5), together with an assessment of the furnace architecture are strongly indicative that this was the location of the tuyere within the furnace.

Case Study 3

This case study examines ***charcoal spreads*** around the site, and aims to differentiate them from other areas/features that have undergone heating. An example of a charcoal spread (e.g. [433], [434]) can be seen in Figure 7.

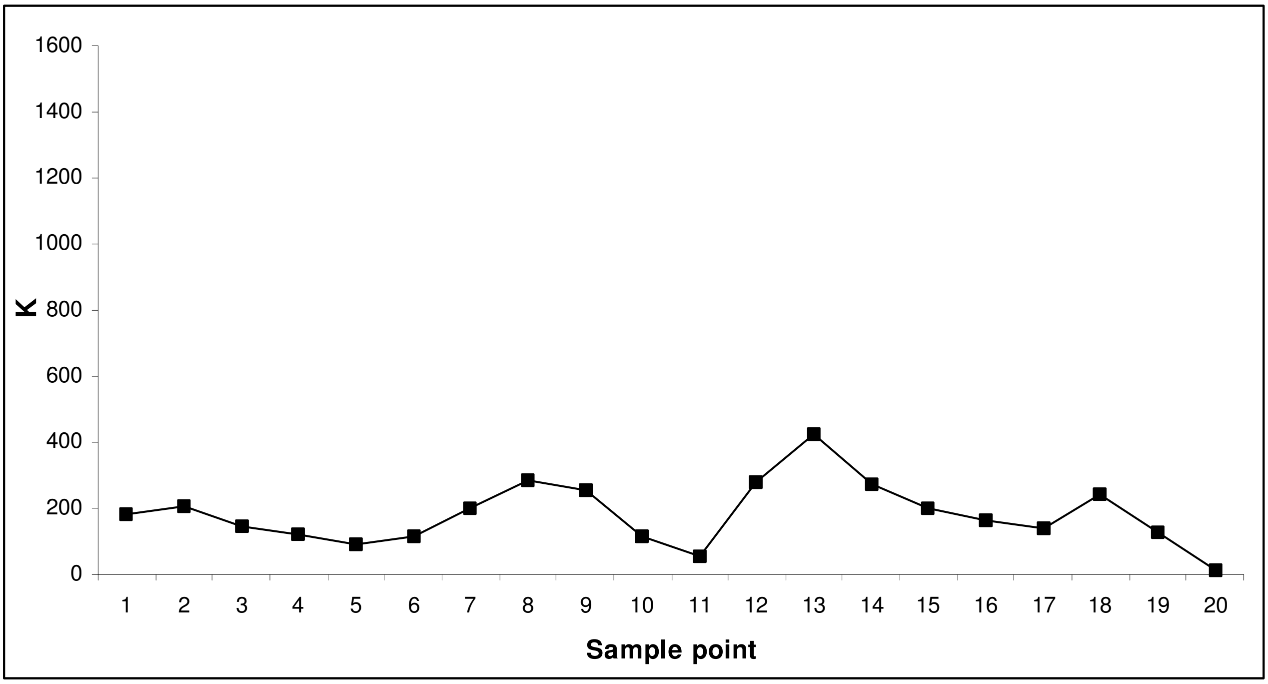


Figure 6. Contexts 397-398. Magnetic susceptibility (***K***) measurements. Continuous spread of black charcoal materials between Furnaces 397 & 398. Pre-excavation. W-E.

Figure 6 indicates a relatively stable enhancement within this charcoal spread between [397]-[398]. This is typical for all charcoal spreads examined on site. Charcoal spreads are enhanced above background magnetic susceptibility values, but not to the same degree as within and around furnaces. It is not likely that there is any slag remains within these spreads.

Case Study 4

This case study entails a ***comparison of pre- and post-excavation magnetic susceptibility data as a means of predicting the location of metalworking features.*** .

Example 1

Figure 7. Context 397 pre-excavation. Possible furnace and charcoal spread are visible. Red lines show approximate paths of magnetic susceptibility sampling points (SASAA image).

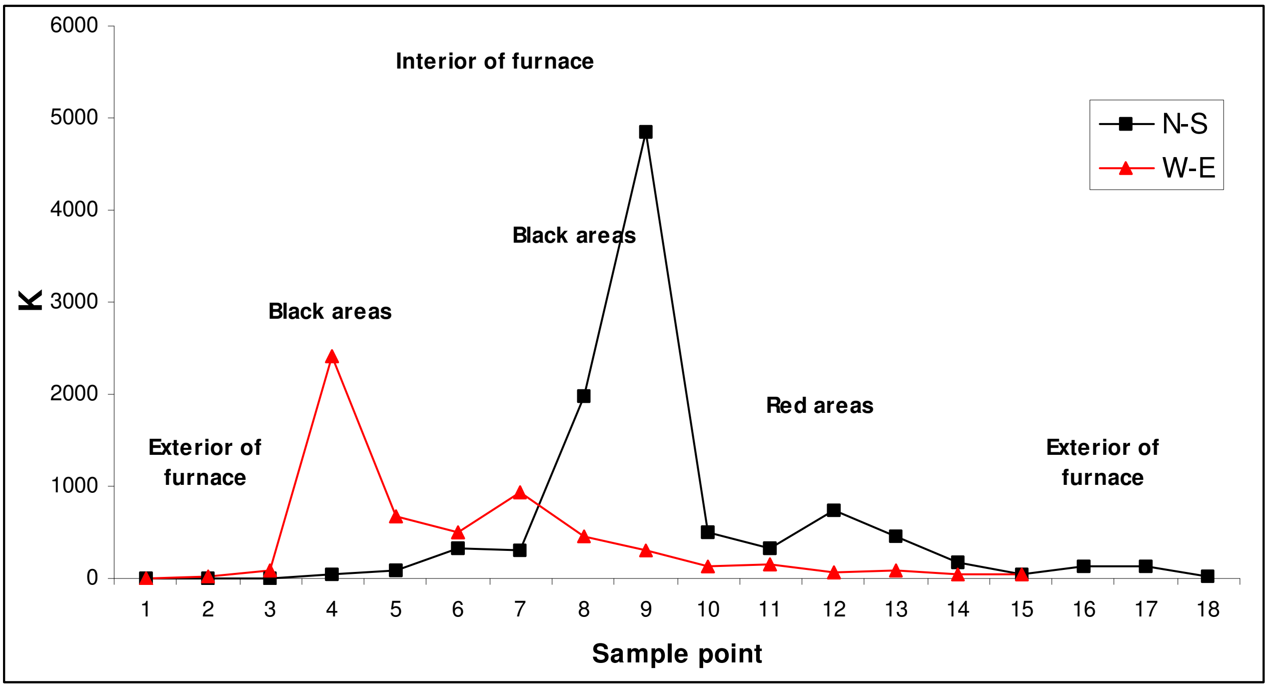


Figure 8. Context 397 pre-excavation. Magnetic susceptibility (***K***) measurements across the activity area from N-S and W-E.

Figure 7 shows the feature pre-excavation, and Figure 8 shows considerable enhancement of ***K*** across the areas of measurement. Black areas in particular are likely to indicate the location of a furnace and/or slag-rich deposit immediately below. Red areas appear to indicate the outer perimeter of heated areas, i.e., exterior edges of furnace structures.

Figure 9. Context 397 post-excavation. Furnace in half-section. Red line shows approximate path of magnetic susceptibility sampling points - W-E (starting from trowel) (SASAA image).

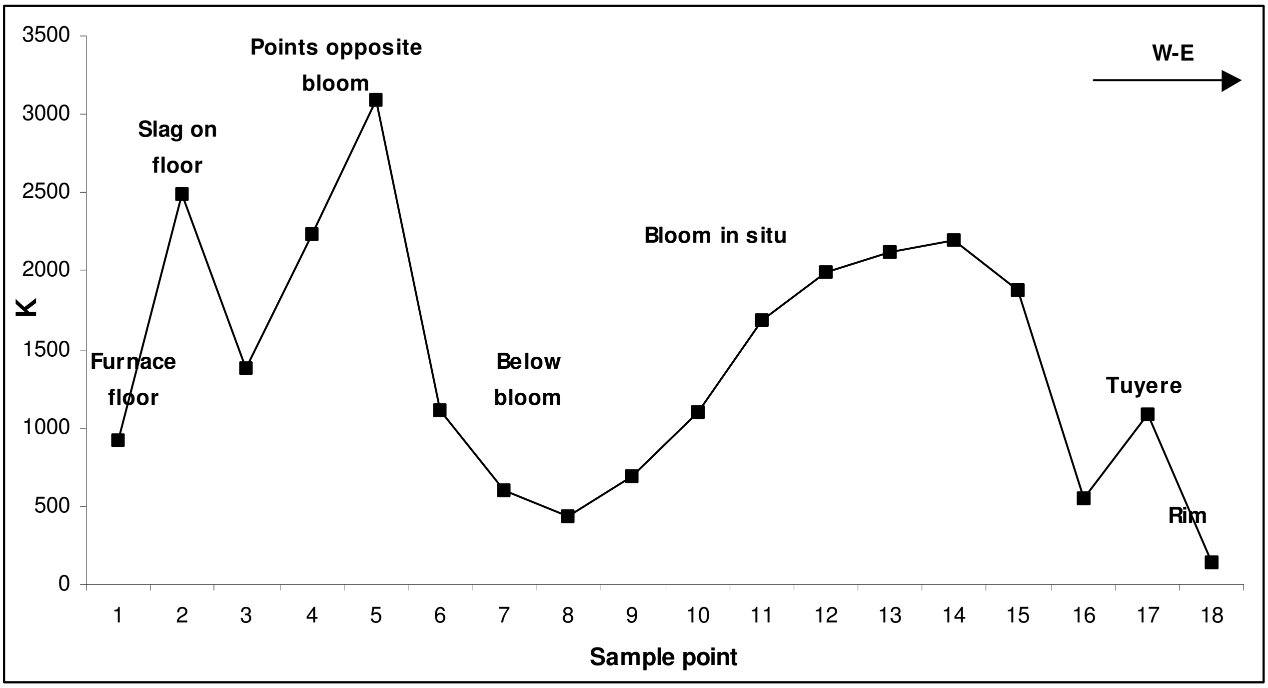


Figure 10. Context 397 post-excavation. Magnetic susceptibility (***K***) measurements from W-E.

Excavation of context 397 has identified the feature as a furnace with bloom in place and intact (Figure 9). Magnetic susceptibility measurements through the U-shaped profile of the structure (Figure 10) from W-E identified the location of the tuyere, and an area exposed to similarly high temperature directly opposite the most likely location of the tuyere, namely above the bloom.

From the comparison of the two sets of data, pre and post excavation, it is clear that the magnetic susceptibility measurements predicted accurately the hot zones of this particular furnace. But they also raised the possibility of a two-tuyere furnace, given that the point directly opposite the bloom gave a high K value.

Example 2

In this example the nature of individual features was examined using magnetic susceptibility. To the SW of the site, immediately S of the large ditch [425], [439], there is a cluster of features, (Contexts 427, 428, 429, 432, 433, 434, Figure 1); one of these features is truncated by the ditch: SASAA aimed to identify the nature of feature 432.

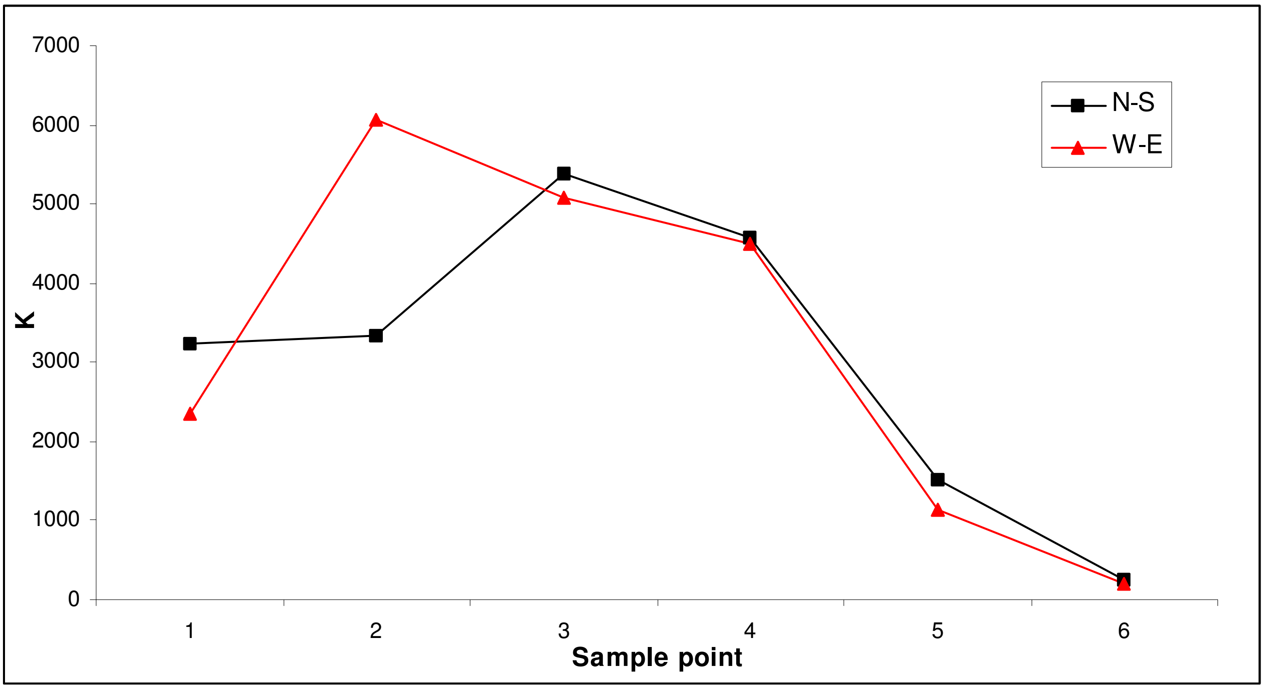


Figure 11. Context 432. Truncated feature pre-excavation. Magnetic susceptibility (***K***) measurements.

Despite truncation of this feature by the ditch to the N ([439]), the enhanced magnetic susceptibility measurements (Figure 11) indicate this feature is a furnace, not a charcoal spread on account of a gradient in the measurements consistent with that obtained from furnaces. In situ magnetic susceptibility can confidently differentiate between furnaces and charcoal spreads pre-excavation. The technique can also characterise truncated features accurately.

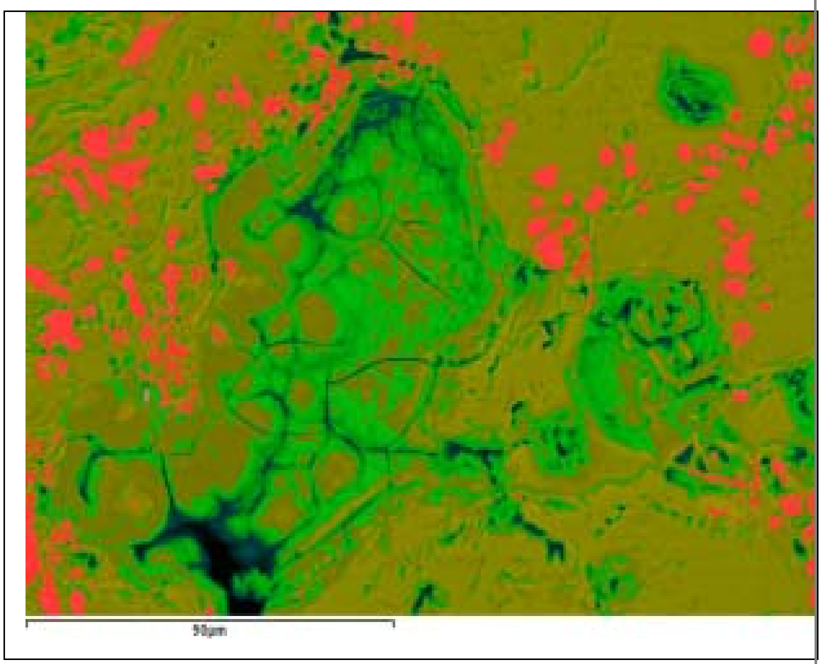
Acknowledgements

SASAA would like to thank Laois County Council for providing the funds for this investigation. ACS Ltd. (Madeleine Hill) for making it happen. We would like to acknowledge the assistance of Anne Marie Lennon and her team: Colm Flynn, Bronwen Chapman, Karen, Joanne Jezierska, and Wojciech Koczorowszi. Last but not least, the farmer Gerry Moylan for insightful comments on the farming activities in and around his land.

ANALYTICAL SERVICES FOR ART & ARCHAEOLOGY (SCOTLAND) LTD.

Derrinsallagh 4, Co. Laois, Eire

Holistic Context Analysis to Further Site Understanding



SASAA 271

This report has been commissioned by
ACS Ltd. Eire.

Cover image shows image analysis of sample SASAA 271.35.iv – a partially reacted fragment of iron ore and surrounding matrix with fayalite and wustite.

7 Belgrave Terrace,
Glasgow, G12 8JD,
Scotland, UK
Tel/fax: +44(0)141 337 2623
Email: enquiries@sasaa.co.uk
Web: www.sasaa.co.uk

Derrinsallagh 4, Co. Laois, Eire

Holistic Context Analysis to Further Site Understanding

Authors: Dr E Photos-Jones and Dr L Wilson, in accordance with SASAA standard procedures.

SASAA 271
Analytical Services for Art & Archaeology (Scotland) Ltd.
Glasgow,
Scotland, UK
July 2007

Executive Summary

Synopsis

SASAA 271 *represents the fourth and final in a series of reports aimed at the investigation of aspects of industrial and domestic activity within the site based on the technical characterisation of materials and features within. Part II of this report is a discussion document, with the collation of all data to create a coherent understanding of the site and the activities within.*

The interim reports in the series:
204.1 *– Derrinsallagh 4, Co. Laois, Eire. In-Situ Magnetic Susceptibility Data: Preliminary Report*

204.2 *- Derrinsallagh 4, Co. Laois, Eire. Geoarchaeological reconnaissance during a one day visit at the above site and surrounding area , 13th February 2006: Preliminary Report*
204.3 – *Derrinsallagh 4, Co. Laois, Eire. 'Soft Archaeology' Characterisation*
271 *- Derrinsallagh 4, Co. Laois, Eire. Holistic Context Analysis and Site Characterisation*

Methodology

Holistic Context Analysis (HCA) is a methodology developed by SASAA whereupon materials scientific analysis expands to all materials making up any archaeological context, to include soils. By testing the properties and analysing the composition of both soils and metallurgical waste a holistic picture of the site emerges and the activities within.

Summary of Results

The technical examination of the materials (metallurgical waste and soils) recovered from within the clusters of furnaces excavated at Derrinsallagh IV, Co Laois, provide a unique insight into a- rather than the- beginning of iron metallurgy in Ireland, emerging out of a copper smelting tradition and seemingly independently of external influences; we cannot ascertain whether Ireland was introduced into iron making, all at once, or different parts of the island came into iron metallurgy at different times. Derrinsallagh IV is fundamental in our understanding of the Irish Iron Age in that it forces us to look closely at an early time, not in terms of chronology, but in terms of technology, namely that of experimentation with the new metal.

Table of Contents

1 Introduction

SASAA received 60 crates of samples from the site at Derrinsallagh 4, Co. Laois, Eire (Site Licence 05E2180). This contained a variety of materials: soils (to a varying degree of heating/vitrification), metallurgical ceramics, slags and charcoals. The total slag weight received was 296kg.
Preliminary radiocarbon dates for Derrinsallagh 4 have been reported as follows:

F9/ C199 (Sample 101):	Cal BC 50 - Cal AD 240
F17/ C357 (Sample 259):	Cal BC 10 - Cal AD 250

Figures 1-3 show the site in three parts.

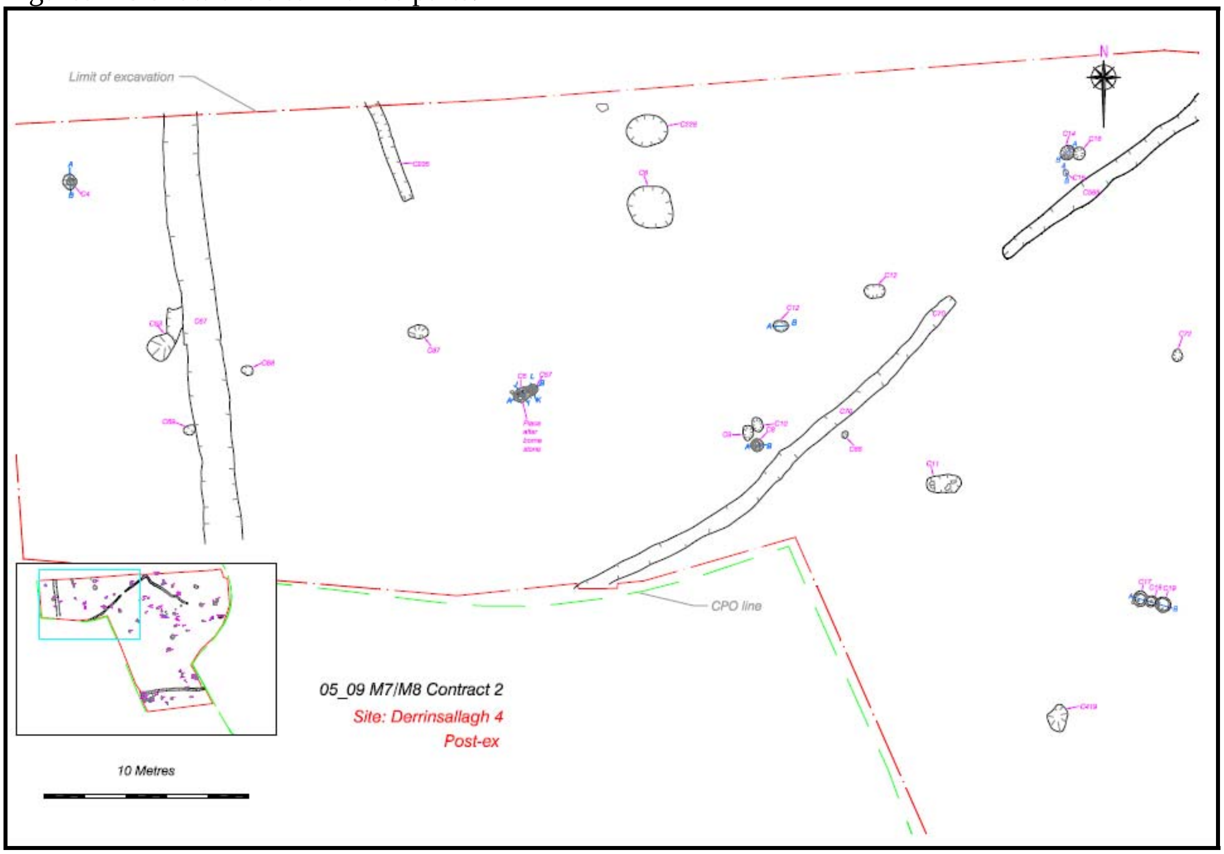


Figure 1. Derrinsallagh 4 site plan – part 1 (ACS Ltd. 2007).

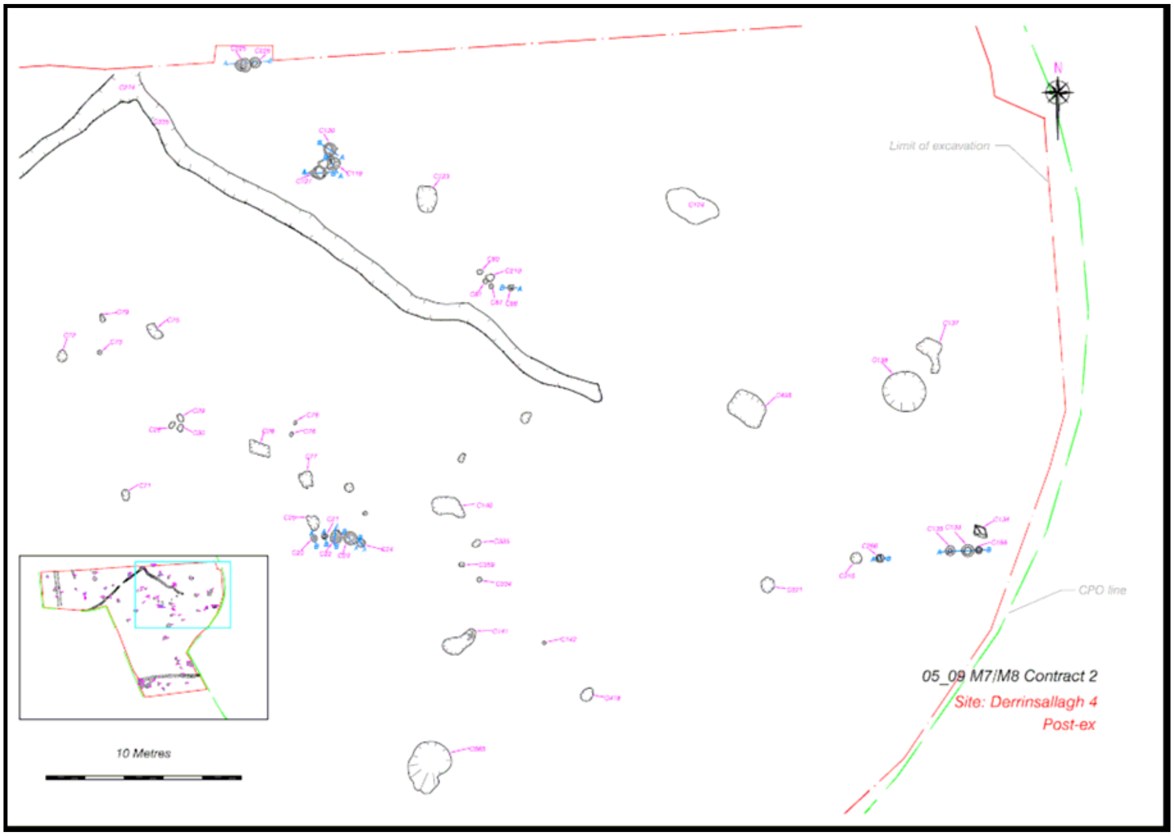


Figure 2. Derrinsallagh 4 site plan – part 2 (ACS Ltd. 2007).

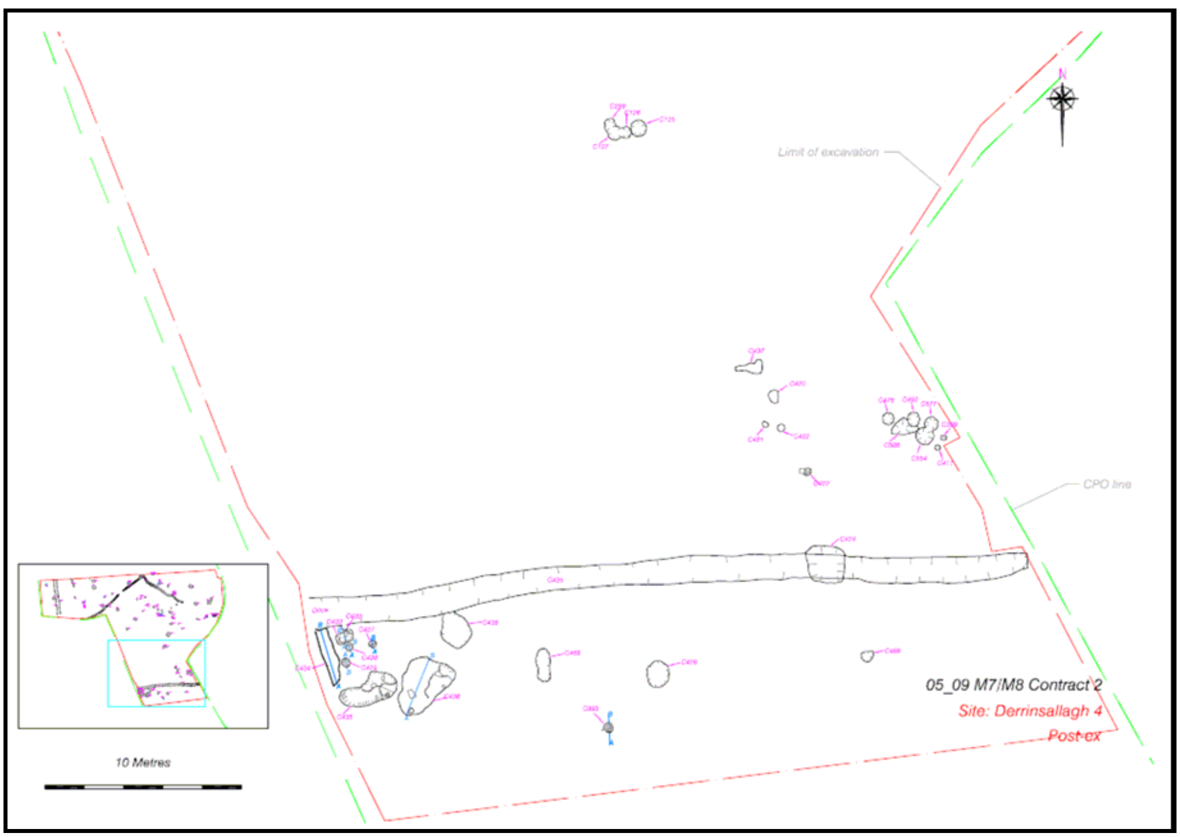


Figure 3. Derrinsallagh 4 site plan – part 3 (ACS Ltd. 2007).

2 Aim and Objectives

Aim

The aim of this project was to enhance our understanding of the entire site at Derrinsallagh 4, a metal-making site dated to the Middle Iron Age, based on the holistic context analysis of all features from the site.

Objective

The aim was achieved via several objectives:

1) **Materials Analysis**
   All materials collected from the site were analysed and the data interpreted.
2) **Features Analysis**
   Furnaces v Non-furnaces were examined in closer detail and compared on the basis of soil chemistry.
3) **Clusters of furnaces**
   Groupings of furnaces were examined to identify similarities in typology and chemical composition of fills and cuts.

NB. Magnetic susceptibility is abbreviated to MS in this document.

3 Materials Analysis

3.1 The Work So Far

SASAA 204.1: Pre- and Mid-Excavation Magnetic Susceptibility Survey

Please see SASAA Report 204.1 for a full description of the work carried out and results. The aim was to assess

heating patterns within furnace areas and charcoal spreads, pre and mid excavation. In summary, this report examined 4 case studies, each targeting a specific question arising from the field evidence and which in situ magnetic susceptibility measurements could potentially clarify.

Case Study 1

This case study examined ***patterns of heating in double furnaces***. The function of the double furnace was not clear, but this question could be clarified by examining the range of heating in and across each furnace (manifest as enhanced magnetic susceptibility measurements).

The data clearly demonstrated enhancement of magnetic susceptibility within the furnace regions above background values. As enhanced magnetic susceptibility is an indicator of the extent to which the soil has been heated, there is firm evidence that Furnace bowl 1 has been exposed to a higher degree of heating than Furnace bowl 2. These bowls are therefore likely to have served different functions.

Case Study 2

This case study aimed to locate the ***position of the tuyere in a furnace***. Again, furnace morphology might have been able to suggest where the tuyere had been positioned, but magnetic susceptibility enhancement could provide firm evidence to that effect because the area around the tuyere is normally the hottest part of the furnace.

e.g.

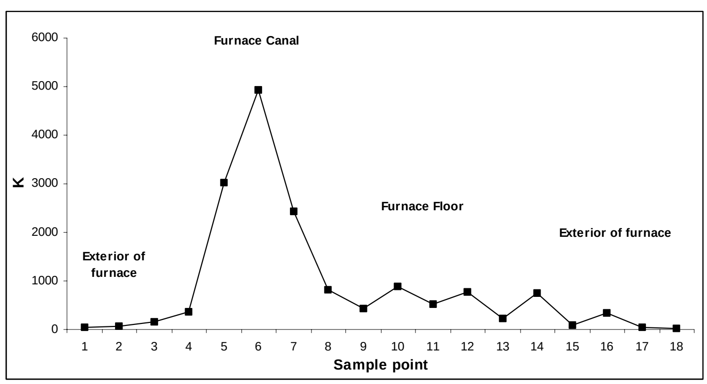


Figure 4. LEFT: Context 121. Furnace. Red line shows approximate path of magnetic susceptibility sampling points from W-E (SASAA image). **RIGHT**: Context 121. Magnetic susceptibility (***K***) measurements across the furnace from W-E.

The extreme enhancement of ***K*** values in and around the region of the furnace canal at the W end of the feature (Figure 4), together with an assessment of the furnace architecture are strongly indicative that this was the location of the tuyere within the furnace.

Case Study 3
This case study examined ***charcoal spreads*** around the site, and aimed to differentiate them from other areas/features that have undergone heating. The results of the investigation showed that the charcoal spreads can be differentiated from other areas which have undergone heating on the basis of their ***K*** values.

Case Study 4
This case study entailed a comparison of pre- and post-excavation magnetic susceptibility data as a means of predicting the location of metalworking features. The results of the investigation showed that the position of the tuyere/air supply can be 'predicted' even before the furnace is actually excavated.

SASAA 204.2: Geoarchaeological Susceptibility Survey

Please see SASAA Report 204.2 for a full description of the work carried out and results. The aim was to determine the potential evidence for a local source of iron ore which might have been used in the small bowl furnaces at Derrinsallagh 4.

In summary, prospecting for the source of iron ore in the vicinity of Derrinsallagh 4, while the excavation was still ongoing, shed light into a fundamental question associated with such (early) metalworking sites. It is often assumed, because of lack of related evidence, that the ore was bog iron. Yet the precise geoarchaeological investigation for such ores has been missing from this type of investigations, despite the recognition and identification of manganese and phosphorus-rich slags as deriving from such ores.

We propose that the source of iron in the area might be from localised iron seepages which would have produced iron precipitates. These precipitates would have built up since post-glacial times. Once the precipitate (resembling bog iron ore) was removed the seepage might continue to produce iron depending on oxidation environment and on the iron content of the rocks below. One such seepage of relatively recent date (5-10 years old) was identified in this field and another made known to us by the local farmer (but was not observed by us).

We suggest that the discovery of such iron seepages like the one discussed here is likely to point to an earlier source of iron in this area. Field development has modified the local drainage. It is argued that these seepages would not have formed randomly but only at spots where conditions, as explained above, would have been favourable. We suggest that these seepages would have come to the attention of the early Derrinsallagh inhabitants on account of their striking red orange colour and as such they may have been collected and dried prior to having been smelted in bowl furnace. Corroborating evidence for the use of such ores will come from the matching of fingerprinting elements in slags with those in the two samples of seepages collected in the course of this visit.

The use of such iron seepages in early bowl furnaces has considerable implications to our understanding of early iron metallurgy in Ireland and beyond. These seepages, the result of drainage of waterlogged fields and appropriate local conditions, would have formed at any time and they would have been noticed, on account of their bright colour, by early farmers. It remains to be seen whether they have been used in smelting, on site, and at what period.

SASAA 204.3: Soft Archaeology Characterisation

Please see SASAA Report 204.3 for a full description of the work carried out and results. The aim of this report was to characterise the 'soft archaeology' of the site at Derrinsallagh 4, for the purpose of assessing evidence for domestic activity within the site. By 'soft archaeology', we refer to soils and the features within such as the cuts made for the primitive bowl furnaces, as well as their walls and wall linings. Soft archaeology was characterised by soil phosphate analysis, organic matter determination and pH measurement.

For example, total soil phosphate on site was measured as below.

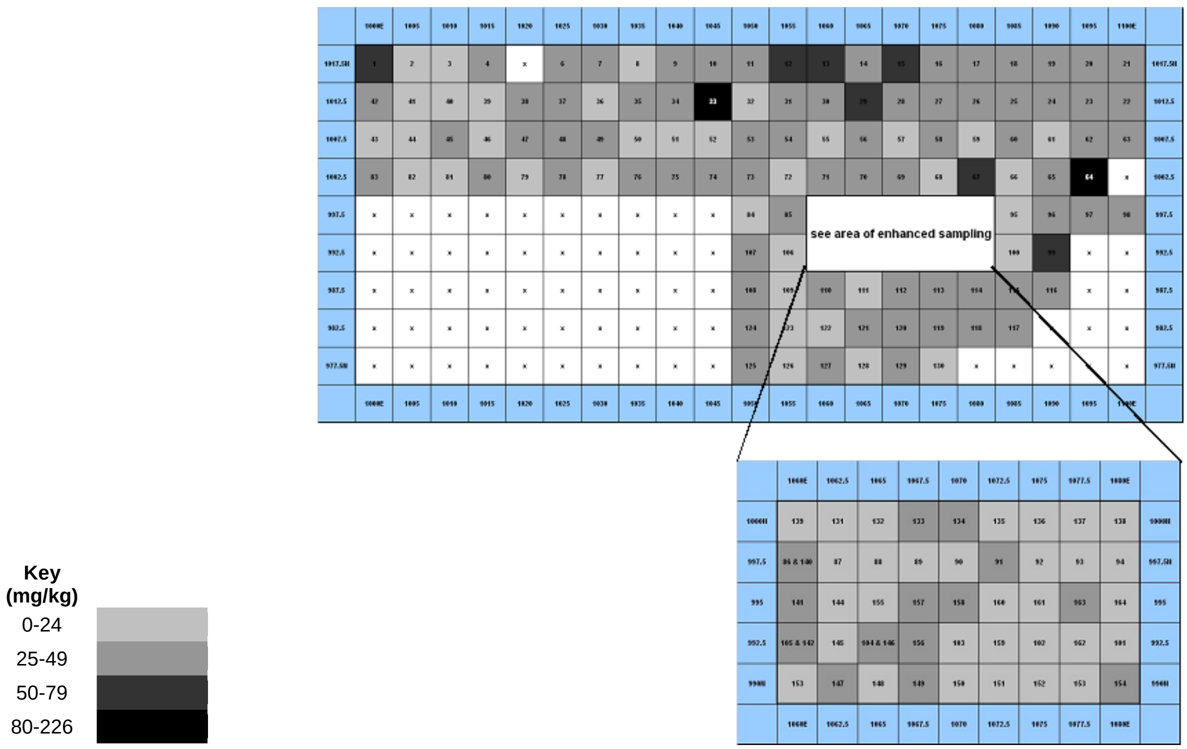


Figure 5. Total phosphate in soil across site at Derrinsallagh 4. N.B. Numbers refer to samples taken. x = point not sampled.

In summary, the analysis of soil chemistry at Derrinsallagh 4 suggests there may be domestic activity to the north and north west of the site, extending into the field beyond (not excavated). There is no evidence of domestic activity within and in the immediate vicinity of the furnace area.

In this report two samples of furnace walls were also appraised. These fragments of furnace walls, provide an insight into how local materials have been adapted/enhanced to generate 'new' materials able to respond to the tasks required (see relevant section in Materials).

3.2 Methodology

a) Metallurgical Waste Characterisation

The typological examination and analysis with SEM-EDAX/XRD/petrography (all or a combination thereof) for the purpose of identifying the metallurgical process: smelting/smithing/alloying/other; the type of ore resource used (bog ore, other and what type); the quantities or metallurgical waste generated.

Slag Typology

The examination (typological) of the metallurgical waste collected from the site, with the aim of establishing the range of sizes and weights, and to carry out sampling for subsequent technical analysis.

Slag Analysis

SEM-EDAX

Materials have been analysed with the scanning electron analyser attached to an energy dispersive unit. A number of samples have been prepared as polished blocks by grinding with a series of silicon carbide papers and polished with 6- and 3-micron diamond paste. Quantitative SEM-EDAX analyses are undertaken first on the entire surface of the polished block, and subsequently on each of the different mineralogical phases observed. Each phase contains, apart from the main constituent elements, a suite of other minor and trace elements. Two sets of analyses are needed. The first type (taken over a mean of three) is aimed to cover the analysis of the entire surface of the polished block and is considered to be representative of the composition of the sample as a whole. The second type is aimed at establishing the composition of each of the mineralogical phases observed and so at identifying the process that generated the sample under investigation. In both types of analyses only major and minor elements are recorded. The sensitivity of the analysis for most elements is c.0.2%.

Metallurgical Ceramics Typology

The examination (typological) of the metallurgical ceramics collected from the site, with the aim of establishing the range of dimensions and weights, and to carry out sampling for subsequent technical analysis. Photography is also carried out.

b) Soils Analysis

Soils analysis is carried out on all available/relevant soil samples (both within and outwith metalworking areas). Soil phosphate, organic content and magnetic susceptibility are measured as standard. The aim is to establish the range and spatial extent of anthropogenic activities within the site, be they industrial, domestic, ritual or other. The purpose of the exercise being two-fold: the elucidation of the *other* (non-metallurgical) activities on site and their juxtaposition to those associated with metal-working.

Phosphate Analysis

Samples were prepared using a standard ignition-hydrochloric acid *total* phosphate extraction procedure (SASAA in-house method – Wilson 2005). The procedure was repeated without ignition for *inorganic* phosphate determination. Phosphate concentrations were then measured colorimetrically, using a WPA Colorimeter. Quantification is achieved by analysis of a series of standards and construction of a calibration curve, against which unknown samples can be plotted and concentrations derived. *Organic* phosphate concentration was then calculated as the difference between total and inorganic components.

Organic Content

Organic matter was determined on a loss-on-ignition basis, following a standard method (Bascomb 1982).

Magnetic Susceptibility

Magnetic susceptibility is a measure of a material's ability to become magnetised by an external magnetic field. Iron compounds have a large positive susceptibility and these form a significant portion of most soils, which vary in magnetic susceptibility due to their different chemical compositions. The compounds usually found in soils can become magnetic and thus acquire a greater magnetic susceptibility by a number of processes, most notably burning of the soil. Thus areas of enhancement may indicate areas of anthropogenic activity such as past settlement sites, industrial activity or heat-affected material (Wilson 2005).

SASAA used a Bartington MS2 magnetic susceptibility system, with an MS2F coil to measure in situ magnetic susceptibility (www.bartington.com). Volume specific magnetic susceptibility was measured (***K***), which is a dimensionless value (Dearing 1999). Background measurements were taken off-site to monitor data quality and to provide values for comparison with magnetic susceptibility measurements taken during the survey. Magnetic susceptibility values are enhanced above background when an area has been exposed to heating (i.e., heated soils in a hearth or furnace, vitrified clay, charcoal), and enhanced further where there are ferrous minerals present (i.e. in the form of iron oxides or iron silicates (slag)), or indeed where metal itself is present.

An in-situ magnetic susceptibility survey was carried out pre- and mid-excavation (SASAA Report 204.1) and post-excavation measurement of magnetic susceptibility on soils from all contexts was carried out for this report.

Portable-XRF Analysis (Chemical Composition)

The chemical composition of all soils, clays, and some slags and charcoals was carried out using a portable X-Ray Fluorescence instrument (Niton XLt 700 series). No sample preparation is necessary – the sample can be held directly against the XRF's testing window. This instrument uses an X-ray tube for excitation and typically analyses one sample in 60-90 seconds. The XLt 700 was set in 'Soil Mode' and a range of elements measured. It is a readily field-portable instrument, being hand held and containing a data logger. Elements measured:

- Pb, Sn, Cd, Sb, Ag, Sr, Rb, Se, As, Hg, Zn, Cu, Ni, Co, Fe, Mn, Cr, V, Ti, Sc, Ca, K
  (where some of these elements have not been reported in data tables, they have not been detected, i.e. they are below the limit of detection).

- Limits of detection for elements are given in the table below. LOD's are dependent on the following factors: a) testing time, b) soil matrix, c) level of statistical confidence and d) excitation source.

Table 1. XRF limits of detection in a sand matrix (ppm).

Element	Pb	Sn	Sb	Sr	Ag	Cd	Rb	Hg	Se	As	Zn	Cu	Ni	Co	Fe	Mn	Cr	V	Ti	Sc	Ca	*K*
LOD	*11*	*50*	*54*	*10*	*30*	*30*	*4*	*12*	*8*	*9*	*24*	*50*	*80*	*150*	*120*	*90*	*60*	*65*	*100*	*45*	*250*	*300*

3.3 Results

1. CONTROL SAMPLES

Several samples were chosen to act as controls – these were fills from postholes around the site at Derrinsallagh 4, and contained very low amount of elements and had low magnetic susceptibility. For the XRF and MS data, an average value was taken from these, with which to compare the other features on site.

Table 2. Typology.

FEATURE	CONTEXT	SAMPLE	ACS DESCRIPTION	SOIL COLOUR	MUNSELL NOTATION	SLAG	CHARCOAL	METALLURGICAL CERAMIC	SOIL DESCRIPTION
301	305	**215**	Soil from c305 a fill of c301, a pit or posthole	light brown	7.5YR 6/4	0	0	0	lumpy soil
72	155	**65**	Soil and Charcoal from c155 a fill of c72, a posthole.	light brown	7.5YR 6/5	0	0	0	lumpy soil
43	42	**43**	Soil from c42 a fill of c43, a possible posthole.	light brown	7.5YR 6/6	0	0	0	lumpy soil
62	61	**46**	Soil from c61 a fill of c62 a posthole.	greyish brown	10YR 5/2	0	0	0	lumpy soil
74	217	**105**	Soil and Charcoal from c217 a fill of c74 a posthole.	light grey	10YR 7/1	0	0	0	sterile fine lumpy soil
145	180	**76**	Soil and Charcoal from c180 a fill of c145, a posthole.	light grey	10YR 7/2	0	0	0	calcareous clay-rich soil
146	181	**77**	Soil and Charcoal from c181 a fill of c146, a posthole.	greyish brown	10YR 5/2	0	0	0	lumpy soil

Table 3. XRF and MS data.

FEATURE	CONTEXT	SAMPLE	MS (K)	Pb	Sn	Sb	Sr	Rb	As	Zn	Cu	Ni	Fe	Mn	Cr	V	Ti	Ca	K
301	305	**215**	3	16.84	0.00	0.00	18.95	53.14	0.00	61.80	0.00	0.00	14956.13	1200.91	0.00	0.00	1782.94	2169.82	8418.99
72	155	**65**	4	19.31	0.00	0.00	17.66	58.57	0.00	66.16	0.00	0.00	14674.48	1046.44	0.00	0.00	2252.46	2332.84	11360.02
43	42	**43**	7	18.93	0.00	0.00	16.68	46.15	0.00	48.91	0.00	0.00	11700.60	600.93	0.00	0.00	2476.08	2131.17	11377.85
74	217	**105**	20	79.24	0.00	0.00	17.64	43.20	0.00	26.92	0.00	0.00	10542.73	1194.17	0.00	0.00	1737.05	1867.92	6601.86
145	180	**76**	21	23.57	0.00	0.00	20.73	46.59	0.00	43.73	0.00	0.00	11602.93	659.41	0.00	0.00	2370.58	2390.52	11012.84
146	181	**77**	35	0.00	0.00	0.00	20.13	42.79	0.00	39.28	0.00	0.00	10240.92	668.01	0.00	0.00	2153.42	1829.52	9119.72
average			**14**	**25.63**	**0.00**	**0.00**	**19.02**	**48.77**	**0.00**	**47.80**	**0.00**	**0.00**	**12779.60**	**960.82**	**0.00**	**0.00**	**2212.76**	**2352.10**	**9958.88**

2. TYPOLOGICAL ASSESSMENT

See Excel File on attached CD.

Typological assessment of soils is based on the following: Colour (Munsell Notation), texture description and a relative appraisal of their inclusions, be they fragments of slag, charcoal or heated/sintered/vitrified clay-based materials.

Typological assessment of slag is based on weight measurement and morphological characteristics. The slag excavated at Derrinsallagh was of the following general types (clinkery and amorphous slag). Slag has been divided into coarse and fine (<1mm) categories to assist in classification.

Figure 6. Typical examples of the range of materials excavated on Irish metallurgical sites dating to the Iron Age and the early medieval period (these are from SASAA projects 258-264).

<table>
<tr>
<td>
</td>
<td>
</td>
<td>
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</tr>
<tr>
<td>Drippy/clinkery slag
(Large fragments: dark grey, dense. Small fragments: porous)
SASAA 261.01</td>
<td>Dense black slag with fine-medium porosity (cake)
SASAA 264.61</td>
<td>Dense black slag with fine-medium porosity (section)
SASAA 264.64</td>
</tr>
</table>

3. MATERIAL GROUPINGS (STATISTICAL TREATMENT OF MATERIALS - XRF DATA)

A. ALL MATERIALS

ALL ELEMENTS, NO MAGNETIC SUSCEPTIBILITY

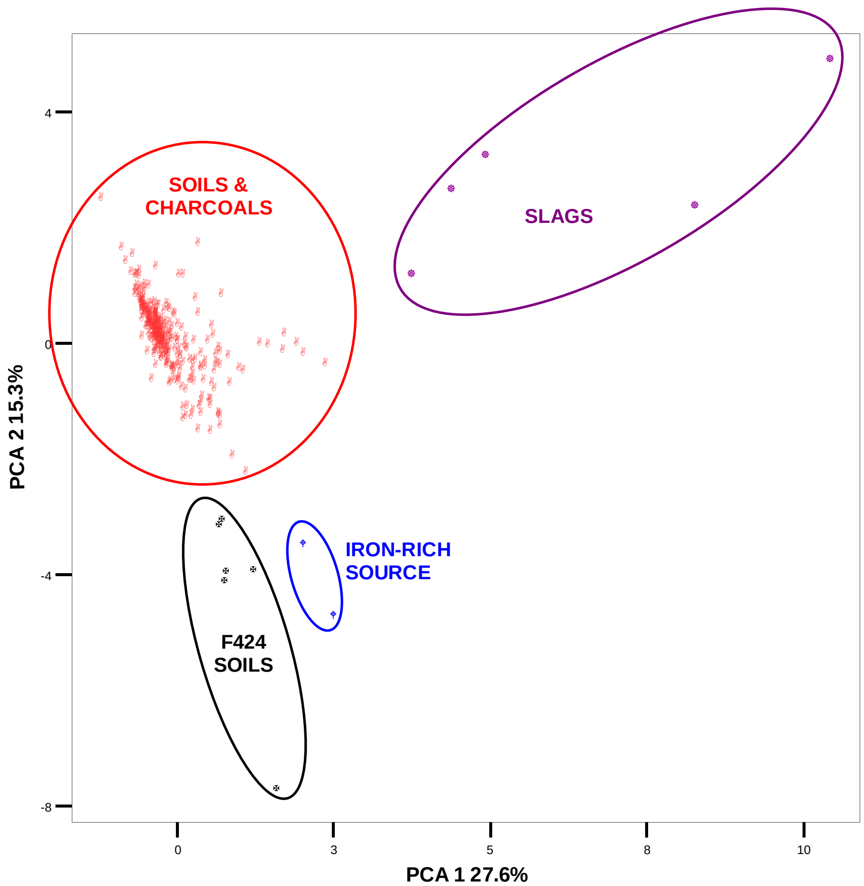


Figure 7. Principal components analysis plot for all materials, using all elements determined by XRF.

Comments: Charcoals and soils cannot be differentiated – they overlap in most cases. The other groups can clearly be separated. F424 soils are clearly different from all others. Interestingly, iron-rich source, thought to be a type of possible ore source does not overlap with most soils or slags.

B. ALL MATERIALS EXCEPT SOILS

ALL ELEMENTS, NO MAGNETIC SUSCEPTIBILITY

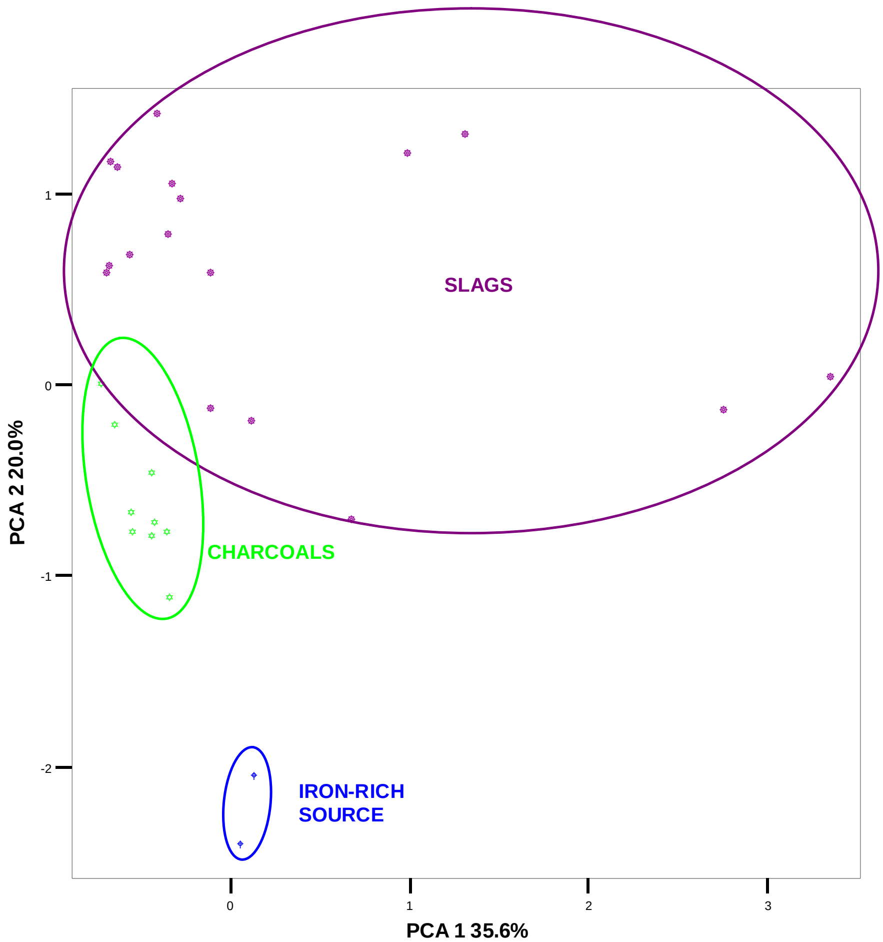


Figure 8. Principal components analysis plot for all materials except soils, using all elements determined by XRF.

Comments: When soils are removed from the body of materials, slags, charcoals and iron-ore sources separate into distinct clusters. There is some overlap between slags and charcoals, as we would expect from the chemical composition of these materials.

4. DATA SUMMARIES BY MATERIAL

A. SLAG

i. XRF & K

Table 4. XRF data for slags (ppm)

Fine slags

FEATURE	CONTEXT	SAMPLE	MS (K)	Pb	Sb	Sr	Rb	As	Zn	Ni	Fe	Mn	V	Ti	Ca	K
10	**223**	**137**	510	42.19	0.00	21.26	51.87	0.00	85.62	0.00	111857.63	11428.17	82.68	2201.26	7333.79	12893.95
10	**221**	**143**	295	21.77	0.00	31.21	46.36	38.80	135.52	0.00	87193.10	10488.71	101.35	2028.00	18253.25	10634.32
99	**105**	**20**	1002	28.61	0.00	22.73	47.65	41.21	0.00	192.79	185261.30	26893.23	108.62	2446.47	6738.12	11984.66
125	**515**	**373**	1729	0.00	0.00	19.52	22.23	187.64	0.00	1049.60	550317.81	68077.92	192.11	1211.02	20591.23	11511.95
134	**162**	**64**	280	32.57	0.00	17.60	46.05	0.00	42.42	0.00	37242.80	3598.06	65.94	2586.73	4751.83	11713.09
266	**286**	**187**	492	30.37	0.00	18.73	64.58	70.53	0.00	145.55	152923.92	16791.80	82.06	2453.16	6958.01	13518.06
468	**495**	**368**	923	0.00	0.00	23.09	47.91	17.89	56.40	0.00	167384.56	17462.59	61.48	2127.41	6517.76	11008.93

Coarse slags

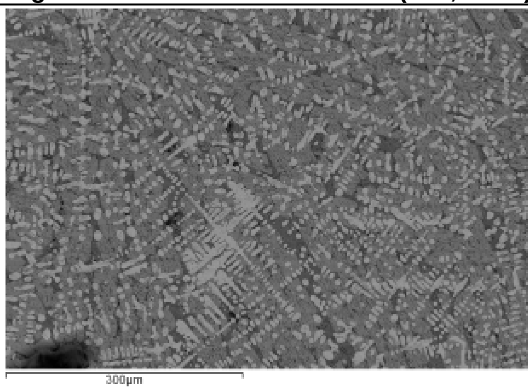
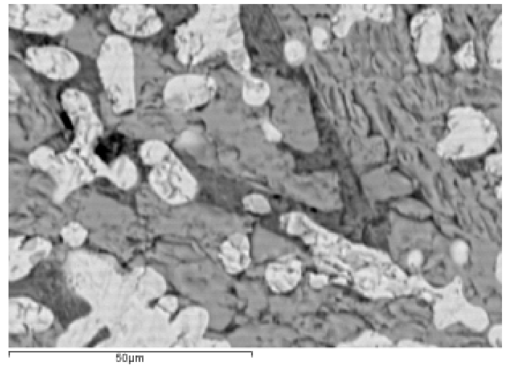
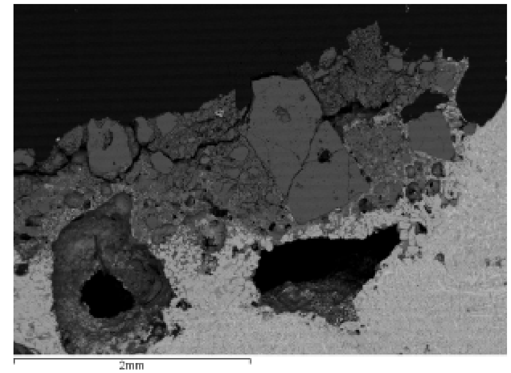
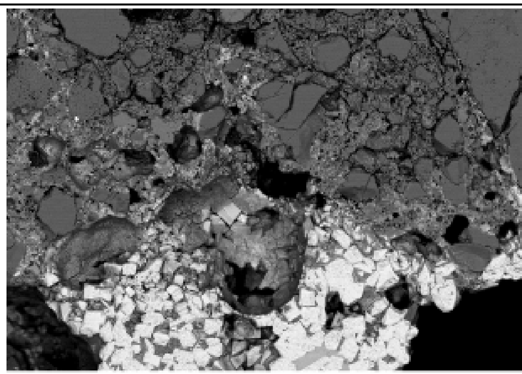
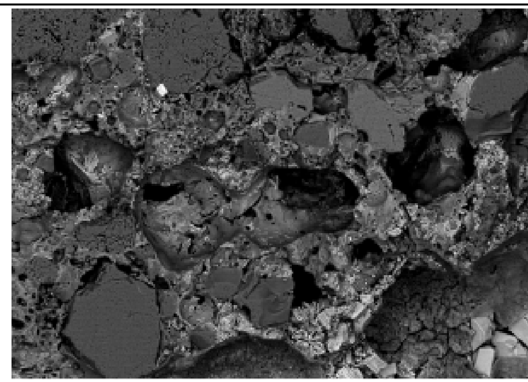
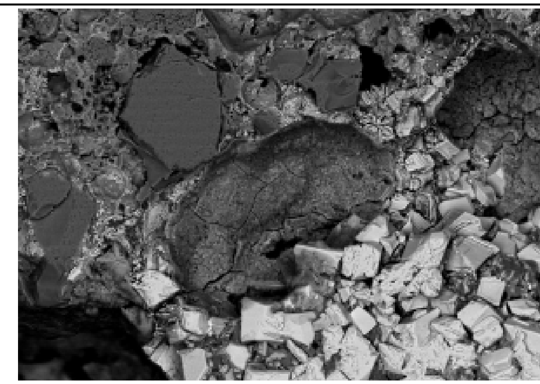
FEATURE	CONTEXT	SAMPLE	MS (K)	Pb	Sb	Sr	Rb	As	Zn	Ni	Fe	Mn	V	Ti	Ca	K
5	**54**	**226 clinkery**	1479	138.15	0.00	61.20	48.07	0.00	0.00	3196.91	1443127.38	242053.92	273.68	1951.54	6407.58	9167.62
5	**54**	**226 vitrified**	1479	0.00	652.55	166.99	49.27	0.00	0.00	4427.11	1808049.13	341757.22	341.48	2139.53	9447.60	0.00
14	**269**	**166**	812	0.00	1291.55	150.56	61.78	0.00	0.00	6227.53	2139285.75	447241.81	196.89	1348.62	4223.46	3541.94
18	**288**	**193 clinkery**	Nd	0.00	0.00	0.00	0.00	0.00	0.00	3436.23	1514813.88	217819.14	0.00	1407.01	7070.29	5073.07
19	**234**	**139**	468	55.29	0.00	31.97	75.46	49.16	0.00	315.06	211244.36	29710.40	0.00	1642.46	1837.28	10891.00
19	**258**	**176**	Nd	113.48	0.00	19.37	37.60	53.08	0.00	687.65	370179.84	51682.03	0.00	1817.36	3544.62	6880.74
21	**273**	**174 clinkery**	1363	76.32	578.42	0.00	64.11	451.60	0.00	1479.78	2772492.75	45839.28	0.00	1296.26	13350.27	10307.13
123	**352**	**284**	860	31.89	0.00	32.21	64.02	0.00	0.00	0.00	130766.23	5222.22	38.10	2080.60	2714.69	9197.92
425	**439**	**470**	Nd	0.00	0.00	29.11	53.58	0.00	84.31	0.00	49743.37	6839.02	0.00	2055.55	3372.13	9329.61
425	**439**	**470 red area**	Nd	0.00	0.00	30.44	67.79	0.00	0.00	0.00	682606.75	29353.23	0.00	1002.90	2520.48	6694.62

Comments on XRF: Slags are presented as coarse or fine; coarse fragments are larger than 1mm, so ‘fines’ are the soils/slags sieved less than 1mm. As expected, Fe and Mn contents of these samples are high. Ca, As, Sb, Zn and V are interesting in that they are present in substantial amounts in some samples, yet completely absent from others. Cu is absent from all slags analysed here.

Comments on K: There is considerable range in ***K*** values from the slags. Some are fairly low, especially in the fine material – this is probably due to the presence of soil within. The majority of coarse slags examined here have typical values of ***K*** we would expect to see in bloomery slags. There is little correlation between morphology (clinkery/amorphous) and ***K*** values.

iii. SEM-EDAX

Figure 9. SAMPLE 271.176 (F19, C258) – images and data table

		
SASAA 271.176.i	**SASAA 271.176.ii** **dendrides of wustite (bright), needles of fayalite (grey), interstitial glass (dark grey)**	**SASAA 271.176.iii** **iron oxides(bright) in the vicinity of ferruginous material**
		
SASAA 271.176.iv **ferruginous matrix (iron oxides with aluminium silicates) with quartz grains; for images v and vi see same area at different magnifications**	**SASAA 271.176.v**	**SASAA 271.176.vi**

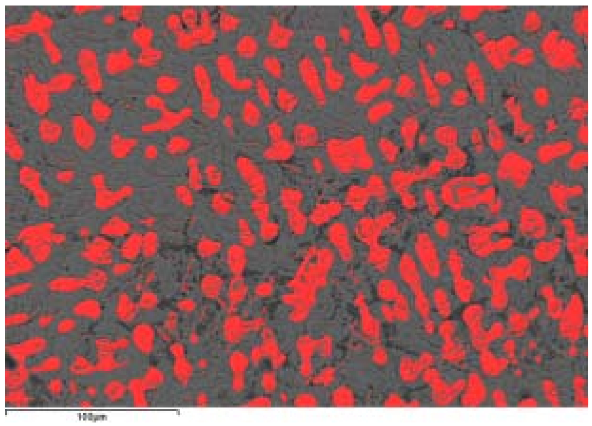
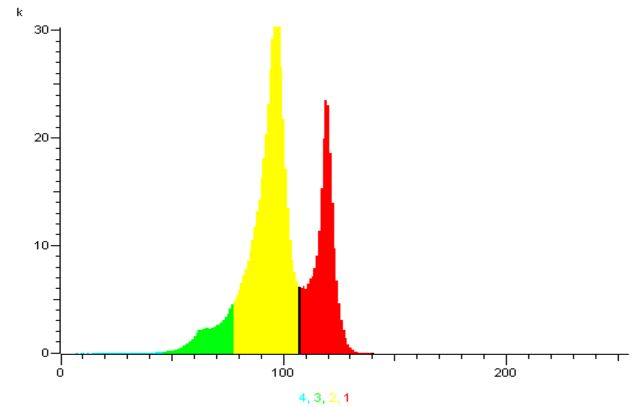


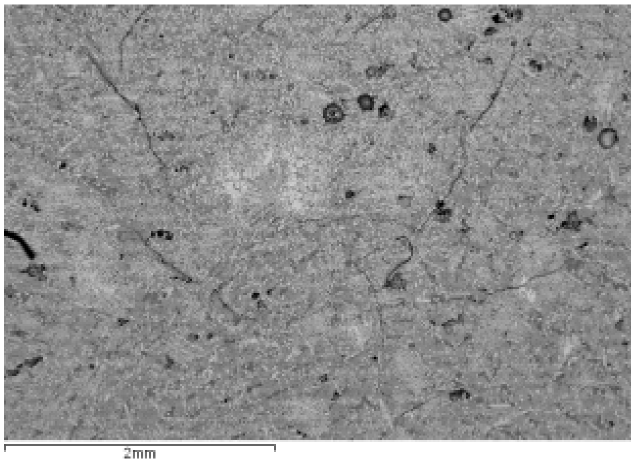
Image analysis for 271.176 highlighting only wustite



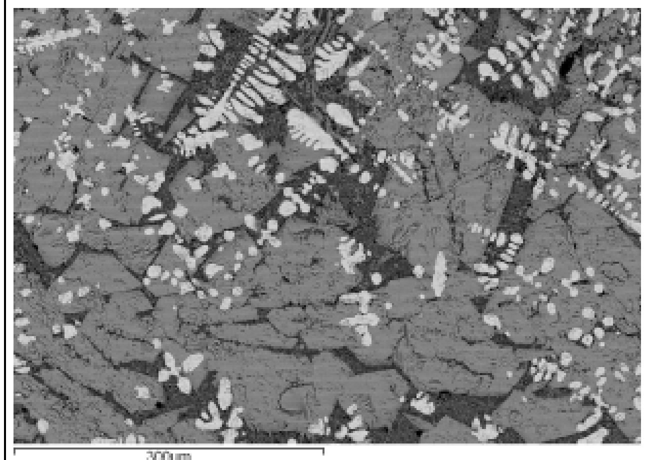
percentage composition of three phases in 271.176: wustite (red), fayalite (yellow) and interstitial glass (green).

Sample	Description	Na2O	MgO	Al2O3	SiO2	P2O5	SO3	K2O	CaO	TiO2	MnO	FeO	BaO	Total
271.176	area ana- image 271.176.i	0.14	0.32	3.80	23.03	1.50	0.09	0.85	5.83	nd	8.22	56.14	nd	100
271.176	fayalite- image 271.176.i	0.07	0.88	0.33	29.77	0.59	0.00	0.00	4.11	nd	13.14	51.20	0.02	100
271.176	wustite- image 271.176.i	0.03	0.00	0.64	0.44	0.00	0.10	0.13	0.26	nd	4.50	93.60	0.31	100
271.176	interstitial glass- image 271.176.i	1.36	0.00	16.28	31.78	7.73	1.16	4.26	16.43	nd	2.88	14.66	3.48	100
271.176	Fe-silicate- image 271.176.iv	0.69	0.93	6.30	65.49	0.50	0.12	2.56	1.25	nd	2.03	19.65	0.49	100
271.176	quartz grains-image 271.176.iv	0.00	0.00	0.00	100.40	0.00	0.00	0.00	nd	nd	nd	nd	0.00	100
271.176	Fe-Al silicate- image 271.176.iv	0.61	0.56	7.48	41.13	1.04	0.18	2.72	2.19	0.53	5.11	38.17	0.23	100
271.176	K-Al silicate - image 271.176.iv	0.35	0.08	17.46	65.32	0.21	0.26	15.43	0.03	nd	0.03	0.43	0.42	100

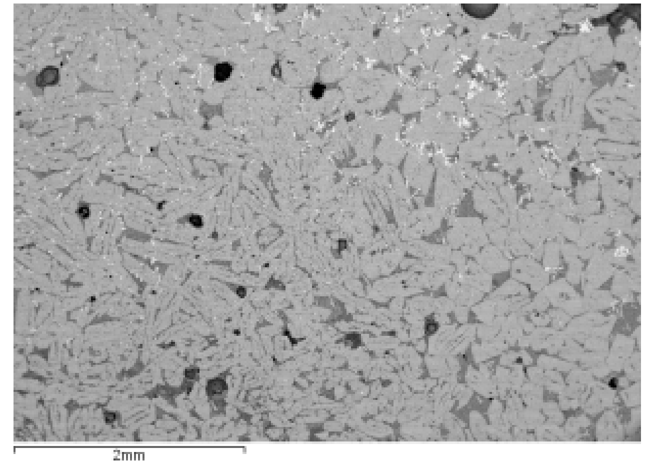
Figure 10. SAMPLES 271.478 (F125, C325) and 271.570 (F142, C154) - images and data table



SASAA 271.478.i



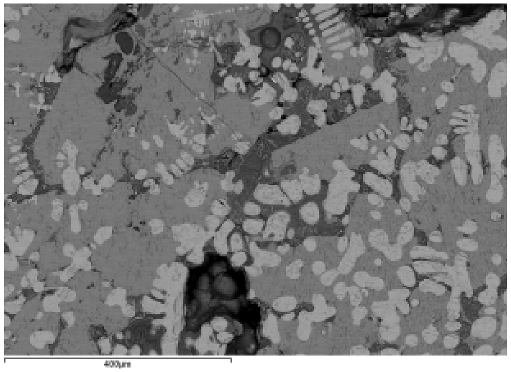
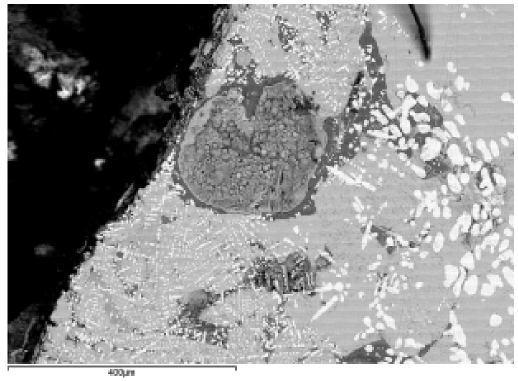
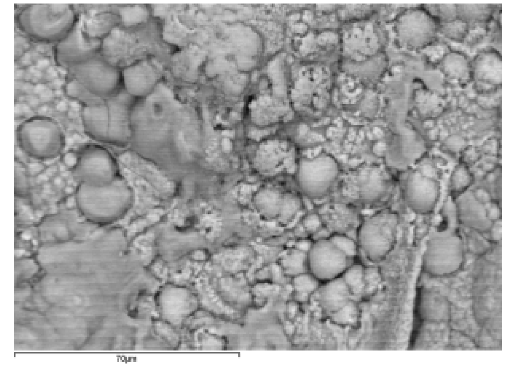
SASAA 271.478.ii
dendrites of wustite, angular fayalite and interstitial glass

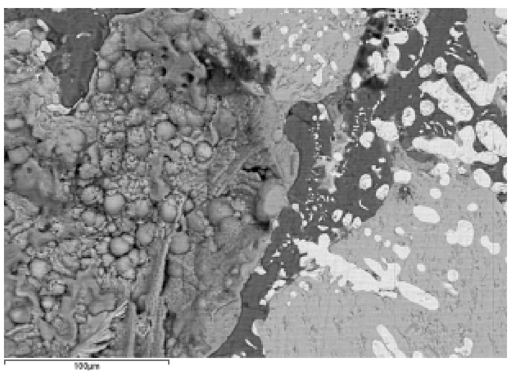
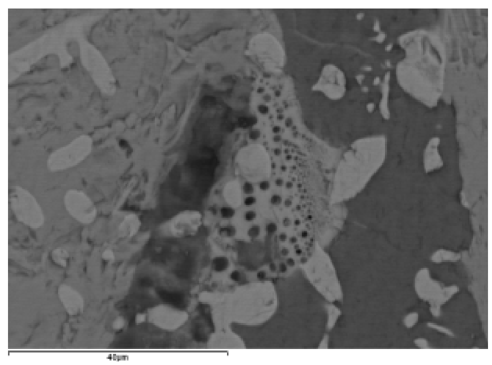
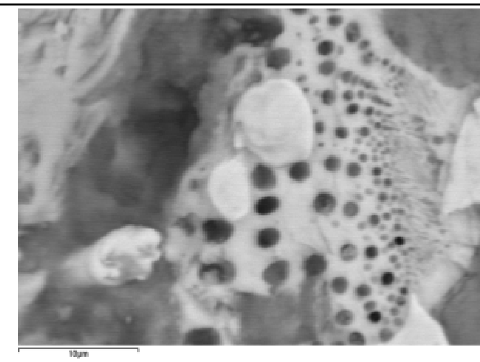


SASAA 271.570.i
fayalite, sparse wustite and interstitial Ca-rich glass

Sample	Description	Na2O	MgO	Al2O3	SiO2	P2O5	SO3	K2O	CaO	TiO2	MnO	FeO	BaO	Total
271.478	area ana-image 271.478.i	0.17	0.46	3.83	24.38	1.17	0.06	0.86	6.69	0.22	9.35	52.45	0.30	100
271.478	wustite-image 271.478.i	0.23	0.13	1.10	0.29	0.00	0.00	0.01	0.13	0.30	6.30	92.04	0.00	101
271.478	interstitial glass -image 271.478.i	0.01	0.49	0.12	33.28	0.00	0.00	0.07	7.51	nd	14.51	44.16	nd	100
271.478	Ca-rich fayalite--image 271.478.i	0.00	0.64	0.02	32.30	0.59	0.00	nd	3.64	nd	14.19	48.66	0.00	100
271.478	Al,Ca glass--image 271.478.ii	1.62	nd	18.84	37.46	4.60	0.73	6.89	12.44	nd	1.79	12.75	2.89	100
271.478	Al, Ca glass--image 271.478.ii	1.10	0.01	15.56	35.11	5.02	0.96	4.59	13.59	0.00	2.49	16.63	5.18	100

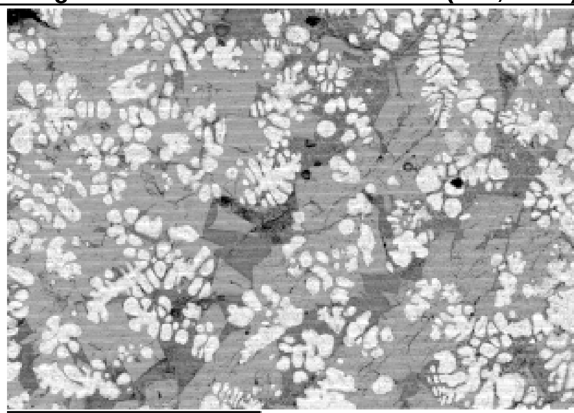
Figure 11. SAMPLE 271.41 (F8, C132) - images and data table

		
SASAA 271.041.i **wustite, fayalite and interstitial glass**	**SASAA 271.041.ii** **wustite, fayalite and interstitial glass; also partially reacted ore nodule**	**SASAA 271.041.iii ore nodule at higher magnification with globules and matrix of iron oxide and silicates**

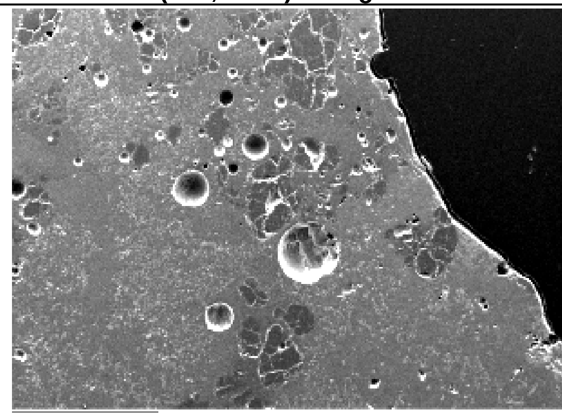
		
SASAA 271.041.iv	**SASAA 271.041.v** **variety of potassium silicate and barium silicate phases**	**SASAA 271.041.vi** **'gruyere cheese phase' associated with Fe-P-silicate**

Sample	Description	Na2O	MgO	Al2O3	SiO2	P2O5	SO3	K2O	CaO	TiO2	MnO	FeO	BaO	Total
271.041	wustite--image 271.041.i	0.00	0.07	0.72	0.36	0.00	0.25	nd	nd	0.25	2.96	95.89	0.04	100
271.041	fayalite-image 271.041.i	0.00	0.77	0.00	31.90	0.44	0.00	nd	1.25	0.00	9.03	56.94	0.33	100
271.041	K-rich alumino silicate-271.041.i	0.31	0.00	16.06	37.19	0.28	0.19	12.23	0.16	0.32	1.02	30.46	1.81	100
271.041	iron ore globule1-image 271.041.iii	0.07	0.20	0.59	7.92	0.91	0.00	0.89	0.84	nd	1.26	87.44	nd	100
271.041	iron ore globule2-image 271.041.iii	0.18	0.04	0.40	10.47	1.18	0.32	0.31	0.40	nd	1.32	85.17	0.21	100
271.041	iron ore globule3-image 271.041.iii	0.23	0.00	0.98	16.65	1.20	0.00	1.10	nd	0.00	1.68	78.50	0.28	100
271.041	iron ore globule4-image 271.041.iii	0.00	0.00	0.00	10.82	1.34	0.15	0.31	0.56	0.08	1.27	85.90	0.08	100
271.041	matrix-image 271.041.iii	0.09	0.00	0.61	14.51	0.58	0.03	1.33	0.61	nd	nd	82.62	0.09	100
271.041	matrix-image 271.041.iii	0.62	0.14	1.03	16.53	1.39	0.38	0.87	0.54	0.00	nd	78.99	0.00	100
271.041	matrix-image 271.041.iii	0.04	0.00	1.11	16.85	0.96	0.00	1.43	0.89	nd	nd	79.03	0.28	100
271.041	matrix-image 271.041.iii	0.08	0.00	1.72	20.93	1.42	0.22	1.66	0.65	0.00	nd	73.56	0.09	100
271.041	matrix-image 271.041.iii	0.31	0.19	0.51	16.75	0.44	0.00	1.34	0.72	0.07	1.10	78.94	0.00	100
271.041	fayalite-image 271.041.iv	0.10	0.46	0.26	32.58	0.28	0.04	0.00	1.80	0.14	7.87	56.63	0.00	100
271.041	K-rich glass-image 271.041.iv	0.52	0.00	22.16	55.90	0.00	0.04	18.85	0.36	0.00	nd	1.29	1.38	100
271.041	K-rich glass-image 271.041.iv	0.52	0.00	22.16	55.90	0.00	0.04	18.85	0.36	0.00	nd	1.29	1.38	100
271.041	Fe-P-silicate glass –image 271.041.v-'gruyere cheese' texture	0.21	0.15	4.12	20.79	20.11	0.11	1.72	7.96	0.07	2.48	41.46	0.82	100
271.041	K-rich silicate glass–image 271.041.v	0.33	0.00	23.24	54.41	0.09	0.08	18.40	0.00	0.05	nd	1.27	2.43	100
271.041	Ba-rich silicate glass–image 271.041.v	0.30	0.22	25.00	36.18	0.81	nd	2.12	0.69	0.07	nd	3.20	31.40	100
271.041	Ba-rich silicate glass–image 271.041.v	0.27	0.02	24.07	36.99	0.41	0.31	2.64	0.70	nd	nd	2.66	31.94	100

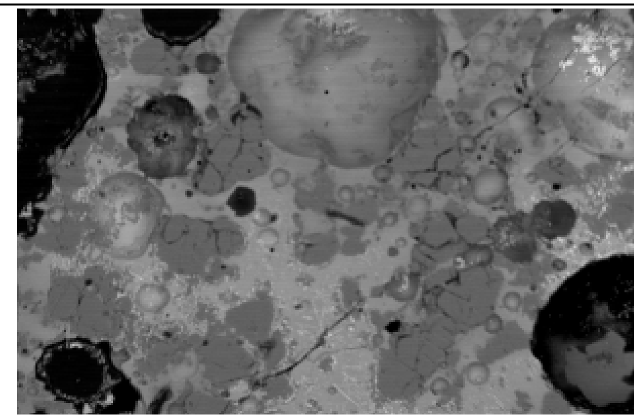
Figure 12. SAMPLES 271. 131 (F14, C192) SAMPLE 271.257 (F17, C357) - images and data table



SASAA 271.131.i
dendrites of wustite, fayalite and interstitial glass



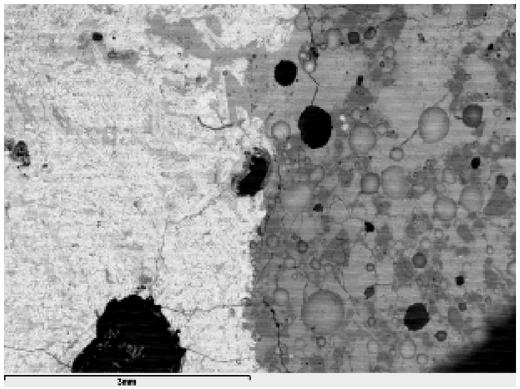
SASAA 271.257. i
metallurgical ceramic matrix (glassy) and quartz inclusions; matrix is an alumino-silicate with small amounts of K and Ca.



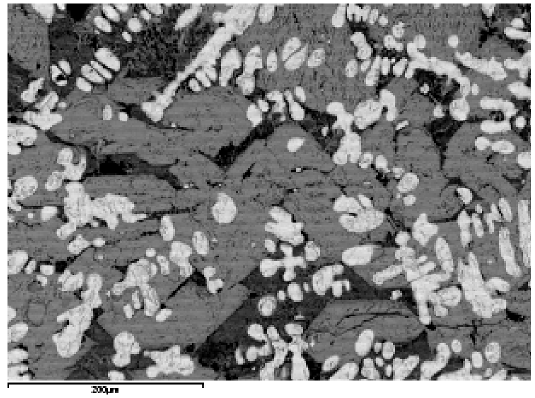
SASAA 271.257.ii glass matrix; heat- fractured quartz grains.

