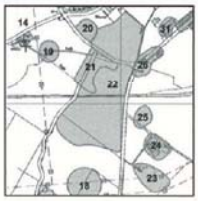






Date: December 2009
Client: Kildare County Council
Project code: KCK06

N9/N10 Kilcullen to Waterford Scheme: Phase 3, Kilcullen to Carlow. Archaeological Services Contract No. 5 – Resolution, Kilcullen to Moone and Athy Link Road.

Final Report on archaeological investigations at Site E2876, in the townland of Ballymount, Co. Kildare.

By: John Twomey
National Monuments Section Registration Number: E2876
Director: Gillian Mc Carthy
NGR: 281976/ 201611
Report Status: Final

HEADLAND ARCHAEOLOGY Ltd

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Executive Summary

This final report presents the results of the archaeological resolution works carried out on behalf of Kildare County Council and the National Roads Authority as part of the Archaeological Services Contract No. 5 - Resolution, Kilcullen to Moone and Athy Link Road. The works were undertaken prior to the commencement of construction of the N9/N10 Kilcullen to Waterford Scheme: Phase 3, Kilcullen to Carlow. The Minister of the Environment, Heritage & Local Government, following consultation with the National Museum of Ireland, issued Directions to Kildare County Council on 8 March 2007 for archaeological resolution works relating to the road development. The registration number, E2876, was allocated by the Department for the excavation of the present site in Ballymount townland under the directorship of Gillian Mc Carthy of Headland Archaeology (Ireland) Ltd.

An Environmental Impact Assessment was published in 2003 for the Kilcullen to Powerstown Scheme, with Valerie J Keeley Ltd preparing the Archaeological, Architectural and Cultural Heritage Assessment. This formed Chapter 10 of the EIS produced by the Roughan and O'Donovan - Faber Maunsell Alliance. Geophysical prospection was carried out on certain areas of high archaeological potential by Bartlett-Clark Consultancy as part of the Environmental Impact Assessment, on behalf of Valerie J. Keeley Ltd/Kildare County Council.

Aerial photography was undertaken along the entire route selection as part of the non-invasive assessment after the EIA stage. This work was carried out in April 2004 by Markus Casey.

Archaeological testing carried out by IAC Ltd for the N9/N10 Kilcullen to Waterford Scheme: Kilcullen to Powerstown. Archaeological Services Contract No. 1 – Test Excavations, Kilcullen to Mullamast under Ministerial Direction Numbers A021/089 on this site between 10 October and 19 November 2005 identified Testing identified a sub-rectangular pit that measured 0.95 m long by 0.38 m wide and was 0.11 m deep. It contained a broken butt end of a polished stone axe head (A021/089:004:001).

Full archaeological resolution was conducted on this site between 9 and 18 October 2007. The feature identified during testing was re-identified along with the remains of two other prehistoric pits, two Iron Age pits, a medieval slag pit furnace, and a posthole. Three ditches also traversed the site. Faunal remains recovered included a complete skeleton of an Iron Age cow and human remains consisted of an Iron Age adult skull bone. Artefacts excavated from this site comprised of pottery which represented a single Middle to Late Bronze Age domestic vessel and unidentifiable prehistoric pottery; three lithic artefacts; a possible bead was also retrieved as well as a single post-medieval pottery sherd from topsoil. A fragment of a polished stone-axe was also identified within a sub-rectangular pit during archaeological testing of the area. A Preliminary Report of works on the site was completed by Headland Archaeology (Ireland) Ltd in April 2009.

1 Introduction

The N9/N10 Kilcullen to Waterford Road Scheme, of which the Kilcullen to Powerstown Scheme forms part, was proposed as a High Quality Dual Carriageway/Motorway, forming the Major Inter Urban route between Dublin and Waterford. The Kilcullen to Powerstown Scheme was advanced as a single entity up to the Compulsory Purchase Order/Environmental Impact Statement and was subsequently divided into two separate construction contracts: the Carlow By-pass (Phase 1) and the Kilcullen to Carlow Scheme (Phase 3). Kildare County Council, National Roads Design Office, has responsibility for overseeing the project management of these two schemes. The entire road scheme from Kilcullen to Waterford has now been designated as Motorway.

An Environmental Impact Assessment was published in 2003 for the Kilcullen to Powerstown Scheme, with Valerie J Keeley Ltd preparing the Archaeological, Architectural and Cultural Heritage Assessment. This formed Chapter 10 of the EIS produced by the Roughan and O'Donovan - Faber Maunsell Alliance. Geophysical prospection was carried out on certain areas of high archaeological potential by Bartlett-Clark Consultancy as part of the Environmental Impact Assessment, on behalf of Valerie J. Keeley Ltd/Kildare County Council.

Aerial photography was undertaken along the entire route selection as part of the non-invasive assessment after the EIA stage. This work was carried out in April 2004 by Markus Casey.

Construction commenced on Phase 1, the Carlow By-pass, in January 2006 and the road was completed and opened in May 2008. Construction of Phase 3, the Kilcullen to Carlow Scheme, which also includes a new single carriage link road to Athy town, commenced in January 2008.

Archaeological test-trenching was undertaken in advance of Phase 1, the Carlow By-pass, by Headland Archaeology (Ireland) Ltd between June and August 2005 (Archaeological Services Contract No. 3). This work identified 64 archaeological sites, which required archaeological excavation in advance of road construction. The resolution works for these sites were undertaken by Headland Archaeology (Ireland) Ltd between January and August 2006 (Archaeological Services Contract No. 4).

Archaeological test-trenching was undertaken in advance of the construction of Phase 3, the Kilcullen to Carlow Scheme, by IAC Ltd and CRDS Ltd, between October to November 2005 and May to August 2006 (Archaeological Services Contracts No. 1 and No. 2, respectively). This work resulted in the identification of 102 archaeological sites, which required resolution in advance of construction. The resolution works for these sites were undertaken by Headland Archaeology (Ireland) Ltd between March and December 2007 (Archaeological Services Contracts No. 5 and No. 6). This report details the results of one of those excavations, undertaken under NMSR Number E2876.

The project was funded by the Irish Government and the European Union through Kildare County Council/National Roads Authority, under the National Development Plan 2000-2006 and 2007-2013.

Construction Phases 2 and 4 relate to the section of road between Powerstown, Co. Carlow and the Waterford city By-pass and are project managed by Waterford County Council, National Roads Design Office.

2 Site description and location

Site E2876 was situated in the townland of Ballymount, parish of Usk, barony of Narragh and Reban East and was located 2 km southeast of Castledermot, Co. Kildare at National Grid Reference 281976/ 201611 (Figure 1). The site was positioned on the southeast facing side of a northwest slope of a hill situated 200 m northwest of the present N9/N10 Waterford to Dublin Road (Figure 1). Narraghmore Bog, which has been partially reclaimed and afforested, was located to the west of the site.

One RMP is recorded within the townland of Ballymount. An enclosure (RMP KD032-052) is located 450 m southeast of the site. Other known archaeological sites in the vicinity of E2876 include a ringfort (RMP KD032-032) 1 km to the south, and an enclosure (RMP KD032-026001) and stone circle (RMP KD032-026002) 1.35 km to the east. The stone circle is referred to as 'The Piper's Stones' on the 2nd Edition 6" Ordnance Survey map no. KE032-07 of 1909, although no reference is made to this feature in the 1st Edition 6" Ordinance Survey map no. KE032 of 1839.

Archaeological investigations undertaken as part of Archaeological Services Contract No. 5 on the road scheme identified a number of burnt mounds with associated features in Ballymount at sites E2871 (Hanbidge 2009d), E2872 (Twomey 2009b), E2873 (Hanbidge 2009e), and E2874 (Hanbidge 2009f) between 600 m and 900 m southwest of this site. Located 30 m to the southwest, also in Ballymount townland, was site E2875, a cluster of pits, postholes, and stakeholes (Frykler 2009), while two Late Bronze Age cremations and three adjacent pits were excavated 1.75 km southwest at Blackrath, E2870 (Twomey 2009a). An early Bronze Age settlement was excavated at Baronsland, E2878, 2.1 km to the northeast (O'Malley *et al* 2009), and an early medieval kiln, and a series of post-medieval agricultural features were uncovered at two further sites in Baronsland, E2880 (O'Malley *et al* 2009b) and E2881 (O'Malley 2009).

3 Aims and methodology

The objective of the work was the preservation by record of any archaeological features that would be impacted by the proposed development, in advance of the road construction programme.

Topsoil stripping of the site was conducted using a 360° tracked machine fitted with a 1.9 m wide ditching (toothless) bucket under constant archaeological supervision. A total area of 400 m² was exposed. The resulting surface was cleaned and all potential features investigated by hand. Archaeological contexts were recorded by photograph and on *pro forma* record sheets. Plans and sections were drawn at scales of 1:50 and 1:10 respectively. Registers are provided in the appendices (Appendices 1-5). Ordnance Datum levels and feature locations were recorded using Penmap and a total station theodolite.

Environmental samples, including animal bone samples, were taken of any deposits suitable for analysis or dating as per Headland Archaeology (Ireland) Ltd environmental guidelines and following consultation with environmental archaeologist and archaeobotanist Karen Stewart and zooarchaeologist Dr. Auli Tourunen. In addition, cremations/inhumations were recovered as per Headland archaeology (Ireland) Ltd treatment of human remains guidelines and following consultation with osteoarchaeologist Carmelita Troy. Artefacts recovered during the excavation were assigned unique numbers and treated in accordance with National Museum of Ireland guidelines.

Full archaeological resolution was conducted on this site between 9 and 18 October 2007. The crew on site E2876 consisted of 1 director, 1 supervisor and 7 site assistants.

Following excavation, artefacts and osteological remains were analysed by the appropriate specialists and reports produced on the findings for incorporation into this report (see appendices).

4 Excavation results

Following topsoil removal, four pits, a possible slag pit furnace, a posthole, and three ditches were revealed. These features have been categorised into four distinct chronological phases.

Phase I

The earliest phase on site was represented by three pits. Pit (053) (Figure 5) was not visible on the surface and was truncated by a much larger pit (050) that is described further in the text in Phase II activities. The pit (053) had an irregular shape in plan and measured 1.26 m long by 1.24 m wide and was 0.50 m deep. This pit contained a total of five fills. Three of these fills were located to the southwest of the pit, with the other four identified in the northeast of the pit. The stratigraphical relationship between the fills to the southwest and northeast could not be determined; as mentioned above, this was due to the truncation of this pit (053) by a later, Phase II pit (050). The lower of the three fills (018) in the northeast of pit (053) consisted of loosely compacted mid yellowish brown silty clay with occasional small stone inclusions. It measured 0.38 m long by 0.25 m wide and was 0.04 m deep. Directly above it was loosely compacted mid yellowish orange clayey silt (045) measuring 1.25 m long by 0.29 m wide and was 0.18 m deep. The upper fill (054) located to the southwest side of the pit comprised of loosely compacted dark yellowish grey silty clayey sand with pebble, charcoal, animal tooth and unidentified burnt bone inclusions (Appendix 8). A single flake of fragmented angular flint debitage was also recovered from this deposit (E2876:054:001) (Appendix 14).

Two further fills were identified in the southwest side of the pit. The basal fill (048) measured 1.25 m long by 0.18 m wide and was 0.18 m deep. It comprised of loosely compacted mid yellowish grey sandy clayey silt with pebble and charcoal inclusions. Over (048) was a fill loosely compacted mid yellowish orange sandy clayey silt with inclusions of charcoal and pebbles (046). This measured 0.64 m long by 0.15 m wide and was 0.11 m deep.

Cut into the fills (046) and (048) of pit (053) was a heavily truncated pit (051) (Figure 5). It measured 0.76 m in length by 0.40 m in width and had a depth of 0.18 m. The sides of this feature were gradually sloping and had gradual breaks of slope leading to a concave base. It had a basal fill (047) measuring 0.76 m long by 0.40 m wide and 0.11 m deep. This consisted of loosely compacted dark brown grey clayey sandy silt with pebble and charcoal inclusions. The upper fill (052) in this pit comprised of loosely compact mid yellowish orange sandy silty clay with inclusions of small pebbles and charcoal. It measured 0.51 m long by 0.32 m wide and was 0.08 m thick.

A shallow pit (003) (Figure 4) was situated approximately 2.60 m east of pit (053). This had a sub-oval shape in plan with gradual breaks of slope at the top and irregular concave sides, leading into an irregular sloped base. It measured approximately 0.92 m long by 0.60 m wide and was 0.08 m deep. This pit was identified as the pit (A021/089:004) revealed during testing in 2005 by IAC Ltd (Bayley *et al* 2005). In the testing report it was described as sub-rectangular in shape, measuring 0.95 m long by 0.38 m wide and was 0.11 m deep and contained a broken butt end of a polished stone axe head (A021/089:004:001) (Bayley *et al* 2005). A single fill (019) of firmly compacted mid greyish brown sandy clay with stone and charcoal inclusions was recorded within pit (003). It contained a single fragment of flint debitage (E2876:019:002) (Appendix 15), minute crumbs of pottery (E2876:019:001, E2876:019:003-004) (Appendix 11), and the upper portion of a shale stone axe (E2876:019:005) (Appendix 14).

Phase II

As mentioned above a large pit (050) truncated the Phase I pit (053). Pit (050) (Figure 5) (Plate 4) had a sub-oval shape in plan with sharp breaks of slope at the top, and steeply sloping sides for a maximum of 0.60 m before dropping vertically for a further 0.30 m. Its base was irregular in shape and flat. The pit measured 1.42 m long by 1.41 m wide and was 0.58 m deep, and contained four fills. Its basal fill (041) was a small slump deposit located to the southwest of the pit. It measured 1.25 m long by 0.13 m wide and was 0.06 m deep, and comprised loosely compacted mid yellowish orange clayey silt. Above it was the main fill in the pit (044). This consisted of loosely compacted mid greyish brown clayey sandy silt with pebble and charcoal inclusions. It measured 1.42 m long by 1.28 m wide and had a depth of 0.60 m. The remains of a complete cattle skeleton (Appendix 8) were identified at the base of the fill as well as several artefacts including: three worn body sherds and one fragment of a middle – late Bronze Age domestic vessel (E2876:044:005-008) (Appendix 11), a fragment of a broken glass bead (E2876:044:001) (Appendix 12), a small fragment of possibly worked bone (E2876:044:002), and two heavily corroded fragments of possible iron (E2876:044:003-004) (Appendix 13) were also recovered from this fill. A cow bone from this deposit was radiocarbon dated to 50 cal BC – cal AD 80 (2σ) (SUERC–25294).