Sample	Description	Na2O	MgO	Al2O3	SiO2	P2O5	SO3	K2O	CaO	TiO2	MnO	FeO	BaO	Total
271.131	area ana- image 271.257.1	0.40	0.60	4.56	55.19	0.72	0.00	1.81	4.71	0.00	4.59	26.86	0.86	100
271.131	interstitial glass-image 271.257.i	0.95	nd	5.23	35.44	2.15	0.03	1.91	17.09	nd	7.58	28.49	1.13	100
271.131	wustite-image 271.257.i	0.18	0.00	0.80	0.79	0.00	0.50	nd	nd	nd	7.02	90.88	0.03	100
271.131	fayalite-image 271.257.i	0.00	0.79	0.02	30.60	0.06	0.23	0.13	3.95	0.00	19.49	44.86	0.05	100
271.257	glass matrix 1	0.62	1.27	9.28	61.43	1.01	nd	2.33	2.81	0.79	3.19	17.27	0.01	100
271.257	glass matrix 2	0.70	1.61	8.99	64.96	0.96	nd	2.55	3.07	0.57	3.57	12.85	0.18	100
271.257	area ana-image 271.257.i	0.67	0.68	7.04	68.44	0.40	0.09	3.44	3.24	0.56	2.42	13.00	nd	100
271.257	quartz grains-image 271.257.i	0.00	0.01	0.00	100.22	0.00	0.03	0.00	0.00	nd	nd	nd	0.04	100
271.257	spot ana1 on glass matrix -image 271.257.ii	0.36	0.17	4.82	58.99	0.51	0.00	2.23	4.37	0.31	4.04	23.83	0.50	100
271.257	spot ana2 on glass matrix	0.44	0.69	5.29	56.68	0.67	0.37	2.61	5.21	0.00	6.39	20.74	1.17	100
271.257	spot ana3 on glass matrix	0.50	1.98	4.23	57.94	0.93	0.00	1.70	8.24	0.40	6.54	17.24	0.49	100

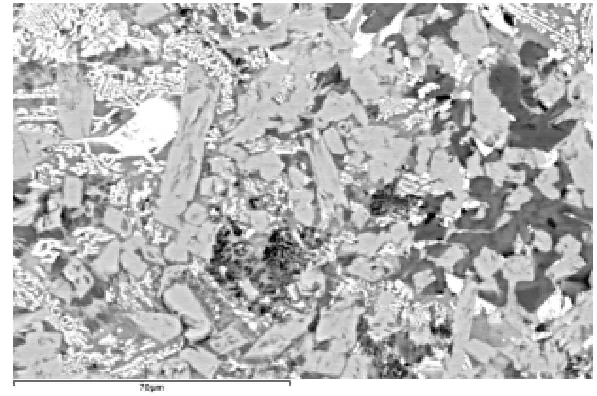
Figure 13. SAMPLE 271.125 (F19, C227) - images and data table



SASAA 271.125.i
cluster of iron oxides (bright) at the interface with an alumino-silicate glass (ceramic) phase



SASAA 271.125 si4.ii
dendrites of wustite, fayalite and interstitial glass



SASA 271.125.iii see analysis for various phases

Sample	Description	Na2O	MgO	Al2O3	SiO2	P2O5	SO3	K2O	CaO	TiO2	MnO	FeO	BaO	Total
271.125	fayalite (bright phase) image 271.125.iii	0.25	4.34	nd	32.56	1.29	nd	nd	1.81	nd	6.12	53.66	nd	100
271.125	glass (light grey phase) image 271.125.iii	3.14	0.18	7.55	44.40	11.09	nd	2.46	16.94	nd	1.57	12.50	0.16	100
271.125	angular (light grey phase) image 271.125.iii	0.13	2.01	nd	52.01	nd	nd	0.18	16.24	nd	5.45	24.23	nd	100
271.125	aluminium silicate glass (dark phase) image 271.125.iii	7.47	0.16	20.79	64.99	nd	nd	2.23	1.40	nd	nd	2.96	nd	100
271.125	iron oxide- image 271.125.v	0.00	0.72	0.12	17.90	4.26	0.31	0.45	0.61	0.00	nd	75.36	0.53	100
271.125	iron oxide- image 271.125.v	0.00	0.00	0.26	0.00	0.71	0.56	0.00	0.04	nd	nd	98.98	0.20	101
271.125	iron manganese oxide image 271.125.v	0.72	0.50	0.34	6.85	9.85	0.22	2.44	6.06	0.00	34.79	36.45	2.08	101
271.125	barium sulphide inclusion image 271.125.iv	0.24	0.18	0.18	0.05	0.00	24.55	nd	0.38	0.00	0.10	4.65	49.11	101
271.125	glass- image 271.125.ii	0.14	0.11	14.35	51.01	0.54	0.33	5.01	1.10	0.52	nd	27.00	0.00	100
271.125	fayalite- image 271.125.ii	0.00	0.63	1.18	20.56	8.25	0.00	1.44	1.19	nd	nd	67.09	0.07	100
271.125	iron- titanium silicate- image 271.125.ii	0.00	1.14	0.09	34.07	0.00	0.00	0.00	3.50	12.02	nd	49.56	0.16	101

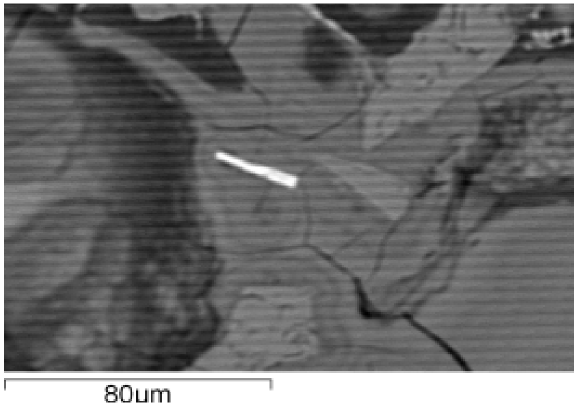
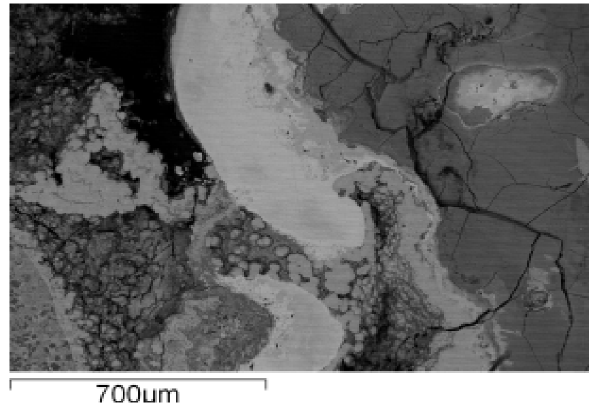
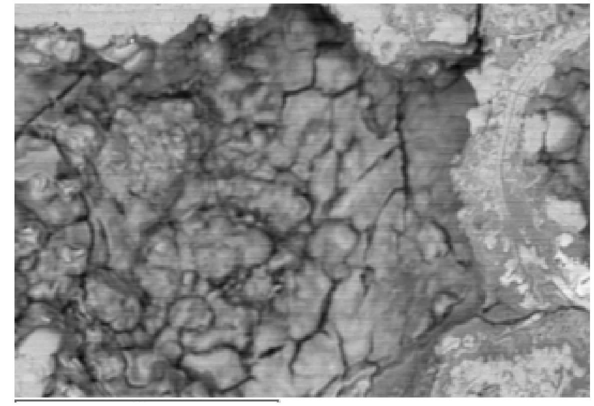
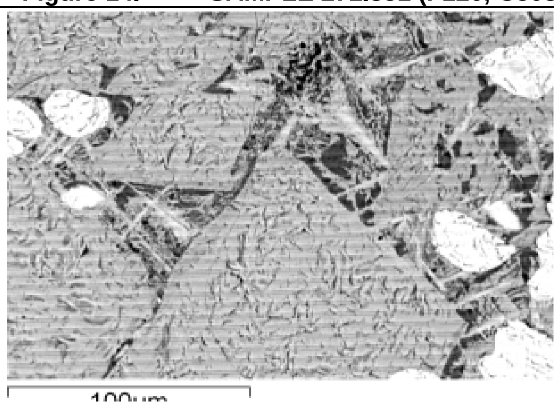
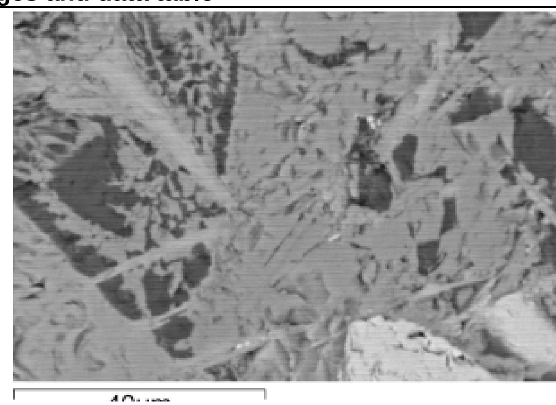
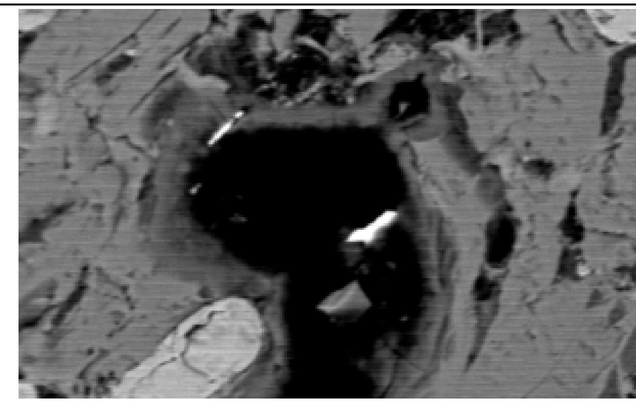
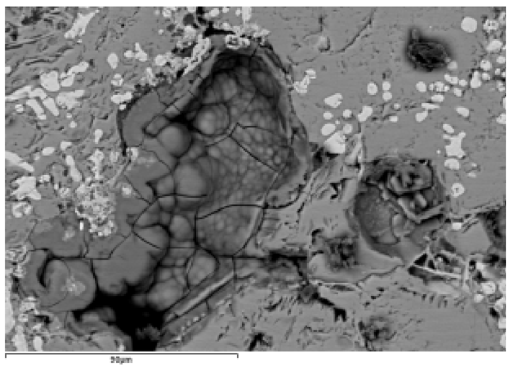
		
SASAA 271.125.iv	**SASAA 271.125.v iron oxide and manganese oxide at varying stage of reduction**	**SASAA 271.125.vi close-up of image v; see Table of analyses**

Figure 14. SAMPLE 271.351 (F120, C503) - images and data table

		
SASAA 271.351.i	**SASAA 271.351.ii**	**SASAA 271.351.iii**



SASAA 271.351.iv partially reacted fragment of iron ore and surrounding matrix with fayalite and wustite

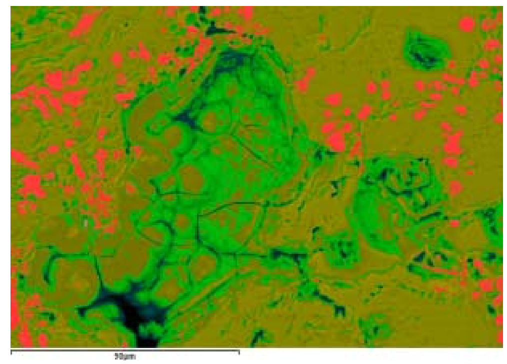
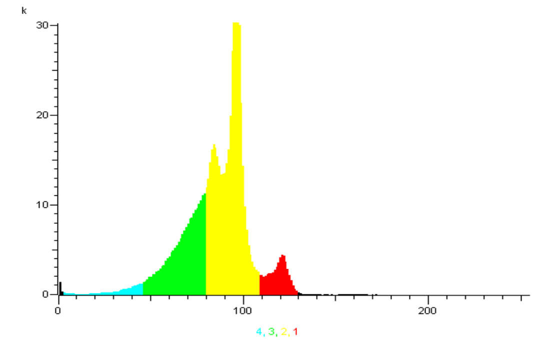


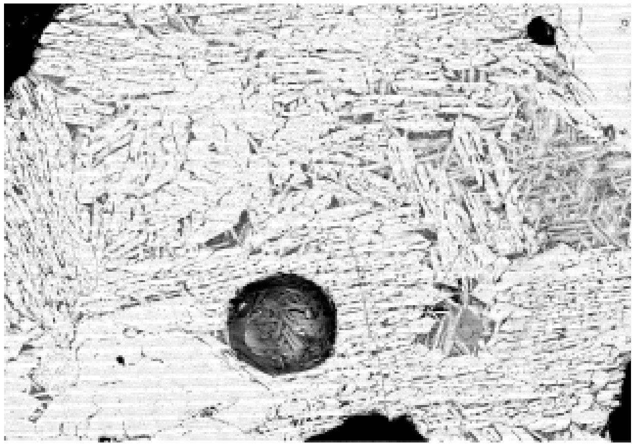
Image analysis of same area as on left highlighting percentage of three different phases



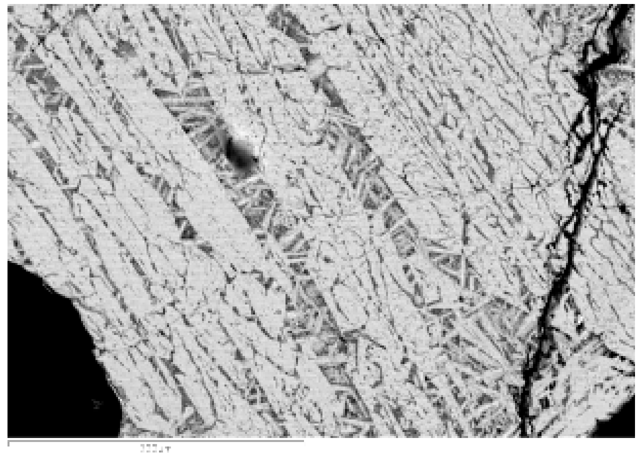
percentage distribution of wustite (red), fayalite (yellow), iron oxide-ore (green) and holes/cavities (light blue).

Sample	Description	Na2O	MgO	Al2O3	SiO2	P2O5	SO3	K2O	CaO	TiO2	MnO	FeO	BaO	Total
271.351	ore nodule spot analysis 1-image 271.351iv	nd	nd	0.84	25.84	0.52	0.08	1.85	0.82	nd	0.48	69.58	nd	100
271.351	ore analysis spot analysis 2 - image 271.351iv	nd	nd	1.89	19.17	0.99	nd	1.12	1.96	nd	2.46	72.14	nd	100
271.351	fayalite- image 271.351iv	nd	0.65	nd	29.07	0.45	nd	nd	6.67	nd	19.47	43.70	nd	100
271.351	wustite- image 271.351iv	nd	nd	nd	nd	nd	nd	nd	nd	nd	7.79	92.21	nd	100
271.351	K-Al silicate-image 271.351.i	2.52	0.11	29.48	40.87	0.17	0.03	23.32	0.41	0.00	0.23	1.31	1.44	100
271.351	fayalite- image 271.351.i	0.00	0.00	0.64	0.70	0.12	0.13	0.00	0.08	0.59	5.00	92.94	0.14	100
271.351	wustite- image 271.351.i	0.00	0.80	0.00	32.38	0.78	0.00	0.00	6.36	0.20	15.12	44.80	0.00	100
271.351	K-Al silicate image 271.351.ii	3.06	0.00	29.60	42.04	0.86	0.00	21.64	1.27	0.29	0.37	1.58	0.00	101
271.351	K-Al silicate image 271.351.ii	2.48	0.00	29.78	41.80	0.01	0.02	23.21	0.19	0.01	0.03	1.29	1.24	100
271.351	Ba-Al silicate- image 271.351.ii	nd	nd	25.06	38.72	0.42	0.00	4.05	0.71	0.87	0.03	2.01	28.24	100

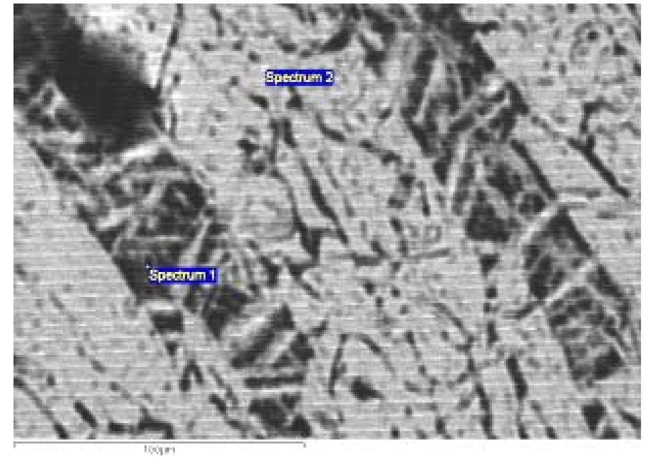
Figure 15. SAMPLE 271.191 (??no sample 191. C191 = F14) - images and data table



SASAA 271.191.i



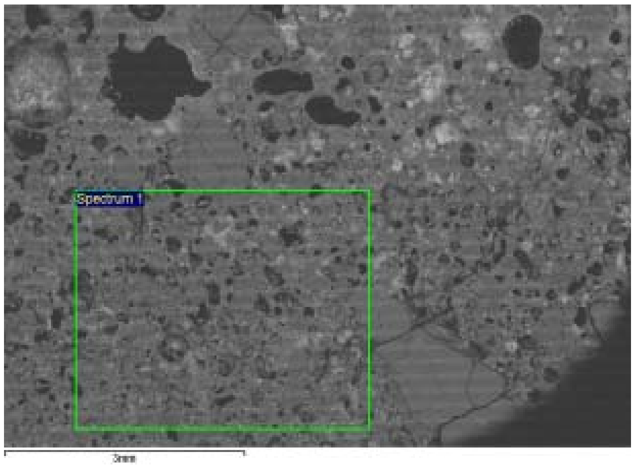
SASAA 271.191.ii



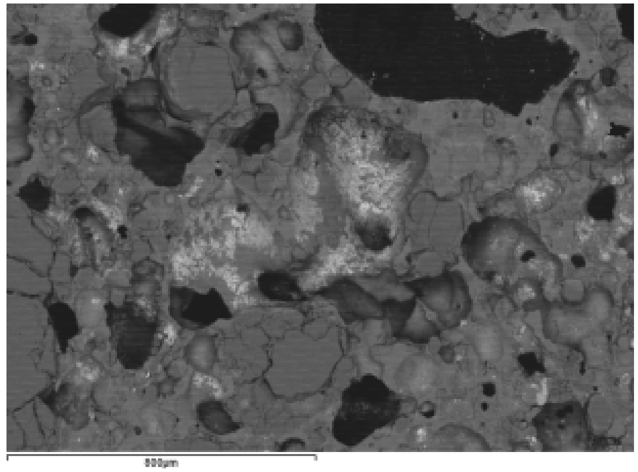
SASAA 271.191.iii

Sample	Description	Na2O	MgO	Al2O3	SiO2	P2O5	SO3	K2O	CaO	TiO2	MnO	FeO	BaO	Total
271.191	area ana image 271.191.i	0.04	0.72	nd	32.29	0.21	0.00	0.00	1.24	0.00	18.99	46.51	0.15	101
271.191	interstitial Ba-rich glass- image 271.191.iii	0.68	0.01	14.21	41.17	3.18	0.17	4.44	5.59	0.37	1.96	21.48	6.83	100
271.191	interstitial Ba-rich glass image 271.191.iii	0.68	0.00	6.28	35.32	1.02	0.09	2.20	5.16	0.46	11.66	34.51	2.91	100
271.191	interstitial glass image 271.191.iii	0.53	0.00	13.19	38.67	4.34	1.71	7.91	12.72	0.17	2.65	16.14	2.19	100
271.191	fayalite- image 271.191.iii	0.08	1.04	0.00	33.25	0.29	0.07	0.09	1.09	0.22	19.69	44.53	0.00	100
271.191	fayalite- image 271.191.iii	0.00	0.73	0.07	32.42	0.25	0.00	0.00	1.79	0.00	18.45	46.18	0.66	101

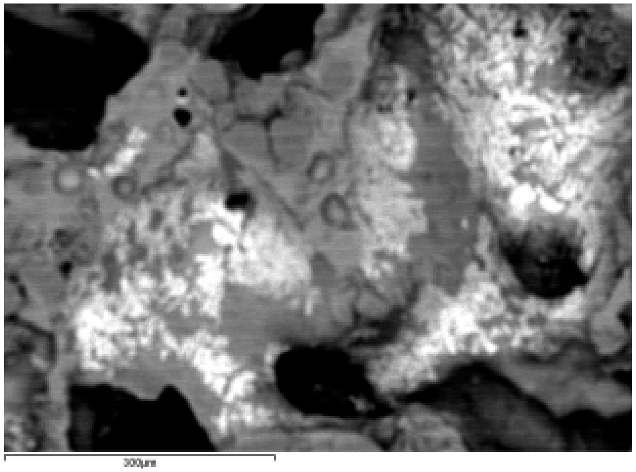
Figure 16. SAMPLE 271.263 (F225, C270) - images and data table



SASAA 271.263 si1



SASAA 271.263 si2

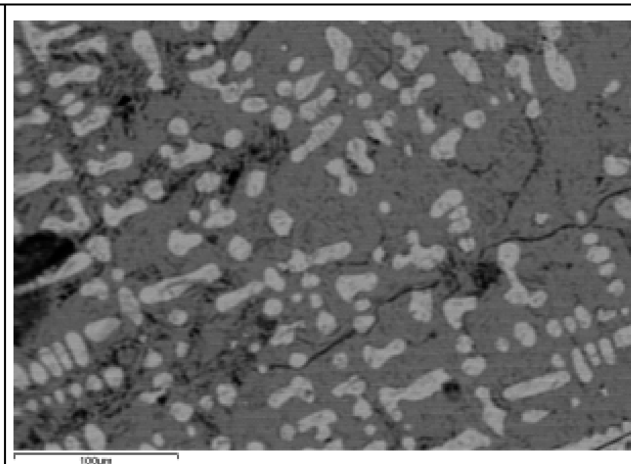


SASAA 271.263 si3

Sample	Description	Na2O	MgO	Al2O3	SiO2	P2O5	SO3	K2O	CaO	MnO	FeO	BaO	Total
271.263	area analysis on silicate matrix	0.74	0.51	9.01	80.37	0.17	0.00	2.04	0.10	nd	6.97	0.52	100

Figure 17. SAMPLE 271.403 (F492, C546) - images and data table

SASAA 271.403.i



SASAA 271.403.ii

Sample	Description	Na2O	MgO	Al2O3	SiO2	P2O5	SO3	K2O	CaO	MnO	FeO	BaO	Total
271.403	area ana- image 271.403.i	0.26	0.36	3.61	23.95	0.66	0.10	0.83	6.06	21.18	42.44	0.56	100
271.403	fayalite- image 271.403.i	0.00	0.98	0.08	32.81	0.16	0.05	0.00	6.07	28.47	31.57	0.03	100
271.403	wustite- image 271.403.i	0.09	0.27	0.24	0.32	0.15	0.00	0.00	0.00	15.84	83.35	0.00	100

Comments

The majority of slags are of fayalitic composition i.e. they are iron silicates with minor constituents, wustite and interstitial glass. They are all bloomery smelting slags. Image analysis over three different areas of the same sample and over 6 samples showed that fayalite made up c. 70% of the total, with c.20% for wustite, c.5% for interstitial glass and c. 5% for pores. The latter varied with level of porosity as per individual sample. The abundance of fayalite over all other phases suggest that conditions within the furnace were not sufficiently reducing and that only 20% of iron present reduced to wustite prior to reacting with the silica present and converting to slag. See example for image analysis SASAA 271.351.iv.

Manganese is clearly a constituent of the charge as it appears in considerable amounts within the slag and as a substitute to iron in fayalite and wustite. Phosphorus is present in minor amounts and in the glass phase or forms separate phases like that in SASAA 271.041.image vi of iron phosphorus silicates. Barium oxide found in the glass derives from barium sulphate. It rarely survives the smelting process but has seen in sample SASAA 271.

Of interest is the insight gained by the analysis of the small ore inclusions within the slag as shown in SASAA.271.351 and SASAA. 271.125. The inclusions are iron silicates with small amount of aluminium, phosphorus, potassium and calcium. There is no evidence for manganese which suggests that manganese oxide nodules were added to the charge separately. The small ore nodules are insufficiently reduced to the fayalite.

Of interest is also the relative absence of charcoal which would normally appear as inclusions within the slag.

The slags all point to inefficient smelting conditions within the furnace. This is hardly surprising since the furnaces are small, not adequately insulated with lining (or at least only partially insulated) and with not sufficient space between the tuyere and the furnace bottom for the bloom to grow.

The SEM data present major and minor constituents of slags. On the other hand XRF analysis targets the trace element constituents within the slag and compares their values with those in other materials.

B. METALLURGICAL CERAMICS (reported in SASAA 204.3)

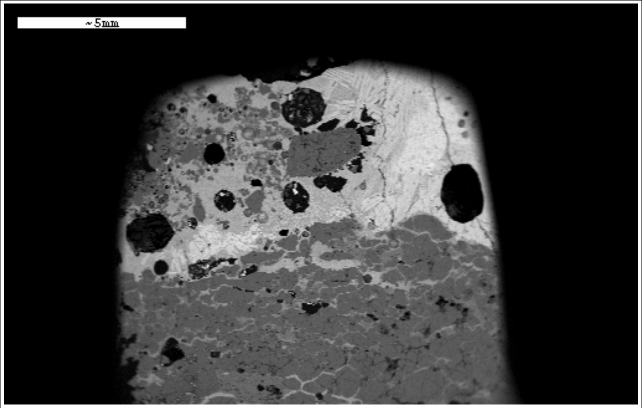
Figure 18 shows the furnace in context 5. Sample 204.3.200 was removed from the protruding wall directly below the stone. The purpose of the analysis is to examine the nature of the wall lining and establish the extent to which it may have undergone any special treatment.

Figure 18. Furnace at Derrinsallagh 4 (context 5). Sample 204.3.200 was taken from within this furnace, below the stone resting under the green ruler in the photo.

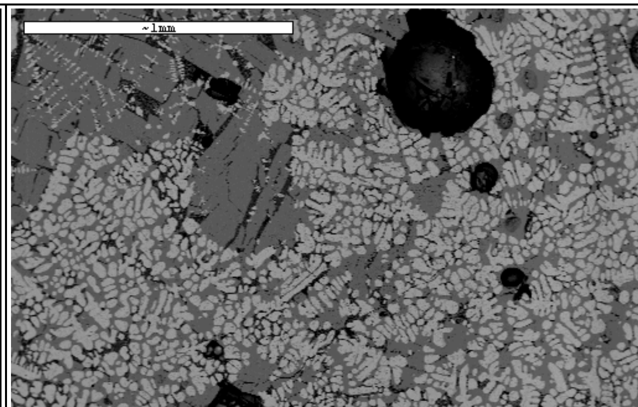
Figure 19. Samples examined by SEM-EDAX.

		
Sample 204.3.200 represents a section of the furnace wall/wall lining of the furnace in Context 5. It was removed by the present investigator from the area just below the stone, presumably the base on which the bellows rested. There was no evidence for bellows.	**Sample 204.3.201A are fragments of furnace wall/wall lining obtained from Context 439. They appear to have been discarded within the ditch.**	**Sample 204.3.201B are fragments of furnace wall/wall lining obtained from Context 439. They appear to have been discarded within the ditch.**

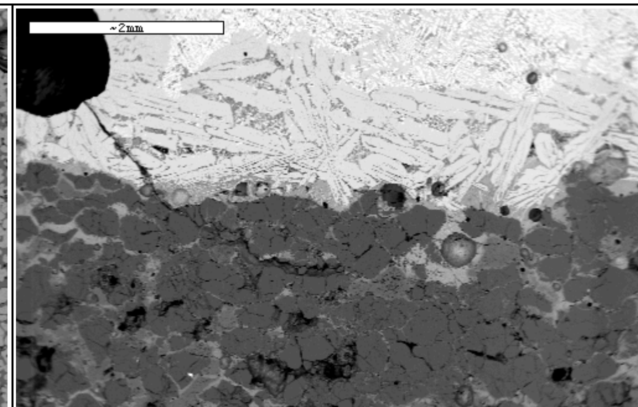
Figure 20. SEM-EDAX images.



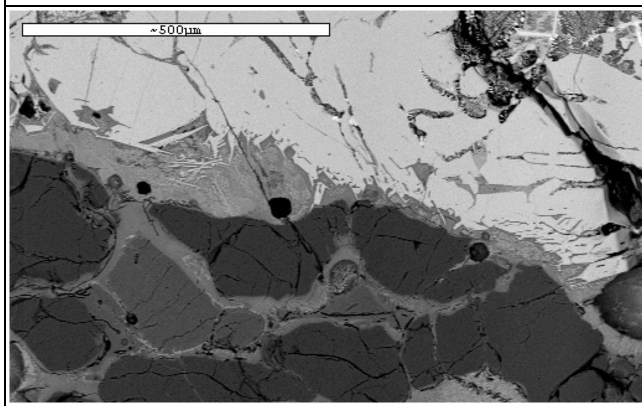
SEM-BS image of sample 204.3.200 shows that it consists of two areas: the furnace wall proper (dark grey and rich in quartz) and the slag which appears to adhere onto the wall



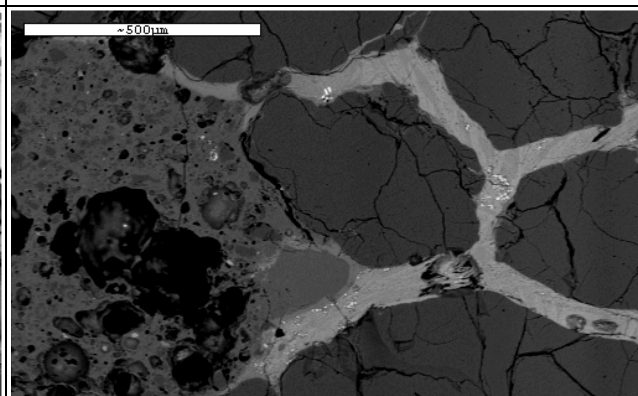
SEM-BS image of sample 204.3.200 showing an area within the slag; dendrites of iron oxides and needles of fayalite with some interstitial glass.



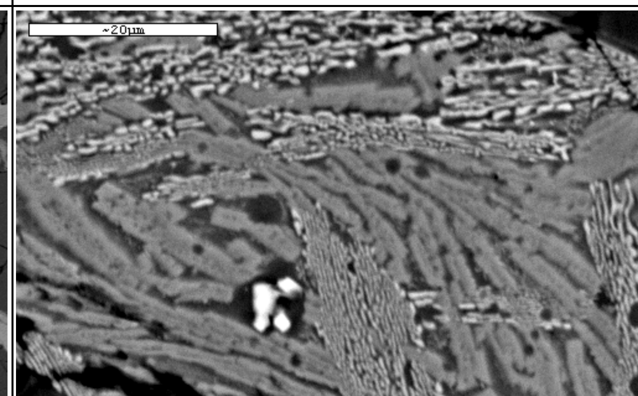
SEM-BS image of sample 204.3.200 showing the 'interface' between the two areas. There is no reaction between the two zones, i.e. the quartz grains appear to have not been heat-affected. The slag simply adheres to the stone surface.



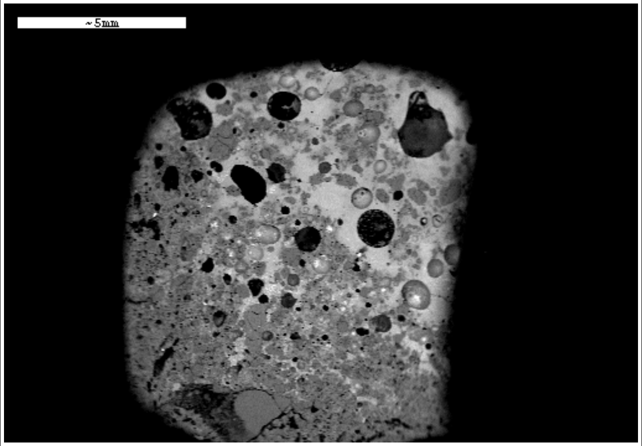
SEM-BS image of sample 204.3.200 showing a close up of the interface between the quartz rich sandstone and the slag.



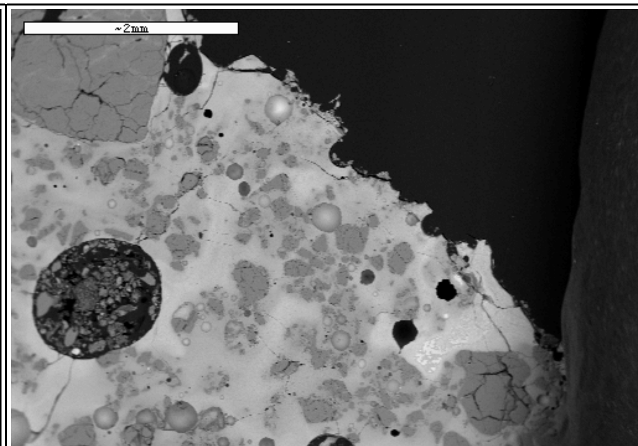
SEM-BS image of sample 204.3.200 showing variety of 'binders' holding the quartz grains together. The darker phase to the left consists primarily of K- alumino-silicates; the bright phase to the right consists of a ferruginous material. Spot analyses on these 'binders' are shown in Table 5.



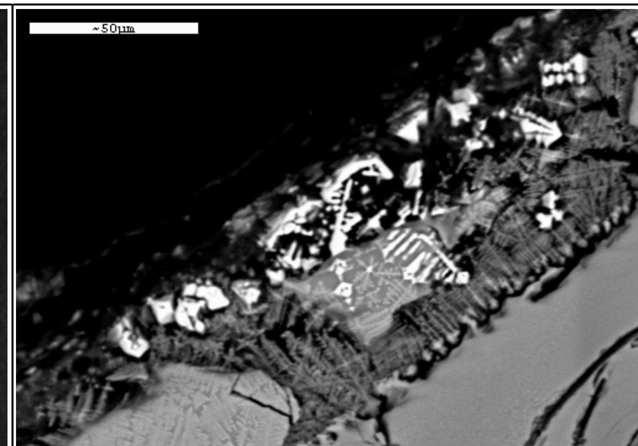
SEM-BS image of sample 204.3.200 showing ferruginous 'binder' within the sandstone having reduced, the result of heating within a reducing environment, to fayalite and iron oxides.



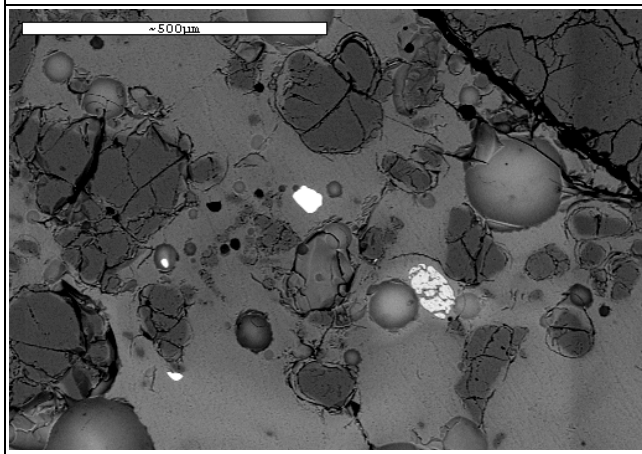
SEM-BS image of sample 204.3.201B showing two sections : a vitrified one(top right) and a low temperature heated one (bottom left) with a gradient of heating in between. This is a ceramic material



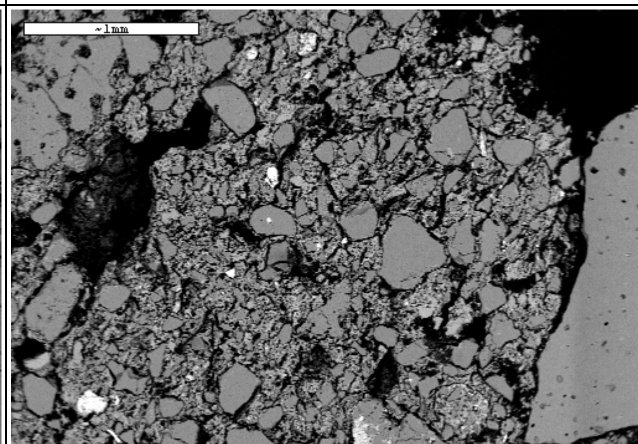
SEM-BS image of a detail within the vitrified area; it consists of partially melted and unaltered grains of quartz within a glassy matrix.



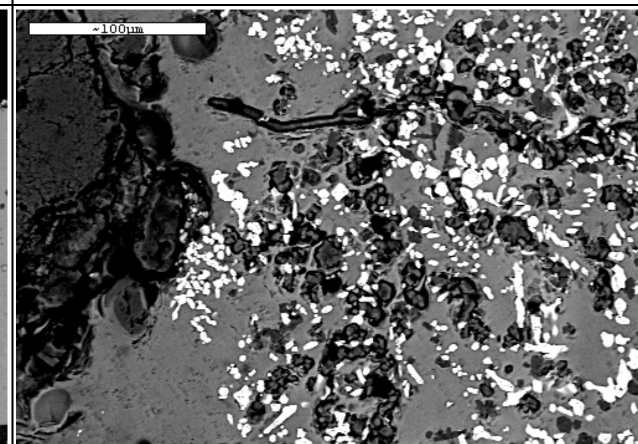
SEM-BS image of a detail within the surface of the vitrified area within sample 204.3.201B, showing the formation of iron oxides.



SEM-BS image of the vitrified section within sample 204.3.201B showing the presence of small inclusions of zircon and titanium iron oxides typical in clays.



SEM_BS image of sample 204.3.201showing the low fired section, with pronounced porosity.



SEM-BS image of the low fired area within sample 204.3.201B showing the formation of iron oxides as a result of localised reducing conditions.

Table 5. SEM-EDAX data (weight %). nd = not detected.

Sample	Description	Na_2O	MgO	Al_2O_3	SiO_2	P_2O_5	SO_3	K_2O	CaO	TiO_2	MnO	FeO	BaO	Total
204.3.200														
204.3.200	mean area analysis on slag section	0.51	0.30	2.83	16.85	0.47	0.31	0.95	1.83	0.44	6.53	69.22	nd	100
204.3.200	mean area analysis on the quartz-rich section	0.47	nd	4.71	87.14	nd	nd	1.88	1.23	0.25	0.39	3.58	nd	100
	slag section													
204.3.200	spot analysis on fayalite within slag section	nd	0.62	nd	29.71	nd	nd	nd	0.51	nd	7.6	61.78	nd	100
204.3.200	spot analysis on wustite within slag section	nd	nd	0.48	0.49	nd	nd	0.27	nd	nd	2.3	95.23	nd	100
204.3.200	spot analysis on interstitial glass within slag section	nd	nd	22.28	49.85	nd	nd	18.58	nd	nd	0.45	5.58	3.58	100
	interface													
204.3.200	infiltration of slag within area of the sandstone section	0.56	0.47	3.50	47.04	nd	nd	2.08	2.18	nd	4.45	39.34	nd	100
	Quartz- rich section													
204.3.200	Spot analysis(1) on the ferruginous binder or space between the quartz grains	nd	nd	17.88	31.58	2.2	0.44	3.8	2.12	0.28	nd	41.62	0.27	100
204.3.200	Spot analysis (2) on the ferruginous binder or space between the quartz grains; the ferruginous material varies in its relative amounts of P and Mn.	nd	nd	1.04	3.5	nd	nd	0.14	0.12	nd	4.22	91.35	nd	100
204.3.200	Spot analysis (3) on the K-aluminosilicate phase; this is not a crystalline phase as can be seen in the SEM images above.	0.86	nd	18.01	64.73	nd	nd	15.73	nd	nd	nd	0.33	nd	100
204.3.200	area analysis of eutectic interstitial material between quartz grains in the sandstone section	0.96	0.36	3.72	49.87	0.45	nd	1.05	12.83	nd	4.03	26.40	nd	100
204.3.200	spot analysis on fayalite within eutectic in sandstone section	0.76	nd	3.71	24.90	nd	nd	1.47	0.49	0.92	0.86	66.73	nd	100
204.3.200	spot analysis on glass within eutectic in sandstone section	1.23	nd	9.08	52.33	0.94	0.63	3.40	6.09	0.73	1.16	24.42	nd	100
204.3.201b														
204.3.201b	mean area analysis on low-fired section	0.58	0.48	8.07	83.72	nd	nd	2.04	0.53	0.64	nd	3.64	nd	100
204.3.201b	mean area analysis on vitrified section	0.84	0.33	6.67	75.24	0.38	nd	2.77	3.24	0.43	0.72	9.53	nd	100
204.3.201b	spot analysis on vitrified section	0.92	0.31	6.74	63.03	nd	nd	2.82	3.97	0.46	1.17	20.30	nd	100

***Comments*: Metallurgical Ceramics (Stone and clay-based furnace walls)**
Two samples have been examined. Sample 204.3.200 was recovered from within the furnace of context 5; sample 204.3.201 was a 'stray' find within context 439.

Sample 204.3.200 is a fragment of the furnace wall (east furnace) of F5 consisting of a small vertical sandstone slab on which slag has adhered. There is no zone of reaction between slag and sandstone. The iron oxide within the interstices of the sandstone have reduced to iron oxides and fayalite, the result of the stone being exposed to the reducing atmosphere of the furnace.

The slag adhering to the stone is a manganese and phosphorus rich iron oxide (wustite) with fayalite (iron silicate) and interstitial glass. Given the lack of a reaction zone between the slag and the stone wall, it is surmised that the temperature prevailing within the furnace could not have exceeded 700º-850º C.   There is no wall lining proper, made of silt or clay and spread over the surface of the stone.

Sample 204.3.201B is a fragment of quartz-enriched and clay-based furnace wall. It is not clear whether this clay-rich material is natural or artificially produced, by mixing locally available clay/silt with crushed-up quartz pebbles. Enrichment in quartz would have made an otherwise 'weak' material more refractory and therefore suitable for use as part of a metallurgical furnace.

The section nearest the source of heat (black) has melted and upon cooling solidified into a glassy surface; there is a temperature gradient between the section exposed to the source of heat and the section least affected by heat. In other words both sections have the same composition, only one has been exposed to higher temperature.

The two fragments of furnace walls consist of different materials: one is ceramic, the other is stone. It is not certain whether the stone wall constitutes an earlier or a later example of furnace wall construction at Derrinsallagh IV. There is certainly only one such example of that type of furnace (A-M Lennon, pers. comm). Although stone would have been a readily available local material, when used in the furnace, it would also have been subject to potential fracturing while the smelting was in progress. Quartz enriched clay/silt would have made a better furnace wall material and would have simulated the action of the sandstone encountered in the previous example, without the side effect of potential fracture.

C. CHARCOAL
i. XRF & K

Table 6. XRF data for charcoals (ppm).

FEATURE	CONTEXT	SAMPLE	MS (K)	Pb	Sr	Rb	As	Zn	Fe	Mn	V	Ti	Ca	K
9	**199**	**101**	810	0.00	15.38	25.31	28.18	25.89	30951.02	2959.51	75.07	1522.41	15945.90	7271.63
10	**221**	**145**	62	0.00	8.72	9.09	0.00	18.45	6035.48	983.12	36.86	1481.13	10844.21	7292.21
21	**272**	**173**	148	0.00	12.33	15.79	6.99	0.00	10949.99	1171.84	34.13	1409.62	12918.49	5992.07
23	**341**	**264**	51	0.00	20.44	15.77	10.98	37.66	15507.91	1448.64	89.22	1667.86	20575.92	5531.46
86	**185**	**78**	793	0.00	15.67	26.32	0.00	0.00	20251.17	2684.18	0.00	974.12	9726.39	3266.13
126	**326**	**323**	44	0.00	11.57	16.87	0.00	21.92	7705.58	1430.43	0.00	1378.11	11156.25	5891.73
133	**170**	**91**	35	16.66	13.64	22.44	0.00	71.17	7751.95	690.74	44.63	1548.66	9304.25	7977.12
142	**151**	**56**	15	41.96	39.06	26.60	0.00	72.76	26368.39	3594.25	119.77	1275.48	33953.53	5892.66
426	**533**	**387**	114	0.00	17.69	32.38	0.00	92.05	9204.06	673.26	36.63	1571.24	6017.95	8994.11

Comments on XRF: Charcoal samples are generally relatively similar in the majority of elements measured, with the exceptions of Pb, As and V.

Comments on K: In general, charcoal K values were in the range 30-60 K. Where higher values were measured, there was usually soil, clay or charcoal within the sample bag too, which would have influenced the measurement.

D. IRON-RICH SOURCES
i. XRF

The two iron rich sources are those discussed at the beginning of this report and as part of SASAA 204.2.

Table 7. XRF data for iron-rich source (ppm)

FEATURE	SAMPLE	Pb	Sr	Rb	Se	As	Fe	Mn	V	Ti	Ca	K
n/a	**bog ore s12**	27.64	173.05	26.08	0.00	65.06	346036.45	1163.90	0.00	588.44	43744.46	4930.35
n/a	**bog ore s13**	20.72	165.28	18.51	0.00	62.43	314754.24	1844.53	54.93	848.18	82190.49	7373.80

Comments: c30% Fe in these samples.

ii. ICP

Table 8. ICP data for iron-rich sources.

Major oxides (%)

Sample	SiO2	Al2O3	Fe2O3	MgO	CaO	Na2O	K2O	TiO2	P2O5	MnO
S12	14.28	3.08	29.54	0.46	8.95	0.16	0.70	0.11	0.98	0.099
S13	32.67	2.06	21.14	0.42	8.94	0.17	0.57	0.10	0.70	0.087

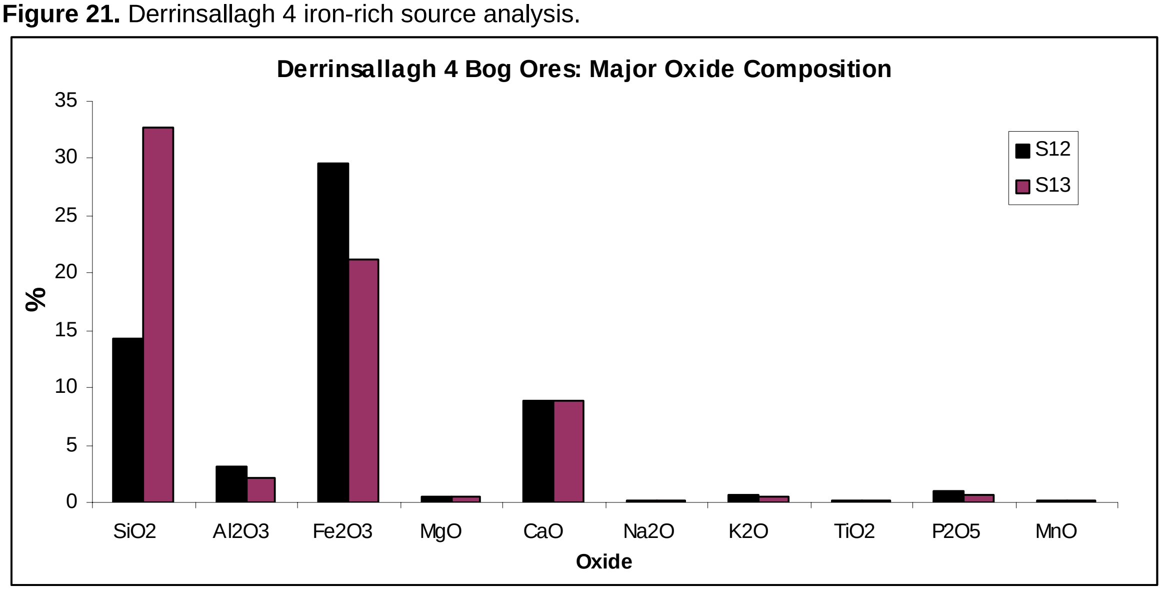
Minor elements (ppm)

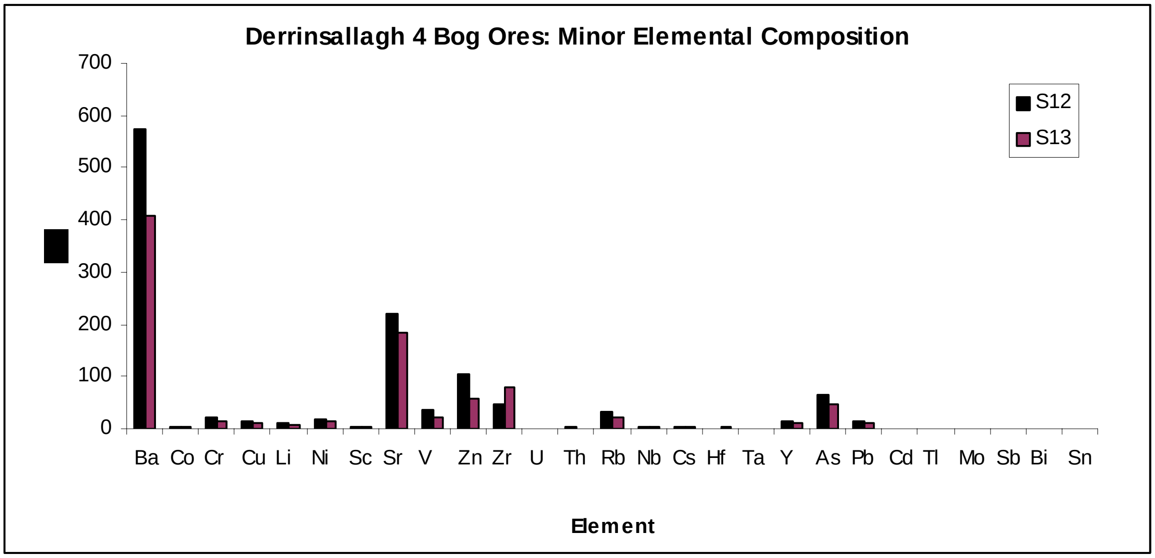
Sample	Ba	Co	Cr	Cu	Li	Ni	Sc	Sr	V	Zn	Zr	U	Th	Rb	Nb	Cs	Hf	Ta	As	Pb	Cd	Tl	Mo	Sb	Bi	Sn	Y
S12	575	3	22	15	11	19	3	221	35	106	48	0.69	2.35	32	3.3	3.14	1.05	0.17	66	15	0.4	0.2	0.6	0.9	0.3	1	16
S13	407	2	14	11	7	13	2	185	22	59	79	0.61	1.73	22	2.8	1.83	1.92	0.17	46	10	0.3	0.1	0.4	0.8	0.2	0	10

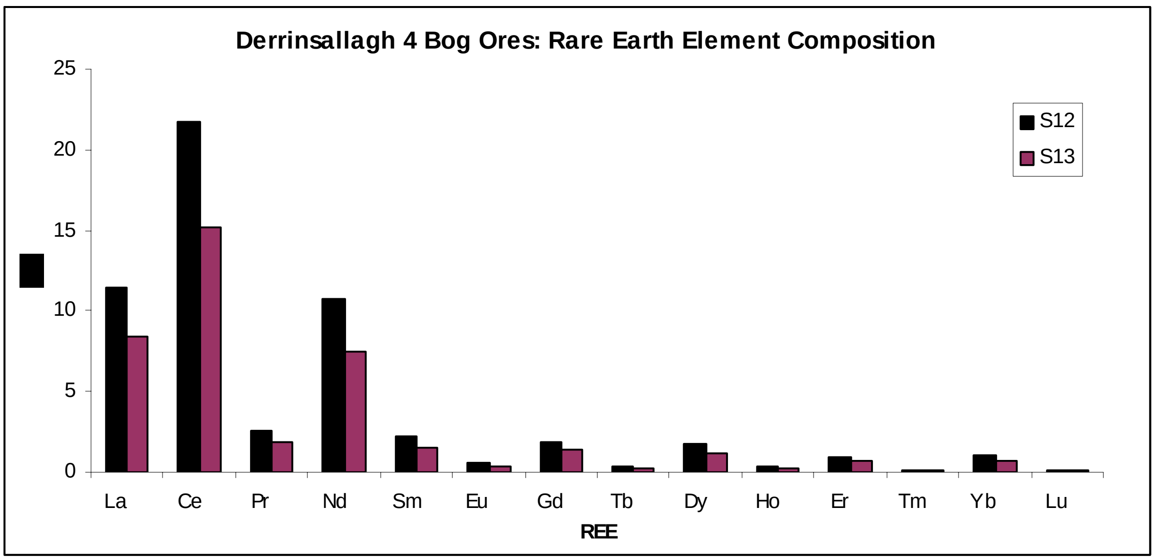
Rare earth elements (ppm)

Sample	La	Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu
S12	11.5	21.7	2.6	10.7	2.2	0.53	1.92	0.31	1.70	0.34	0.97	0.15	1.00	0.15
S13	8.4	15.2	1.9	7.4	1.6	0.37	1.36	0.22	1.14	0.24	0.65	0.11	0.73	0.10

Figure 21. Derrinsallagh 4 iron-rich source analysis.







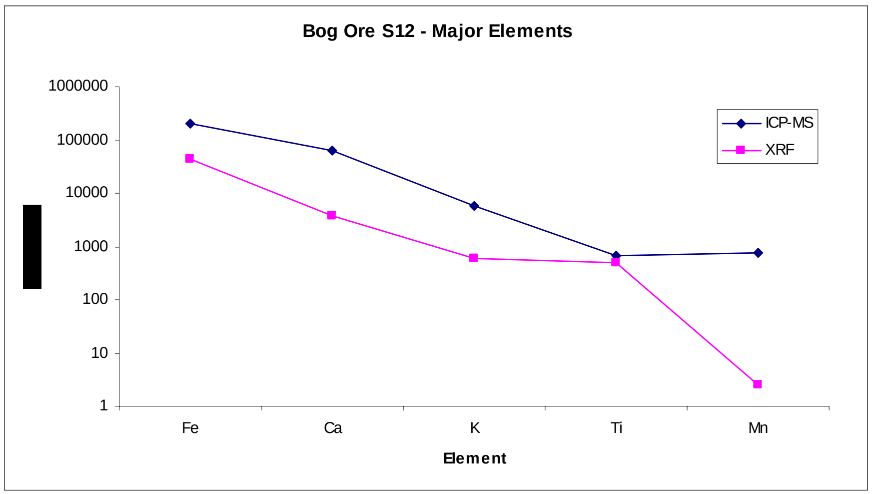
Comments: c25% Fe measured in the bog ores. Quite a lot of Ba and Sr too.

iii. ICP vs XRF

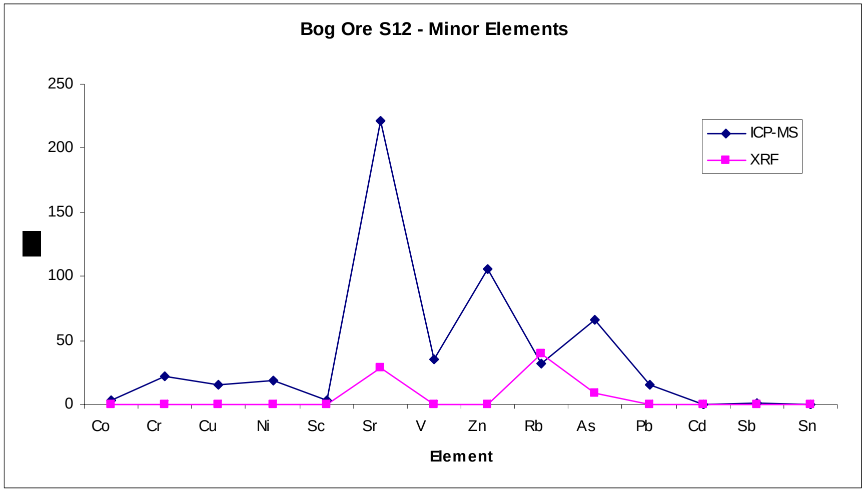
Table 9. ICP vs XRF Data (ppm).

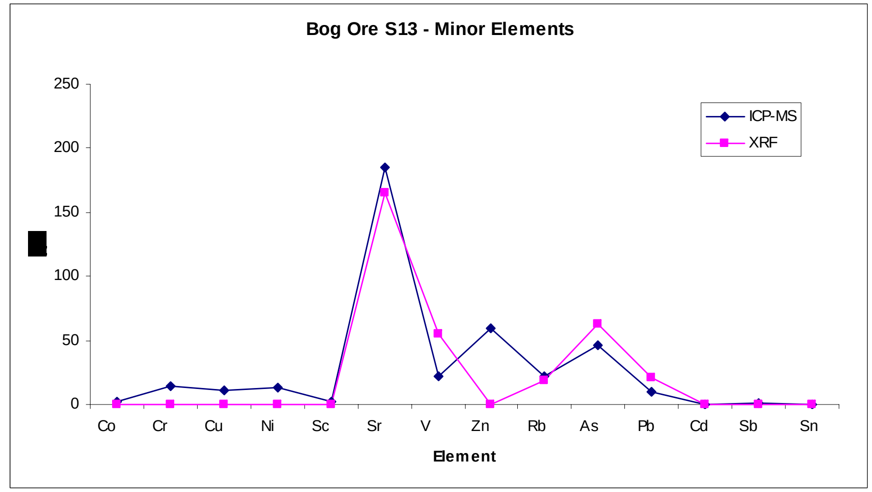
Sample	Analysis	Fe	Ca	K	Ti	Mn	Co	Cr	Cu	Ni	Sc	Sr	V	Zn	Rb	As	Pb	Cd	Sb	Sn
S12	**ICP-MS**	206603	63966	5811	659	767	3	22	15	19	3	221	35	106	32	66	15	0	1	1
S12 mean	**XRF**	43856	3708	580	481	3	< LOD	< LOD	< LOD	< LOD	< LOD	29	< LOD	< LOD	40	9	0	< LOD	< LOD	< LOD
S13	**ICP-MS**	147853	63894	4732	600	674	2	14	11	13	2	185	22	59	22	46	10	0	1	0
S13 mean	**XRF**	314754	82190	7374	848	1845	< LOD	< LOD	< LOD	< LOD	< LOD	165	55	< LOD	19	62	21	< LOD	< LOD	< LOD

Figure 22. ICP vs XRF Data (ppm).



MAJOR ELEMENTS





MINOR ELEMENTS

Comments: With sample S13, there is very good agreement between the analyses by ICP and XRF for both major and minor elements. The agreement is not so good with sample S12, but there was less physical sample here and this may have impacted on the quality of the XRF data (there was not sufficient coverage of the XRF sampling window).

iv. K – measurement and heating experiments

Method: Magnetic susceptibility of iron-rich source from near to the site of Derrinsallagh 4 was measured (K and Xlf) as unheated sample, at 300ºC and at 500ºC (samples heated for 30mins at each T).

Table 10. *K* heating experiment results.

Temperature	K	Xlf
Unheated	10	33.7
300ºC	1653	5306.6
500ºC	4002	12292.5

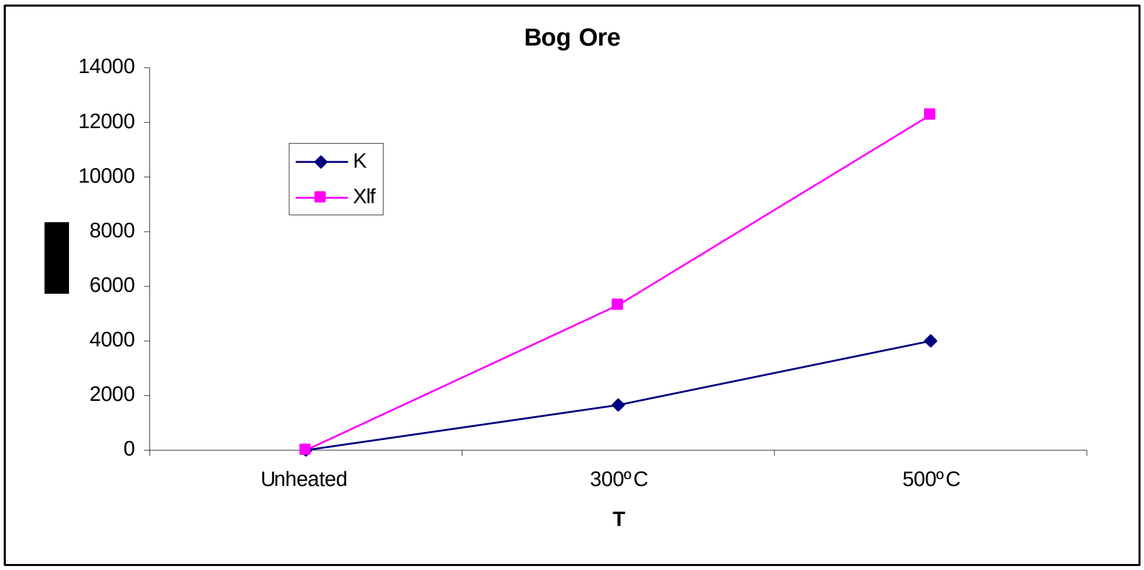


Figure 23. Iron-rich source K heating experiments.

Comments: Bog ore, when heated, produces values of magnetic susceptibility of a magnitude similar to those seen in some soil samples from the site at Derrinsallagh 4. It can therefore be concluded that it is not simply the presence of Fe in soils that is important to the magnetic susceptibility measurement, but the phase the Fe is in.

E. SOILS/CLAYS
i. XRF & K

Table 11. XRF and K data for soils.

FEATURE	CONTEXT	SAMPLE	MS (K)	Pb	Sn	Sb	Sr	Rb	As	Zn	Cu	Ni	Fe	Mn	Cr	V	Ti	Ca	K
4	**114**	**48**	2556	21.73	0.00	0.00	18.56	29.24	104.25	0.00	0.00	187.61	253493.75	19093.29	0.00	103.78	1481.54	11043.36	10776.59
4	**96**	**49**	703	14.18	0.00	0.00	15.12	49.61	0.00	38.75	0.00	0.00	13610.16	1190.51	0.00	0.00	1800.99	2220.22	7225.20
4	**102**	**50**	1030	22.14	0.00	0.00	14.96	44.14	0.00	65.95	0.00	0.00	15997.36	1258.75	0.00	0.00	2112.65	2450.28	7915.85
4	**101**	**51**	821	21.64	0.00	0.00	17.54	47.16	0.00	74.82	0.00	0.00	15556.21	936.88	0.00	34.44	2443.55	2826.49	11004.55
4	**100**	**52**	387	59.99	0.00	0.00	15.46	48.36	0.00	31.68	0.00	0.00	12676.26	648.63	0.00	0.00	1701.38	1422.60	10133.91
4	**104**	**53**	503	36.35	0.00	0.00	15.37	51.67	0.00	61.01	0.00	0.00	16497.39	1021.61	0.00	0.00	2404.17	1896.07	13120.40
5	**56**	**12**	1189	0.00	0.00	0.00	25.64	51.15	19.58	47.89	0.00	0.00	24942.67	2386.08	0.00	0.00	2026.18	4502.68	9001.57
5	**56**	**14**	474	24.38	0.00	0.00	22.97	50.26	34.37	45.25	0.00	0.00	60770.26	4277.09	0.00	0.00	1929.25	3574.02	7848.45
5	**54**	**221**	1379	22.55	0.00	0.00	17.07	44.71	13.86	61.49	0.00	0.00	31628.49	2871.25	0.00	0.00	2368.69	7594.53	10292.25
5	**54**	**222**	1591	0.00	0.00	0.00	26.54	50.86	20.67	47.32	0.00	0.00	33121.10	2435.17	0.00	57.25	1669.66	11793.71	9076.56
5	**371**	**270**	2444	0.00	0.00	0.00	12.05	23.69	101.52	0.00	0.00	313.97	231124.98	30495.40	0.00	109.15	1466.21	8576.27	8212.28
5	**381**	**275**	286	19.48	0.00	0.00	18.50	41.88	0.00	47.72	0.00	0.00	17128.89	634.20	0.00	33.59	2583.33	2454.98	10912.75
5	**382**	**276**	578	27.04	0.00	0.00	18.69	48.38	17.08	46.56	0.00	0.00	34760.74	3095.00	0.00	45.48	1913.29	2989.35	8093.96
5	**55**	**383**	333	22.90	0.00	0.00	20.96	65.74	0.00	43.11	0.00	0.00	13337.58	584.86	0.00	37.37	2377.47	1769.70	15085.50
6	**157**	**59**	15	23.78	0.00	0.00	20.25	41.60	0.00	39.96	38.97	0.00	10260.07	1224.26	0.00	0.00	2258.86	2110.99	8655.77
8	**115**	**16**	1176	19.97	0.00	0.00	13.58	38.49	0.00	32.85	0.00	0.00	14382.83	1326.28	0.00	0.00	1770.94	1928.65	6549.82
8	**130**	**38**	458	44.30	0.00	0.00	21.60	46.85	0.00	26.07	0.00	0.00	11958.13	454.86	0.00	0.00	2216.92	1902.77	9966.12
8	**131**	**39**	576	25.22	0.00	0.00	21.88	58.97	14.49	104.15	0.00	0.00	18532.37	867.71	0.00	0.00	2510.76	2048.19	12534.16
8	**132**	**40**	1838	33.63	0.00	0.00	20.87	48.09	31.87	42.21	48.52	0.00	59364.11	9066.08	0.00	69.20	1986.62	5621.84	9906.45
9	**116**	**18**	394	25.93	0.00	0.00	21.29	53.35	0.00	43.29	0.00	0.00	17605.10	1562.62	0.00	47.28	2007.56	3201.04	9358.29
9	**186**	**85**	670	19.71	0.00	0.00	24.01	50.47	78.97	0.00	0.00	171.63	157765.56	19583.28	0.00	107.67	2010.14	13769.50	9803.42
9	**183**	**87**	743	30.80	0.00	0.00	17.58	54.69	0.00	75.95	0.00	0.00	17215.32	820.40	0.00	0.00	2425.31	1899.47	11075.55
9	**184**	**100**	147	19.10	0.00	0.00	18.51	54.41	0.00	0.00	0.00	0.00	10401.87	434.20	0.00	0.00	1610.25	1201.28	8112.46

9	**182**	**103**	278	25.13	0.00	0.00	15.14	50.79	0.00	48.66	0.00	0.00	15363.69	805.48	0.00	32.43	1880.56	1387.17	9236.89
9	**214**	**104**	43	17.76	0.00	0.00	14.08	115.23	0.00	29.22	0.00	0.00	21048.13	706.88	0.00	0.00	2683.02	2483.95	18426.55
10	**117**	**26**	285	21.02	0.00	0.00	19.34	50.50	12.75	52.02	0.00	0.00	15715.74	1965.55	0.00	0.00	1716.01	3721.33	7430.91
10	**220**	**136**	579	21.26	0.00	0.00	19.91	46.45	0.00	115.86	0.00	0.00	20854.04	1591.16	0.00	0.00	1821.43	3116.48	8533.71
10	**222**	**144**	400	21.36	0.00	0.00	18.16	57.18	18.14	54.84	0.00	0.00	17551.35	1060.80	0.00	0.00	2703.21	3357.71	12841.89
10	**221**	**146**	150	14.45	0.00	0.00	24.97	42.82	20.45	68.18	0.00	0.00	34144.73	4070.91	0.00	62.93	1571.20	17590.15	9685.30
10	**246**	**147**	320	18.01	0.00	0.00	23.48	49.92	0.00	28.45	0.00	0.00	12753.42	549.64	0.00	0.00	2303.55	1789.81	12178.06
12	**12**	**23**	37	47.30	0.00	0.00	20.67	45.11	0.00	58.57	0.00	0.00	9927.54	589.56	0.00	0.00	1844.73	1800.07	8045.57
12	**12**	**24**	27	29.06	0.00	0.00	20.21	51.74	0.00	39.74	36.75	0.00	8994.57	753.63	0.00	0.00	2379.87	2441.86	10473.17
14	**190**	**81**	418	11.43	0.00	0.00	12.53	38.29	9.85	43.96	0.00	0.00	10266.83	613.14	0.00	30.15	1848.07	3656.36	7228.38
14	**19**	**83**	596	0.00	0.00	0.00	21.95	38.52	10.27	59.06	0.00	0.00	13998.63	1182.76	0.00	0.00	2133.90	9837.99	7644.91
14	**192**	**131**	430	27.10	0.00	0.00	20.97	37.63	0.00	95.80	0.00	0.00	24989.62	1339.28	0.00	0.00	2272.45	3947.90	9675.87
14	**191**	**133**	527	0.00	0.00	0.00	23.37	39.28	15.13	52.04	0.00	0.00	12052.23	712.94	0.00	34.35	1738.26	15856.90	6792.66
14	**193**	**148**	497	19.24	0.00	0.00	17.42	45.38	14.95	72.97	0.00	0.00	15656.42	1088.33	0.00	0.00	2034.43	2984.19	7944.45
14	**192**	**149**	549	27.96	0.00	0.00	18.42	62.75	13.96	191.67	0.00	0.00	21483.28	1420.55	0.00	54.75	2517.72	3957.89	11715.70
14	**193**	**163**	896	26.37	0.00	0.00	20.41	51.05	0.00	93.73	0.00	0.00	17567.34	1438.76	0.00	0.00	2028.73	3215.55	8253.95
14	**194**	**164**	1052	24.34	0.00	0.00	18.50	44.38	0.00	74.60	0.00	0.00	16187.66	1206.15	0.00	32.23	2091.12	2704.34	7929.46
14	**276**	**178**	574	26.51	0.00	0.00	37.05	48.83	68.36	0.00	0.00	131.43	130483.89	15179.26	0.00	81.13	1672.28	17649.05	8955.97
14	**269**	**180**	1344	23.89	0.00	0.00	23.29	52.00	19.51	66.05	0.00	0.00	26566.95	2733.69	0.00	52.01	2171.36	4243.21	10392.32
14	**194**	**183**	1093	35.28	0.00	0.00	22.46	55.85	0.00	70.41	0.00	0.00	18183.24	757.46	0.00	56.14	2745.83	2355.83	13074.09
15	**173**	**67**	3231	25.40	0.00	0.00	17.02	39.47	0.00	48.48	0.00	0.00	29580.73	2621.52	0.00	0.00	2022.95	5063.20	8758.25
15	**175**	**74**	482	0.00	0.00	0.00	31.38	32.29	32.51	0.00	0.00	0.00	58699.64	6119.58	0.00	0.00	1594.79	22262.43	5995.35
15	**176**	**75**	631	27.87	0.00	0.00	23.64	43.25	20.63	0.00	0.00	0.00	48210.59	4713.17	0.00	89.22	1965.52	13108.04	9862.52
15	**173**	**108**	-	13.95	0.00	0.00	18.82	44.78	0.00	22.15	0.00	0.00	10072.20	548.78	0.00	28.56	1784.45	1520.20	7668.09
15	**173**	**109**	532	23.71	0.00	0.00	18.37	42.51	12.93	31.67	37.66	0.00	21966.81	2200.91	0.00	41.30	1888.30	4330.23	7311.49
15	**173**	**110**	212	30.05	0.00	0.00	34.43	54.16	25.04	50.35	0.00	123.95	84930.41	7339.32	0.00	0.00	1916.88	4773.11	9298.86
15	**174**	**111**	915	0.00	0.00	0.00	18.01	36.88	48.66	0.00	0.00	0.00	91067.52	9644.58	0.00	87.89	1722.36	12590.77	9274.42
15	**175**	**114**	713	46.67	0.00	0.00	26.46	35.14	21.80	0.00	36.63	0.00	46832.28	5348.33	0.00	54.34	1646.75	21249.72	8119.63
15	**176**	**116**	724	12.39	0.00	0.00	15.45	27.09	32.94	0.00	0.00	52.32	65933.46	5654.53	0.00	31.23	2187.58	8827.27	8086.83
15	**177**	**117**	528	24.07	0.00	0.00	19.20	41.01	0.00	26.84	36.17	0.00	20660.88	2350.06	0.00	60.72	1976.41	13781.81	9049.31

16	**211**	**96**	864	0.00	0.00	0.00	15.66	46.38	13.39	44.28	0.00	0.00	17021.18	1512.71	0.00	0.00	2242.31	2714.47	9530.23
16	**297**	**207**	1244	0.00	0.00	0.00	16.81	50.05	26.95	43.75	0.00	0.00	51044.30	5048.25	0.00	55.68	1832.35	3342.25	8455.73
16	**297**	**208**	444	0.00	0.00	0.00	14.93	45.74	57.57	0.00	0.00	222.46	200372.75	24382.64	0.00	39.44	1094.77	2959.75	3883.60
16	**211**	**210**	698	0.00	0.00	0.00	17.82	47.12	0.00	76.84	0.00	0.00	19560.11	1620.63	0.00	0.00	1950.23	1877.79	7460.49
16	**211**	**211**	412	30.32	0.00	0.00	20.95	50.09	0.00	570.89	0.00	0.00	25073.36	1165.30	73.14	41.57	2560.73	2976.16	10945.83
16	**298**	**223**	2002	0.00	0.00	0.00	12.09	34.28	65.39	0.00	0.00	153.55	146778.81	19092.26	0.00	126.74	1713.35	11295.41	10513.82
16	**298**	**224**	1146	16.53	0.00	0.00	18.33	43.41	33.33	0.00	0.00	0.00	65210.25	7617.54	0.00	53.98	1695.97	10493.31	7320.28
16	**212**	**250**	704	27.18	0.00	0.00	24.37	47.11	0.00	46.01	0.00	0.00	18116.47	1461.85	0.00	0.00	1397.81	1470.48	6418.52
17	**309**	**216**	409	24.02	0.00	0.00	19.98	54.83	0.00	47.41	0.00	0.00	17983.43	1847.13	0.00	0.00	1959.34	2681.80	9498.68
17	**317**	**243**	584	26.43	0.00	0.00	16.96	52.38	0.00	47.36	0.00	0.00	14924.03	1149.02	0.00	37.95	2093.74	4023.88	9344.88
17	**310**	**252**	855	20.52	0.00	0.00	19.11	54.44	14.14	123.73	0.00	0.00	24478.49	1797.73	0.00	35.97	2269.26	3024.37	10520.03
17	**357**	**258**	2718	0.00	0.00	0.00	11.02	30.36	55.56	0.00	0.00	260.29	196308.13	26668.06	0.00	88.75	1238.37	12783.54	6734.73
17	**366**	**272**	930	26.00	0.00	0.00	13.88	49.20	0.00	32.34	0.00	0.00	24109.66	2480.75	0.00	34.14	1522.76	2316.41	8779.26
17	**370**	**279**	366	24.54	0.00	0.00	20.55	52.27	0.00	47.37	0.00	0.00	13814.55	603.58	0.00	35.32	2205.38	1538.08	9814.16
18	**237**	**188**	226	29.16	0.00	0.00	18.30	52.17	0.00	42.55	0.00	0.00	17011.40	1177.97	0.00	34.91	2199.58	2451.25	9777.77
18	**287**	**192**	2328	35.51	0.00	0.00	20.17	40.08	56.47	63.57	0.00	235.93	190510.84	24350.24	0.00	63.46	1729.07	6338.97	8353.25
18	**288**	**194**	2130	0.00	0.00	0.00	23.56	33.40	67.61	0.00	0.00	0.00	147454.02	16206.02	0.00	105.88	1977.34	15730.08	9168.68
18	**295**	**206**	670	53.11	0.00	0.00	17.24	47.73	0.00	58.59	0.00	0.00	18205.48	1174.97	0.00	0.00	1394.17	1086.20	5295.11
18	**368**	**277**	551	44.07	0.00	0.00	22.46	59.04	0.00	46.15	0.00	0.00	15608.29	708.22	0.00	0.00	2006.87	1791.08	12000.65
18	**369**	**278**	265	28.10	0.00	0.00	22.74	51.64	0.00	30.03	0.00	0.00	14903.90	1148.37	0.00	0.00	2252.31	2068.66	10422.09
19	**227**	**124**	1092	31.01	0.00	0.00	19.80	56.60	0.00	92.55	0.00	0.00	19783.20	1689.58	0.00	0.00	2582.53	3025.77	13007.76
19	**233**	**134**	1243	26.57	0.00	0.00	19.80	31.71	31.20	113.91	35.80	0.00	49070.55	7546.96	84.01	86.10	1928.23	13597.97	7998.04
19	**234**	**138**	647	35.89	0.00	0.00	28.34	40.98	37.38	63.96	0.00	0.00	48802.08	6718.85	0.00	55.59	1616.06	12859.66	8939.83
19	**436**	**168**	646	34.49	0.00	0.00	23.22	54.88	0.00	66.77	0.00	0.00	19100.76	1283.05	0.00	0.00	1665.80	1804.98	10040.12
19	**258**	**177**	852	33.66	0.00	0.00	19.09	65.50	18.01	58.33	0.00	0.00	18251.94	1275.10	0.00	0.00	2271.25	3168.04	12514.91
20	**259**	**160**	862	16.51	0.00	0.00	18.02	46.99	15.68	29.24	0.00	0.00	28327.32	3511.77	0.00	0.00	1882.19	4159.52	8171.50
21	**272**	**172**	344	0.00	0.00	0.00	30.94	47.97	28.47	0.00	0.00	0.00	43191.69	3053.67	0.00	52.62	1737.24	20031.70	8155.02
21	**273**	**175**	1154	37.43	0.00	0.00	21.34	35.22	27.84	0.00	0.00	0.00	43628.73	5049.08	0.00	31.33	823.31	7404.94	3135.08
22	**277**	**195**	512	27.89	0.00	0.00	19.21	46.75	17.99	485.18	0.00	0.00	21534.29	872.18	0.00	46.97	2555.59	2191.27	10951.88

22	**278**	**197**	372	26.54	0.00	0.00	30.30	46.76	85.45	0.00	0.00	0.00	232844.23	11052.66	0.00	0.00	1651.33	18382.93	8070.73
22	**283**	**200**	1149	28.13	0.00	0.00	23.39	39.33	88.03	0.00	0.00	0.00	288555.88	13418.30	0.00	58.61	1295.62	8020.08	6310.09
22	**280**	**212**	167	0.00	0.00	0.00	20.36	44.64	0.00	56.79	0.00	0.00	11439.34	433.76	0.00	0.00	1657.96	1226.88	6237.32
23	**339**	**247**	67	28.19	0.00	0.00	25.60	51.93	40.41	0.00	0.00	0.00	171492.11	11841.27	0.00	64.01	1823.29	11632.67	8812.98
23	**340**	**248**	76	27.59	0.00	0.00	34.62	38.24	78.85	0.00	0.00	0.00	251680.42	14073.33	0.00	197.00	1978.02	20843.68	9785.30
23	**343**	**267**	94	26.82	0.00	0.00	21.34	69.92	0.00	41.66	0.00	0.00	17207.35	652.93	0.00	38.45	1232.77	1171.92	7283.08
23	**362**	**268**	209	0.00	0.00	0.00	21.70	53.30	66.99	0.00	0.00	0.00	153586.17	9777.31	0.00	67.85	1305.84	10604.08	7782.42
24	**379**	**283**	48	14.62	0.00	0.00	18.52	52.02	0.00	31.61	0.00	0.00	11366.71	507.30	0.00	0.00	1813.50	1767.09	8650.15
43	**42**	**43**	7	18.93	0.00	0.00	16.68	46.15	0.00	48.91	0.00	0.00	11700.60	600.93	0.00	0.00	2476.08	2131.17	11377.85
51	**50**	**45**	56	0.00	0.00	0.00	20.02	55.46	0.00	34.97	0.00	0.00	13429.00	1338.62	0.00	0.00	1880.45	1849.89	11594.95
60	**59**	**47**	376	15.03	0.00	0.00	18.90	54.93	0.00	68.59	55.41	0.00	12252.04	1535.06	0.00	36.18	1968.44	3656.91	9663.03
62	**61**	**46**	11	21.52	0.00	0.00	22.46	50.97	0.00	103.56	56.27	0.00	13200.72	1355.90	0.00	0.00	2716.82	3220.30	11820.86
66	**113**	**35**	1179	315.84	0.00	0.00	18.83	42.54	0.00	39.97	0.00	0.00	57342.14	10099.52	0.00	0.00	1807.82	8818.73	9086.14
68	**27**	**15**	76	19.60	0.00	0.00	15.43	52.03	0.00	24.25	0.00	0.00	10135.00	857.47	0.00	0.00	1926.38	2607.72	7976.23
69	**69**	**22**	54	20.78	0.00	0.00	17.07	46.00	0.00	37.03	0.00	0.00	9907.27	549.04	0.00	0.00	2023.14	1476.78	7631.94
72	**155**	**65**	4	19.31	0.00	0.00	17.66	58.57	0.00	66.16	0.00	0.00	14674.48	1046.44	0.00	0.00	2252.46	2332.84	11360.02
74	**217**	**105**	20	79.24	0.00	0.00	17.64	43.20	0.00	26.92	0.00	0.00	10542.73	1194.17	0.00	0.00	1737.05	1867.92	6601.86
80	**249**	**140**	174	28.06	0.00	0.00	20.80	58.12	0.00	40.61	0.00	0.00	13093.18	823.38	0.00	0.00	1905.87	2104.35	8498.66
82	**209**	**94**	869	18.30	0.00	0.00	21.01	50.01	21.30	47.26	0.00	0.00	25048.94	1403.52	0.00	0.00	1652.85	4947.64	6857.83
86	**185**	**78**	793	29.80	0.00	0.00	20.27	48.51	14.47	30.24	37.54	0.00	29995.62	2841.87	0.00	54.52	1849.67	9121.47	7612.63
87	**106**	**27**	74	14.05	0.00	0.00	15.39	48.92	0.00	34.43	0.00	0.00	9504.59	594.69	0.00	0.00	1093.89	1033.94	4162.03
87	**107**	**28**	87	14.94	0.00	0.00	17.70	55.18	0.00	29.70	0.00	0.00	10098.63	550.56	0.00	0.00	2181.47	2051.26	8386.83
91	**90**	**42**	107	37.19	0.00	0.00	21.17	46.51	0.00	55.62	0.00	0.00	9508.66	302.88	0.00	0.00	1535.99	1400.06	6925.21
95	**94**	**44**	5	36.35	0.00	0.00	19.35	52.89	0.00	40.69	0.00	0.00	13799.66	570.92	0.00	0.00	2288.06	2578.69	11315.92
99	**105**	**21**	1002	0.00	0.00	0.00	18.68	45.94	28.97	0.00	0.00	114.06	88376.71	12264.28	0.00	98.48	1855.36	8964.67	7153.50
118	**189**	**122**	530	26.76	0.00	0.00	25.12	50.82	0.00	33.94	0.00	0.00	14996.36	2129.10	0.00	0.00	2075.17	2731.25	7921.32
118	**195**	**123**	1242	24.44	0.00	0.00	17.34	46.42	13.74	43.16	0.00	0.00	24279.71	4619.76	0.00	0.00	2000.53	2073.60	7381.89
118	**159**	**159**	361	24.26	0.00	0.00	26.48	57.49	0.00	46.48	0.00	0.00	15348.46	1998.63	0.00	46.20	2121.01	4656.04	8727.36
119	**291**	**234**	182	21.80	0.00	0.00	19.17	55.97	0.00	36.18	0.00	0.00	16321.90	1541.79	0.00	0.00	1832.00	1949.94	7247.90
119	**292**	**235**	91	21.48	0.00	0.00	21.58	55.21	0.00	52.55	0.00	0.00	15564.09	863.07	0.00	0.00	2382.26	2455.78	10611.84
119	**293**	**236**	283	28.05	0.00	0.00	20.26	47.94	0.00	84.25	0.00	0.00	23584.12	1255.50	0.00	0.00	1753.40	2002.74	7182.49
119	**294**	**237**	850	0.00	0.00	0.00	17.49	23.04	35.70	55.81	0.00	0.00	91648.01	11583.38	0.00	82.82	1254.25	20406.98	6303.00