A tertiary fill (043) in this pit comprised loosely compacted mid yellowish grey sand with occasional stone inclusions and measured 0.76 m long by 0.55 m wide and was 0.12 m deep. The upper fill (042) consisted of loosely compacted mid brownish grey clay silt and measured 0.73 m long by 0.50 m wide and was 0.12 m thick. This pit was truncated by a ditch (034) which is described below.

A large pit (006) (Figure 4) (Plate 2) truncated the Phase I pit (003) on its western side. This had an irregular, slightly sub-oval in shape in plan and measured 2.40 m long by 1.65 m wide and 0.78 m deep. It had gradual breaks of slope at the top, concave sides leading into a concave base and contained a total of 11 fills. The basal fill (016) measured 0.83 m long by 0.70 m wide and was 0.21 m deep. It comprised of loosely compacted mid yellowish brown silty clay and had inclusions of animal bone and occasional stone. Above it was loosely compacted light brownish grey gravel with pebble and charcoal inclusions (015). This measured 1.48 m long by 1.05 m wide and was 0.18 m deep. A third fill (014) consisted of loosely compacted greyish brown sand with charcoal inclusions and measured 0.57 m long by 0.38 m wide and was 0.14 m deep. Overlying this was a fill (013) comprised of loosely compacted greyish yellow clay with inclusions of animal bone measuring 0.13 m long, 0.80 m wide and 1.71 m deep. Directly over this was a fill (012) that comprised of loosely compacted dark brownish grey clay with animal bone and pebble inclusions. It measured 1.80 m long by 1.25 m wide and had a depth of 0.20 m. A loosely compacted deposit of mid greyish yellow clay (017) containing inclusions of animal bone was sealed between fills (008) and (011). This measured 0.30 m long by 0.18 m wide and had a depth of 0.05 m.

Overlying (012) was a loosely compacted mid brownish grey clayey silt (011) containing inclusions of animal bone, charcoal, and a fragment of flint debitage (E2876:011:001). It had a length of 1.80 m, a width of 1.05 m, and a depth of 0.15m. A loosely compacted mid yellow brown silty clay (010) with occasional animal bone and stone inclusions, and a single fragment of unidentifiable prehistoric pottery (E2876:010:001) overlies (011). It measured 1.30 m long by 0.70 m wide and was 0.15 m deep. Directly above (010) in the northwest of the pit was a small slump fill (009). This measured 0.80 m long by 0.30 m wide and was 0.29 m deep. It comprised loosely compacted light grey brown sandy silt with animal bone and stone inclusions.

The penultimate fill in this pit (008) measured 1.80 m long by 1.64 m wide and was 0.15 m deep. It consisted of loosely compacted dark brown black clayey silt with charcoal and stone inclusions. Animal bone was also recovered from this fill along with three fragments of a human occipital bone (Appendix 9) which returned a radiocarbon date range of 360 – 50 cal BC (2σ) (SUERC – 26402) . The

upper fill (007) measured 1.80 m long by 1.15 m wide and was 0.12 m deep. It comprised loosely compact medium grey silt clay with a moderate amount of charcoal inclusions and occasional animal bone.

Phase III

Located 3.80 m east of pit (003) (Figure 4) was a possible slag pit furnace (004). This measured 0.50 m in diameter and was 0.30 m deep. It was sub-circular in shape with sharp breaks of slope on top, a steeply sloping vertical side to the north and slightly concave sides to the south, which lead into a rounded base. There was no evidence of burning *in situ* within the pit. It was filled with loosely compact dark black brown peat (005) with frequent inclusions of charcoal and slag (Appendix 15).

Phase IV

The fourth phase of activity on site was characterised by a number of post-medieval agricultural features. Three ditches, (021), (020) (Figure 5), and (034), were identified on site E2876. All three were orientated in a northwest/southeast direction and continued beyond the limits of the site. Two of the ditches, (020) and (021), had formed part of a field boundary. Part of these field boundaries were recorded on the 1st Edition Ordnance Survey map no. KE032 of 1839 and the 2nd Edition 6" Ordnance Survey map no. KE032 of 1909, but the portion situated within the extent of site E2876 had been removed prior to the compilation of these maps. The earlier of the two ditches (021) extended beyond the CPO at the southeast end, was 1.20 m – 1.55 m wide and 0.52 m deep. It had sharp breaks of slope at the top, sloping sides leading into an irregular rounded base, and contained a single fill (025) of loosely compact light yellow brown sandy clay with a moderate amount of stone inclusions. This ditch (021) was truncated by a later ditch (020), which also extended beyond the CPO at the southeast end, was 1.50 m – 2.30 m wide and was 0.55 m deep. This ditch was filled with loosely compact yellow brown sandy clay with occasional stone inclusions (029).

The final ditch (034) truncated both ditch (021) and the Phase II pit (050). It extended 16 m east from ditches (020) and (021) and beyond the CPO at the southeast end. It had a width of 1.85 m and was 0.55 m deep, and had gradual breaks of slope and concave sides, leading to a concave base. Two fills were identified in the east of the ditch. The lower fill (036) comprised of loosely compacted mid greyish brown sandy silty clay with occasional stone inclusions, and measured 13 m long by 1.85 m wide and was 0.42 m deep. Above it was loosely compacted light greyish brown silty sandy clay (035) with occasional stone inclusions. This measured 13 m long by 1.85 m wide and was 0.33 m deep. A further three fills were identified directly over the Phase II pit (050) and possibly represent disturbance by ditch (034) in this area. The lower fill (040) measured approximately 3 m long by 0.84 m wide and was 0.15 m thick. It comprised of loosely compact dark yellow brown sandy silt with occasional stone and charcoal inclusions. Animal bone was recovered from this fill. Directly over this was fill (040), a firmly compacted mid yellowish orange silty clay (039) with a moderate amount of stone and charcoal inclusions. The upper fill (038) in this part of the ditch (034) comprised firmly compacted dark reddish brown sandy clay silt with a moderate amount of pebble and charcoal inclusions. Animal bone, slag (Appendix 15), presumably as a result of disturbance to the nearby slag pit furnace (004), and one fragment and four crumbs of prehistoric pottery (E2876:038:001-005) (Appendix 11) were recovered from this fill.

Undated features

A single isolated posthole (032) (Figure 3) was uncovered 0.80 m southwest of the possible pit furnace (004). It had a circular in shape with sharp breaks of slope at the top, and vertical sides leading into a rounded base. It measured 0.22 m in diameter, 0.15 m deep, and was filled with loosely compact medium yellow brown silty sand (033) with occasional stone inclusions.

5 Discussion

The results of the excavation at Ballymount are discussed here following stratigraphic, environmental, dating and artefactual analysis. The site is then discussed on a local level and related to other sites known in the vicinity (including those discovered on the current scheme). Finally the site is discussed on a national level in an attempt to place it in context and assess how it contributes to the archaeological record in general.

Phasing and Chronology
Although the site was relatively small four defined phases of activity identified. These reflect distinct episodes on site and aid our understanding of these events. The first three phases of activity appear to be prehistoric in date – analysis of the artefacts and radiocarbon dating suggests a Bronze Age to Iron Age date range for these phases. The final phase of activity (Phase IV) was characterised by a series of post-medieval field boundaries.

In addition a single unstratified feature, the posthole (032) was identified at the site. Due to the absence of any diagnostic elements or artefacts uncovered from this feature no further information can be extrapolated from it.

Phase I
Phase I comprises three pits located in the centre of the site. No dates were attained for any of the features, but stratigraphically all predate the Iron Age features of Phase II. Within pit (003) a fragment of flint debitage and the butt end of a shale stone axe or possibly an adze was recovered. Stone axes have long been considered one of the characteristic artefact types of the Neolithic Period in Ireland (4000-2500 BC), and they are known to have been in use from the earliest phase of human settlement in the Early Mesolithic Period, to well into the Bronze Age. The axe would have been hafted by inserting it into a perforated piece of wood, and may have been binded with leather, or bonded with resin, to the haft. Residue from such resin can sometimes be identified on the surface of stones. The majority range between 8 and 16 cm in length, the smaller examples thought to have been used for woodworking, the larger for felling trees, while smaller and larger axes beyond this range are thought to have had purely symbolic or decorative functions. The polishing of the cutting edge of the axe would have improved its cutting capability and increased its efficiency, but the polishing of the entire surface of axes would appear to be for purely decorative reasons. The majority of the axes are of a porcellanite composition, but shale axes represent circa. 14% of over 20,000 examples known from Ireland (Waddell 2005, 47-9). Adzes were a tool used for shaping, trimming or digging, as they were hafted with the object mounted transversely in the handle.The deposition of this artefact may have symbolic resonances, as the digging of a pit simply to dispose of a broken axe seems unlikely, though Waddell notes 'the deposition of parts of broken axes is unusual' (2005, 129). The presence of burnt animal bone showing signs of skinning, filleting and consumption along with the stone axe/adze raises the possibility of a ritual function for this feature. The other lithic recovered from this pit (E2876:019:002) was a fragment of flint debitage and is unlikely to have been deliberate deposited, while the small pottery fragments (E2876:019:001, E2876:019:003-004) were identified as prehistoric but no further information could be extrapolated from them (Appendix 11).

No evidence existed for a relationship between pit (003) and pits (051) and (053). The charcoal retrieved from pit (051) and the flint debitage, animal teeth, unidentified burnt bone and charcoal retrieved from pit (053) lend to the interpretation of these features as domestic waste pits related to activities within the surrounding landscape.

Phase II

A radiocarbon of 360 – 50 cal BC (2σ) was attained from a human skull (occipital) bone deposited in pit (006). Three fragments of this bone were retrieved from (008), one of the upper fills of (006) (Appendix 8). They represent the well preserved remains of an occipital bone belonging to an adult ageing between 18 and 34. A small perforation with a diameter of 5mm is evident at the point where the three fragments meet when conjoined. This may be the result of a medical procedure; cranial trepanation, in which a hole is cut or scraped into the human skull, in order to treat health problems related to intracranial diseases e.g. epileptic seizures, migraines and mental disorders Given the uniformity of the perforation, such a hypothesis is a more likely cause than the piercing of the skull by a projectile such as an arrowhead. However, as the undertaking of this trepanation procedure would have led to adjacent scratch or cut marks on the bone, and no healing of the area took place, it seems that any such event took place, may have been the cause of death or occurred post-mortem.

The faunal assemblage recovered from pit (006) in association with the human bone showed evidence for all stages of the processing of cattle, and the waste produced reflected both food and remains from slaughter. Cut marks on the bones shows signs of skinning, filleting, and of cutting of the carcass into smaller pieces for consumption. A number of these bones also showed signs of burning, possibly from roasting. The remains of three calves, ageing between three weeks and five months were identified, as well as those of cattle, sheep, goat, pig and horse (Appendix 8). The presence of calf bones in association with human bone suggests the possibility of a ritual activity having taken place (Appendix 8). The animal bone roughly corresponds with the faunal remains uncovered at Dún Ailinne, a large hillfort, referred to as the seat of the kings of Leinster in early Irish literature, located 6.2 km to the north. Here cattle constituted the largest proportion of faunal remains recovered, with pig also common. Remains of horse and sheep were also identified. Many of the cattle bones were from calves, killed shortly after birth in April or May, and in late September/early October. This is thought to reflect feasting at the site at two different times in the year, possibly having a ritual significance (Waddell 2005, 343-7).

This is one of a number of sites in the surrounding landscape to show evidence for Iron Age activity. As mentioned above, located 6.2 km to the north is Dún Ailinne hillfort. Partial excavation of the hillfort has shown five phases of Iron Age activity, but no indications of domestic or residential use (O'Kelly 1993, 316-19). Rather, what may possibly be a large ceremonial site was identified. As at Ballymount E2876, domestic activity relating to the Iron Age was revealed at Moone, site E2981, 8.4 km to the southwest where a pit returned a radiocarbon date of 40 cal BC – cal AD 130 (2σ) (Dennehy and Mallia-Guest 2009).

A radiocarbon date of 50 cal BC – cal AD 80 (2σ) was secured from a cattle bone belonging to the skeleton retrieved from pit (050). This firmly places pit (050) in the Iron Age. In light of the radiocarbon date returned from this pit the Middle – Late Bronze Age pottery sherds recovered must be seen as being secondary deposits which ended up in the pit at a later date. The cattle skeleton deposited in this pit was the remains of a mature male, probably an ox, and showed some cut marks. The possibility of the cattle skeleton deriving from a castrated male ox, was based on the lower withers height of the metapodials (long bones of the hand and feet), as well as the difference between the mandibular wear and epiphyseal age, as castration is one factor that can affect the timing of epiphyseal closure and castration also affects the shape of metapodials (Appendix 8). The size of the animal is within the range observed in an Iron Age sample from Moone, site E2980, 7.5 km to the southwest. It was decapitated, skinned, and its tail was also removed (perhaps during skinning), but all the remains were buried together. This indicates that the skeleton could represent a diseased or perished animal that was skinned and buried. However, especially in the context of human skull and calf bones found in the adjacent feature (006), the ox skeleton could represent ritual deposition of a

sacrificed animal (Appendix 8), this being the only trace of a ritual feast or the passing on of material wealth in the form of livestock to the next world.

Other Iron Age activity noted in the surrounding landscape was of a funerary/ritual nature. A number of infant skeletons were uncovered at Moone E2982 8.3 km to the southwest (Dennehy 2009). These were located adjacent to a townland boundary, reflecting a practice of burying infants in liminal zones which continued up until the last century. These burials returned a range of radiocarbon dates between 200 cal BC and cal AD 120 (2σ). Located 1 km west of this burial site, Burtown Little E2989 contained a ringditch, the upper fill of which contained charcoal and burnt bone and returned a radiocarbon date of cal AD 20 – 250 (2σ)(Moloney 2009). The predominance of funerary/ritual features amongst the Iron Age activities revealed within this landscape is continued with a further ringditch oat Mullamast E2973 containing three cremations, where one was radiocarbon dated to 360 – 40 cal BC (SUERC-25467, 2σ) (Hackett 2009b). Paralleling the cattle burial in pit (050) the remains of a dog were also interred within the ringditch. Interestingly, at both sites E2973 and E2989 the cremation remains consist of skull fragments, perhaps reflecting a choice of the skull, as the most striking and symbolic body part, to represent the individual in the burial rite.

A number of Middle – Late Bronze Age pottery sherds were retrieved from pit (050) reflecting the abundance of Bronze Age activity in the surrounding landscape. Numerous burnt mounds dating to the Bronze Age were uncovered within 5 km of site E2876 during the excavation phase of this road scheme: Inchaquire E2867 (Hanbidge 2009a); Inchaquire E2869 (Hanbidge 2009c), Blackrath E2871 (Hanbidge 2009d), Ballymount E2872 (Twomey 2009a), E2873 (Hanbidge 2009e), Ballymount E2874 (Hanbidge 2009f), Kilgowan E2886 (Hackett 2009a), Old Kilcullen E2887 (Cagney 2009). A Bronze Age settlement was uncovered at Baronsland E2878 located 2.1 km northeast of this site (O'Malley *et al* 2009a). This contained two non contemporary structures which appear to suggest a long term settlement by a small group of people at the site. Located 3 km southwest of E2876 at Inchaquire E2868 a number of pits were excavated which related to Bronze Age activities (Hanbidge 2009b). These contained artefacts including two spindle whorls, which point to the domestic nature of much of the activities being undertaken.

Phase III

The slag pit furnace (004) is indicative of use of the bloomery (direct) process of smelting ore as a means of creating usable iron. Slag pit furnace technology is believed to originate in northern Europe during the Iron Age and was spread by the mass migrations of Angles, Jutes, Saxons *etc*. in the 5th and 6th centuries. Slag pit furnaces are common in Anglo-Saxon England and it is likely that the technology was gradually introduced to Ireland from the 7th century onwards. Later Scandinavian settlers also brought slag pit furnace technology with them to Ireland (Tylecote 2001), where it continued in use as the main means of smelting iron ore through until the late 16th century. The remains from pit (004) suggest possibly a single episode occurred at Ballymount, the presence of some hammerscale pointing to the undertaking of some primary smithing on-site also (Appendix 15). The iron ore for such a process would be expected to have been sourced locally, the adjacent Narraghmore Bog perhaps being one such possible source for bog ore.

The absence of *in situ* burning may be considered unusual for furnaces; however, certain furnace constructions such as slag pit furnaces do not necessarily leave any evidence of high temperatures other than the slag itself. A slag pit furnace is a furnace over the pit that collects the slag produced during the smelting process. This means that the smelter can produce bigger blooms as it takes longer for the furnace to 'clog up' with slag, making it a more efficient technology than the primitive 'bowl furnace'. One hundred percent of the charcoal retrieved from this feature for environment analysis was discovered to be oak (Appendix 7). This would have enabled the highest temperature possible to

be achieved during the smelting process, and the exclusion of all other potential wood fuels shows a deliberate and selective exploitation of this wood by those undertaking this process.

Phase IV

The final phase of activity on site, ditches (020) and (021), represent the remains of a field boundary still partially extant in the 1st and 2nd Edition OS maps of 1839 and 1909. The realignment of this boundary, as possibly represented by ditch (034), and its subsequent removal, shows the impact of different farming practices, and the landscape changes these effect over time.

All the archaeology related to this site within the CPO has been resolved.

6 Archive quantities

The site archive is comprised of the following materials:

Item	Quantity
Context Sheets	54
Plans	2
Sections	7
Photographs	46
Registers	4
Notebooks	-

The archive material is contained within 1 box.

Storage of the archive in a suitable format and location is required in order to provide for any future archaeological research. It is proposed that in addition to the paper archive a digital copy is prepared. The archive is currently stored in the offices of Headland Archaeology (Ireland) Ltd., Unit 1, Wallingstown Business Park, Little Island, Co. Cork. It is proposed that following completion of post-excavation analysis, the archive is appropriately deposited in consultation with the National Museum of Ireland.

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- Graphics department, Headland Archaeology (Ireland) Ltd.
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- The excavation team.

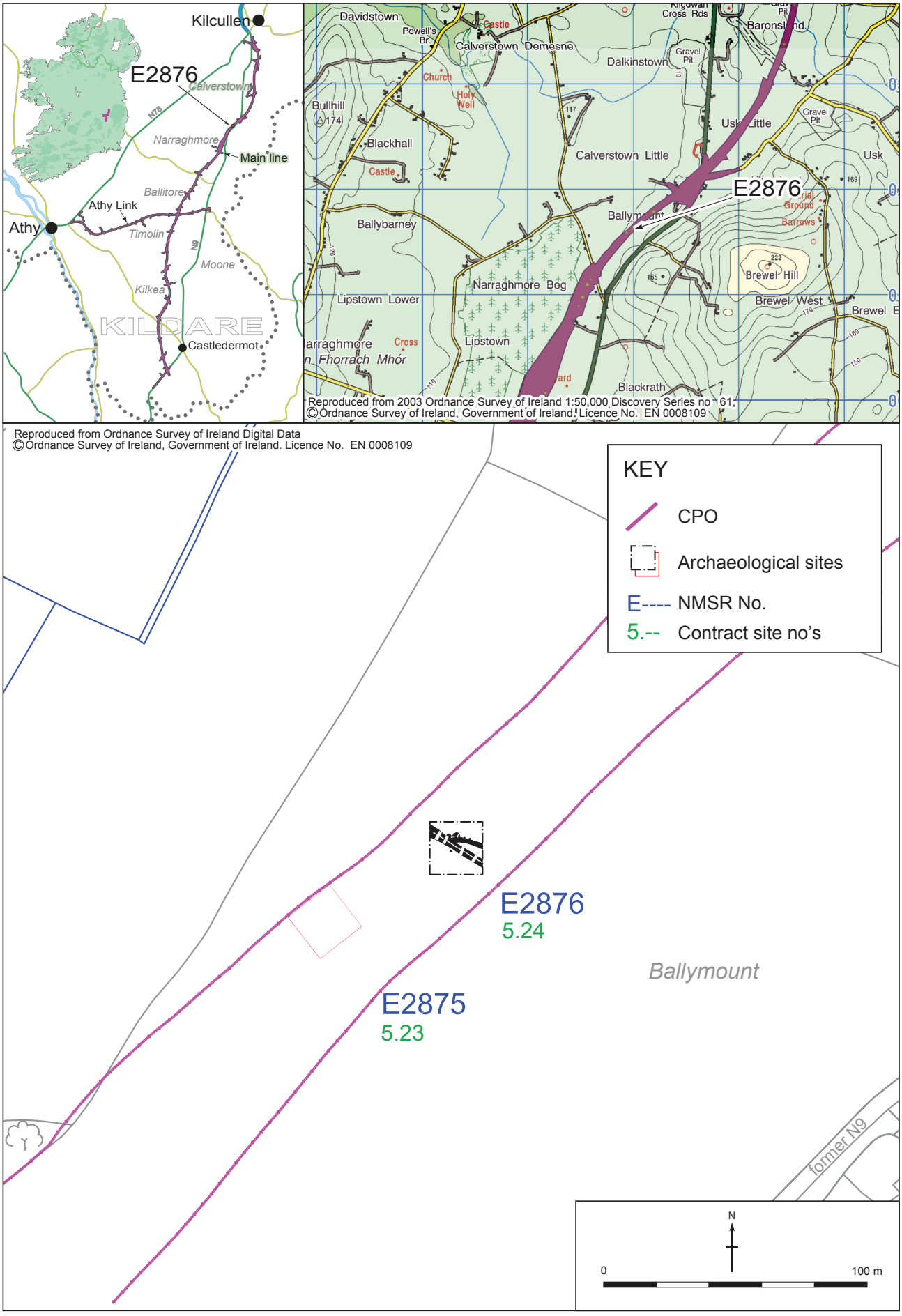


Figure 1 - N9/N10 Kilcullen to Waterford Scheme: Phase 3, Kilcullen to Carlow. Archaeological Services Contract No. 5 – Resolution, Kilcullen to Moone and Athy Link Road: E2876 site location.

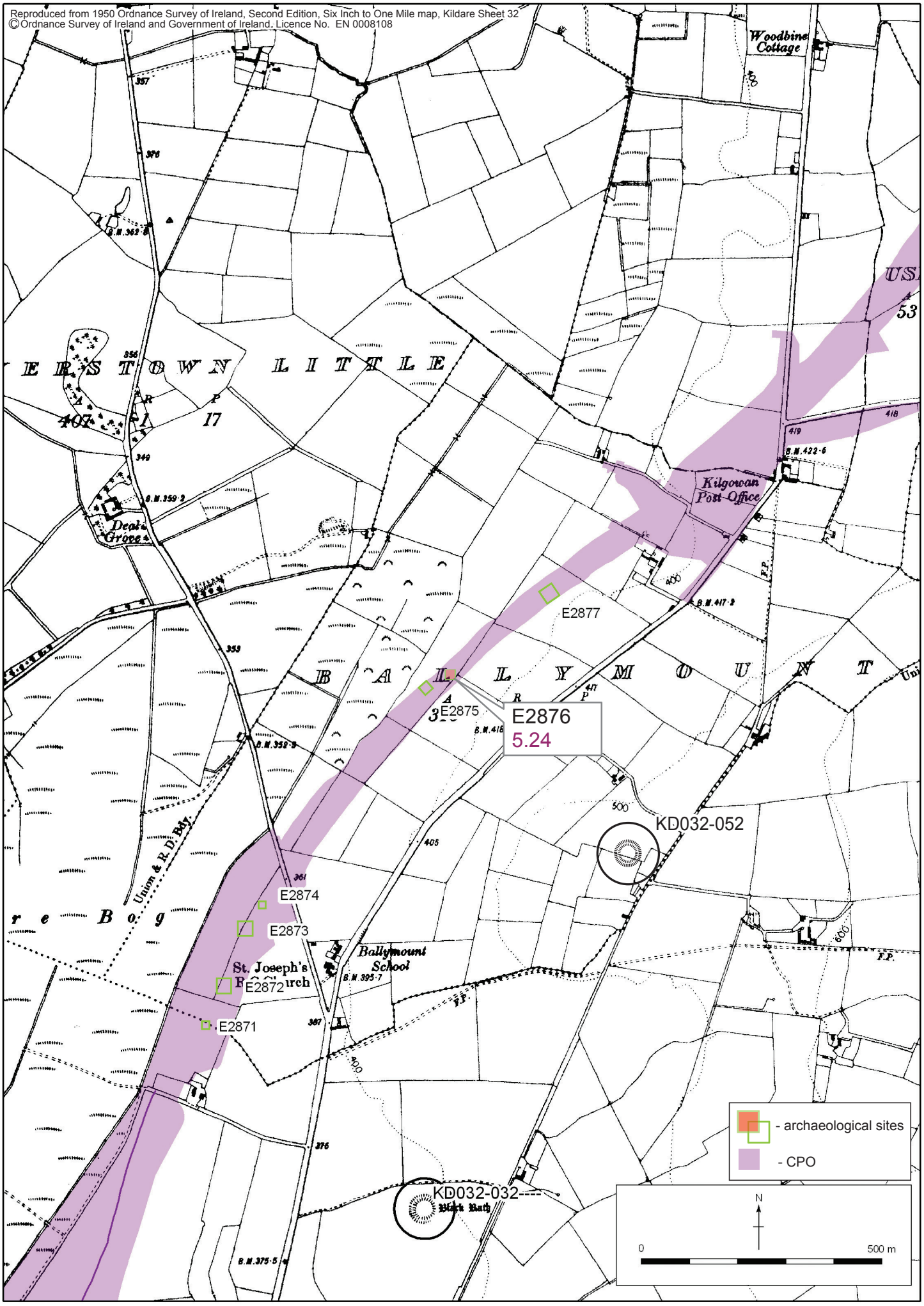
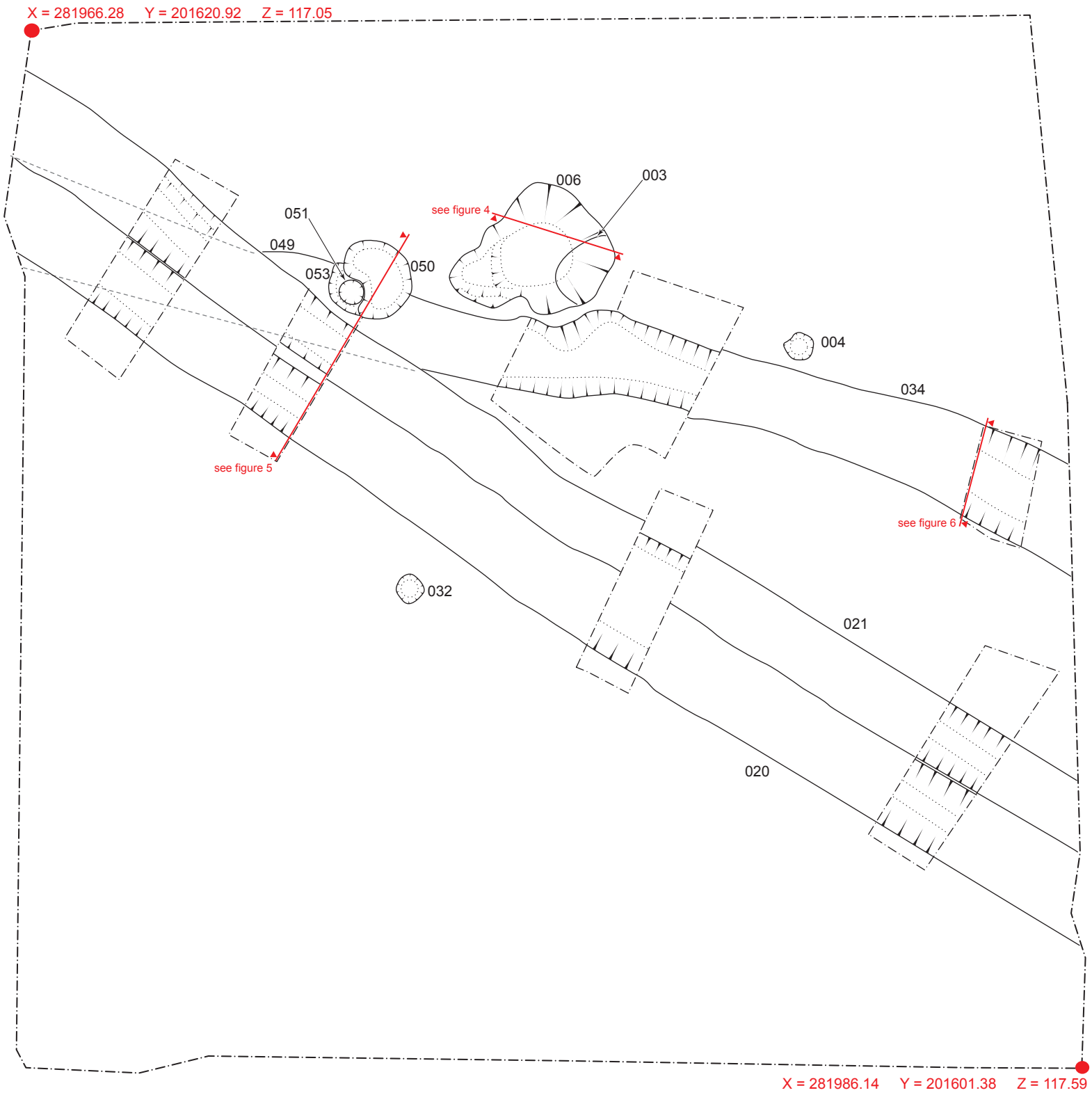