119	**324**	**238**	1130	0.00	0.00	0.00	9.41	19.89	41.37	80.50	53.46	147.28	162858.66	11650.93	0.00	115.15	1351.30	7996.82	9595.95
119	**415**	**285**	357	42.61	0.00	0.00	21.14	61.47	0.00	76.66	0.00	0.00	18746.69	995.24	0.00	36.59	2670.95	2081.53	13875.68
119	**416**	**286**	650	27.89	0.00	0.00	24.68	62.67	0.00	78.05	0.00	0.00	25111.54	1574.00	0.00	35.81	2074.82	3241.73	9905.19
120	**387**	**287**	1539	26.59	0.00	0.00	21.38	60.19	0.00	198.81	0.00	0.00	19102.70	1029.90	0.00	33.57	2448.36	2576.67	11701.17
120	**288**	**288**	788	18.64	0.00	0.00	20.09	53.35	0.00	60.94	0.00	0.00	16515.43	1681.58	0.00	0.00	1933.77	2031.40	7414.17
120	**389**	**289**	205	49.49	0.00	0.00	22.81	69.15	0.00	37.43	0.00	0.00	19805.39	872.24	0.00	0.00	2318.86	1693.10	12238.24
121	**245**	**156**	923	17.84	0.00	0.00	18.65	56.25	0.00	40.09	0.00	0.00	19836.82	2100.72	0.00	0.00	1947.75	2416.29	8150.49
121	**262**	**328**	2977	0.00	0.00	0.00	15.69	32.48	124.87	0.00	0.00	536.19	379485.41	61621.65	0.00	126.63	1583.14	10275.78	8743.38
121	**263**	**329**	911	27.49	0.00	0.00	19.86	49.29	0.00	60.96	0.00	0.00	17815.19	1000.25	0.00	0.00	2378.91	2130.07	10890.65
121	**264**	**330**	313	27.03	0.00	0.00	22.41	61.32	0.00	115.28	0.00	0.00	17689.88	1063.74	0.00	0.00	2075.61	1847.60	12009.12
121	**480**	**332**	1015	24.55	0.00	0.00	41.88	44.73	49.36	78.26	112.06	119.48	101775.74	16146.90	0.00	156.66	2019.96	34513.18	8938.91
121	**481**	**334**	273	35.66	0.00	0.00	18.38	49.16	0.00	0.00	0.00	0.00	11716.78	447.16	0.00	0.00	1960.63	1307.43	10268.17
121	**482**	**335**	1015	33.45	0.00	0.00	20.63	52.05	0.00	145.39	0.00	0.00	19559.09	1205.95	0.00	0.00	2071.68	1699.24	9730.12
121	**484**	**337**	464	28.87	0.00	0.00	19.86	60.34	0.00	70.93	0.00	0.00	17532.10	954.40	0.00	33.07	2028.80	1731.68	8875.65
123	**123**	**36**	218	0.00	0.00	0.00	0.00	37.07	0.00	0.00	0.00	0.00	6293.08	0.00					
123	**255**	**255**	1112	0.00	0.00	0.00	12.93	43.00	0.00	0.00	0.00	0.00	21953.37	2567.00	0.00	0.00	1350.29	3102.08	4677.69
123	**353**	**256**	167	21.36	0.00	0.00	21.65	62.05	0.00	38.27	0.00	0.00	24788.05	2519.85	0.00	39.24	1490.62	2855.57	6179.09
123	**392**	**281**	85	21.92	0.00	0.00	24.05	54.86	0.00	30.77	0.00	0.00	10960.85	764.80	0.00	39.24	2124.91	3033.59	8691.54
124	**256**	**150**	47	23.63	0.00	0.00	13.63	51.47	0.00	33.07	0.00	0.00	10731.43	969.82	0.00	0.00	1750.73	1804.38	7262.08
124	**256**	**151**	11	20.44	0.00	0.00	15.14	37.36	0.00	19.82	0.00	0.00	8686.16	1014.11	0.00	0.00	1817.91	3958.28	6510.41
124	**463**	**319**	1112	25.97	0.00	0.00	21.94	59.01	12.78	41.50	48.26	0.00	32010.09	2312.70	0.00	64.90	2362.70	5916.11	12064.19
125	**125**	**128**	0.000000001	28.53	0.00	0.00	25.51	52.89	0.00	45.91	0.00	0.00	14836.11	1010.67	0.00	0.00	1830.42	3098.96	7857.71
125	**323**	**360**	1352	18.51	0.00	0.00	17.58	39.37	14.86	112.33	0.00	0.00	13873.89	1086.63	0.00	0.00	2042.96	2135.65	7746.13
125	**323**	**361**	858	36.46	0.00	0.00	17.60	55.62	0.00	141.83	0.00	0.00	21299.13	1327.61	0.00	0.00	2758.04	2504.04	11501.35
125	**323**	**362**	250	42.76	0.00	0.00	23.97	55.04	19.18	514.26	0.00	0.00	25277.36	2424.18	0.00	51.96	2746.19	2915.18	12607.45
125	**514**	**369**	1215	0.00	0.00	0.00	17.06	32.53	62.57	149.98	0.00	0.00	168738.52	23799.58	0.00	0.00	991.28	3119.74	3791.06
125	**515**	**371**	2186	23.57	0.00	0.00	17.66	34.31	74.37	76.42	67.63	302.06	251994.67	38317.79	0.00	0.00	1758.67	9759.86	9824.64
125	**515**	**373**	1729	0.00	0.00	0.00	22.95	23.04	180.86	0.00	0.00	723.91	573778.06	69395.72	0.00	146.94	1349.90	14005.13	11137.46
125	**516**	**374**	23	26.72	0.00	0.00	25.75	75.92	0.00	94.88	0.00	0.00	21670.24	581.27	0.00	0.00	2834.91	2876.21	14414.71

125	**323**	**375**	2143	32.63	0.00	0.00	16.53	40.00	76.09	0.00	0.00	0.00	230047.09	6712.06	0.00	0.00	1871.73	9655.42	9246.79
125	**517**	**376**	2327	39.64	0.00	0.00	18.26	48.30	0.00	50.30	0.00	0.00	24779.98	2424.91	0.00	42.23	1988.07	2988.62	8244.35
126	**326**	**242**	7190	17.06	0.00	0.00	24.55	41.95	0.00	38.38	0.00	0.00	20588.60	3195.37	0.00	38.31	1757.32	8290.69	7552.71
127	**327**	**240**	361	38.79	0.00	0.00	20.58	60.72	34.92	52.01	0.00	0.00	57205.21	6645.31	0.00	58.99	2040.14	6387.28	11309.87
127	**597**	**486**	1281	47.72	0.00	0.00	19.41	41.59	0.00	0.00	0.00	0.00	11037.69	780.20	0.00	0.00	2563.29	2319.54	9967.31
133	**170**	**88**	893	21.39	0.00	0.00	16.53	49.48	0.00	110.57	0.00	0.00	16779.34	1252.42	0.00	0.00	1909.68	2001.36	8614.95
133	**207**	**121**	1679	23.50	0.00	0.00	16.66	45.37	0.00	163.29	0.00	0.00	15384.63	1179.85	0.00	0.00	1973.23	2149.00	8634.74
133	**207**	**395**	540	27.24	0.00	0.00	19.35	55.82	0.00	145.34	0.00	0.00	19654.25	1160.29	0.00	0.00	2000.35	2237.85	12991.69
133	**536**	**396**	322	35.25	0.00	0.00	20.65	62.15	0.00	186.05	0.00	0.00	20130.76	1193.93	0.00	39.80	2724.25	4624.52	14072.76
133	**206**	**445**	290	37.94	0.00	0.00	26.99	64.53	0.00	69.06	0.00	0.00	21742.91	1100.58	0.00	0.00	2722.95	2150.58	14024.65
134	**162**	**63**	492	25.63	0.00	0.00	22.66	49.19	24.78	43.44	0.00	0.00	20692.93	1330.21	0.00	36.87	2371.77	4029.93	9542.01
135	**171**	**120**	351	22.67	0.00	0.00	25.27	55.08	24.77	81.14	0.00	0.00	68955.76	9153.66	0.00	79.77	1862.61	15191.04	11050.65
135	**318**	**233**	273	24.78	0.00	0.00	17.05	66.25	0.00	37.50	0.00	0.00	17604.24	1328.80	0.00	0.00	1989.00	2335.97	10711.00
137	**284**	**182**	66	36.59	0.00	0.00	21.18	53.65	0.00	41.27	0.00	0.00	12362.43	817.66	0.00	36.55	2124.63	2041.18	9391.53
138	**187**	**79**	142	23.30	0.00	0.00	16.18	53.22	0.00	12.88	0.00	0.00	10628.73	1038.60	0.00	15.75	1822.26	2112.83	7312.15
140	**198**	**118**	262	24.33	0.00	0.00	19.45	52.30	0.00	90.03	28.56	0.00	14003.55	873.36	0.00	0.00	2741.44	2418.34	10416.32
140	**219**	**119**	109	13.69	0.00	0.00	19.49	48.55	0.00	57.32	0.00	0.00	11712.79	721.08	0.00	0.00	2218.55	2168.53	9601.04
141	**156**	**54**	421	20.19	0.00	0.00	19.95	52.66	0.00	59.02	35.66	0.00	11803.07	1413.68	0.00	0.00	2338.01	3466.09	10239.55
141	**163**	**60**	53	14.69	0.00	0.00	22.75	48.93	0.00	60.20	41.68	0.00	11842.32	1613.39	0.00	0.00	2187.85	3610.90	9836.92
141	**164**	**61**	75	18.82	0.00	0.00	21.68	51.27	0.00	90.02	66.42	0.00	15304.20	2274.52	0.00	0.00	2303.79	6117.91	9737.83
141	**179**	**126**	698	24.58	0.00	0.00	22.97	36.46	0.00	83.47	0.00	0.00	17827.54	1219.83	0.00	38.23	2585.61	5768.71	10525.02
141	**164**	**127**	286	21.54	0.00	0.00	21.30	50.38	0.00	71.54	70.76	0.00	14512.83	2313.71	0.00	0.00	2671.23	6099.17	11189.38
142	**151**	**55**	205	23.82	0.00	0.00	28.38	38.02	28.77	50.58	0.00	0.00	52154.05	4829.22	0.00	97.84	1648.44	23863.04	8204.42
142	**154**	**57**	15	14.16	0.00	0.00	26.22	42.51	23.85	25.43	0.00	0.00	23140.83	1020.93	0.00	43.10	2141.32	12867.92	9223.50
145	**180**	**76**	21	23.57	0.00	0.00	20.73	46.59	0.00	43.73	0.00	0.00	11602.93	659.41	0.00	0.00	2370.58	2390.52	11012.84
146	**181**	**77**	35	0.00	0.00	0.00	20.13	42.79	0.00	39.28	0.00	0.00	10240.92	668.01	0.00	0.00	2153.42	1829.52	9119.72
152	**153**	**62**	125	0.00	0.00	0.00	21.46	59.85	0.00	63.06	0.00	0.00	22226.00	2148.79	0.00	0.00	1717.57	2331.92	7304.78
165	**166**	**72**	628	37.58	0.00	0.00	19.46	60.48	22.52	68.47	0.00	0.00	36923.25	3064.44	0.00	45.75	2488.53	5660.07	14189.84
168	**169**	**71**	212	20.92	0.00	0.00	21.58	53.12	0.00	78.25	0.00	0.00	13463.74	985.71	0.00	0.00	2068.13	2199.06	9807.06
168	**524**	**386**	523	15.03	0.00	0.00	17.78	33.94	0.00	40.89	0.00	0.00	11799.55	653.74	0.00	0.00	1075.99	1129.81	4896.20
168	**542**	**401**	286	22.29	0.00	0.00	18.74	50.71	0.00	81.31	0.00	0.00	14908.08	929.75	0.00	33.18	2117.28	4437.52	10702.6

																			2
168	**586**	**444**	110	22.33	0.00	0.00	20.13	58.50	0.00	32.56	0.00	0.00	14093.81	477.41	0.00	51.82	2574.42	1979.71	15252.12
188	**204**	**93**	707	18.37	0.00	0.00	24.30	48.94	18.49	64.99	0.00	0.00	31007.06	1927.37	0.00	44.30	1971.74	8639.13	8366.38
196	**197**	**92**	1062	27.84	0.00	0.00	20.72	48.47	0.00	108.88	0.00	0.00	16299.77	1337.21	0.00	44.86	1868.54	3567.92	9594.26
225	**240**	**154**	2466	0.00	0.00	0.00	13.89	28.14	111.97	0.00	0.00	662.23	335226.65	49417.55	0.00	128.03	1755.03	7653.76	8062.95
225	**270**	**169**	1376	0.00	0.00	0.00	0.00	23.96	32.87	167.99	0.00	199.51	134742.84	25819.42	0.00	39.10	646.06	1765.04	1565.58
225	**239**	**261**	508	22.47	0.00	0.00	24.77	54.42	0.00	31.05	0.00	0.00	15689.29	572.56	0.00	0.00	1840.82	1397.40	8542.19
225	**270**	**263**	456	32.21	0.00	0.00	15.27	44.76	0.00	50.43	0.00	0.00	21870.88	2772.18	0.00	38.15	2167.85	2500.36	9914.32
226	**242**	**155**	2441	19.09	0.00	0.00	17.90	48.02	21.55	50.95	0.00	0.00	37811.53	6756.88	0.00	0.00	2044.33	3724.87	8954.81
226	**271**	**170**	1234	26.70	0.00	0.00	19.97	27.73	33.72	41.68	37.64	121.38	72067.01	15796.68	0.00	74.70	1677.82	16124.64	8232.30
226	**241**	**262**	176	32.84	0.00	0.00	21.62	52.65	0.00	25.30	0.00	0.00	16062.93	933.81	0.00	0.00	2159.64	1859.08	10190.87
232	**207**	**158**	863	17.25	0.00	0.00	20.80	51.56	0.00	56.88	0.00	0.00	15158.69	940.40	0.00	0.00	2318.26	1749.95	10834.78
238	**250**	**141**	92	19.69	0.00	0.00	23.54	48.06	0.00	29.94	0.00	0.00	10114.19	364.63	0.00	0.00	2306.55	2463.52	8775.73
238	**254**	**167**	223	25.72	0.00	0.00	20.30	43.82	0.00	24.52	0.00	0.00	10014.31	304.40	0.00	0.00	1689.05	1598.44	7506.47
266	**268**	**185**	380	27.45	0.00	0.00	21.21	59.66	0.00	62.54	0.00	0.00	17572.39	1518.84	0.00	38.43	2112.86	2602.75	10567.49
266	**286**	**186**	486	21.10	0.00	0.00	23.80	65.40	19.33	0.00	0.00	0.00	51022.19	6507.53	0.00	81.14	1852.51	8374.21	11617.10
266	**281**	**203**	580	29.39	0.00	0.00	21.00	62.79	0.00	38.60	0.00	0.00	26805.64	2586.92	0.00	45.87	1900.25	2722.64	11848.97
266	**282**	**204**	280	35.30	0.00	0.00	17.70	57.42	0.00	89.76	0.00	0.00	22663.08	2174.25	0.00	0.00	2409.58	2396.27	11396.81
266	**311**	**218**	300	44.36	0.00	0.00	19.19	66.57	0.00	34.66	0.00	0.00	25939.70	1792.42	0.00	0.00	1723.43	1785.71	9469.83
274	**320**	**254**	143	27.22	0.00	0.00	21.49	56.06	0.00	53.23	0.00	0.00	15599.89	1767.24	0.00	0.00	1557.26	2320.51	5124.88
299	**300**	**229**	6046	16.66	0.00	0.00	18.69	43.17	0.00	0.00	0.00	0.00	20948.15	3230.64	0.00	0.00	1644.93	4317.38	6730.26
299	**312**	**230**	666	34.37	0.00	0.00	26.40	52.27	0.00	79.62	0.00	0.00	22052.72	1770.43	0.00	38.09	2309.53	2538.31	10560.10
299	**313**	**231**	1012	20.28	0.00	0.00	17.65	36.80	14.07	29.77	0.00	0.00	28554.44	4334.52	0.00	0.00	2176.66	3202.91	9229.96
299	**386**	**471**	411	25.80	0.00	0.00	21.49	46.61	13.74	26.61	0.00	0.00	11996.09	628.88	0.00	34.41	2451.53	1613.22	9783.65
299	**600**	**479**	534	70.96	0.00	0.00	20.20	48.02	0.00	0.00	0.00	0.00	16679.84	1303.14	0.00	0.00	2511.45	2528.28	10134.86
299	**314**	**482**	459	19.11	0.00	0.00	15.25	42.10	0.00	43.20	0.00	0.00	12302.28	895.46	0.00	0.00	2660.52	2237.97	9595.39
299	**601**	**483**	170	19.14	0.00	0.00	16.46	37.14	0.00	0.00	0.00	0.00	20660.70	2424.72	0.00	0.00	2721.09	2655.50	7805.38
299	**312**	**485**	1325	27.63	0.00	0.00	20.75	63.44	65.01	0.00	0.00	370.45	197703.95	48911.74	0.00	146.73	2691.96	5550.06	17499.61
299	**313**	**490**	212	36.38	0.00	0.00	21.12	42.13	0.00	46.42	0.00	0.00	26996.57	4433.64	0.00	44.26	1906.68	2204.37	7553.68
299	**313**	**491**	315	51.21	0.00	0.00	23.08	49.50	0.00	61.55	0.00	0.00	24873.34	4943.55	0.00	76.79	2261.03	8165.05	10184.40
299	**602**	**494**	712	52.27	0.00	0.00	20.78	60.31	15.29	154.10	0.00	0.00	19596.07	1016.16	0.00	36.97	2560.49	2163.45	12481.3

																			2
301	**304**	**214**	7	0.00	120.08	171.57	30.56	42.29	0.00	50.27	0.00	0.00	10863.89	355.75	0.00	0.00	742.97	975.70	3054.39
301	**305**	**215**	3	16.84	0.00	0.00	18.95	53.14	0.00	61.80	0.00	0.00	14956.13	1200.91	0.00	0.00	1782.94	2169.82	8418.99
303	**302**	**227**	31	21.78	0.00	0.00	18.01	56.62	0.00	42.37	0.00	0.00	15313.20	1355.38	0.00	0.00	1804.25	2538.99	7868.82
334	**348**	**251**	24	15.24	0.00	0.00	20.67	59.57	11.45	88.04	36.32	0.00	11011.14	1030.11	0.00	0.00	2076.71	2474.94	9646.42
375	**376**	**273**	17	23.69	0.00	0.00	33.24	74.37	16.20	107.48	0.00	0.00	25162.59	1516.07	0.00	46.30	1580.96	1830.05	13015.89
393	**430**	**292**	8190	37.36	0.00	0.00	23.42	46.68	0.00	0.00	0.00	438.82	433682.63	29282.13	0.00	0.00	1098.16	4712.80	4037.09
393	**555**	**406**	310	52.57	0.00	0.00	22.02	81.55	0.00	92.19	0.00	0.00	29416.25	1320.57	0.00	38.99	2535.95	2302.27	14357.33
393	**556**	**407**	184	28.55	0.00	0.00	20.90	74.92	0.00	0.00	0.00	0.00	23061.94	949.75	0.00	0.00	2690.86	3288.57	16231.83
397	**449**	**306**	583	18.07	0.00	0.00	13.94	52.94	0.00	81.25	0.00	0.00	16178.61	1506.67	0.00	0.00	1841.32	2143.12	7230.32
397	**403**	**307**	382	16.75	0.00	0.00	17.03	48.97	0.00	104.50	0.00	0.00	17825.14	1460.59	0.00	0.00	2219.98	2521.85	10218.23
397	**451**	**309**	252	27.06	0.00	0.00	35.29	42.97	0.00	103.34	0.00	0.00	52246.76	12354.91	0.00	107.17	1640.49	9951.98	6299.62
397	**402**	**341**	1850	16.26	0.00	0.00	20.27	38.01	16.35	67.77	0.00	0.00	35062.79	8074.25	0.00	63.35	1834.79	3912.22	9007.60
398	**459**	**437**	311	15.31	0.00	0.00	15.88	43.00	0.00	32.28	0.00	0.00	12569.18	1246.08	0.00	29.06	1781.49	3645.74	7560.71
398	**574**	**439**	2110	19.72	0.00	0.00	15.90	45.16	0.00	57.83	0.00	0.00	15134.23	808.36	0.00	19.25	2356.91	2260.18	11048.05
398	**575**	**440**	1111	0.00	0.00	0.00	23.24	34.45	27.62	98.38	0.00	0.00	55258.31	16741.03	0.00	144.07	1914.80	15713.90	7973.66
398	**575**	**441**	1915	25.13	0.00	0.00	23.22	61.04	17.32	58.86	0.00	0.00	17268.22	931.68	0.00	0.00	1768.43	1126.26	9040.52
398	**576**	**442**	157	24.01	0.00	0.00	22.72	66.46	11.83	70.45	0.00	0.00	20736.39	804.98	0.00	49.72	2613.18	2340.85	15229.84
398	**407**	**454**	354	29.75	0.00	0.00	18.03	49.05	0.00	25.06	0.00	0.00	12967.47	439.25	0.00	0.00	2449.80	1818.25	11064.50
398	**576**	**457**	124	24.36	0.00	0.00	21.12	49.95	0.00	38.26	0.00	0.00	13983.12	737.50	0.00	0.00	2402.43	1806.83	12578.82
398	**585**	**455**	0.00000001	28.12	0.00	0.00	17.79	34.55	0.00	85.77	0.00	0.00	18284.08	601.23	0.00	0.00	2791.56	1645.47	10571.65
399	**408**	**436**	1001	17.31	0.00	0.00	16.64	42.87	0.00	32.68	0.00	0.00	17233.17	3285.83	0.00	0.00	2156.16	2049.26	10804.65
400	**409**	**412**	1623	29.77	0.00	0.00	22.60	47.15	0.00	157.64	0.00	0.00	15987.13	1116.07	0.00	55.56	2372.48	2107.03	10323.23
400	**553**	**414**	1280	0.00	0.00	0.00	13.47	35.14	38.04	112.13	0.00	0.00	55620.20	12865.76	0.00	89.84	2513.72	4875.73	8204.06
400	**410**	**416**	260	0.00	0.00	0.00	24.01	37.39	0.00	30.85	0.00	0.00	10856.81	530.91	0.00	0.00	2365.09	2186.75	8518.23
400	**410**	**465**	265	21.25	0.00	0.00	17.81	41.78	16.11	69.07	0.00	0.00	13609.55	844.01	0.00	0.00	2034.57	1451.38	7001.14
400	**412**	**469**	250	38.37	0.00	0.00	13.87	46.88	0.00	52.67	0.00	0.00	12595.60	414.80	0.00	0.00	2333.18	1749.43	10303.35
418	**431**	**294**	41	22.15	0.00	0.00	20.03	44.41	0.00	43.45	35.32	0.00	10797.12	968.94	0.00	0.00	2407.48	2312.36	9931.04
419	**587**	**447**	56	32.92	0.00	0.00	31.17	49.12	0.00	58.38	51.07	0.00	10562.87	1586.00	0.00	0.00	1909.37	10760.80	8216.30

420	**455**	**312**	558	14.94	0.00	0.00	19.52	48.26	15.37	44.46	0.00	0.00	20102.77	1801.07	0.00	35.34	2341.32	4726.96	10366.01
421	**445**	**311**	220	26.94	0.00	0.00	22.13	42.57	0.00	36.93	0.00	0.00	13946.07	1388.38	0.00	30.22	1911.09	5013.23	8064.18
422	**453**	**305**	626	18.08	0.00	0.00	21.25	43.91	16.48	49.06	0.00	0.00	42693.80	5034.07	0.00	44.19	2000.89	3454.95	9471.94
422	**457**	**313**	393	14.60	0.00	0.00	16.07	46.95	0.00	0.00	0.00	0.00	15255.67	892.20	0.00	0.00	2131.13	2026.65	10151.75
424	**489**	**339**	310	23.20	0.00	0.00	92.47	45.03	0.00	573.28	106.89	0.00	11222.71	4723.03	0.00	39.81	1613.02	17139.84	7151.14
424	**489**	**342**	91	24.52	0.00	0.00	44.87	59.68	0.00	285.93	0.00	0.00	15769.49	1744.89	0.00	33.04	1820.27	9199.93	9202.19
424	**489**	**346**	4	0.00	0.00	0.00	98.90	12.04	0.00	1822.26	153.13	0.00	5237.18	8203.90	0.00	71.58	999.47	37198.55	3618.97
424	**525**	**422**	62	17.39	0.00	0.00	33.64	43.72	0.00	268.86	0.00	0.00	10022.79	1547.84	0.00	0.00	1812.65	5812.61	7145.06
424	**528**	**423**	136	14.22	0.00	0.00	43.82	37.95	0.00	242.12	32.90	0.00	9599.27	1744.79	0.00	35.81	1866.89	10271.24	7814.99
424	**490**	**426**	136	25.44	0.00	0.00	32.51	52.69	0.00	242.26	0.00	0.00	13587.58	1696.80	0.00	51.14	2194.66	6542.58	11591.08
424	**487**	**427**	123	18.56	0.00	0.00	98.25	37.76	0.00	548.01	78.55	0.00	10016.98	2696.41	0.00	50.44	2039.84	26885.87	9194.28
424	**571**	**431 direct**	259	23.65	0.00	0.00	120.25	54.69	0.00	661.13	207.63	0.00	13463.47	4287.57	0.00	49.33	2059.83	25083.71	11621.62
424	**571**	**431**	259	19.36	0.00	0.00	103.34	43.92	0.00	509.93	188.02	0.00	10268.35	3313.17	0.00	36.11	1589.78	16020.52	7228.14
424	**526**	**449**	78	17.38	0.00	0.00	161.29	44.51	0.00	980.33	53.33	0.00	26599.86	3545.33	0.00	99.23	2068.01	30107.60	10333.08
426	**533**	**389**	130	16.77	0.00	0.00	14.17	54.31	0.00	35.97	0.00	0.00	14686.96	1183.41	0.00	0.00	1540.49	1501.25	9602.35
427	**507**	**363**	1190	20.96	0.00	0.00	20.03	44.41	25.65	0.00	0.00	0.00	114832.96	10517.91	0.00	59.51	2105.82	6351.64	10282.96
427	**507**	**364**	3604	0.00	0.00	0.00	12.81	23.79	35.05	81.31	0.00	246.55	245325.27	19355.34	0.00	0.00	1793.37	5607.35	8523.26
427	**508**	**365**	150	0.00	0.00	0.00	19.08	28.75	0.00	49.24	0.00	0.00	13459.34	1670.18	0.00	0.00	2281.76	2165.77	7529.39
427	**509**	**366**	232	0.00	0.00	0.00	24.60	31.80	0.00	0.00	0.00	0.00	6501.57	372.16	0.00	0.00	2373.68	1698.30	8595.41
428	**442**	**295**	4131	0.00	0.00	0.00	20.09	19.20	100.72	0.00	0.00	815.58	458837.59	59820.79	0.00	160.89	1803.69	11455.17	9260.91
428	**296**	**296**	2374	0.00	0.00	0.00	16.95	27.31	168.12	0.00	0.00	823.63	677090.94	49382.46	0.00	143.93	1707.35	14861.80	9627.30
428	**441**	**315**	4163	28.31	0.00	0.00	27.11	38.98	54.86	0.00	0.00	136.01	120813.27	20437.88	0.00	123.45	3041.72	12481.44	11204.39
428	**442**	**316**	3204	0.00	0.00	0.00	26.99	32.50	105.98	0.00	0.00	695.15	399466.00	74428.55	0.00	194.95	2510.83	15085.22	8445.98
429	**447**	**302**	1587	24.83	0.00	0.00	25.60	41.93	0.00	200.27	0.00	0.00	80040.64	4227.98	0.00	51.06	1764.70	5520.99	8497.54
429	**448**	**304**	211	46.95	0.00	0.00	18.77	44.33	0.00	209.71	0.00	0.00	13592.56	552.88	0.00	0.00	2536.64	2800.59	9040.84
429	**557**	**408**	111	33.61	0.00	0.00	23.17	53.38	0.00	75.85	0.00	0.00	16980.35	269.49	0.00	0.00	1528.90	1158.92	6666.77
429	**558**	**409**	230	24.01	0.00	0.00	22.02	34.89	0.00	115.85	0.00	0.00	14050.69	522.10	0.00	32.14	2342.11	1850.35	9549.03
432	**444**	**300**	5162	0.00	0.00	0.00	24.99	44.33	44.70	128.58	0.00	0.00	99905.05	6687.93	0.00	0.00	2263.86	7135.29	10794.62
432	**444**	**321**	0.000000	17.38	0.00	0.00	21.40	58.09	0.00	58.14	0.00	0.00	16306.28	1847.33	0.00	36.66	2201.22	2595.17	9686.83

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432	**473**	**325**	499	38.48	0.00	0.00	19.69	21.33	109.43	0.00	0.00	0.00	500026.59	20337.43	0.00	0.00	1701.83	8160.85	8303.69
432	**474**	**326**	1025	0.00	0.00	0.00	17.65	36.14	16.66	83.27	0.00	0.00	31832.49	1161.55	0.00	0.00	2089.42	2705.21	8862.52
432	**477**	**327**	89	19.42	0.00	0.00	21.40	46.35	0.00	49.07	0.00	0.00	13948.60	729.58	0.00	0.00	1982.70	2167.18	10911.92
433	**443**	**299**	45	25.71	0.00	0.00	18.49	40.87	22.92	35.87	0.00	137.51	91384.38	11551.52	0.00	30.99	1445.30	6227.35	6226.36
433	**504**	**354**	51	22.51	0.00	0.00	17.82	42.81	0.00	52.49	0.00	0.00	9579.78	266.89	0.00	0.00	2510.92	3451.80	8878.40
433	**443**	**355**	17	18.76	0.00	0.00	24.34	44.27	0.00	44.39	0.00	0.00	5708.78	0.00	0.00	0.00	2195.01	1946.68	7611.87
434	**518**	**384**	408	15.53	0.00	0.00	20.00	45.20	0.00	30.17	0.00	0.00	10409.78	408.05	0.00	0.00	2076.96	2840.44	7524.03
435	**538**	**400**	55	15.13	0.00	0.00	20.32	38.87	10.20	32.82	0.00	0.00	6852.66	142.65	0.00	0.00	1930.84	3597.88	9959.81
435	**539**	**404**	6	0.00	0.00	0.00	14.15	31.41	0.00	24.83	0.00	0.00	4528.47	0.00	0.00	32.39	1804.69	2118.15	8770.95
435	**540**	**405**	0.00	0.00	0.00	0.00	24.00	25.44	0.00	0.00	0.00	0.00	2192.31	0.00	0.00	0.00	2079.69	1747.79	6444.26
436	**562**	**418**	62	21.31	0.00	0.00	22.64	50.32	0.00	54.96	0.00	0.00	12346.45	392.70	0.00	0.00	2282.05	3961.25	13297.37
436	**563**	**419**	4	29.19	0.00	0.00	19.54	51.99	34.22	37.25	0.00	228.61	111766.43	4576.06	0.00	32.77	1706.51	2572.62	10871.75
437	**485**	**338**	228	21.10	0.00	0.00	19.32	49.56	0.00	30.07	0.00	0.00	13816.02	694.83	0.00	0.00	2062.47	3508.74	7861.01
438	**579**	**458**	45	20.81	0.00	0.00	22.00	46.87	0.00	97.96	36.95	0.00	10327.90	849.00	0.00	0.00	2313.10	6816.77	10112.59
438	**580**	**459**	9	0.00	0.00	0.00	22.38	49.79	11.58	82.41	0.00	0.00	11918.08	289.30	0.00	32.04	1853.92	5066.66	10788.65
438	**581**	**460**	41	16.02	0.00	0.00	24.73	46.25	0.00	103.98	0.00	0.00	9879.41	470.83	0.00	0.00	1945.23	2479.52	8187.50
438	**582**	**461**	71	14.54	0.00	0.00	37.73	44.20	0.00	161.43	38.66	0.00	10269.58	913.42	0.00	0.00	1389.08	11799.07	7326.26
456	**460**	**314**	1814	31.38	0.00	0.00	20.38	65.09	0.00	48.53	0.00	0.00	59334.06	5903.73	0.00	61.39	2067.59	8567.11	10839.35
492	**406**	**353**	259	16.37	0.00	0.00	18.56	49.76	0.00	51.06	0.00	0.00	14496.47	1327.91	0.00	43.22	2123.13	3055.33	9022.39
492	**406**	**357**	262	19.67	0.00	0.00	14.94	49.89	0.00	40.15	0.00	0.00	15249.76	1798.88	0.00	0.00	2349.57	3483.41	8481.71
492	**491**	**359**	87	0.00	0.00	0.00	21.38	49.08	0.00	32.39	0.00	0.00	12252.26	677.35	0.00	0.00	1943.70	1991.02	8188.20
492	**494**	**377**	551	22.24	0.00	0.00	21.41	47.37	0.00	59.59	0.00	0.00	14064.08	1210.95	0.00	32.39	1982.95	3213.81	8853.81
492	**510**	**378**	212	12.40	0.00	0.00	12.20	35.86	0.00	0.00	0.00	0.00	8558.35	783.12	0.00	0.00	1347.18	1649.08	4766.00
492	**511**	**379**	594	26.94	0.00	0.00	20.47	48.42	0.00	58.43	35.27	0.00	18379.99	2829.74	0.00	34.25	2035.49	6806.87	8198.66
492	**519**	**380**	745	23.09	0.00	0.00	20.83	48.16	0.00	77.07	0.00	0.00	12756.91	901.47	0.00	0.00	2016.23	2473.41	7745.76
492	**520**	**381**	723	32.84	0.00	0.00	22.90	57.69	0.00	74.25	0.00	0.00	17016.25	654.70	0.00	31.83	1922.71	1886.87	9815.49
492	**535**	**391**	1564	17.90	0.00	0.00	9.55	30.87	19.09	81.17	0.00	0.00	19214.68	3761.85	0.00	71.09	1218.79	3029.31	6248.40
492	**519**	**393**	676	26.46	0.00	0.00	14.52	38.66	0.00	96.67	0.00	0.00	16499.94	635.07	0.00	34.95	1865.04	1994.72	9275.68
492	**519**	**398**	168	0.00	0.00	0.00	16.26	35.44	0.00	64.26	0.00	0.00	16097.15	704.16	0.00	0.00	1657.72	1472.44	6286.96
492	**493**	**402**	787	29.01	0.00	0.00	22.56	53.34	0.00	59.35	41.42	0.00	36473.32	1178.59	0.00	0.00	1593.12	2208.89	8979.36
492	**546**	**403**	247	27.96	0.00	0.00	17.03	39.09	0.00	64.68	0.00	0.00	16561.64	1084.17	0.00	0.00	2339.23	1996.63	8870.82
498	**513**	**390**	74	19.57	0.00	0.00	15.77	43.60	0.00	0.00	0.00	0.00	9892.19	701.05	0.00	0.00	903.56	1489.22	3245.97
498	**527**	**399**	84	0.00	0.00	0.00	13.73	42.34	0.00	29.70	0.00	0.00	9043.93	452.54	0.00	0.00	1151.85	5671.08	5136.27
583	**583**	**463**	154	20.34	0.00	0.00	26.23	51.65	0.00	35.49	38.16	0.00	17468.68	3722.04	0.00	0.00	2097.91	3085.30	8788.95

583	**583**	**467**	13	0.00	0.00	0.00	22.46	42.19	0.00	25.65	0.00	0.00	10693.03	1035.45	0.00	0.00	1815.36	1835.21	6708.73
583	**583**	**468**	811	28.94	0.00	0.00	18.50	36.98	34.11	184.85	58.79	127.30	84554.95	19895.31	0.00	84.13	2493.92	5893.07	8761.12

Comments: Considerable variation amongst the soil samples. Difficult to comment on such a large dataset without statistical analysis- see next section.

ii. Statistical Analysis
- all soils (by feature number)

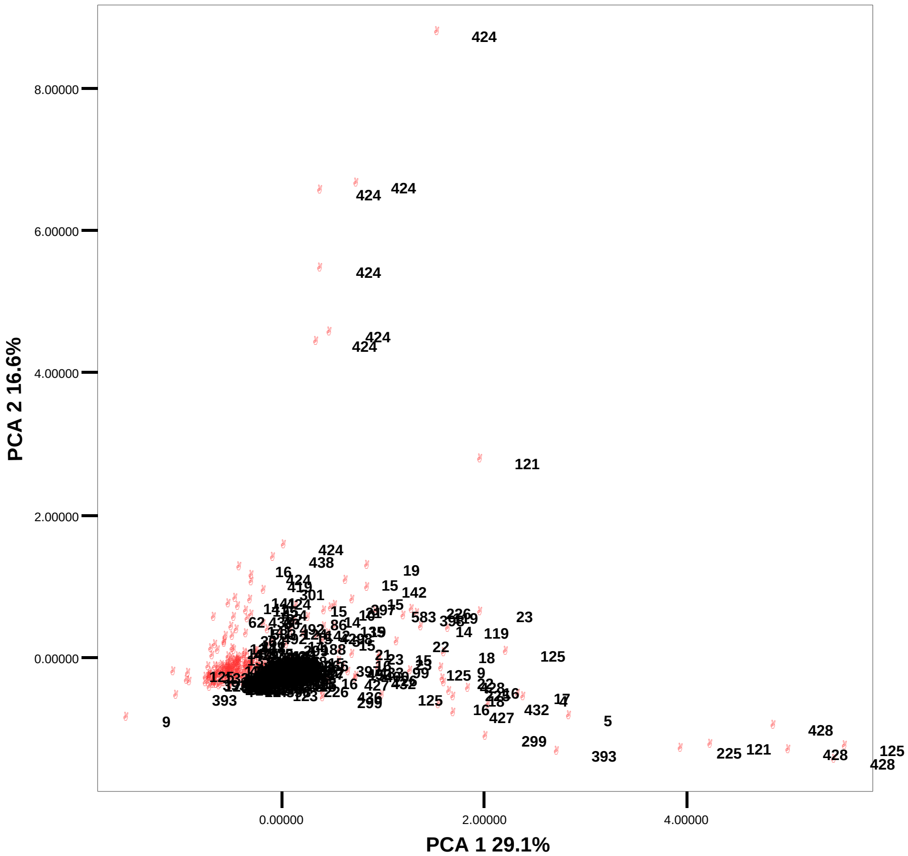


Figure 24. Principal components analysis of soils. All elements determined by XRF plus magnetic susceptibility.

Comments: Soils – some distinct outliers. Majority very geochemically similar.

- minus extreme outliers (by feature number)

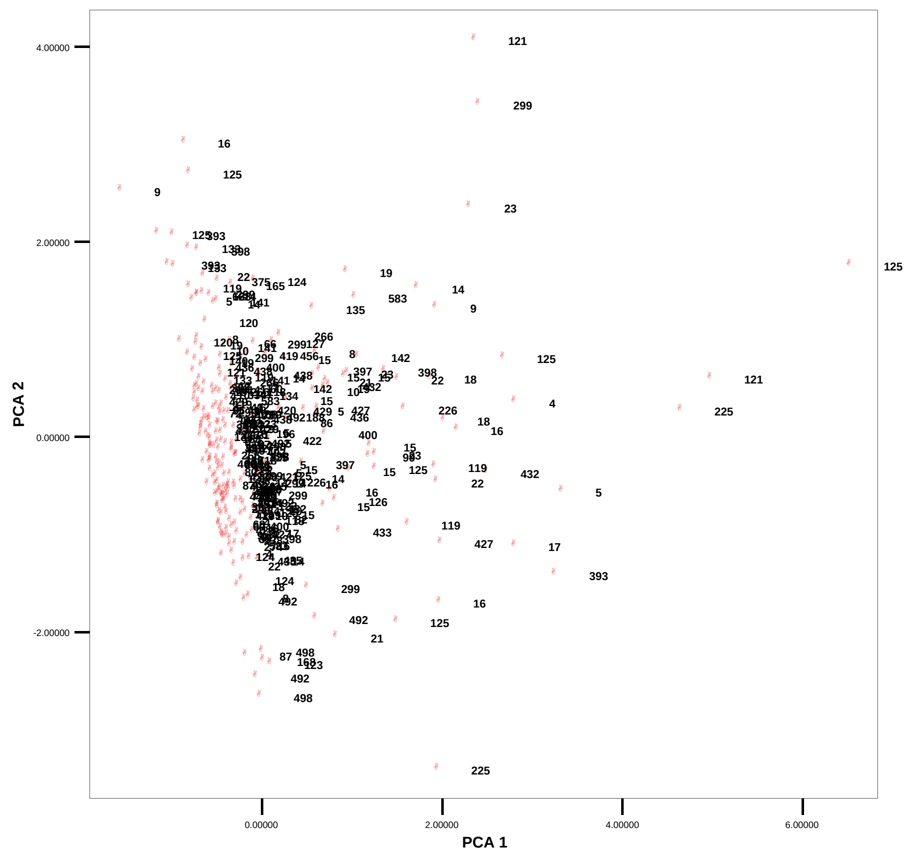


Figure 25. Principal components analysis of soils, minus outliers. All elements determined by XRF plus magnetic susceptibility.

Comments: Removal of outliers allows us to see a linear grouping of a large number of features, but still some outliers.

- **Furnaces v Non-furnaces**
- **furnaces (by feature number)**

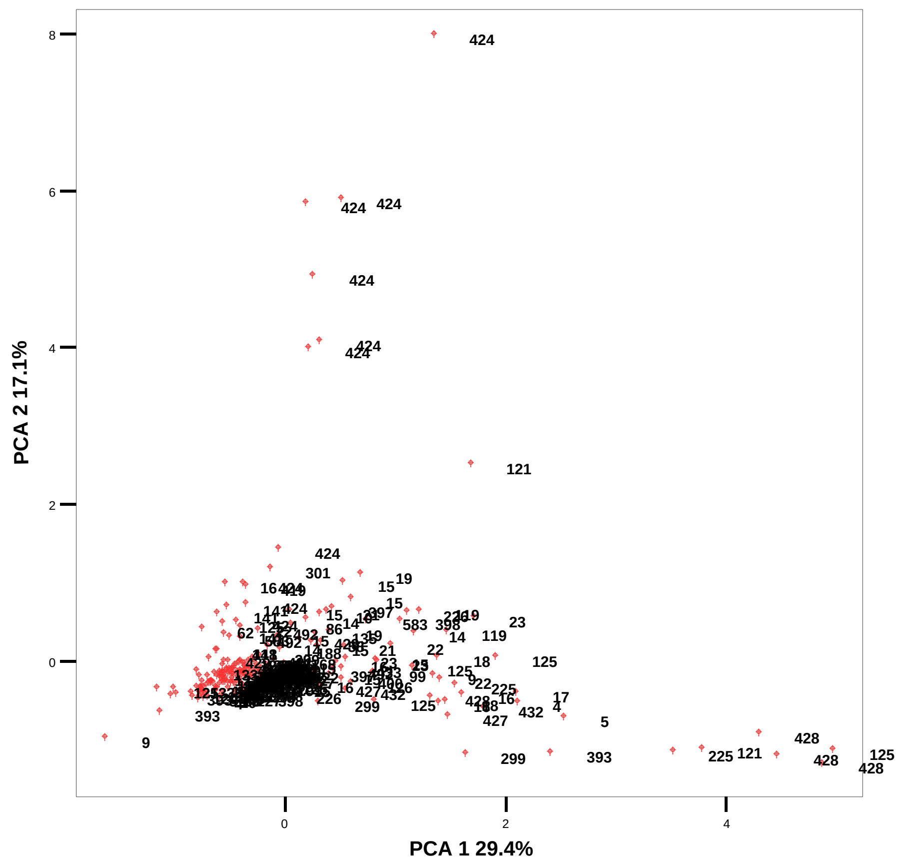


Figure 26. Principal components analysis of furnace features. All elements determined by XRF plus magnetic susceptibility.

Comments:

There is some clustering of furnaces, but also a significant amount of spread.

- non-furnaces (by feature number)

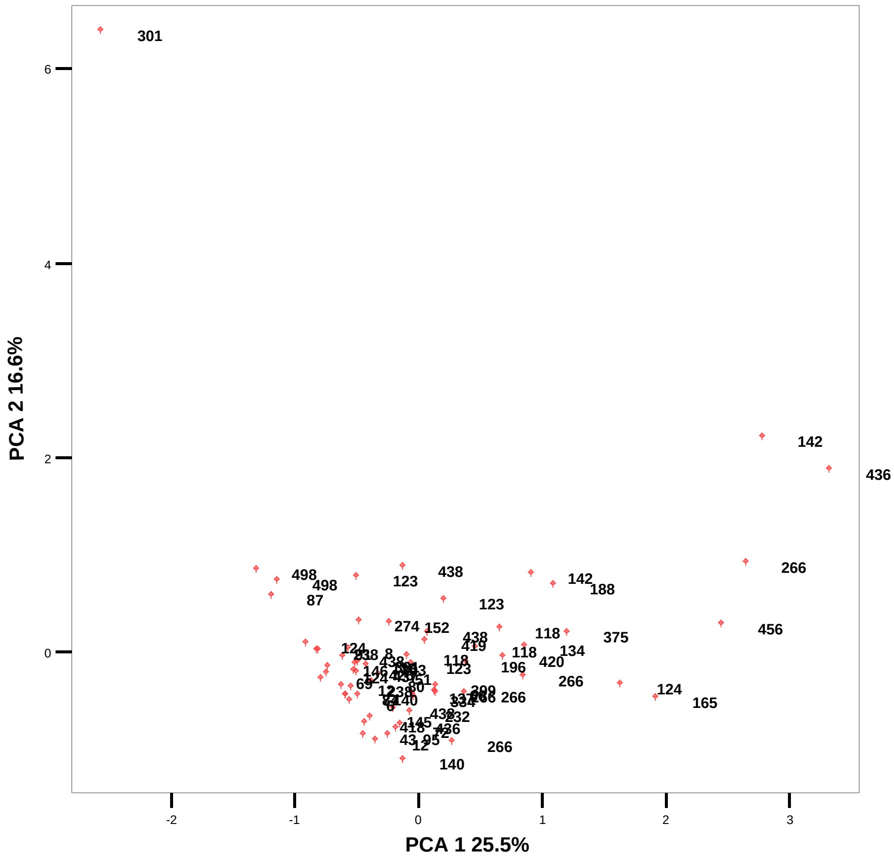


Figure 27. Principal components analysis of non-furnace features. All elements determined by XRF plus magnetic susceptibility.

Comments:
Again, there is a distinct grouping of non furnace features, with a few outliers.

iii. Magnetic Susceptibility – data interpretation

Presentation of Conclusions
Summary of Magnetic Susceptibility Data for Furnace Clusters

The aim of the exercise is to assess the range of temperatures that each furnace within a cluster of furnaces has been exposed to. To that end MS K values have been converted to degrees C in the manner explained in the sections that follow. The experimental work included in these sections was a necessary step in the elucidation of activities at Derrinsallagh IV.

Clusters of furnaces are assigned on the basis of proximity to each other – as per plan of site and with no other criterion in mind. Cluster numbers have been assigned arbitrarily and for purposes of referencing.

Table 12. Summary of Magnetic Susceptibility Data for Furnace Clusters. N.B. These clusters of furnaces have been determined by visual inspection of Derrinsallagh 4 site plan. They have been assigned arbitrary numbers for identification.

Cluster	Feature	Average K	T (ºC)	Inclusions	Contexts with very high K	Contexts with very high K – location in furnace	Cluster comments
1	**14**	627	400-600	Slag: low-mod Charcoal: low-mod Met. Cer: mod-high	-	-	Approx. equal moderate heating amongst this cluster of furnaces. F15 perhaps achieved slightly higher T
	15	984	400-600	Slag: 0-low Charcoal: mod-high Met. Cer: mod-high	173	Upper fill of bowl furnace	
	16	778	400-600	Slag: 0-low Charcoal: 0 Met. Cer: low-mod	-	-	
2	**17**	986	400-600	Slag: mod Charcoal: high Met. Cer: mod	357	Not on section drawing	Approx. equal moderate heating amongst this cluster of furnaces.
	18	1035	400-600	Slag: 0 Charcoal: mod Met. Cer: mod	288	Lower fill (not adhering to furnace walls)	
	19	906	400-600	Slag: mod Charcoal: mod-high Met. Cer: 0	-	-	
3	**21**	344	400-600	No inclusions	-	-	Moderate T in two furnaces to the Left, lower T in two furnaces to the R.
	22	486	400-600	Slag: low-mod Charcoal: 0 Met. Cer: low-mod	-	-	
	23	123	0-400	Slag: low (except C339 high) Charcoal: low-mod Met. Cer: low-mod	-	-	
	24	48	0-400	No inclusions	-	-	
4	**225**	1487	400-600	No inclusions	240	Not on section drawing	Moderate T in furnace to the Left, lower T in furnace to the R.
	226	175	0-400	No inclusions	-	-	
5	**119**	703	400-600	Slag: 0-low	-	-	Approx. equal moderate

				Charcoal: low-mod Met. Cer: low-high			heating amongst this cluster of furnaces. F121 to the S of the cluster perhaps achieved slightly higher T
	120	844	400-600	No inclusions	-	-	
	121	1307	400-600	Slag: 0 Charcoal: mod-high Met. Cer: low-high	262	Lower fill (not adhering to furnace walls)	
6	**133**	684	400-600	Slag: 0-low Charcoal: 0-low Met. Cer: mod	-	-	Approx. equal moderate heating amongst this cluster of furnaces. F133 in the centre of the cluster perhaps achieved slightly higher T
	135	312	400-600	Slag: 0 Charcoal: 0-low Met. Cer: mod	-	-	
	168	203	400-600	Slag: 0 Charcoal: mod Met. Cer: low-mod	-	-	
7	**125**	1366	400-600	Slag: low-mod Charcoal: low-mod Met. Cer: mod	515, 323, 517	Not on section drawing	F125 separate from F299/126/127. Approx. equal moderate heating amongst this cluster of furnaces. F127 in the centre of F299/126/127 perhaps achieved lower T. F299 and F125 perhaps higher T.
	126	7190 (slag?)	400-600	Slag: mod Charcoal: mod Met. Cer: low	326	Only fill of furnace – contains charcoal (and possibly slag?)	
	127	821	400-600	Slag: 0 Charcoal: 0-low Met. Cer: mod	-	-	
	299	1184	400-600	Slag: 0 Charcoal: 0-mod Met. Cer: 0-low	300	Not on section drawing	
8	**506**	-	-	No samples	-	-	No samples from F506. Approx. equal moderate heating amongst this cluster of furnaces.
	492	535	400-600	Slag: 0-low Charcoal: low-mod Met. Cer: mod	-	-	
	577 = 398	423	400-600	Slag: mod Charcoal: lmod Met. Cer: mod	-	-	
	400	925	400-600	Slag: 0 Charcoal: 0 Met. Cer: low	-	-	
9	**5**	1099	400-600	Slag: low-mod Charcoal: mod-high Met. Cer: mod	371	Lowest fill, beneath slag	No samples from F57. Moderate heating in F5.
	57	-	-	No samples	-	-	
10	**434**	408	400-600	No inclusions	-	-	
	438	42	0-400	Slag: 0 Charcoal: low Met. Cer: low	-	-	F433, 435. 436, 438: unheated-low heated. F427, 429, 432, 434: moderately heated. F428: highly heated. F428 is in the centre of this cluster of features.
	433	38	0-400	No inclusions	-	-	
	436	33	0-400	Slag: 0	-	-	

				Charcoal: 0 Met. Cer: mod			
	432	557	400-600	Slag: 0 Charcoal: 0 Met. Cer: high	-	-	
	428	3468	600-1200	No inclusions	441, 442, 443, 296	C441 lower fill, C442 upper fill. C443 and C296 not on section drawing	
	429	899	400-600	Slag: low Charcoal: 0 Met. Cer: 0	-	-	
	427	1294	400-600	Slag: 0 Charcoal: 0 Met. Cer: low	507	Upper fill	
	435	31	0-400	No inclusions	-	-	

Comments

- Most furnaces operate at low-moderate T (400-600ºC) (i.e. possibly at insufficiently high T to produce iron).
- There are differences between individual furnaces within clusters: this may relate to differing functions for different bowls – to be looked at on individual cluster basis.
- Very high values of K seen in some soils are related to soil composition and the presence of Fe in a particular phase. These high values are comparable with heated bog ore MS.
- Based on the magnetic susceptibility values of the feature fills and bog ore, it is plausible that bog ore was used by the smiths at Derrinsallagh 4.

The Conversion of K values to temperature ranges

- Calibration by experimental heating of Derrinsallagh 4 soils

Objective

To investigate the increase in K with heating of the soils, to allow interpolation of heating temperature with K values measured in Derrinsallagh 4 soils.

Method

To facilitate this quantification of the temperature ranges for MS data, we heated a selection of soils with low/background magnetic susceptibility from Derrinsallagh 4 at a range of temperatures and examined the resultant data.

Six samples were chosen from the site at Derrinsallagh 4: two from features which are unlikely to have been heated (low K, ACS interpretation as pit/posthole) and four from grid points sampled for SASAA 204.3 which recorded low MS. A range of temperatures (T) was chosen which reflect the likely T range which may have been attained in a bowl furnace or the surrounding vicinity (0-1100ºC).

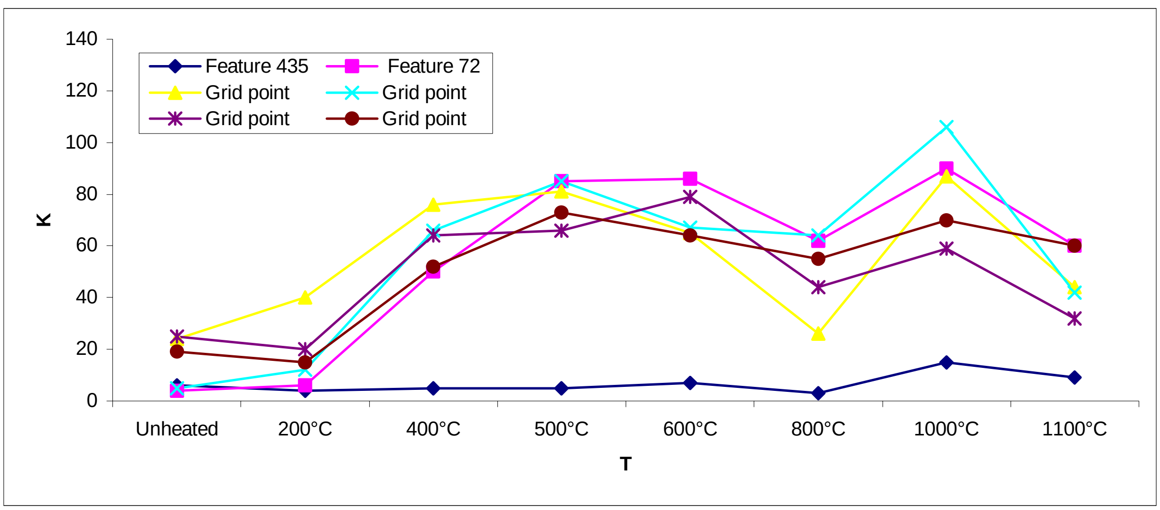
Samples were first disaggregated with a mortar and pestle prior to any heating. Samples were then heated for 2 hours at each T. MS was measured in two ways as a double check of the values: *K* recorded using Bartington MS2F system and *Xlf* recorded using Bartington MS2B system. See Wilson 2005 (SASAA 158) for full MS methodology.

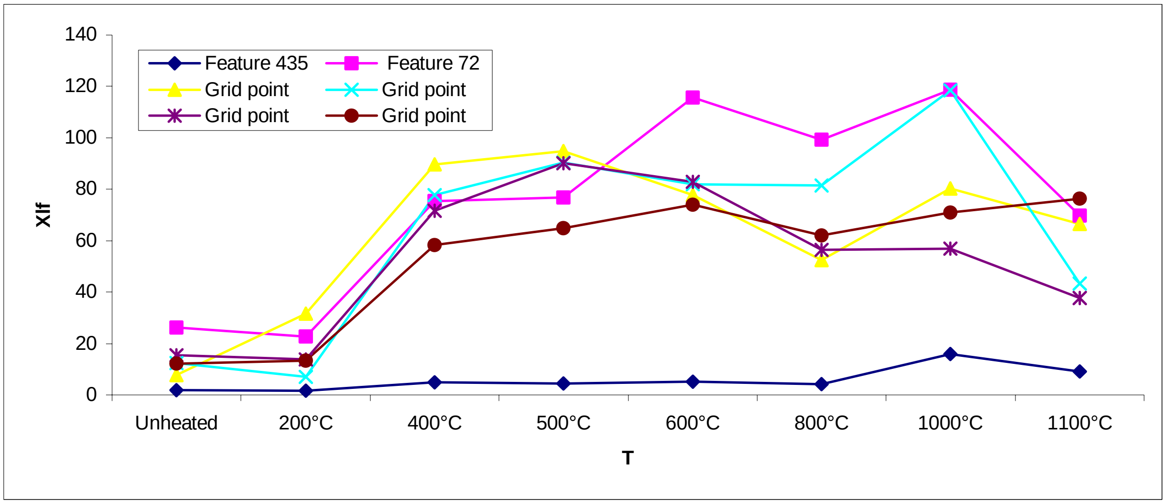
Results

Table 13. Magnetic susceptibility change with sample heating.

Feature/Grid Reference	Sample #	***K* and Xlf**							
		Unheated	**200°C**	**400°C**	**500°C**	**600°C**	**800°C**	**1000°C**	**1100°C**
F435, C539 (pit/archaeological spread?)	404	*6*	*4*	*5*	*5*	*7*	*3*	*15*	*9*
		1.8	1.7	4.8	4.4	5.1	4.2	15.9	9.1
F72, C155 (posthole?)	65	*4*	*6*	*50*	*85*	*86*	*62*	*90*	*60*
		26.3	22.7	75.3	76.8	115.7	99.2	118.8	69.7
1017.5N, 1000E	1/42	*24*	*40*	*76*	*81*	*65*	*26*	*87*	*44*
		7.8	31.6	89.7	94.8	77.7	52.4	80.2	66.4
1017.5N,1100E	21	*5*	*12*	*66*	*85*	*67*	*64*	*106*	*42*
		12.3	7.0	77.8	90.4	81.9	81.5	118.5	43.4
997.5N, 1060E	127	*25*	*20*	*64*	*66*	*79*	*44*	*59*	*32*
		15.4	13.9	71.6	90.2	82.9	56.5	56.8	37.6
995N, 1070E	158	*19*	*15*	*52*	*73*	*64*	*55*	*70*	*60*
		12.1	13.4	58.3	64.8	74.0	62.0	71.0	76.3

Figure 28. (a) ***K*** at range of T for 6 samples under analysis. (b) Xlf at range of T for 6 samples under analysis.





Results

- Heating **above 200°C** (possibly **250°C)** enhances the magnetic susceptibility of these soils (both K and Xlf).
- One sample (Feature 435) was not affected until heating at 1000°C – suggesting the absence of magnetite/goethite.
- K/Xlf dips at 800°C and again at 1100°C – this may be related to mineral transformations.
- K/Xlf peaks at 500-600°C and at 1000°C.
- K/Xlf seen in these test samples is significantly lower than those measured on some of the Derrinsallagh 4 soils.

Comments

- Dearing (1999: 39) states that magnetite and goethite are the main magnetic components of soils (possibly accounting for 93% of the total magnetic susceptibility).
- Common high temperature mineral transformations (Dearing 1999: 49):
    - Magnetite > Haematite at ~300°C (**loss of susceptibility**)
    - Lepidocrocite > Maghemite at 250-350°C (**gain of susceptibility**)
    - Goethite > dehydrates to haematite at 300-400°C (little change in susceptibility)
    - Para-antiferro > reduction/oxidation to magnetite/maghemite on cooling from ~600°C (**gain in susceptibility**)
    - Oxidation of magnetite producing hematite at >600°C (**decrease in susceptibility**) (Morinaga *et al*. 1999: 381)

- From Ketterings *et al.* (2000: 1112):

T (°C)	*Xlf (sand-sized fraction)*
Unheated (forest)	*11.2*
100	*69.4*
300	*133.5*
600	*192.2*
>600	*2583.9*

- We can identify heating increments 0-250, 250-600, >600°C:

T (ºC)	*K*
Unheated	*0-20*
0-250	*20-200*
250-600	*200-2000*
600-1200	*2000-20000*

Colour Variations as a Result of Heating

Objective

To determine colour change with sample heating. This is a visual and readily available depiction of effect of heating.

Method

Samples were first disaggregated with a mortar and pestle prior to any heating. Samples were then heated for 2 hours at each T. Colour change was recorded using a Munsell chart.

Table 14. Colour change with sample heating.

Feature/Grid Reference	Sample #	Colour							
		Unheated	**200°C**	**400°C**	**500°C**	**600°C**	**800°C**	**1000°C**	**1100°C**
F435, C539 (pit/archaeological spread?)	404	greyish brown	grey	brown	light brown	light brown	reddish yellow	yellowish red	yellowish red
		10YR 5/2	10YR 5/1	10YR 5/3	7.5YR 6/4	7.5YR 6/4	5YR 5/8	5YR 5/8	5YR 5/8
F72, C155 (posthole?)	65	light yellowish brown	pale brown	dark yellowish brown	reddish yellow	light brown	yellowish red	yellowish red	yellowish red
		10YR 6/4	10YR 6/3	10YR 4/4	7.5YR 6/6	7.5YR 6/4	5YR 5/6	5YR 4/6	5YR 4/6
1017.5N, 1000E	1/42	light yellowish brown	very pale brown	brown	reddish yellow	strong brown	yellowish red	yellowish red	yellowish red
		10YR 6/4	10YR 7/3	10YR 4/3	7.5YR 6/6	7.5YR 5/6	5YR 5/6	5YR 5/8	5YR 4/6
1017.5N,1100E	21	very pale brown	very pale brown	brown	reddish yellow	strong brown	yellowish red	yellowish red	yellowish red
		10YR 7/4	10YR 7/3	10YR 4/3	7.5YR 6/6	7.5YR 5/6	5YR 5/6	5YR 5/8	5YR 4/6
997.5N, 1060E	127	light yellowish brown	very pale brown	brown	reddish yellow	strong brown	yellowish red	yellowish red	yellowish red
		10YR 6/4	10YR 7/3	10YR 4/3	7.5YR 6/6	7.5YR 5/6	5YR 5/6	5YR 5/8	5YR 4/6
995N, 1070E	158	yellowish brown	very pale brown	brown	light brown	strong brown	yellowish red	yellowish red	yellowish red
		10YR 5/4	10YR 7/3	10YR 4/3	7.5YR 6/4	7.5YR 5/6	5YR 5/6	5YR 5/6	5YR 4/6

Comments

- The main colour change seen in these soils is a gradual shift from brown/yellow brown to yellow red/red. This is directly related to the change in speciation of Fe within the soil sample as it is heated (see Table 7).
- In a recent study on Sumatran slash and burn soils, "pronounced reddening was only visible when topsoil had been exposed to temperatures exceeding 600ºC in portions of the primary

burn. This color change was due to the thermal conversion of goethite (yellow) to maghemite (reddish brown) and hematite (red)" (Ketterings and Bigham 2000).

- From Morinaga *et al.* (1999: 378): Colour change in soils, related to heating:
  Reddened appearance of soils – formation of **hematite (Fe_2O_3)** .
  Blackened appearance of soils – formation of **magnetite (Fe_3O_4)or maghemite(γ-Fe_2O_3)**.

- In the Derrinsallagh soils, hematite is forming on heating. In situ, there is evidence of distinct reddening and blackening of the soils in concentric circles radiating out from the furnaces. This must correspond to the formation of hematite and magnetite and maghemite due to heating.

Table 15. Soil colour related to minerals within.
(after http://soils.usda.gov/education/resources/k_12/lessons/color/ Accessed 300407).
N.B. This table does not refer to heated soils.

Mineral	Formula	Munsell Notation	Colour
goethite	FeOOH	10YR 8/6	yellow
goethite	FeOOH	7.5YR 5/6	strong brown
hematite	Fe_2O_3	5R 3/6	red
hematite	Fe_2O_3	10R 4/8	red
lepidocrocite	FeOOH	5YR 6/8	reddish-yellow
lepidocrocite	FeOOH	2.5YR 4/6	red
ferrihydrite	$Fe(OH)_3$	2.5YR 3/6	dark red
glauconite	$K(Si_xAl_{4-x})(Al,Fe,Mg)O_{10}(OH)_2$	5Y 5/1	dark grey
iron sulfide	FeS	10YR 2/1	black
pyrite	FeS_2	10YR 2/1	black (metallic)
jarosite	$K Fe_3 (OH)_6 (SO_4)_2$	5Y 6/4	pale yellow
todorokite	MnO_4	10YR 2/1	black
humus		10YR 2/1	black
calcite	$CaCO_3$	10YR 8/2	white
dolomite	$CaMg (CO_3)_2$	10YR 8/2	white
gypsum	$CaSO_{4x}$ $2H_2O$	10YR 8/3	very pale brown
quartz	SiO_2	10YR 6/1	light grey

Why do we not see such high K/Xlf values as we see in magnetic susceptibility analysis of features (e.g. some as high as 8000K)?

- Is MS2F instrument working properly? - YES – very good correlation between Xlf and K on 6 samples. Also, water and steel calibrations OK.
- Are higher values on feature soils due to influence of ore? - POSSIBLY. Heating bog ore gave very enhanced MS values.
- Alternatively, higher values seen in and around features must be due to compositional variations between these samples and the ones analysed in this heating experiment. – YES.

Does magnetic susceptibility value change as a result of reheating at the same temperature?

Objective

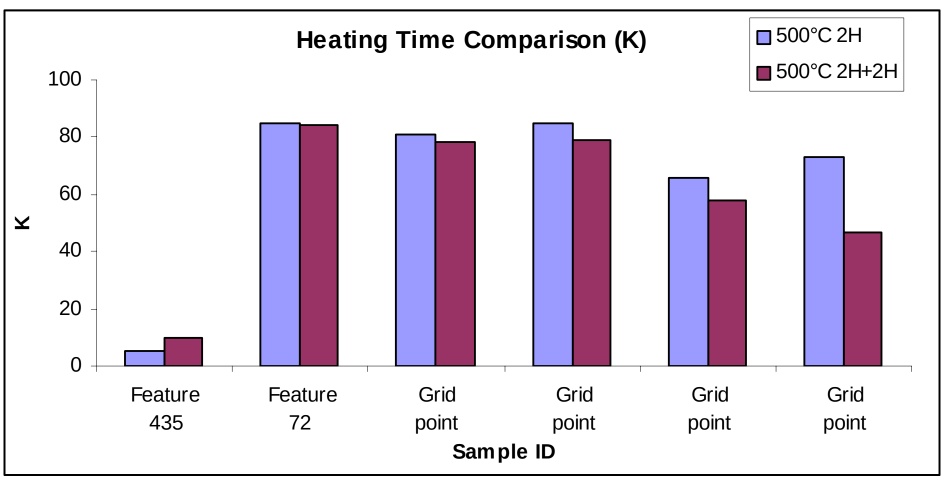
We next wanted to investigate whether re-heating affected the MS value, i.e. consecutive heatings in a bowl furnace of the linings etc. contribute to the MS value. We heated each of the 6 soils under analysis at 500ºC for 2h, then allowed to cool, measured MS; then heated for a further 2h, and measured the MS.

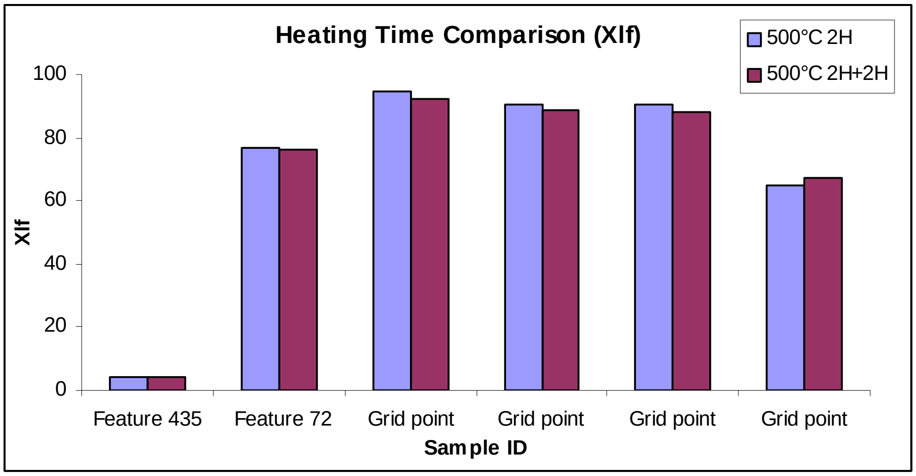
Results

Table 16. Magnetic susceptibility change at 500°C, with variable duration of heating.

Feature/Grid Reference	Sample #	K and Xlf	
		500°C 2H	**500°C 2H+2H**
F435, C539 (pit/archaeological spread?)	404	*5*	*10*
		4.4	4.4
F72, C155 (posthole?)	65	*85*	*84*
		76.8	76.3
1017.5N, 1000E	1/42	*81*	*78*
		94.8	92.3
1017.5N,1100E	21	*85*	*79*
		90.4	88.9
997.5N, 1060E	127	*66*	*58*
		90.2	88.1
995N, 1070E	158	*73*	*47*
		64.8	67.2

Figure 29. Magnetic susceptibility change at 500°C, with variable duration of heating: 2hr and 2hr+2hr. (a) K for 6 samples under analysis. (b) Xlf for 6 samples under analysis.





Comments

Repeated heating at 500°C does not appear to have any influence on magnetic susceptibility (either K or Xlf) for these 6 samples. MS reaches a plateau after a short time, and is not influenced by further heatings (see Ketterings *et al*. 2000: 1116).

4 Metallurgical Features Analysis

4.1 Aim and Objectives

Aim

a) To differentiate between metallurgical and non-metallurgical features.

b) To identify single furnaces and clusters of furnaces in an attempt to elucidate practices on site.

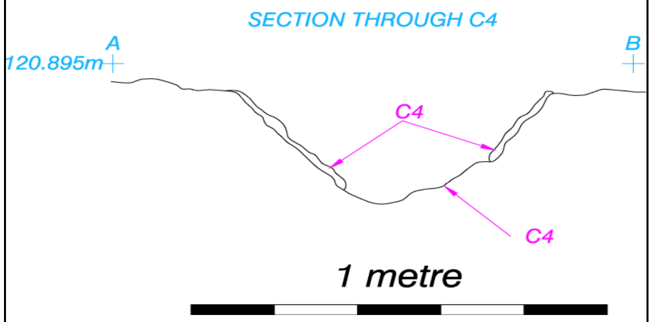
The objective is to characterise furnaces on the basis of stratigraphy (number of contexts), magnetic susceptibility data, slag quantities and soil chemistry.

4.2 Results

Table 17. List of furnace and non-furnace features, listed by feature number.

Furnaces	Furnaces	Non-furnaces	Non-furnaces
4	133	6	238
5	134	12	266
8	135	43	274
9	141	51	303
10	168	60	301
14	225	69	334
15	226	72	375
16	299	74	399
17	393	80	418
18	397	87	419
19	428	91	420
20	429	95	423
21	432	118	425
22	398	123	426
23	400	124	436
24	421	134	437
62	422	137	438
66	424	138	456
68	428	140	468
81	433	142	498
82	434	145	
86	435	146	
99	468	152	
119	492	165	
120	583	188	
121		196	
125		210	
126		232	
127			

F4

		
F4	mid ex from W	Mid ex fom N

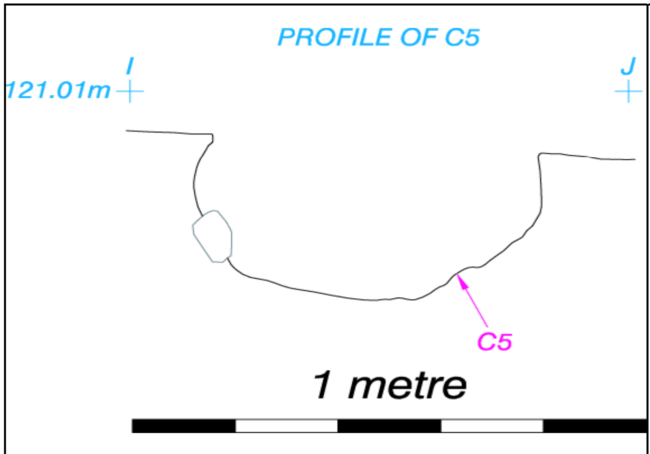
FEATURE	SAMPLE	CONTEXT	ACS DESCRIPTION	SOIL COLOUR	MUNSELL NOTATION	SLAG	CHARCOAL	METALLURGICAL CERAMIC	METALLURGICAL CERAMIC DESCRIPTION	SOIL DESCRIPTION	MS (K)	SLAG DESCRIPTION	LARGE SLAG WEIGHT (g)	COARSE SLAG WEIGHT (g)	TOTAL SLAG WEIGHT (g)	FINE MATERIAL <1MM SEPARATED FROM SLAG WEIGHT (g)
4	50	102	Soil and Slag from c102 a fill of c4, a bowl furnace. 3 bags.	brown	10YR 4/3						1030	1 x frgt of ceramic from floor, 1 x furnace bottom, slag, coarse frgts, fines	7120	2290	9410	487
4	51	101	Soil and Slag from c101 a fill of c4 a bowl furnace. 2 bags.	light brown	7.5YR 6/4	0	0	1.5	sintered/vitrified clay	sandy	821					
4	49	96	Soil and Slag from c96 a fill of c4, a bowl furnace. 2 bags.	strong brown	7.5YR 5/6	0	0	1		lumpy soil	703					
4	52	100	Soil and Slag from c100 a fill of c4, a bowl furnace. 2 bags.	strong brown	7.5YR 5/6	0	0	1.5	heated clay	sandy	387	sintered and burnt clay & stones & soil	4550		4550	410
4	3	14	Slag from c14 a bowl furnace. 0.080 kilograms.								104	large frgts heat affected & vitrified clay & soil	715		715	16
4	48	114	Soil and Slag from c114 a fill of c4, a bowl furnace. 2 bags.								2556	large & coarse frgts slag, clay & soil	750	1860	2610	450
4	53	104	Soil and Slag from c104 a fill of c4, a bowl furnace. 2.6 kilograms.								503	coarse frgts sintered clay, large frgts slag, soil	2200	1050	3250	205

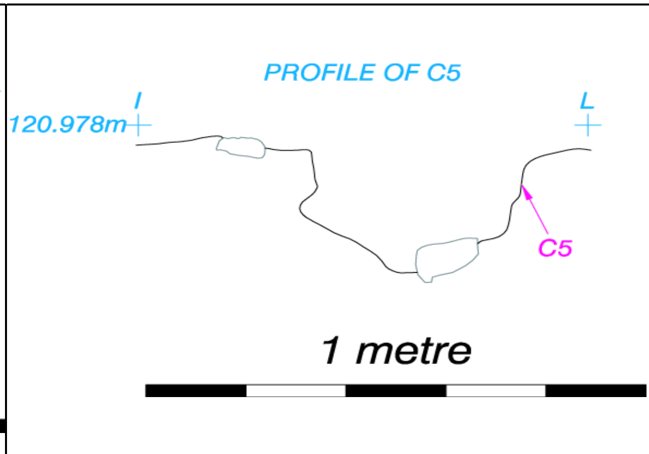
XRF Data

FEATURE	CONTEXT	SAMPLE	Pb	Sn	Sb	Sr	Rb	As	Zn	Cu	Ni	Fe	Mn	Cr	V	Ti	Ca	K
CONTROL	**CONTROL**	**CONTROL**	**25.63**	**0.00**	**0.00**	**19.02**	**48.77**	**0.00**	**47.80**	**0.00**	**0.00**	**12779.60**	**960.82**	**0.00**	**0.00**	**2212.76**	**2352.10**	**9958.88**
4	114	**48**	21.73	0.00	0.00	18.56	29.24	104.25	0.00	0.00	187.61	253493.75	19093.29	0.00	103.78	1481.54	11043.36	10776.59
4	96	**49**	14.18	0.00	0.00	15.12	49.61	0.00	38.75	0.00	0.00	13610.16	1190.51	0.00	0.00	1800.99	2220.22	7225.20
4	102	**50**	22.14	0.00	0.00	14.96	44.14	0.00	65.95	0.00	0.00	15997.36	1258.75	0.00	0.00	2112.65	2450.28	7915.85
4	101	**51**	21.64	0.00	0.00	17.54	47.16	0.00	74.82	0.00	0.00	15556.21	936.88	0.00	34.44	2443.55	2826.49	11004.55
4	100	**52**	59.99	0.00	0.00	15.46	48.36	0.00	31.68	0.00	0.00	12676.26	648.63	0.00	0.00	1701.38	1422.60	10133.91
4	104	**53**	36.35	0.00	0.00	15.37	51.67	0.00	61.01	0.00	0.00	16497.39	1021.61	0.00	0.00	2404.17	1896.07	13120.40

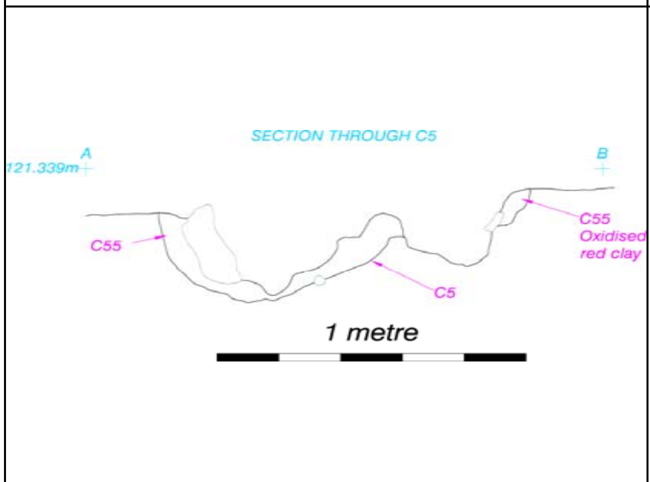
No of contexts: 7
Maximum MS (soil): 821K, associated with C101
Total amount of slag: 20535 g; max amount associated with C 102
Chemical composition: the Fe/Mn/As/Ca suite for C114/S48
the Cu/Zn suite – no samples

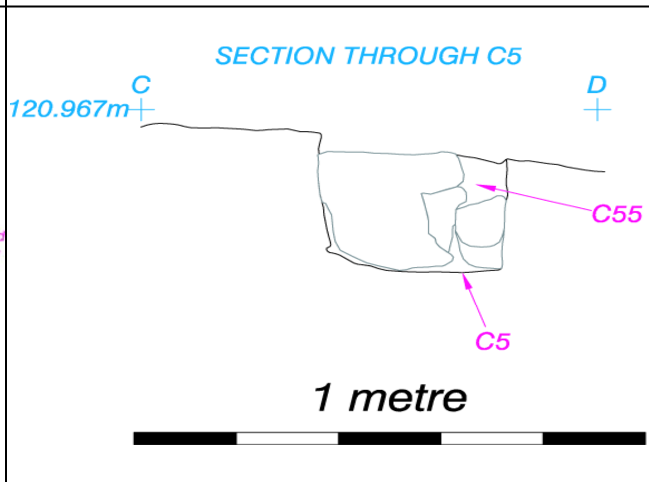
F5

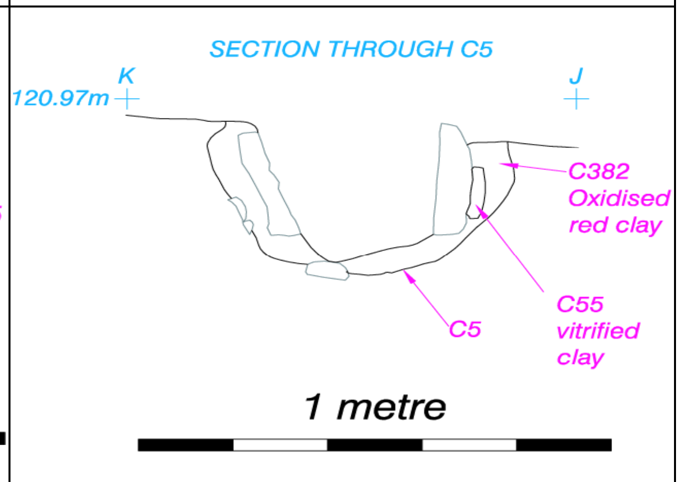

PROFILE OF C5
I
J
121.01m
C5
1 metre

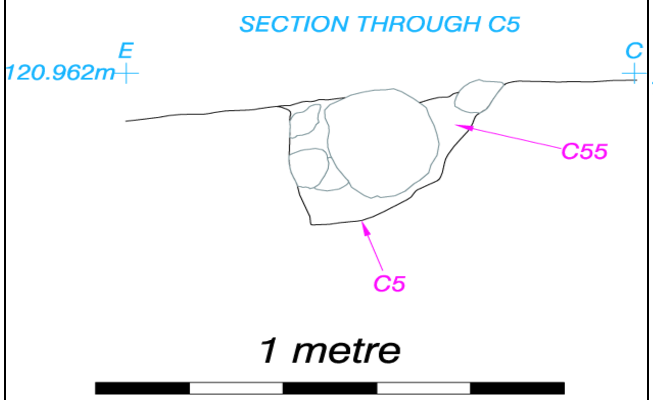
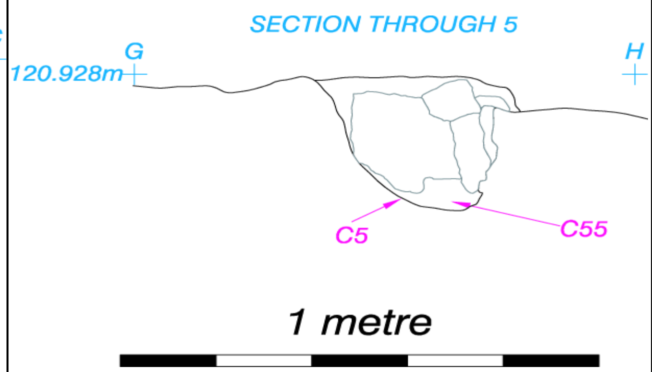
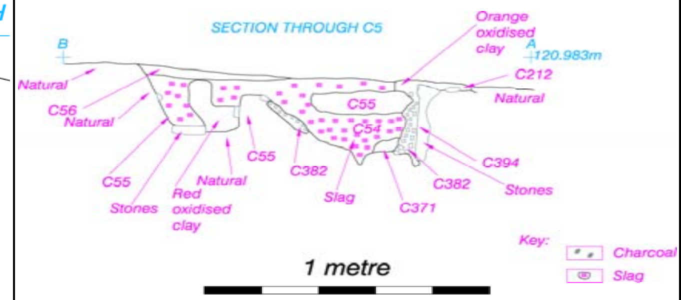

PROFILE OF C5
I
L
120.978m
C5
1 metre


PROFILE OF C5
A
B
121.00m
C5
1 metre


SECTION THROUGH C5
A
B
121.339m
C55
C55
Oxidised
red clay
C5
1 metre


SECTION THROUGH C5
C
D
120.967m
C55
C5
1 metre


SECTION THROUGH C5
K
J
120.97m
C382
Oxidised
red clay
C55
vitrified
clay
C5
1 metre

		
		
Mid ex from N	**Mid ex from E**	**Mid ex from N**

		
Mid ex from W	**Mid ex from SE**	**Mid ex from S**

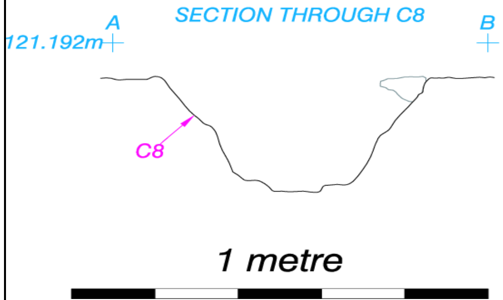
No of contexts: 6
Maximum MS (soil): 2444K, associated with C371
Total amount of slag: 20560g; max amount associated with C 54/S 226
Chemical composition: the Fe/Mn/As/Ca suite for C371/S270
the Cu/Zn suite – no samples

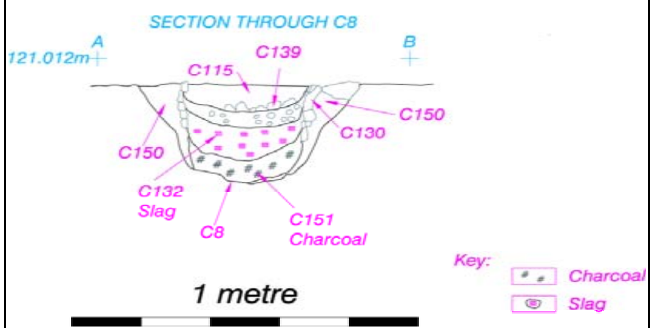
FEATURE	SAMPLE	CONTEXT	ACS DESCRIPTION	SOIL COLOUR	MUNSELL NOTATION	SLAG	CHARCOAL	METALLURGICAL CERAMIC	METALLURGICAL CERAMIC DESCRIPTION	SOIL DESCRIPTION	MS (K)	SLAG DESCRIPTION	LARGE SLAG WEIGHT (g)	COARSE SLAG WEIGHT (g)	TOTAL SLAG WEIGHT (g)	FINE MATERIAL <1MM SEPARATED FROM SLAG WEIGHT (g)
5	222	54	Charcoal from c54 a fill of c5, a bowl furnace.	black grey	10YR 3/1	0	4	0		lumpy soil	1591					
5	270	371	Soil from c371 a fill of c5, a bowl furnace.	brown	10YR 4/3	1	1	1		lumpy soil, stones	2444					
5	221	54	Soil from c54 a fill of c5, a bowl furnace.	dark brown	10YR 3/3	0	1.5	0		lumpy soil	1379					
5	12	56	Soil from c54 and c56, fills of c5, a bowl furnace. 4 bags.	greyish brown	10YR 5/2	0	1	0		lumpy soil	1189					
5	14	56	Slag from c56 a fill of c5, a bowl furnace. 0.054 kilograms.	greyish brown	10YR 5/2	2	2	1		lumpy soil	474	small frgts of round globular slag with some vitrified clay & soil	450		450	10
5	10	54 and 56	Charcoal from c54 and c56, fills of c5 a bowl furnace.	strong brown	7.5YR 5/6	1	1	1		lumpy soil	213					
5	275	381	Oxidised clay from c381 a fill of c5, a bowl furnace.	strong brown	7.5YR 5/6	1	1	1		lumpy soil	286					
5	383	55	Oxidised clay from c55 a fill of c5, a bowl furnace.	strong brown	7.5YR 5/6	0	0	3	light heat affected clay	lumpy soil	333					
5	11	56	Slag from c54 and c56, fills of c5, a bowl furnace. 1.00 kilograms.	pinkish grey	7.5YR 6/2						1035	2 x frgts vitirified clay & slag & soil	850		850	35
5	13	54	Slag from c54 a fill of c5, a bowl furnace. 0.05 kilograms.								-	clinkery slag & frgts of furnace ining (4-5)	360	1050	1410	70
5	220	-	Sample cancelled								-					
5	219	371	Charcoal from c371 a fill of c5, a bowl furnace.								14					
5	226	54	Slag from c54 a fill of c5, a bowl furnace. 15.1 kilograms.								1479	slag & soil	15800		15800	490
5	276	382	Vitrified clay from c382 a fill of c5, a bowl furnace.								578	furnace lining/ceramic, many frgts (rather than slag - if there is slag it is VFA or some frothy material embedded within context of vitrified walls)	2050		2050	

XRF Data

FEATURE	CONTEXT	SAMPLE	Pb	Sn	Sb	Sr	Rb	As	Zn	Cu	Ni	Fe	Mn	Cr	V	Ti	Ca	K
CONTROL	**CONTROL**	**CONTROL**	**25.63**	**0.00**	**0.00**	**19.02**	**48.77**	**0.00**	**47.80**	**0.00**	**0.00**	**12779.60**	**960.82**	**0.00**	**0.00**	**2212.76**	**2352.10**	**9958.88**
5	56	**12**	0.00	0.00	0.00	25.64	51.15	19.58	47.89	0.00	0.00	24942.67	2386.08	0.00	0.00	2026.18	4502.68	9001.57
5	56	**14**	24.38	0.00	0.00	22.97	50.26	34.37	45.25	0.00	0.00	60770.26	4277.09	0.00	0.00	1929.25	3574.02	7848.45
5	54	**221**	22.55	0.00	0.00	17.07	44.71	13.86	61.49	0.00	0.00	31628.49	2871.25	0.00	0.00	2368.69	7594.53	10292.25
5	54	**222**	0.00	0.00	0.00	26.54	50.86	20.67	47.32	0.00	0.00	33121.10	2435.17	0.00	57.25	1669.66	11793.71	9076.56
5	371	**270**	0.00	0.00	0.00	12.05	23.69	101.52	0.00	0.00	313.97	231124.98	30495.40	0.00	109.15	1466.21	8576.27	8212.28
5	381	**275**	19.48	0.00	0.00	18.50	41.88	0.00	47.72	0.00	0.00	17128.89	634.20	0.00	33.59	2583.33	2454.98	10912.75
5	382	**276**	27.04	0.00	0.00	18.69	48.38	17.08	46.56	0.00	0.00	34760.74	3095.00	0.00	45.48	1913.29	2989.35	8093.96
5	55	**383**	22.90	0.00	0.00	20.96	65.74	0.00	43.11	0.00	0.00	13337.58	584.86	0.00	37.37	2377.47	1769.70	15085.50

F8





Mid ex from S

S facing section

Post ex

Post ex from E F8, 9, 10

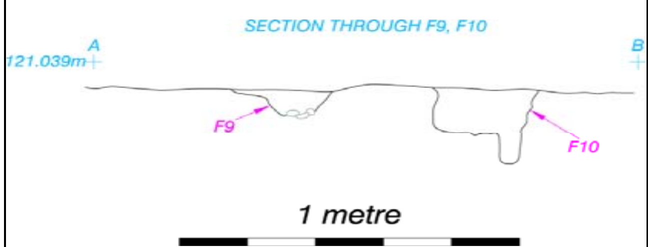
FEATURE	SAMPLE	CONTEXT	ACS DESCRIPTION	SOIL COLOUR	MUNSELL NOTATION	SLAG	CHARCOAL	METALLURGICAL CERAMIC	METALLURGICAL CERAMIC DESCRIPTION	SOIL DESCRIPTION	MS (K)	SLAG DESCRIPTION	LARGE SLAG WEIGHT (g)	COARSE SLAG WEIGHT (g)	TOTAL SLAG WEIGHT (g)	FINE MATERIAL <1MM SEPARATED FROM SLAG WEIGHT (g)
8	1	151	Slag from c8 a bowl furnace. 0.020 kilograms.								-	round lumps of amorphous slag	163.5		163.5	
8	16	115	Soil from c115 a fill of c8, a bowl furnace. 3 bags.	strong brown	7.5YR 5/6	1	1	1		lumpy soil	1176					
8	17	115	Charcoal from c115 a fill of c8, a bowl furnace.								23					
8	37	139	Slag from c139 a fill of c8, a bowl furnace. 2 bags.	light yellowish brown	10YR 6/2						-	clinkery slag, sintered clay & grey orange soil	1250		1250	90
8	38	130	Vitrified clay from c130 a fill of c8, a bowl furnace. 3 bags.	strong brown	7.5YR 5/6	0	0	0		lumpy soil	458					
8	39	131	Vitrified clay from c131, a fill of c8, a bowl furnace. 3 bags.	strong brown	7.5YR 5/6	1	0	2.5	lumps of heat affected/vitrified clay - part of a furnace wall	coarse lumpy soil	576	sintered clay & some slag	2300	290	2590	140
8	40	132	Soil from c132 a fill of c8, a bowl furnace. 2 bags.	brown		1	1	1		lumpy soil	1838					
8	41	132	Slag from c132 a fill of c8, a bowl furnace. 3 bags.	dark brown	10YR 3/3						-	1 x large furnace bottom frgt 20cm long axis, frgts of slag (coarse & clinkery, small <5cm), with clay (oxidised/sintered) adhering to its surface & fines	7600	1150	8750	440
8	58	150	missing								-					

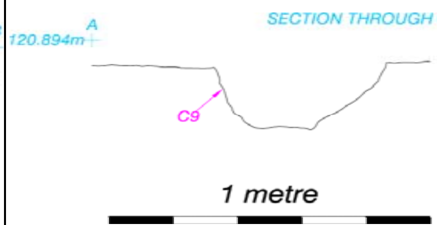
XRF Data

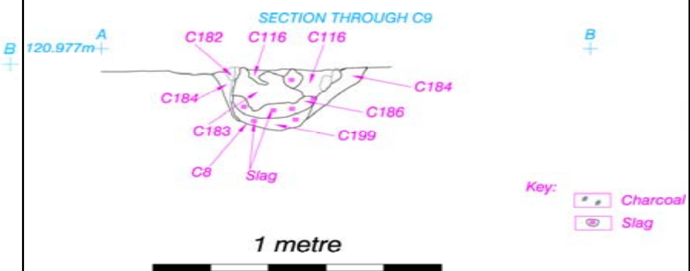
FEATURE	CONTEXT	SAMPLE	Pb	Sn	Sb	Sr	Rb	As	Zn	Cu	Ni	Fe	Mn	Cr	V	Ti	Ca	K
CONTROL	**CONTROL**	**CONTROL**	**25.63**	**0.00**	**0.00**	**19.02**	**48.77**	**0.00**	**47.80**	**0.00**	**0.00**	**12779.60**	**960.82**	**0.00**	**0.00**	**2212.76**	**2352.10**	**9958.88**
8	115	**16**	19.97	0.00	0.00	13.58	38.49	0.00	32.85	0.00	0.00	14382.83	1326.28	0.00	0.00	1770.94	1928.65	6549.82
8	130	**38**	44.30	0.00	0.00	21.60	46.85	0.00	26.07	0.00	0.00	11958.13	454.86	0.00	0.00	2216.92	1902.77	9966.12
8	131	**39**	25.22	0.00	0.00	21.88	58.97	14.49	104.15	0.00	0.00	18532.37	867.71	0.00	0.00	2510.76	2048.19	12534.16
8	132	**40**	33.63	0.00	0.00	20.87	48.09	31.87	42.21	48.52	0.00	59364.11	9066.08	0.00	69.20	1986.62	5621.84	9906.45

No of contexts: 7
Maximum MS (soil): 1838K, associated with C132 and C115
Total amount of slag: 12850 g; max amount associated with C 132
Comments: presence of wall lining is evidence for heating of the furnace walls; also evidence for small white stone on the rim of the furnace associated with tuyere (?)
Chemical composition: the Cu/Zn suite for C132/S40

F9







Post ex from E F8, 9, 10

Mid ex from SW

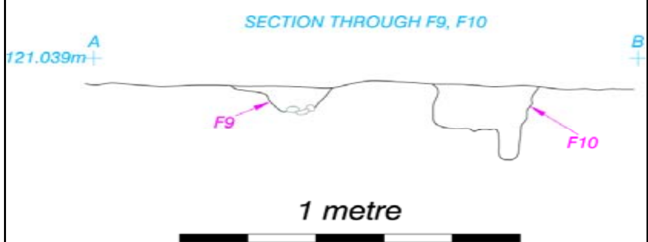
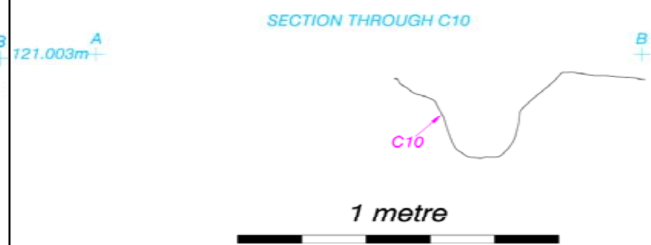
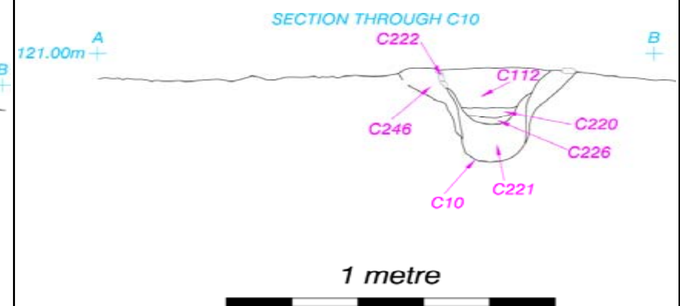
FEATURE	SAMPLE	CONTEXT	ACS DESCRIPTION	SOIL COLOUR	MUNSELL NOTATION	SLAG	CHARCOAL	METALLURGICAL CERAMIC	METALLURGICAL CERAMIC DESCRIPTION	SOIL DESCRIPTION	MS (K)	SLAG DESCRIPTION	LARGE SLAG WEIGHT (g)	COARSE SLAG WEIGHT (g)	TOTAL SLAG WEIGHT (g)	FINE MATERIAL <1MM SEPARATED FROM SLAG WEIGHT (g)
9	18	116	Soil from c116 a fill of c9, a bowl furnace. 2 bags.	strong brown	7.5YR 5/6	0	0	0		fine soil	394					
9	19	116	Charcoal from c116 a fill of c9, a bowl furnace.								57					
9	85	186	Soil from c186 a fill of c9, a bowl furnace.	dark brown	10YR 3/3	0	0	0		lumpy soil	670					
9	86	183	slag from c183 a fill of c9, a bowl furnace. 2 bags								-	pieces of slag & vitrified clay	180	820	1000	
9	87	183	Clay from c183 a fill of c9, a bowl furnace.	strong brown	7.5YR 5/6	0	0	3.5	lge quantities heat affected clay	lumpy soil	743					
9	99	186	Slag from c186 a fill of c9, a bowl furnace.								-	clinkery slag	3050		3050	170
9	100	184	Soil from c184 a fill of c9, a bowl furnace. 2 bags.	light brown	7.5YR 6/3	0	0	2	sintered clay	lumpy soil, few stones	147					
9	101	199	Charcoal from c199 a fill of c9, a bowl furnace.							fine soil	810					
9	102		sample cancelled								-					
9	103	182	Soil from c182 a fill of c9, a bowl furnace.	strong brown	7.5YR 5/6	0	0	2	sintered clay	lumpy soil	278					
9	104	214	Soil from c214 a fill of c9, a bowl furnace.	light brownish grey	10YR 6/2	0	0	1	sintered clay	lumpy soil, few stones	43					

XRF data

FEATURE	CONTEXT	SAMPLE	Pb	Sn	Sb	Sr	Rb	As	Zn	Cu	Ni	Fe	Mn	Cr	V	Ti	Ca	K
CONTROL	**CONTROL**	**CONTROL**	**25.63**	**0.00**	**0.00**	**19.02**	**48.77**	**0.00**	**47.80**	**0.00**	**0.00**	**12779.60**	**960.82**	**0.00**	**0.00**	**2212.76**	**2352.10**	**9958.88**
9	116	**18**	25.93	0.00	0.00	21.29	53.35	0.00	43.29	0.00	0.00	17605.10	1562.62	0.00	47.28	2007.56	3201.04	9358.29
9	186	**85**	19.71	0.00	0.00	24.01	50.47	78.97	0.00	0.00	171.63	157765.56	19583.28	0.00	107.67	2010.14	13769.50	9803.42
9	183	**87**	30.80	0.00	0.00	17.58	54.69	0.00	75.95	0.00	0.00	17215.32	820.40	0.00	0.00	2425.31	1899.47	11075.55
9	184	**100**	19.10	0.00	0.00	18.51	54.41	0.00	0.00	0.00	0.00	10401.87	434.20	0.00	0.00	1610.25	1201.28	8112.46
9	182	**103**	25.13	0.00	0.00	15.14	50.79	0.00	48.66	0.00	0.00	15363.69	805.48	0.00	32.43	1880.56	1387.17	9236.89
9	214	**104**	17.76	0.00	0.00	14.08	115.23	0.00	29.22	0.00	0.00	21048.13	706.88	0.00	0.00	2683.02	2483.95	18426.55

No of contexts: 7
Maximum MS (soil): 800K, associated with C199
Total amount of slag: 4050g; max amount associated with C 183/C186
Comments: heavy quantity of lining but in actual fact it may be the partially reacted ore
Chemical composition: the Fe/Mn/As/Ca suite for C186/S85
the Cu/Zn suite – no contexts

F10

		
		
Mid ex from E F8, 9, 10	**Mid ex showing C221 from SE**	**Mid ex from E**

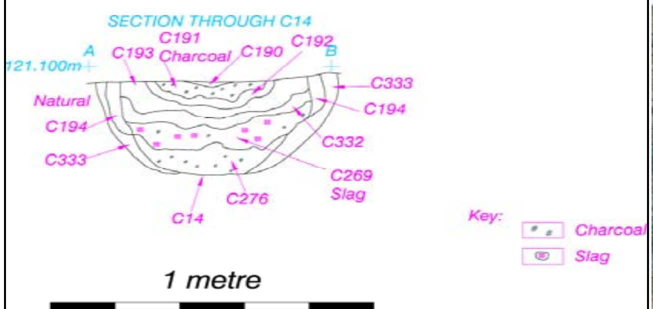
FEATURE	SAMPLE	CONTEXT	ACS DESCRIPTION	SOIL COLOUR	MUNSELL NOTATION	SLAG	CHARCOAL	METALLURGICAL CERAMIC	METALLURGICAL CERAMIC DESCRIPTION	SOIL DESCRIPTION	MS (K)	SLAG DESCRIPTION	LARGE SLAG WEIGHT (g)	COARSE SLAG WEIGHT (g)	TOTAL SLAG WEIGHT (g)	FINE MATERIAL <1MM SEPARATED FROM SLAG WEIGHT (g)
10	26	117	Soil from c117, a fill of c10, a bowl furnace. 3 bags.	light brownish grey	10YR 6/2	0.5	0	0		fine lumpy soil	285					
10	29	117	Charcoal from c117 a fill of c10, a bowl furnace.								133					
10	31	117	Slag from c117 a fill of c10, a bowl furnace. 2 bags.								639	coarse frgt & larger pieces of slag & fines	600	80	680	9
10	136	220	Soil from c220 a fill of c10, a bowl furnace.	strong brown	7.5YR 5/6	0	0	2	sintered clay	lumpy soil	579					
10	137	223	Slag from c223 a fill of c10, a bowl furnace.								510	fine material				20
10	143	221	Slag from c221 a fill of c10, a bowl furnace.								295	2x slag frgts, 1 x sintered clay, charcoal	450		450	12
10	144	222	Soil from c222 a fill of c10, a bowl furnace.	greyish brown	10YR 5/2	0	0	1	burnt, partly sintered clay	lumpy soil	400					
10	145	221	Charcoal from c221 a fill of c10, a bowl furnace.								62					
10	146	221	Soil from c221 a fill of c10, a bowl furnace.	dark brown	10YR 3/3	0	2	0		lumpy soil	150					
10	147	246	Clay from c246 a fill of c10, a bowl furnace.	strong brown	7.5YR 5/6	0	0	1.5	burnt clay	lumpy soil, few stones	320					

XRF data

FEATURE	CONTEXT	SAMPLE	Pb	Sn	Sb	Sr	Rb	As	Zn	Cu	Ni	Fe	Mn	Cr	V	Ti	Ca	K
CONTROL	**CONTROL**	**CONTROL**	**25.63**	**0.00**	**0.00**	**19.02**	**48.77**	**0.00**	**47.80**	**0.00**	**0.00**	**12779.60**	**960.82**	**0.00**	**0.00**	**2212.76**	**2352.10**	**9958.88**
10	117	**26**	21.02	0.00	0.00	19.34	50.50	12.75	52.02	0.00	0.00	15715.74	1965.55	0.00	0.00	1716.01	3721.33	7430.91
10	220	**136**	21.26	0.00	0.00	19.91	46.45	0.00	115.86	0.00	0.00	20854.04	1591.16	0.00	0.00	1821.43	3116.48	8533.71
10	222	**144**	21.36	0.00	0.00	18.16	57.18	18.14	54.84	0.00	0.00	17551.35	1060.80	0.00	0.00	2703.21	3357.71	12841.89
10	221	**146**	14.45	0.00	0.00	24.97	42.82	20.45	68.18	0.00	0.00	34144.73	4070.91	0.00	62.93	1571.20	17590.15	9685.30
10	246	**147**	18.01	0.00	0.00	23.48	49.92	0.00	28.45	0.00	0.00	12753.42	549.64	0.00	0.00	2303.55	1789.81	12178.06

No of contexts: 6
Maximum MS (soil): 579K, associated with C220/S136
Total amount of slag: 1130g; max amount associated with C 117/C221
Comments: small well for slag collection
Chemical composition: the Fe/Mn/As/Ca suite for C221/S146
the Cu/Zn suite – no contexts

F14

		
	Post ex from N	**Post ex from W, F14, 15, 16**

FEATURE	SAMPLE	CONTEXT	ACS DESCRIPTION	SOIL COLOUR	MUNSELL NOTATION	SLAG	CHARCOAL	METALLURGICAL CERAMIC	METALLURGICAL CERAMIC DESCRIPTION	SOIL DESCRIPTION	MS (K)	SLAG DESCRIPTION	LARGE SLAG WEIGHT (g)	COARSE SLAG WEIGHT (g)	TOTAL SLAG WEIGHT (g)	FINE MATERIAL <1MM SEPARATED FROM SLAG WEIGHT (g)
14	81	190	Soil from c190 a fill of c14 a bowl furnace.	strong brown	7.5YR 5/6	0	2.5	1.5		fine soil	418					
14	82	192	Vitrified clay from c192 a fill of c14, a bowl furnace.	strong brown	7.5YR 5/6	0	1.5	3	heated clay	lumpy soil	72	coarse frgts heated clay & charcoal & soil		79	79	2
14	83	19	Charcoal and soil from c191 a fill of c14, a bowl furnace.	black	7.5YR 2.5/1	1	1	1		lumpy soil	596					
14	84	191	Slag from c191 a fill of c14, a bowl furnace.								142	clinkery slag & fines	114		114	3
14	131	192	Vitrified and oxidized clay from c192 a fill of c14, a bowl furnace.	strong brown	7.5YR 5/6	0	0	3	heated clay	lumpy soil	430	coarse frgts heated clay & soil	209		209	15
14	132	191	Slag from c191 a fill of c14, a bowl furnace.								-	small frgts clinkery slag		43	43	
14	133	191	Soil and charcoal from c191 a fill of c14, a bowl furnace. 2 bags.	very dark brown	10YR 2/2	0	3	1		lumpy soil	527					
14	148	193	Soil from c193 a fill of c14, a bowl furnace. 4 bags.	dark brown	10YR 3/3	1.5	2.5	1.5		lumpy soil	497					
14	149	192	Vitrified clay from c192 a fill of c14, a bowl furnace. 2 bags.	brown	10YR 4/3	2	2	2.5	sintered clay	coarse lumpy soil	549					
14	152	192	slag								102	large frgts light & frothy slag, fines	1750		1750	25
14	163	193	Soil from c193 a fill of c14, a bowl furnace. 2 Bags.	greyish brown	10YR 5/2	2	2	1		lumpy soil	896					
14	164	194	Vitrified clay from c194 a fill of c14, a bowl furnace.	brown	10YR 5/3	0.5	1	2	some sintered, very few vitrified frgts	lumpy soil	1052					
14	165	194	Slag from c194 a fill of c14, a bowl furnace.								555	slag, small frgts, fines	925		925	50
14	166	269	Slag from c269 a fill of c14, a bowl furnace. 3 bags. 8 kilograms.								812	large & coarse frgts slag , some clinkery & fines	6600	2160	8760	342
14	178	276	Soil and charcoal from c276 a fill of c14, a bowl furnace. 4 bags.	dark brown	10YR 3/3	0.5	1.5	0		fine lumpy soil	574					
14	179	269	Slag from c276 a fill of c14, a bowl furnace.								412	clinkery slag & fines	510		510	7
14	180	269	Soil from c269 a fill of c14, a bowl furnace. 2 bags.	brown		0	0	0		lumpy soil	1344					
14	181	270	Charcoal from c270 a fill of c14 a bowl furnace.		7.5YR 5/4						30					
14	183	194	Vitrified clay from c194 a fill of c14, a bowl furnace.	light brown	7.5YR 6/3	0	0	2.5	large frgts partly sintered clay		1093					
14	184	194	Slag from c194 a fill of c14, a bowl furnace.								160	large & coarse frgts slag	1360	350	1710	10

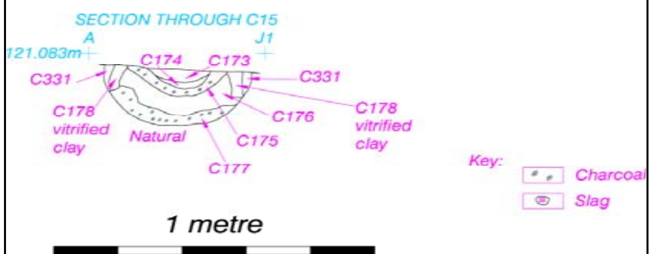
XRF data

FEATURE	CONTEXT	SAMPLE	Pb	Sn	Sb	Sr	Rb	As	Zn	Cu	Ni	Fe	Mn	Cr	V	Ti	Ca	K
CONTROL	**CONTROL**	**CONTROL**	**25.63**	**0.00**	**0.00**	**19.02**	**48.77**	**0.00**	**47.80**	**0.00**	**0.00**	**12779.60**	**960.82**	**0.00**	**0.00**	**2212.76**	**2352.10**	**9958.88**
14	190	**81**	11.43	0.00	0.00	12.53	38.29	9.85	43.96	0.00	0.00	10266.83	613.14	0.00	30.15	1848.07	3656.36	7228.38
14	19	**83**	0.00	0.00	0.00	21.95	38.52	10.27	59.06	0.00	0.00	13998.63	1182.76	0.00	0.00	2133.90	9837.99	7644.91
14	192	**131**	27.10	0.00	0.00	20.97	37.63	0.00	95.80	0.00	0.00	24989.62	1339.28	0.00	0.00	2272.45	3947.90	9675.87
14	191	**133**	0.00	0.00	0.00	23.37	39.28	15.13	52.04	0.00	0.00	12052.23	712.94	0.00	34.35	1738.26	15856.90	6792.66

14	193	**148**	19.24	0.00	0.00	17.42	45.38	14.95	72.97	0.00	0.00	15656.42	1088.33	0.00	0.00	2034.43	2984.19	7944.45
14	192	**149**	27.96	0.00	0.00	18.42	62.75	13.96	191.67	0.00	0.00	21483.28	1420.55	0.00	54.75	2517.72	3957.89	11715.70
14	193	**163**	26.37	0.00	0.00	20.41	51.05	0.00	93.73	0.00	0.00	17567.34	1438.76	0.00	0.00	2028.73	3215.55	8253.95
14	194	**164**	24.34	0.00	0.00	18.50	44.38	0.00	74.60	0.00	0.00	16187.66	1206.15	0.00	32.23	2091.12	2704.34	7929.46
14	276	**178**	26.51	0.00	0.00	37.05	48.83	68.36	0.00	0.00	131.43	130483.89	15179.26	0.00	81.13	1672.28	17649.05	8955.97
14	269	**180**	23.89	0.00	0.00	23.29	52.00	19.51	66.05	0.00	0.00	26566.95	2733.69	0.00	52.01	2171.36	4243.21	10392.32
14	194	**183**	35.28	0.00	0.00	22.46	55.85	0.00	70.41	0.00	0.00	18183.24	757.46	0.00	56.14	2745.83	2355.83	13074.09

No of contexts: 8
Maximum MS (soil): 1344K, associated with C269 and C192 (equivalent to that of heated soils)
Total amount of slag: 14454g; max amount associated with C269, C192, C194 (contexts with highest amounts of slag)
Chemical composition: the Fe/Mn/As/Ca suite for C276/S178
the Cu/Zn suite – no contexts, although C192/S149 has enhanced Zn

F15

		
		
Mid ex from N	**Post ex from W**	**Post ex from E F14,15,16**

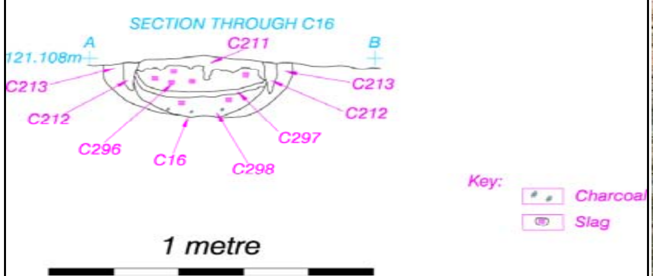
FEATURE	SAMPLE	CONTEXT	ACS DESCRIPTION	SOIL COLOUR	MUNSELL NOTATION	SLAG	CHARCOAL	METALLURGICAL CERAMIC	METALLURGICAL CERAMIC DESCRIPTION	SOIL DESCRIPTION	MS (K)	SLAG DESCRIPTION	LARGE SLAG WEIGHT (g)	COARSE SLAG WEIGHT (g)	TOTAL SLAG WEIGHT (g)	FINE MATERIAL <1MM SEPARATED FROM SLAG WEIGHT (g)
15	67	173	Soil from c173 a fill of c15, a bowl furnace.	strong brown	7.5YR 5/6	0	1	1.5	heated/vitrified clay	lumpy soil	3231					
15	68	175	Slag from c175 a fill of c15, a bowl furnace.								-	clinkery slag & fines	380		380	12
15	70	176	Vitrified clay from c176 a fill of c15, a bowl furnace.	strong brown	7.5YR 5/6	0	0	3	vitrified clay	lumpy soil	921	small frgts vitirified clay	50		50	1
15	74	175	Soil and Charcoal from c175 a fill of c15, a bowl furnace.	very dark greyish blac	10YR 3/2	0	3	0		lumpy soil	482					
15	75	176	Soil from c176 a fill of c15, a bowl furnace.	strong brown	7.5YR 5/6	0	1	1			631					
15	108	173	Slag from c173 a fill of c15, a bowl furnace.								-	small frgts slag	22		22	
15	109	173	Soil from c173 a fill of c15, a bowl furnace.	strong brown	7.5YR 5/6	0	1	1.5	heated/vitrified clay	lumpy soil	532					
15	110	173	Vitrified clay from c173 a fill of c15, a bowl furnace.	strong brown	7.5YR 5/6	0	0	3	vitrified clay	lumpy soil	212	coarse frgts vitrified/heat affected clay & fines	69	34	103	3
15	111	174	Soil from c174 a fill of c15, a bowl furnace.	dark brown	10YR 3/3	1	0	0		sandy soil	915					
15	112	174	Slag from c174 a fill of c15, a bowl furnace.								-	small frgts slag	22		22	
15	113	175	Slag from c175 a fill of c15, a bowl furnace.								-	2 x frgt slag	18		18	
15	114	175	Soil and Charcoal from c175, a fill of c15, a bowl furnace.	black grey	10YR 3/1	0	2.5	1		lumpy soil	713					
15	115	176	Slag from c176 a fill of c15, a bowl furnace.								-	clinkery slag & fines	420		420	7
15	116	176	Soil from c176 a fill of c15, a bowl furnace.	black grey	10YR 3/1	0	2.5	1		lumpy soil	724					
15	117	177	Soil and Charcoal from c177 a fill of c15, a bowl furnace.	black grey	10YR 3/1	0	2.5	1		lumpy soil, clay and stones	528					

XRF data

FEATURE	CONTEXT	SAMPLE	Pb	Sn	Sb	Sr	Rb	As	Zn	Cu	Ni	Fe	Mn	Cr	V	Ti	Ca	K
CONTROL	**CONTROL**	**CONTROL**	**25.63**	**0.00**	**0.00**	**19.02**	**48.77**	**0.00**	**47.80**	**0.00**	**0.00**	**12779.60**	**960.82**	**0.00**	**0.00**	**2212.76**	**2352.10**	**9958.88**
15	173	**67**	25.40	0.00	0.00	17.02	39.47	0.00	48.48	0.00	0.00	29580.73	2621.52	0.00	0.00	2022.95	5063.20	8758.25
15	175	**74**	0.00	0.00	0.00	31.38	32.29	32.51	0.00	0.00	0.00	58699.64	6119.58	0.00	0.00	1594.79	22262.43	5995.35
15	176	**75**	27.87	0.00	0.00	23.64	43.25	20.63	0.00	0.00	0.00	48210.59	4713.17	0.00	89.22	1965.52	13108.04	9862.52
15	173	**108**	13.95	0.00	0.00	18.82	44.78	0.00	22.15	0.00	0.00	10072.20	548.78	0.00	28.56	1784.45	1520.20	7668.09
15	173	**109**	23.71	0.00	0.00	18.37	42.51	12.93	31.67	37.66	0.00	21966.81	2200.91	0.00	41.30	1888.30	4330.23	7311.49
15	175	**114**	46.67	0.00	0.00	26.46	35.14	21.80	0.00	36.63	0.00	46832.28	5348.33	0.00	54.34	1646.75	21249.72	8119.63
15	177	**117**	24.07	0.00	0.00	19.20	41.01	0.00	26.84	36.17	0.00	20660.88	2350.06	0.00	60.72	1976.41	13781.81	9049.31
15	173	**110**	30.05	0.00	0.00	34.43	54.16	25.04	50.35	0.00	123.95	84930.41	7339.32	0.00	0.00	1916.88	4773.11	9298.86
15	174	**111**	0.00	0.00	0.00	18.01	36.88	48.66	0.00	0.00	0.00	91067.52	9644.58	0.00	87.89	1722.36	12590.77	9274.42
15	176	**116**	12.39	0.00	0.00	15.45	27.09	32.94	0.00	0.00	52.32	65933.46	5654.53	0.00	31.23	2187.58	8827.27	8086.83

No of contexts: 5
Maximum MS (soil): 3231K, associated with C 173/S 67
Total amount of slag: 1015g; max amount associated with C176/ S115
Chemical composition: the Fe/Mn/As/Ca suite – no contexts
the Cu/Zn suite – C173/S109, C177/S117. NB. C175/S114 has Cu, but no Zn

F16



Post ex from E

Post ex from E F14, 15, 16

Mid ex from E

Mid ex from E

Mid ex from E

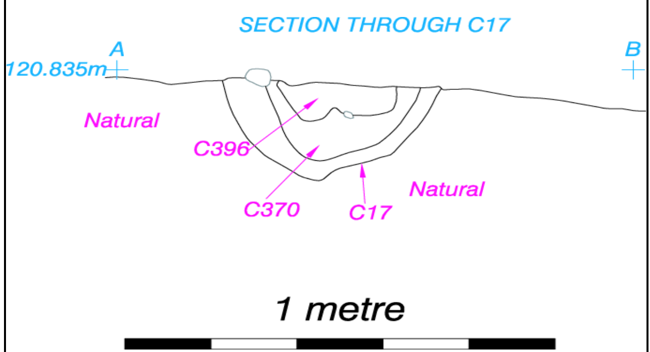
FEATURE	SAMPLE	CONTEXT	ACS DESCRIPTION	SOIL COLOUR	MUNSELL NOTATION	SLAG	CHARCOAL	METALLURGICAL CERAMIC	METALLURGICAL CERAMIC DESCRIPTION	SOIL DESCRIPTION	MS (K)	SLAG DESCRIPTION	LARGE SLAG WEIGHT (g)	COARSE SLAG WEIGHT (g)	TOTAL SLAG WEIGHT (g)	FINE MATERIAL <1MM SEPARATED FROM SLAG WEIGHT (g)
16	96	211	Soil from c211 a fill of c16, a bowl furnace.	brown	7.5YR 5/4	0	0	0		lumpy soil	864					
16	97	212	Vitrified clay from c212 a fill of c16, a bowl furnace.	strong brown	7.5YR 5/6	0	0	3		lumpy soil	641	coarse frgts, vitrified clay & soil		94	94	8
16	98	211	Slag from c211 a fill of c16, a bowl furnace.								-	clinkery slag	112		112	
16	205	296	Slag from c296 a fill of c16, a bowl furnace. 2 bags. 9 kilograms.								431	clinkery slag & fines	5375		5375	75
16	207	297	Soil from c297 a fill of c16, a bowl furnace.	brown	7.5YR 5/4	0	0	0		fine lumpy soil	1244					
16	208	297	Soil from c298 a fill of c16, a bowl furnace.	strong brown	7.5YR 5/6	1	0	0		lumpy soil	444					
16	209	298	Slag from c298 a fill of c16, a bowl furnace.								800	clinkery slag & fines	1610		1610	100
16	210	211	Soil from c211 a fill of c16, a bowl furnace.	strong brown	7.5YR 5/6	0	0	1		fine lumpy soil	698					
16	211	211	Oxidised clay from c211 a fill of c16, a bowl furnace.	strong brown	7.5YR 5/6	1	0	1	sintered clay	lumpy soil	412					
16	223	298	Soil from c298 a fill of c16, a bowl furnace.	strong brown	7.5YR 5/6	1	1	2	heated clay	lumpy soil	2002					
16	224	298	Soil from c298 a fill of c16, a bowl furnace.	very dark brown	10YR 2/2	0	0	0		lumpy soil	1146					
16	225	298	Charcoal from c298 a fill of c16, a bowl furnace.								37					
16	250	212	Vitrified clay from c212 a fill of c16, a bowl furnace.	brown	7.5YR 5/4	0	0	0.5		lumpy soil, many stones	704					

XRF data

FEATURE	CONTEXT	SAMPLE	Pb	Sn	Sb	Sr	Rb	As	Zn	Cu	Ni	Fe	Mn	Cr	V	Ti	Ca	K
CONTROL	**CONTROL**	**CONTROL**	**25.63**	**0.00**	**0.00**	**19.02**	**48.77**	**0.00**	**47.80**	**0.00**	**0.00**	**12779.60**	**960.82**	**0.00**	**0.00**	**2212.76**	**2352.10**	**9958.88**
16	211	**96**	0.00	0.00	0.00	15.66	46.38	13.39	44.28	0.00	0.00	17021.18	1512.71	0.00	0.00	2242.31	2714.47	9530.23
16	297	**207**	0.00	0.00	0.00	16.81	50.05	26.95	43.75	0.00	0.00	51044.30	5048.25	0.00	55.68	1832.35	3342.25	8455.73
16	297	**208**	0.00	0.00	0.00	14.93	45.74	57.57	0.00	0.00	222.46	200372.75	24382.64	0.00	39.44	1094.77	2959.75	3883.60
16	211	**210**	0.00	0.00	0.00	17.82	47.12	0.00	76.84	0.00	0.00	19560.11	1620.63	0.00	0.00	1950.23	1877.79	7460.49
16	211	**211**	30.32	0.00	0.00	20.95	50.09	0.00	570.89	0.00	0.00	25073.36	1165.30	73.14	41.57	2560.73	2976.16	10945.83
16	298	**223**	0.00	0.00	0.00	12.09	34.28	65.39	0.00	0.00	153.55	146778.81	19092.26	0.00	126.74	1713.35	11295.41	10513.82
16	298	**224**	16.53	0.00	0.00	18.33	43.41	33.33	0.00	0.00	0.00	65210.25	7617.54	0.00	53.98	1695.97	10493.31	7320.28
16	212	**250**	27.18	0.00	0.00	24.37	47.11	0.00	46.01	0.00	0.00	18116.47	1461.85	0.00	0.00	1397.81	1470.48	6418.52

No of contexts: 5
Maximum MS (soil): 2002K, associated with C298/S223
Total amount of slag: 7191g; max amount associated with C296/S205
Chemical composition: the Fe/Mn/As/Ca suite for C297/S208, C298/S223
the Cu/Zn suite – no contexts, although C211/S211 very high Zn

F17



Pre ex from S F17,18

mid ex from N F17, 18, 19

Mid ex from N F17, 18,19

Mid ex from W showing C396

Mid ex from E

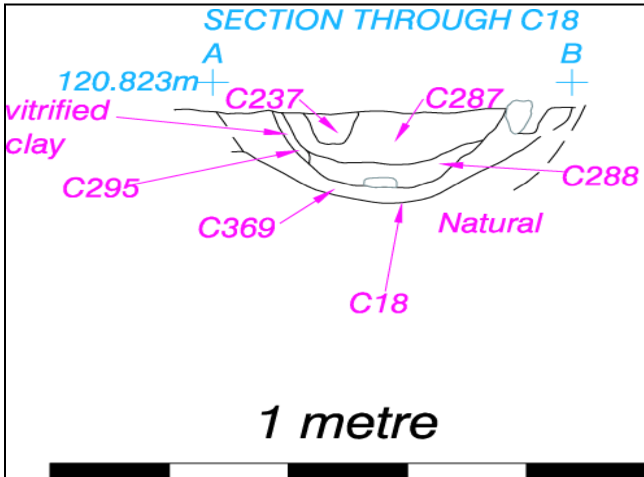
FEATURE	SAMPLE	CONTEXT	ACS DESCRIPTION	SOIL COLOUR	MUNSELL NOTATION	SLAG	CHARCOAL	METALLURGICAL CERAMIC	SOIL DESCRIPTION	MS (K)	SLAG DESCRIPTION	LARGE SLAG WEIGHT (g)	COARSE SLAG WEIGHT (g)	TOTAL SLAG WEIGHT (g)	FINE MATERIAL <1MM SEPARATED FROM SLAG WEIGHT (g)
17	2	17	Slag from c17 a bowl furnace. 0.020 kilograms.							-	1x 5cm frgt slag & small frgts <1cm		122	122	
17	216	309	Soil from c309 a fill of c17, a bowl furnace.	strong brown	7.5YR 5/6	0	0	0	lumpy soil	409					
17	217	309	Slag from c309 a fill of c17, a bowl furnace.							-	small frgts of slag/VFA		35	35	
17	243	317	Soil from c317 a fill of c17, a bowl furnace.	greyish brown	10YR 5/2	2	3	2	lumpy soil	584					
17	244	317	Slag from c317 a fill of c17, a bowl furnace.	brown	10YR 4/3					-	1 x large frgt 7cm amorphous, multiple small coarse slag frgts <5cm	650	250	900	
17	252	310	Oxidised clay from c310 a fill of c17, a bowl furnace.	strong brown	7.5YR 5/6	0	2	0	lumpy soil	855					
17	253	310	Slag from c310 a fill of c17, a bowl furnace. 1.1 kilograms.	greyish brown	10YR 5/2					-	small frgts slag <5cm & fines		1600	1600	150
17	257	357	Slag from c357 a fill of c17, a bowl furnace. 2 bags. 2.94 kilograms.	brown	10YR 4/3					1268	large frgts, coarse <5cm & fines	2350	1050	3400	180
17	258	357	Soil from c357 a fill of c17, a bowl furnace. 2 bags.	dark brown	10YR 3/3	2.5	2.5	0	lumpy soil	2718					
17	259	357	Charcoal from c357 a fill of c17, a bowl furnace.							398					
17	272	366	Vitrified clay from c366 a fill of c17, a bowl furnace	very dark brown	10YR 2/2	3	2	1.5	lumpy soil	930	1 x frgt furnace bottom & 3 x smaller frgts, coarse <5cm & fines	1200	950	2150	250
17	279	370	Oxidised clay from c370 a fill of c17, a bowl furnace.	strong brown	7.5YR 5/6	0	0	0	lumpy soil	366					

XRF data

FEATURE	CONTEXT	SAMPLE	Pb	Sn	Sb	Sr	Rb	As	Zn	Cu	Ni	Fe	Mn	Cr	V	Ti	Ca	K
CONTROL	**CONTROL**	**CONTROL**	**25.63**	**0.00**	**0.00**	**19.02**	**48.77**	**0.00**	**47.80**	**0.00**	**0.00**	**12779.60**	**960.82**	**0.00**	**0.00**	**2212.76**	**2352.10**	**9958.88**
17	309	**216**	24.02	0.00	0.00	19.98	54.83	0.00	47.41	0.00	0.00	17983.43	1847.13	0.00	0.00	1959.34	2681.80	9498.68
17	317	**243**	26.43	0.00	0.00	16.96	52.38	0.00	47.36	0.00	0.00	14924.03	1149.02	0.00	37.95	2093.74	4023.88	9344.88
17	310	**252**	20.52	0.00	0.00	19.11	54.44	14.14	123.73	0.00	0.00	24478.49	1797.73	0.00	35.97	2269.26	3024.37	10520.03
17	357	**258**	0.00	0.00	0.00	11.02	30.36	55.56	0.00	0.00	260.29	196308.13	26668.06	0.00	88.75	1238.37	12783.54	6734.73
17	366	**272**	26.00	0.00	0.00	13.88	49.20	0.00	32.34	0.00	0.00	24109.66	2480.75	0.00	34.14	1522.76	2316.41	8779.26
17	370	**279**	24.54	0.00	0.00	20.55	52.27	0.00	47.37	0.00	0.00	13814.55	603.58	0.00	35.32	2205.38	1538.08	9814.16

No of contexts: 6
Maximum MS (soil): 2700K, associated with C357 (heated soil/soil and charcoal/soil and slag)
Total amount of slag: 8787g; max amount associated with C357, C366, C310, C317 (slag rich)
Chemical composition: the Fe/Mn/As/Ca suite for C357/S258
the Cu/Zn suite – no contexts, although C310/S252 has high Zn

F18

		
	Pre ex from S F17, 18	**Mid ex from N F17, 18,19**
		
Mid ex from S	**Mid ex from S**	**Mid ex from S**

Mid ex from W showing C396

mid ex from N

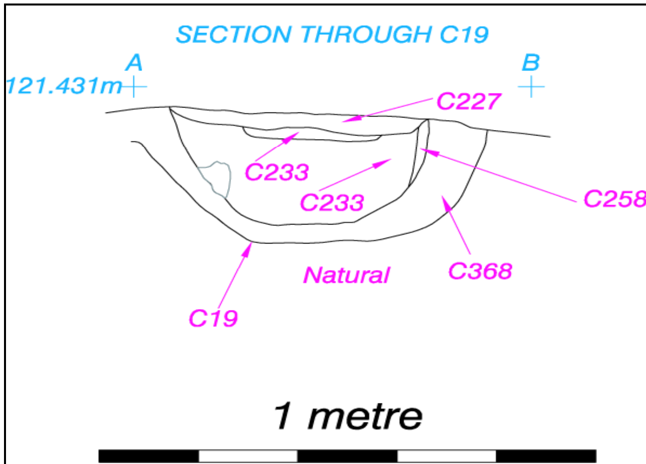
FEATURE	SAMPLE	CONTEXT	ACS DESCRIPTION	SOIL COLOUR	MUNSELL NOTATION	SLAG	CHARCOAL	METALLURGICAL CERAMIC	METALLURGICAL CERAMIC DESCRIPTION	SOIL DESCRIPTION	MS (K)	SLAG DESCRIPTION	LARGE SLAG WEIGHT (g)	COARSE SLAG WEIGHT (g)	TOTAL SLAG WEIGHT (g)	FINE MATERIAL <1MM SEPARATED FROM SLAG WEIGHT (g)
18	4	18	Slag from c18 a bowl furnace. 0.070 kilograms.								-	1 x frgts 7cm long axis		600	600	
18	188	237	Soil from c237 a fill of c18, a bowl furnace.	light brown	7.5YR 6/3	0	0	0		lumpy soil	226					
18	189	237	Slag from c237 a fill of c18, a bowl furnace.								752	slag & soil	450		450	20
18	190	287	Slag from c287 a fill of c18, a bowl furnace.								-	2 x cakes slag, coarse frgts & soil	2050	1050	3100	50
18	192	287	Soil from c287 a fill of c18, a bowl furnace.	dark brown	10YR 3/3	0	0	0		lumpy soil	2328					
18	193	288	Slag from c288 a fill of c18, a bowl furnace. 2 bags.								-	many frgts clinkery slag	615		615	
18	194	288	Soil from c288 a fill of c18, a bowl furnace.	dark brown	10YR 3/3	0	1.5	0		lumpy soil	2130					
18	206	295	Vitrified clay from c295 of c18, a bowl furnace.	greyish brown	10YR 5/2	0	0	1	sintered clay	lumpy soil	670					
18	277	368	Oxidised clay from c368 a fill of c18, a bowl furnace.	strong brown	7.5YR 5/6	0	0	0		lumpy soil	551					
18	278	369	Oxidised clay from c369 a fill of c18, a bowl furnace.	strong brown	7.5YR 5/6	0	0	0		lumpy soil	265					

XRF Data

FEATURE	CONTEXT	SAMPLE	Pb	Sn	Sb	Sr	Rb	As	Zn	Cu	Ni	Fe	Mn	Cr	V	Ti	Ca	K
CONTROL	**CONTROL**	**CONTROL**	**25.63**	**0.00**	**0.00**	**19.02**	**48.77**	**0.00**	**47.80**	**0.00**	**0.00**	**12779.60**	**960.82**	**0.00**	**0.00**	**2212.76**	**2352.10**	**9958.88**
18	237	**188**	29.16	0.00	0.00	18.30	52.17	0.00	42.55	0.00	0.00	17011.40	1177.97	0.00	34.91	2199.58	2451.25	9777.77
18	287	**192**	35.51	0.00	0.00	20.17	40.08	56.47	63.57	0.00	235.93	190510.84	24350.24	0.00	63.46	1729.07	6338.97	8353.25
18	288	**194**	0.00	0.00	0.00	23.56	33.40	67.61	0.00	0.00	0.00	147454.02	16206.02	0.00	105.88	1977.34	15730.08	9168.68
18	295	**206**	53.11	0.00	0.00	17.24	47.73	0.00	58.59	0.00	0.00	18205.48	1174.97	0.00	0.00	1394.17	1086.20	5295.11
18	368	**277**	44.07	0.00	0.00	22.46	59.04	0.00	46.15	0.00	0.00	15608.29	708.22	0.00	0.00	2006.87	1791.08	12000.65
18	369	**278**	28.10	0.00	0.00	22.74	51.64	0.00	30.03	0.00	0.00	14903.90	1148.37	0.00	0.00	2252.31	2068.66	10422.09

No of contexts: 6
Maximum MS (soil): 2328K, associated with C287 and C288
Total amount of slag: 4764g; max amount associated with C287
Chemical composition: the Fe/Mn/As/Ca suite for C287/S192, C288/S194
the Cu/Zn suite – no contexts

F19



Pre ex from S F17, 18

Mid ex from N F17, 18,19

Mid ex from S

Mid ex from S

Mid ex from S

FEATURE	SAMPLE	CONTEXT	ACS DESCRIPTION	SOIL COLOUR	MUNSELL NOTATION	SLAG	CHARCOAL	METALLURGICAL CERAMIC	SOIL DESCRIPTION	MS (K)	SLAG DESCRIPTION	LARGE SLAG WEIGHT (g)	COARSE SLAG WEIGHT (g)	TOTAL SLAG WEIGHT (g)	FINE MATERIAL <1MM SEPARATED FROM SLAG WEIGHT (g)
19	5	18	Slag from c19 a bowl furnace. 0.047 kilograms.							-	1 x frgt 7cm dense amorphous slag, multiple frgts <5cm, 4 x frfgt heated & vitrified metallurgical ceramics	295	34	329	0
19	124	227	Soil from c227 a fill of c19, a bowl furnace.	strong brown	7.5YR 5/6	0	0	0	lumpy soil	1092					
19	125	227	Slag from c227 a fill of c19, a bowl furnace.							-	slag with grey orange lining, also amorphous slag (may be related to lining) & soil	850		850	138
19	134	233	Soil and charcoal from c233 a fill of c19, a bowl furnace. 3 bags.	very dark brown	10YR 2/2	2.5	2.5	0	lumpy soil	1243					
19	135	233	Slag from c233 a fill of c19, a bowl furnace. 2 bags.							647	large frgts of amorphous slag, clinkery slag, 3 x frgts quite heavy (metal within?), smaller frgts slag & soil	1900	2150	4050	206
19	138	234	Soil from c234 a fill of c19, a bowl furnace. 2 bags.	very dark brown	10YR 2/2	0	3	0	lumpy soil	647					
19	139	234	Slag from c234 a fill of c19, a bowl furnace.							468	mostly clinkery slag, 2 x frgts of slag & soil	2050	1200	3250	67
19	168	436	Oxidised clay from c436 a fill of c19, a bowl furnace.	reddish yellow	7.5YR 6/8	0	0	0	lumpy soil	646					
19	176	258	Slag from c258 a fill of c19, a bowl furnace.							-	slag with crystalline structure	200		200	
19	177	258	Vitrified clay from c258 a fill of c19, a bowl furnace.							852					

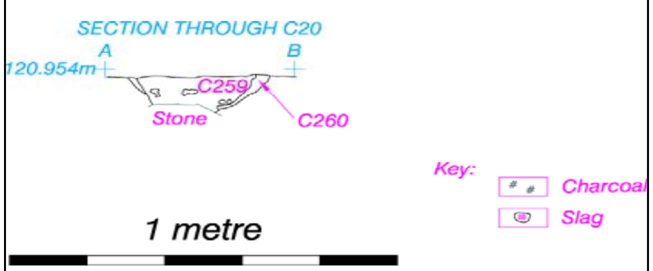
XRF Data

FEATURE	CONTEXT	SAMPLE	Pb	Sn	Sb	Sr	Rb	As	Zn	Cu	Ni	Fe	Mn	Cr	V	Ti	Ca	K
CONTROL	**CONTROL**	**CONTROL**	**25.63**	**0.00**	**0.00**	**19.02**	**48.77**	**0.00**	**47.80**	**0.00**	**0.00**	**12779.60**	**960.82**	**0.00**	**0.00**	**2212.76**	**2352.10**	**9958.88**
19	227	**124**	31.01	0.00	0.00	19.80	56.60	0.00	92.55	0.00	0.00	19783.20	1689.58	0.00	0.00	2582.53	3025.77	13007.76
19	233	**134**	26.57	0.00	0.00	19.80	31.71	31.20	113.91	35.80	0.00	49070.55	7546.96	84.01	86.10	1928.23	13597.97	7998.04
19	234	**138**	35.89	0.00	0.00	28.34	40.98	37.38	63.96	0.00	0.00	48802.08	6718.85	0.00	55.59	1616.06	12859.66	8939.83
19	436	**168**	34.49	0.00	0.00	23.22	54.88	0.00	66.77	0.00	0.00	19100.76	1283.05	0.00	0.00	1665.80	1804.98	10040.12
19	258	**177**	33.66	0.00	0.00	19.09	65.50	18.01	58.33	0.00	0.00	18251.94	1275.10	0.00	0.00	2271.25	3168.04	12514.91

No of contexts: 6

Maximum MS (soil): 1243K, associated with C233 and C227 ; values equivalent to lightly heated soil and slag
Total amount of slag: 9090g; max amount associated with C233, C234 and C227 (high amounts of slag)
Chemical composition: the Fe/Mn/As/Ca suite – no contexts
the Cu/Zn suite – C233/S134

F20



Pre ex from W F20, 21, 22, 23,23

Mid ex from W

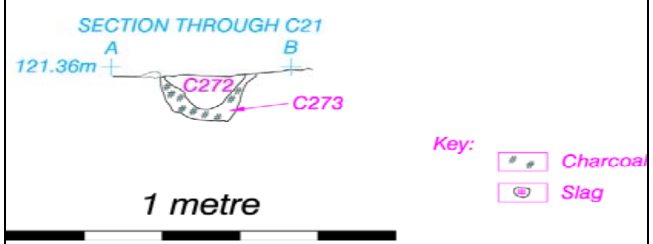
FEATURE	SAMPLE	CONTEXT	ACS DESCRIPTION	SOIL COLOUR	MUNSELL NOTATION	SLAG	CHARCOAL	METALLURGICAL CERAMIC	SOIL DESCRIPTION	MS (K)	SLAG DESCRIPTION	LARGE SLAG WEIGHT (g)	COARSE SLAG WEIGHT (g)	TOTAL SLAG WEIGHT (g)	FINE MATERIAL <1MM SEPARATED FROM SLAG WEIGHT (g)
20	6	20	Slag from c20 a bowl furnace. 0.012 kilograms.							-	slag	25		25	
20	160	259	Soil from c259 a fill of c20, a bowl furnace.	greyish brown	10YR 5/2	0	0	0	lumpy soil	862					
20	161	259	Charcoal from c259, a fill of c20 a bowl furnace.							83	charcoal (not only charcoal, it has soil attached too)	24		24	
20	162	259	Slag from c259 a fill of c20, a bowl furnace.							-	small frgts clinkery slag & 3 x larger frgts	650	550	1200	100

XRF Data

FEATURE	CONTEXT	SAMPLE	Pb	Sn	Sb	Sr	Rb	As	Zn	Cu	Ni	Fe	Mn	Cr	V	Ti	Ca	K
CONTROL	**CONTROL**	**CONTROL**	**25.63**	**0.00**	**0.00**	**19.02**	**48.77**	**0.00**	**47.80**	**0.00**	**0.00**	**12779.60**	**960.82**	**0.00**	**0.00**	**2212.76**	**2352.10**	**9958.88**
20	259	**160**	16.51	0.00	0.00	18.02	46.99	15.68	29.24	0.00	0.00	28327.32	3511.77	0.00	0.00	1882.19	4159.52	8171.50

No of contexts: 1
Maximum MS (soil): K, associated with C259 (Single context shows high MS variation)
Total amount of slag: 1349g; max amount associated with C259/S162
Comments: Furnace is shallow with flat stone deliberately positioned within
Chemical composition: the Fe/Mn/As/Ca suite – no contexts
the Cu/Zn suite – no contexts

F21



Pre ex from W F20, 21, 22, 23,24

F21 Post ex from W

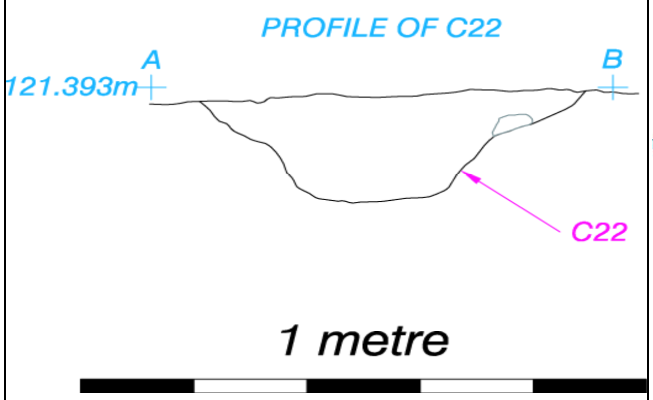
FEATURE	SAMPLE	CONTEXT	ACS DESCRIPTION	SOIL COLOUR	MUNSELL NOTATION	SLAG	CHARCOAL	METALLURGICAL CERAMIC	SOIL DESCRIPTION	MS (K)	SLAG DESCRIPTION	LARGE SLAG WEIGHT (g)	COARSE SLAG WEIGHT (g)	TOTAL SLAG WEIGHT (g)	FINE MATERIAL <1MM SEPARATED FROM SLAG WEIGHT (g)
21	7	21	Slag from c21 a bowl furnace. 0.011 kilograms.							-	1 x frgt clinkery slag		25	25	
21	171	272	Slag from c272 a fill of c21, a bowl furnace.							-	slag	150		150	
21	172	272	Soil from c272 a fill of c21, a bowl furnace.	dark brown	10YR 3/3	0	0	0	lumpy soil	344					
21	173	272	Charcoal from c273 a fill of c21, a bowl furnace.						slag & vitrified clay	148	coarse frgts slag & vitrified clay	230	550	780	
21	174	273	Slag from c273 a fill of c21, a bowl furnace.							1363	clinkery slag & soil	900		900	379
21	175	273	Soil from c273 a fill of c21, a bowl furnace.	dark brown	10YR 3/3	0	0	1	lumpy soil	1154					

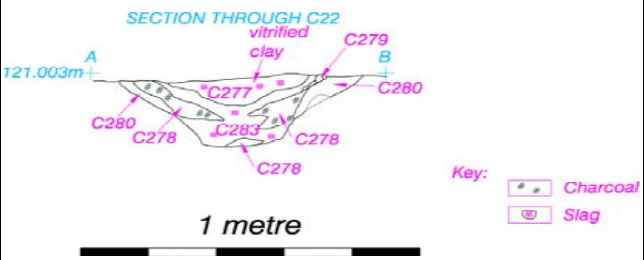
XRF Data

FEATURE	CONTEXT	SAMPLE	Pb	Sn	Sb	Sr	Rb	As	Zn	Cu	Ni	Fe	Mn	Cr	V	Ti	Ca	K
CONTROL	**CONTROL**	**CONTROL**	**25.63**	**0.00**	**0.00**	**19.02**	**48.77**	**0.00**	**47.80**	**0.00**	**0.00**	**12779.60**	**960.82**	**0.00**	**0.00**	**2212.76**	**2352.10**	**9958.88**
21	272	**172**	0.00	0.00	0.00	30.94	47.97	28.47	0.00	0.00	0.00	43191.69	3053.67	0.00	52.62	1737.24	20031.70	8155.02
21	273	**175**	37.43	0.00	0.00	21.34	35.22	27.84	0.00	0.00	0.00	43628.73	5049.08	0.00	31.33	823.31	7404.94	3135.08

No of contexts: 2
Maximum MS (soil): 1154K, associated with C273/S175
Total amount of slag: 2234g; max amount associated with C273/S174
Chemical composition: the Fe/Mn/As/Ca suite – no contexts
the Cu/Zn suite – no contexts

F22





Pre ex from W F20, 21, 22, 23,23

Pre ex

Mid ex from W

Post ex from W

FEATURE	SAMPLE	CONTEXT	ACS DESCRIPTION	SOIL COLOUR	MUNSELL NOTATION	SLAG	CHARCOAL	METALLURGICAL CERAMIC	METALLURGICAL CERAMIC DESCRIPTION	SOIL DESCRIPTION	MS (K)	SLAG DESCRIPTION	LARGE SLAG WEIGHT (g)	COARSE SLAG WEIGHT (g)	TOTAL SLAG WEIGHT (g)	FINE MATERIAL <1MM SEPARATED FROM SLAG WEIGHT (g)
22	9	22	Slag from c22 a bowl furnace. 0.095 kilograms.								-	slag frgts	790		790	
22	195	277	Soil from c277 a fill of c22, a bowl furnace.	strong brown	7.5YR 5/6	0	0	2	sintered clay	lumpy soil	512					
22	196	277	Slag from c277 a fill of c22, a bowl furnace.								-	slag & vitrified clay	980		980	60
22	197	278	Soil from c278 a fill of c22, a bowl furnace.	dark greyish brown	10YR 4/2	0.5	0.5	0		lumpy soil	372					
22	198	278	Slag from c278 a fill of c22, a bowl furnace.								-	sample missing				
22	199	278	Charcoal from c278 a fill of c22, a bowl furnace.								152					
22	200	283	Soil from c283 a fill of c22, a bowl furnace.	brown	10YR 4/3	0.5	0	0		silty soil	1149					
22	201	283	Slag from c283 a fill of c22, a bowl furnace.								793	clinkery slag & fines	1840		1840	90
22	202	283	Charcoal from c283 a fill of c22, a bowl furnace.								1625	slag				
22	212	280	Vitrified clay from c280 a fill of c22, a bowl furnace.	light brown	7.5YR 6/4	0	0	1	burnt sintered clay	lumpy soil	167					
22	213	279	Vitrified clay from c279 a fill of c22, a bowl furnace.	greyish brown	10YR 5/2	1.5	0	1		silty soil, few frgts slag	230					

XRF Data

FEATURE	CONTEXT	SAMPLE	Pb	Sn	Sb	Sr	Rb	As	Zn	Cu	Ni	Fe	Mn	Cr	V	Ti	Ca	K
CONTROL	**CONTROL**	**CONTROL**	**25.63**	**0.00**	**0.00**	**19.02**	**48.77**	**0.00**	**47.80**	**0.00**	**0.00**	**12779.60**	**960.82**	**0.00**	**0.00**	**2212.76**	**2352.10**	**9958.88**
22	277	**195**	27.89	0.00	0.00	19.21	46.75	17.99	485.18	0.00	0.00	21534.29	872.18	0.00	46.97	2555.59	2191.27	10951.88
22	278	**197**	26.54	0.00	0.00	30.30	46.76	85.45	0.00	0.00	0.00	232844.23	11052.66	0.00	0.00	1651.33	18382.93	8070.73
22	283	**200**	28.13	0.00	0.00	23.39	39.33	88.03	0.00	0.00	0.00	288555.88	13418.30	0.00	58.61	1295.62	8020.08	6310.09
22	280	**212**	0.00	0.00	0.00	20.36	44.64	0.00	56.79	0.00	0.00	11439.34	433.76	0.00	0.00	1657.96	1226.88	6237.32

No of contexts: 5

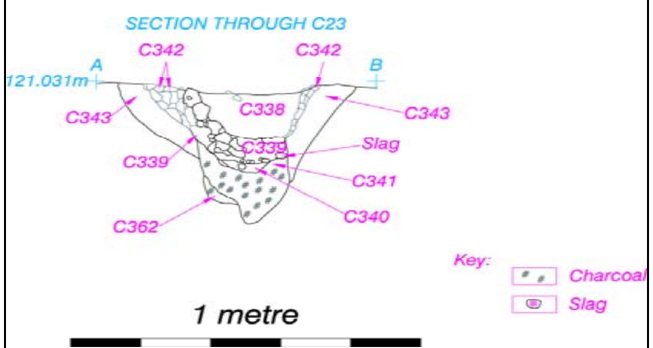
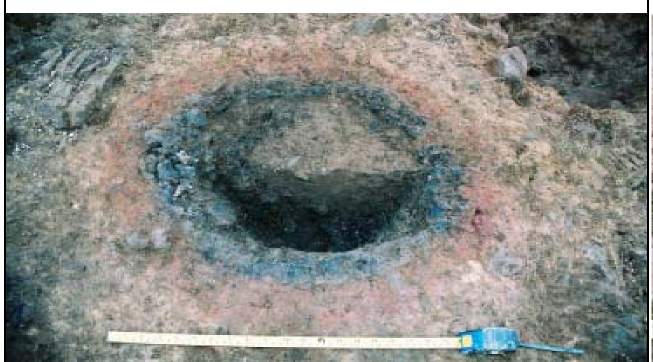
Maximum MS (soil): 1149K, associated with C283/S200 (soils heated at low temperatures: C278, C279, C280; soils heated at higher temperatures: C283)

Total amount of slag: 3740g; max amount associated with C277 and C283

Chemical composition: the Fe/Mn/As/Ca suite for C278/S197, C283/S200

the Cu/Zn suite – no contexts, although C277/S195 very high Zn

F23

		
	Pre ex from W F20, 21, 22, 23,23	**Mid ex from NW**
		
SE facing section	**Mid ex from NE**	**Post ex from NE**

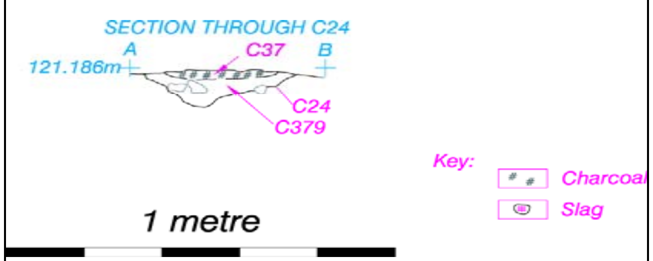
FEATURE	SAMPLE	CONTEXT	ACS DESCRIPTION	SOIL COLOUR	MUNSELL NOTATION	SLAG	CHARCOAL	METALLURGICAL CERAMIC	METALLURGICAL CERAMIC DESCRIPTION	SOIL DESCRIPTION	MS (K)	SLAG DESCRIPTION	LARGE SLAG WEIGHT (g)	COARSE SLAG WEIGHT (g)	TOTAL SLAG WEIGHT (g)	FINE MATERIAL <1MM SEPARATED FROM SLAG WEIGHT (g)
23	245	338	Slag from c338 a fill of c23, a bowl furnace.								-	slag of various sizes	640	80	720	30
23	246	339	Slag from c339 a fill of c23, a bowl furnace. 2 bags.	dark brown	10YR 3/3	4	0	1		amorphous lumps slag, large frgt, coarse frgts	168	large frgts, clinkery slag & soil	1590	2700	4290	350
23	247	339	Soil from c339 a fill of c23, a bowl furnace.	strong brown	7.5YR 5/8	0.5	0.5	0		lumpy soil	67					
23	248	340	Soil from c340 a fill of c23, a bowl furnace.	strong brown	7.5YR 5/6	0	0.5	0		lumpy soil	76					
23	249	342	Clay from c342 a fill of c23, a bowl furnace.								511	sintered clay & fines	2150		2150	135
23	264	341	Charcoal from c341 a fill of c23, a bowl furnace.								51					
23	265	341	Slag from c341 a fill of c23, a bowl furnace.								132	clinkery slag	730		730	7
23	266		Cancelled								-					
23	267	343	Vitrified clay from c343 a fill of c23, a bowl furnace.	strong brown	7.5YR 5/6	0	0	2	sintered clay	lumpy soil	94					
23	268	362	Soil from c362 a fill of c23, a bowl furnace.	dark greyish brown	10YR 4/2	0	1.5	0		lumpy soil, charcoal frgts	209					

XRF Data

FEATURE	CONTEXT	SAMPLE	Pb	Sn	Sb	Sr	Rb	As	Zn	Cu	Ni	Fe	Mn	Cr	V	Ti	Ca	K
CONTROL	**CONTROL**	**CONTROL**	**25.63**	**0.00**	**0.00**	**19.02**	**48.77**	**0.00**	**47.80**	**0.00**	**0.00**	**12779.60**	**960.82**	**0.00**	**0.00**	**2212.76**	**2352.10**	**9958.88**
23	339	**247**	28.19	0.00	0.00	25.60	51.93	40.41	0.00	0.00	0.00	171492.11	11841.27	0.00	64.01	1823.29	11632.67	8812.98
23	340	**248**	27.59	0.00	0.00	34.62	38.24	78.85	0.00	0.00	0.00	251680.42	14073.33	0.00	197.00	1978.02	20843.68	9785.30
23	343	**267**	26.82	0.00	0.00	21.34	69.92	0.00	41.66	0.00	0.00	17207.35	652.93	0.00	38.45	1232.77	1171.92	7283.08
23	362	**268**	0.00	0.00	0.00	21.70	53.30	66.99	0.00	0.00	0.00	153586.17	9777.31	0.00	67.85	1305.84	10604.08	7782.42

No of contexts: 7
Maximum MS (soil): 511K, associated with C342 (MS reflects soils heated at relatively low temperatures; max MS associated with C342, a clay lining)
Total amount of slag: 8412g; max amount associated with C339/S246
Comments: Deep and conical shaped furnace. Although the mean MS is relatively low, the presence of a lip on the rim of the furnace suggests that the furnace was indeed used for smelting.
Chemical composition: the Fe/Mn/As/Ca suite for C339, C340, C362
the Cu/Zn suite – no contexts

F24



F24

Pre ex from W F20, 21, 22, 23,24

F24 Pre ex

FEATURE	SAMPLE	CONTEXT	ACS DESCRIPTION	SOIL COLOUR	MUNSELL NOTATION	SLAG	CHARCOAL	METALLURGICAL CERAMIC	SOIL DESCRIPTION	MS (K)	SLAG DESCRIPTION	LARGE SLAG WEIGHT (g)	TOTAL SLAG WEIGHT (g)
24	8	24	Slag from c24 a bowl furnace. 0.013 kilograms.							-	clinkery slag (2 frgts)	40	40
24	282	377	Charcoal from c377 a fill of c24, a bowl furnace.							69			
24	283	379	Soil from c379 a fill of c24, a bowl furnace.	brown	7.5YR 5/4	0	0	0	lumpy soil	48			

XRF Data

FEATURE	CONTEXT	SAMPLE	Pb	Sn	Sb	Sr	Rb	As	Zn	Cu	Ni	Fe	Mn	Cr	V	Ti	Ca	K
CONTROL	**CONTROL**	**CONTROL**	**25.63**	**0.00**	**0.00**	**19.02**	**48.77**	**0.00**	**47.80**	**0.00**	**0.00**	**12779.60**	**960.82**	**0.00**	**0.00**	**2212.76**	**2352.10**	**9958.88**
24	379	**283**	14.62	0.00	0.00	18.52	52.02	0.00	31.61	0.00	0.00	11366.71	507.30	0.00	0.00	1813.50	1767.09	8650.15

No of contexts: 2
Maximum MS (soil): 69K, associated with C377/S282 (considerably low, i.e. nearly background)
Total amount of slag: 40g; max amount associated with C24/S8
Chemical composition: the Fe/Mn/As/Ca suite – no contexts
the Cu/Zn suite – no contexts

F62

[No images]

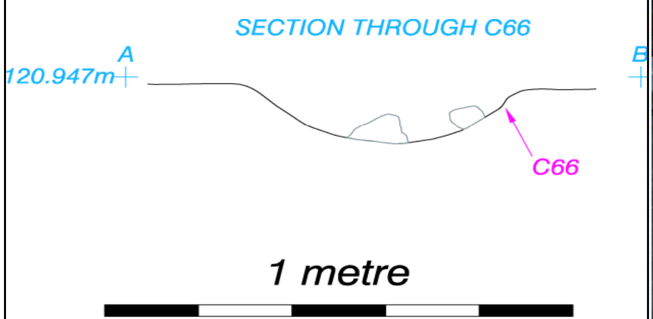
FEATURE	SAMPLE	CONTEXT	ACS DESCRIPTION	SOIL COLOUR	MUNSELL NOTATION	SLAG	CHARCOAL	METALLURGICAL CERAMIC	SOIL DESCRIPTION	MS (K)
62	46	61	Soil from c61 a fill of c62 a posthole.	greyish brown	10YR 5/2	0	0	0	lumpy soil	11

XRF Data

FEATURE	CONTEXT	SAMPLE	Pb	Sn	Sb	Sr	Rb	As	Zn	Cu	Ni	Fe	Mn	Cr	V	Ti	Ca	K
CONTROL	**CONTROL**	**CONTROL**	**25.63**	**0.00**	**0.00**	**19.02**	**48.77**	**0.00**	**47.80**	**0.00**	**0.00**	**12779.60**	**960.82**	**0.00**	**0.00**	**2212.76**	**2352.10**	**9958.88**
62	61	**46**	21.52	0.00	0.00	22.46	50.97	0.00	103.56	56.27	0.00	13200.72	1355.90	0.00	0.00	2716.82	3220.30	11820.86

No of contexts: 1
Maximum MS (soil): 11K, associated with C61 (background K)
Total amount of slag: 0g
Chemical composition: the Fe/Mn/As/Ca suite – no contexts
the Cu/Zn suite for C61

F66

		
	Mid ex from W	Mid ex from E
		
Post ex from W	Post ex from S	Post ex from E

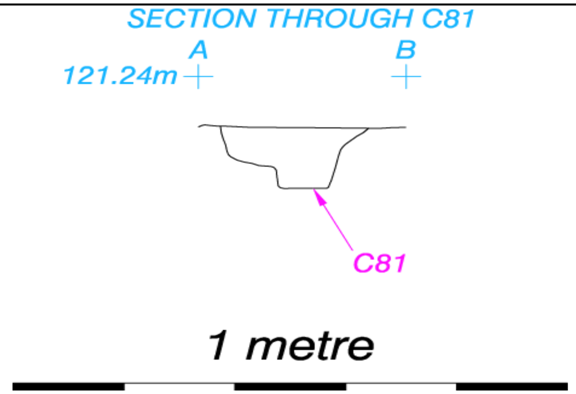
FEATURE	SAMPLE	CONTEXT	ACS DESCRIPTION	SOIL COLOUR	MUNSELL NOTATION	SLAG	CHARCOAL	METALLURGICAL CERAMIC	SOIL DESCRIPTION	MS (K)	SLAG DESCRIPTION	LARGE SLAG WEIGHT (g)	COARSE SLAG WEIGHT (g)	TOTAL SLAG WEIGHT (g)	FINE MATERIAL <1MM SEPARATED FROM SLAG WEIGHT (g)
66	35	113	Soil from c113 a fill of c66, a bowl furnace.	dark brown	10YR 3/3	0	0	0	lumpy soil	1179					
66	33	113	Charcoal from c113 a fill of c66, a bowl furnace.							174					
66	34	113	Slag from c113 a fill of c66, a bowl furnace.							-	many frgts clinkery slag & soil	1550		1550	50

XRF Data

FEATURE	CONTEXT	SAMPLE	Pb	Sn	Sb	Sr	Rb	As	Zn	Cu	Ni	Fe	Mn	Cr	V	Ti	Ca	K
CONTROL	**CONTROL**	**CONTROL**	**25.63**	**0.00**	**0.00**	**19.02**	**48.77**	**0.00**	**47.80**	**0.00**	**0.00**	**12779.60**	**960.82**	**0.00**	**0.00**	**2212.76**	**2352.10**	**9958.88**
66	113	**35**	315.84	0.00	0.00	18.83	42.54	0.00	39.97	0.00	0.00	57342.14	10099.52	0.00	0.00	1807.82	8818.73	9086.14

No of contexts: 1
Maximum MS (soil): 1179K, associated with C11/S35
Total amount of slag: 1550g associated with C113/S34
Chemical composition: the Fe/Mn/As/Ca suite – no contexts
the Cu/Zn suite – no contexts

F81

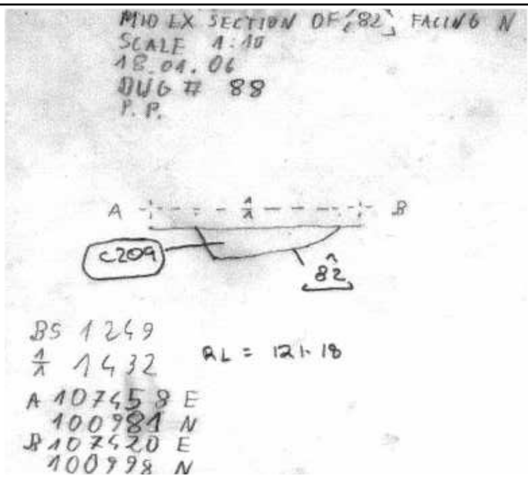
		
	Pre ex from W	Pre ex from N
		
N facing section from N	Post ex from S	

FEATURE	SAMPLE	CONTEXT	ACS DESCRIPTION	SOIL COLOUR	MUNSELL NOTATION	SLAG	CHARCOAL	METALLURGICAL CERAMIC	SOIL DESCRIPTION	MS (K)	SLAG DESCRIPTION	LARGE SLAG WEIGHT (g)	COARSE SLAG WEIGHT (g)	TOTAL SLAG WEIGHT (g)	FINE MATERIAL <1MM SEPARATED FROM SLAG WEIGHT (g)
81	129	229	Soil and charcoal from c229 a fill of c81, a bowl furnace. 2 bags.	light brownish grey	10YR 6/2	0	0	0	lumpy soil	699					
81	130	229	Slag from c229 a fill of c81, a bowl furnace.							-	amorphous globular slag, small frgts some with clay attached & soil	223	11	234	8

[No XRF Data]

No of contexts: 1
Maximum MS (soil): 699K, associated with C229/S129
Total amount of slag: 234g, associated with C229/S130

F82



		
Pre ex from W	**Mid ex from E**	**Post ex from S**

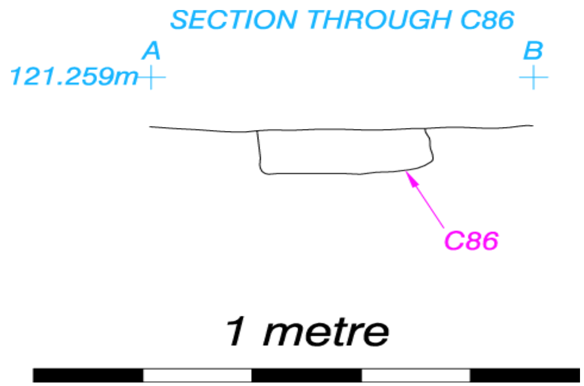
FEATURE	SAMPLE	CONTEXT	ACS DESCRIPTION	SOIL COLOUR	MUNSELL NOTATION	SLAG	CHARCOAL	METALLURGICAL CERAMIC	SOIL DESCRIPTION	MS (K)	SLAG DESCRIPTION	LARGE SLAG WEIGHT (g)	COARSE SLAG WEIGHT (g)	TOTAL SLAG WEIGHT (g)
82	94	209	Soil and charcoal from c209 a fill of c82, a bowl furnace. 2 bags.	greyish brown	10YR 5/2	0	3	0	lumpy soil	869				
82	95	209	Slag from c209 a fill of c82, a bowl furnace.							-	very small frgt slag	75		75

XRF Data

FEATURE	CONTEXT	SAMPLE	Pb	Sn	Sb	Sr	Rb	As	Zn	Cu	Ni	Fe	Mn	Cr	V	Ti	Ca	K
CONTROL	**CONTROL**	**CONTROL**	**25.63**	**0.00**	**0.00**	**19.02**	**48.77**	**0.00**	**47.80**	**0.00**	**0.00**	**12779.60**	**960.82**	**0.00**	**0.00**	**2212.76**	**2352.10**	**9958.88**
82	209	**94**	18.30	0.00	0.00	21.01	50.01	21.30	47.26	0.00	0.00	25048.94	1403.52	0.00	0.00	1652.85	4947.64	6857.83

No of contexts: 1
Maximum MS (soil): 869K, associated with C209/S94
Total amount of slag: 75g
Chemical composition: the Fe/Mn/As/Ca suite – no contexts
the Cu/Zn suite – no contexts

F86

		
	Pre ex from W	Pre ex from W
		
W facing section	Post ex from N	Post ex from S

FEATURE	SAMPLE	CONTEXT	ACS DESCRIPTION	SOIL COLOUR	MUNSELL NOTATION	SLAG	CHARCOAL	METALLURGICAL CERAMIC	SOIL DESCRIPTION	MS (K)	SLAG DESCRIPTION	LARGE SLAG WEIGHT (g)	COARSE SLAG WEIGHT (g)	TOTAL SLAG WEIGHT (g)	FINE MATERIAL <1MM SEPARATED FROM SLAG WEIGHT (g)
86	78	185	Charcoal from c185 a fill of c86, a bowl furnace.	very dark greyish brown	10YR 3/2	0	2	1	lumpy soil	793					
86	80	185	Slag from c185 a fill of c86, a bowl furnace.							264	clinkery slag & fines	300		300	10

XRF Data

FEATURE	CONTEXT	SAMPLE	Pb	Sn	Sb	Sr	Rb	As	Zn	Cu	Ni	Fe	Mn	Cr	V	Ti	Ca	K
CONTROL	**CONTROL**	**CONTROL**	**25.63**	**0.00**	**0.00**	**19.02**	**48.77**	**0.00**	**47.80**	**0.00**	**0.00**	**12779.60**	**960.82**	**0.00**	**0.00**	**2212.76**	**2352.10**	**9958.88**
86	185	**78**	29.80	0.00	0.00	20.27	48.51	14.47	30.24	37.54	0.00	29995.62	2841.87	0.00	54.52	1849.67	9121.47	7612.63

No of contexts: 1
Maximum MS (soil): 793K, associated with C185/S78
Total amount of slag: 300g
Chemical composition: the Fe/Mn/As/Ca suite – no contexts
the Cu/Zn suite for C185/S78

F99

[No images]

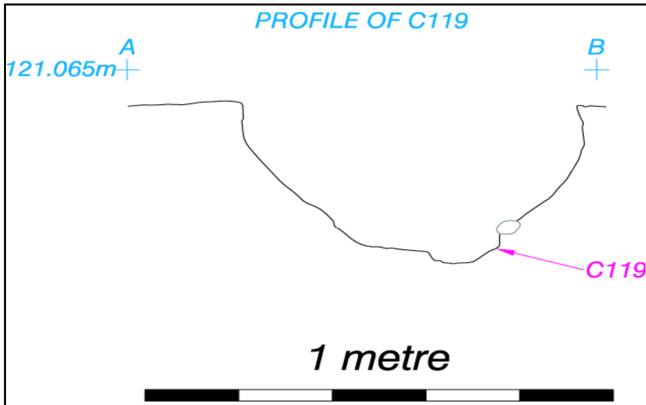
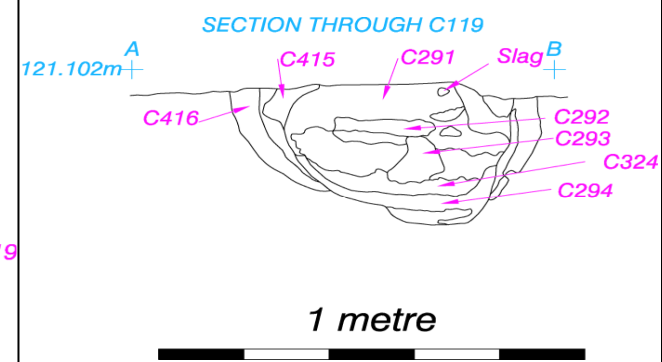
FEATURE	SAMPLE	CONTEXT	ACS DESCRIPTION	SOIL COLOUR	MUNSELL NOTATION	SLAG	CHARCOAL	METALLURGICAL CERAMIC	SOIL DESCRIPTION	MS (K)	SLAG DESCRIPTION	LARGE SLAG WEIGHT (g)	COARSE SLAG WEIGHT (g)	TOTAL SLAG WEIGHT (g)	FINE MATERIAL <1MM SEPARATED FROM SLAG WEIGHT (g)
99	21	105	Soil from c105 a fill of c99, a pit of unknown function.	dark brown	10YR 3/3	1	1	0	black and light grey earthy material. Organic content must be high.	3784					
99	20	105	Slag from c105 a fill of c99, a pit of unknown function. 1.2 kilograms.							1002	slag frgts of various sizes & fines	1000	100	1100	114