Figure 2 - N9/N10 Kilcullen to Waterford Scheme: Phase 3, Kilcullen to Carlow. Archaeological Services Contract No. 5 - Resolution, Kilcullen to Moone and Athy Link Road: E2876 extract from RMP.



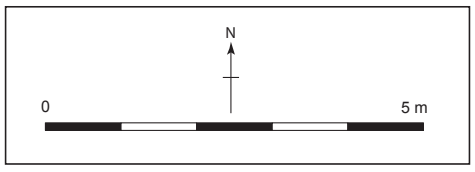


Figure 3 - N9/N10 Kilcullen to Waterford Scheme: Phase 3, Kilcullen to Carlow. Archaeological Services Contract No. 5 - Resolution, Killcullen to Moone and Athy Link Road: E2876 site layout.

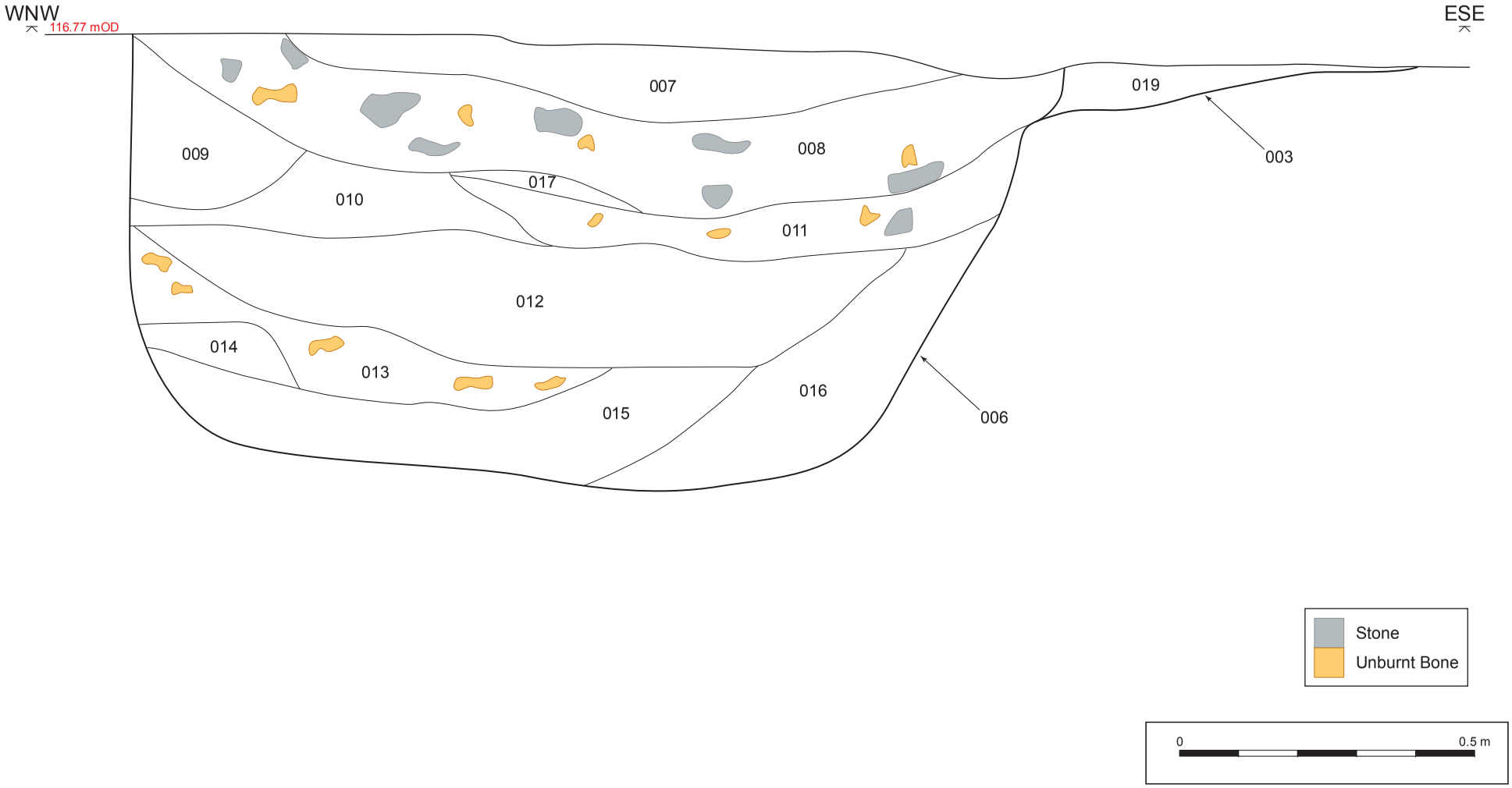
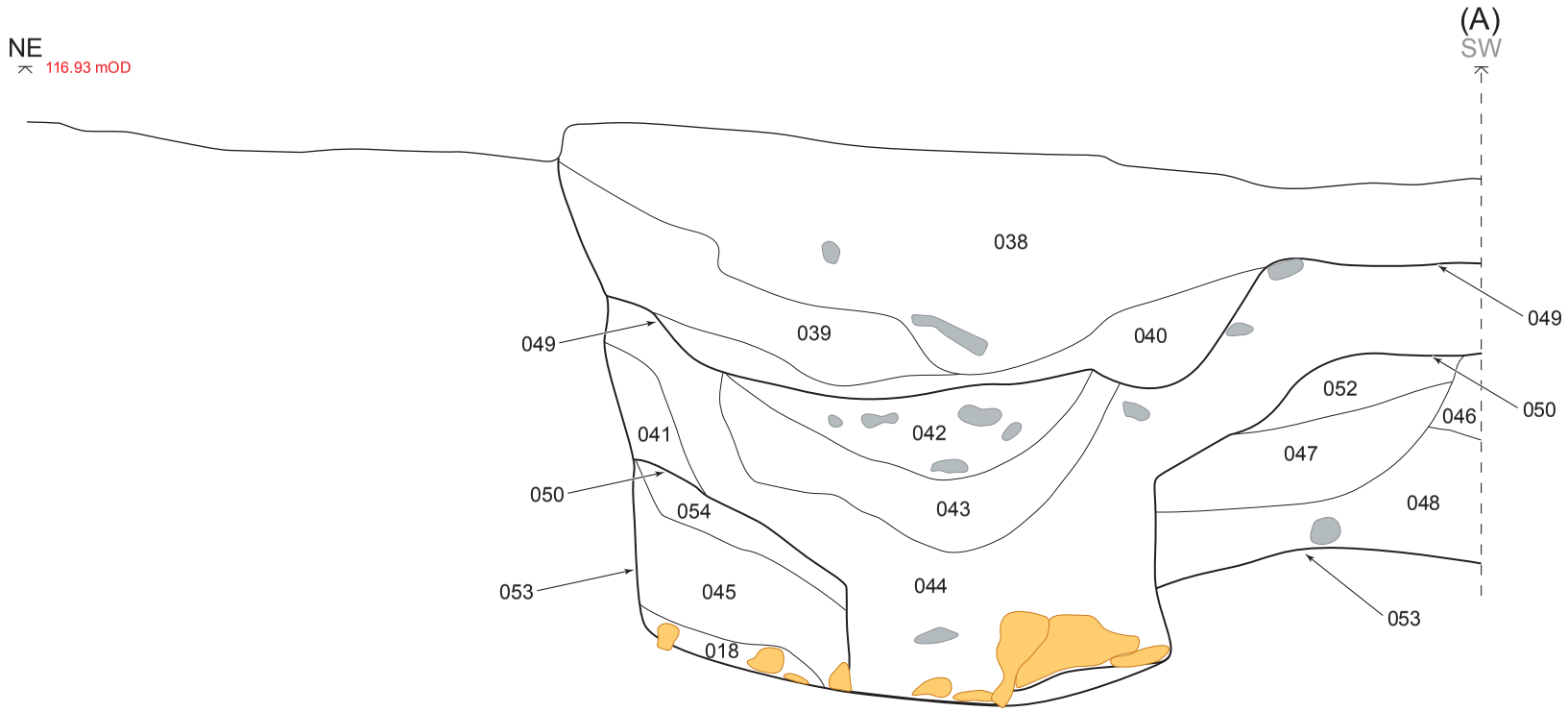


Figure 4 - N9/N10 Kilcullen to Waterford Scheme; Phase 3: Kilcullen to Carlow.
Contract No. 5 - Killcullen to Moone and Athy Link Road:
E2876 south-facing section of pits (003) and (006).



(A)

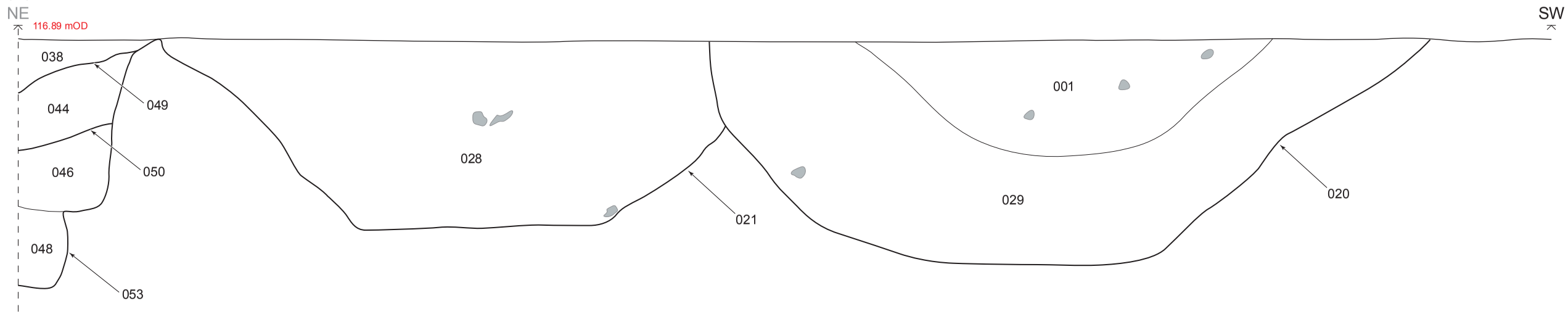


Figure 5 - N9/N10 Kilcullen to Waterford Scheme; Phase 3: Kilcullen to Carlow.
Contract No. 5 - Killcullen to Moone and Athy Link Road:
E2876 northwest-facing section of pits (049), (053), (051) and (050) and ditches (021) and (020).