XRF Data

FEATURE	CONTEXT	SAMPLE	Pb	Sn	Sb	Sr	Rb	As	Zn	Cu	Ni	Fe	Mn	Cr	V	Ti	Ca	K
CONTROL	**CONTROL**	**CONTROL**	**25.63**	**0.00**	**0.00**	**19.02**	**48.77**	**0.00**	**47.80**	**0.00**	**0.00**	**12779.60**	**960.82**	**0.00**	**0.00**	**2212.76**	**2352.10**	**9958.88**
99	105	**21**	0.00	0.00	0.00	18.68	45.94	28.97	0.00	0.00	114.06	88376.71	12264.28	0.00	98.48	1855.36	8964.67	7153.50

No of contexts: 1
Maximum MS (soil): 3784K, associated with C105/S21 (very high organic content)
Total amount of slag: 1100g
Chemical composition: the Fe/Mn/As/Ca suite – no contexts
the Cu/Zn suite – no contexts

F119

		
		Post ex from NW F119, 120
		
Mid ex from NE	Mid ex from NE	Mid ex from NE

		
Mid ex from NE	**Post ex from NE**	**Mid ex from NE**
		
NE facing section from NE	**NE facing section from NE**	**NE facing section from NE**

		
NE facing section from NE	**Post ex from NE**	**Post ex from NE**
		
Post ex from NE	**Post ex from S**	**Post ex from NW F119, 120, 121**

FEATURE	SAMPLE	CONTEXT	ACS DESCRIPTION	SOIL COLOUR	MUNSELL NOTATION	SLAG	CHARCOAL	METALLURGICAL CERAMIC	METALLURGICAL CERAMIC DESCRIPTION	SOIL DESCRIPTION	MS (K)	SLAG DESCRIPTION	LARGE SLAG WEIGHT (g)	COARSE SLAG WEIGHT (g)	TOTAL SLAG WEIGHT (g)	FINE MATERIAL <1MM SEPARATED FROM SLAG WEIGHT (g)
119	234	291	Soil from c291 a fill of c119, a bowl furnace.	greyish brown	10YR 5/2	0	1	0		lumpy soil	182					
119	235	292	Soil from c292 a fill of c119, a bowl furnace.	light brown	7.5YR 6/3	0	0	2	heated clay	lumpy soil	91					
119	236	293	Oxidised clay from c293 a fill of c119, a bowl furnace.	strong brown	7.5YR 5/6						283	many large frgts oxidised/sintered clay. Some vitrified clay with gradient in colour & soil.	3500		3500	170
119	237	294	Soil from c294 a fill of c119, a bowl furnace.	very dark greyish blac	10YR 3/2	0	3	0		charcoal rich soil	850					
119	238	324	Soil from c324 a fill of c119, a bowl furnace.	light brown	7.5YR 6/3	0.5	0	0		lumpy soil	1130					
119	239	119	Slag from c119 a bowl furnace. 2 bags.								350	large frgt slag, coarse frgts (including 1 x globular slag with some clay) & clay, fines	4180	700	4880	85
119	285	415	Vitrified clay from c415 a fill of c119, a bowl furnace.	light brown	7.5YR 6/3						357	many frgts of oxidised/sintered clay (some vitrified surfaces are clay linings of furnace walls) & soil	3500	120	3620	120
119	286	416	Oxidised clay from c416 a fill of c119, a bowl furnace.	strong brown	7.5YR 5/6	0	0	3	sintered & burnt clay		650		3050		3050	

XRF Data

FEATURE	CONTEXT	SAMPLE	Pb	Sn	Sb	Sr	Rb	As	Zn	Cu	Ni	Fe	Mn	Cr	V	Ti	Ca	K
CONTROL	**CONTROL**	**CONTROL**	**25.63**	**0.00**	**0.00**	**19.02**	**48.77**	**0.00**	**47.80**	**0.00**	**0.00**	**12779.60**	**960.82**	**0.00**	**0.00**	**2212.76**	**2352.10**	**9958.88**
119	291	**234**	21.80	0.00	0.00	19.17	55.97	0.00	36.18	0.00	0.00	16321.90	1541.79	0.00	0.00	1832.00	1949.94	7247.90
119	292	**235**	21.48	0.00	0.00	21.58	55.21	0.00	52.55	0.00	0.00	15564.09	863.07	0.00	0.00	2382.26	2455.78	10611.84
119	293	**236**	28.05	0.00	0.00	20.26	47.94	0.00	84.25	0.00	0.00	23584.12	1255.50	0.00	0.00	1753.40	2002.74	7182.49
119	294	**237**	0.00	0.00	0.00	17.49	23.04	35.70	55.81	0.00	0.00	91648.01	11583.38	0.00	82.82	1254.25	20406.98	6303.00
119	324	**238**	0.00	0.00	0.00	9.41	19.89	41.37	80.50	53.46	147.28	162858.66	11650.93	0.00	115.15	1351.30	7996.82	9595.95
119	415	**285**	42.61	0.00	0.00	21.14	61.47	0.00	76.66	0.00	0.00	18746.69	995.24	0.00	36.59	2670.95	2081.53	13875.68
119	416	**286**	27.89	0.00	0.00	24.68	62.67	0.00	78.05	0.00	0.00	25111.54	1574.00	0.00	35.81	2074.82	3241.73	9905.19

F119
No of contexts: 7
Max MS (soil): 1130K associated with C324/S238
Total amount of slag: 15425g; max amount associated with contexts C119, C293, C425
Comments: raised lip around the rim of the furnace; keyhole shaped furnace design; white stone for the positioning of the bellows.
Chemical composition: Fe/Mn/As suite for C324/S238; Cu/Zn for same

F120

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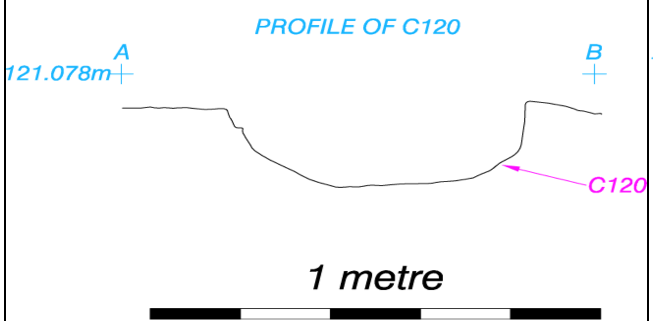
<td>
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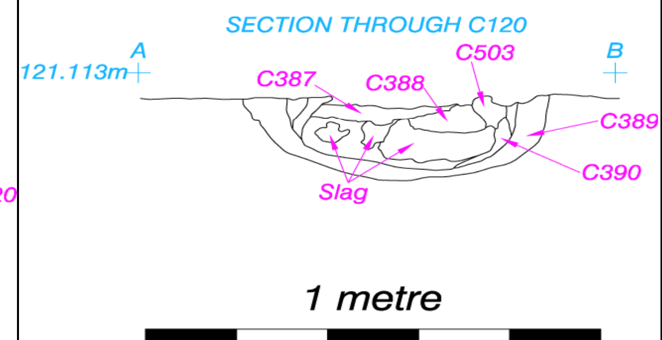
<td>
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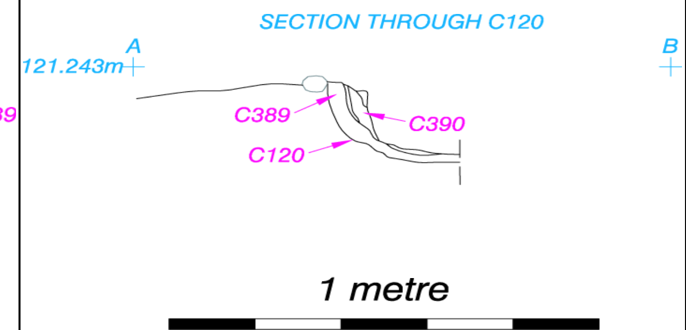
<td>
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<td>Pre ex from W</td>
<td>Mid ex from NE</td>
<td>Post ex from NW F119, 120, 121</td>
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Mid ex from N

Mid ex from NE

Mid ex from NE

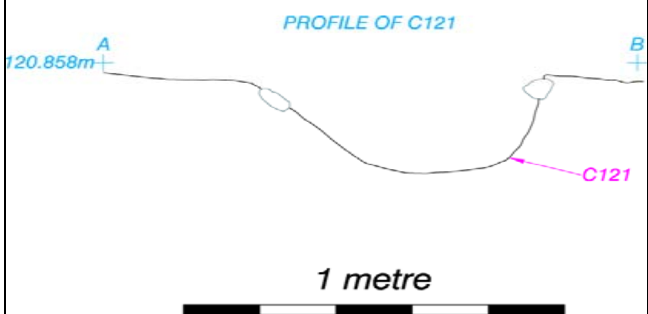
FEATURE	SAMPLE	CONTEXT	ACS DESCRIPTION	SOIL COLOUR	MUNSELL NOTATION	SLAG	CHARCOAL	METALLURGICAL CERAMIC	SOIL DESCRIPTION	MS (K)	SLAG DESCRIPTION	LARGE SLAG WEIGHT (g)	COARSE SLAG WEIGHT (g)	TOTAL SLAG WEIGHT (g)	FINE MATERIAL <1MM SEPARATED FROM SLAG WEIGHT (g)
120	287	387	Oxidised clay from c387 a fill of c120, a bowl furnace.	strong brown	7.5YR 5/6	0	0	0	lumpy soil	1539					
120	288	288	Soil from c288 a fill of c120, a bowl furnace.	strong brown	7.5YR 5/6	0	0	0	lumpy soil	788					
120	289	389	oxidised clay from c389, a fill of c120, a bowl furnace	strong brown	7.5YR 5/6	0	0	0	lumpy soil	205					
120	290	390	Vitrified clay from c390 a fill of c120, a bowl furnace.							726	vitrified clay & slag & stone, coarse frgts <5cm & fines	1850	550	2400	150
120	291	291	Slag from c291 a fill of c120, a bowl furnace. 2 bags.							1076	slag (some clinkery, but globular & lumpy) & soil	2080	2550	4630	175
120	351	503	Vitrified clay from c503 a fill of c120, a bowl furnace. 4 bags.	greyish brown	10YR 5/2					362	2 x furnace bottom frgt, 2 x large frgts slag (15cm & 20m long axis), 1 x small cake, little fines	2600		2600	300
120	352	120	Slag from c120, a bowl furnace. 5.2 kilograms.							1426	1 x furnace bottom (30cm) charcoal inclusions attached, smaller frgts coarse slag (sintered clay attached) & soil	3550	800	4350	150

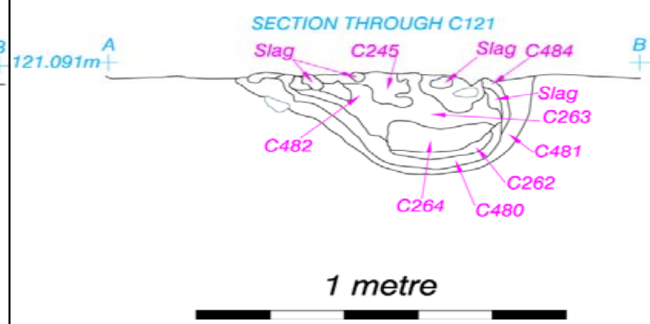
XRF Data

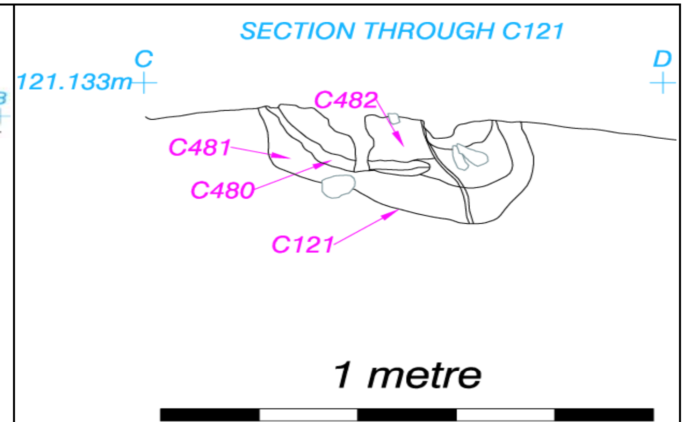
FEATURE	CONTEXT	SAMPLE	Pb	Sn	Sb	Sr	Rb	As	Zn	Cu	Ni	Fe	Mn	Cr	V	Ti	Ca	K
CONTROL	**CONTROL**	**CONTROL**	**25.63**	**0.00**	**0.00**	**19.02**	**48.77**	**0.00**	**47.80**	**0.00**	**0.00**	**12779.60**	**960.82**	**0.00**	**0.00**	**2212.76**	**2352.10**	**9958.88**
120	387	**287**	26.59	0.00	0.00	21.38	60.19	0.00	198.81	0.00	0.00	19102.70	1029.90	0.00	33.57	2448.36	2576.67	11701.17
120	288	**288**	18.64	0.00	0.00	20.09	53.35	0.00	60.94	0.00	0.00	16515.43	1681.58	0.00	0.00	1933.77	2031.40	7414.17
120	389	**289**	49.49	0.00	0.00	22.81	69.15	0.00	37.43	0.00	0.00	19805.39	872.24	0.00	0.00	2318.86	1693.10	12238.24

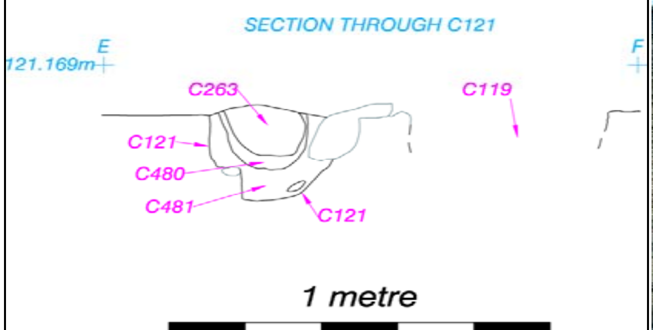
No of contexts: 6
Max MS (soil): 1539K associated with C387/S287
Total amount of slag: 14755g; max amount associated with contexts C390, C291, C503, C120
Chemical Composition: Fe/Mn/As suite for no particular context; Cu/Zn suite for C387/S287 oxidised clay

F121









Pre ex from W

Post ex from NW F119, 120, 121

		
Mid ex from S	**Mid ex from S**	**Mid ex from S**
		
E facing section	**E facing section**	**S facing section**

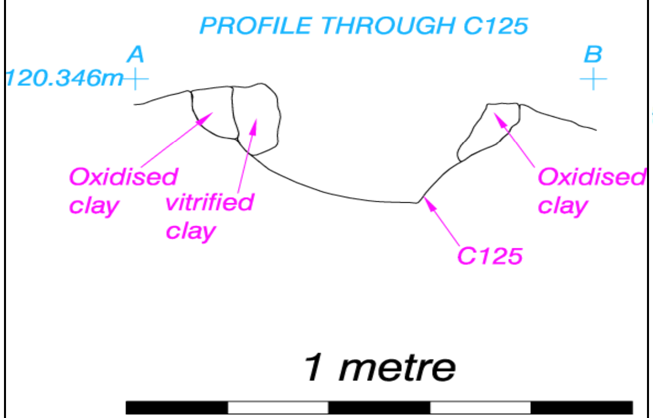
FEATURE	SAMPLE	CONTEXT	ACS DESCRIPTION	SOIL COLOUR	MUNSELL NOTATION	SLAG	CHARCOAL	METALLURGICAL CERAMIC	METALLURGICAL CERAMIC DESCRIPTION	SOIL DESCRIPTION	MS (K)	SLAG DESCRIPTION	LARGE SLAG WEIGHT (g)	COARSE SLAG WEIGHT (g)	TOTAL SLAG WEIGHT (g)	FINE MATERIAL <1MM SEPARATED FROM SLAG WEIGHT (g)
121	156	245	Soil and charcoal from c245 a fill of c121, a bowl furnace.	greyish brown	10YR 5/2	0	1.5	0		lumpy soil	923					
121	328	262	Soil from c262 a fill of c121, a bowl furnace.	dark brown	10YR 3/3	0	2.5	0		lumpy soil	2977					
121	329	263	Oxidised clay from c263 a fill of c121, a bowl furnace.								911					
121	330	264	Oxidised clay from c264 a fill of c121, a bowl furnace.	strong brown	7.5YR 5/6	0	0	0.5		lumpy soil	313					
121	331	265	Slag from c265 a fill of c121, a bowl furnace.	dark brown	10YR 3/3						-	large collection of clinkery frgts & fines	2650		2650	
121	332	480	Soil from c480 a fill of c121, a bowl furnace.	very dark greyish black	10YR 3/2	0	3	1	sintered clay	lumpy soil, charcoal frgts	1015					
121	334	481	Oxidised clay from c481 a fill of c121, a bowl furnace.								273					
121	335	482	Oxidised clay from c482 a fill of c121, a bowl furnace. 2 bags.								1015					
121	336	483	Soil (pebbles, slag, clay) from c483 a fill of c121, a bowl furnace.	greyish brown	10YR 5/2	2	0	1.5		pebbles, slag, clay	464	small frgt, amorphous, not exceeding 5cm	1000		1000	50
121	337	484	Vitrified clay from c484 a fill of c121, a bowl furnace. 4 bags.								772	large frgts slag, sintered clay (part of furnace wall/floor) & soil	4230	644	4874	225

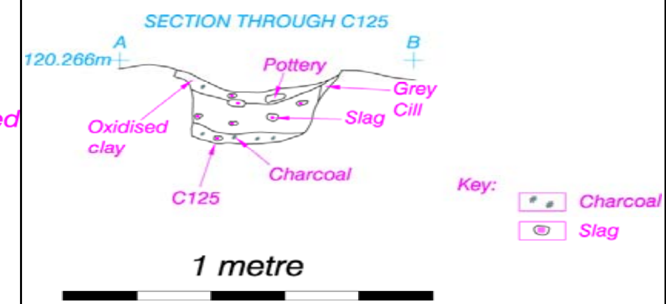
XRF Data

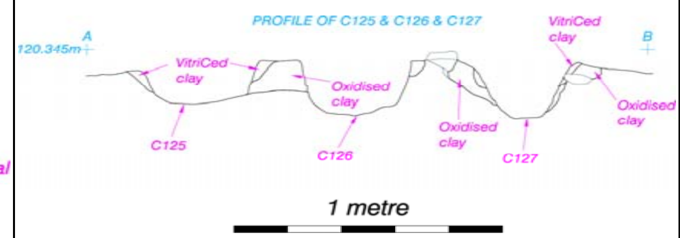
FEATURE	CONTEXT	SAMPLE	Pb	Sn	Sb	Sr	Rb	As	Zn	Cu	Ni	Fe	Mn	Cr	V	Ti	Ca	K
CONTROL	**CONTROL**	**CONTROL**	**25.63**	**0.00**	**0.00**	**19.02**	**48.77**	**0.00**	**47.80**	**0.00**	**0.00**	**12779.60**	**960.82**	**0.00**	**0.00**	**2212.76**	**2352.10**	**9958.88**
121	245	**156**	17.84	0.00	0.00	18.65	56.25	0.00	40.09	0.00	0.00	19836.82	2100.72	0.00	0.00	1947.75	2416.29	8150.49
121	262	**328**	0.00	0.00	0.00	15.69	32.48	124.87	0.00	0.00	536.19	379485.41	61621.65	0.00	126.63	1583.14	10275.78	8743.38
121	263	**329**	27.49	0.00	0.00	19.86	49.29	0.00	60.96	0.00	0.00	17815.19	1000.25	0.00	0.00	2378.91	2130.07	10890.65
121	264	**330**	27.03	0.00	0.00	22.41	61.32	0.00	115.28	0.00	0.00	17689.88	1063.74	0.00	0.00	2075.61	1847.60	12009.12
121	480	**332**	24.55	0.00	0.00	41.88	44.73	49.36	78.26	112.06	119.48	101775.74	16146.90	0.00	156.66	2019.96	34513.18	8938.91
121	481	**334**	35.66	0.00	0.00	18.38	49.16	0.00	0.00	0.00	0.00	11716.78	447.16	0.00	0.00	1960.63	1307.43	10268.17
121	482	**335**	33.45	0.00	0.00	20.63	52.05	0.00	145.39	0.00	0.00	19559.09	1205.95	0.00	0.00	2071.68	1699.24	9730.12
121	484	**337**	28.87	0.00	0.00	19.86	60.34	0.00	70.93	0.00	0.00	17532.10	954.40	0.00	33.07	2028.80	1731.68	8875.65

F121
No of contexts: 10
Max MS: 2900K associated with C262/S328 indicating heated soil with charcoal; also 1100K for C480/S332 indicating
Total amount of slag: 8775g associated with C483 and C484
Comments: keyhole shaped furnace; clinkery slag
Chemical Composition: Fe/As/Ca/Mn suite for C480/S332 and C262/S328; Cu/Zn for C480/S332; also C264/S330 and C482/S335

F125







S facing section

Profile from S

Mid ex from W showing vitrified clay on NW of feature

		
Mid ex from S	**Mid ex from N**	**S facing section**
		
Profile from SW	**Post ex from W F125, 126, 127, 299**	**Post ex from W F125, 126, 127, 299**

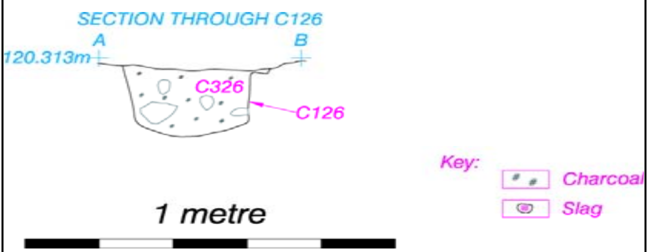
FEATURE	SAMPLE	CONTEXT	ACS DESCRIPTION	SOIL COLOUR	MUNSELL NOTATION	SLAG	CHARCOAL	METALLURGICAL CERAMIC	METALLURGICAL CERAMIC DESCRIPTION	SOIL DESCRIPTION	MS (K)	SLAG DESCRIPTION	LARGE SLAG WEIGHT (g)	COARSE SLAG WEIGHT (g)	TOTAL SLAG WEIGHT (g)	FINE MATERIAL <1MM SEPARATED FROM SLAG WEIGHT (g)
125	128	125	Soil and charcoal from c125, a bowl furnace.								-					
125	228	244	Slag from c244 a fill of c125, a bowl furnace.	brown	10YR 4/3						401	clinker & fines	1650		1650	140
125	360	323	Soil from c323 a fill of c125, a bowl furnace. 2 bags.	strong brown	7.5YR 5/6	0	0	0		lumpy soil	1352					
125	361	323	Soil from c323 a fill of c125, a bowl furnace.	strong brown	7.5YR 5/6	0	0	3		lumpy soil	858					
125	362	323	Slag from c323 a fill of c125, a bowl furnace. ***soil - not slag***	strong brown	7.5YR 5/6	0	0	0		lumpy soil	250					
125	369	514	Soil from c514 a fill of c125, a bowl furnace. 2 bags.	greyish brown	10YR 5/2	1.5	1.5	1.5	heated clay	lumpy soil	1215	mixed small frgts slag, clay, flux, ore residues & soil	2420		2420	905
125	370	514	Slag from c514 a fill of c125, a bowl furnace.								1549	small frgts amorphous slag with clinkery tap slag, amorphous lumpy slag & soil	2550	187	2737	150
125	371	515	Soil from c515 a fill of c125, a bowl furnace. 1.6 kilograms.	dark brown	10YR 3/3	0	0	0		lumpy soil	2186					
125	372	515	Charcoal from c515 a fill of c125, a bowl furnace.								159					
125	373	515	Slag from c515 a fill of c125, a bowl furnace.	dark brown	10YR 3/3	0	0.5	1	heated clay	lumpy soil	1729					
125	374	516	Soil from c516 a fill of c125, a bowl furnace.	strong brown	7.5YR 5/6	0	0	0		fine lumpy soil	23					
125	375	323	Soil from c323 a fill of c125, a bowl furnace.	brown	10YR 4/3	0	0	0			2143					
125	376	517	Soil from c517 a fill of c125, a bowl furnace.	light brown	7.5YR 6/3	2	2	0		lumpy soil	2327					
125	478	325	Vitrified clay from c325 a fill of c125, a bowl furnace.								5030	a) slag which has stuck to the floor of the furnace, b) same as a with ceramic, c) same as a with coil	925	1400	2325	320
125	480	595	Soil from c595 a fill of c125, a bowl furnace.								-					
125	484	515	Slag from c515 a fill of c125, a bowl furnace. 0.035 kilograms.								-	small frgts clinkery slag		28	28	
125	493	323	Slag from c323, a bowl furnace. 0.16 kilograms								-	small frgts slag & ore	112	25	137	

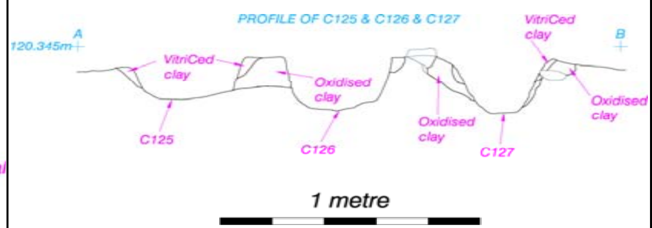
XRF Data

FEATURE	CONTEXT	SAMPLE	Pb	Sn	Sb	Sr	Rb	As	Zn	Cu	Ni	Fe	Mn	Cr	V	Ti	Ca	K
CONTROL	**CONTROL**	**CONTROL**	**25.63**	**0.00**	**0.00**	**19.02**	**48.77**	**0.00**	**47.80**	**0.00**	**0.00**	**12779.60**	**960.82**	**0.00**	**0.00**	**2212.76**	**2352.10**	**9958.88**
125	125	**128**	28.53	0.00	0.00	25.51	52.89	0.00	45.91	0.00	0.00	14836.11	1010.67	0.00	0.00	1830.42	3098.96	7857.71
125	323	**360**	18.51	0.00	0.00	17.58	39.37	14.86	112.33	0.00	0.00	13873.89	1086.63	0.00	0.00	2042.96	2135.65	7746.13
125	323	**361**	36.46	0.00	0.00	17.60	55.62	0.00	141.83	0.00	0.00	21299.13	1327.61	0.00	0.00	2758.04	2504.04	11501.35
125	323	**362**	42.76	0.00	0.00	23.97	55.04	19.18	514.26	0.00	0.00	25277.36	2424.18	0.00	51.96	2746.19	2915.18	12607.45
125	514	**369**	0.00	0.00	0.00	17.06	32.53	62.57	149.98	0.00	0.00	168738.52	23799.58	0.00	0.00	991.28	3119.74	3791.06
125	515	**371**	23.57	0.00	0.00	17.66	34.31	74.37	76.42	67.63	302.06	251994.67	38317.79	0.00	0.00	1758.67	9759.86	9824.64
125	515	**373**	0.00	0.00	0.00	22.95	23.04	180.86	0.00	0.00	723.91	573778.06	69395.72	0.00	146.94	1349.90	14005.13	11137.46
125	516	**374**	26.72	0.00	0.00	25.75	75.92	0.00	94.88	0.00	0.00	21670.24	581.27	0.00	0.00	2834.91	2876.21	14414.71
125	323	**375**	32.63	0.00	0.00	16.53	40.00	76.09	0.00	0.00	0.00	230047.09	6712.06	0.00	0.00	1871.73	9655.42	9246.79
125	517	**376**	39.64	0.00	0.00	18.26	48.30	0.00	50.30	0.00	0.00	24779.98	2424.91	0.00	42.23	1988.07	2988.62	8244.35

F125
No of Contexts: 7
Max MS (soil): 2327for C517/S376
Total amount of slag: 10814g ; fines= 1517gr associated with contexts C514,C325, C244
Chemical composition: Fe/As/Mn/Ca suite for C515/S371, S373; Cu/Zn suite for C323/S362, S361,S360; also for C515/S371

F126





Mid ex from W showing vitrified clay on NW of feature

Mid ex from S

Mid ex from S

Post ex from W F125, 126, 127, 299

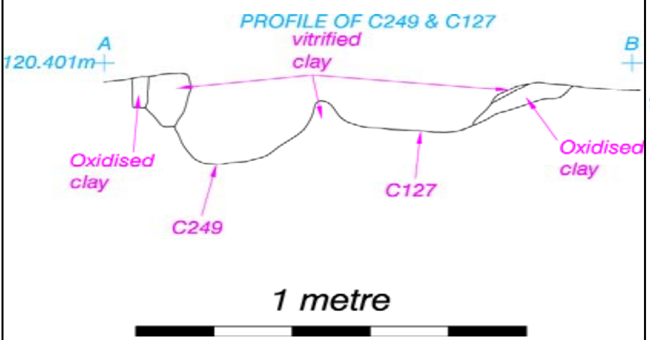
FEATURE	SAMPLE	CONTEXT	ACS DESCRIPTION	SOIL COLOUR	MUNSELL NOTATION	SLAG	CHARCOAL	METALLURGICAL CERAMIC	METALLURGICAL CERAMIC DESCRIPTION	SOIL DESCRIPTION	MS (K)	SLAG DESCRIPTION	LARGE SLAG WEIGHT (g)	COARSE SLAG WEIGHT (g)	TOTAL SLAG WEIGHT (g)	FINE MATERIAL <1MM SEPARATED FROM SLAG WEIGHT (g)
126	242	326	Soil from c326 a fill of c126, a bowl furnace. 6 bags.	grey	10YR 5/1	1.5	2.5	1	heated clay	lumpy soil,few stones	7190					
126	323	326	Charcoal from c326 a fill of c126, a bowl furnace. 2 bags.								44					
126	324	326	Slag from c326 a fill of c126, a bowl furnace.								-	several frgts dense amorphous slag & 2 x met. ceramics	330	60	390	10

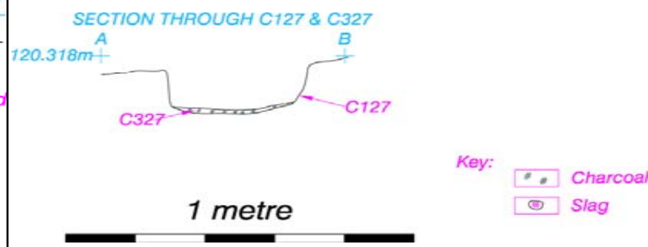
XRF Data

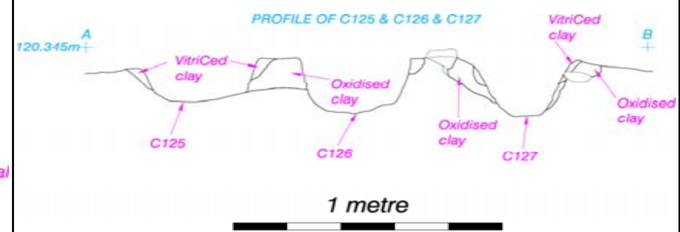
FEATURE	CONTEXT	SAMPLE	Pb	Sn	Sb	Sr	Rb	As	Zn	Cu	Ni	Fe	Mn	Cr	V	Ti	Ca	K
CONTROL	**CONTROL**	**CONTROL**	**25.63**	**0.00**	**0.00**	**19.02**	**48.77**	**0.00**	**47.80**	**0.00**	**0.00**	**12779.60**	**960.82**	**0.00**	**0.00**	**2212.76**	**2352.10**	**9958.88**
126	326	**242**	17.06	0.00	0.00	24.55	41.95	0.00	38.38	0.00	0.00	20588.60	3195.37	0.00	38.31	1757.32	8290.69	7552.71

F126
No of contexts: 1
Total amount of slag: 400g
Max MS (soil): 7190K for C326/S242; an exceptionally high K value for a non-ferrugenous soil; it may be justified by the presence of a slag sample.
Chemical composition: no correlation with any of the two suites of elements

F127



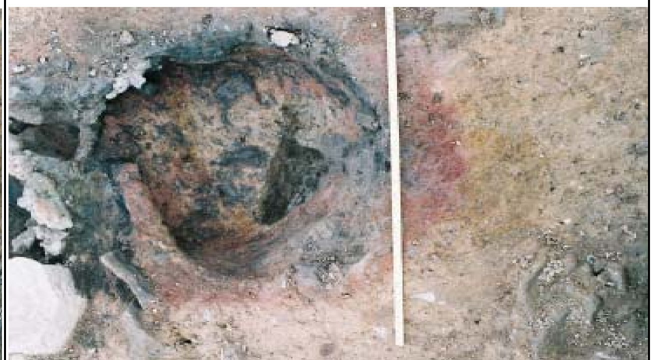
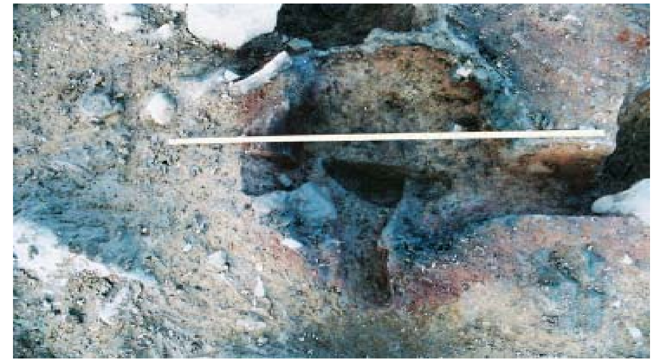




Mid ex from E F125, 126, 127, 299

Mid ex from SW F125, 126, 127, 299

Mid ex from W F127, 299

<table>
<tr><td></td><td></td><td></td></tr>
<tr><td>Mid ex from S F127, 299</td><td>Mid ex from S</td><td>Profile from S</td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td>Mid ex</td><td>Mid ex</td><td>Profile from S F127, 299</td></tr>
</table>

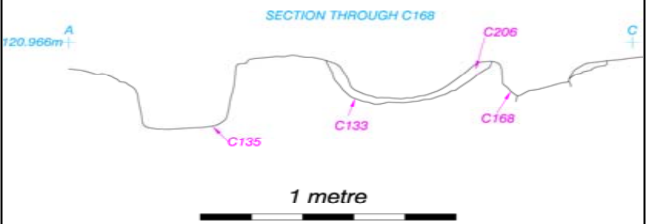
FEATURE	SAMPLE	CONTEXT	ACS DESCRIPTION	SOIL COLOUR	MUNSELL NOTATION	SLAG	CHARCOAL	METALLURGICAL CERAMIC	METALLURGICAL CERAMIC DESCRIPTION	SOIL DESCRIPTION	MS (K)	SLAG DESCRIPTION	LARGE SLAG WEIGHT (g)	TOTAL SLAG WEIGHT (g)	FINE MATERIAL <1MM SEPARATED FROM SLAG WEIGHT (g)
127	240	327	Slag from c327 a fill of c127, a bowl furnace.	greyish brown	10YR 5/2	0	1	2	heated clay	coarse lumpy soil	361	slag, small stones, soil	900	900	43
127	241	327	Charcoal from c327 a fill of c127, a bowl furnace.								1052				
127	477	329	Vitrified clay from c329 a fill of c127, a bowl furnace.	strong brown	7.5YR 5/6	0	0	2			2503				
127	486	597	Oxidised clay from c597 a fill of c127, a bowl furnace.	light brown	7.5YR 6/3	0	0	1	burnt partly sintered clay	lumpy soil, few stones	1281				
127	492	127	Slag from c127, a bowl furnace. 0.03 kilograms.								-	3 x frgts drippy/clinkery slag	25	25	

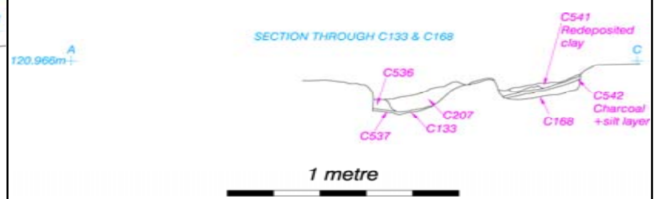
XRF Data

FEATURE	CONTEXT	SAMPLE	Pb	Sn	Sb	Sr	Rb	As	Zn	Cu	Ni	Fe	Mn	Cr	V	Ti	Ca	K
CONTROL	**CONTROL**	**CONTROL**	**25.63**	**0.00**	**0.00**	**19.02**	**48.77**	**0.00**	**47.01**	**0.00**	**0.00**	**12779.60**	**960.82**	**0.00**	**0.00**	**2212.76**	**2352.10**	**9958.88**
127	327	**240**	38.79	0.00	0.00	20.58	60.72	34.92	52.01	0.00	0.00	57205.21	6645.31	0.00	58.99	2040.14	6387.28	11309.87
127	597	**486**	47.72	0.00	0.00	19.41	41.59	0.00	0.00	0.00	0.00	11037.69	780.20	0.00	0.00	2563.29	2319.54	9967.31

F127
No of contexts: 4
Max MS (soil): 2503K associated with C329/S477
Total amount of slag: c. 1kg associated with C327
Chemical composition: no correlation with any of the two suites of elements

F133





Post ex F133, 168

Mid ex from S F133, 168

Mid ex from S

Mid ex from S showing from left to right F133 and F168

FEATURE	SAMPLE	CONTEXT	ACS DESCRIPTION	SOIL COLOUR	MUNSELL NOTATION	SLAG	CHARCOAL	METALLURGICAL CERAMIC	METALLURGICAL CERAMIC DESCRIPTION	SOIL DESCRIPTION	MS (K)	SLAG DESCRIPTION
133	88	170	Soil from c170 a fill of c133, a bowl furnace. 2 bags.	brown	7.5YR 5/4	0	1.5	1.5			893	
133	90	170	Slag from c170 a fill of c133, a bowl furnace.	greyish brown	10YR 5/2						-	6 x frgts amorphous slag <5cm
133	91	170	Charcoal from c170 a fill of c133, a bowl furnace.								35	
133	121	207	Soil and charcoal from c207 a fill of c133, a bowl furnace.	light brown	7.5YR 6/3	0	0	0		lumpy soil	1679	
133	395	207	Soil from c207 a fill of c133, a bowl furnace.	strong brown	7.5YR 5/6	0	0	0		lumpy soil	540	
133	396	536	Silt from c536 a fill of c133, a bowl furnace.	light brown	7.5YR 6/3	0	0	0		lumpy soil	322	
133	397	537	Charcoal from c537 a fill of c133, a bowl furnace.	strong brown	7.5YR 5/6	0	2	1		lumpy soil	705	
133	411	560	Soil from c560 a fill of c133, a bowl furnace.	greyish brown	10YR 5/2	0	0	2.5	large frgts sintered clay		370	
133	445	206	Soil from c206 a fill of c133, a bowl furnace.	reddish brown	2.5YR 4/4	0	0	0		lumpy soil	290	

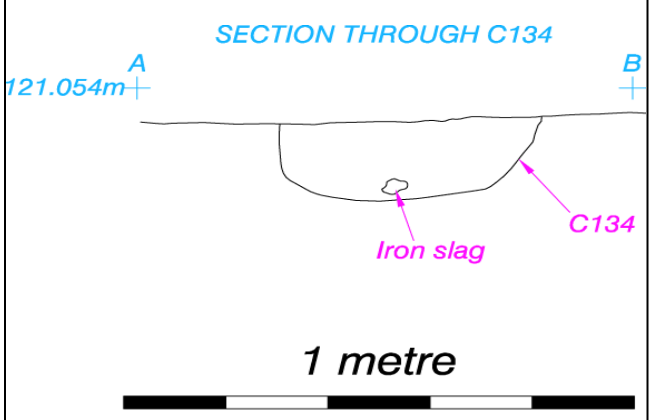
XRF Data

FEATURE	CONTEXT	SAMPLE	Pb	Sn	Sb	Sr	Rb	As	Zn	Cu	Ni	Fe	Mn	Cr	V	Ti	Ca	K
CONTROL	**CONTROL**	**CONTROL**	**25.63**	**0.00**	**0.00**	**19.02**	**48.77**	**0.00**	**47.80**	**0.00**	**0.00**	**12779.60**	**960.82**	**0.00**	**0.00**	**2212.76**	**2352.10**	**9958.88**
133	170	**88**	21.39	0.00	0.00	16.53	49.48	0.00	110.57	0.00	0.00	16779.34	1252.42	0.00	0.00	1909.68	2001.36	8614.95
133	207	**121**	23.50	0.00	0.00	16.66	45.37	0.00	163.29	0.00	0.00	15384.63	1179.85	0.00	0.00	1973.23	2149.00	8634.74
133	207	**395**	27.24	0.00	0.00	19.35	55.82	0.00	145.34	0.00	0.00	19654.25	1160.29	0.00	0.00	2000.35	2237.85	12991.69
133	536	**396**	35.25	0.00	0.00	20.65	62.15	0.00	186.05	0.00	0.00	20130.76	1193.93	0.00	39.80	2724.25	4624.52	14072.76
133	206	**445**	37.94	0.00	0.00	26.99	64.53	0.00	69.06	0.00	0.00	21742.91	1100.58	0.00	0.00	2722.95	2150.58	14024.65

F133

No of contexts: 4
Max MS (soil): 1679K associated with C207/S395
Total amount of slag: c. kg associated with C
Chemical composition: no correlation with any of the two suites of elements

F134




Pre ex from W


counter-clockwise from the bottom F135, 168, 134

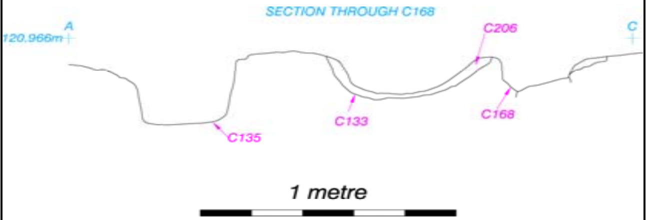
FEATURE	SAMPLE	CONTEXT	ACS DESCRIPTION	SOIL COLOUR	MUNSELL NOTATION	SLAG	CHARCOAL	METALLURGICAL CERAMIC	SOIL DESCRIPTION	MS (K)	SLAG DESCRIPTION	LARGE SLAG WEIGHT (g)	TOTAL SLAG WEIGHT (g)	FINE MATERIAL <1MM SEPARATED FROM SLAG WEIGHT (g)
134	63	162	Soil and Charcoal from c162 a fill of c134, a bowl furnace.	light brownish grey	10YR 6/2	0	1	0	fine lumpy soil	492				
134	64	162	Slag from c162 a fill of c134, a bowl furnace.							280	clinkery slag & fines	1035	1035	25
134	73	166	Slag from c166 a fill of c165, a pit beneath c134.							-	6 x frgts drippy/clinkery slag	185	185	15

XRF Data

FEATURE	CONTEXT	SAMPLE	Pb	Sn	Sb	Sr	Rb	As	Zn	Cu	Ni	Fe	Mn	Cr	V	Ti	Ca	K
CONTROL	**CONTROL**	**CONTROL**	**25.63**	**0.00**	**0.00**	**19.02**	**48.77**	**0.00**	**47.01**	**0.00**	**0.00**	**12779.60**	**960.82**	**0.00**	**0.00**	**2212.76**	**2352.10**	**9958.88**
134	162	**63**	25.63	0.00	0.00	22.66	49.19	24.78	43.44	0.00	0.00	20692.93	1330.21	0.00	36.87	2371.77	4029.93	9542.01

No of contexts: 2
Max MS (soil): 492 associated with C162/S63
Total amount of slag: c. 1300g
Chemical composition: no correlation with any of the two suites of elements

F135




Mid ex from S F133, 134, 135, 168


Mid ex from S F133, 134, 135, 168


Post ex from S


Mid ex from S


Mid ex from S

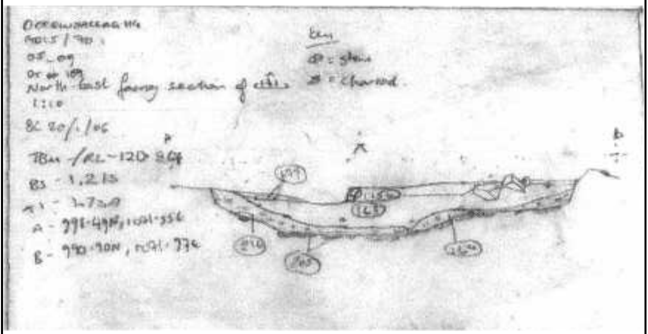
FEATURE	SAMPLE	CONTEXT	ACS DESCRIPTION	SOIL COLOUR	MUNSELL NOTATION	SLAG	CHARCOAL	METALLURGICAL CERAMIC	METALLURGICAL CERAMIC DESCRIPTION	SOIL DESCRIPTION	MS (K)	SLAG DESCRIPTION	LARGE SLAG WEIGHT (g)	COARSE SLAG WEIGHT (g)	TOTAL SLAG WEIGHT (g)	FINE MATERIAL <1MM SEPARATED FROM SLAG WEIGHT (g)
135	120	171	Soil and charcoal from c171 a fill of c135, a bowl furnace. 2 bags.	brown	10YR 5/3	1	1.5	0		fine lumpy soil, few stones	351					
135	153	171	Slag from c171 a fill of c135, a bowl furnace.								-	2x large pieces slag & clinkery slag & vitrified/sintered ceramics	3250	2625	5875	115
135	157	253	Soil from c253 a fill of c135, a bowl furnace.	strong brown	7.5YR 5/6	0	0	3	vitrified & sintered clay		245					4920
135	233	318	Oxidised clay from c318 a fill of c135, a bowl furnace. 2 bags.	light brown	7.5YR 6/3	0	0	2	burnt clay	lumpy soil, few stones	273					

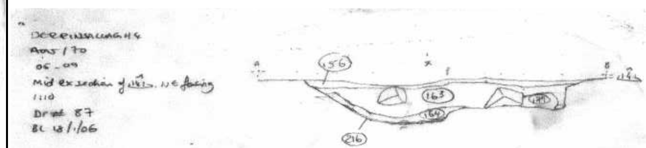
XRF Data

FEATURE	CONTEXT	SAMPLE	Pb	Sn	Sb	Sr	Rb	As	Zn	Cu	Ni	Fe	Mn	Cr	V	Ti	Ca	K
CONTROL	**CONTROL**	**CONTROL**	**25.63**	**0.00**	**0.00**	**19.02**	**48.77**	**0.00**	**47.80**	**0.00**	**0.00**	**12779.60**	**960.82**	**0.00**	**0.00**	**2212.76**	**2352.10**	**9958.88**
135	171	**120**	22.67	0.00	0.00	25.27	55.08	24.77	81.14	0.00	0.00	68955.76	9153.66	0.00	79.77	1862.61	15191.04	11050.65
135	318	**233**	24.78	0.00	0.00	17.05	66.25	0.00	37.50	0.00	0.00	17604.24	1328.80	0.00	0.00	1989.00	2335.97	10711.00

F135
No of contexts: 2
Max MS (soil): 351K associated with C171/S120
Total amount of slag: c. 5875g
Chemical composition: no correlation with any of the two suites of elements

F141





FEATURE	SAMPLE	CONTEXT	ACS DESCRIPTION	SOIL COLOUR	MUNSELL NOTATION	SLAG	CHARCOAL	METALLURGICAL CERAMIC	METALLURGICAL CERAMIC DESCRIPTION	SOIL DESCRIPTION	MS (K)
141	126	179	Soil and charcoal from c179 a fill of c141, a possible platform/pit.	brown	10YR 4/3	0	0	0		fine clay	698
141	61	164	Soil and Charcoal from c164 a fill of c141, a possible platform/pit.	dark brown	10YR 3/3	0	1	0		fine lumpy soil, some charcoal	75
141	54	156	Soil and Charcoal from c156 a fill of c141, a possible platform/pit. 3 bags.	greyish brown	10YR 5/2	0	0	1.5	burnt clay	coarse lumpy soil	421
141	60	163	Soil and Charcoal from c163 a fill of c141, a possible platform/pit. 3 bags.	greyish brown	10YR 5/2	0	0.5	0.5	sintered clay	lumpy soil, few stones	53
141	127	164	Soil and charcoal from c164 a fill of c141, a possible platform/pit.	greyish brown	10YR 5/2	0	0	0		fine clay, stones	286

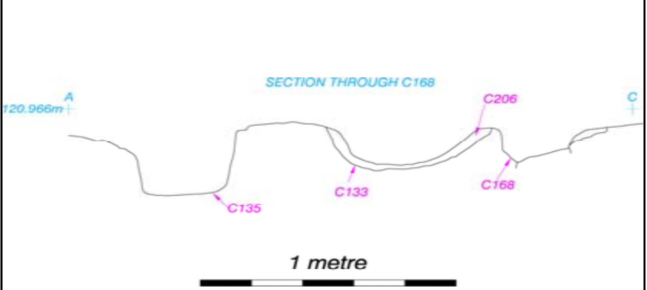
XRF Data

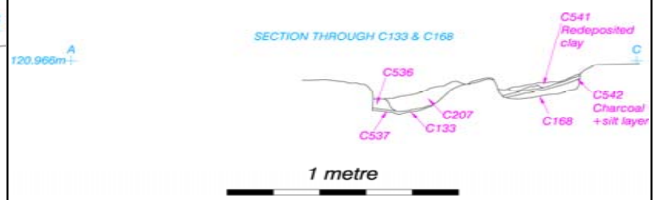
FEATURE	CONTEXT	SAMPLE	Pb	Sn	Sb	Sr	Rb	As	Zn	Cu	Ni	Fe	Mn	Cr	V	Ti	Ca	K
CONTROL	**CONTROL**	**CONTROL**	**25.63**	**0.00**	**0.00**	**19.02**	**48.77**	**0.00**	**47.80**	**0.00**	**0.00**	**12779.60**	**960.82**	**0.00**	**0.00**	**2212.76**	**2352.10**	**9958.88**
141	156	**54**	20.19	0.00	0.00	19.95	52.66	0.00	59.02	35.66	0.00	11803.07	1413.68	0.00	0.00	2338.01	3466.09	10239.55
141	163	**60**	14.69	0.00	0.00	22.75	48.93	0.00	60.20	41.68	0.00	11842.32	1613.39	0.00	0.00	2187.85	3610.90	9836.92
141	164	**61**	18.82	0.00	0.00	21.68	51.27	0.00	90.02	66.42	0.00	15304.20	2274.52	0.00	0.00	2303.79	6117.91	9737.83
141	179	**126**	24.58	0.00	0.00	22.97	36.46	0.00	83.47	0.00	0.00	17827.54	1219.83	0.00	38.23	2585.61	5768.71	10525.02
141	164	**127**	21.54	0.00	0.00	21.30	50.38	0.00	71.54	70.76	0.00	14512.83	2313.71	0.00	0.00	2671.23	6099.17	11189.38

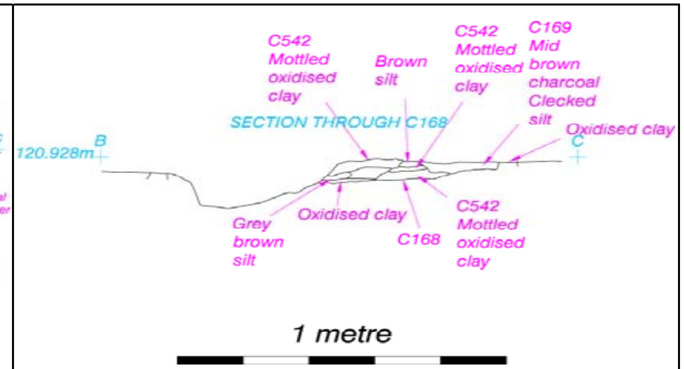
F141

No of contexts: 4
Max MS (soil): 698K associated with C179/S126
Total amount of slag: N/A
Chemical composition: the Fe/Mn/As/Ca suite – no contexts
the Cu/Zn suite for C156, C163, C164

F168







Mid ex from S : from left to right : F133, 168, 134 (to the north)

Mid ex from S : from left to right : F135, 133, 168, 134 (to the north)

Mid ex from S: from left to right, F133, 168; superficial lining of F133 with clay that has vitrified in situ

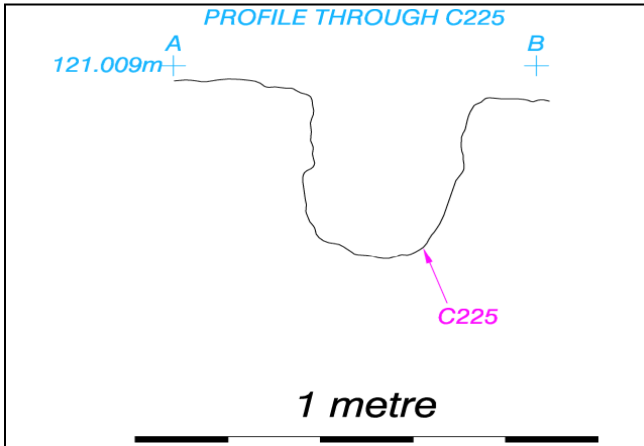
FEATURE	SAMPLE	CONTEXT	ACS DESCRIPTION	SOIL COLOUR	MUNSELL NOTATION	SLAG	CHARCOAL	METALLURGICAL CERAMIC	METALLURGICAL CERAMIC DESCRIPTION	SOIL DESCRIPTION	MS (K)
168	71	169	Soil and Charcoal from c169, a fill of c168, a pit/posthole. 2 bags.	light brown	7.5YR 6/3	0	2	1.5	sintered clay	lumpy soil	212
168	386	524	Soil from c524 a fill of c168, a pit of unknown function.	strong brown	7.5YR 5/8	1	1.5	2.5	heated clay lumps	fine soil	523
168	444	586	Soil from c586 a fill of c168, a pit.	strong brown	7.5YR 5/6	0	0	0.5		coarse lumpy soil	110
168	401	542	soil from c542 a fill of c168, a pit	light brown	7.5YR 6/3	0	2	1	burnt clay	lumpy soil	286

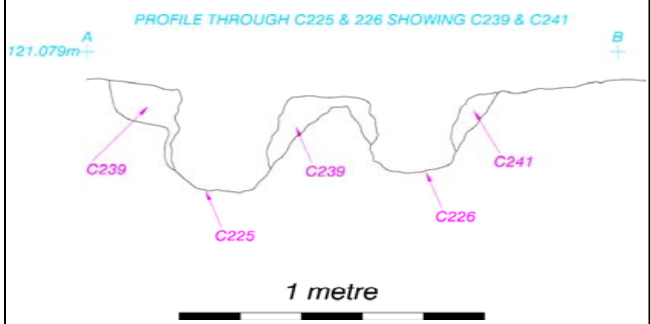
XRF Data

FEATURE	CONTEXT	SAMPLE	Pb	Sn	Sb	Sr	Rb	As	Zn	Cu	Ni	Fe	Mn	Cr	V	Ti	Ca	K
CONTROL	**CONTROL**	**CONTROL**	**25.63**	**0.00**	**0.00**	**19.02**	**48.77**	**0.00**	**47.80**	**0.00**	**0.00**	**12779.60**	**960.82**	**0.00**	**0.00**	**2212.76**	**2352.10**	**9958.88**
168	169	**71**	20.92	0.00	0.00	21.58	53.12	0.00	78.25	0.00	0.00	13463.74	985.71	0.00	0.00	2068.13	2199.06	9807.06
168	524	**386**	15.03	0.00	0.00	17.78	33.94	0.00	40.89	0.00	0.00	11799.55	653.74	0.00	0.00	1075.99	1129.81	4896.20
168	542	**401**	22.29	0.00	0.00	18.74	50.71	0.00	81.31	0.00	0.00	14908.08	929.75	0.00	33.18	2117.28	4437.52	10702.62
168	586	**444**	22.33	0.00	0.00	20.13	58.50	0.00	32.56	0.00	0.00	14093.81	477.41	0.00	51.82	2574.42	1979.71	15252.12

F168
No of contexts: 3
Max MS (soil): 523K associated with C524/S386
Total amount of slag: N/A.
Chemical composition: no correlation with any of the two suites of elements

F225





S facing profile F225, 226

Post ex from E F225, 226

S facing section

Post ex from N

S facing section

Post ex F225, 226

S facing profile F225, 226

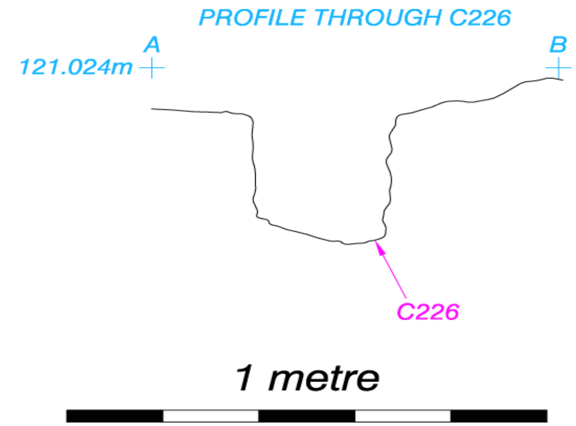
FEATURE	SAMPLE	CONTEXT	ACS DESCRIPTION	SOIL COLOUR	MUNSELL NOTATION	SLAG	CHARCOAL	METALLURGICAL CERAMIC	SOIL DESCRIPTION	MS (K)	SLAG DESCRIPTION	LARGE SLAG WEIGHT (g)	TOTAL SLAG WEIGHT (g)	FINE MATERIAL <1MM SEPARATED FROM SLAG WEIGHT (g)
225	154	240	Soil from c240 a fill of c225, a bowl furnace	very dark brown	7.5YR 2.5/2	0	0	0		2466				
225	169	270	Slag and soil from c270 a fill of c225, a bowl furnace							1376	amorphous slag & fines	350	350	45
225	261	239	Oxidised soil from c239 a fill of c225, a bowl furnace	strong brown	7.5YR 5/6	0	0	0	lumpy soil	508				
225	263	270	Vitrified clay from c270 a fill of c225, a bowl furnace							456	large frgt furnace wall with curvature	2600	2600	150

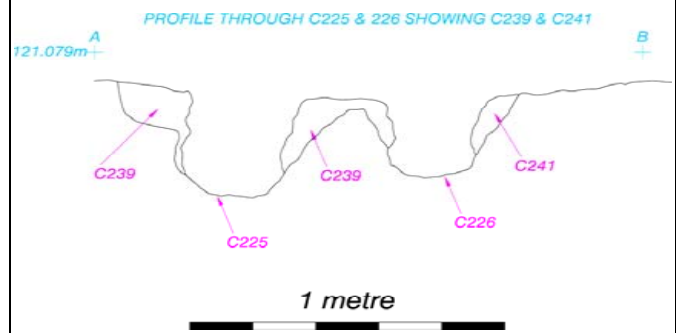
XRF Data

FEATURE	CONTEXT	SAMPLE	Pb	Sn	Sb	Sr	Rb	As	Zn	Cu	Ni	Fe	Mn	Cr	V	Ti	Ca	K
CONTROL	**CONTROL**	**CONTROL**	**25.63**	**0.00**	**0.00**	**19.02**	**48.77**	**0.00**	**47.80**	**0.00**	**0.00**	**12779.60**	**960.82**	**0.00**	**0.00**	**2212.76**	**2352.10**	**9958.88**
225	240	**154**	0.00	0.00	0.00	13.89	28.14	111.97	0.00	0.00	662.23	335226.65	49417.55	0.00	128.03	1755.03	7653.76	8062.95
225	270	**169**	0.00	0.00	0.00	0.00	23.96	32.87	167.99	0.00	199.51	134742.84	25819.42	0.00	39.10	646.06	1765.04	1565.58
225	239	**261**	22.47	0.00	0.00	24.77	54.42	0.00	31.05	0.00	0.00	15689.29	572.56	0.00	0.00	1840.82	1397.40	8542.19
225	270	**263**	32.21	0.00	0.00	15.27	44.76	0.00	50.43	0.00	0.00	21870.88	2772.18	0.00	38.15	2167.85	2500.36	9914.32

F225
No of contexts: 3
Max MS (soil): 523K associated with C524/S386
Total amount of slag: 3000g associated with C270/S263
Chemical composition: Fe/AS/Mn/Ca for contexts C240/S154 and C270/S169; Zn associated with C270/S169

F226





S facing profile F225, 226

Post ex from E F225, 226

Post ex from N

		
S facing section	S facing profile F225, 226	Post ex from S

FEATURE	SAMPLE	CONTEXT	ACS DESCRIPTION	SOIL COLOUR	MUNSELL NOTATION	SLAG	CHARCOAL	METALLURGICAL CERAMIC	SOIL DESCRIPTION	MS (K)	SLAG DESCRIPTION	LARGE SLAG WEIGHT (g)	COARSE SLAG WEIGHT (g)	TOTAL SLAG WEIGHT (g)	FINE MATERIAL <1MM SEPARATED FROM SLAG WEIGHT (g)
226	155	242	Soil from c242 a fill of c226, a bowl furnace	strong brown	7.5YR 5/6	0	0	1	lumpy soil	2441					
226	170	271	Slag and soil from c271 a fill of c226, a bowl furnace							1234	coarse frgts slag, sintered clay, charcoal & soil	2360	2085	4445	1280
226	262	241	Oxidised soil from c241 a fill of c226, a bowl furnace	strong brown	7.5YR 5/6	0	0	0	lumpy soil	176					

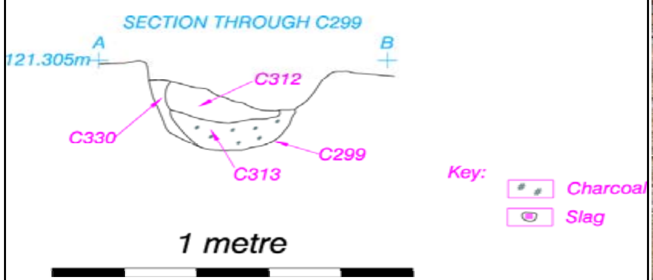
XRF Data

FEATURE	CONTEXT	SAMPLE	Pb	Sn	Sb	Sr	Rb	As	Zn	Cu	Ni	Fe	Mn	Cr	V	Ti	Ca	K
CONTROL	**CONTROL**	**CONTROL**	**25.63**	**0.00**	**0.00**	**19.02**	**48.77**	**0.00**	**47.80**	**0.00**	**0.00**	**12779.60**	**960.82**	**0.00**	**0.00**	**2212.76**	**2352.10**	**9958.88**
226	242	**155**	19.09	0.00	0.00	17.90	48.02	21.55	50.95	0.00	0.00	37811.53	6756.88	0.00	0.00	2044.33	3724.87	8954.81
226	271	**170**	26.70	0.00	0.00	19.97	27.73	33.72	41.68	37.64	121.38	72067.01	15796.68	0.00	74.70	1677.82	16124.64	8232.30
226	241	**262**	32.84	0.00	0.00	21.62	52.65	0.00	25.30	0.00	0.00	16062.93	933.81	0.00	0.00	2159.64	1859.08	10190.87

F226

No of contexts: 3
Max MS (soil): 2441K associated with C242/S155
Total amount of slag: 5730g associated with C271/S170
Chemical composition: some correlation of Cu with C271/S170

F299

		
	Mid ex showing vitrified clay	Mid ex showing vitrified clay
		
Mid ex from S showing vitrified clay on N side of feature	Mid ex from S showing vitrified clay on N side of feature	SE facing section

FEATURE	SAMPLE	CONTEXT	ACS DESCRIPTION	SOIL COLOUR	MUNSELL NOTATION	SLAG	CHARCOAL	METALLURGICAL CERAMIC	METALLURGICAL CERAMIC DESCRIPTION	SOIL DESCRIPTION	MS (K)	SLAG DESCRIPTION	LARGE SLAG WEIGHT (g)	COARSE SLAG WEIGHT (g)	TOTAL SLAG WEIGHT (g)	FINE MATERIAL <1MM SEPARATED FROM SLAG WEIGHT (g)
299	229	300	Soil from c300 a fill of c299, a bowl furnace associated with c127.	greyish brown	10YR 5/2	0	0	1.5	heated clay	lumpy soil	6046					
299	230	312	Soil from c312 a fill of c299, a bowl furnace associated with c127.	greyish brown	10YR 5/2	0	0.5	1		lumpy soil	666					
299	231	313	Soil from c313 a fill of c299, a bowl furnace associated with c127.	greyish brown	10YR 5/2	0	0	1		lumpy soil	1012					
299	232	313	Slag from c313 a fill of c299, a bowl furnace associated								1632	clinkery slag & fines	3350		3350	202
299	471	386	Oxidised clay from c386 a fill of c299, a bowl furnace.	strong brown	7.5YR 5/6	0	0	0		sterile lumpy soil	411					
299	476	314	Vitrified clay from c314 a fill of c299, a bowl furnace.	dark brown	10YR 3/3						147	1 x large furnace bottom 25cm, 1 x small cake like, coarse: many small frgts & fines	1950	300	2250	150
299	479	600	Vitrified clay from c600 a fill of c299, a bowl furnace.	light brown	7.5YR 6/3	0	0	0		fine lumpy soil, stones	534					
299	482	314	vitrified clay *** NOT MISSING***	light brown	7.5YR 6/3	0	0	1.5		lumpy soil, clay & stones	459					
299	483	601	Vitrified clay from c601 a fill of c299, a bowl furnace.	greyish brown	10YR 5/2	0	0.5	0		lumpy soil	170					
299	485	312	Slag from c312 a fill of c299, a bowl furnace. 0.075 kilograms. **not slag??**	strong brown	7.5YR 5/6	0	0.5	1	heated clay	lumpy soil	1325					
299	487	598	Vitrified clay from c598 a fill of c299, a bowl furnace.								193	large frgt slag, coarse frgts, sintered clay & fines	1460	130	1590	10
299	488	313	Slag from c313 a fill of c299, a bowl furnace. 0.966 kilograms.								301	lge pieces slag, sintered & vitrified clay & fines	570	320	890	81
299	490	313	Soil from c313 a fill of c299, a bowl furnace.	strong brown	7.5YR 5/8	0	0	0		coarse lumpy clay	212					
299	491	313	Soil from c313 a fill of c299, a bowl furnace.	strong brown	7.5YR 5/8	0	2	0		fine lumpy clay	315					
299	494	602	Soil from c602 a fill of c299, a bowl furnace.	strong brown	7.5YR 5/8	0	1	2		fine lumpy clay	712					

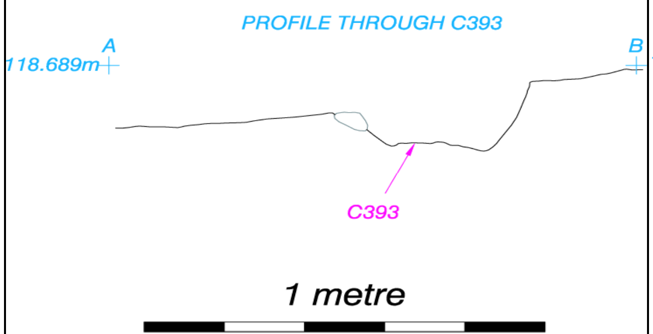
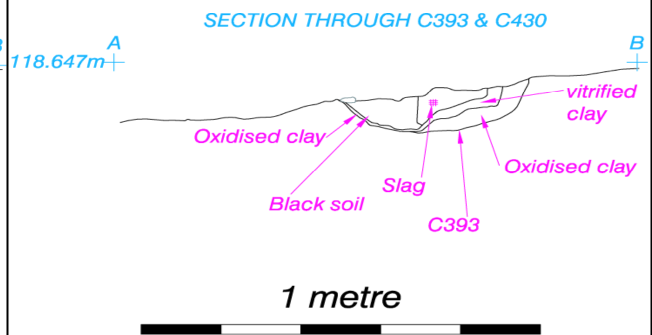
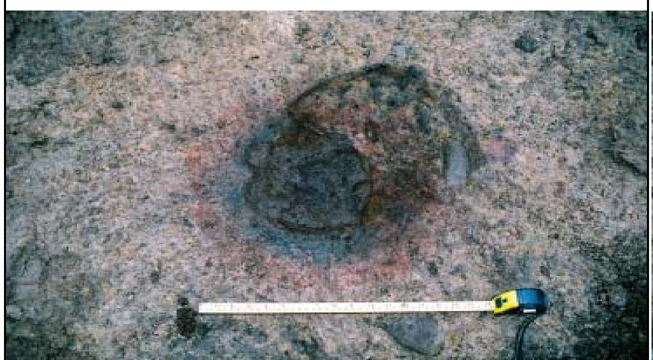
XRF Data

FEATURE	CONTEXT	SAMPLE	Pb	Sn	Sb	Sr	Rb	As	Zn	Cu	Ni	Fe	Mn	Cr	V	Ti	Ca	K
CONTROL	**CONTROL**	**CONTROL**	**25.63**	**0.00**	**0.00**	**19.02**	**48.77**	**0.00**	**47.80**	**0.00**	**0.00**	**12779.60**	**960.82**	**0.00**	**0.00**	**2212.76**	**2352.10**	**9958.88**
299	300	**229**	16.66	0.00	0.00	18.69	43.17	0.00	0.00	0.00	0.00	20948.15	3230.64	0.00	0.00	1644.93	4317.38	6730.26
299	312	**230**	34.37	0.00	0.00	26.40	52.27	0.00	79.62	0.00	0.00	22052.72	1770.43	0.00	38.09	2309.53	2538.31	10560.10
299	313	**231**	20.28	0.00	0.00	17.65	36.80	14.07	29.77	0.00	0.00	28554.44	4334.52	0.00	0.00	2176.66	3202.91	9229.96
299	386	**471**	25.80	0.00	0.00	21.49	46.61	13.74	26.61	0.00	0.00	11996.09	628.88	0.00	34.41	2451.53	1613.22	9783.65
299	600	**479**	70.96	0.00	0.00	20.20	48.02	0.00	0.00	0.00	0.00	16679.84	1303.14	0.00	0.00	2511.45	2528.28	10134.86
299	314	**482**	19.11	0.00	0.00	15.25	42.10	0.00	43.20	0.00	0.00	12302.28	895.46	0.00	0.00	2660.52	2237.97	9595.39
299	601	**483**	19.14	0.00	0.00	16.46	37.14	0.00	0.00	0.00	0.00	20660.70	2424.72	0.00	0.00	2721.09	2655.50	7805.38

299	312	**485**	27.63	0.00	0.00	20.75	63.44	65.01	0.00	0.00	370.45	197703.95	48911.74	0.00	146.73	2691.96	5550.06	17499.61
299	313	**490**	36.38	0.00	0.00	21.12	42.13	0.00	46.42	0.00	0.00	26996.57	4433.64	0.00	44.26	1906.68	2204.37	7553.68
299	313	**491**	51.21	0.00	0.00	23.08	49.50	0.00	61.55	0.00	0.00	24873.34	4943.55	0.00	76.79	2261.03	8165.05	10184.40
299	602	**494**	52.27	0.00	0.00	20.78	60.31	15.29	154.10	0.00	0.00	19596.07	1016.16	0.00	36.97	2560.49	2163.45	12481.32

F299
No of contexts: 9
Max MS (soil): 6000Kvariation within soils from the same content; MS max value for context: C330/300 (c. 6000)
Total amount of slag: c. 13040g associated with C313, C314, C598
Chemical composition: no correlation with any suite of either elements

F393

		
		Pre ex from SW
		
Mid ex from W	Mid ex from W after removal of C555 (slag)	E facing section

		
E facing section	**Post ex from E**	

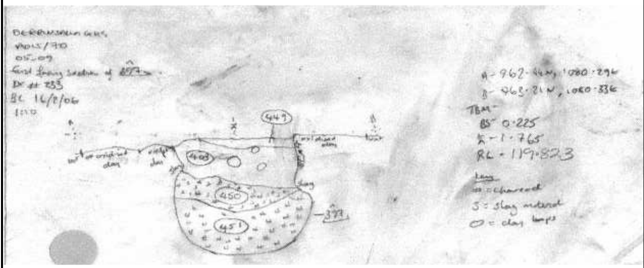
FEATURE	SAMPLE	CONTEXT	ACS DESCRIPTION	SOIL COLOUR	MUNSELL NOTATION	SLAG	CHARCOAL	METALLURGICAL CERAMIC	METALLURGICAL CERAMIC DESCRIPTION	SOIL DESCRIPTION	MS (K)	SLAG DESCRIPTION	LARGE SLAG WEIGHT (g)	COARSE SLAG WEIGHT (g)	TOTAL SLAG WEIGHT (g)	MATERIAL <1MM SEPARATED FROM SLAG WEIGHT (g)
393	292	430	soil from c430 a fill of c393, a bowl furnace	brown	10YR 4/3	0	0	0		lumpy soil	8190					
393	406	555	Vitrified clay c555 a fill of c393, a bowl furnace.	light brown	7.5YR 6/3	0	0	1	burnt clay	lumpy soil	310					
393	407	556	Oxidised clay from c556 a fill of c393, a bowl furnace.	strong brown	7.5YR 5/6	0	0	3	burnt clay	lumpy soil	184					
393	293	430	Slag from c430 a fill of c393, a bowl furnace								330	frgts slag, orange-	1800		1800	25

XRF Data

FEATURE	CONTEXT	SAMPLE	Pb	Sn	Sb	Sr	Rb	As	Zn	Cu	Ni	Fe	Mn	Cr	V	Ti	Ca	K
CONTROL	**CONTROL**	**CONTROL**	**25.63**	**0.00**	**0.00**	**19.02**	**48.77**	**0.00**	**47.80**	**0.00**	**0.00**	**12779.60**	**960.82**	**0.00**	**0.00**	**2212.76**	**2352.10**	**9958.88**
393	430	**292**	37.36	0.00	0.00	23.42	46.68	0.00	0.00	0.00	438.82	433682.63	29282.13	0.00	0.00	1098.16	4712.80	4037.09
393	555	**406**	52.57	0.00	0.00	22.02	81.55	0.00	92.19	0.00	0.00	29416.25	1320.57	0.00	38.99	2535.95	2302.27	14357.33
393	556	**407**	28.55	0.00	0.00	20.90	74.92	0.00	0.00	0.00	0.00	23061.94	949.75	0.00	0.00	2690.86	3288.57	16231.83

No of contexts: 3
Maximum MS (soil): 8190K, associated with C430/S292
Total amount of slag: 1800g, associated with C430/S293
Chemical composition: the Fe/Mn/As/Ca suite, C430/S292
the Cu/Zn suite - no contexts, although C406/S555 has high Zn

F397



		
Pre ex from SW	**Pre ex from NW F397, 398, 399, 400**	**Mid ex showing slag deposit from W**

		
Mid ex section showing slag from E	Mid ex section showing slag from W	Mid ex after removal of C452 from E

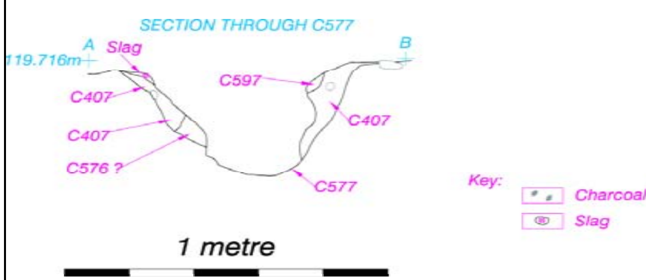
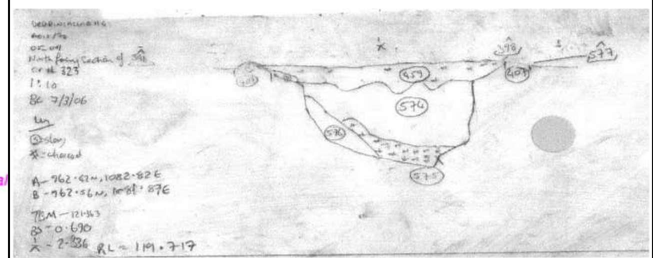
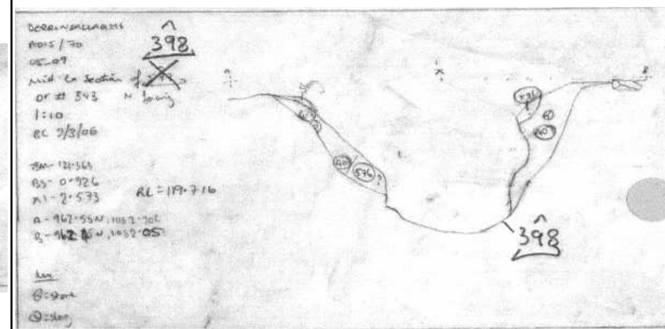
FEATURE	SAMPLE	CONTEXT	ACS DESCRIPTION	SOIL COLOUR	MUNSELL NOTATION	SLAG	CHARCOAL	METALLURGICAL CERAMIC	METALLURGICAL CERAMIC DESCRIPTION	SOIL DESCRIPTION	MS (K)	SLAG DESCRIPTION	LARGE SLAG WEIGHT (g)	COARSE SLAG WEIGHT (g)	TOTAL SLAG WEIGHT (g)	FINE MATERIAL <1MM SEPARATED FROM SLAG WEIGHT (g)
397	341	402	Soil from c402 a fill of c397, a bowl furnace	dark brown	10YR 3/3	0	0	0.5		lumpy soil	1850					
397	309	451	Soil from c451 a fill of c397, a bowl furnace.	dark greyish brown	10YR 4/2	1	1.5	0		coarse lumpy soil	252					
397	306	449	Soil from c449 a fill of c397, a bowl furnace.	light brown	7.5YR 6/3	0	0	1.5	sintered clay	lumpy soil	583					
397	307	403	Oxidised clay from c403 a fill of c397, a bowl furnace.	light brown	7.5YR 6/4	0	0	1	sintered clay	lumpy soil	382					
397	308	450	Slag from c450 a fill of c397, a bowl furnace. 2 bags.								821	slag frgts of various sizes, fines	770	4810	5580	500
397	310	442	Slag from c442 a fill of c397, a bowl furnace.								-	large frgt slag, coarse frgts & fines	1000	25	1025	

XRF Data

FEATURE	CONTEXT	SAMPLE	Pb	Sn	Sb	Sr	Rb	As	Zn	Cu	Ni	Fe	Mn	Cr	V	Ti	Ca	K
CONTROL	**CONTROL**	**CONTROL**	**25.63**	**0.00**	**0.00**	**19.02**	**48.77**	**0.00**	**47.80**	**0.00**	**0.00**	**12779.60**	**960.82**	**0.00**	**0.00**	**2212.76**	**2352.10**	**9958.88**
397	449	**306**	18.07	0.00	0.00	13.94	52.94	0.00	81.25	0.00	0.00	16178.61	1506.67	0.00	0.00	1841.32	2143.12	7230.32
397	403	**307**	16.75	0.00	0.00	17.03	48.97	0.00	104.50	0.00	0.00	17825.14	1460.59	0.00	0.00	2219.98	2521.85	10218.23
397	451	**309**	27.06	0.00	0.00	35.29	42.97	0.00	103.34	0.00	0.00	52246.76	12354.91	0.00	107.17	1640.49	9951.98	6299.62
397	402	**341**	16.26	0.00	0.00	20.27	38.01	16.35	67.77	0.00	0.00	35062.79	8074.25	0.00	63.35	1834.79	3912.22	9007.60

No of contexts: 6
Maximum MS (soil): 1850K, associated with C402
Total amount of slag: 6605g
Chemical composition: the Fe/Mn/As/Ca suite – no contexts
the Cu/Zn suite – no contexts, although all contexts have high Zn

F398

		
F577 = 398		
		
Pre ex from NW F397, 398, 399, 400	Pre ex from S	Mid ex from N

		
Mid ex from N	**Mid ex from N**	**Mid ex from N showing extent of C575**
		
Mid ex from N showing oxidised clay C407 and 576	**Post ex from S**	**Post ex from S**

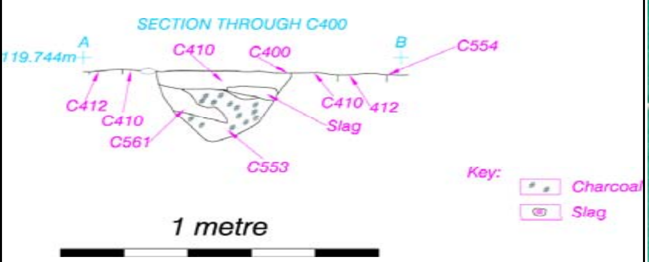
FEATURE	SAMPLE	CONTEXT	ACS DESCRIPTION	SOIL COLOUR	MUNSELL NOTATION	SLAG	CHARCOAL	METALLURGICAL CERAMIC	METALLURGICAL CERAMIC DESCRIPTION	SOIL DESCRIPTION	MS (K)	SLAG DESCRIPTION	LARGE SLAG WEIGHT (g)	COARSE SLAG WEIGHT (g)	TOTAL SLAG WEIGHT (g)	FINE MATERIAL <1MM SEPARATED FROM SLAG WEIGHT (g)
398	437	459	Soil from c459 a fill of c398, a bowl furnace.	brown	10YR 4/3	2	2	0		friable fine lumpy soil	311					
398	440	575	Soil from c575 a fill of c398, a bowl furnace. 2 bags.	very dark brown	10YR 2/2	2	3	0		friable, lumpy clay	1111					
398	438	574	Soil from c574 a fill of c398, a bowl furnace.	light brown	7.5YR 6/4	0	0	2	heated clay	lumpy soil	2110					
398	439	574	Slag from c574 a fill of c398, a bowl furnace.	light brown	7.5YR 6/4	0	0	2	heated clay	lumpy soil	650	sintered/heated clay, coarse frgts & soil	2550	210	2760	120
398	442	576	Soil from c576 a fill of c398, a bowl furnace.	strong brown	7.5YR 5/6	0	0	0		lumpy soil	157					
398	457	576	Oxidised clay from c576 a fill of c398, a bowl furnace.	strong brown	7.5YR 5/6	0	0	0		lumpy soil	124					
398	441	575	Slag from c575 a fill of c398, a bowl furnace. 2 bags								1915	small frgts slag (some clinkery) & fines	2960	589	3549	90
398	454	407	Oxidised clay from c407 a fill of c398, a bowl furnace. 2 bags.								354					
398	455	585	oxidised clay (no other description - not on ACS sample list)	dark brown	10YR 3/3	0.5	2	1	sintered clay	lumpy soil	182					
398	456	407	Slag from c407 a fill of c398, a bowl furnace.								651	large frgt slag, coarse frgts & fines	1250	690	1940	90

XRF Data

FEATURE	CONTEXT	SAMPLE	Pb	Sn	Sb	Sr	Rb	As	Zn	Cu	Ni	Fe	Mn	Cr	V	Ti	Ca	K
CONTROL	**CONTROL**	**CONTROL**	**25.63**	**0.00**	**0.00**	**19.02**	**48.77**	**0.00**	**47.80**	**0.00**	**0.00**	**12779.60**	**960.82**	**0.00**	**0.00**	**2212.76**	**2352.10**	**9958.88**
398	459	**437**	15.31	0.00	0.00	15.88	43.00	0.00	32.28	0.00	0.00	12569.18	1246.08	0.00	29.06	1781.49	3645.74	7560.71
398	574	**439**	19.72	0.00	0.00	15.90	45.16	0.00	57.83	0.00	0.00	15134.23	808.36	0.00	19.25	2356.91	2260.18	11048.05
398	575	**440**	0.00	0.00	0.00	23.24	34.45	27.62	98.38	0.00	0.00	55258.31	16741.03	0.00	144.07	1914.80	15713.90	7973.66
398	575	**441**	25.13	0.00	0.00	23.22	61.04	17.32	58.86	0.00	0.00	17268.22	931.68	0.00	0.00	1768.43	1126.26	9040.52
398	576	**442**	24.01	0.00	0.00	22.72	66.46	11.83	70.45	0.00	0.00	20736.39	804.98	0.00	49.72	2613.18	2340.85	15229.84
398	407	**454**	29.75	0.00	0.00	18.03	49.05	0.00	25.06	0.00	0.00	12967.47	439.25	0.00	0.00	2449.80	1818.25	11064.50
398	576	**457**	24.36	0.00	0.00	21.12	49.95	0.00	38.26	0.00	0.00	13983.12	737.50	0.00	0.00	2402.43	1806.83	12578.82
398	585	**455**	28.12	0.00	0.00	17.79	34.55	0.00	85.77	0.00	0.00	18284.08	601.23	0.00	0.00	2791.56	1645.47	10571.65

No of contexts: 7
Maximum MS (soil): 2110K, associated with C574/S439
Total amount of slag: 8249g
Chemical composition: the Fe/Mn/As/Ca suite – no contexts
the Cu/Zn suite – no contexts

F400

<table>
<tr><td></td><td></td><td></td></tr>
<tr><td></td><td>Pre ex from NW F397, 398, 399, 400</td><td>Pre ex from S</td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td>Mid ex from S</td><td>Mid ex showing slag on N side from S</td><td>Mid ex showing slag on N side from N</td></tr>
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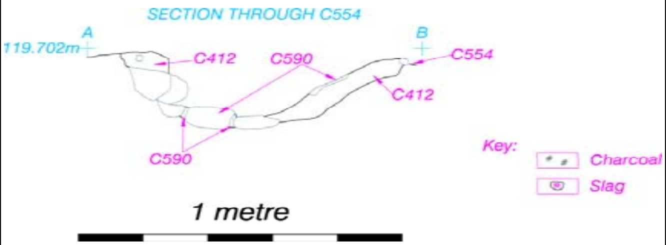
S facing section showing oxidised clay C412	**S facing section showing oxidised clay C412**	**Post ex showing lining**
		
Post ex showing lining		**F554 – cancelled as duplicate for F400**

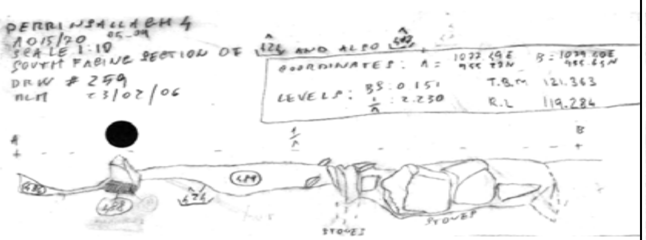
FEATURE	SAMPLE	CONTEXT	ACS DESCRIPTION	SOIL COLOUR	MUNSELL NOTATION	SLAG	CHARCOAL	METALLURGICAL CERAMIC	METALLURGICAL CERAMIC DESCRIPTION	SOIL DESCRIPTION	MS (K)	SLAG DESCRIPTION	LARGE SLAG WEIGHT (g)	COARSE SLAG WEIGHT (g)	TOTAL SLAG WEIGHT (g)	FINE MATERIAL <1MM SEPARATED FROM SLAG WEIGHT (g)
400	414	553	Soil from c553 a fill of c400, a bowl furnace. 2.2 kilograms.	dark brown	10YR 3/3	0	0	0			1280					
400	465	410	Vitrified clay from c410 a fill of c400, a bowl furnace.	greyish brown	10YR 5/2	1.5	0	1	partly vitrified clay	lumpy soil	265					
400	469	412	Oxidised clay from c412 a fill of c400, a bowl furnace.	light brown	7.5YR 6/4	0	0	1	heated clay	lumpy soil, few stones	250					
400	412	409	Oxidised clay from c409 a fill of c400, a bowl furnace.	strong brown	7.5YR 5/6	0	0	0			1623					
400	416	410	Vitrified clay from c410 a fill of c400, a bowl furnace.	strong brown	7.5YR 5/6	0	0	1.5	heated clay	lumpy soil	260	1 x frgt furnace bottom, 20cm long axis	1600		1600	
400	413	409	Slag from c409 a fill of c400, a bowl furnace. 0.32 kilograms.								-	frgts of slag/clay <5cm & fines	271		271	25
400	415	553	Slag from c553 a fill of c400, a bowl furnace.								-	clinkery slag & fines	1900		1900	100
400	464	553	Soil from c553 a fill of c400, a bowl furnace.								sample missing					
400	466	561	Slag from c561 a fill of c400, a bowl furnace.								-	sample missing				

XRF Data

FEATURE	CONTEXT	SAMPLE	Pb	Sn	Sb	Sr	Rb	As	Zn	Cu	Ni	Fe	Mn	Cr	V	Ti	Ca	K
CONTROL	**CONTROL**	**CONTROL**	**25.63**	**0.00**	**0.00**	**19.02**	**48.77**	**0.00**	**47.80**	**0.00**	**0.00**	**12779.60**	**960.82**	**0.00**	**0.00**	**2212.76**	**2352.10**	**9958.88**
400	409	**412**	29.77	0.00	0.00	22.60	47.15	0.00	157.64	0.00	0.00	15987.13	1116.07	0.00	55.56	2372.48	2107.03	10323.23
400	553	**414**	0.00	0.00	0.00	13.47	35.14	38.04	112.13	0.00	0.00	55620.20	12865.76	0.00	89.84	2513.72	4875.73	8204.06
400	410	**416**	0.00	0.00	0.00	24.01	37.39	0.00	30.85	0.00	0.00	10856.81	530.91	0.00	0.00	2365.09	2186.75	8518.23
400	410	**465**	21.25	0.00	0.00	17.81	41.78	16.11	69.07	0.00	0.00	13609.55	844.01	0.00	0.00	2034.57	1451.38	7001.14
400	412	**469**	38.37	0.00	0.00	13.87	46.88	0.00	52.67	0.00	0.00	12595.60	414.80	0.00	0.00	2333.18	1749.43	10303.35

No of contexts: 5
Maximum MS (soil): 1623K, associated with C409/S412
Total amount of slag: 3771g, associated mainly with C410 and C553
Chemical composition: the Fe/Mn/As/Ca suite – no contexts
the Cu/Zn suite – no contexts, although C553 and C409 have high Zn

F424



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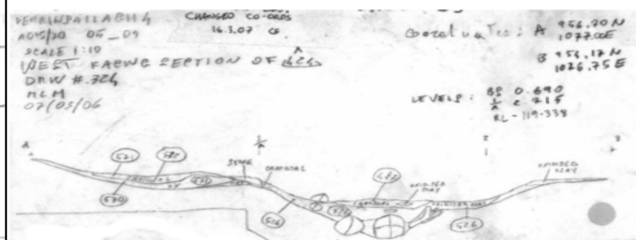
SOUTH FACING SECTION OF
DRW # 259
COORDINATES: A: 1077.59E
B: 1079.20E
LEVELS: BS: 0.151
T.B.M. 121.363
R.L 119.284
A
B
STONES



CHANGED CO-ORDS
16.3.07 CF.
SCALE 1:10
WEST FACING SECTION OF
DRW #.326
MCM
07/05/06
A 956.70N
1077.00E
B 956.17N
1026.75E
LEVELS: BS 0.690
RL - 119.338
A
570
526

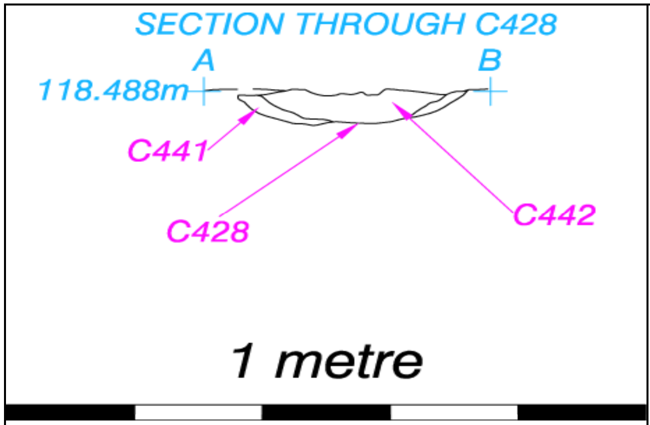
FEATURE	SAMPLE	CONTEXT	ACS DESCRIPTION	SOIL COLOUR	MUNSELL NOTATION	SLAG	CHARCOAL	METALLURGICAL CERAMIC	METALLURGICAL CERAMIC DESCRIPTION	SOIL DESCRIPTION	MS (K)	SLAG DESCRIPTION	LARGE SLAG WEIGHT (g)	COARSE SLAG WEIGHT (g)	TOTAL SLAG WEIGHT (g)	FINE MATERIAL <1MM SEPARATED FROM SLAG WEIGHT (g)
424	342	489	Oxidised clay from c489 a fill of c424, a pit.	brown	10YR 4/3	0	0	2	burnt clay	lumpy soil, few stones	91					
424	423	528	Soil from c528 a fill of c424, a hearth/charcoal kiln.	brown	10YR 4/3	0	0	1.5	heat affected clay	lumpy soil	136					
424	449	526	Oxidised clay from c526 a fill of c424, a hearth/charcoal kiln.	brown	10YR 4/3	0	1	0		lumpy soil	78					
424	345	489	Vitrified clay from c489 a fill of c424, a hearth/charcoal kiln.(NO - actually slag)	dark brown	10YR 3/3	0	0	2.5	sintered/vitrified clay	lumpy soil	4000					
424	339	489	Soil from c489 a fill of c424, a pit.	grey	10YR 5/1	0	0	1	burnt clay	lumpy soil	310					
424	426	490	Soil from c490 a fill of c424, a hearth/charcoal kiln.	greyish brown	10YR 5/2	0	0	1.5	traces of heated clay	lumpy soil	136	slag/heated clay, coarse slag <5cm & fines	1450	150	1600	70
424	427	487	Soil from c487 a fill of c424, a hearth/charcoal kiln.	greyish brown	10YR 5/2	0	1	0		lumpy soil	123					
424	431	571	soil/charcoal (no other description - not on ACS sample list)	greyish brown	10YR 5/2	0	0	0		fine lumpy soil	259					
424	346	489	Vitrified clay from c489 a fill of c424, a hearth/charcoal kiln.	light brown	7.5YR 6/3	0	0	1	heat affected clay	very small sample	4					
424	422	525	Soil from c525 a fill of c424, a hearth/charcoal kiln.	light brownish grey	10YR 6/2	0	1	0		lumpy soil	62					
424	343	488	Charcoal from c488 a fill of c424, a hearth/charcoal kiln.								52					
424	344	489	Charcoal from c489 a fill of c424, a hearth/charcoal kiln.								87					
424	347	486	Slag from c486 a fill of c424, a hearth/charcoal kiln.								-	1 x frgt drippy/clinkery slag	75		75	
424	434	528	Slag from c528 a fill of c424, a hearth/charcoal kiln.								-	2 x frags amorphous slag	30		30	
424	435	528	Charcoal from c528 a fill of c424, a hearth/charcoal kiln.								9					
424	448	576	Slag from c576 a fill of c424, a hearth/charcoal kiln.								-	1 single piece of slag				
424	450	487	Charcoal from c487 a fill of c424, a hearth/charcoal kiln.								22					

XRF Data

FEATURE	CONTEXT	SAMPLE	Pb	Sn	Sb	Sr	Rb	As	Zn	Cu	Ni	Fe	Mn	Cr	V	Ti	Ca	K
CONTROL	**CONTROL**	**CONTROL**	**25.63**	**0.00**	**0.00**	**19.02**	**48.77**	**0.00**	**47.80**	**0.00**	**0.00**	**12779.60**	**960.82**	**0.00**	**0.00**	**2212.76**	**2352.10**	**9958.88**
424	489	**339**	23.20	0.00	0.00	92.47	45.03	0.00	573.28	106.89	0.00	11222.71	4723.03	0.00	39.81	1613.02	17139.84	7151.14
424	489	**342**	24.52	0.00	0.00	44.87	59.68	0.00	285.93	0.00	0.00	15769.49	1744.89	0.00	33.04	1820.27	9199.93	9202.19
424	489	**346**	0.00	0.00	0.00	98.90	12.04	0.00	1822.26	153.13	0.00	5237.18	8203.90	0.00	71.58	999.47	37198.55	3618.97
424	525	**422**	17.39	0.00	0.00	33.64	43.72	0.00	268.86	0.00	0.00	10022.79	1547.84	0.00	0.00	1812.65	5812.61	7145.06
424	528	**423**	14.22	0.00	0.00	43.82	37.95	0.00	242.12	32.90	0.00	9599.27	1744.79	0.00	35.81	1866.89	10271.24	7814.99
424	490	**426**	25.44	0.00	0.00	32.51	52.69	0.00	242.26	0.00	0.00	13587.58	1696.80	0.00	51.14	2194.66	6542.58	11591.08
424	487	**427**	18.56	0.00	0.00	98.25	37.76	0.00	548.01	78.55	0.00	10016.98	2696.41	0.00	50.44	2039.84	26885.87	9194.28
424	571	**431 direct**	23.65	0.00	0.00	120.25	54.69	0.00	661.13	207.63	0.00	13463.47	4287.57	0.00	49.33	2059.83	25083.71	11621.62
424	571	**431**	19.36	0.00	0.00	103.34	43.92	0.00	509.93	188.02	0.00	10268.35	3313.17	0.00	36.11	1589.78	16020.52	7228.14
424	526	**449**	17.38	0.00	0.00	161.29	44.51	0.00	980.33	53.33	0.00	26599.86	3545.33	0.00	99.23	2068.01	30107.60	10333.08

F424
No of contexts: 7
Max MS (soils): 4000K associated with C489
Total amount of slag: 1705g associated with C490
Chemical composition: the Fe/Mn/As/Ca suite – no contexts
the Cu/Zn suite – C489, C528, C487, C571, C526

F428




Pre ex from E


Mid ex showing C439 from W


Mid ex from W


Post ex from E

FEATURE	SAMPLE	CONTEXT	ACS DESCRIPTION	SOIL COLOUR	MUNSELL NOTATION	SLAG	CHARCOAL	METALLURGICAL CERAMIC	SOIL DESCRIPTION	MS (K)	SLAG DESCRIPTION	LARGE SLAG WEIGHT (g)	TOTAL SLAG WEIGHT (g)
428	295	442	Soil from c442 a fill of c428, a bowl furnace.	dark brown-black	7.5YR 2/1	0	0	0	fine lumpy soil, friable/clayish	4131	1 x cake slag		
428	296	296	Soil from c296 a fill of c428, a bowl furnace.	dark brown	10YR 3/3	0	0	0	fine lumpy soil, friable	2374			
428	297	441	Slag from c441 a fill of c428, a bowl furnace.							-	1 x cake slag	205	205
428	315	441	Soil from c441 a fill of c428, a bowl furnace.	dark brown	10YR 3/3	0	0	0		4163			
428	316	442	Soil from c442 a fill of c428, a bowl furnace.	dark brown	10YR 3/3	0	0	0	fine lumpy soil, friable	3204			
428	317	461	Oxidised clay from c461 a fill of c428, a bowl furnace.							-			
428	318	442	Slag from c442 a fill of c428, a bowl furnace.							-	coarse frgts <5cm		

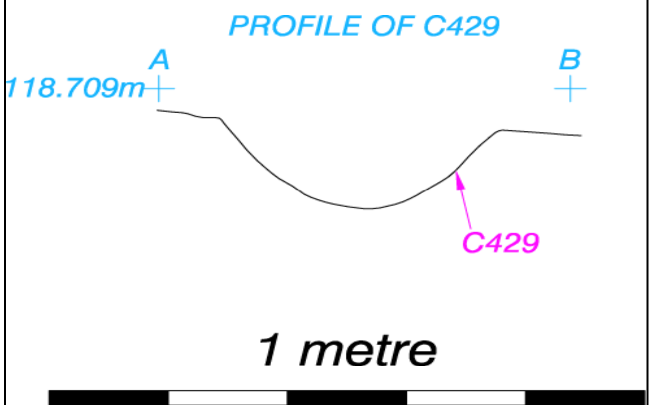
XRF Data

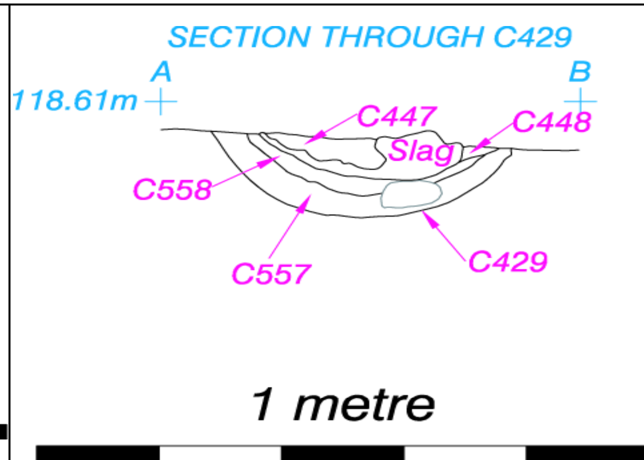
FEATURE	CONTEXT	SAMPLE	Pb	Sn	Sb	Sr	Rb	As	Zn	Cu	Ni	Fe	Mn	Cr	V	Ti	Ca	K
CONTROL	**CONTROL**	**CONTROL**	**25.63**	**0.00**	**0.00**	**19.02**	**48.77**	**0.00**	**47.80**	**0.00**	**0.00**	**12779.60**	**960.82**	**0.00**	**0.00**	**2212.76**	**2352.10**	**9958.88**
428	442	**295**	0.00	0.00	0.00	20.09	19.20	100.72	0.00	0.00	815.58	458837.59	59820.79	0.00	160.89	1803.69	11455.17	9260.91
428	296	**296**	0.00	0.00	0.00	16.95	27.31	168.12	0.00	0.00	823.63	677090.94	49382.46	0.00	143.93	1707.35	14861.80	9627.30
428	441	**315**	28.31	0.00	0.00	27.11	38.98	54.86	0.00	0.00	136.01	120813.27	20437.88	0.00	123.45	3041.72	12481.44	11204.39
428	442	**316**	0.00	0.00	0.00	26.99	32.50	105.98	0.00	0.00	695.15	399466.00	74428.55	0.00	194.95	2510.83	15085.22	8445.98

F428

No of Contexts: 3
Max MS (soils): 4136K associated with C442
Total amount of slag: 200g
Chemical composition: max correlation (i.e. all contexts) with Fe/Mn/As/Ca

F429





Post ex from W

Mid ex from W

Mid ex from W

Mid ex from W

FEATURE	SAMPLE	CONTEXT	ACS DESCRIPTION	SOIL COLOUR	MUNSELL NOTATION	SLAG	CHARCOAL	METALLURGICAL CERAMIC	SOIL DESCRIPTION	MS (K)	SLAG DESCRIPTION	LARGE SLAG WEIGHT (g)	COARSE SLAG WEIGHT (g)	TOTAL SLAG WEIGHT (g)	FINE MATERIAL <1MM SEPARATED FROM SLAG WEIGHT (g)
429	302	447	Soil from c447 a fill of c429, a bowl furnace.	greyish brown	10YR 5/2	1	0	0	fine lumpy soil	1587					
429	303	429	Slag from c429, a bowl furnace.							859	slag & vitrified clay	250		250	5
429	304	448	Soil from c448 a fill of c429, a bowl furnace.	grey brown	10YR 5/2	0	0	0	fine lumpy soil	211					
429	408	557	Oxidised clay from c557 a fill of c429, a bowl furnace.							111					
429	409	558	Vitrified clay from c558 a fill of c429, a bowl furnace.							230					
429	410	559	Vitrified clay from c559 a fill of c429, a bowl furnace.							1781	frgts vitrified & sintered clay amorphous slag & fines	1175	200	1375	75

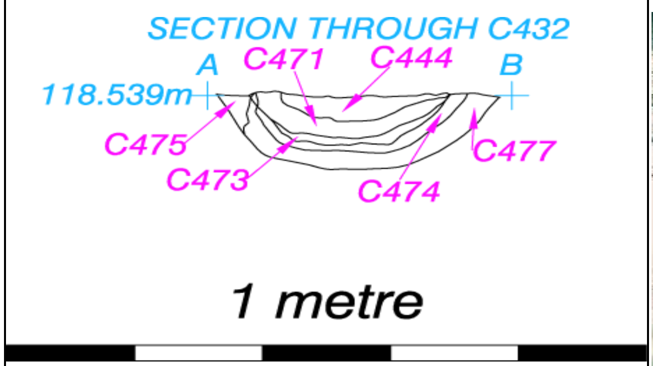
XRF Data

FEATURE	CONTEXT	SAMPLE	Pb	Sn	Sb	Sr	Rb	As	Zn	Cu	Ni	Fe	Mn	Cr	V	Ti	Ca	K
CONTROL	**CONTROL**	**CONTROL**	**25.63**	**0.00**	**0.00**	**19.02**	**48.77**	**0.00**	**47.80**	**0.00**	**0.00**	**12779.60**	**960.82**	**0.00**	**0.00**	**2212.76**	**2352.10**	**9958.88**
429	447	**302**	24.83	0.00	0.00	25.60	41.93	0.00	200.27	0.00	0.00	80040.64	4227.98	0.00	51.06	1764.70	5520.99	8497.54
429	448	**304**	46.95	0.00	0.00	18.77	44.33	0.00	209.71	0.00	0.00	13592.56	552.88	0.00	0.00	2536.64	2800.59	9040.84
429	557	**408**	33.61	0.00	0.00	23.17	53.38	0.00	75.85	0.00	0.00	16980.35	269.49	0.00	0.00	1528.90	1158.92	6666.77
429	558	**409**	24.01	0.00	0.00	22.02	34.89	0.00	115.85	0.00	0.00	14050.69	522.10	0.00	32.14	2342.11	1850.35	9549.03

F429

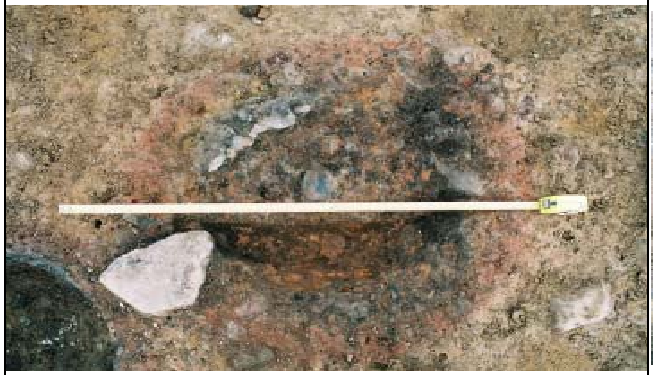
No of Contexts: 4
Max MS (soils): 1587K associated with C447/S302
Chemical composition: some correlation with Fe/As/Ca/Mn suite for C448/S304
Total amount of slag: 1700g associated with C559

F432



Pre ex from W

Mid ex from E before removal of vitrified clay



Mid ex from E before removal of slag

Mid ex from S after removal of slag

E facing sections F428, 432, 433

Post ex from E

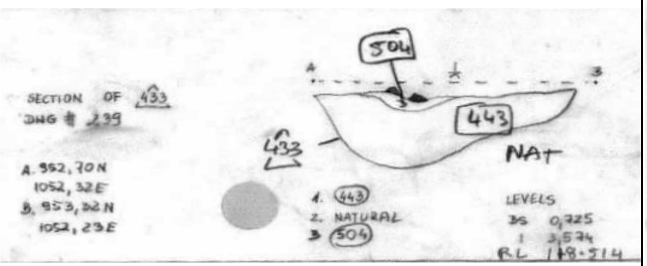
FEATURE	SAMPLE	CONTEXT	ACS DESCRIPTION	SOIL COLOUR	MUNSELL NOTATION	SLAG	CHARCOAL	METALLURGICAL CERAMIC	SOIL DESCRIPTION	MS (K)	SLAG DESCRIPTION	LARGE SLAG WEIGHT (g)	COARSE SLAG WEIGHT (g)	TOTAL SLAG WEIGHT (g)	FINE MATERIAL <1MM SEPARATED FROM SLAG WEIGHT (g)
432	300	444	Soil from c444 a fill of c432, a bowl furnace.	brown	10YR 4/3	0	0	0	fine lumpy soil, friable/clayish	5162					
432	325	473	Soil from c473 a fill of c432, a bowl furnace.	brown	10YR 4/3	0	0	0	fine lumpy soil, friable/clayish	499					
432	326	474	Vitrified clay from c474 a fill of c432, a bowl furnace. 2 bags.	strong brown	7.5YR 5/6	0	0	3	lumpy soil	1025	slag/vitrified clay, coarse slag <5cm & fines	2000	450	2450	70
432	327	477	Oxidized clay from c477 a fill of c432, a bowl furnace.	strong brown	7.5YR 5/6	0	0	3	lumpy soil	89					
432	301	444	Slag from c444 a fill of c432, a bowl furnace.							-	small frgts amorphous vitrified clay				
432	321	444	Soil from c444 a fill of c432, a bowl furnace.							sample missing					
432	322	471	Slag from c471 a fill of c432, a bowl furnace.							4722	2 x furnace bottom frgts 25cm & 20cm long axis coarse slag <5cm & fines	1800	130	1930	110
432	333	473	Slag from c473 a fill of c432, a bowl furnace.							-	heat affected clay & coarse/fine frgts	75		75	50

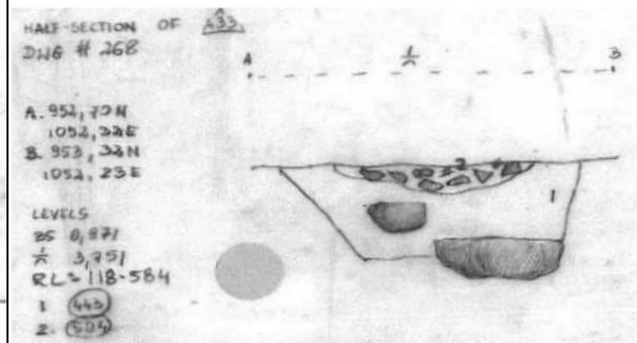
XRF Data

FEATURE	CONTEXT	SAMPLE	Pb	Sn	Sb	Sr	Rb	As	Zn	Cu	Ni	Fe	Mn	Cr	V	Ti	Ca	K
CONTROL	**CONTROL**	**CONTROL**	**25.63**	**0.00**	**0.00**	**19.02**	**48.77**	**0.00**	**47.80**	**0.00**	**0.00**	**12779.60**	**960.82**	**0.00**	**0.00**	**2212.76**	**2352.10**	**9958.88**
432	444	**300**	0.00	0.00	0.00	24.99	44.33	44.70	128.58	0.00	0.00	99905.05	6687.93	0.00	0.00	2263.86	7135.29	10794.62
432	444	**321**	17.38	0.00	0.00	21.40	58.09	0.00	58.14	0.00	0.00	16306.28	1847.33	0.00	36.66	2201.22	2595.17	9686.83
432	473	**325**	38.48	0.00	0.00	19.69	21.33	109.43	0.00	0.00	0.00	500026.59	20337.43	0.00	0.00	1701.83	8160.85	8303.69
432	474	**326**	0.00	0.00	0.00	17.65	36.14	16.66	83.27	0.00	0.00	31832.49	1161.55	0.00	0.00	2089.42	2705.21	8862.52
432	477	**327**	19.42	0.00	0.00	21.40	46.35	0.00	49.07	0.00	0.00	13948.60	729.58	0.00	0.00	1982.70	2167.18	10911.92

No of contexts: 4
Maximum MS (soil): 5169K, associated with C444/S300
Total amount of slag: 4455g, associated with C471 and C474
Chemical composition: the Fe/Mn/As/Ca suite for C473/S325
the Cu/Zn suite – no contexts, although C444/S300 has high Zn

F433





E facing sections F428, 432, 433

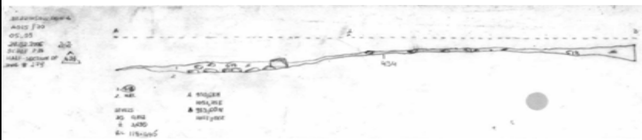
FEATURE	SAMPLE	CONTEXT	ACS DESCRIPTION	SOIL COLOUR	MUNSELL NOTATION	SLAG	CHARCOAL	METALLURGICAL CERAMIC	SOIL DESCRIPTION	MS (K)
433	299	443	Soil from c443 a fill of c433, a pit/archaeological spread. 3 bags.	light grey	10YR 7/1	0	0	0	lumpy soil, few stones	45
433	355	443	soil sample (no other description - not on ACS sample list)	light grey	10YR 7/1	0	0	0	fine lumpy soil	17
433	354	504	soil sample (no other description - not on ACS sample list)	grey	10YR 5/1	0	0	0	fine lumpy soil, few stones	51

XRF Data

FEATURE	CONTEXT	SAMPLE	Pb	Sn	Sb	Sr	Rb	As	Zn	Cu	Ni	Fe	Mn	Cr	V	Ti	Ca	K
CONTROL	**CONTROL**	**CONTROL**	**25.63**	**0.00**	**0.00**	**19.02**	**48.77**	**0.00**	**47.80**	**0.00**	**0.00**	**12779.60**	**960.82**	**0.00**	**0.00**	**2212.76**	**2352.10**	**9958.88**
433	443	**299**	25.71	0.00	0.00	18.49	40.87	22.92	35.87	0.00	137.51	91384.38	11551.52	0.00	30.99	1445.30	6227.35	6226.36
433	504	**354**	22.51	0.00	0.00	17.82	42.81	0.00	52.49	0.00	0.00	9579.78	266.89	0.00	0.00	2510.92	3451.80	8878.40
433	443	**355**	18.76	0.00	0.00	24.34	44.27	0.00	44.39	0.00	0.00	5708.78	0.00	0.00	0.00	2195.01	1946.68	7611.87

F433
No of Contexts: 2
Max MS (soils): 45K , no evidence for heating
Total amount of slag: N/A
Chemical composition: some correlation with Fe/As/Ca/Mn suite for C443/S299

F434

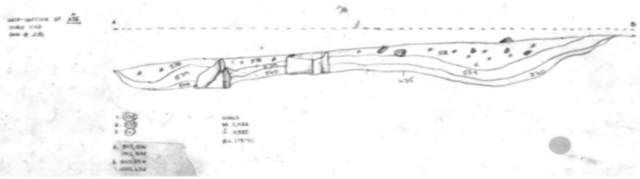
FEATURE	SAMPLE	CONTEXT	ACS DESCRIPTION	SOIL COLOUR	MUNSELL NOTATION	SLAG	CHARCOAL	METALLURGICAL CERAMIC	SOIL DESCRIPTION	MS (K)	SLAG DESCRIPTION	LARGE SLAG WEIGHT (g)	COARSE SLAG WEIGHT (g)	TOTAL SLAG WEIGHT (g)	FINE MATERIAL <1MM SEPARATED FROM SLAG WEIGHT (g)
434	384	518	Soil from c518 a fill of c434, a pit/archaeological spread. 2 bags.	pale yellow	2.5YR 7/3	0	0	0	fine lumpy soil	408					
434	385	518	Slag from c518 a fill of c434, a pit/archaeological spread. 2 bags.							-	large collection dense amorphous slag	2965	900	3865	35

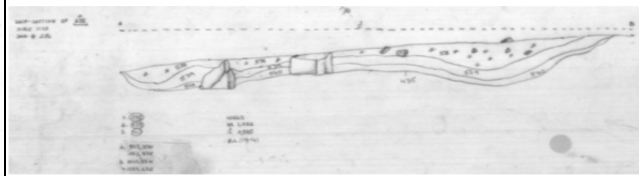
XRF Data

FEATURE	CONTEXT	SAMPLE	Pb	Sn	Sb	Sr	Rb	As	Zn	Cu	Ni	Fe	Mn	Cr	V	Ti	Ca	K
CONTROL	**CONTROL**	**CONTROL**	**25.63**	**0.00**	**0.00**	**19.02**	**48.77**	**0.00**	**47.80**	**0.00**	**0.00**	**12779.60**	**960.82**	**0.00**	**0.00**	**2212.76**	**2352.10**	**9958.88**
434	518	**384**	15.53	0.00	0.00	20.00	45.20	0.00	30.17	0.00	0.00	10409.78	408.05	0.00	0.00	2076.96	2840.44	7524.03

F434
Number of Contexts: 1
Max MS(soils): 408 associated with C518
Total amount of slag: 3000g
Chemical composition: no correlation with either suite of elements

F435





FEATURE	SAMPLE	CONTEXT	ACS DESCRIPTION	SOIL COLOUR	MUNSELL NOTATION	SLAG	CHARCOAL	METALLURGICAL CERAMIC	SOIL DESCRIPTION	MS (K)
435	400	538	Soil from c538 a fill of c435, a pit/archaeological spread. 4 bags.	grey	10YR 5/1	0	0	0	lumpy soil, few stones	55
435	404	539	Soil from c539 a fill of c435, a pit/archaeological spread.	grey	10YR 5/1	0	0	0	lumpy soil	6
435	405	540	Soil from c540 a fill of c435, a pit/archaeological spread.	light grey	10YR 7/1	0	0	0	lumpy soil, few stones	0

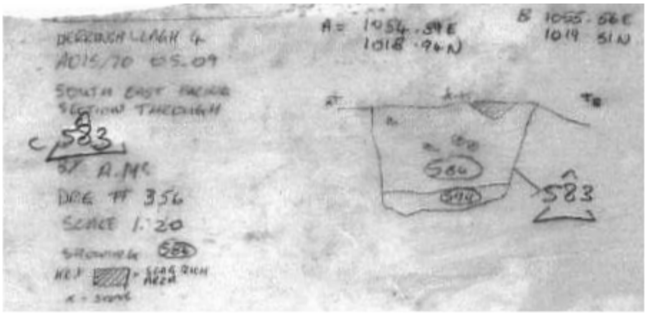
XRF Data

FEATURE	CONTEXT	SAMPLE	Pb	Sn	Sb	Sr	Rb	As	Zn	Cu	Ni	Fe	Mn	Cr	V	Ti	Ca	K
CONTROL	**CONTROL**	**CONTROL**	**25.63**	**0.00**	**0.00**	**19.02**	**48.77**	**0.00**	**47.80**	**0.00**	**0.00**	**12779.60**	**960.82**	**0.00**	**0.00**	**2212.76**	**2352.10**	**9958.88**
435	538	**400**	15.13	0.00	0.00	20.32	38.87	10.20	32.82	0.00	0.00	6852.66	142.65	0.00	0.00	1930.84	3597.88	9959.81
435	539	**404**	0.00	0.00	0.00	14.15	31.41	0.00	24.83	0.00	0.00	4528.47	0.00	0.00	32.39	1804.69	2118.15	8770.95
435	540	**405**	0.00	0.00	0.00	24.00	25.44	0.00	0.00	0.00	0.00	2192.31	0.00	0.00	0.00	2079.69	1747.79	6444.26

F435

Number of Contexts: 3
Max MS(soils): 55K associated with C538
Total amount of slag: 0g
Chemical composition: no correlation with either suite of elements

F583



FEATURE	SAMPLE	CONTEXT	ACS DESCRIPTION	SOIL COLOUR	MUNSELL NOTATION	SLAG	CHARCOAL	METALLURGICAL CERAMIC	METALLURGICAL CERAMIC DESCRIPTION	SOIL DESCRIPTION	MS (K)	SLAG DESCRIPTION	LARGE SLAG WEIGHT (g)	COARSE SLAG WEIGHT (g)	TOTAL SLAG WEIGHT (g)	FINE MATERIAL <1MM SEPARATED FROM SLAG WEIGHT (g)
583	468	584	Soil from c584 a fill of c583, a pit of unknown function.	greyish brown	10YR 5/2	0	0.5	1.5	sintered clay	fine lumpy soil	811					
583	463	584	Soil from c584 a fill of c583, a pit of unknown function.	light brown	7.5YR 6/3	1.5	0	0		fine lumpy soil	154					
583	467	594	Soil from c594 a fill of c583, a pit of unknown function.	light brownish grey	10YR 6/2	0	0	0		lumpy soil, stones	13					
583	462	584	Slag from c584 a fill of c583, a pit of unknown function.								-	slag of various sizes & fines	2150	875	3025	85

XRF Data

FEATURE	CONTEXT	SAMPLE	Pb	Sn	Sb	Sr	Rb	As	Zn	Cu	Ni	Fe	Mn	Cr	V	Ti	Ca	K
CONTROL	**CONTROL**	**CONTROL**	**25.63**	**0.00**	**0.00**	**19.02**	**48.77**	**0.00**	**47.80**	**0.00**	**0.00**	**12779.60**	**960.82**	**0.00**	**0.00**	**2212.76**	**2352.10**	**9958.88**
583	583	**463**	20.34	0.00	0.00	26.23	51.65	0.00	35.49	38.16	0.00	17468.68	3722.04	0.00	0.00	2097.91	3085.30	8788.95
583	583	**467**	0.00	0.00	0.00	22.46	42.19	0.00	25.65	0.00	0.00	10693.03	1035.45	0.00	0.00	1815.36	1835.21	6708.73
583	583	**468**	28.94	0.00	0.00	18.50	36.98	34.11	184.85	58.79	127.30	84554.95	19895.31	0.00	84.13	2493.92	5893.07	8761.12

F583

Number of Contexts: 2
Max MS (soils): 811K associated with C583
Total amount of slag: 3100g associated with C584/S462
Chemical composition: the Fe/Mn/As/Ca suite – no contexts
the Cu/Zn suite for C583/S463 and C583/S468

5 Non Metallurgical Features Analysis

For the list of Non-metallurgical features, see Table 18.

The typological data for this set of features are included in the CD enclosed.

The XRF data associated with these features are shown in Table 19.
The data are scrutinised for the two suites of elements discussed in the context of the metallurgical features, i.e. Fe/Mn/As/Ca and Cu/Zn

The non metallurgical features are hardly ferruginous i.e. the iron content does not exceed the background. However there are some features which correlate well with the Cu/Zn suite. These include F60, F438, F140 and F334. Other features which are distinguished by their above background values of Cu/Zn are included in Table 20.

The Cu/Zn correlating contexts are also scrutinised for their MS values. F438 and F334 correspond to background; F60 and F 140 slightly heated. Those features with MS above 500K include F12, F196, F266, F168.

Table 19. XRF data for non metallurgical features.

FEATURE	CONTEXT	SAMPLE	MS (K)	Pb	Sn	Sb	Sr	Rb	As	Zn	Cu	Ni	Fe	Mn	Cr	V	Ti	Ca	K
6	**157**	**59**	15	23.78	0	0	20.25	41.6	0	39.96	38.97	0	10562.87	1586	0	0	2510.76	2048.19	7944.45
12	**12**	**23**	37	47.3	0	0	20.67	45.11	0	58.57	0	0	9927.54	589.56	0	0	1844.73	1800.07	9040.52
12	**12**	**24**	27	29.06	0	0	20.21	51.74	0	39.74	36.75	0	11222.71	4723.03	0	0	2034.57	1451.38	11204.39
24	**379**	**283**	48	14.62	0	0	18.52	52.02	0	31.61	0	0	11366.71	507.3	0	0	1813.5	1767.09	3791.06
43	**42**	**43**	7	18.93	0	0	16.68	46.15	0	48.91	0	0	11700.6	600.93	0	0	2476.08	2131.17	10560.1
51	**50**	**45**	56	0	0	0	20.02	55.46	0	34.97	0	0	13429	1338.62	0	0	1880.45	1849.89	9807.06
60	**59**	**47**	376	15.03	0	0	18.9	54.93	0	68.59	55.41	0	49070.55	7546.96	84.01	58.61	1295.62	8020.08	9905.19
69	**69**	**22**	54	20.78	0	0	17.07	46	0	37.03	0	0	9907.27	549.04	0	0	2023.14	1476.78	11075.55
72	**155**	**65**	4	19.31	0	0	17.66	58.57	0	66.16	0	0	14674.48	1046.44	0	0	2252.46	2332.84	6666.77
74	**217**	**105**	20	79.24	0	0	17.64	43.2	0	26.92	0	0	10542.73	1194.17	0	0	1737.05	1867.92	11004.55
80	**249**	**140**	174	28.06	0	0	20.8	58.12	0	40.61	0	0	13093.18	823.38	0	0	1905.87	2104.35	7929.46
87	**107**	**28**	87	14.94	0	0	17.7	55.18	0	29.7	0	0	10098.63	550.56	0	0	2181.47	2051.26	12514.91
91	**90**	**42**	107	37.19	0	0	21.17	46.51	0	55.62	0	0	9508.66	302.88	0	0	1535.99	1400.06	13074.09
95	**94**	**44**	5	36.35	0	0	19.35	52.89	0	40.69	0	0	13799.66	570.92	0	0	2288.06	2578.69	10282.96
118	**159**	**159**	361	24.26	0	0	26.48	57.49	0	46.48	0	0	15348.46	1998.63	0	46.2	2121.01	4656.04	6734.73
118	**195**	**123**	1242	24.44	0	0	17.34	46.42	13.74	43.16	0	0	24279.71	4619.76	0	52.01	2171.36	4243.21	8939.83
118	**189**	**122**	530	26.76	0	0	25.12	50.82	0	33.94	0	0	14996.36	2129.1	0	0	2075.17	2731.25	7973.66
123	**353**	**256**	167	21.36	0	0	21.65	62.05	0	38.27	0	0	24788.05	2519.85	0	39.24	1490.62	2855.57	8093.96
123	**392**	**281**	85	21.92	0	0	24.05	54.86	0	30.77	0	0	10960.85	764.8	0	39.24	2124.91	3033.59	7153.5
123	**255**	**255**	1112	0	0	0	12.93	43	0	0	0	0	21953.37	2567	0	0	1350.29	3102.08	8045.57
123	**123**	**36**	218	0	0	0	0	37.07	0	0	0	0	6293.08	0					5295.11
124	**463**	**319**	1112	25.97	0	0	21.94	59.01	12.78	41.5	48.26	0	13200.72	1355.9	0	34.35	1738.26	15856.9	1565.58
124	**256**	**150**	47	23.63	0	0	13.63	51.47	0	33.07	0	0	10731.43	969.82	0	0	1750.73	1804.38	9686.83
124	**256**	**151**	11	20.44	0	0	15.14	37.36	0	19.82	0	0	8686.16	1014.11	0	0	1817.91	3958.28	11048.05
134	**162**	**63**	492	25.63	0	0	22.66	49.19	24.78	43.44	0	0	20692.93	1330.21	0	146.73	2691.96	5550.06	10513.82
137	**284**	**182**	66	36.59	0	0	21.18	53.65	0	41.27	0	0	12362.43	817.66	0	36.55	2124.63	2041.18	7529.39
138	**187**	**79**	142	23.3	0	0	16.18	53.22	0	12.88	0	0	10628.73	1038.6	0	15.75	1822.26	2112.83	10911.92
140	**198**	**118**	262	24.33	0	0	19.45	52.3	0	90.03	28.56	147.28	162858.66	11650.93	0	60.72	1976.41	13781.81	3135.08
140	**219**	**119**	109	13.69	0	0	19.49	48.55	0	57.32	0	0	11712.79	721.08	0	0	2218.55	2168.53	11377.85
142	**151**	**55**	205	23.82	0	0	28.38	38.02	28.77	50.58	0	0	52154.05	4829.22	0	107.67	2010.14	13769.5	9498.68
142	**154**	**57**	15	14.16	0	0	26.22	42.51	23.85	25.43	0	0	23140.83	1020.93	0	39.44	1094.77	2959.75	9814.16
145	**180**	**76**	21	23.57	0	0	20.73	46.59	0	43.73	0	0	11602.93	659.41	0	0	2370.58	2390.52	9344.88
146	**181**	**77**	35	0	0	0	20.13	42.79	0	39.28	0	0	10240.92	668.01	0	0	2153.42	1829.52	8812.98
152	**153**	**62**	125	0	0	0	21.46	59.85	0	63.06	0	0	22226	2148.79	0	0	1717.57	2331.92	10794.62
165	**166**	**72**	628	37.58	0	0	19.46	60.48	22.52	68.47	0	0	36923.25	3064.44	0	88.75	1238.37	12783.54	8204.42
168	**542**	**401**	286	22.29	0	0	18.74	50.71	0	81.31	0	0	14908.08	929.75	0	33.18	2117.28	4437.52	8727.36
168	**169**	**71**	212	20.92	0	0	21.58	53.12	0	78.25	0	0	13463.74	985.71	0	0	2068.13	2199.06	7553.68
168	**524**	**386**	523	15.03	0	0	17.78	33.94	0	40.89	0	0	11799.55	653.74	0	0	1075.99	1129.81	12000.65
168	**586**	**444**	110	22.33	0	0	20.13	58.5	0	32.56	0	0	14093.81	477.41	0	51.82	2574.42	1979.71	6418.52

FEATURE	CONTEXT	SAMPLE	MS (K)	Pb	Sn	Sb	Sr	Rb	As	Zn	Cu	Ni	Fe	Mn	Cr	V	Ti	Ca	K
188	204	93	707	18.37	0	0	24.3	48.94	18.49	64.99	0	0	31007.06	1927.37	0	53.98	1695.97	10493.31	7857.71
196	197	92	1062	27.84	0	0	20.72	48.47	0	108.88	0	0	16299.77	1337.21	0	44.86	1868.54	3567.92	11137.46
232	207	158	863	17.25	0	0	20.8	51.56	0	56.88	0	0	15158.69	940.4	0	0	2318.26	1749.95	9358.29
238	250	141	92	19.69	0	0	23.54	48.06	0	29.94	0	0	10114.19	364.63	0	0	2306.55	2463.52	9595.39
238	254	167	223	25.72	0	0	20.3	43.82	0	24.52	0	0	10014.31	304.4	0	0	1689.05	1598.44	10392.32
266	282	204	280	35.3	0	0	17.7	57.42	0	89.76	0	0	22663.08	2174.25	0	0	2409.58	2396.27	15085.5
266	268	185	380	27.45	0	0	21.21	59.66	0	62.54	0	0	17572.39	1518.84	0	38.43	2112.86	2602.75	9777.77
266	281	203	580	29.39	0	0	21	62.79	0	38.6	0	0	26805.64	2586.92	0	45.87	1900.25	2722.64	7868.82
266	311	218	300	44.36	0	0	19.19	66.57	0	34.66	0	0	25939.7	1792.42	0	0	1723.43	1785.71	7283.08
266	286	186	486	21.1	0	0	23.8	65.4	19.33	0	0	0	51022.19	6507.53	0	58.99	2040.14	6387.28	9391.53
274	320	254	143	27.22	0	0	21.49	56.06	0	53.23	0	0	15599.89	1767.24	0	0	1557.26	2320.51	4896.2
301	305	215	3	16.84	0	0	18.95	53.14	0	61.8	0	0	14956.13	1200.91	0	0	1782.94	2169.82	10711
301	304	214	7	0	120.08	171.57	30.56	42.29	0	50.27	0	0	10863.89	355.75	0	0	742.97	975.7	12238.24
303	302	227	31	21.78	0	0	18.01	56.62	0	42.37	0	0	15313.2	1355.38	0	0	1804.25	2538.99	9627.3
334	348	251	24	15.24	0	0	20.67	59.57	11.45	88.04	36.32	0	20660.88	2350.06	0	0	1716.01	3721.33	7631.94
375	376	273	17	23.69	0	0	33.24	74.37	16.2	107.48	0	0	25162.59	1516.07	0	55.68	1832.35	3342.25	8064.18
399	408	436	1001	17.31	0	0	16.64	42.87	0	32.68	0	0	17233.17	3285.83	0	0	2156.16	2049.26	10133.91
418	431	294	41	22.15	0	0	20.03	44.41	0	43.45	35.32	0	10260.07	1224.26	0	54.75	2517.72	3957.89	7861.01
419	587	447	56	32.92	0	0	31.17	49.12	0	58.38	51.07	0	5237.18	8203.9	0	46.3	1580.96	1830.05	10422.09
420	455	312	558	14.94	0	0	19.52	48.26	15.37	44.46	0	0	20102.77	1801.07	0	36.87	2371.77	4029.93	8775.73
426	533	389	130	16.77	0	0	14.17	54.31	0	35.97	0	0	14686.96	1183.41	0	0	1540.49	1501.25	8770.95
433	504	354	51	22.51	0	0	17.82	42.81	0	52.49	0	0	9579.78	266.89	0	0	2510.92	3451.8	10333.08
433	443	355	17	18.76	0	0	24.34	44.27	0	44.39	0	0	5708.78	0	0	0	2195.01	1946.68	8216.3
433	443	299	45	25.71	0	0	18.49	40.87	22.92	35.87	0	137.51	91384.38	11551.52	0	63.46	1729.07	6338.97	12064.19
434	518	384	408	15.53	0	0	20	45.2	0	30.17	0	0	10409.78	408.05	0	0	2076.96	2840.44	9836.92
435	538	400	55	15.13	0	0	20.32	38.87	10.2	32.82	0	0	6852.66	142.65	0	0	2089.42	2705.21	8979.36
435	539	404	6	0	0	0	14.15	31.41	0	24.83	0	0	4528.47	0	0	32.39	1804.69	2118.15	8655.77
435	540	405	0.00000001	0	0	0	24	25.44	0	0	0	0	2192.31	0	0	0	2079.69	1747.79	7326.26
436	562	418	62	21.31	0	0	22.64	50.32	0	54.96	0	0	12346.45	392.7	0	0	2282.05	3961.25	7311.49
436	563	419	4	29.19	0	0	19.54	51.99	34.22	37.25	0	228.61	111766.43	4576.06	0	143.93	1707.35	14861.8	7612.63
437	485	338	228	21.1	0	0	19.32	49.56	0	30.07	0	0	13816.02	694.83	0	0	2062.47	3508.74	10112.59
438	582	461	71	14.54	0	0	37.73	44.2	0	161.43	38.66	0	10797.12	968.94	0	32.04	1853.92	5066.66	7998.04
438	581	460	41	16.02	0	0	24.73	46.25	0	103.98	0	0	9879.41	470.83	0	0	1945.23	2479.52	8303.69
438	579	458	45	20.81	0	0	22	46.87	0	97.96	36.95	0	21966.81	2200.91	0	71.09	1218.79	3029.31	8119.63
438	580	459	9	0	0	0	22.38	49.79	11.58	82.41	0	0	11918.08	289.3	0	46.97	2555.59	2191.27	8445.98
456	460	314	1814	31.38	0	0	20.38	65.09	0	48.53	0	0	59334.06	5903.73	0	61.39	2067.59	8567.11	8212.28
498	527	399	84	0	0	0	13.73	42.34	0	29.7	0	0	9043.93	452.54	0	0	1151.85	5671.08	7805.38
498	513	390	74	19.57	0	0	15.77	43.6	0	0	0	0	9892.19	701.05	0	0	903.56	1489.22	4037.09

Table 20. Typological data for non metallurgical features with Cu/Zn correlations.

FEATURE	SAMPLE	CONTEXT	ACS DESCRIPTION	SOIL COLOUR	SLAG	CHARCOAL	METALLURGICAL CERAMIC	METALLURGICAL CERAMIC DESCRIPTION	SOIL DESCRIPTION	ADDITIONAL NOTES	MS (K)
140	118	198	Soil and Charcoal from c198 a fill of c140, a pit. 2 bags.	light brown	0	0	0		lumpy soil	clay & stones	262
140	119	219	Soil and charcoal from c219 a fill of c140, a pit.	beige brown	0	0	0		lumpy soil	clay & stones	109
438	458	579	Soil from c579 a fill of c438, a pit/archaeological spread.	grey brown	0	1	0		lumpy soil	charcoal frgts	45
438	459	580	Soil from c580 a fill of c438, a pit/archaeological spread.	grey brown	0	1.5	1.5	heated clay	lumpy soil		9
438	460	581	Soil from c581 a fill of c438, a pit/archaeological spread.	grey brown	0	0	0.5	heated clay		few stones	41
438	461	582	Soil from c582 a fill of c438, a pit/archaeological spread.	grey brown	0	1.5	0		lumpy soil		71
60	47	59	Soil from c59 a fill of c60 a possible posthole.	light orange brown	0	0	0		lumpy soil		376
334	251	348	soil from c348 fill of c334, a possible posthole	orange brown	0	0	1.5	heated clay	lumpy soil	few stones	24
418	294	431	soil from c431 a fill of c418, a posthole	orange brown	0	1	0		lumpy soil	few stones	41
419	447	587	Soil from c587 a fill of c419, a pit. 2 bags.	grey brown black	0	1.5	0		coarse lumpy soil		56
6	59	157	Soil and Charcoal from c157 a fill of c6, a possible working platform.	light grey brown	0	0	0.5		very lumpy soil		15
12	23	12	Soil from c12, a bowl furnace.	light grey	0	1.5	0		lumpy soil		37
12	24	12	Soil from c12, a bowl furnace.	light brown	0	0.5	0		fine lumpy soil	few sandstones	27
12	25	12	Slag from c12, a bowl furnace. 0.038 kilograms.								-
196	92	197	Soil and Charcoal from c197 a fill of c196, a posthole beneath c133.	yellow grey	0	1.5	2	heat affected clay	lumpy soil	lumpy clay & stones	1062
375	273	376	Pit associated with C023. Filled by C376. Soil from C376. 1 Bag.	light orange brown	0	0	1	heated clay	lumpy soil		17
168	71	169	Soil and Charcoal from c169, a fill of c168, a pit/posthole. 2 bags.	light brown	0	2	1.5	sintered clay	lumpy soil		212
168	386	524	Soil from c524 a fill of c168, a pit of unknown function.	strong brown	1	1.5	2.5	heated clay lumps	fine soil		523
168	444	586	Soil from c586 a fill of c168, a pit.	strong brown	0	0	0.5		coarse lumpy soil		110
168	401	542	soil from c542 a fill of c168, a pit	light brown	0	2	1	burnt clay	lumpy soil		286
266	187	286	Slag from C286. 2 Bags.								492
266	185	268	soil and charcoal from c268 a fill of c266, a pit of unknown function	orange brown	1	0.5	2	slightly sintered clay	lumpy soil		380
266	186	286	Soil & Charcoal from C286. 1 Bag.	orange brown	1	2.5	2	heated clay	fine lumpy soil		486
266	203	281	Vitrified clay from C281. 1 Bag.	light orange brown	0	0.5	2	sintered clay	lumpy soil		580
266	204	282	Oxidised clay from C282. 1 Bag.	light brown	0	0	1.5	burnt clay	tiny lumps clay with coase soil		280
266	218	311	Oxidized clay from C311. 1 Bag.	light orange	0	0	1.5	burnt clay	lumpy soil		300

6 Cluster of Furnaces Analysis

The aim is to draw out similarities and differences between individual features within clusters of furnaces. A summary is presented here, followed by a discussion.

SINGLE FURNACES

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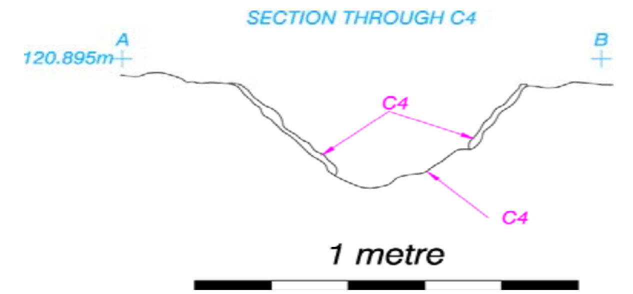
<td>
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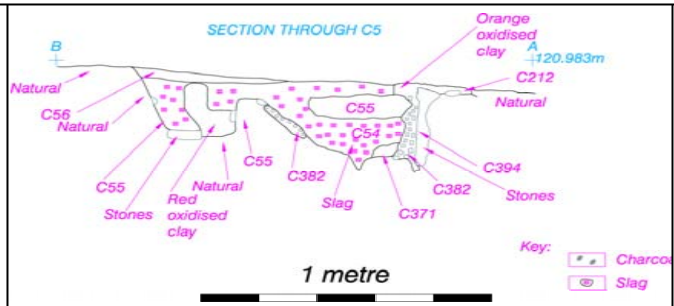
<td>
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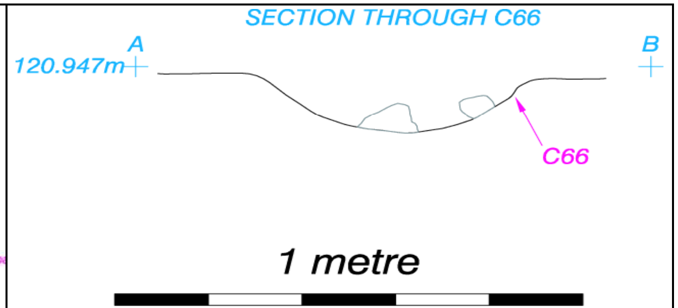
<td>
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<td>F4
No of contexts: 7
Maximum MS (soil): 821K, associated with C101
Total amount of slag: 20535 g; max amount associated with C 102
Chemical composition: the Fe/Mn/As/Ca suite for C114/S48 the Cu/Zn suite – no samples</td>
<td>F5
No of contexts: 6
Maximum MS (soil): 2444K, associated with C371
Total amount of slag: 20560g; max amount associated with C54/S 226
Chemical composition: the Fe/Mn/As/Ca suite forC371/S270; the Cu/Zn suite – no samples</td>
<td>F66
No of contexts: 1
Maximum MS (soil): 1179K, associated with C11/S35
Total amount of slag: 1550g associated with C113/S34
Chemical composition: the Fe/Mn/As/Ca suite – no contexts; the Cu/Zn suite – no contexts</td>
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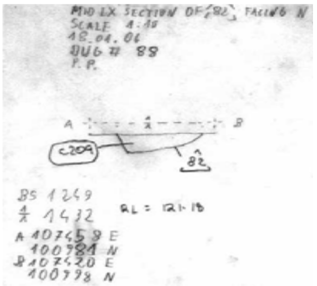
<td>
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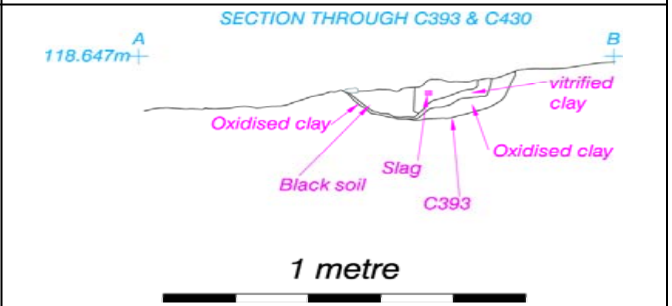
<td>
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No of contexts: 1
Maximum MS (soil): 869K, associated with C209/S94
Total amount of slag: 75g
Chemical composition: the Fe/Mn/As/Ca suite – no contexts; the Cu/Zn suite – no contexts</td>
<td>F99
No of contexts: 1
Maximum MS (soil): 3784K, associated with C105/S21 (very high organic content)
Total amount of slag: 1100g
Chemical composition: the Fe/Mn/As/Ca suite – no contexts; the Cu/Zn suite – no contexts</td>
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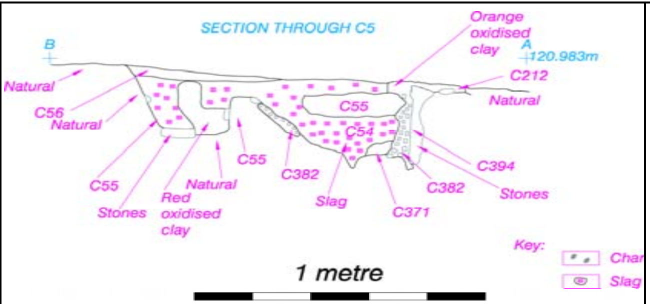
<td></td>
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<td>F5
No of contexts: 6
Maximum MS (soil): 2444K, associated with C371
Total amount of slag: 20560g; max amount associated with C54/S 226
Chemical composition: the Fe/Mn/As/Ca suite forC371/S270; the Cu/Zn suite – no samples</td>
<td>Fattened white stone, edged against the grey stone, on which the bellows would have rested. The bridge (dividing wall) between the two furnaces is vitrified.(SASAA photo)</td>
<td>The furnace floor in F5 is merely heated while the stone walls have slag adhering to it. A sample was removed from the stone wall and showed apart from the usual silicate phases, small amounts of iron. (SASAA photo)</td>
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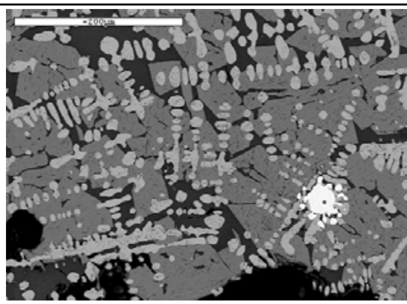
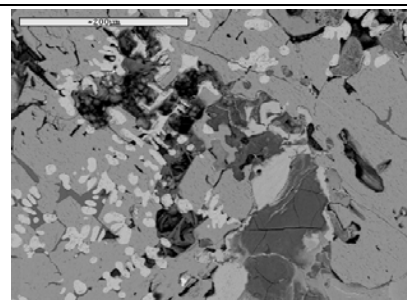
<td></td>
<td></td>
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<td>typical silicate phases within slag from the section adhering to the stone wall in F5 with small amounts of metallic iron.</td>
<td>Fayalite, wustite and partially reduced ore in sample of slag adhering to the stone wall</td>
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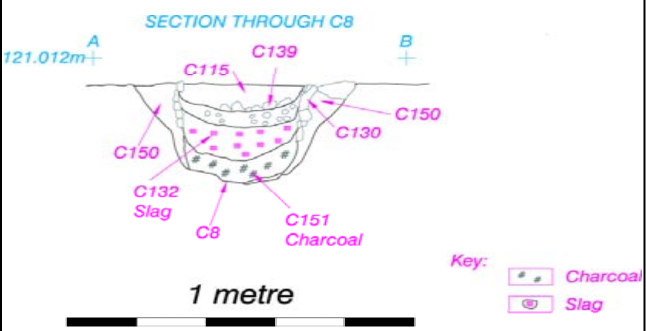
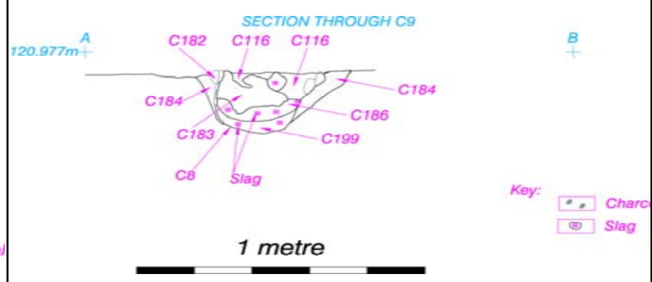
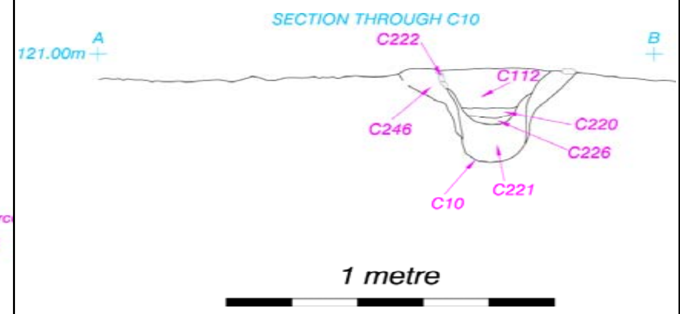
F8/F9/F10

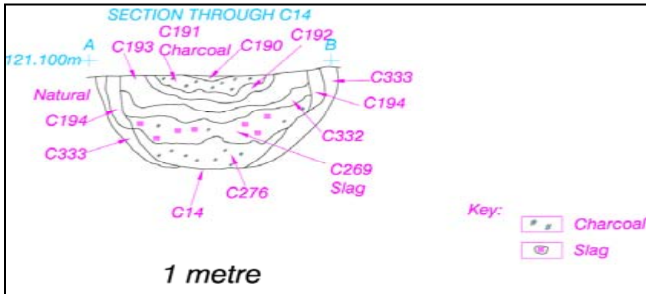


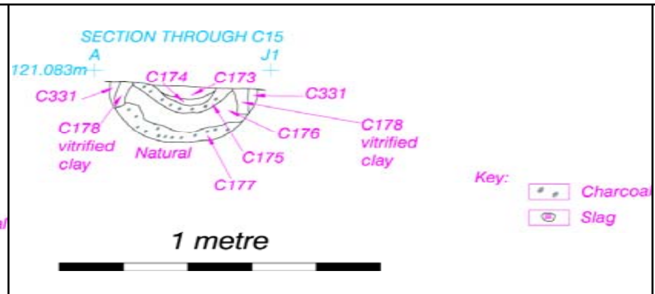


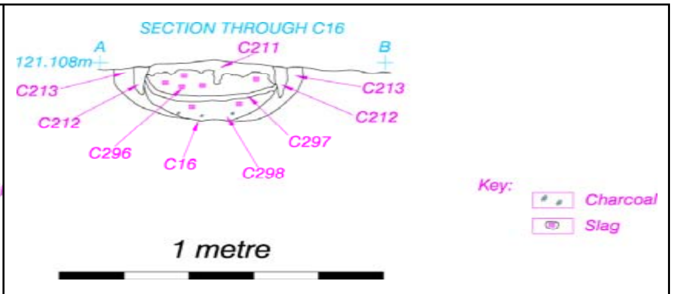


F8 **No of contexts: 7** **Maximum MS (soil): 1838K, associated with C132 and C115** **Total amount of slag: 12850 g;** **max amount associated with C 132** **Comments: presence of wall lining is evidence for heating of the furnace walls; also evidence for small white stone on the rim of the furnace; could it be associated with tuyere?** **Chemical composition: the Fe/Mn/As/Ca suite for C132/S40; the Cu/Zn suite for C132/S40**	**F9** **No of contexts: 7** **Maximum MS (soil): 800K, associated with C199** **Total amount of slag: 4050g; max amount associated with C 183/C186** **Comments: heavy quantity of lining but in actual fact it may be the partially reacted ore** **Chemical composition: the Fe/Mn/As/Ca suite for C186/S85; the Cu/Zn suite – no contexts**	**F10** **No of contexts: 6** **Maximum MS (soil): 579K, associated with C220/S136** **Total amount of slag: 1130g; max amount associated with C117/C221** **Comments: small well for slag collection** **Chemical composition: the Fe/Mn/As/Ca suite for C221/S146; the Cu/Zn suite – no contexts**

F14/F15/F16







F14	**F15**	**F16**
No of contexts: 8 **Maximum MS (soil): 1344K, associated with C269 and C192 (equivalent to that of heated soils)** **Total amount of slag: 14454g; max amount associated with C269, C192, C194 (contexts with highest amounts of slag)** **Comments:** **Chemical composition: the Fe/Mn/As/Ca suite for C276/S178; the Cu/Zn suite – no contexts, although C192/S149 has enhanced Zn**	**No of contexts: 5** **Maximum MS (soil): 3231K, associated with C 173/S 67** **Total amount of slag: 1015g; max amount associated with C176/ S115** **Comments:** **Chemical composition: the Fe/Mn/As/Ca suite – no contexts the Cu/Zn suite – C173/S109, C177/S117. NB. C175/S114 has Cu, but no Zn**	**No of contexts: 5** **Maximum MS (soil): 2002K, associated with C298/S223** **Total amount of slag: 7191g; max amount associated with C296/S205** **Comments:** **Chemical composition: the Fe/Mn/As/Ca suite for C297/S208, C298/S223 the Cu/Zn suite – no contexts, although C211/S211 very high Zn**

F17/F18/F19

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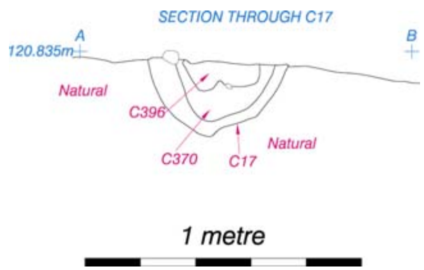
<td>
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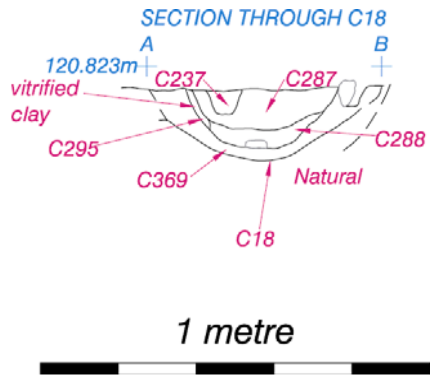
<td>
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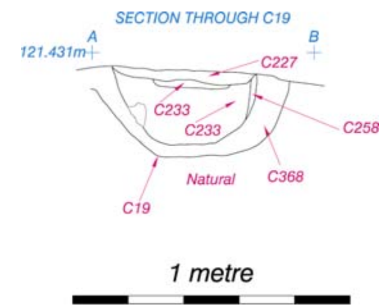
<td>
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No of contexts: 6
Maximum MS (soil): 2700K, associated with C357 (heated soil/soil and charcoal/soil and slag)
Total amount of slag: 8787g; max amount associated with C357, C366, C310, C317 (slag rich)
Comments:
Chemical composition: the Fe/Mn/As/Ca suite for C357/S258; the Cu/Zn suite – no contexts, although C310/S252 has high Zn</td>
<td>F18
No of contexts: 6
Maximum MS (soil): 2328K, associated with C287 and C288
Total amount of slag: 4764g; max amount associated with C287
Comments:
Chemical composition: the Fe/Mn/As/Ca suite for C287/S192, C288/S194; the Cu/Zn suite – no contexts</td>
<td>F19
No of contexts: 6
Maximum MS (soil): 1243K, associated with C233 and C227 ; values equivalent to lightly heated soil and slag
Total amount of slag: 9090g; max amount associated with C233, C234 and C227 (high amounts of slag)
Comments:
Chemical composition: the Fe/Mn/As/Ca suite – no contexts the Cu/Zn suite – C233/S134</td>
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F20/F21/F22/F23/F24/F25

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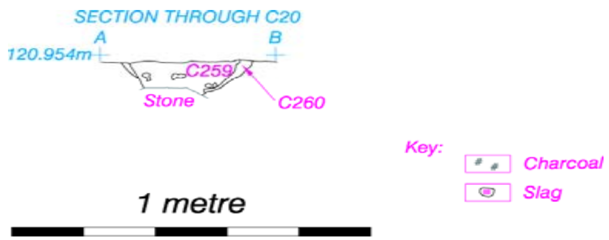
<td>
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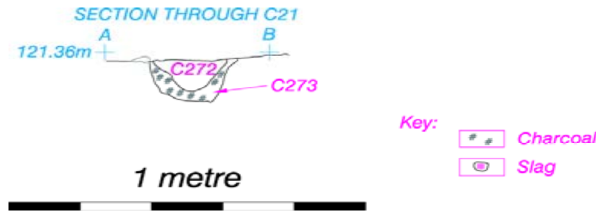
<td>
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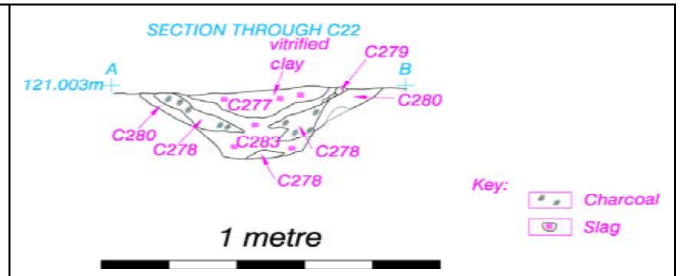
<td>
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<td>F20
No of contexts: 1
Maximum MS (soil): K, associated with C259 (Single context shows high MS variation)
Total amount of slag: 1349g; max amount associated with C259/S162
Comments: Furnace is shallow with flat stone deliberately positioned within
Chemical composition: the Fe/Mn/As/Ca suite – no contexts; the Cu/Zn suite – no contexts</td>
<td>F21
No of contexts: 2
Maximum MS (soil): 1154K, associated with C273/S175
Total amount of slag: 2234g; max amount associated with C273/S174
Chemical composition: the Fe/Mn/As/Ca suite – no contexts the Cu/Zn suite – no contexts</td>
<td>F22
No of contexts: 5
Maximum MS (soil): 1149K, associated with C283/S200 (soils heated at low temperatures: C278, C279, C280; soils heated at higher temperatures: C283)
Total amount of slag: 3740g; max amount associated with C277 and C283
Chemical composition: the Fe/Mn/As/Ca suite for C278/S197, C283/S200; the Cu/Zn suite – no contexts, although C277/S195 very high Zn</td>
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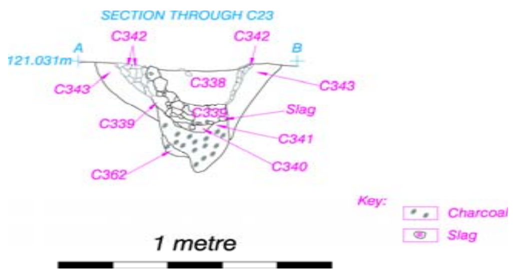
<td>
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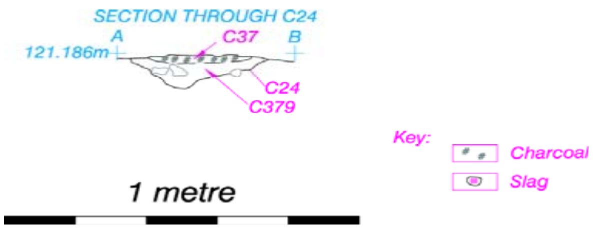
<td>
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<td>F23
No of contexts: 7
Maximum MS (soil): 511K, associated with C342 (MS reflects soils heated at relatively low temperatures; max MS associated with C342, a clay lining)
Total amount of slag: 8412g; max amount associated with C339/S246
Comments: Deep and conical shaped furnace. Although the mean MS is relatively low, the presence of a lip on the rim of the furnace suggests that the furnace was indeed used for smelting.
Chemical composition: the Fe/Mn/As/Ca suite for C339, C340, C362; the Cu/Zn suite – no contexts</td>
<td>F24
No of contexts: 2
Maximum MS (soil): 69K, associated with C377/S282 (considerably low, i.e. nearly background)
Total amount of slag: 40g; max amount associated with C24/S8
Comments:
Chemical composition: the Fe/Mn/As/Ca suite – no contexts; the Cu/Zn suite – no contexts</td>
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F80/F81/86/87/210

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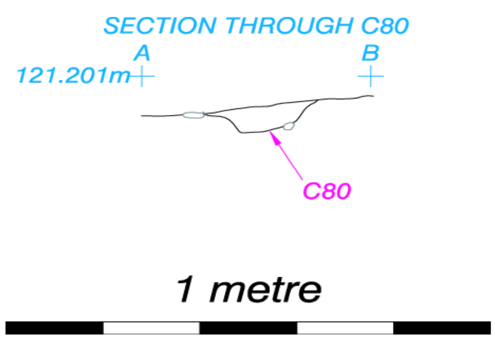
<td>
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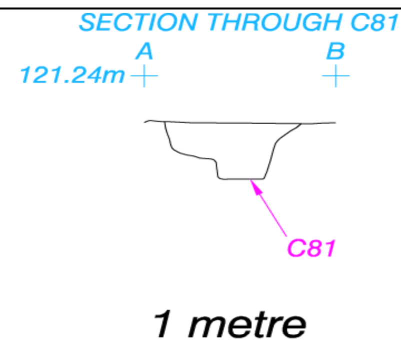
<td>
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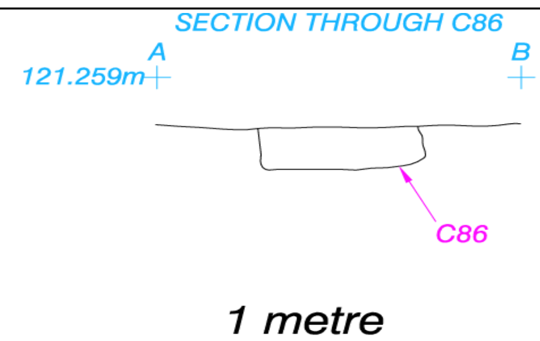
<td>
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<tr>
<td>F80</td>
<td>F81
No of contexts: 1
Maximum MS (soil): 699K, associated with C229/S129
Total amount of slag: 234g, associated with C229/S130</td>
<td>F86
No of contexts: 1
Maximum MS (soil): 793K, associated with C185/S78
Total amount of slag: 300g
Chemical composition: the Fe/Mn/As/Ca suite – no contexts the Cu/Zn suite for C185/S78</td>
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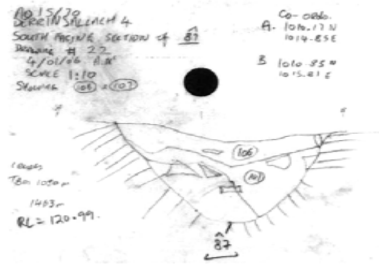
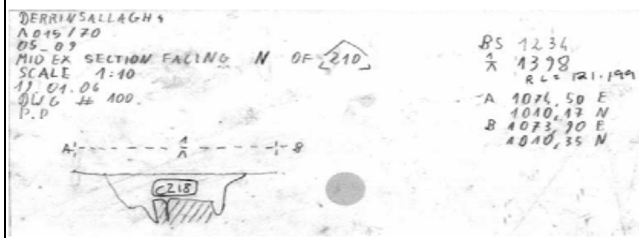
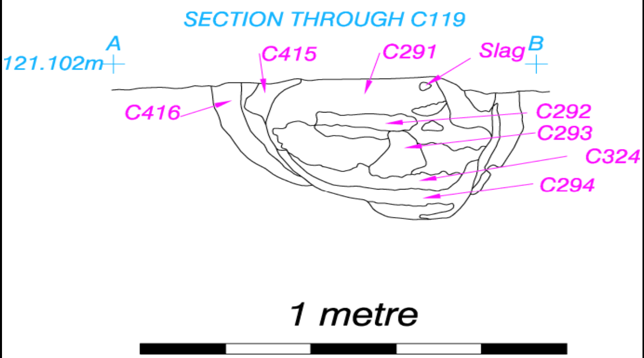
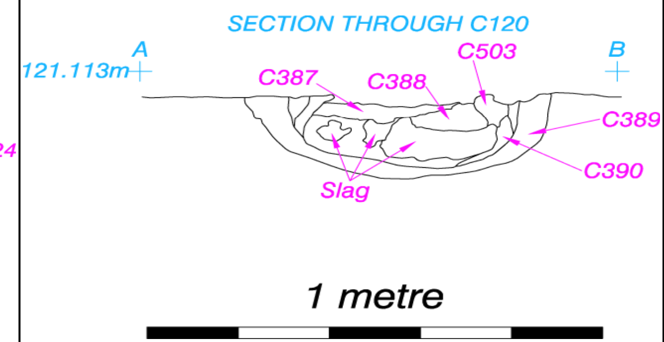
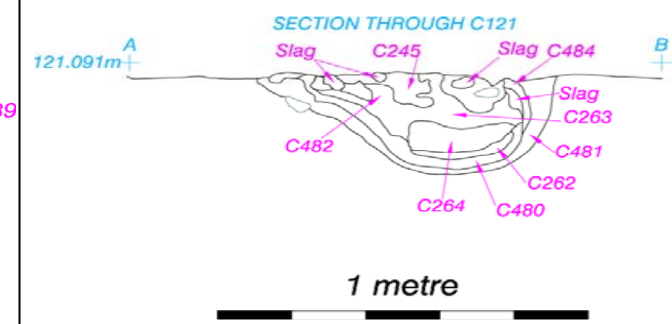
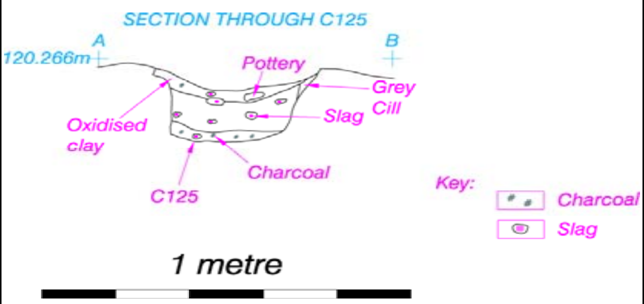
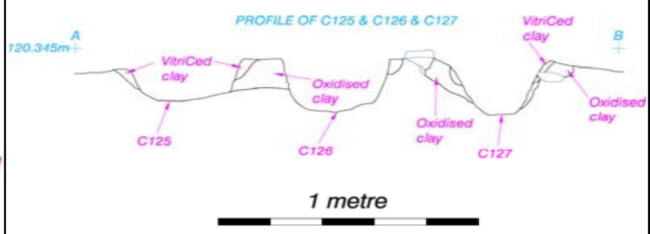
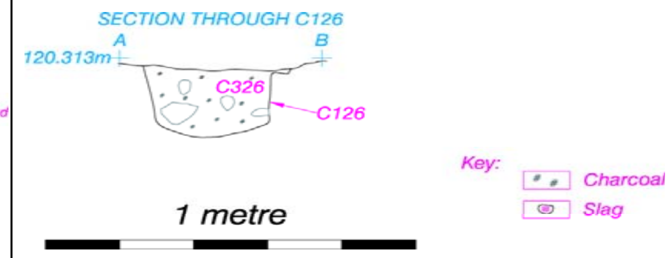
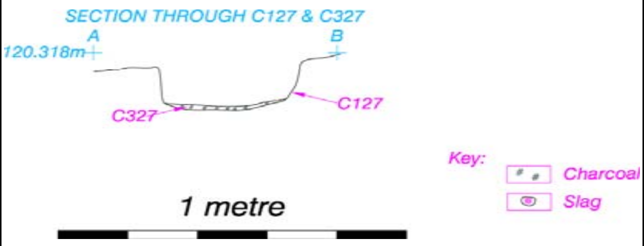
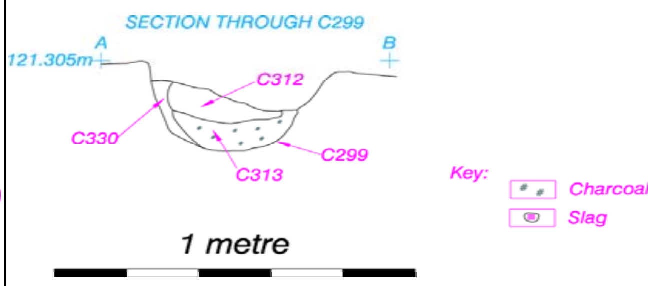
 SCALE 1:10 RL = 120.99 106 87	 DERRINSALLAGH 4 A015/70 MID EX SECTION FACING N OF 210 SCALE 1:10 DWG # 100. BS 1234 1398 A 1076.50 E 1010.17 N B 1073.90 E 1010.35 N C218	
F87	**F210**	