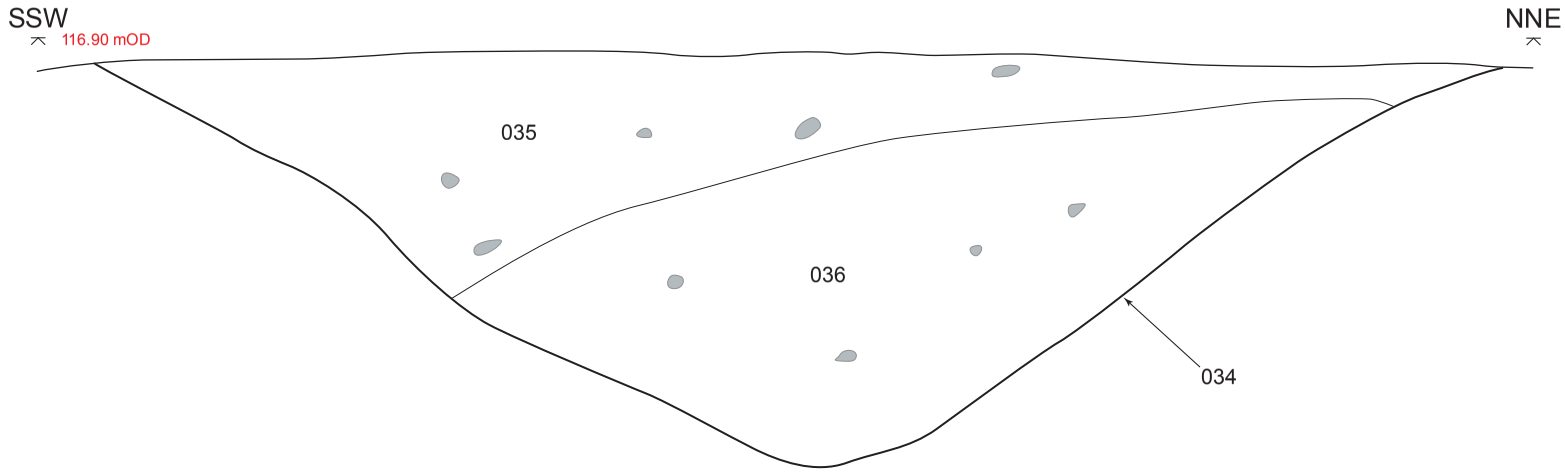


Figure 6 - N9/N10 Kilcullen to Waterford Scheme: Phase 3, Kilcullen to Carlow. Archaeological Services Contract No. 5 - Resolution, Killcullen to Moone and Athy Link Road: E2876 southeast-facing section of ditch (034).

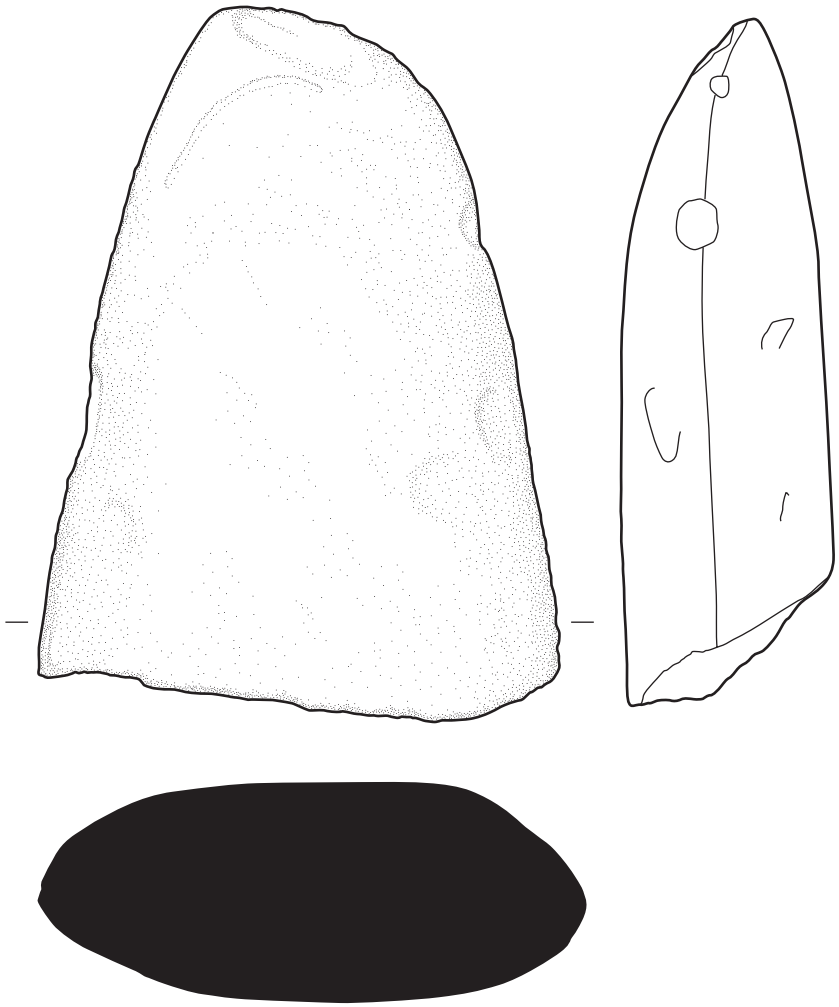


Figure 7 - N9/N10 Kilcullen to Waterford Scheme: Phase 3, Kilcullen to Carlow. Archaeological Services Contract No. 5 - Resolution, Kilcullen to Moone and Athy Link Road: E2876, stone axe (E2876:019:005).

Plate 1 - Pre-excavation of pit (004) with iron slag, facing north.


Plate 2 - Section through pit (006) showing layers, facing north.

Plate 3 - Section through ditches (020) and (022), facing west.

Plate 4 - Cattle skeleton within pit (050), facing south.

Appendix 1 – Context Register for Site E2876

Context no.	Type	Fill of:	Filled by:	Length (m)	Width (m)	Depth (m)	Description	Interpretation
001	Deposit	n/a	n/a	0.32	n/a	n/a	Topsoil	Topsoil.
002	Deposit	n/a	n/a	n/a	n/a	n/a	Natural	Natural. Same as (030), (031), (024) and (027).
003	Cut	n/a	(019)	0.08	0.60	0.92	Sub-oval feature with rounded corners, gradual break of slope at the top, concave sides leading into a sloped irregular base.	Cut of shallow pit. Truncated by pit (006).
004	Cut	n/a	(005)	0.30	0.51	0.51	Sub-circular feature with a sharp break at top, steeply sloping vertical side to the north and concave sides to the south leading into a rounded base.	Cut of possible slag pit furnace.
005	Fill	(004)	n/a	0.30	0.51	0.51	Loosely compact dark black brown peat fill with inclusions of slag and charcoal.	Fill in pit (004).
006	Cut	n/a	(007), (008), (009), (010), (011), (012), (013), (014), (015), (016), (017), (018)	0.78	1.65	2.40	Irregular sub-oval feature, it had a gradual break of slope at the top, concave sides, leading into a concave base. Pit contained animal bone and flint.	Cut of pit.
007	Fill	(006)	n/a	0.12	1.15	1.80	Loosely compact medium grey clay silt with inclusions of charcoal.	Upper fill of pit (006).
008	Fill	(006)	n/a	0.15	1.64	1.80	Loosely compact dark brown black clay silt with inclusions of stone and charcoal.	Fill of pit (006).

Context no.	Type	Fill of:	Filled by:	Length (m)	Width (m)	Depth (m)	Description	Interpretation
009	Fill	(006)	n/a	0.29	0.30	0.80	Loosely compact light grey brown sandy silt with some stone inclusions.	Fill of pit (006).
010	Fill	(006)	n/a	0.15	0.70	1.30	Loosely compact medium yellow brown silty clay with stone inclusions.	Fill of pit (006).
011	Fill	(006)	n/a	0.15	0.97	1.45	Loosely compact medium brown grey clay silt with inclusions of charcoal, pebbles and flint debitage.	Fill of pit (006).
012	Fill	(006)	n/a	0.21	1.32	1.82	Loosely compact dark brown grey clay with inclusions of pebbles.	Fill of pit (006).
013	Fill	(006)	n/a	0.13	0.80	1.71	Loosely compact grey yellow clay with inclusions of animal bones.	Fill of pit (006).
014	Fill	(006)	n/a	0.10	0.38	0.57	Loosely compact grey brown sand with inclusions of charcoal.	Fill of pit (006).
015	Fill	(006)	n/a	0.18	1.05	1.48	Loosely compact light brown grey gravel with pebbles and charcoal inclusions.	Fill of pit (006).
016	Fill	(006)	n/a	0.21	0.70	0.83	Loosely compact medium yellow brown silty clay with occasional stone inclusions.	Fill of pit (006).
017	Fill	(006)	n/a	0.03	0.34	0.51	Loosely compact medium yellow clay with inclusions of pebbles.	Fill of pit (006).
018	Fill	(006)	n/a	0.04	0.25	0.38	Loosely compact medium yellow brown silty clay with stone inclusions.	Fill of pit (053).
019	Fill	(003)	n/a	0.10	0.62	0.92	Firmly compact medium grey brown sandy clay with stone, charcoal, pottery and flint inclusions.	Fill of shallow pit (003).
020	Cut	n/a	(026)= (029)	0.55	1.50-2.30	23.50	Linear in plan with a sharp break of slope at the top, steeply sloping sides leading into an irregular flat base.	Cut of ditch/field boundary, continued outside limit of excavation.
021	Cut	n/a	(024), (025)= (028)	0.52	1.20-1.55	24.00	Linear in plan with a sharp break of slope at top, sloping sides leading into an irregular rounded base.	Cut of ditch/field boundary, continued outside limit of excavation.

Context no.	Type	Fill of:	Filled by:	Length (m)	Width (m)	Depth (m)	Description	Interpretation
022	Cut	n/a	(023)	0.14	0.54	0.54	Sub-circular feature with a gradual break of slope at the top, concave sides leading into base.	Cut of small pit/tree bowl, non archaeological feature
023	Fill	(022)	n/a	0.14	0.54	0.54	Loosely compact medium grey brown silt with some charcoal inclusions.	Fill of pit/tree bowl (022), non archaeological feature.
024	Deposit	n/a	n/a	n/a	n/a	n/a	Natural	Natural. Same as (002), (030), (031), (024), (037) and (027)
025	Fill	(021)	n/a	0.52	1.20-1.55	24.00	Loosely compact light yellow brown sandy clay which contained inclusions of stones.	Fill of ditch (021). Same as (028).
026	Fill	(020)	n/a	0.55	1.50-2.30	23.50	Loosely compact yellow brown sandy clay with inclusions of stones.	Fill of ditch (020). Same as (029).
027	Deposit	n/a	n/a	n/a	n/a	n/a	Natural	Natural subsoil. Same as (002), (030), (037), (031), (024).
028	Fill	(021)	n/a	0.52	1.20-1.55	24.00	Loosely compact light yellow brown sandy clay which contained inclusions of stones.	Fill of ditch (021). Same as (025).
029	Fill	(020)	n/a	0.55	1.50-2.30	23.50	Loosely compact yellow brown sandy clay with inclusions of stones.	Fill of ditch (020). Same as (026).
030	Deposit	n/a	n/a	n/a	n/a	n/a	Natural	Natural subsoil. Same as (002), (031), (037), (024) and (027).
031	Deposit	n/a	n/a	n/a	n/a	n/a	Natural	Natural subsoil. Same as (002), (030), (037), (024) and (027).
032	Cut	n/a	(033)	0.15	0.22	0.22	Sub-circular feature with a sharp break at top, vertical sides leading into a rounded base.	Cut of posthole.
033	Fill	(032)	n/a	0.15	0.22	0.22	Loosely compact medium yellow brown silty sand with inclusions of stones.	Fill of posthole (032).
034	Cut	n/a	(035), (036).	0.55	1.85	16.00	Linear feature with rounded corners, a gradual break in slope at top, concave sides leading into a concave base.	Cut of ditch/field boundary, continues outside limit of excavation. Same as (049).
035	Fill	(034)	n/a	0.33	1.85	13.00	Loosely compact light grey brown silty sandy clay which contained inclusions of stones.	Upper fill of ditch (034).

Context no.	Type	Fill of:	Filled by:	Length (m)	Width (m)	Depth (m)	Description	Interpretation
036	Fill	(034)	n/a	0.42	1.85	13.00	Loosely compact medium grey brown sandy silty clay which contained inclusions of stones.	Basal fill of ditch (034).
037	Deposit	n/a	n/a	n/a	n/a	n/a	Natural	Natural subsoil. Same as (002), (031), (024) and (027).
038	Fill	(034=049)	n/a	0.30	1.35	3.00	Firmly compact dark red brown sandy clay silt which contained inclusions of pebbles, charcoal, slag, pottery and bones.	Fill of linear (049).
039	Fill	(034=049)	n/a	0.17	0.53	3.00	Firmly compact medium yellow orange silty clay inclusions of pebbles charcoal.	Fill of linear (049).
040	Fill	(034=049)	n/a	0.15	0.84	3.00	Loosely compact dark yellow brown sandy silt with inclusions of pebbles, bones and charcoal	Fill of linear (049).
041	Fill	(050)	n/a	0.06	0.13	1.25	Loosely compact medium yellow orange clay silt with no inclusions.	Fill in pit (050).
042	Fill	(050)	n/a	0.12	0.50	0.73	Loosely compact medium brown grey clay silt with no inclusions.	Fill in pit (050).
043	Fill	(050)	n/a	0.10	0.55	0.76	Loosely compact medium yellow grey sand with some stone inclusions.	Fill in pit (050).
044	Fill	(050)	n/a	0.60	1.28	1.42	Loosely compact medium grey brown clay sandy silt with inclusions of pebbles, charcoal and animal bones. A broken bead and possible prehistoric pottery were also recovered.	Fill of pit (050).
045	Fill	(053)	n/a	0.18	0.29	1.25	Loosely compact medium yellow orange clay silt with no inclusions.	Fill in truncated pit (053).
046	Fill	(053)	n/a	0.11	0.15	0.64	Loosely compact medium yellow orange sandy clay silt which contained inclusions of pebbles and charcoal.	Fill of truncated pit (053).
047	Fill	(053)	n/a	0.11	0.40	0.76	Loosely compact dark brown grey clay sandy	Fill of truncated pit (053).

Context no.	Type	Fill of:	Filled by:	Length (m)	Width (m)	Depth (m)	Description	Interpretation
							silt which contained inclusions of pebbles and charcoal.	
048	Fill	(053)	n/a	0.18	0.52	1.25	Loosely compact medium yellow grey sandy clay silt which contained inclusions of pebbles and charcoal.	Fill of truncated pit (053).
049	Cut	n/a	(038), (039), (040).	0.55	1.85	16.00	Linear feature with rounded corners, a gradual break in slope at top, concave sides leading into a concave base.	Cut of ditch/field boundary, continues outside limit of excavation. Same as (034).
050	Cut	n/a	(041), (042), (043), (044).	0.58	1.41	1.42	Sub-oval feature with sharp break at the top, steeply sloping sides for a maximum depth of 0.60 m; it then vertically dropped into an irregular flat base.	Cut of pit. Truncated earlier pit (053)
051	Deposit	n/a	n/a	0.21	0.52	0.55	Loosely compact medium brown silty clay with occasional stone and root inclusions.	Non archaeological deposit, remains of topsoil.
052	Fill	(051)	n/a	0.08	0.32	0.51	Loosely compact medium yellow orange sandy silty clay with inclusions of pebbles and charcoal	Fill of feature (053).
053	Cut	n/a	(045), (046), (047), (048), (052), (054), (018)	0.50	1.24	1.26	Sub-circular in shape. With an imperceptible break of slope at the top, almost vertical sides leading into an irregular base.	Cut of pit. Truncated by pit (050).
054	Fill	(050)	n/a	0.05	0.33	0.84	Loosely compact dark yellow grey silty clay sand which contained inclusions of charcoal, bones and pebbles.	Fill of pit (053).

Appendix 2 – Finds Register for Site E2876

Find no.	Material	Type	Identification	Description
E2876:001:001	Ceramic	Sherd	Post medieval	Red earthen black glazed pottery sherd
E2876:010:001	Ceramic	Fragment	Prehistoric pottery	Fragment of pottery with medium dolerite inclusions
E2876:011:001	Stone	Flint	Prehistoric	Amber coloured flint debitage
E2876:019:001	Ceramic	Crumb	Prehistoric	Minute crumbs of pottery
E2876:019:002	Stone	Flint	Prehistoric	Grey coloured flint debitage
E2876:019:003	Ceramic	Crumb	Prehistoric	Minute crumbs of pottery
E2876:019:004	Ceramic	Crumb	Prehistoric	Minute crumbs of pottery
E2876:019:005	Stone	Axe	Prehistoric	Polished stone axe head with a broken butt end
E2876:038:001	Ceramic	Fragment	Prehistoric	Fragment of pottery
E2876:038:002	Ceramic	Small crumb	Prehistoric	Minute crumbs of pottery
E2876:038:003	Ceramic	Small crumb	Prehistoric	Minute crumbs of pottery
E2876:038:004	Ceramic	Small crumb	Prehistoric	Minute crumbs of pottery
E2876:038:005	Ceramic	Small crumb	Prehistoric	Minute crumbs of pottery
E2876:044:001	Glass	Broken bead	Possibly prehistoric	Half of a broken bead with dotted decoration on the surface
E2876:044:002	Possibly bone	Fragment	Possibly prehistoric	Small fragment of possible worked bone
E2876:044:003	Metal	Possibly Iron	Unknown	Heavily corroded small fragment of metal
E2876:044:004	Metal	Possibly Iron	Unknown	Heavily corroded small fragment of metal
E2876:044:005	Ceramic	Sherd	Middle – Late Bronze Age	Bodysherd - red-buff fabric with blackened internal surface
E2876:044:006	Ceramic	Sherd	Middle – Late Bronze Age	Bodysherd - red-buff fabric with blackened internal surface
E2876:044:007	Ceramic	Sherd	Middle – Late Bronze Age	Bodysherd - red-buff fabric with blackened internal surface
E2876:044:008	Ceramic	Fragment	Middle – Late Bronze Age	Fragment: - red-buff fabric with blackened internal surface
E2876:054:001	Stone	Flint	Prehistoric	Weathered buff flint debitage

Appendix 3 – Sample Register for Site E2876

Sample no.	Context no.	Description
E2876:001	(005)	Slag removed from possible slag pit furnace (004)
E2876:002	(005)	Soil with large amount of charcoal from pit (004)
E2876:003	(019)	Charcoal from shallow pit (003)
E2876:004	(007)	Medium grey fill from pit (006)
E2876:005	(008)	Fill in pit (006)
E2876:006	(009)	Light brown silty fill in pit (006)
E2876:007	(010)	Yellow clay fill in pit (006)
E2876:008	(011)	Medium grey silt fill in pit (006)
E2876:009	(012)	Dark grey clay fill in pit (006)
E2876:010	(013)	Yellow clay fill in pit (006)
E2876:011	(014)	Medium brown clay sand in pit (006)
E2876:012	(017)	Yellow clay fill in pit (006)
E2876:013	(016)	Yellow clay fill in pit (006)
E2876:014	(019)	Medium grey brown fill in pit (003)
E2876:015	(018)	Yellow brown clay fill in pit (053)
E2876:016	(008)	Animal bone from pit (006)
E2876:017	(011)	Animal bone from pit (006)
E2876:018	(013)	Animal bone from pit (006)
E2876:019	(023)	Soil sample from (022)
E2876:020	(037)	Dark grey yellow fill of possible deposit
E2876:021	(044)	Medium grey brown silty sand under bones in pit (050)
E2876:022	(044)	Animal bones from pit (050)
E2876:023	(040)	Animal bones from pit (034=049)
E2876:024	(038)	Animal bones from pit (034=049)
E2876:025	(054)	Dark yellowish grey silty sand from pit (053)
E2876:026	(001)	Slag recovered from the topsoil
E2876:027	(038)	Slag recovered from fill in ditch (049)=(034)

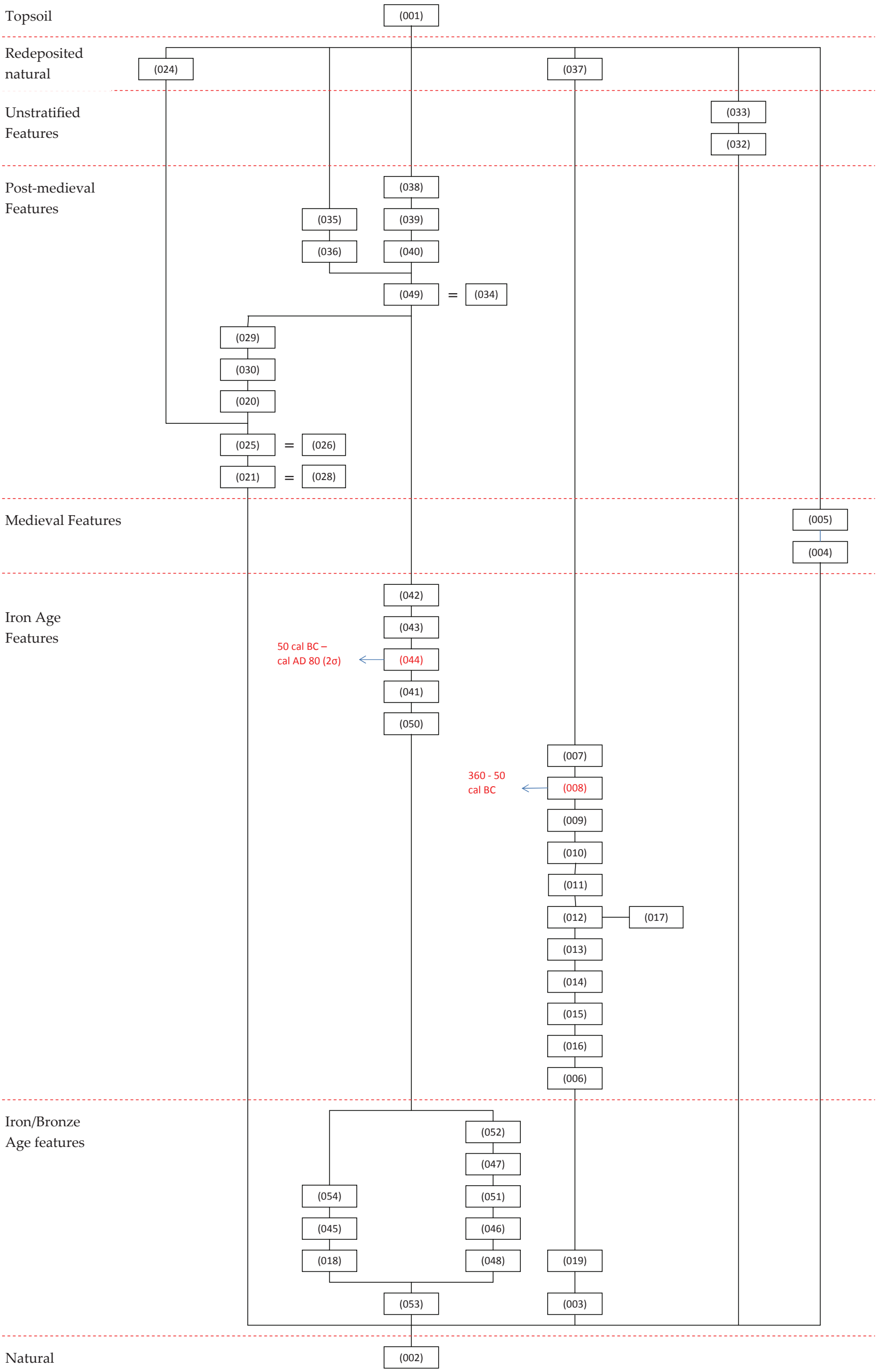
Appendix 4 – Photo Register for Site E2876

Photo Number	Direction facing	Description
E2876:001	North	Pre-excavation of possible slag pit furnace (004)
E2876:002	North	Pre-excavation of possible slag pit furnace (004)
E2876:003	North	Pre-excavation of shallow pit (003)
E2876:004	North	Pre-excavation of shallow pit (003)
E2876:005	South	Pre-excavation of shallow pit (003) and pit (006)
E2876:006	South	Pre-excavation of shallow pit (003) and pit (006)
E2876:007	Northeast	Mid-excavation of possible slag pit furnace (004)
E2876:008	North	Mid-excavation of pottery in situ in shallow pit (003)
E2876:009	North	Mid-excavation of pottery in situ in shallow pit (003)
E2876:010	North	Mid-excavation of pottery in situ in shallow pit (003)
E2876:011	North	Mid-excavation of pottery in situ in shallow pit (003)
E2876:012	North	Mid-excavation of pottery in situ in shallow pit (003)
E2876:013	North	Mid-excavation of pottery in situ in shallow pit (003)
E2876:014	North	Mid-excavation of pit (006)
E2876:015	North	Mid-excavation of pit (006)
E2876:016	North	Mid-excavation of pit (006)
E2876:017	North	Mid-excavation of pit (006)
E2876:018	North	Mid-excavation of pit (006)
E2876:019	North	Mid-excavation of pit (006)
E2876:020	North	Mid-excavation of pit (006)
E2876:021	Northeast	Mid-excavation of pit (006)
E2876:022	Northeast	Mid-excavation of shallow pit (003)
E2876:023	North	Mid-excavation of shallow pit (003)
E2876:024	Northwest	Post-excavation of possible slag pit furnace (004)
E2876:025	Northwest	Mid-excavation section of ditches (020) and (021), Slot 1
E2876:026	Northwest	Mid-excavation section of ditches (020) and (021), Slot 3
E2876:027	Northeast	Mid-excavation section of ditches (020) and (021), Slot 3
E2876:028	Southeast	Mid-excavation section of ditches (020) and (021), Slot 1
E2876:029	Northwest	Mid-excavation section of ditches (020) and (021), Slot 2
E2876:030	Northeast	Mid-excavation section of ditches (020) and (021), Slot 2
E2876:031	Southwest	Post-excavation of pit (006)
E2876:032	Southwest	Post-excavation of pit (006)
E2876:033	Southwest	Post-excavation of pit (006)
E2876:034	North	Post-excavation of pit (006)
E2876:035	North	Post-excavation of pit (006)
E2876:036	Southwest	Pre-excavation of posthole (032)
E2876:037	Southwest	Mid-excavation of posthole (032)
E2876:038	Southeast	Post-excavation of pit (006) and ditches (034), (020) and (021)
E2876:039	South	Post-excavation of pit (006) and ditch (034)
E2876:040	South	Post-excavation of pit (006) and ditches (034), (020) and (021)
E2876:041	Southeast	Mid-excavation of ditches (020) and (021)
E2876:042	South	Mid-excavation of animal burial in pit (050)
E2876:043	Southwest	Mid-excavation of animal burial in pit (050)
E2876:044	Northeast	Mid-excavation of animal burial in pit (050)
E2876:045	Southeast	Mid-excavation of animal burial in pit (050)

Appendix 5 – Drawing Register for Site E2876

Drawing No.	Sheet no.	Type	Scale	Description
E2876:001	1	Plan	1:50	Pre-excavation plan of site E2876
E2876:002	2	Section	1:10	Mid-excavation section of (003) and (006)
E2876:003	3	Section	1:10	Mid-excavation section of (020) and (021)
E2876:004	4	Section	1:10	Mid-excavation section of (020) and (021), slot 2
E2876:005	4	Section	1:10	Mid-excavation section of (020) and (021), slot 3
E2876:006	5	Section	1:10	Mid-excavation section of ditch (034)
E2876:007	4	Section	1:10	Mid-excavation section of pit (050), (053) and (049)
E2876:008	6	Plan	1:10	Pre-excavation plan of site E2876
E2876:009	7	Plan	1:10	Pre-excavation plan of site E2876
E2876:010	8	Plan	1:10	Pre-excavation plan of site E2876
E2876:011	9	Plan	1:50	Post-excavation plan of site E2876

Appendix 6 - Site Matrix for Site E2876



Appendix 7 – Palaeoenvironmental samples report for Ballymount, Co. Kildare, E2876
By: Karen Stewart

Introduction

Eighteen samples were taken during excavation of Site E2876 at Ballymount, Co. Kildare, a site comprising features including four pits (003), (006), (053) and (050), a pit furnace (004), a posthole (032) and three ditches (020), (021) and (034), divided into five phases of activity. All of these samples were processed in order to recover any artefactual or palaeoenvironmental material that may aid in the interpretation of the site.