F119/F120/F121

		
F119 **No of contexts: 7** **Max MS (soil): 1130K associated with C324/S238** **Total amount of slag: 15425g; max amount associated with contexts C119, C293, C425** **Comments: raised lip around the rim of the furnace; keyhole shaped furnace design;** **white stone for the positioning of the bellows.** **Chemical composition: Fe/Mn/As suite for C324/S238; Cu/Zn for same**	**F120** **No of contexts: 6** **Max MS (soil): 1539K associated with C387/S287** **Total amount of slag: 14755g; max amount associated with contexts C390, C291, C503, C120** **Chemical Composition: Fe/Mn/As suite for no particular context; Cu/Zn suite for C387/S287 oxidised clay**	**F121** **No of contexts: 10** **Max MS: 2900K associated with C262/S328 indicating heated soil with charcoal; also 1100K for C480/S332 indicating** **Total amount of slag: 8775g associated with C483 and C484** **Comments: keyhole shaped furnace; clinkery slag** **Chemical Composition: Fe/As/Ca/Mn suite for C480/S332 and C262/S328; Cu/Zn for C480/S332; also C264/S330 and C482/S335**
	**F121 (left) : The raised lip forms the base of a dome which would not have completely covered the furnace; it is about 3cm thick but at places thicker; it is extensively vitrified (SASAA photo).** **F120 (right) : the mass of slag seen here points to an unsuccesful smelt. F121 contains an accumulation charcoal and small fragments of slag. (SASAA photo).**	

F125/F126/F127/F299

		
F125 **No of Contexts: 7** **Max MS (soil): 2327K for C517/S376** **Total amount of slag: 10814g ; fines= 1517gr associated with contexts C514,C325, C244** **Chemical composition: Fe/As/Mn/Ca suite for C515/S371, S373; Cu/Zn suite for C323/S362, S361,S360; also for C515/S371**		**F126** **No of contexts: 1** **Total amount of slag: 400g** **Max MS (soil): 7190K for C326/S242; an exceptionally high K value for a non-ferrugenous soil; it may be justified by the presence of a slag sample.** **Chemical composition: no correlation with any of the two suites of elements**
		

F127 **No of contexts: 4** **Max MS (soil): 2503K associated with C329/S477** **Total amount of slag: c. 1kg associated with C327** **Chemical composition: no correlation with any of the two suites of elements**	**F299** **No of contexts: 9** **Max MS (soil): 6000K variation within soils from the same content; MS max value for context: C330/300 (c. 6000)** **Total amount of slag: c. 13040g associated with C313, C314, C598** **Chemical composition: no correlation with any suite of either elements**	**F125 is a multi-context furnace displaying a range of MS readings and so of multiple temperatures of heating.** **F126 is a single-context furnace with primarily heated soils, charcoal and slag displaying considerably high magnetic susceptibility.** **F127 is a four-context furnace with evidence for low heated soils (F327) suggesting that it was not exposed to high temperatures**
		
concave white stone positioned between F299 and F127. the purpose of these concave stones might have been to crush the ore. (SASAA photo)	**another base stone between F126 and F125, perhaps for bellows support**	**the clay based raised lip is vitrified and served the purpose of containing the charcoal within the furnace. it may have risen to some height but it is unlikely that it sealed the furnace.**

F133/ F134/ F135/ F168

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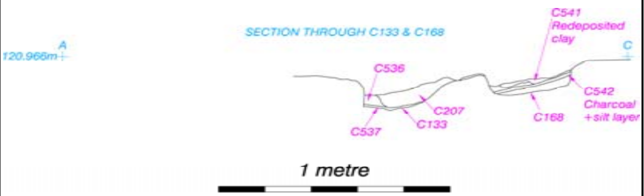
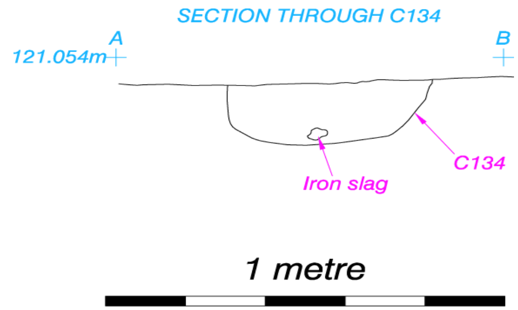
<td></td>
<td></td>
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<td>F133
No of contexts: 4
Max MS (soil): 1679K associated with C207/S395
Total amount of slag: c. kg associated with C
Chemical composition: no correlation with any of the two suites of elements</td>
<td>F134
No of contexts: 2
Max MS (soil): 492 associated with C162/S63
Total amount of slag: c. 1300g
Chemical composition: no correlation with any of the two suites of elements</td>
<td>F135
No of contexts: 2
Max MS (soil): 351K associated with C171/S120
Total amount of slag: c. 5875g
Chemical composition: no correlation with any of the two suites of elements</td>
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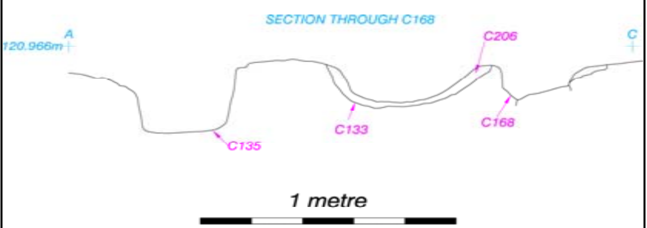
<td></td>
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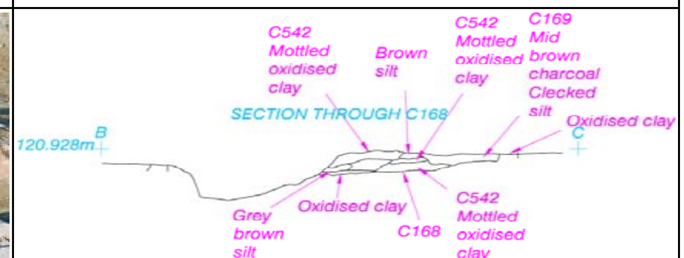
<td></td>
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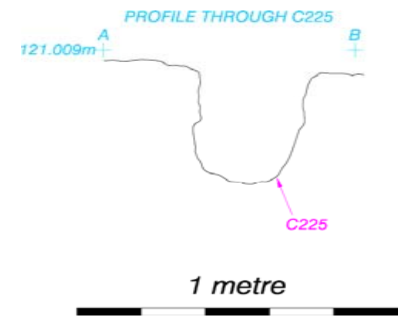
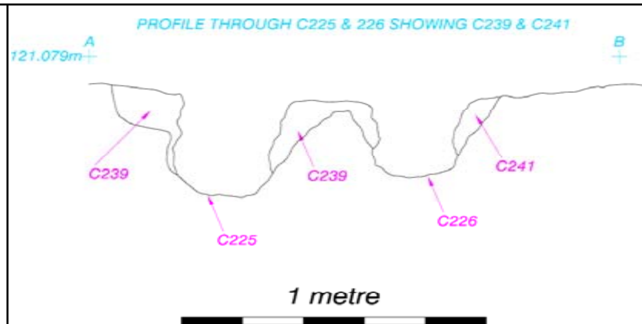
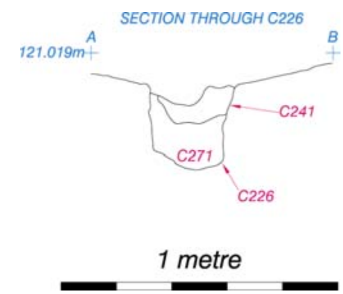
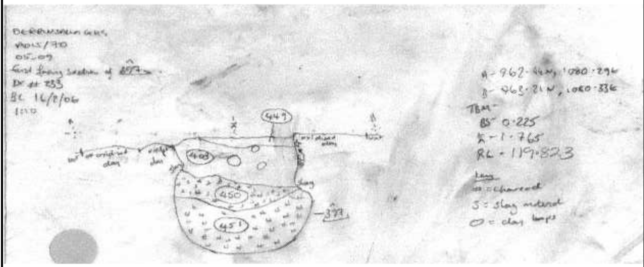
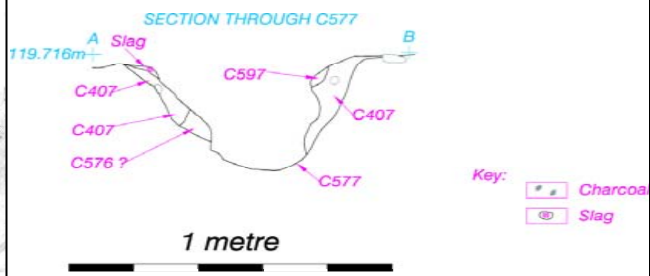
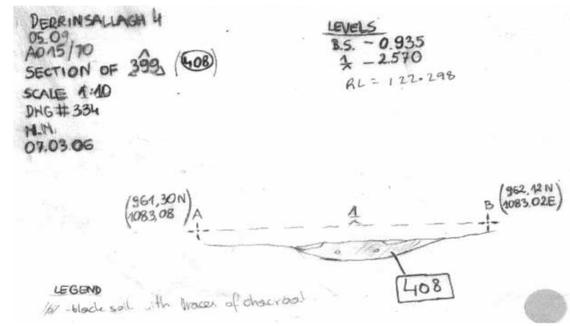
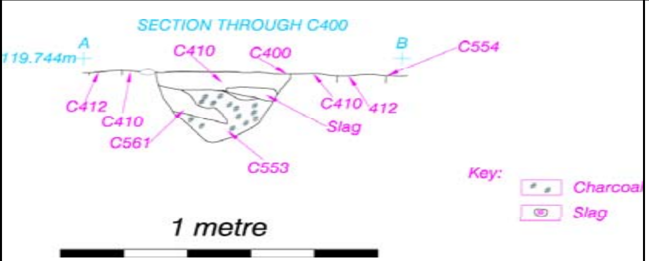
F168 **No of contexts: 3** **Max MS (soil): 523K associated with C524/S386** **Total amount of slag: ????** **Chemical composition: no correlation with any of the two suites of elements**	**Mid ex from S : from left to right : F135, 133, 168, 134 (to the north)**	

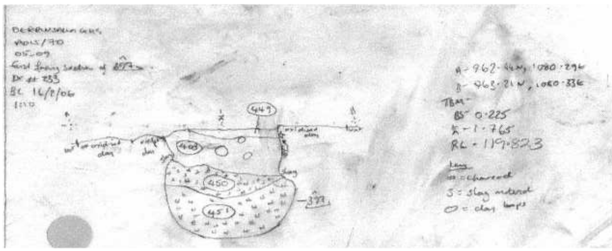
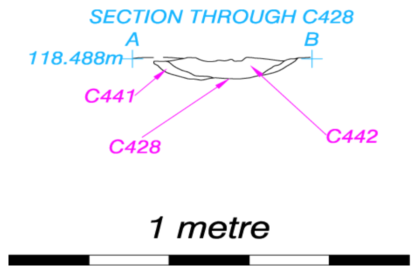
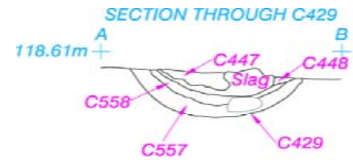
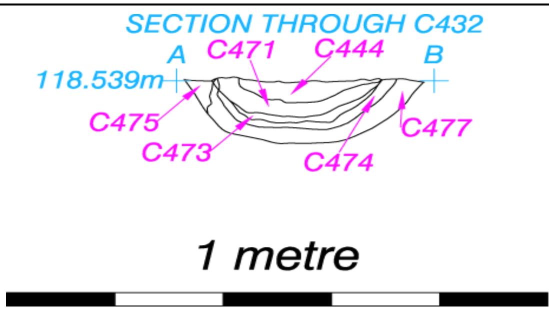
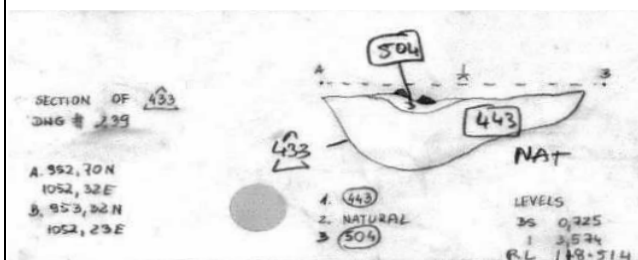
F225/F226

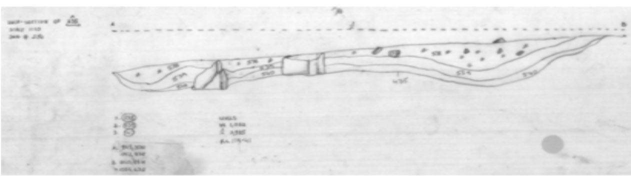
		
F225 **No of contexts: 3** **Max MS (soil): 523K associated with C524/S386** **Total amount of slag: 3000g associated with C270/S263** **Chemical composition: Fe/AS/Mn/Ca for contexts C240/S154 and C270/S169; Zn associated with C270/S169**	**S facing profile F225, 226**	**F226** **No of contexts: 3** **Max MS (soil): 2441K associated with C242/S155** **Total amount of slag: 5730g associated with C271/S170** **Chemical composition: some correlation of Cu with C271/S170**

F397/F398/399/400

		
F397 **No of contexts: 6** **Maximum MS (soil): 1850K, associated with C402** **Total amount of slag: 6605g** **Chemical composition: the Fe/Mn/As/Ca suite – no contexts the Cu/Zn suite – no contexts, although all contexts have high Zn**	**F398=F577** **No of contexts: 7** **Maximum MS (soil): 2110K, associated with C574/S439** **Total amount of slag: 8249g** **Chemical composition: the Fe/Mn/As/Ca suite – no contexts the Cu/Zn suite – no contexts**	**F399**
		
F400 **No of contexts: 5** **Maximum MS (soil): 1623K, associated with C409/S412** **Total amount of slag: 3771g, associated mainly with C410 and C553** **Chemical composition: the Fe/Mn/As/Ca suite – no contexts; the Cu/Zn suite – no contexts, although C553 and C409 have high Zn**	**F397: contents and container have 'merged' into a single mass of slag resulting in an unsuccessful smelt**	**F124? metalled surface. Small platforms like these may have been used to keep charcoal and/or dry**

F424/F425/F427/F428/F429/430/F432/F433/F434

		
F424 **No of contexts: 7** **Max MS (soils): 4000K associated with C489** **Total amount of slag: 1705g associated with C490** **Chemical composition: the Fe/Mn/As/Ca suite – no contexts; the Cu/Zn suite – C489, C528, C487, C571, C526**	**F428** **No of Contexts: 3** **Max MS (soils): 4136K associated with C442** **Total amount of slag: 200g** **Chemical composition: max correlation (ie all contexts) with Fe/Mn/As/Ca**	**F429** **No of Contexts: 4** **Max MS (soils): 1587K associated with C447/S302** **Chemical composition: some correlation with Fe/As/Ca/Mn suite for C448/S304** **Total amount of slag: 1700g associated with C559**
		

F432 No of contexts: 4 Maximum MS (soil): 5169K, associated with C444/S300 Total amount of slag: 4455g, associated with C471 and C474 Chemical composition: the Fe/Mn/As/Ca suite for C473/S325; the Cu/Zn suite – no contexts, although C444/S300 has high Zn	**F433 No of Contexts: 2 Max MS (soils): 45K , no evidence for heating Total amount of slag: n/a Chemical composition: some correlation with Fe/As/Ca/Mn suite for C443/S299**	**F434 Number of Contexts: 1 Max MS(soils): 408 associated with C518 Total amount of slag: 3000g Chemical composition: no correlation with either suite of elements**
		
F435 Number of Contexts: 3 Max MS(soils): 55 associated with C538 Total amount of slag:N/A Chemical composition: no correlation with either suite of elements		

7 Discussion

At the time of writing no structures report was made available to us, therefore the discussion focuses on the scrutiny of the analytical data generated here. The data derive from

a. The measurement of physical/chemical parameters of soils, slags, charcoal and the two samples of the iron ore source-seepages from a neighbouring field
b. The typology of individual features, metallurgical and non-metallurgical and the cluster of metallurgical features and their significance. Only the metallurgical features are discussed in full.

This section attempts to elucidate the following questions/issues

- What is the nature of the metalworking activity on site?
- What are the raw materials and the level of technological know-how as manifested by the combined study of the soils and waste as well as the typology of furnaces?
- What observations can be deduced from the study of these furnaces?
- What is the meaning of the clusters of furnaces and what type of metallurgical practice/smiths' 'routine' do they reflect?
- Given that our knowledge about IA metallurgy is deduced from the study of artefacts and metalworking installations, is there 'agency' from the part of the smith and how can this be manifested? By 'agency' we mean to imply the opportunity to examine not the 'work of the smith' but the 'smith at work'.

The methodology implemented in this study is that of Holistic Context Analysis (HCA) developed by SASAA (Photos-Jones et al in press; SASAA 139.1; SASAA 171). The furnaces and their contents are scrutinised not only on the basis of the metallurgical waste within but also on the basis of the soils enclosed, the aim being to extract as much information as possible from the study of their physical parameters. For the purposes of this discussion these parameters are chemical composition and magnetic susceptibility (MS). MS values reflect the temperature range to which the soils within each feature have been exposed; chemical composition identifies the type of ore used as well as other materials present, against the background of the natural soils.

We opted to undertake chemical analysis of ALL soil samples, rather than a select number as originally planned. To that end we chose to use a portable XRF facility, which allows a fast, reliable and cost effective analysis (see Table 11). Light elements are excluded from the analysis on account of low sensitivity. The values obtainable from the XRF were checked against ICP data with particular reference to the two samples of the iron ore source. The correlation between ICP (see Table 8) and XRF (see Table 7) data is good, the results being presented in Table 9/Figure 22.

Grouping of samples based on chemical analysis is shown in the PCA plot of Figure 7. Charcoal and the majority of soils form one group, the slags form a separate group, the soils of F424 form a third and finally the two sources of iron ore seepages form a fourth.

The discussion of the analytical data starts with the establishment of a soils control group which will serve to establish the 'background' (see Table 3). Samples are chosen from soils within postholes and with no evidence for heating (i.e. baseline MS values).

Ores

In SASAA 204.2 we suggested that the most likely source of ore would have been the striking red orange iron rich encrustations, a renewable source of iron ore, which is often to be found within drainage channels at the edge of fields. The striking red orange colour of these encrustations which dry up in the summer could not have escaped the notice of the Derrinsallagh people.

Aalen et al suggested that wooden trackways across bogs were put in place not only to connect separate fields but also 'to (sometimes) provide access to the deposits of ochre which occurred at seepage areas in the bog. The ore deposits were smelted to produce the iron which was so vital to the economy, possibly using charcoal made from turf...' (Aalen et al 1997, 115).

The iron encrustations are not strictly speaking iron oxides (ochres) but iron oxy-hydroxides. They are non crystalline and of a pasty texture, occasionally rich in calcium, and alumino-silicates (clays). They own their formation to bacterial action which oxidise the iron out of the underlying the streams rock (Hall and Photos-Jones 1998). These seepages would have had to be air dried and made into small balls prior to charging in the small furnaces. It is possible that one of the furnaces amidst the clusters of furnaces would have been used for this purpose, alone. We show below that attributing different functions to different furnaces within each cluster is not easy, given that nearly all furnaces appear to have been heated at the same temperature range of c. 400^0-600^0C.

We argued that analysis of these seepages and comparison with the chemical data deriving from slags would establish their use on site. To that end we undertook ICP analysis as a means of establishing the major element composition and in particular the iron content thereof. At c. 30% Fe_2O_3, (see Table 8) these encrustations would have constituted a 'respectable' ore, which, furthermore would have been easy to 'harvest', ie scoop out with hardly any effort involved. Being reliably regenerative-over a cycle of one or two decades- they would have made an ideal source for the Derinsallagh IV iron furnaces.

In addition to iron, other elements like calcium, strontium, barium and arsenic are present in elevated levels relatively to the local background and, as such, can potentially fingerprint this source of ore.

The pasty, in terms of texture, and clayish in terms of composition nature of this ore suggests that it will not be easily 'recoverable' from the furnace, in means other than chemical analysis.

Charcoal

Chemical analysis of charcoals (see Table 6) shows that there are no particular elements which can fingerprint them. Calcium/magnesium normally attributed to charcoal/wood ash are already present in increased levels in the iron encrustations, as already discussed. Charcoal speciation is still pending and the information derived from that study will be eventually incorporated within the data presented here. The identification of the potential presence of peat /turf burning will also be of interest.

Slags

Typologically the slags are amorphous and dense with relatively medium porosity (see Figure 6 for colour photos). They often incorporate earthy materials and they are occasionally of the drippy type often associated-to our view wrongly- with tapped slag. There is definitely no case for tapping to be made here. The majority of slags have not been able to 'drain' out of the bloom since it is unlikely that any (bloom) formed at all. Instead it is more a case of slag accumulation clogging the furnace.

What at first glance might have appeared as furnace fill and post-smelt, on closer examination appears to reflect the smelt itself.

The majority of slags are of fayalitic composition, ie they are iron silicates (fayalite) with minor constituents, wustite (iron oxide) and interstitial glass. They are all bloomery smelting slags with no identifiable examples of smithing slags.

Image analysis over three different areas of the same sample and over six samples showed that fayalite made up c. 70% of the total slag mineralogical composition, with c.20% for wustite, c.5% for interstitial glass and c. 5% for pores. The latter varied with level of porosity as per individual sample. The abundance of fayalite over all other phases suggest that conditions within the furnace were not sufficiently reducing and that only 20% of the iron present managed to reduce to wustite prior to reacting with the silica present and converting to slag. In other words a substantial amount of iron was lost in making slag before it was given the chance to convert to iron .

Apart from iron and silicon, the main chemical elements of these slags include a) manganese in the form of manganese oxide, a constituent of the charge; it appears in considerable amounts within the slag and as a substitute to iron in fayalite and wustite; b) phosphorus, present in minor amounts and in the glass phase c) barium deriving from barium sulphate found as an element in the glass.

Of interest are the small inclusions of iron silicates with small amount of aluminium, phosphorus, potassium and calcium which represent iron ore in different degrees of reduction to fayalite. There is no evidence for manganese within these small inclusions which suggests that manganese oxide nodules were added to the charge separately.

The slags mineralogy points to inefficient smelting conditions within the furnace. This is hardly surprising since the furnaces are small, not adequately insulated with lining and with not sufficient space between the tuyere and the furnace bottom for the bloom to grow.

To summarise we suggest that the suite of element Fe/As/Ca fingerprint the type of ore while the suite Fe/Mn/Ca/As can fingerprint the slag. We suggest that the elements Fe/As/Ca can be used to highlight the presence of ore within any metallurgical feature. The substantial levels of manganese in the slag suggest, as already discussed, a separate addition of manganese oxide nodules. Additional elements like Pb, Sb, and Ni, which are above background level do not correlate with other elements and therefore are not considered any further.

Metallurgical ceramics

No metallurgical ceramics, as per fragments of tuyeres, have been identified on site which of course does not resolve the issue of what exactly was the means of providing air supply to the furnaces. We suggest that either an organic material was used or even contemplate the possibility that none was used. We shall await the results of the structures report and in particular the nature and 'strategic' positioning of what appears from the photographs of the furnaces to be 'key' stones at the entrance of some of the furnaces. We propose to return to this issue when a report for publication is undertaken and completed.

Tuyeres of round and conical shape are particularly common among Early Christian sites in Ireland and this author has examined and analysed a collection of such materials (SASAA 238). We argue that we should not necessarily make every effort possible to 'introduce' these artefacts into the site even though the evidence is not there to substantiate it. It is possible that they were made of unfired clay which disintegrated or 'merged' into the background of other vitrified/heated clay-based materials; alternatively, as we already mentioned, that there were none present

There are a substantial number of heated earthy materials on site discussed in the context of soils (see relevant Tables within individual features) but only a few have actually gone to vitrification (see Figures 19 and 20). This observation is corroborated by the low temperature range that the soils within the furnaces have been exposed to (see discussion below). The features have been heated to a varying degree of temperatures but that temperature range does not exceed 600^0C. The lip over some of the furnaces is made of earthy materials and the furnaces themselves have not been lined, intentionally.

Features and the chemistry of their soils

We turn now to the furnace soils which we suggest hold the key in the elucidation of activities on site. Figure 7 shows a PCA plot for all features and suggests that all soils form a tight group with only some outliers. The outliers have been divided in two subgroups, the distant and the close outliers.

Among the close outliers are the soils of F424. Among the distant outliers are the soil samples associated with features F424, F121, F428, F225, F125. None of these features are made uniquely of outliers, ie they incorporate soils which belong to the main group.

We focused the investigation on the XRF data for the following elements: Fe, Mn, Cu, Zn, As and in one occasion only, Pb.

The features which are characterised by high Fe contents are clearly metallurgical particularly, when Fe is associated with Mn/As/Ca.

The contexts with Cu (Background 0ppm; LOD (limit of detection) 50ppm) include: F424,F121,F125, F141, F583. Other contexts near the limit of detection include F62, F60, F119, F8. All, with the exception of F60, have been identified as typologically metallurgical.

The contexts with Zn (background 48ppm; LOD= 25ppm) include F424, F583, F438, F19, F140, F141, F334, F119, F121, F128, and F160

The contexts with As (background 0ppm; LOD= 9ppm) include F125, F121, F121, F583, F226, F8, F19, F86, F15, F124, F334

There is only one feature, which has slightly increased levels of Pb (LOD=11ppm): F 66

From the above it is concluded that metallurgical features can be identified on the basis of Fe/Mn/As/Ca. Those features which display Cu/Zn (although not necessarily both elements for all contexts) include F424, F121, F125, F141, F583, F62, F8, F19. F424, F121 are also among the close outliers in the PCA plot of Figure 7, while the rest are part of the secondary outliers.

The main outlier in terms of the Cu/Zn/As suite of elements is F424, which is described as a charcoal spread. Interestingly the only place where a metallurgical ceramic was found was in the vicinity of F424.

This suggests to us that across the site we may potentially have two sources of iron ore used. That associated with iron seepages and that associated with copper sulphide (fahlertz) ores like tennantite, ($Cu_{12}As_4S_{13}$). Such deposits are found in the well known Bronze Age mining/smelting site of Ross Island, near Killarney, Co Kerry (O Brien 1995; Ixer et al 1995). A wide range of metals including Ag, Fe, Zn, Cd and Hg can substitute for copper, and these elements may be carried over into any metal smelted from these ores (Ixer et al 1995). Similar type of mineralisation and evidence for Bronze Age exploitation occurs on Mount Gabriel, Co Cork (Jackson 1968;1980).

There was NO presence of copper/zinc in the slags analysed here (in the glassy phase or within any metallic phase) so we cannot put forward the suggestion that copper metallurgy was carried out on site. Merely that the ore source in the Derrinsallagh IV furnaces is of a mineralisation which is potentially similar to iron associated with tennantite deposits.

Furnace dates

C-14 dates suggest that the clusters of furnaces F8/9/10 and F17/18/19 are contemporary. F9/ C199 (Sample 101): Cal BC 50 - Cal AD 240; F17/ C357 (Sample 259): Cal BC 10 - Cal AD 250

Furnace typology

The furnaces are small ranging between 30-40 cm and of roughly the same depth indicating a bowl furnace of a H/W ratio=1. More data re dimensions should be forthcoming pending the writing of the structures report.

There appears to have been no superstructure in any of them, only a raised 'lip' no higher than 4-5cm high, to contain the charcoal within. This lip is often well finished thus precluding any scenario of a shaft. The interior of the furnace was not intentionally lined; there was no attempt to insulate against the loss of heat. The partially sintered/at places vitrified interior of the furnace was due not the presence of an added lining but rather the materials of the furnace wall sintering/melting.

Furnace positioning

In SASAA 204.2 we suggested that the domestic area of Derrinsallagh IV may have been located to the N of the field, based on the localised enrichment in phosphates. Indeed the positioning of the furnaces suggest that they radiated away from that field to the N and towards the S. The first radial/linear group consists of F4, F14/15/16, F225/226 and F119/120/121 which lie roughly in a straight line; the second group consists of F5, F8/9/10, F17/18/19, F 20/21/22/23/24 and F135/133/134/168 while the third consists of F125/126/127/299; a fourth consists of the furnaces associated with F400 and finally the fifth group lies further downhill and is associated with F432.

Furnace cluster chemistry

We group the furnaces according to their fingerprinting elements

Single furnaces
F4/F5: Fe
F583: Cu/Zn/Fe
Cluster Group I associated with Fe/As/Mn/Ca:
F125/F126/F127/F299 and F133/F134/F135/F168

Cluster Group II associated with Cu/Fe/Zn:
F8/F9/F10; F14/F15/F16; F17/F18/F19; F20/F21/F22/F23/F24; F119/F120/F121/F122; F225/F226; F424/F425/F427/F428/F429/F432; F397/F398/F399/400; F80/F81/86/F87/210

Of the Group II clusters which furnace within each cluster is associated with Cu/Zn?

Of the group F8/F9/F10 only F8 is
Of F14/F15/F16, all are
Of F17/F18/F19, all are
Of F20/F21/F22/F23/F24, only F22 is
Of F119/F120/F121/F122, all are
Of F225/F226, all are
Of F424/F425/F427/F428/F429/F432, only F424/F429/F432 are; the furnace F428 contains Fe only
Of F397/F398/F399/400, nearly all are and finally
Of F80/F81/86/F87/210, only F86 is

Can any inferences be drawn from the above? We can infer that all furnaces within each of the above clusters have been associated with Cu/Zn rich iron ores but in some the concentration of the above seem higher. We cannot suggest that smelting may have taken place in some furnaces in preference to others since the MS data do not overall corroborate such assumptions (see discussion below).

Testing the temperature within the furnace

Not all furnaces within individual clusters have been heated similarly. However because the temperature range is low (400^0C-600^0C) it is difficult to pin point the variations within. Table 12 highlights these variations and takes into account the make-up of the contents of each feature

For clusters
F14/F15/F16;
F17/F18/F19;
F119/F120/F121/F122;
F133/F134/F135/F168;
F125/F126/F127/F299;
F397/F398/F399/400 all furnaces have been exposed to the same T range (400^0-600^0C)

For cluster F20/F21/F22/F23/F24, furnaces F23/F24 have been heated at a lower T (0^0C-400C)
For cluster F225/F226, furnace F226 has been heated at a lower T (0^0C-400^0C)

Within cluster F424/F425/F427/F428/F429/F432 not all features are furnaces and this is reflected in the T range.
F438/F433/F436/435, the T range is (0^0C-400C)
F434/F432/429/427, the T range is (400^0C -600^0C)
F428, the T range is (600^0C -1200^0C).

In conclusion, of all the furnaces listed above the one with the most likely hood of generating iron was F428. For the majority of furnaces on site the only product certain to have come out of these furnaces would have been ......slag.

Furnace meaning

What do these features represent?

The Derrinsallagh IV furnaces and their contents must be seen as the effort of local individuals (1st century BC- 2nd century AD) to make iron and not necessarily as representative of iron metallurgy across Ireland, at the time. The knowledge and understanding of how to make iron with local ores may have not developed and spread with the same pace and at the same time throughout Ireland.

It appears that the multitude of furnaces represent repeated 'fresh starts'. Our understanding is that there is little reported scatter of slag across the site implying that the slag may have 'never' been removed from the furnaces and so no bloom was obtained.

The association with Cu/Zn/As deposits show a familiarity with copper smelting and indeed copper deposits from Bronze Age mining sites like Ross Island, Co Kerry are characterised by such deposits. We presume that the smelting furnaces from Ross Island would be no different from those at Derrinsallagh IV. It is certain that these furnaces did reach temperatures of c. 1000C (O Brien 1995). With one exception, ie the furnace F428, this does not appear to be the case at Derrinsallagh IV.

At Derrinsallagh IV we are witnessing an effort to smelt iron ore from iron deposits associated with tennantite. Is this source actually coming from Ross Island, Co Kerry, thus reflecting a direct continuation of a metals making tradition? Are there similar types of ore available in Co Laois nearer to the site? We suggest that Derrinsallagh IV people knew about copper ore sourcing/smelting, had identified/understood that iron associated with these deposits could be smelted on its own right and iron made from these ores, but were only beginning to learn how to make iron.

If we subscribe to an independent development of copper metallurgy in Ireland as reflected in the Bronze Age mining/smelting sites of Ross Island, Co Kerry and Mount Gabriel, Co Cork then Derrinsallagh IV surely points to an independent development of iron metallurgy emerging out of this tradition.

What about the use of the local iron seepages? Were the cluster of furnaces (ie F125/F126/F127/F299 and F133/F134/F135/F168), where this type of ore source was used, contemporary with the rest of the furnaces? There is a need to acquire more C-14 dates from the different clusters of furnaces. Two dates is far too few a number for such a site.

To the present authors, Derrinsallagh IV is a site of great scientific interest and significance. The introduction of iron as a working tool cannot be ascertained merely on the back of the presence of iron artefacts but rather on the basis of early attempts at iron making. Derinsallagh IV clearly points to such an activity.

At the start of this section we argued that the opportunity arises to study not 'the work of the smith' but 'the smith at work'. For anyone who has tried to make bloomery iron the Derrinsallagh attempts strike a vital chord. It is not easy to appreciate what one needs to do to make metallic iron and lots of it in a bloom that can be worked into even the smallest of objects. Slag is more often than not the only 'product' on site. Popular (and academic) literature identifies the 'smith' as a master craftsman of superior abilities, the maker of iron, the forger of swords, etc, etc. Derrinsallagh IV urges the practicing archaeologist, the academic and the public at large to put matters in their proper perspective and to approach the craft from the bottom up, its rather difficult and frustrating beginnings. It is little wonder that the standard metal of the Iron Age was bronze.

8 Summary and Suggestions for Further Work

- We suggest the acquisition of more C-14 dates to firm up our confidence in the period of activity involved.

- Following the write up of a structures report and the equivalent for other sites at Derrinsallagh and the greater vicinity, we propose to revisit the data and discuss the results in the framework of a publication paper. No further scientific analysis will be required. We suggest that **the materials are not disposed of** until such time as this second report/publication paper is completed. **The site is fundamental to our understanding of Irish Iron Age not to warrant a comprehensive exposure.** This report merely serves to set the scene.

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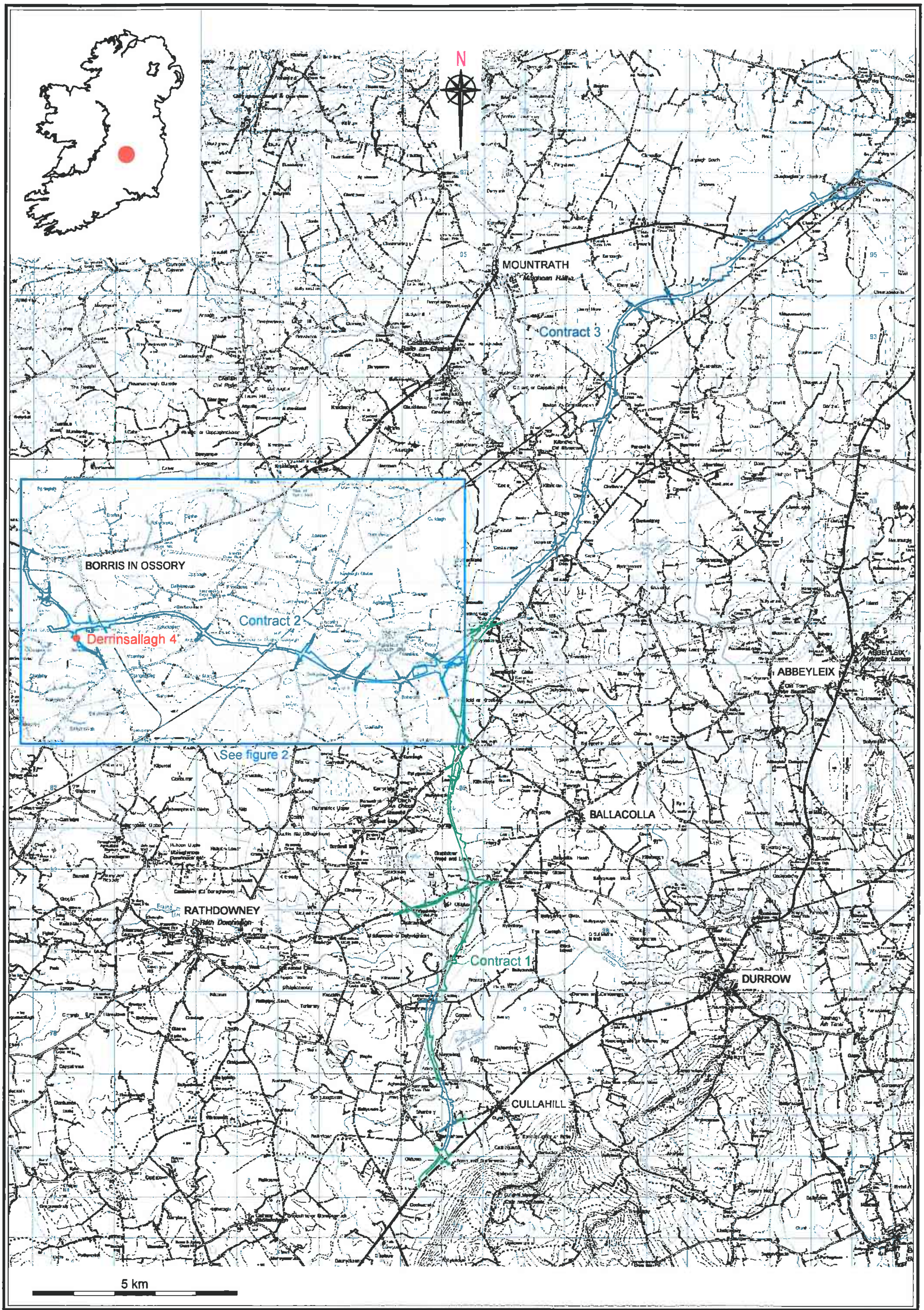

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		Date: Apr '09
	Issued for: Archaeological excavation report	*Origin: ACS Ltd*
	Client: Laois County Council	*Drawing no.: 05_09_C18001*

Figure 1: Location of M7/M8 Motorway Scheme showing location of Derrinsallagh 4

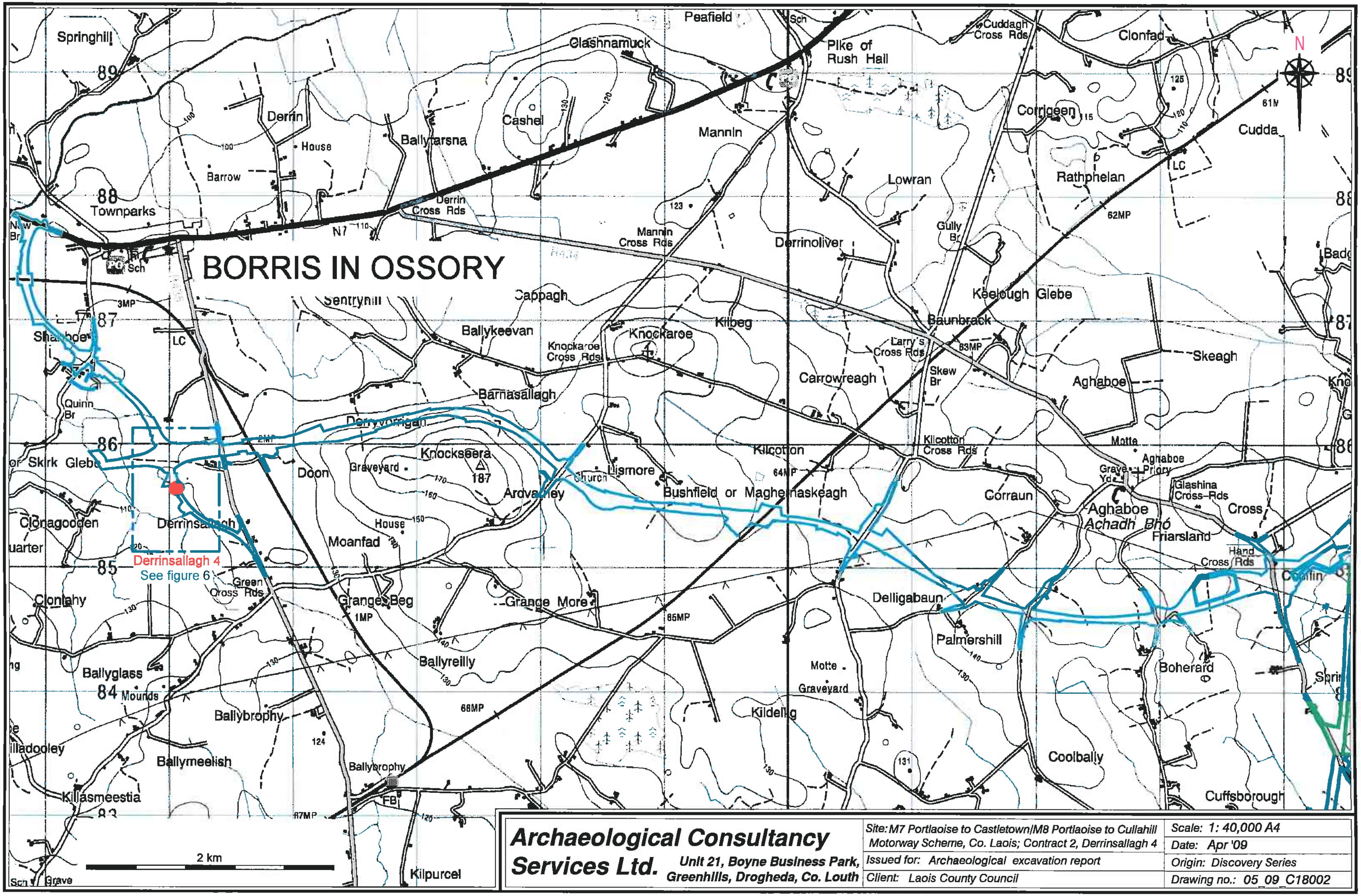
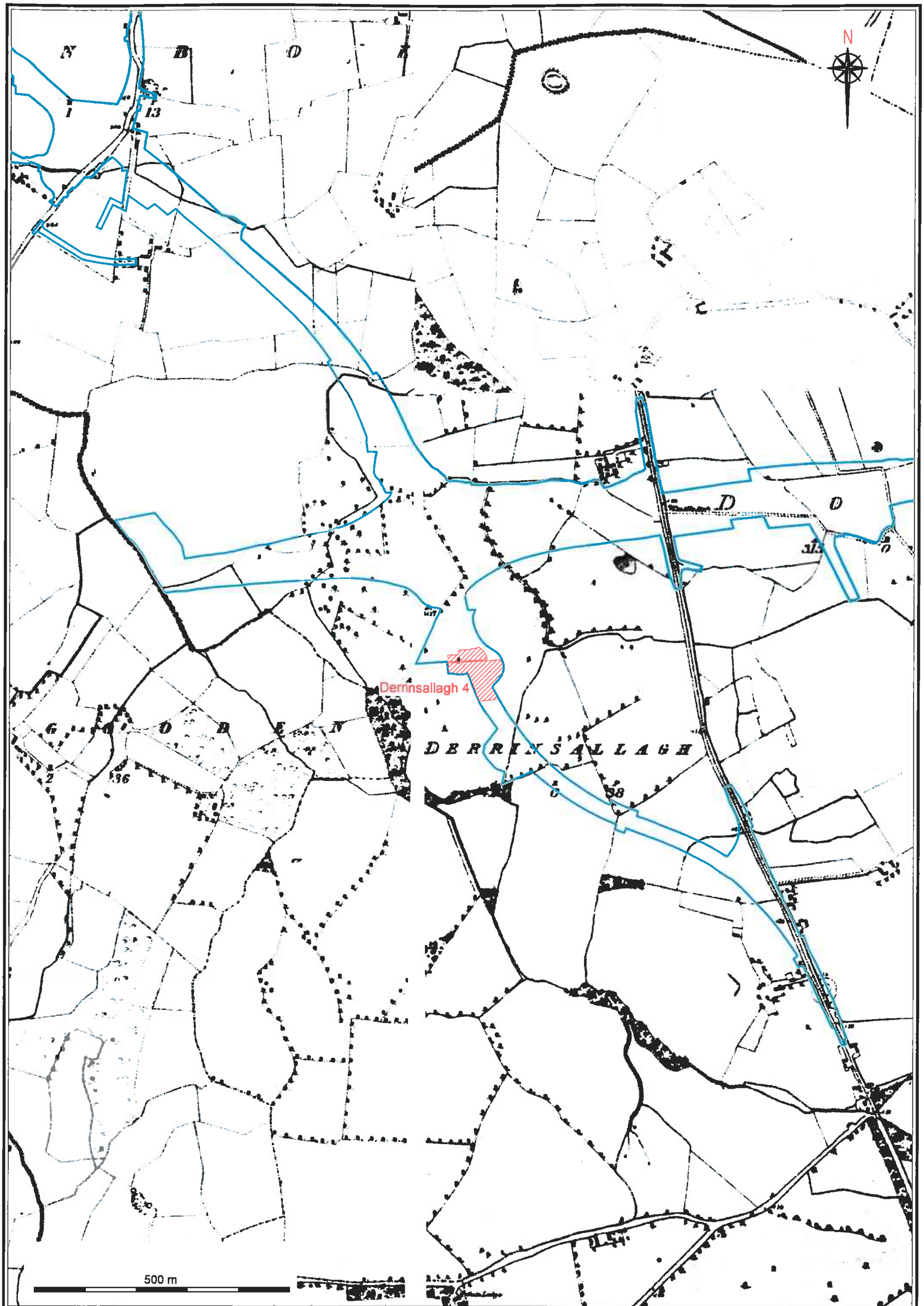


Figure 2: Location of Contract 2 showing Derrinsallagh 4



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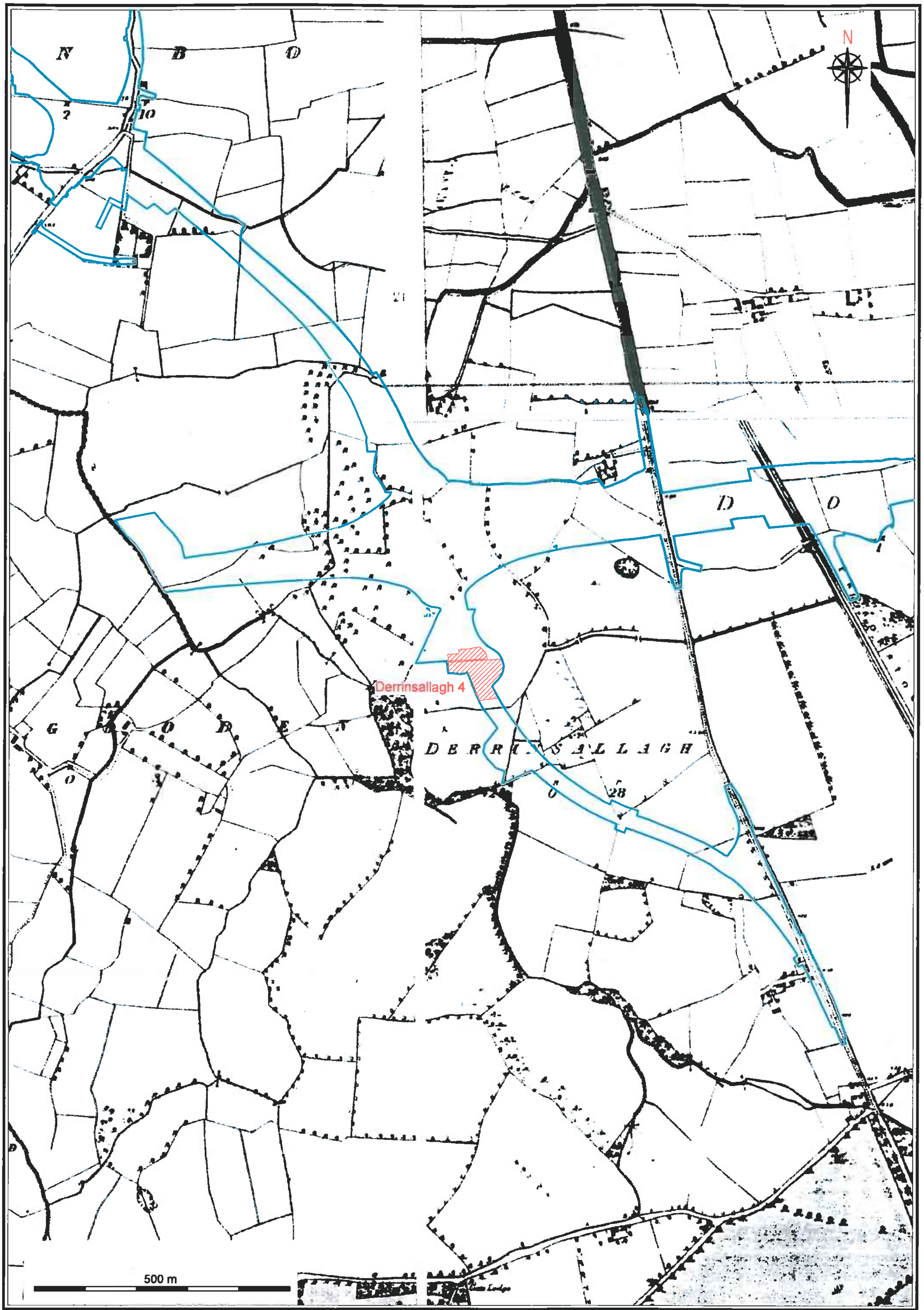
Issued for: Archaeological excavation report	Origin: OSi Laois 1st Ed. (1839)
Client: Laois County Council	Drawing no.: 05_09_C18003

Figure 3: Plan showing Derrinsallagh 4 on OSi Laois 1st Ed. (1839) background



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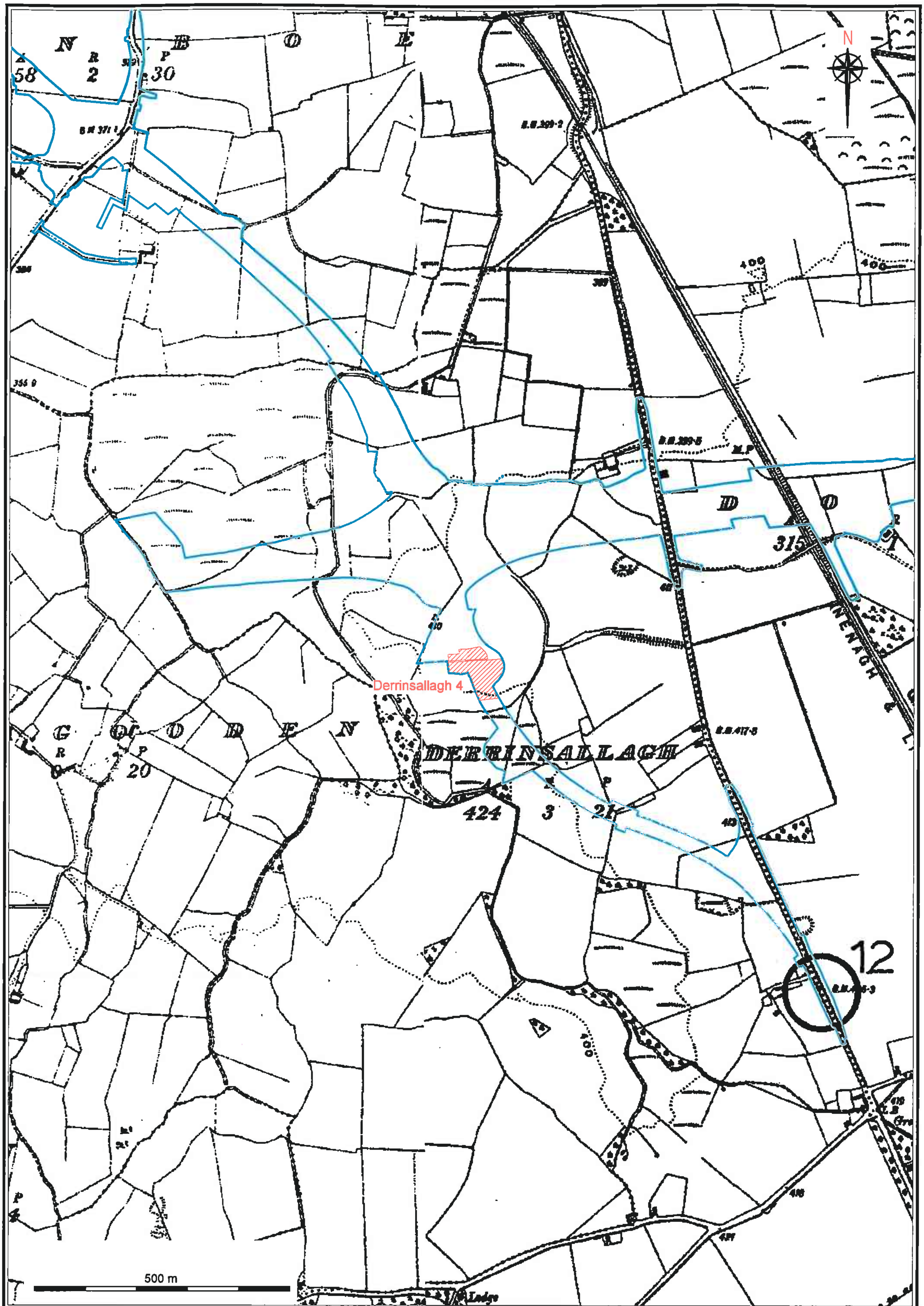
		Date: Apr '09
	Issued for: Archaeological excavation report	Origin: OSi Laois 2nd Ed. (1889-91)
	Client: Laois County Council	Drawing no.: 05_09_C18004

Figure 4: Plan showing Derrinsallagh 4 on OSi Laois 2nd Ed. (1889-91) background



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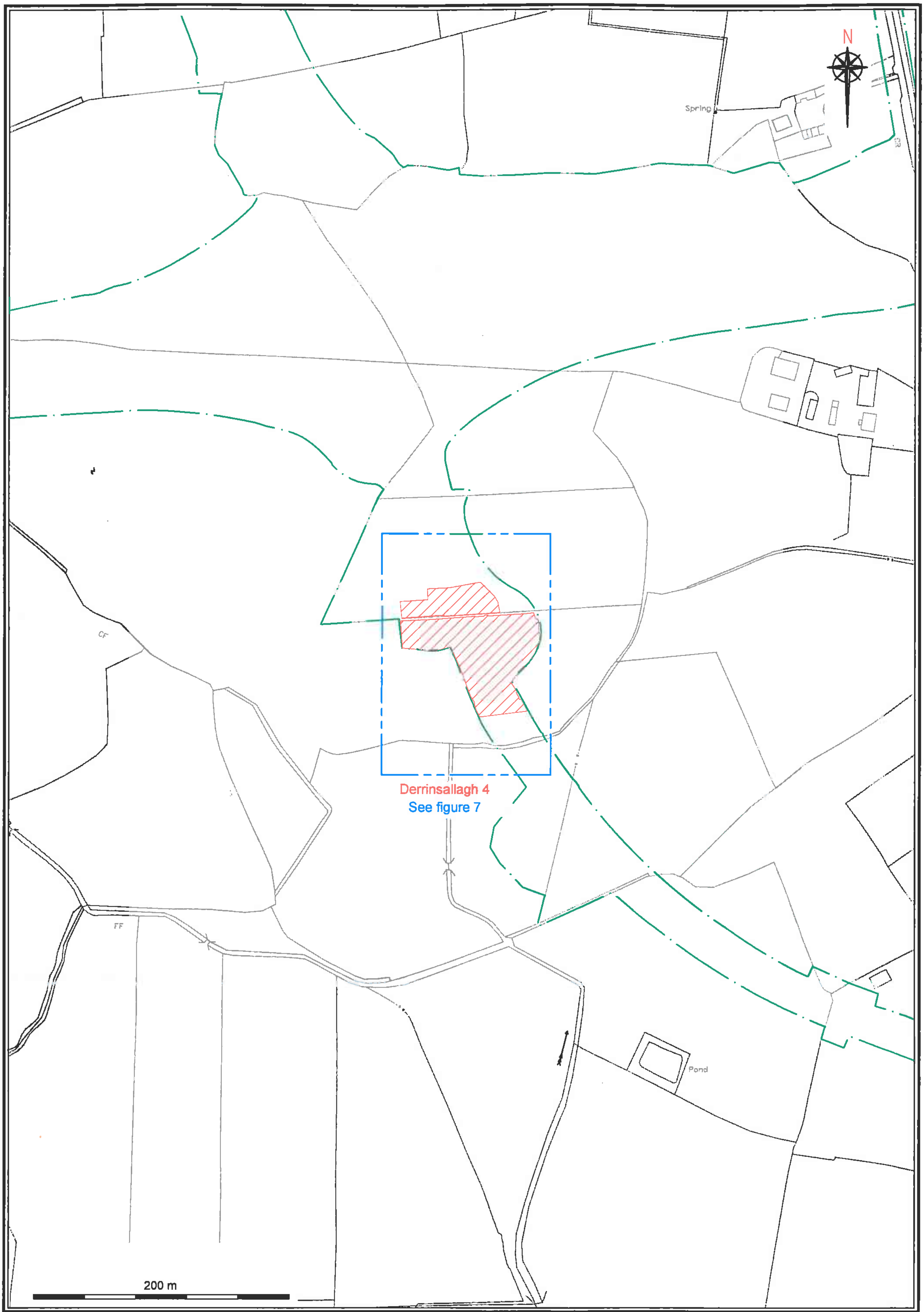
		Date: Apr '09
	Issued for: Archaeological excavation report	Origin: OSi Laois SMR 1909
	Client: Laois County Council	Drawing no.: 05_09_C18005

Figure 5: Plan showing Derrinsallagh 4 on OSi Laois SMR 1909 background



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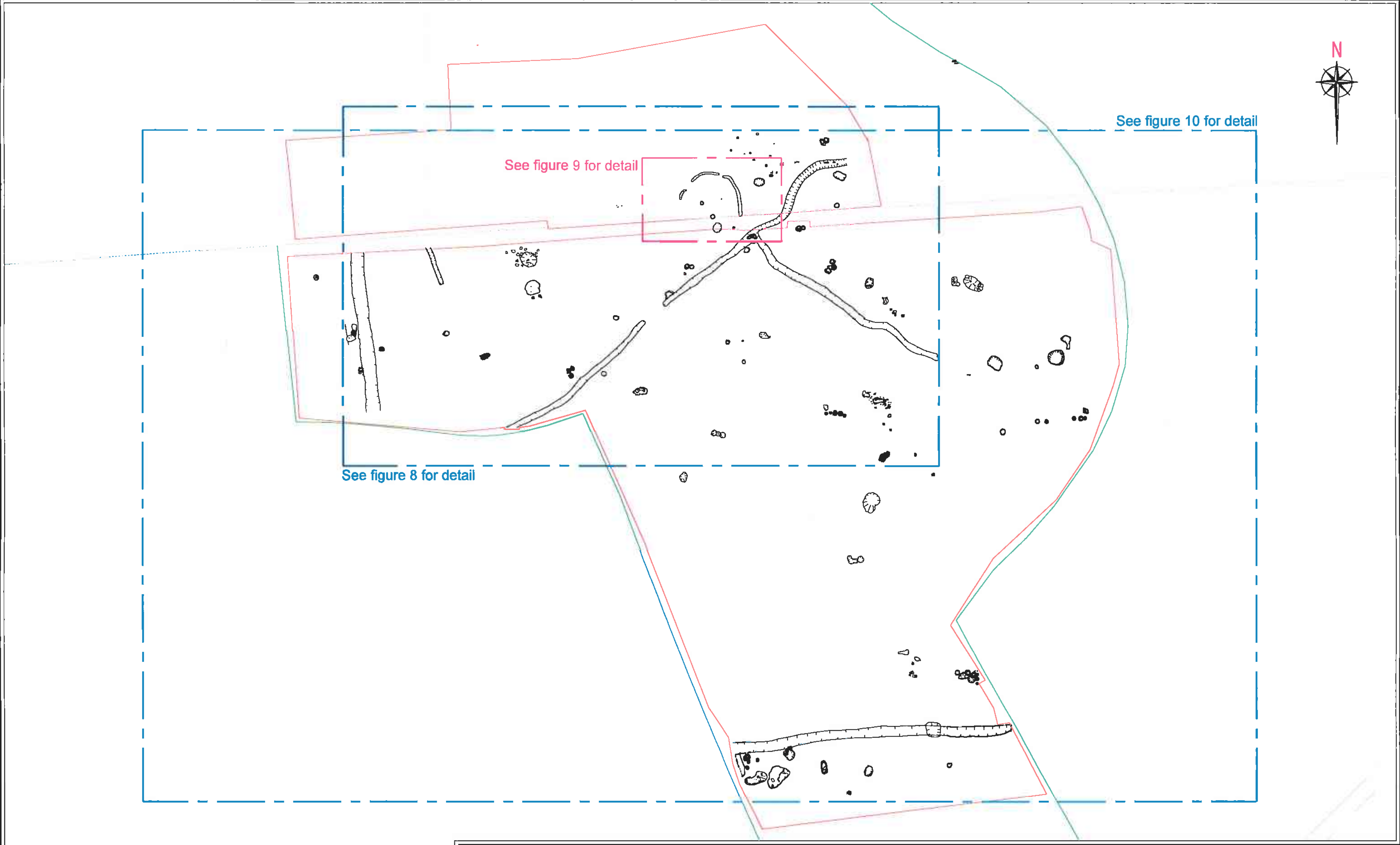
Issued for: Archaeological excavation report	Origin: ACS Ltd
Client: Laois County Council	Drawing no.: 05_09_C18006

Figure 6: Location of Derrinsallagh 4



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	Client: Laois County Council	Drawing no.: 05_09_C18007

Figure 7: Plan showing extent of site

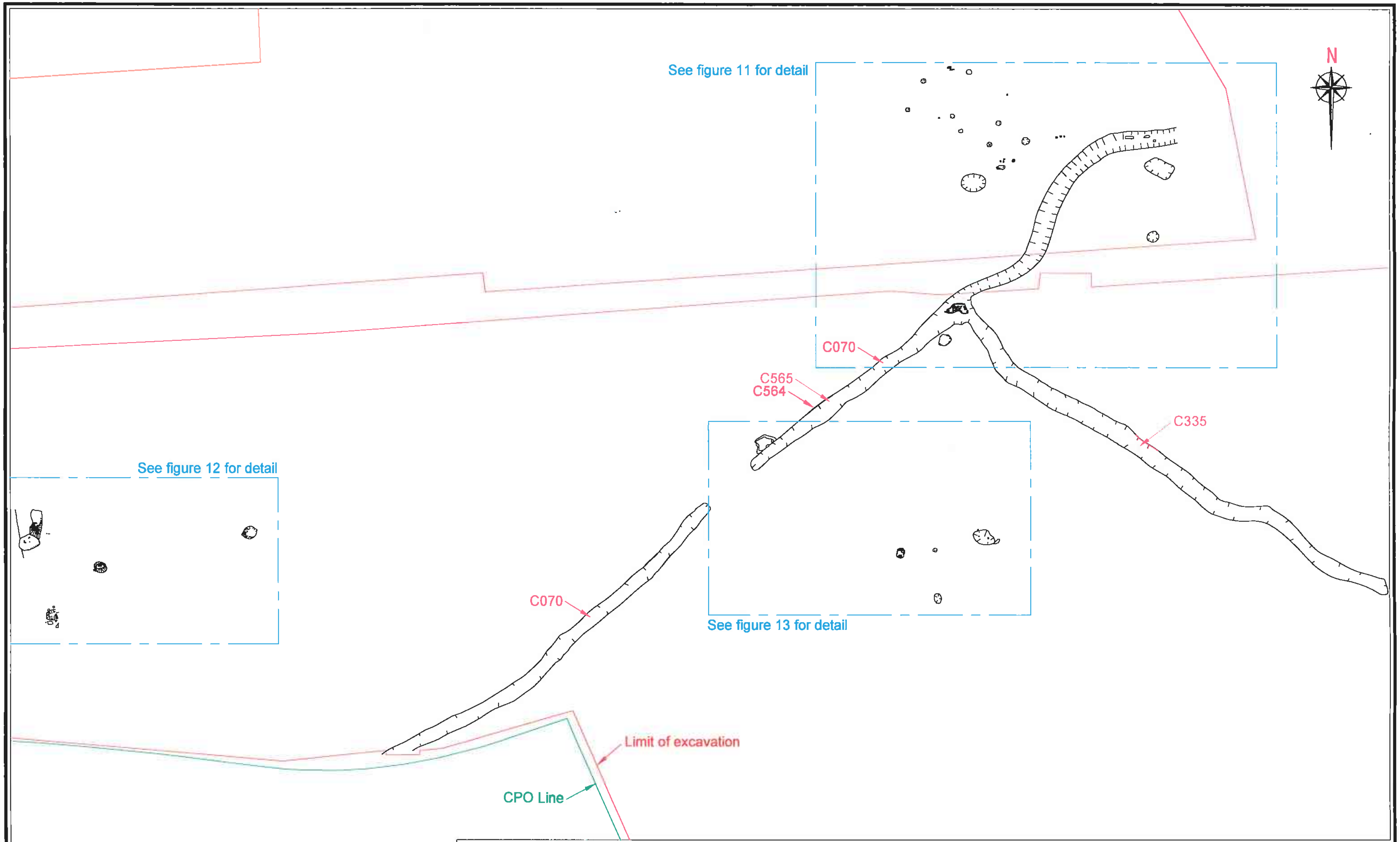

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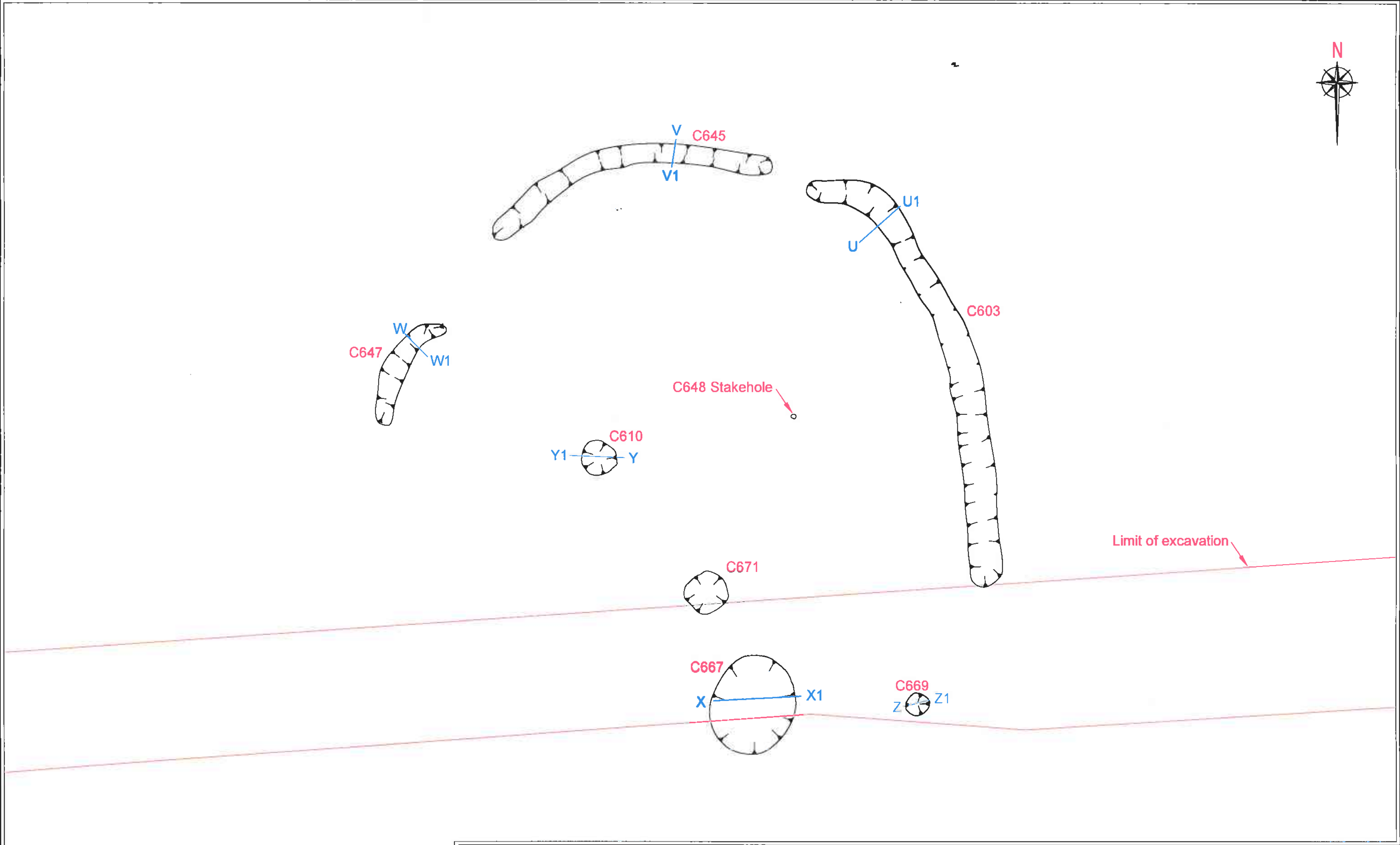
Figure 8: Post excavation detail of C070 and C335



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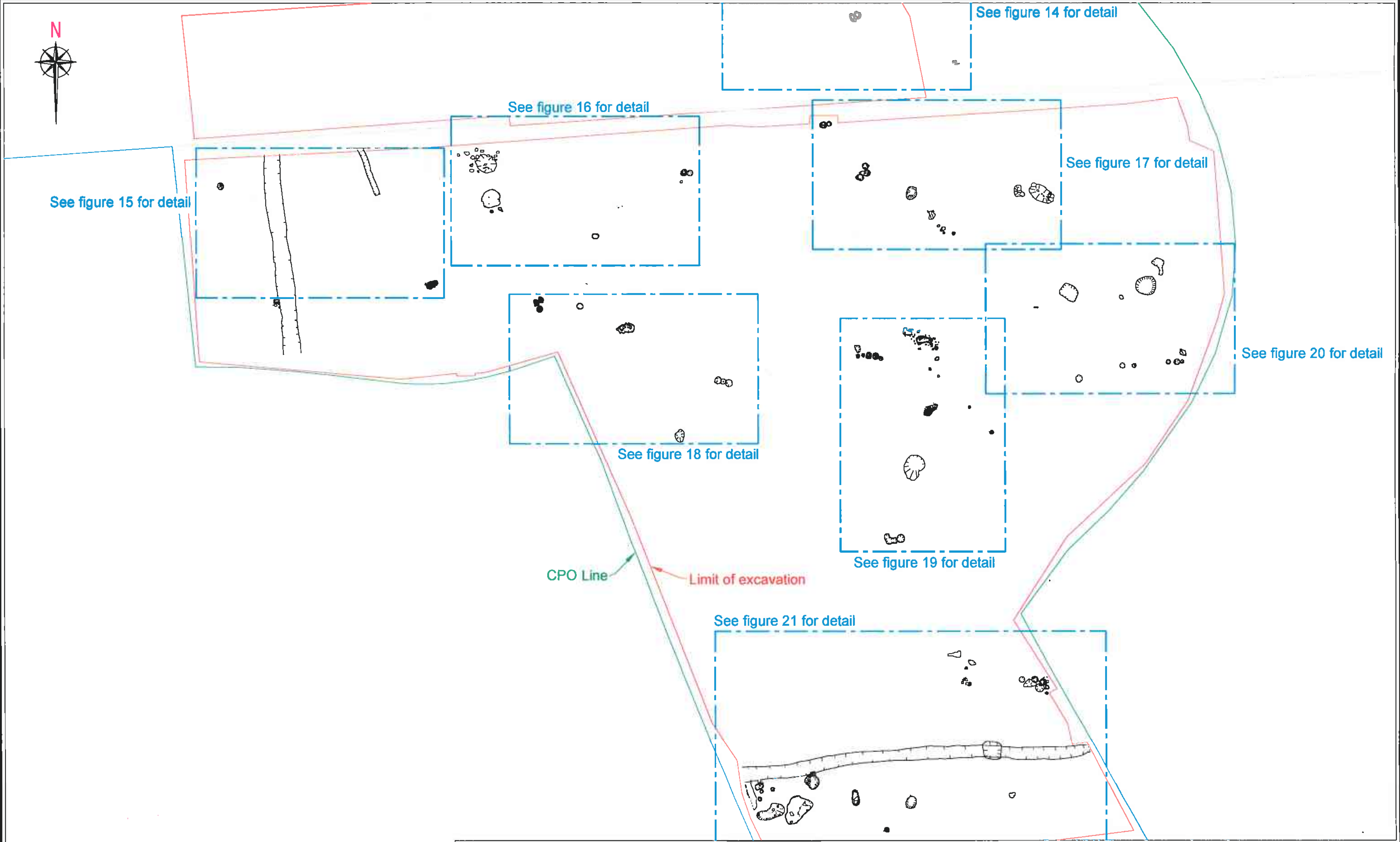
		Drawing no.: 05_09_C18009

Figure 9: Detail of middle Bronze Age activity



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	Client: Laois County Council	Drawing no.: 05_09_C18010

Figure 10: Detail of Iron Age structure

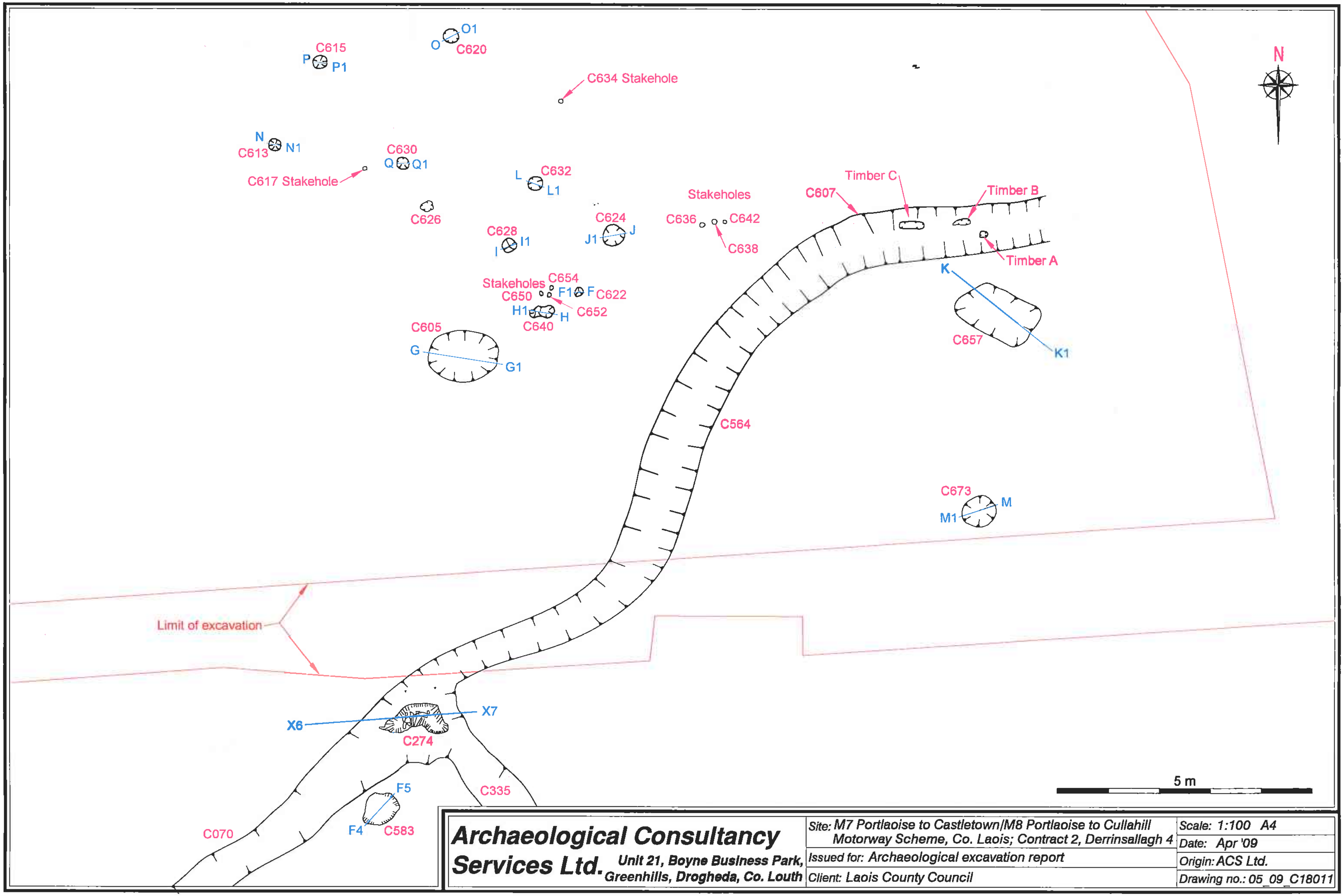
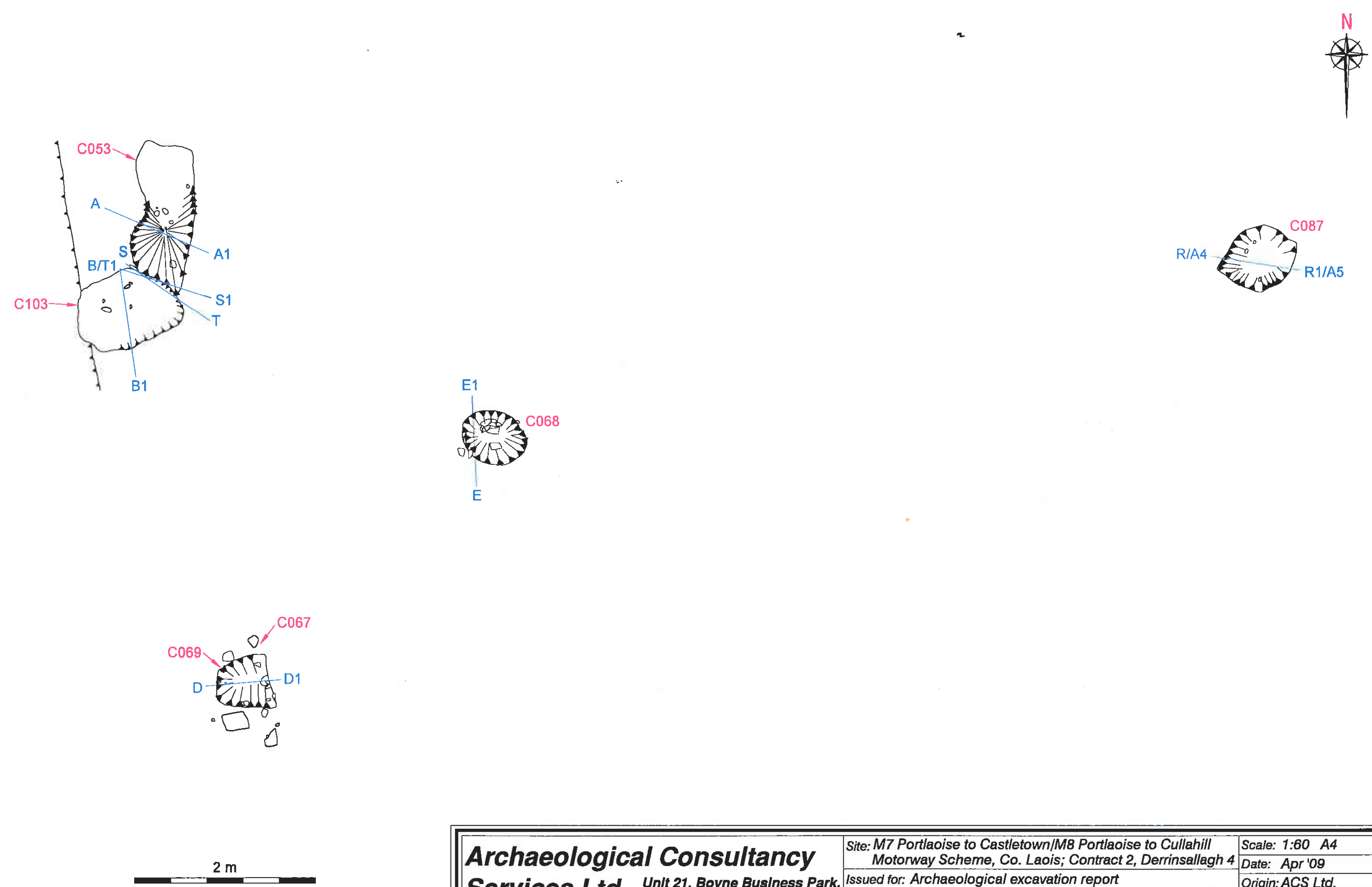


Figure 11: Extent of Iron Age activity



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	Client: Laois County Council	Drawing no.: 05_09_C18012

Figure 12: Pits to west of site

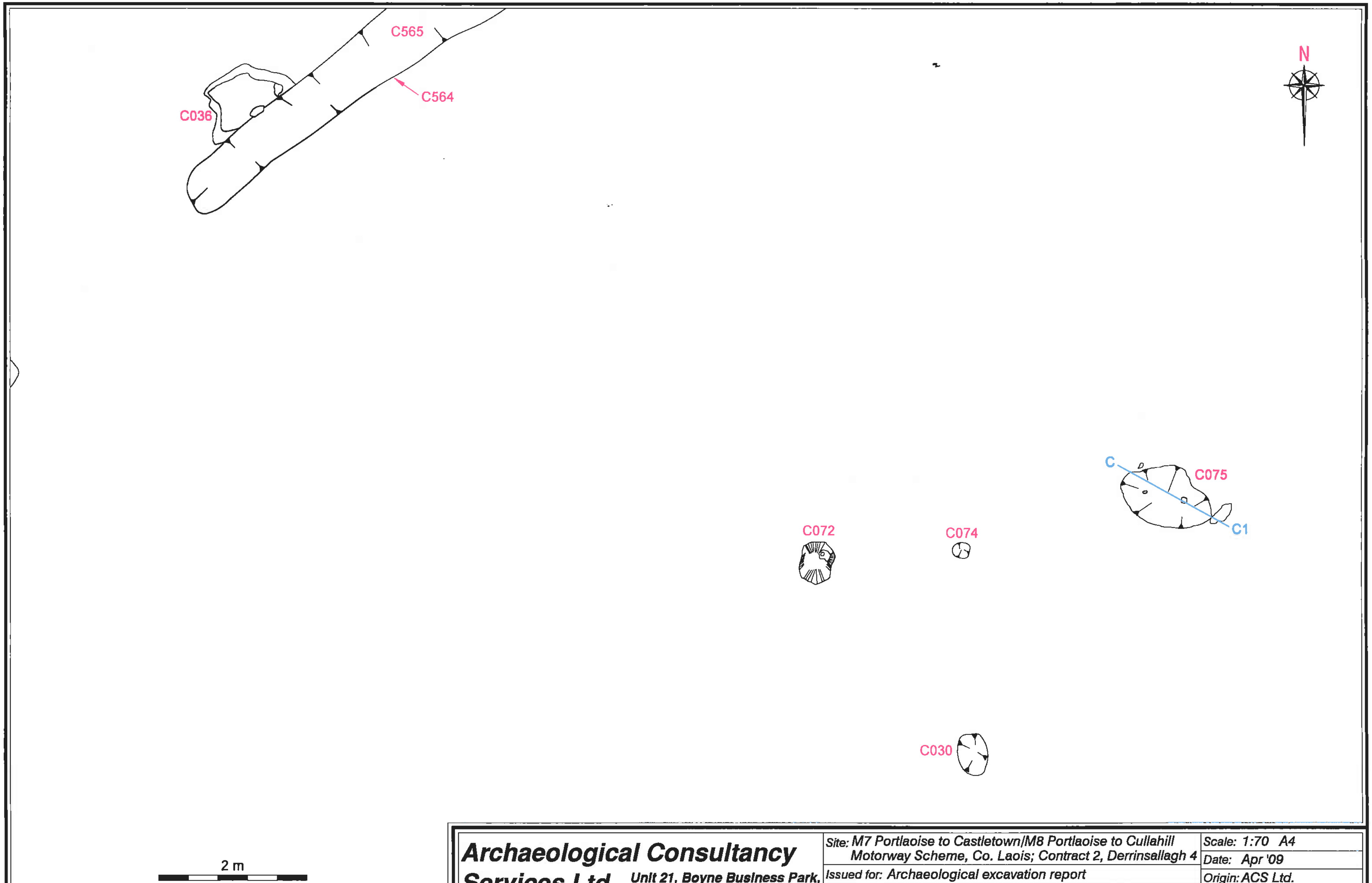

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Figure 13: Pits and postholes to west of site