Methodology

Samples
Samples of approximately 10 L were taken on site under the direction of an environmental archaeologist. Samples were processed in laboratory conditions using a standard flotation method (cf. Kenward *et al*, 1980). This was then sorted by eye and any material of archaeological significance removed. All plant macrofossil samples were analysed using a stereomicroscope at magnifications of x10 and up to x100 where necessary to aid identification. Identifications were confirmed using modern reference material and seed atlases including Cappers *et al* (2006).

Charcoal identification
The charcoal was broken or fractured in order to view the three sectional surfaces [transverse (TS), tangential (TLS) and radial (RLS)] necessary for microscopic wood identification. Each piece was initially viewed under a binocular microscope at a magnification of 10 - 40x in order to count the number of tree-rings present. The charcoal fragments were examined using an incident light microscope at magnifications of 100x, 200x and 400x, where applicable. Identifications were made using the wood key by Schweingruber (1978), IAWA (1989) and Schoch *et al* (2004).

Results

The results are summarised below in Tables 2 (Composition of flots) and 3 (Composition of retents). All plant material was preserved by charring. Samples 015 and 020 were found not to contain any material of archaeological significance and have thus been recorded as 'archaeologically sterile'.

Wood charcoal
Wood charcoal was recovered from every sample not found to be archaeologically sterile. In samples 002 and 003 the charcoal was most abundant, and was also noted to be well preserved, with little abrasion of the fragments. Sample 2 was taken from the fill (005) of a pit (004). Sample 3 was retrieved from the fill (019) of a pit (003). In the remaining samples, the charcoal was noted to be both fragmented and abraded.

Fifty fragments from the flot and 50 from the retent of Sample 002 were identified to species. All were found to be oak (*Quercus* sp.).

Other material
Charred hazelnut (*Corylus avellana*) shell was recovered from Sample (009) in low concentrations.

Bone, both burnt and unburnt, was recovered from a number of samples. This is discussed in Appendix 8, the Faunal Remains Report.

Lithics were recovered from Sample 25 which was taken from the fill (054) of a pit (053) and these are discussed in Appendix 14, the Lithics Report.

Pottery was recovered from Sample (007) from the fill (010) of a pit (006) and this is discussed in Appendix 11, the Prehistoric Pottery Report.

Results of radiocarbon dating
Radiocarbon dates were retrieved from two samples. The earliest was retrieved from Sample 22, cow bone from fill (044) of pit (050) and was dated to 50 cal BC - cal AD 80 (2σ) (SUERC – 25294). The second was retrieved from sample 16, human bone from fill (008) of pit (006) and was dated to 360 - 50 cal BC (2σ) (SUERC-26402).

Radiocarbon dating was undertaken by Gordon Cooke at Scottish Universities Environmental Research Centre (SUERC), after Reimer *et al* (2004). Calibrated age ranges were calculated using radiocarbon calibration program CALIB REV5.0.2. The results are presented in Table 1.

Discussion

Phase I
The earliest phase on site was represented by three pits (053), (051) and (003). The paleoenvironmental material recovered from this phase, included only small and very fragmented and abraded amounts of charcoal.

Phase II
This phase of activity on site is represented by a two of pit features (050) and (006).

The paleoenvironmental material recovered from feature (050) derives from fill (044) and consisted of very abraded and fragmented charcoal together. The eleven fills (017), (016), (015), (014), (013), (012), (011), (010), (009), (008) and (007) of pit feature (006) also included small amount of charcoal and one fragment of hazelnut shell from fill (012).

A bone from a cow skeleton within fill (044) of pit (050), was radiocarbon dated to 50 cal BC – cal AD 80 (2σ) (SUERC – 25294), placing the activity in the Iron Age. Among the unburnt bone recovered within feature (006), a fragment of a possibly trepanned human skull was identified. A sample of this was submitted for AMS dating and returned a date of 360 – 290 cal BC (SUERC – 26402), also suggesting an Iron Age date for this activity.

Phase III
A possible slag pit furnace (004) constitutes this phase of activity on the site, which based on metallurgical waste debris evidence has been interpreted as medieval in date.

The fill (005) of furnace pit (004) contained frequent fragments of charcoal. In order to ascertain the fuel composition of the wood species utilised, 50 fragments of charcoal were randomly selected, all of which proved to be oak.

Phase IV

The fourth established phase of activity on site referred to a number of post-medieval agricultural features. Three ditches (021), (020) and (034), two of which formed part of a field boundary recorded on the First and Second Edition OS map of the area. No samples were assessed from this phase of activity.

Undated features

A single isolated posthole (032) was unstratified and could not be related to any defined phase of activity at the site; no diagnostic materials were retrieved.

The differences between the phases are visible in the environmental material recovered. The charcoal from Sample 002 from fill (005) of furnace (004) and Sample 003 from fill (019) of pit (003) were much less abraded than that from other samples. It may be the case that this charcoal represents primary deposition while that taken from other features may have been exposed or transported before deposition.

Prehistoric phase

Hazel nuts were an important part of the prehistoric diet, and occur frequently on prehistoric sites (McComb and Simpson 1999), and those preserved by charring likely represent a small fraction of what might have been consumed on the site (*ibid*.). While they could certainly have been eaten raw, and the shells discarded into a fire where they became charred, it is also possible that they came into contact with fire during processing of some kind, such as roasting, which would preserve the nuts for a longer period. Storage of such a staple resource would have been an important concern.

Medieval phase

Unfortunately identification to specific species is not possible for oak based on microscopic anatomical features. The oak charcoal present within slag pit furnace (004) may thus represent either one of Ireland's two native oak species - pedunculate oak (*Quercus robur)* and the sessile oak (*Quercus petraea*). Pedunculate (or common) oak tends to moist humus rich soils while sessile oak tends to lighter free draining soils, and most commonly grows on higher ground. As all of the charcoal present was identified as oak, it is possible that it all derives from a single tree, and that a tree may thus have been felled specifically for the purpose of fuelling the furnace (004). Oak produces high temperatures for a prolonged period when burned.

The metallurgical waste material recovered from pit (004) has been identified as residues from iron smelting (see Appendix 13). This process requires temperatures of 1100 – 1200°C (*ibid)*, and so oak is an ideal fuel to use for this process, though as oak can be difficult to initially combust, kindling may have been required, though no evidence of this was found in the samples.

Conclusion

Four distinct phases of activity are present on the site and palaeoenvironmental evidence was recovered from features in all four phases, two of which, Phase II and Phase III, have been further differentiated by the environmental evidence recovered from the sampling programme at the site. No further work is to be undertaken on this material as no conclusive interpretation of the features or their use can be made through further analysis, given the limited character of the assemblage.

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E-Number	SUERC-Number	Sample ID	Material	δ13C	Radiocarbon age BP	Calibrated Age Ranges (1σ)	Relative probability	Calibrated Age Ranges (2σ)	Relative probability
E2876	SUERC-26402	sample#16, context 008	Human bone	-21.5	2135 +/- 35	350-320 cal BC	8.0	360-290 cal BC	17.4
						210-100 cal BC	60.2	230-50 cal BC	78.0
E2876	SUERC - 25294	bone sample #022, context 044	cow bone	-21.6	1980 +/- 30	40-30 cal BC	3.7	50 cal BC-cal AD 80	95.4
						20-10 cal BC	5.6		
						5 cal BC-cal AD 60	58.9		

Table 1 – Results of radiocarbon dating

Context number	Sample number	Total flot vol. (ml)	Charcoal			Comments
			Quantity	Max size (cm^3)	AMS	
005	002	100	++++	2	*	Fragmented but not abraded charcoal; 50 frags analysed – all oak
019	003	25	++++	1	*	Fragmented but not abraded charcoal
007	004	10	+	0.3		
008	005	10	+++	0.6	*	
009	006	15	+	0.2		
010	007	5	+	0.1		
011	008	2	+	0.2		
012	009	10	+	0.2		
013	010	5				Archaeologically sterile
014	011	5				Archaeologically sterile
017	012	2				Archaeologically sterile
016	013	2				Archaeologically sterile
019	014	15	+	0.1		
018	015	10				Archaeologically sterile
023	019	2	+	0.1		
037	020	2				Archaeologically sterile
044	021	4				Archaeologically sterile
054	025	20	+	0.2		

Table 2 – Composition of flots
Key: + = rare, ++ = occasional, +++ = common and ++++ = abundant
* = sufficient sized charcoal for identification and AMS dating

Context number	Sample number	Retent vol (L)	Context/ Sample description	Wood charcoal		Mammal Bone		Nutshell	Worked stone	Ceramics	Industrial	Other	Comments
				Qty	AMS	Burnt	Unburnt						
005	002	2	Fill of pit (004)	+++	*						++++ Slag	+ Burnt clay	50 fragments analysed – all oak
019	003	0.1	Fill of pit (003)	+++	*	+							fragmented but not abraded charcoal
007	004	0.2	Upper fill of pit (006)	++		+	++				+ Slag		
008	005	0.1	Fill of pit (006)	+		+	+						
009	006	0.2	Fill of pit (006)	+		+							
010	007	0.3	Fill of pit (006)	+		+				+			
011	008	0.1	Fill of pit (006)	+		+							
012	009	0.1	Fill of pit (006)	++		+		+					
013	010	0.1	Fill of pit (006)	+									
014	011	0.1	Fill of pit (006)										Archaeologically sterile
017	012	0.15	Fill of pit (006)	++									
016	013	0.1	Fill of pit (006)	+		+							
019	014	0.1	Fill of pit (003)	+			+						
018	015	0.1	Fill of pit (053)										Archaeologically sterile
023	019	0.1	Fill of pit/tree bowl (022)	+									
037	020	0.3	Natural										Archaeologically sterile
044	021	0.3	Fill of pit (050)	++	*	++	++						Very abraded charcoal
054	025	1	Fill of pit (053)	+		+			+ Flint				

Table 3 – Composition of retents

Key: + = rare, ++ = occasional, +++ = common and ++++ = abundant

* = sufficient sized charcoal for identification and AMS dating

Appendix 8 – Final report on the faunal remains from Ballymount (E2876), Co. Kildare
By: Auli Tourunen PhD and Albína Hulda Pálsdóttir MA

Introduction

This report discusses the results of the animal bone analysis from Ballymount, Co. Kildare (E2876). The resolution of the site revealed remains of three pits, a possible slag pit furnace, a posthole and three ditches. The animal bone specimens were recovered by hand-picking and from soil samples by sieving. The animal bones analysed for this report derive from fills (007, 008, 009, 010, 011, 012, 013, 016) of pit (006); fill (019) of pit (003); fill (044) of pit (050); fill (054) of pit (053) and from fill (040) of linear (049).

Methodology

During the analysis each specimen was identified and recorded according to species, skeletal element, age and sex where possible. The animal bone reference collection located in Headland Archaeology (Ireland) Ltd, Unit 1 Wallingstown Business Park, Little Island, Co. Cork was utilised. The York System bone database program was used for recording (Harland *et al.* 2003). The material was quantified by using the number of identified specimens (NISP) and minimum number of individuals (MNI) where appropriate. Distinctions made between sheep and goat follow Boessneck (1969) and Prummel & Frisch (1986). The categories "large mammal" (lm) and "medium mammal" (mm) were used for specimens (mainly ribs and vertebrae) which could not be assigned to a species. The specimens categorised as large mammal are likely to belong to either cattle or horse; red deer was absent in the assemblage. Medium mammal specimens are most likely to consist of sheep, goat and pig bones.

Tooth eruption and wear were recorded according to Grant (1982). Mandibles were further divided into age groups presented by O'Connor (2003, 160). For ages of tooth eruption and epiphyseal fusion, Silver's (1969) figures were followed. Measurements were taken following von den Driesch (1976). In addition, during the analysis pathological changes, carnivore and rodent gnawing, signs of burning and butchery marks were recorded. All data is stored in digital and written form in Headland Archaeology (Ireland) Ltd, Unit 1 Wallingstown Business Park, Little Island, Co. Cork.

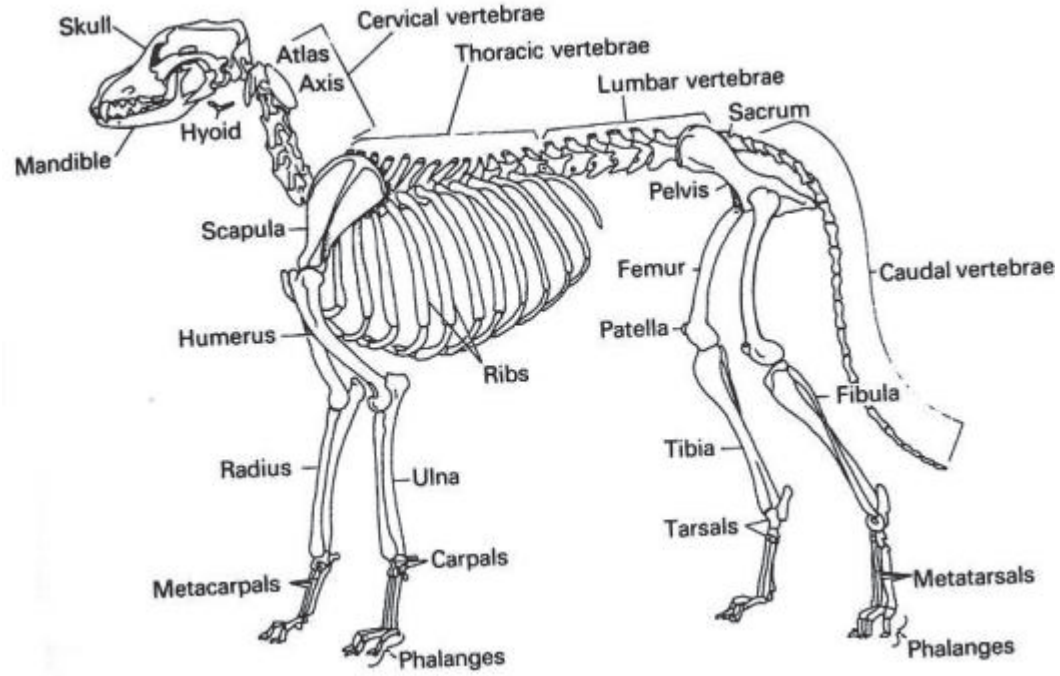

Figure 1 – Location on animal skeleton of terms referred to in text (Davis 1987, 54, in Reitz & Wing 1999)

Results

A total of 1,507 bone specimens were analysed from the site (Table 1). The material derives from five different features and three phases.