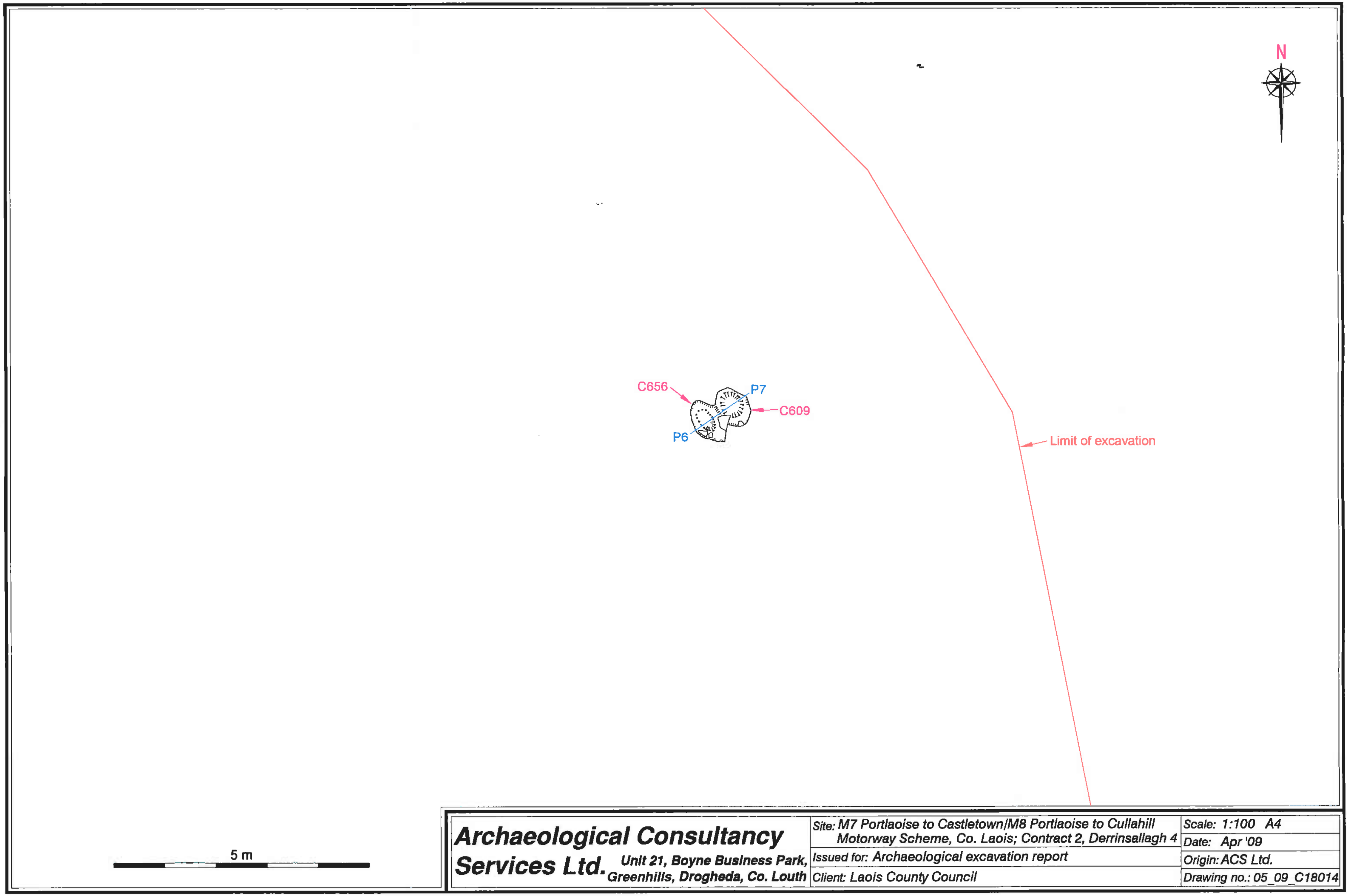
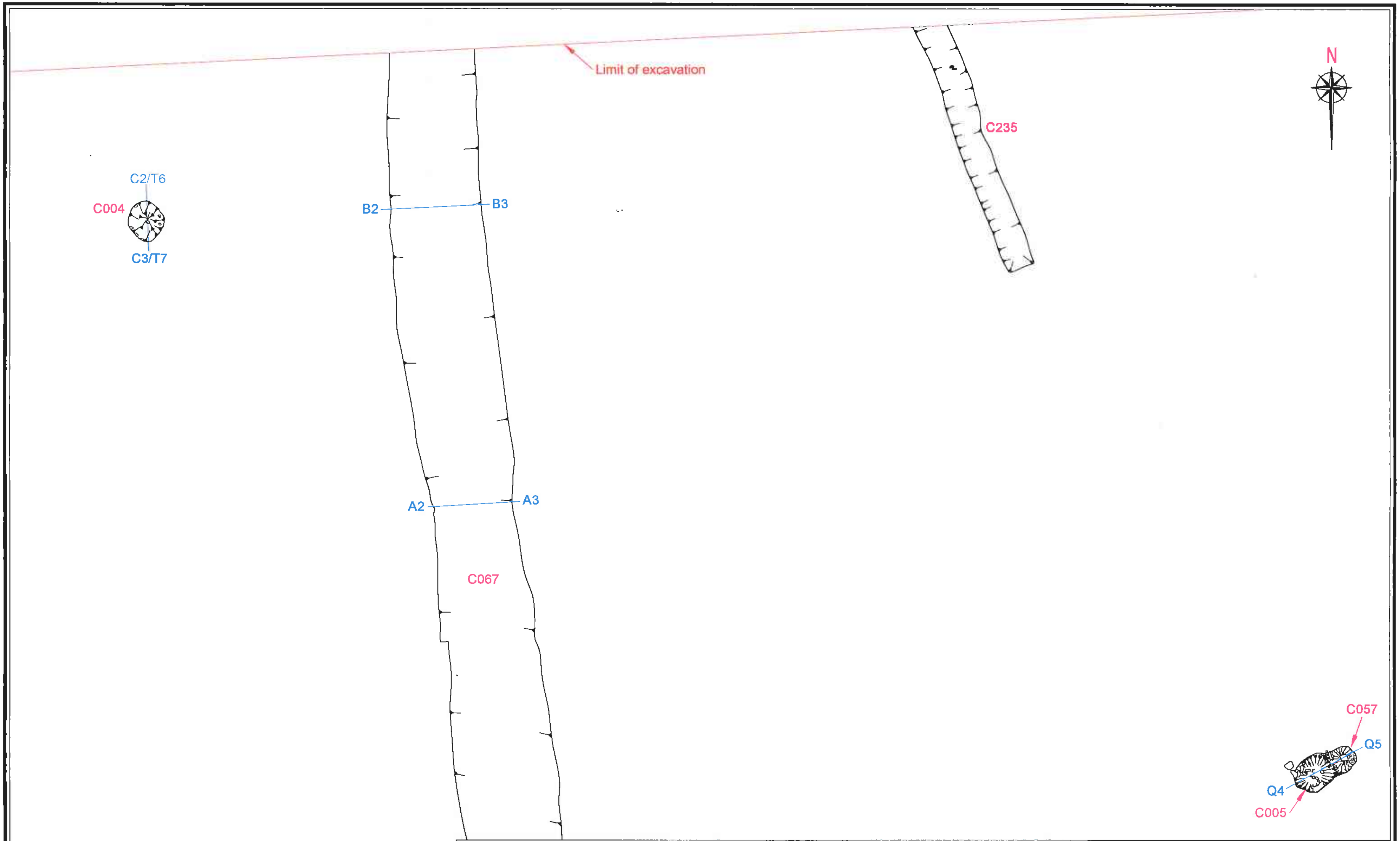
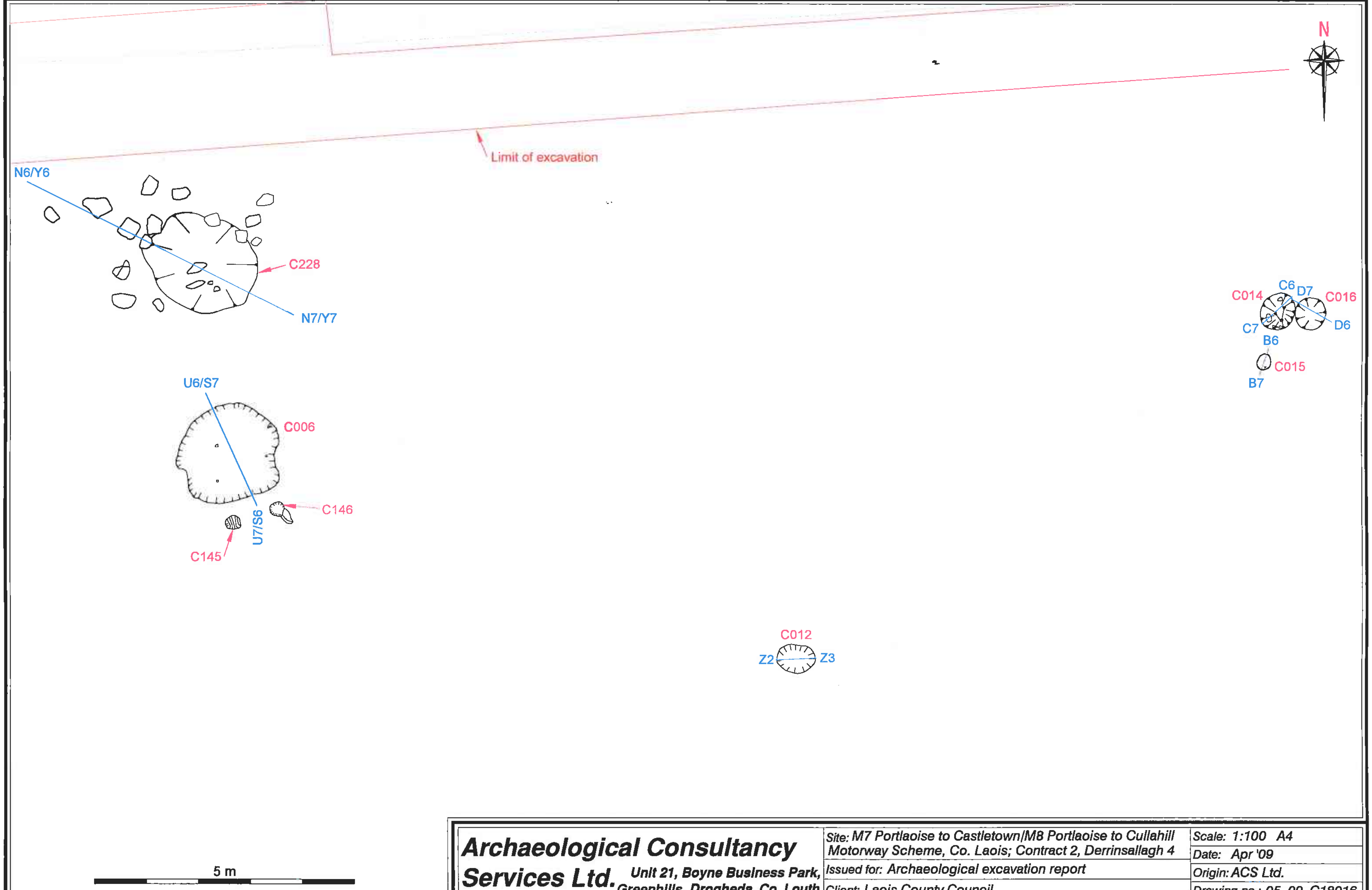


Figure 14: Bowl furnaces to north of site



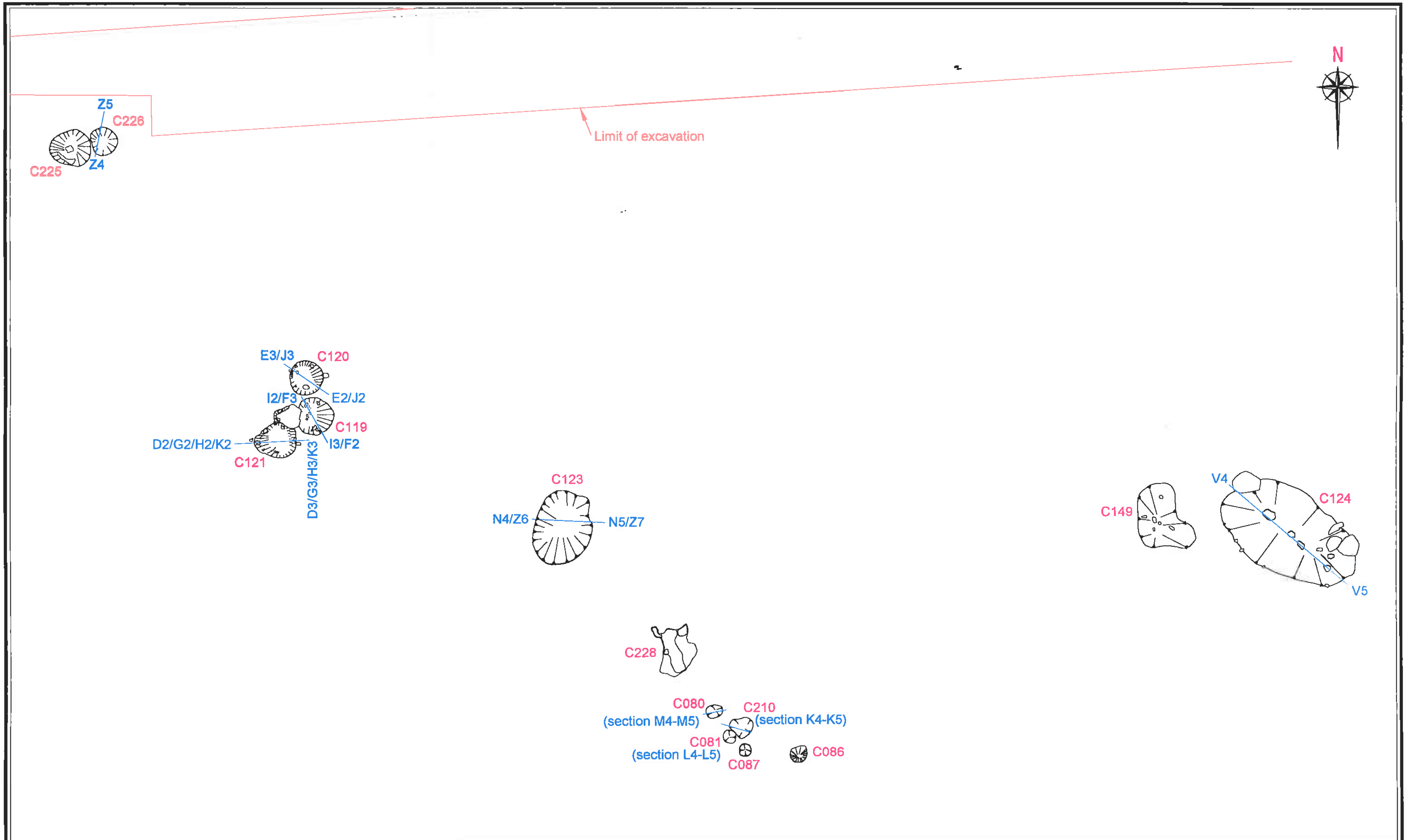
Archaeological Consultancy Services Ltd. Unit 21, Boyne Business Park, Greenhills, Drogheda, Co. Louth	Site: M7 Portlaoise to Castletown/M8 Portlaoise to Cullahill Motorway Scheme, Co. Laois; Contract 2, Derrinsallagh 4	Scale: 1:100 A4
		Date: Apr '09
	Issued for: Archaeological excavation report	Origin: ACS Ltd.
	Client: Laois County Council	Drawing no.: 05_09_C18015

Figure 15: Bowl furnaces and linear ditch to west of site



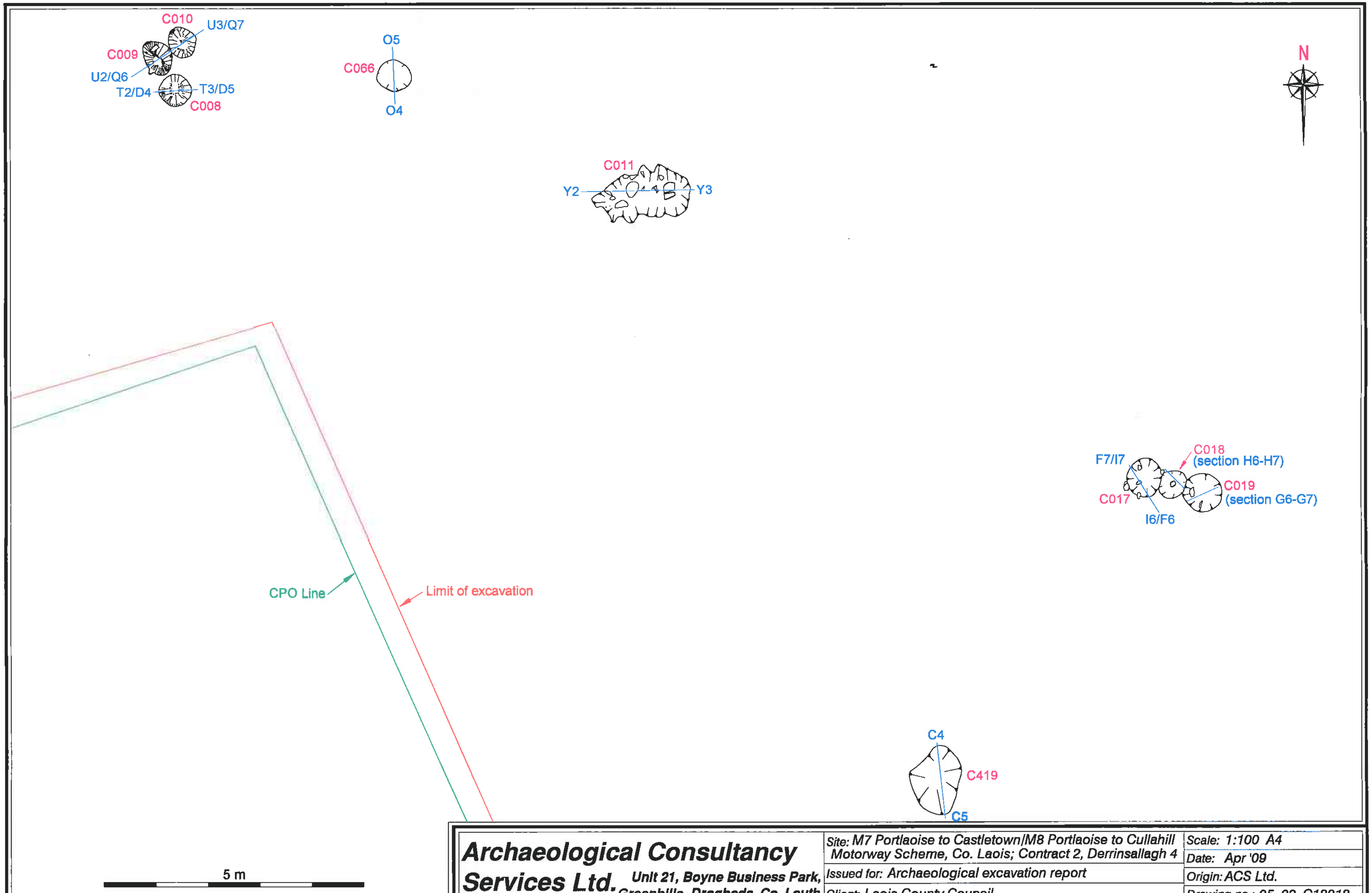
Archaeological Consultancy Services Ltd. Unit 21, Boyne Business Park, Greenhills, Drogheda, Co. Louth	Site: M7 Portlaoise to Castletown/M8 Portlaoise to Cullahill Motorway Scheme, Co. Laois; Contract 2, Derrinsallagh 4	Scale: 1:100 A4
		Date: Apr '09
	Issued for: Archaeological excavation report	Origin: ACS Ltd.
	Client: Laois County Council	Drawing no.: 05_09_C18016

Figure 16: Bowl furnaces and pits to west of site



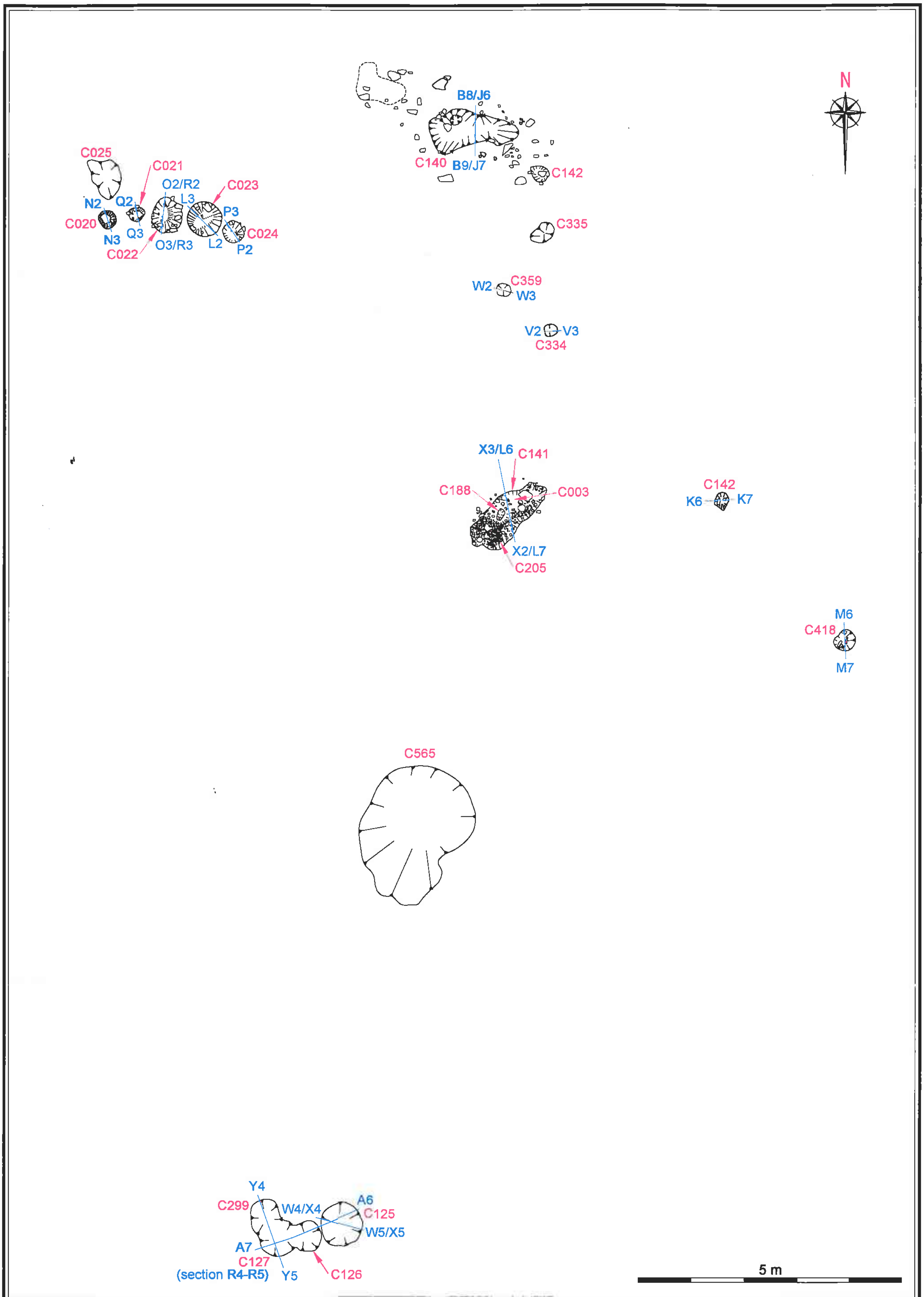
Archaeological Consultancy Services Ltd. Unit 21, Boyne Business Park, Greenhills, Drogheda, Co. Louth	Site: M7 Portlaoise to Castletown/M8 Portlaoise to Cullahill Motorway Scheme, Co. Laois; Contract 2, Derrinsallagh 4	Scale: 1:100 A4
		Date: Apr '09
	Issued for: Archaeological excavation report	Origin: ACS Ltd.
	Client: Laois County Council	Drawing no.: 05_09_C18017

Figure 17: Bowl furnaces and pits to east of site



Archaeological Consultancy Services Ltd. Unit 21, Boyne Business Park, Greenhills, Drogheda, Co. Louth	Site: M7 Portlaoise to Castletown/M8 Portlaoise to Cullahill Motorway Scheme, Co. Laois; Contract 2, Derrinsallagh 4	Scale: 1:100 A4
		Date: Apr '09
	Issued for: Archaeological excavation report	Origin: ACS Ltd.
	Client: Laois County Council	Drawing no.: 05_09_C18018

Figure 18: Bowl furnaces and pits to centre of site



Archaeological Consultancy Services Ltd. Unit 21, Boyne Business Park, Greenhills, Drogheda, Co. Louth	Site: M7 Portlaoise to Castletown/M8 Portlaoise to Cullahill Motorway Scheme, Co. Laois; Contract 2, Derrinsallagh 4	Scale: 1:100 A4 Date: Apr '09
	Issued for: Archaeological excavation report	Origin: ACS Ltd.
	Client: Laois County Council	Drawing no.: 05_09_C18019

Figure 19: Bowl furnaces, pits and stone surfaces to centre site

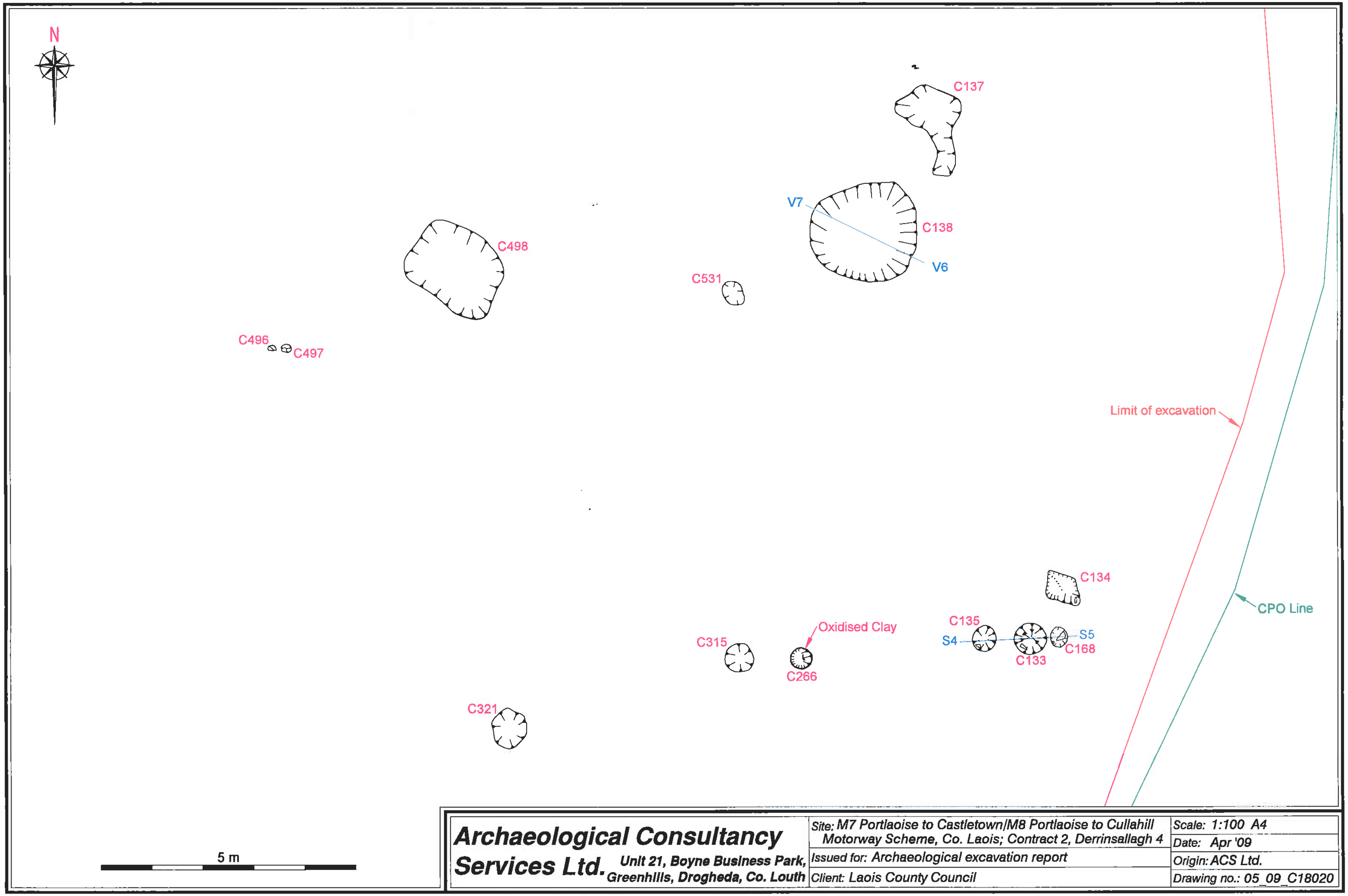
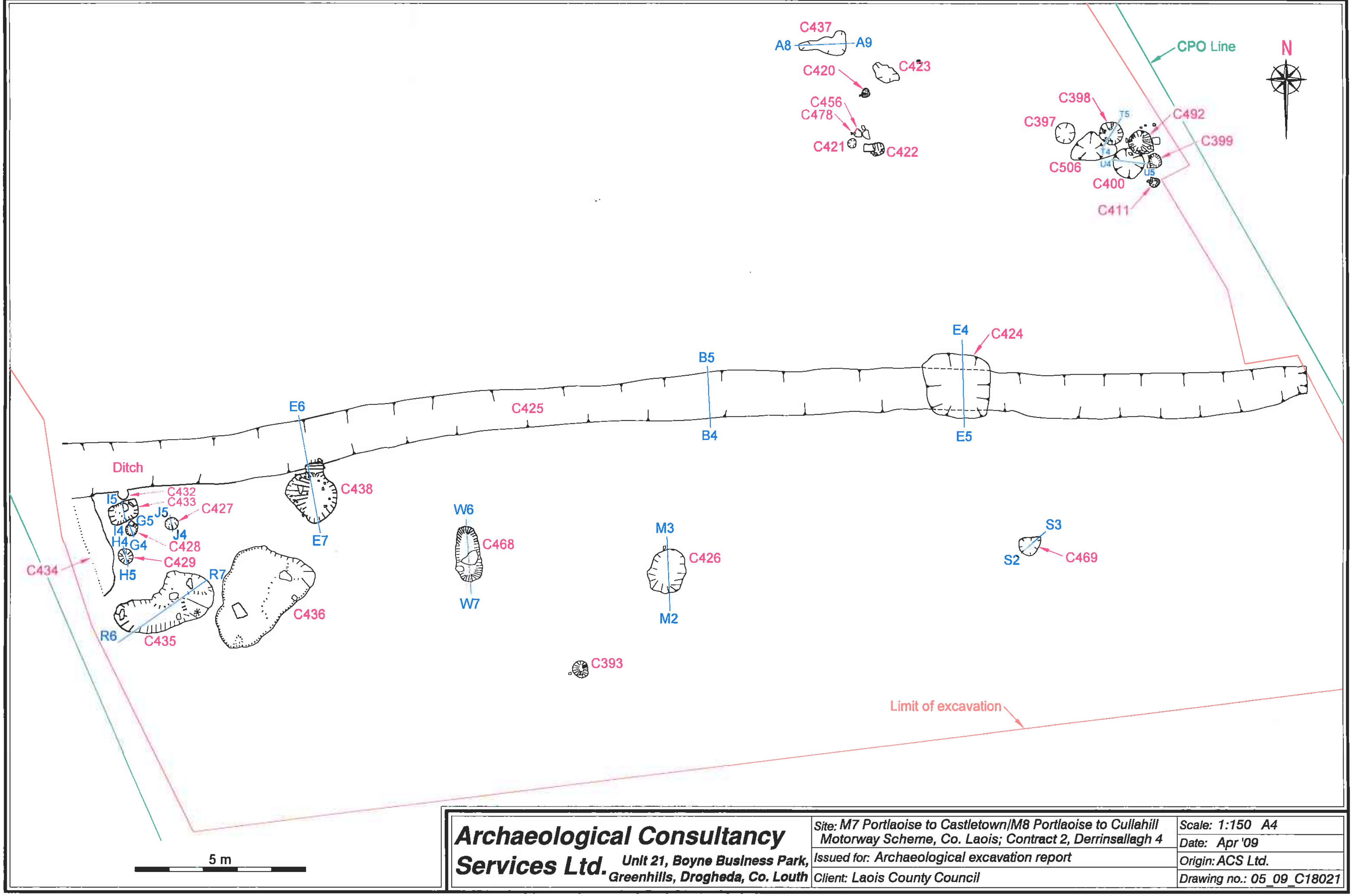
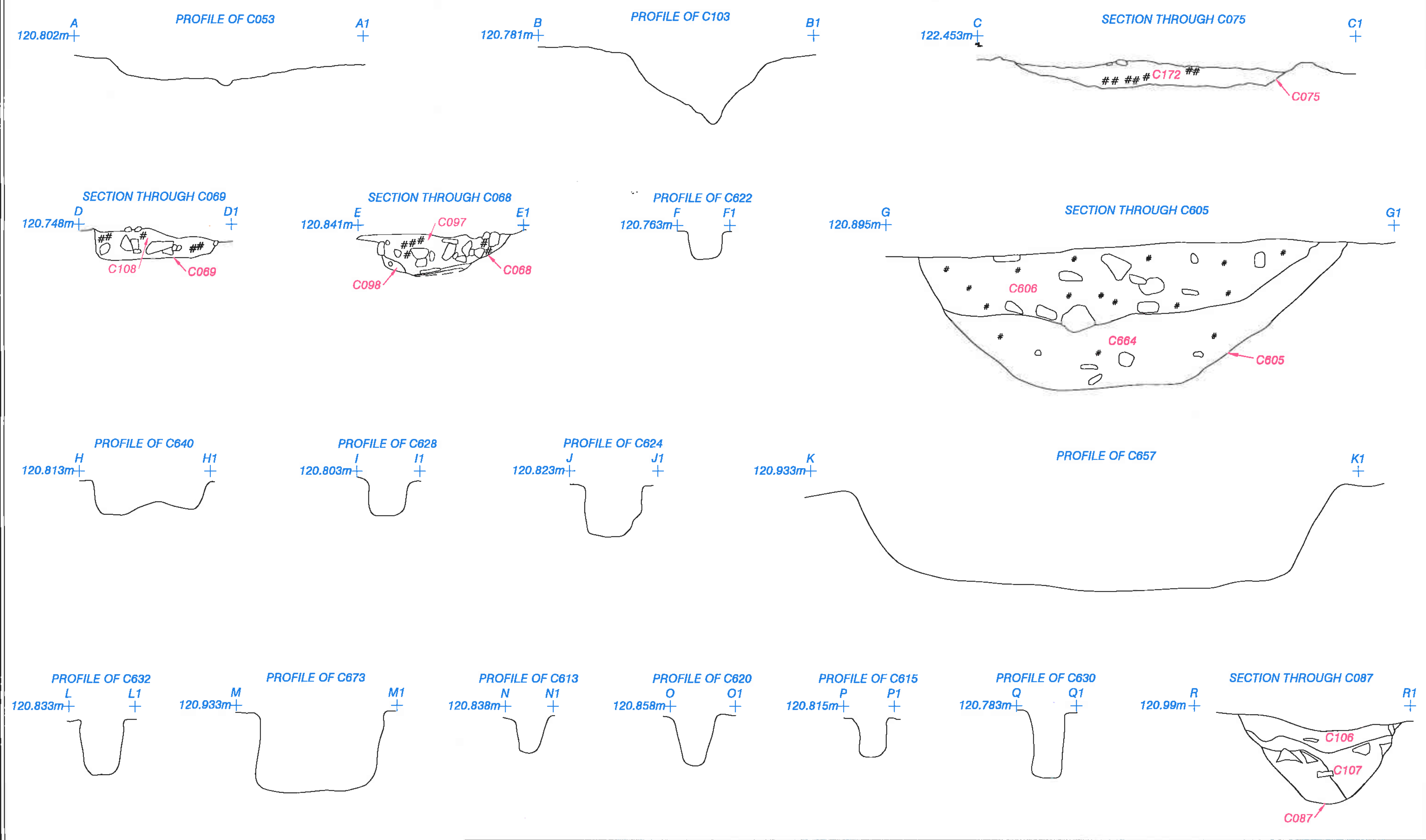


Figure 20: Bowl furnaces and pits to east of site



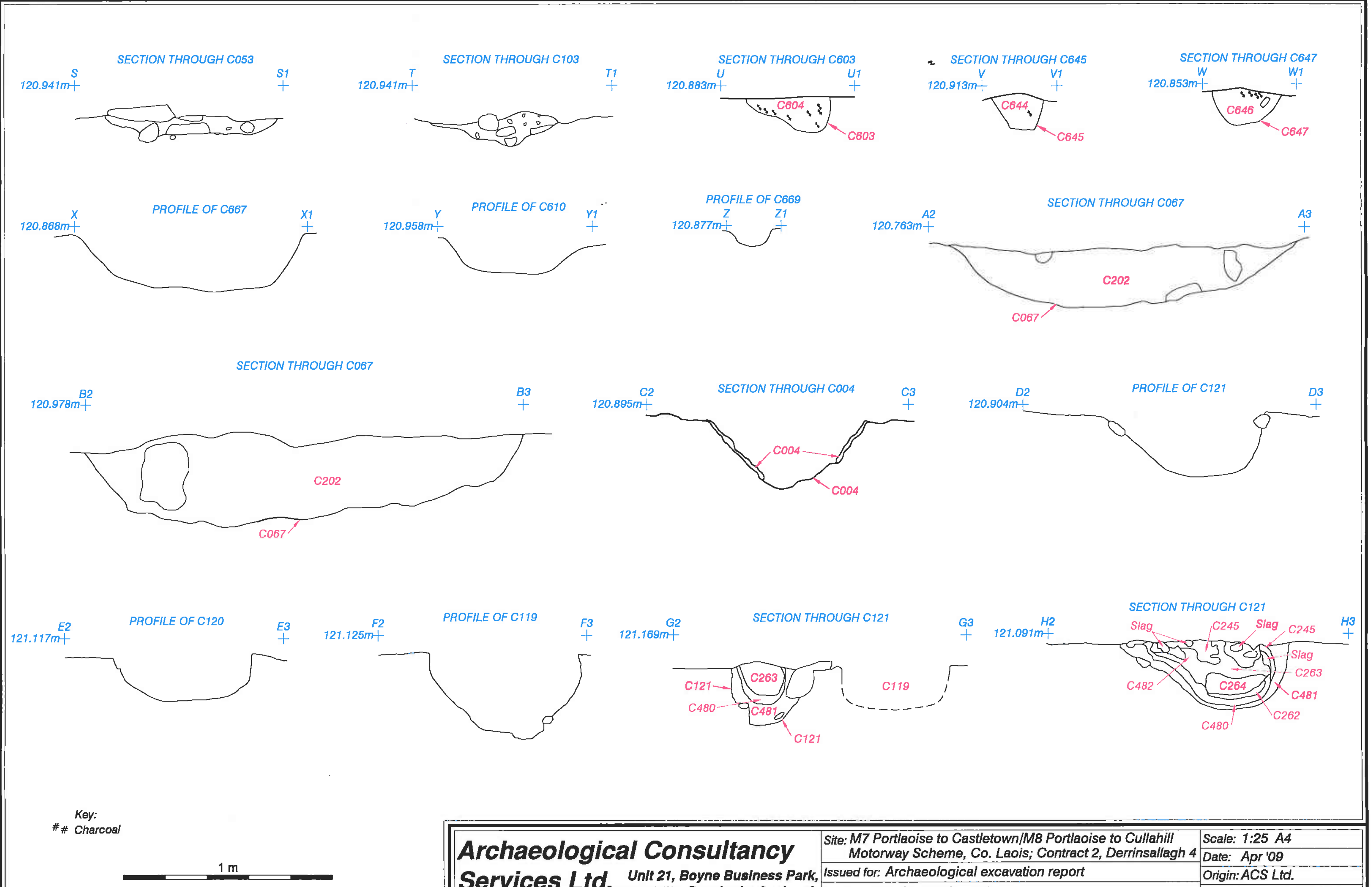
Archaeological Consultancy Services Ltd. Unit 21, Boyne Business Park, Greenhills, Drogheda, Co. Louth	Site: M7 Portlaoise to Castletown/M8 Portlaoise to Cullahill Motorway Scheme, Co. Laois; Contract 2, Derrinsallagh 4	Scale: 1:150 A4
		Date: Apr '09
	Issued for: Archaeological excavation report	Origin: ACS Ltd.
	Client: Laois County Council	Drawing no.: 05_09_C18021

Figure 21: Bowl furnaces, pits and linear ditch to south of site



Archaeological Consultancy Services Ltd. Unit 21, Boyne Business Park, Greenhills, Drogheda, Co. Louth	Site: M7 Portlaoise to Castletown/M8 Portlaoise to Cullahill Motorway Scheme, Co. Laois; Contract 2, Derrinsallagh 4	Scale: 1:25 A4
		Date: Apr '09
	Issued for: Archaeological excavation report	Origin: ACS Ltd.
	Client: Laois County Council	Drawing no.: 05_09_C18022

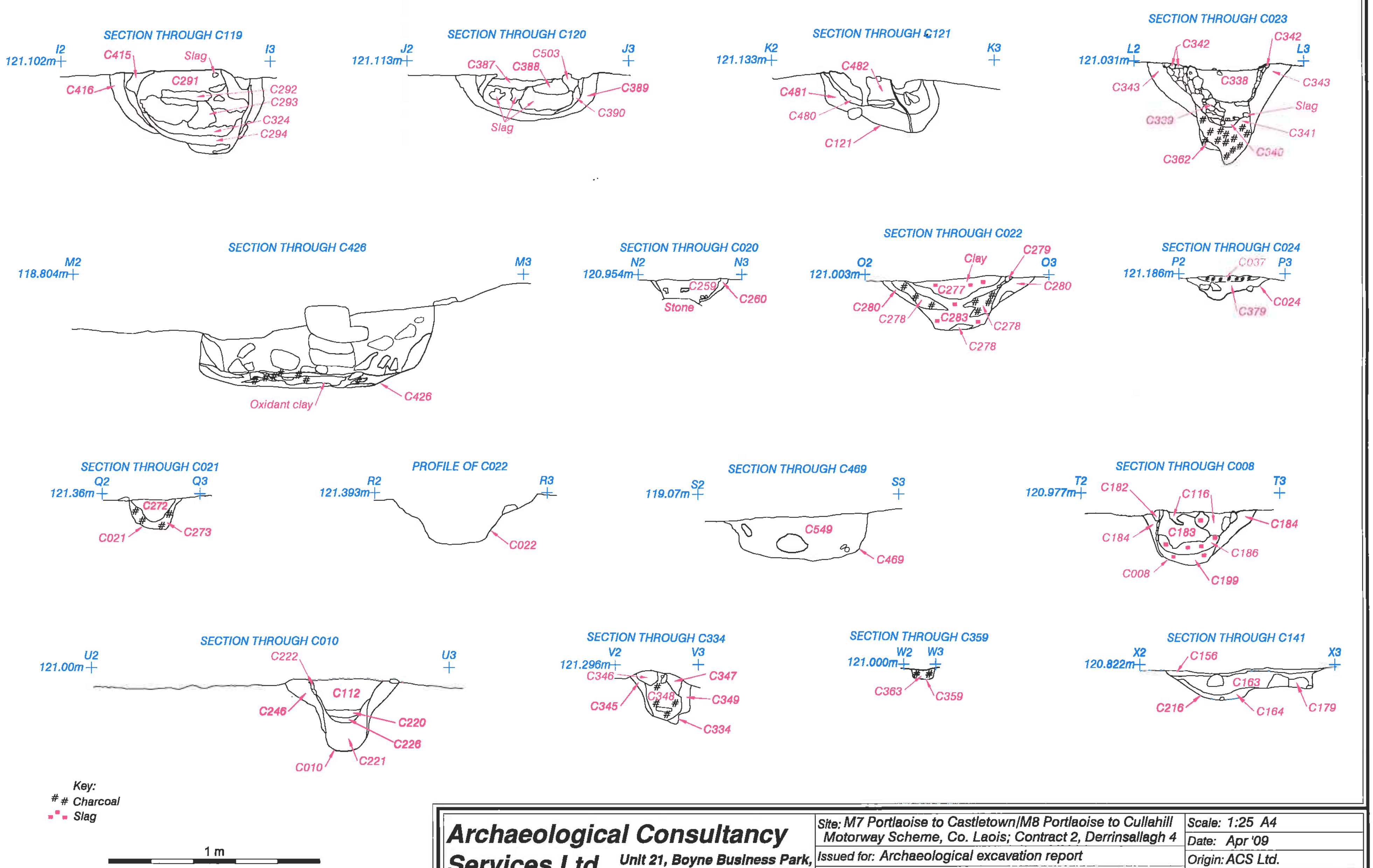
Figure 22: Sections and profiles



Archaeological Consultancy Services Ltd. Unit 21, Boyne Business Park, Greenhills, Drogheda, Co. Louth

Site: M7 Portlaoise to Castletown/M8 Portlaoise to Cullahill Motorway Scheme, Co. Laois; Contract 2, Derrinsallagh 4	Scale: 1:25 A4
	Date: Apr '09
Issued for: Archaeological excavation report	Origin: ACS Ltd.
Client: Laois County Council	Drawing no.: 05_09_C18023

Figure 23: Sections and profiles



Archaeological Consultancy Services Ltd. Unit 21, Boyne Business Park, Greenhills, Drogheda, Co. Louth	Site: M7 Portlaoise to Castletown/M8 Portlaoise to Cullahill Motorway Scheme, Co. Laois; Contract 2, Derrinsallagh 4	Scale: 1:25 A4
		Date: Apr '09
	Issued for: Archaeological excavation report	Origin: ACS Ltd.
	Client: Laois County Council	Drawing no.: 05_09_C18024

Figure 24: Sections and profiles

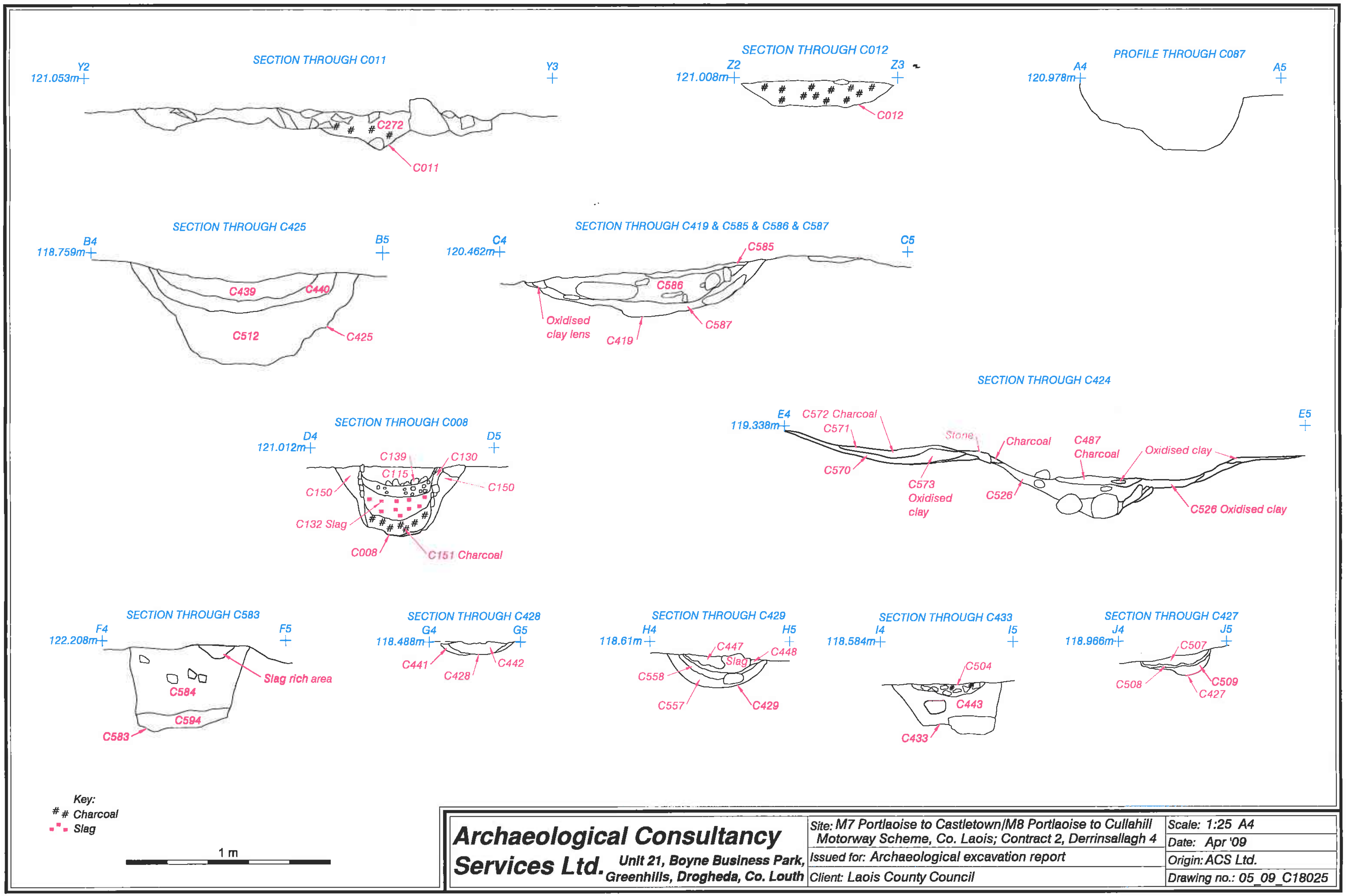


Figure 25: Sections and profiles

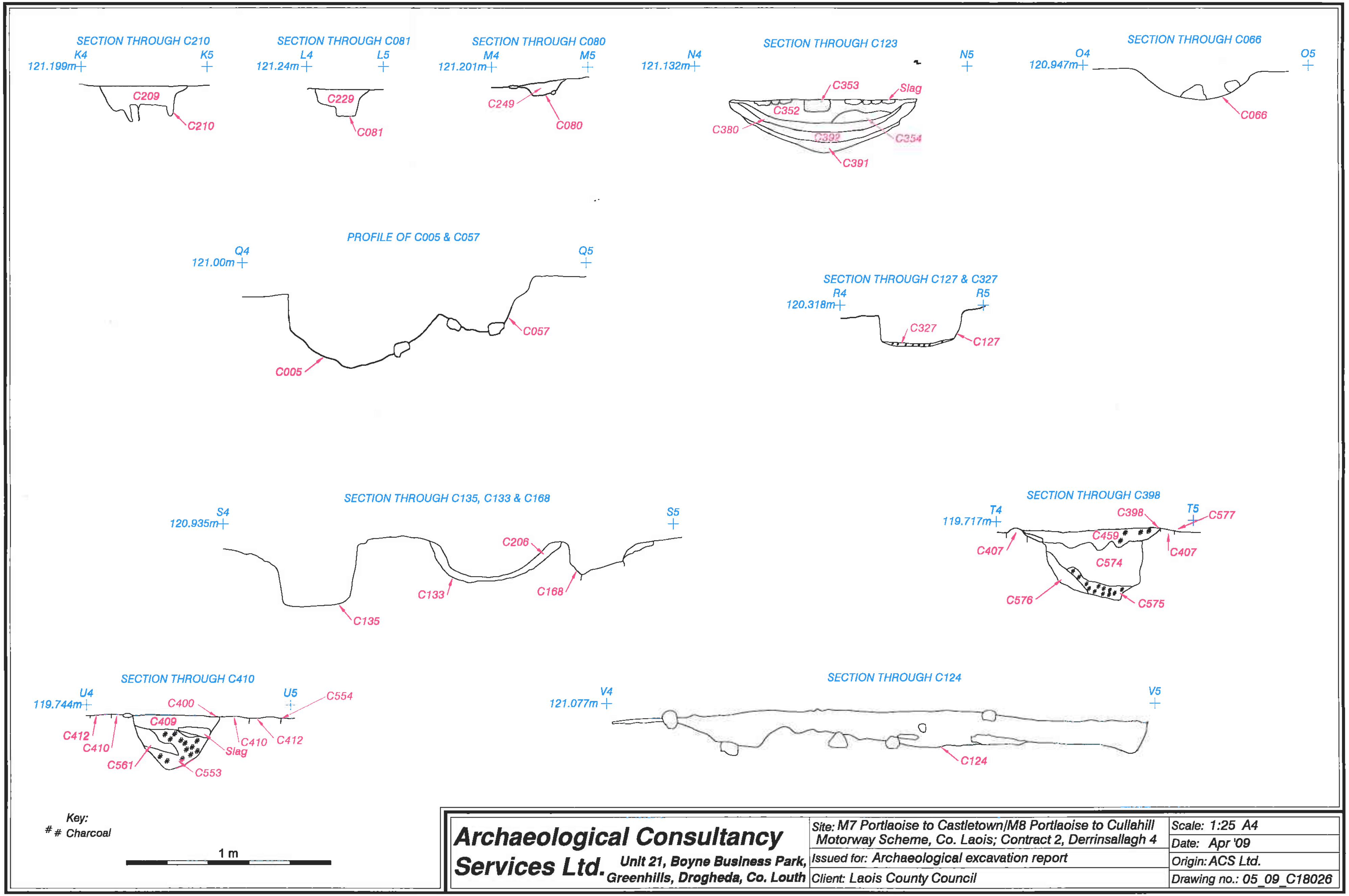


Figure 26: Sections and profiles

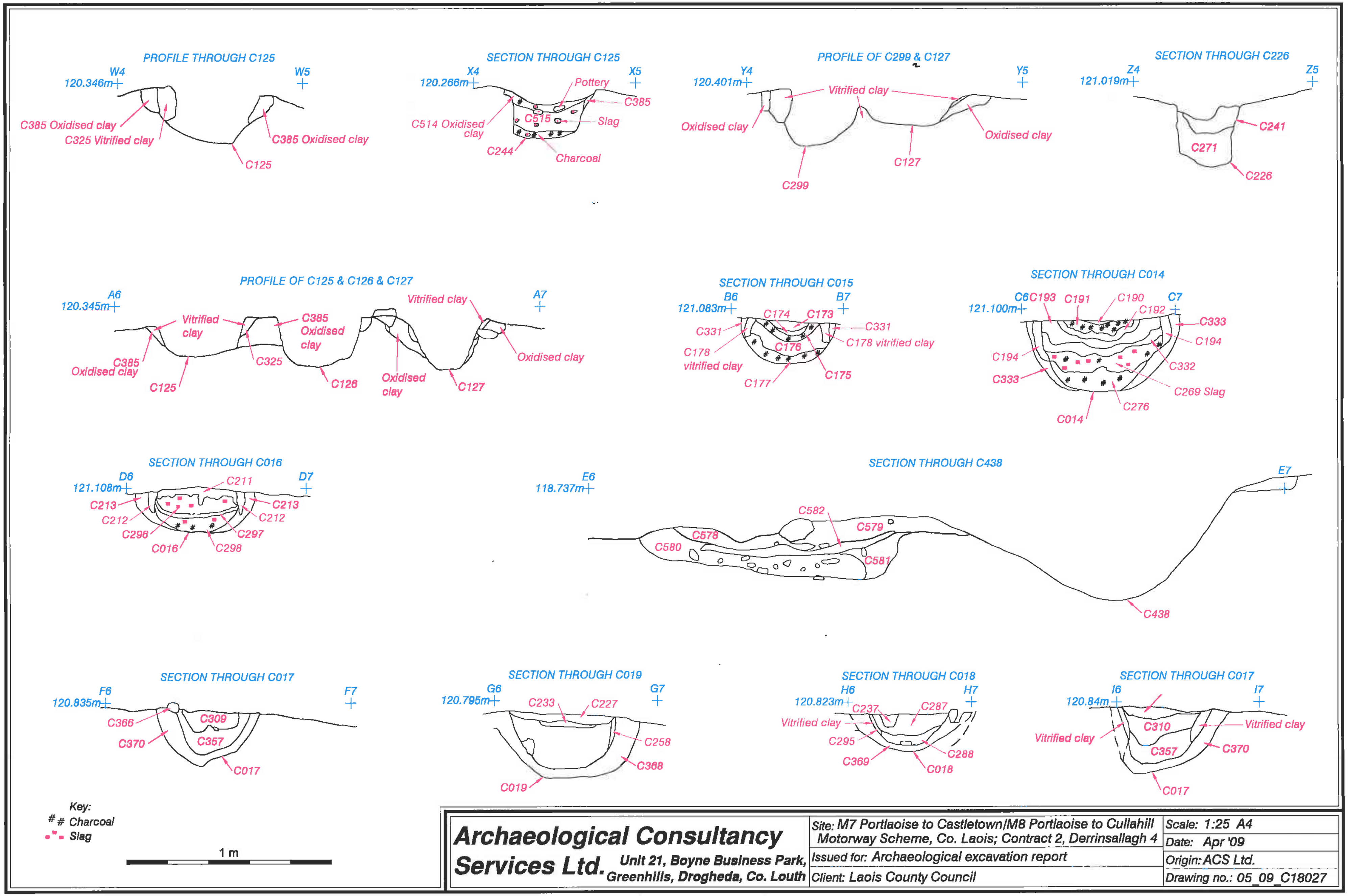


Figure 27: Sections and profiles

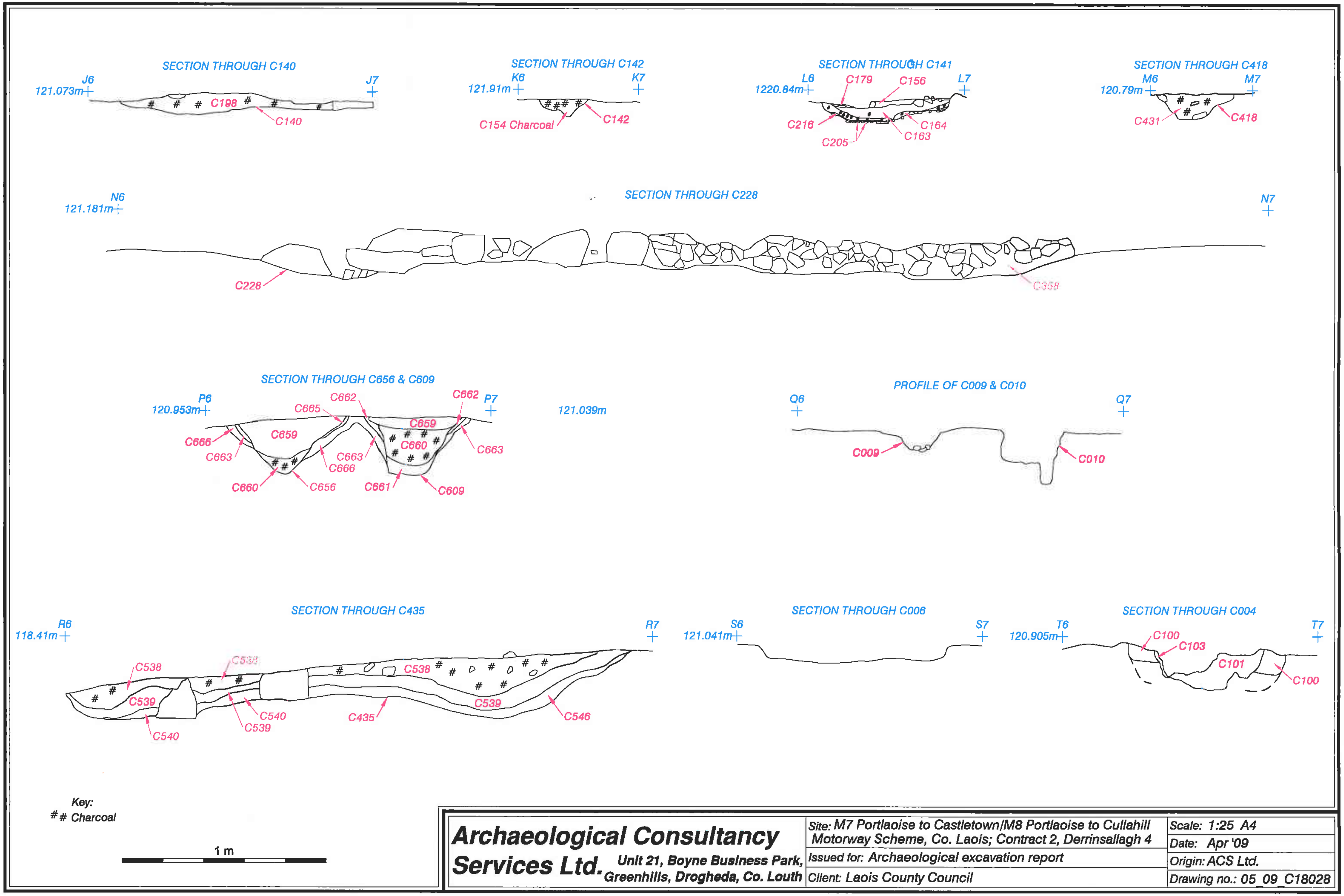
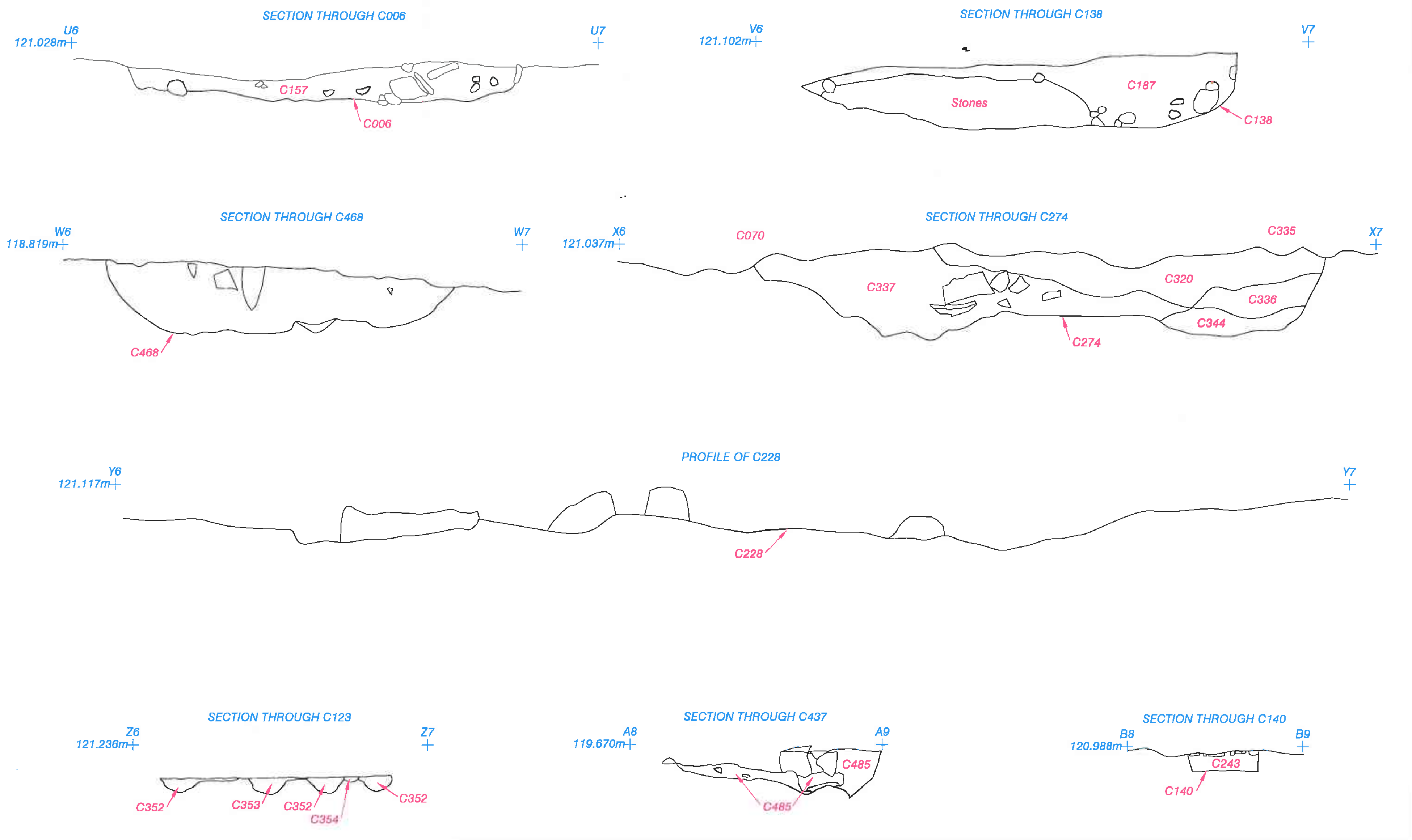


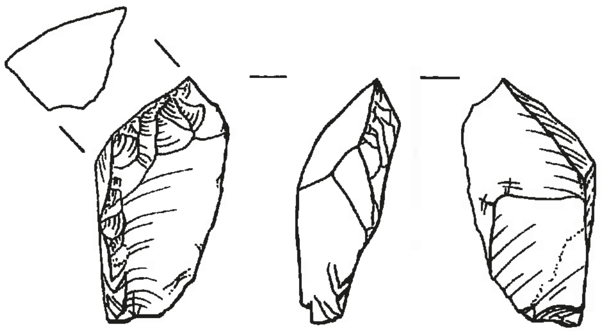
Figure 28: Sections and profiles



1 m

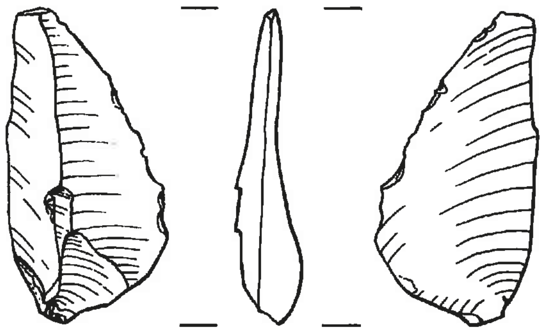
Archaeological Consultancy Services Ltd. Unit 21, Boyne Business Park, Greenhills, Drogheda, Co. Louth	Site: M7 Portlaoise to Castletown/M8 Portlaoise to Cullahill Motorway Scheme, Co. Laois; Contract 2, Derrinsallagh 4	Scale: 1:25 A4
		Date: Apr '09
	Issued for: Archaeological excavation report	Origin: ACS Ltd.
	Client: Laois County Council	Drawing no.: 05_09_C18029

Figure 29: Sections and profiles

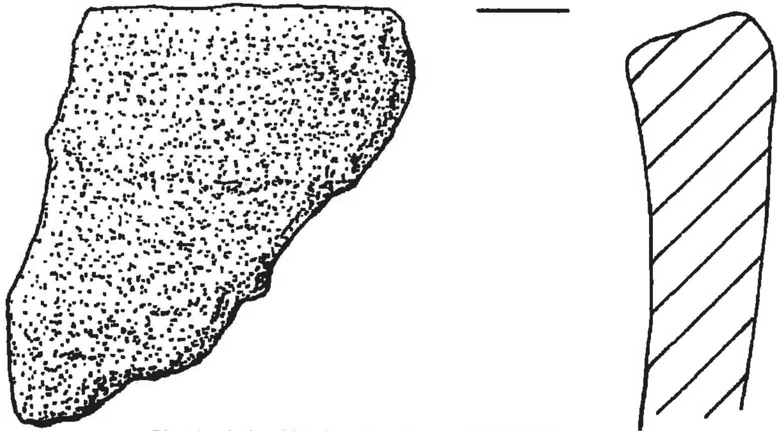


Flint core E2180:2:1

Flint scraper E2180:320:2



Flint blade E2180:612:1



Rim sherd of prehistoric pottery (vessel 1) E2180:117:2

5 cm

Archaeological Consultancy Services Ltd. *Unit 21, Boyne Business Park, Greenhills, Drogheda, Co. Louth*	*Site: M7 Portlaoise to Castletown/M8 Portlaoise to Cullahill Motorway Scheme, Co. Laois; Contract 2, Derrinsallagh 4*	*Scale: 1:1 A4*
		Date: Apr '09
	Issued for: Archaeological excavation report	*Origin: ACS Ltd.*
	Client: Laois County Council	*Drawing no.: 05_09_C18030*

Figure 30: Finds illustrations

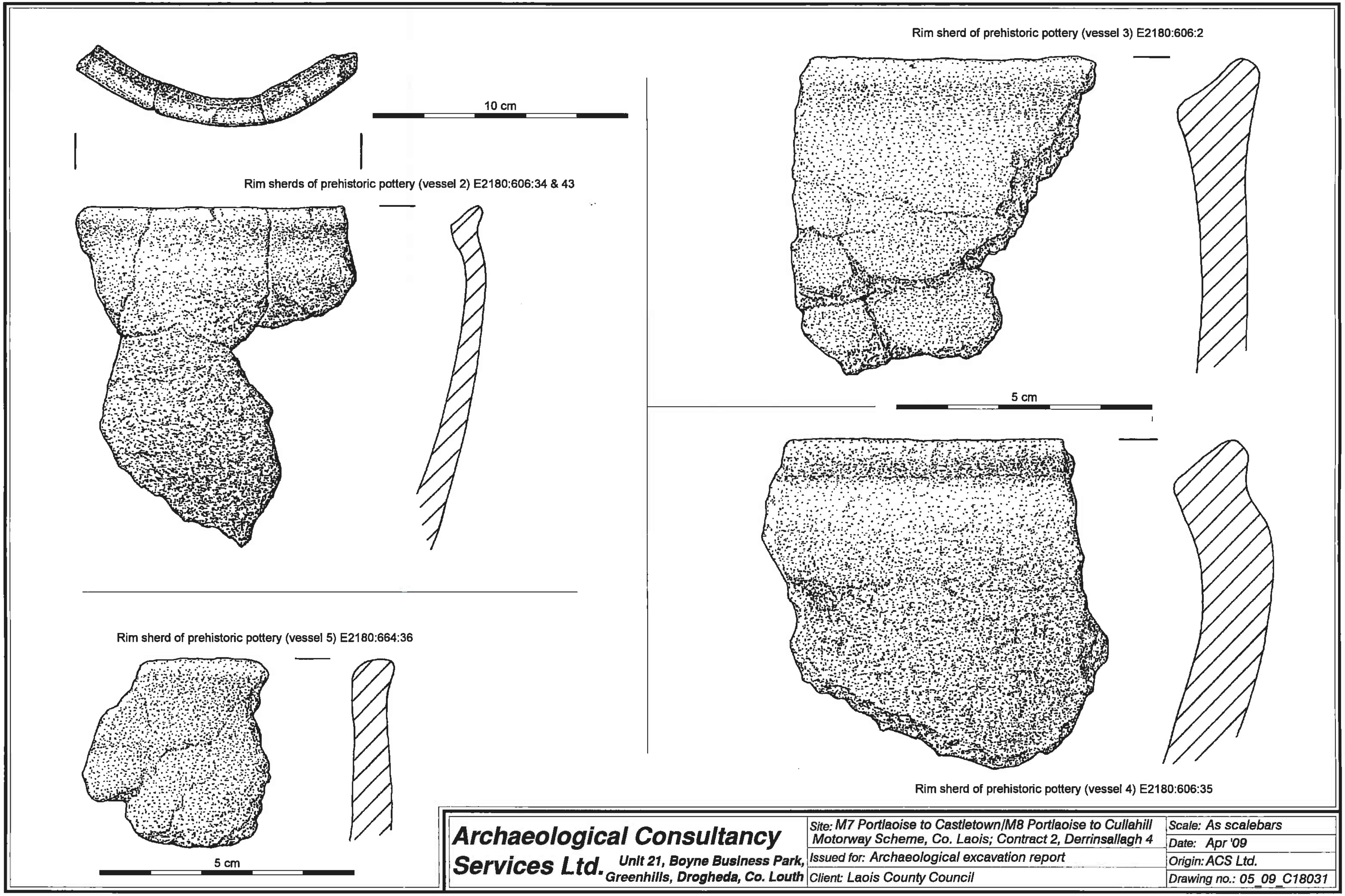


Figure 31: Finds illustrations

Plate 1: Detail of Bronze Age activity (05_09_CP841_09)

Plate 2: Mid-excavation of C605 (05_09_CP837_03)

Plate 3: Mid-excavation of C657 (05_09_CP840_03)

Plate 4: Pre-excavation of Iron Age structure (05_09_CP836_23)


Plate 5: Post-excavation of Iron Age structure (05_09_CP841_17)


Plate 6: Linear trench C607/C70 (05_09_CP841_04)


Plate 7: Pre-excavation of bowl furnaces C609 and C659 (05_09_CP108_03)


Plate 8: Mid-excavation of bowl furnaces C609 and C659 (05_09_CP839_04)

Plate 9: Post-excavation of bowl furnaces C609 and C659 (05_09_CP840_04)

Plate 10a: Mid-excavation of bowl furnace C005 and C057 (05_09_CP020_20)

Plate 10b: Mid-excavation of bowl furnace C005 and C057 (05_09_CP026_21)

Plate 11: Mid-excavation of bowl furnace C004 (05_09_CP007_09)

Plate 12a: Mid-excavation of bowl furnaces C008, C009 and C010 (05_09_CP007_01)

Plate 12b: Post-excavation of bowl furnaces C008, C009 and C010 (05_09_CP17_09)

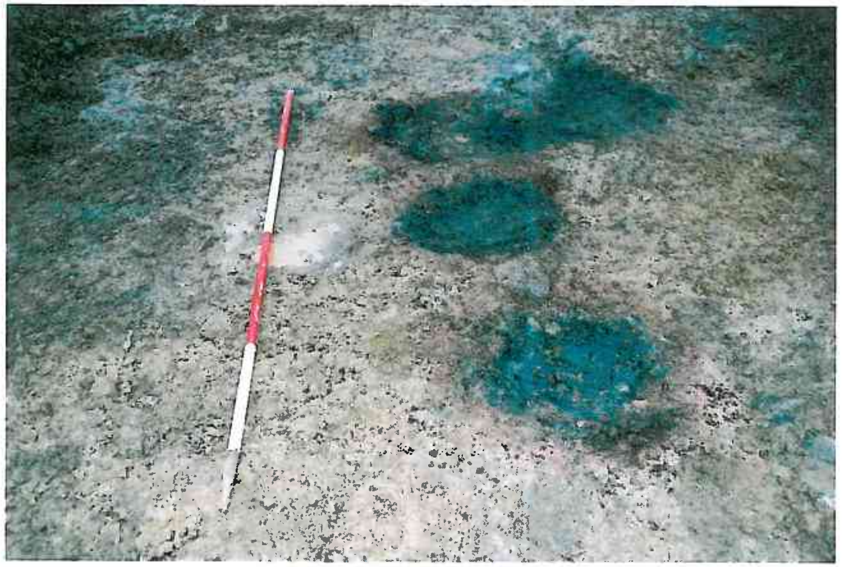


Plate 13a: Pre-excavation detail of bowl furnaces C125, C126, C127 and C299 (05_09_CP008_09)

Plate 13b: Mid-excavation detail of bowl furnaces C125, C126, C127 and C299 (05_09_CP028_08)

Plate 13c: Post-excavation detail of bowl furnaces C125, C126, C127 and C299 (05_09_CP042_08)

Plate 14a: Pre-excavation of C119, C120 and C121 (05_09_CP008_17)

Plate 14b: Mid-excavation of C119, C120 and C121 (05_09_CP037_22)

Plate 14c: Post-excavation of C119, C120 and C121 (05_09_CP037_22)

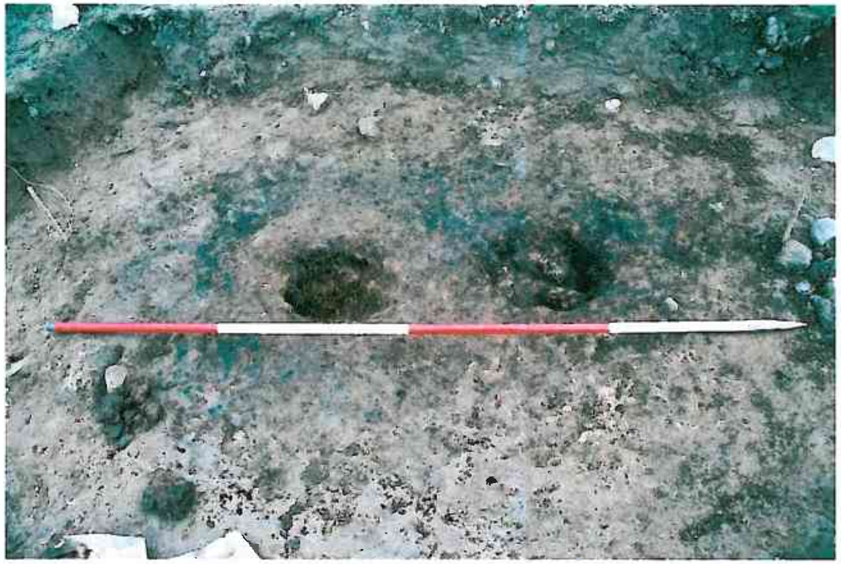


Plate 15: Mid-excavation of bowl furnaces C225 and C226 (05_09_CP018_13)

Plate 16: Mid-excavation of bowl furnaces C020, C021, C022, C023, and C025 (05_09_CP019_24)

Plate 17: Pre-excavation of C397, C398, C399 and C400 (05_09_CP029_18)

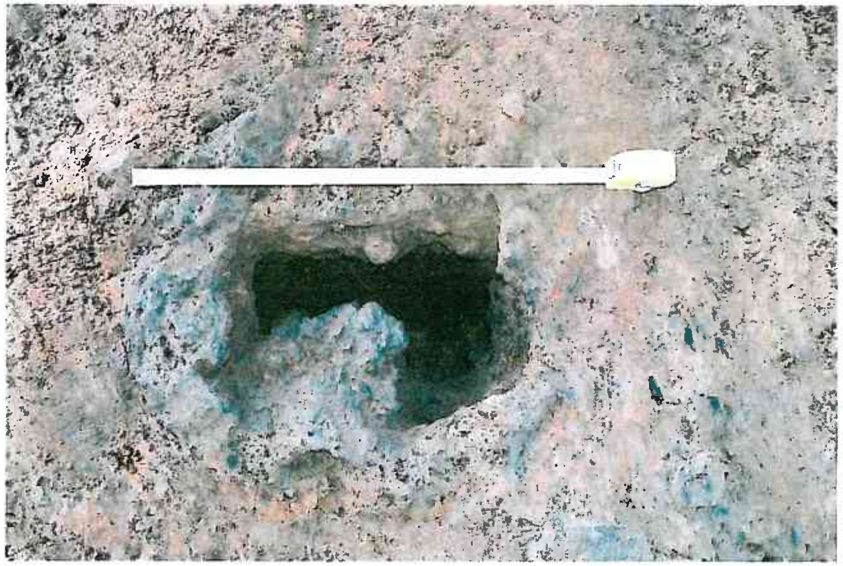


Plate 18: Mid-excavation of C397 showing slag in-situ (05_09_CP032_12)

Plate 19: Pre-excavation of bowl furnace 39 (C422) (05_09_CP030_12)

Plate 20a: Detail of bowl furnace C400 showing slag and vitrified clay (05_09_CP043_25)

Plate 20b: Detail of bowl furnace C400 showing slag and vitrified clay (05_09_CP047_05)

Plate 21: Pre-excavation of bowl furnaces C420, C421 and C422 (05_09_CP030_12)

Plate 22: Mid-excavation of pits C428, C433 and C432 (05_09_CP031_24)

Plate 23: Mid-excavation of pit C138 (05_09_CP010_15)

Plate 24: Pre-excavation of pit C228 (05_09_CP015_05)

Plate 25: Spread of compact stone C140 (05_09_CP014_02)

Plate 26: Mid-excavation of charcoal production pit C419 (05_09_CP047_21)

Plate 27: Mid-excavation of hearth C424 (05_09_CP038_05)

Plate 28a: Mid-excavation of ditch C425 (05_09_CP031_06)

Plate 28b: Mid-excavation of ditch C425 (05_09_CP040_25)

Plate 29: Post-excavation of ditch C425 (05_09_CP044_08)

Plate 30: Mid-excavation of linear trench C607/C070 (05_09_CP043_17)

Plate 31: Entrance across trench C609/C070 (05_09_CP043_21)

Plate 32: Photo of flint core E2180:2:1_001

Plate 33: Photo of flint scraper
E2180:320:2_001

Plate 34: Photo of flint blade
E2180:612:1_002

Plate 35: Photo of rim sherd of prehistoric pottery (vessel 1) E2180:117:2_001

Plate 36: Photo of rim sherd of prehistoric pottery (vessel 2) E2180:606:34_001


Plate 37: Photo of rim sherd of prehistoric pottery (vessel 2) E2180:606:43_002

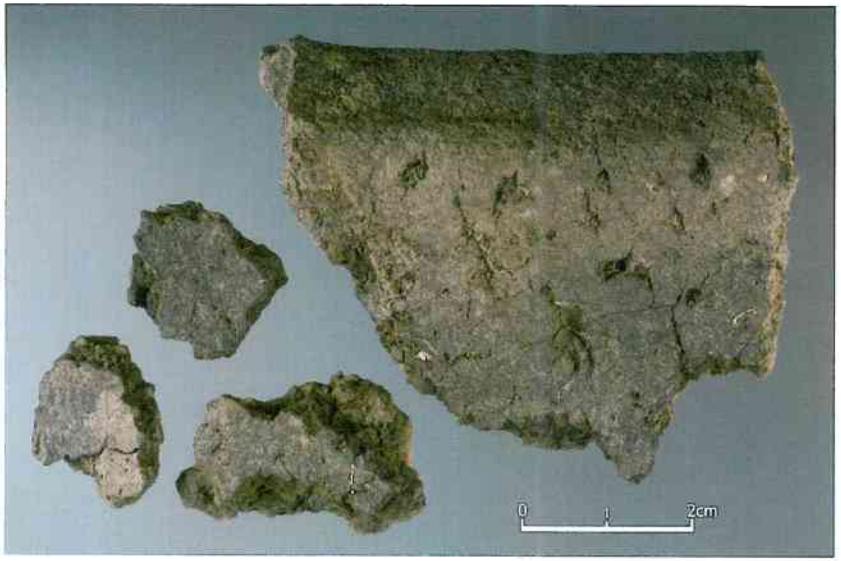


Plate 38: Photo of rim sherd of prehistoric pottery (vessel 3) E2180:606:2_003

Plate 39: Photo of rim sherd of prehistoric pottery (vessel 4) E2180:606:35_001

Plate 40: Photo of rim sherd of prehistoric pottery (vessel 5) E2180:664:36_001