Phase	*Feature*	*Context*	*Cattle*	*Sheep*	*Goat*	*Sh/g*	*Pig*	*Horse*	*Lm*	*Mm*	*Unid*	***Total***
Iron/Bronze Age	003	019									7	7
Iron Age	006	007									51	51
Iron Age	006	008	24	4	1	10	1	1	28	22	321	412
Iron Age	006	009									6	6
Iron Age	006	010									13	13
Iron Age	006	011	49	11		3		2	18	1	123	207
Iron Age	006	012									36	36
Iron Age	006	013	17				1		9		63	90
Iron Age	006	016									4	4
Iron Age	050	044	9 (*245)*						3		169	426
Iron Age	053	054									33	33
Medieval/Post-medieval	049	040	1						1		220	222
		Total	100 *(245)*	15	1	13	2	3	59	23	1046	**1507**

Table 1 – Species representation of sample (NISP). Sh/g = sheep or goat, lm = large mammal, mm = medium mammal, unid = unidentified. Articulating cattle skeleton in italics

Most of the disarticulated material derives from fills (007, 008, 009, 010, 011, 012, 013, 016) of pit (006). Cattle, sheep, goat, pig and horse are represented in the sample. Fills (008), (011) and (013) include bones from at least three calves (MNI 3) between 3 weeks and 5 months of age. Even when excluding

calf bones, the bone material from pit (006) is dominated by cattle and proved to include remains from all stages of the processing of cattle carcasses (Table 2).

Element	*Cattle*	*Sheep*	*Sh/g*	*Goat*	*Pig*	*Horse*	*Lm*	*Mm*	*Unid*	***Total***
Horn core	4			1						5
Skull	2								19	21
Mandible	1		2							3
Hyoid	1									1
Axis	1									1
Thoracic vertebra							4			4
Lumbar vertebra							5			5
Sacrum	2									2
Vertebra							1	1		2
Rib							26	10	1	37
Scapula	4						2			6
Humerus	2		1		1					4
Radius			2					1		3
Radius/ulna	2									2
Carpals	1									1
Metacarpal	1	2								3
Pelvis	1		1				3			5
Femur	2					1				3
Patella	1									1
Tibia	7		2				1			10
Malleolus	1									1
Astragalus	3									3
Calcaneus			1							1
Metatarsal	1	1								2
Metapodial		1	1							2
Phalanx1	2	4	2							8
Phalanx2	7	5								12
Phalanx3	1	2								3
Teeth	14		1		1	2			17	35
Shaft							5	11	1	17
Unidentified									579	579
Total	61	15	13	1	2	3	47	23	617	**782**

Table 2 – Anatomical representation of material from pit (006) excluding calf bones (NISP). Sh/g = sheep/goat, Lm = large mammal, mm = medium mammal, unid = unidentified

Several measurements were taken from the bones to examine the size of the animals (Table 3). Only one cattle radius was available for withers heights reconstruction and gained the result of 114 cm (method by Matolcsi 1970).

Element	*Context*	*Sample*	*GL*	*Bd*	*GLl*	*GLm*
Astragalus	011	017		39.4	62.4	56.7
Astragalus	011	017		38.9	62.1	56.3
Tibia	011	017		55.9		
Radius/ulna	013	018	265			
Tibia	013	018		53.7		

Table 3 – Measurements. GL= greatest length, Bd = distal breadth, GLl = greatest lateral length, GLm = greatest medial length

Several cattle and large mammal bones exhibited cut marks (Table 4). Most of the cut marks have resulted from cutting up the carcass into smaller pieces for consumption or from filleting (vertebrates, ribs and long bones). Knife marks in astragalus indicate skinning. Several cattle bones (long bones, skull, a large mammal rib) and a horse femur showed charring or signs of damage by heating, possibly indicating roasting. The horse femur also exhibited a spiral fracture which indicates that the bone was broken while still fresh.

In addition, the bone sample included some signs of primary deposition. The fills (016) and (017) included several epiphysis with the adjoining metaphysis as well as several bones likely articulating (e.g. lower leg bones of sheep). Thus, these bones were likely to be deposited in the layers before the soft tissue connecting them was rotten. This indicates primary deposition of the bone material.

Context	*Species*	*NISP*	*Element*	*Butchery*
011	Large mammal	1	Lumbar vertebra	Cut
011	Large mammal	1	Lumbar vertebra	Cut
011	Large mammal	1	Rib	>1 knife marks
011	Cattle	1	Astragalus	>1 knife marks
011	Sheep/goat	1	Humerus	Cut
013	Large mammal	1	Thoracic vertebra	Chop
013	Cattle	1	Sacrum	Cut

Table 4 – Butchery

Fill (054) of pit (053) includes unidentified animal tooth fragments and unidentified burnt bone.

Cattle skeleton A complete cattle skeleton, dating to Iron Age (50 cal BC – 80 cal AD (2σ) (SUERC – 25249)) was found from fill (044) of pit (050). Few bones could be used for sex determination; metacarpal (according to method by Mennerich 1968), and the basal circumference of horn core (Prillof 2000, 30-34; Vretemark 1997, 106; Wigh 2001, 65). Both results indicate male animal.

A total of four bones were available for withers heights reconstruction (Table 5). The withers height gained from radius and a femur were 127 and 128 cm respectively (method by Matolcsi 1970). The metacarpal, however, only gained withers heights of approximately 116 cm and metatarsal 120 cm (method by Fock 1966).

Several cattle tailbones exhibited pathological changes. A total of five vertebrates from the upper part of the tail showed signs of inflammation with deposition of extra porous bone on their body.

Element	*Context*	*Sample*	*GL*	*Bp*	*SD*	*Dd*	*Bd*	*GLl*	*GLm*	*BT*
Calcaneus	044	022	135							
Femur	044	022	397	117.0			95.0			
Humerus	044	022								79.8
Metacarpal	044	022	186	60.9	32.2	22.4	62.7			
Metatarsal	044	022	217	49.2	27.3	25.9	56.0			
Radius/ulna	044	022	295							
Astragalus	044	022					45.2	65.2	58.0	
Tibia	044	022					64.0			

Table 5 – Measurements of cattle skeleton (044). GL= greatest length, proximal Breadth, SD = smallest breadth of the shaft, Dd = smallest depth of the shaft, Bd = distal breadth, GLl = Greatest lateral length, GLm = greatest medial length, BT= greatest breadth of the trochlea

The best indicators for ageing mammal osteological material are usually obtained from the wear and eruption of mandibular teeth. The mandible derives from an elderly animal (Grant (1982) M3 wear stage l, category according to O'Connor's method, 2003). However, several epiphyses were still open (ulna proximal) or in the state of fusing (humerus and tibia proximal, most of the spine). According to Silver (1969) proximal ulna, humerus and tibia fuse before the age of 4 years. This seems very low compared with the mandibular wear and stage of fusing in vertebrates, where the fusing starts from the lumbar region and proceeds towards the cervical vertebra which fuse after 8 years of age (Habermehl 1975: 106-109). The epiphyseal fusion is usually seen as less reliable method than tooth wear. Several factors can affect the timing of the epiphyseal closure, including castration. Thus is seems possible, that the cattle skeleton derives from castrated male (ox). As castration also affects the shape of metapodials, this could explain the lower withers height results from metacarpal and metatarsal as well as the difference between the mandibular wear and epiphyseal age.

The cattle bones exhibited some cut marks (Table 6). Most of the marks relate to skinning (knife marks in calcaneus, central tarsal and skull). Atlas and cervical vertebra had chop marks indicating crude decapitation. One of the tail bones had been chopped through in order to detach the tail. Two large mammal rib bones with chop marks were recovered from this context, but it could not be verified if they belong to the cattle skeleton or not.

Species	*NISP*	*Element*	*Butchery*
Cattle	1	Atlas	Chop
Cattle	1	Calcaneus	Knife
Cattle	1	Caudal vertebra	Chop
Cattle	1	Central tarsal	>1 knife marks
Cattle	1	Cervical vertebra	Chop
Cattle	1	Skull	>1 knife marks
Large mammal	2	Rib	Chops

Table 6 – Butchery marks in cattle skeleton (044)

Iron/Bronze Age material: Bone material from fill (019) of pit (003) includes only burnt bone fragments unidentified either to human or animal.

Medieval/post-medieval material: From the medieval/post-medieval phase bone was recovered from only one context, fill (040) of linear ditch/field boundary (049). The fill contained a cattle humerus, a

badly preserved large mammal shaft fragment and unidentified bone fragments, all possibly deriving from a single humerus. None of the bones were burnt or showed signs of gnawing, pathology or butchery.

Discussion

The bone material from Ballymount, Co Kildare is too small for conclusive comparison against other assemblages. However, some general observations can be made.

Of the small number of Iron Age animal bones assemblages analyzed and published in Ireland, most derive from high-status ceremonial sites (McCormick & Murray 2007, 31). For example, in Dún Ailinne Co. Kildare cattle, pig, sheep/goat and horse bones were identified, interpreted to relate to ritual activities (Crabtree 2002).

The bone material from pit (003) included only burnt bone fragments unidentified either to human or animal. The Iron/Bronze Age date of the material and the pit fill context that the bone was found in makes both possibilities equally likely. The material from pit (006) includes both food and slaughter waste as well signs of skinning, filleting and consumption (burning). Signs of burning and spiral-formed fracture indicate that the horse femur might have been consumed. The sample also included calf bones from a least three different individuals. The calf bones may represent veal consumption, vellum production or disposal of deceased calves. The pit could also represent domestic waste. However, high proportions of calf bones have previously been found in the Iron Age ritual site of Dún Ailinne, Co. Kildare (Crabtree 2002, 64). Identifying ritual deposits is not always an easy task (*ibid*, 2002). Sometimes bones (or the animals they derive from) were a part of ritual act very different from 'normal' domestic tasks. For example, this may include depositions of selected elements like cattle skulls and mandibles (Long 2010; Tourunen and Pálsdóttir 2010c), complete animals such as dog skeletons from King's Stables (McCormick 1991, 8) or special and exotic species like Barbary ape from Navan (McCormick & Murray 2007, 32). However, sometimes the act itself (like slaughtering animals or consuming them) is not any different from its everyday counterpart: it is only the context where the act is performed that makes the difference. Therefore the animal bone assemblage always has to be analyzed and interpreted along with other evidence from the site.

The complete Iron Age cattle skeleton from pit (050) is likely to represent a mature male cattle, probably an ox. The size of the animal is within the range observed in Iron Age sample in Moone (E2980) (Tourunen and Pálsdóttir 2009). It was decapitated, skinned and its tail was also removed (perhaps during skinning), but all the remains were buried together. The animal could represent diseased or perished animal that was skinned and buried. However, especially in the context of human skull and calf bones found in the same site, the ox skeleton could represent ritual deposition of sacrificed animal (see Appendix 9).

Recent excavations in the Carlow/Kildare area have revealed a number of Iron Age sites some of which yielded faunal assemblages. A nearly complete skeleton of a large dog was found at Mullamast, Co. Kildare (E2973) in the fill of a ring-ditch. A cremated human bone dating to the Early Iron Age was found in another fill of the same ring-ditch and the dog skeleton might be connected to ritual activity (Pálsdóttir 2010b,). A large number of animal bones dating to the Late Iron Age were recovered from the fills of an enclosure ditch Moone, Co. Kildare (E2980); cattle dominates the sample, followed by pig, sheep/goat and horse. The assemblage also included, dog, red deer, wood mouse and whale bones. In addition, material included a few bones of small songbirds (Passeriformes) and (unidentified) fish bones. Some pig bones derive from very large and robust individuals, either from wild boar or very large domestic animals (Tourunen and Pálsdóttir 2010a).

Faunal remains dating to the Late Iron Age have been found at Prumplestown Lower, Co. Kildare (E2967) where a number of cattle, sheep/goat, pig and horse bones were recovered from a context that also contained cremated human bone (Tourunen and Pálsdóttir 2010b). From Mullamast, Co. Kildare (E2860) burnt cattle and sheep/goat bones were recovered from a hearth fill as well as unidentified bone coming from both the hearth and associated pits all dating to the Late Iron Age to early medieval period (Tourunen and Pálsdóttir 2009). At Hallahoise, Co. Kildare (E2948) burnt bone unidentifiable as either human or animal was recovered from a pit dated to the Late Iron Age (Pálsdóttir 2010a). From Ballybannon, Co. Carlow (E2612) a small faunal assemblage dating to the Early Iron Age was recovered from a fill of a re-cut of an enclosure ditch. Most of the identified bones derive from cattle and red deer, with dog also being represented in the sample. The cattle bones derived mainly from head and limb bones but the red deer bones in the sample consisted solely of pieces of antler (Tourunen 2009).

With the ever increasing number of Iron Age sites that have been excavated in Ireland in recent years, some of which have yielded animal bone, our view of animal exploitation and ritual activity in the time period is bound to become much more nuanced.

Due to the small size and high level of fragmentation of the assemblage from the medieval/post-medieval phase in Ballymount no conclusions can be drawn about site function during that period from the faunal material. The only identifiable specimen belonged to cattle which usually is the most common species recovered from Irish archaeological sites dating to the medieval and post-medieval period (Denham 2007, 189; Murray 2004, 565).

Context	*Sample*	*Species*	*Element*	*NISP*	*Side*	*GT50*	*Prox*	*Dist*	*Age*	*Modifications*	*Notes*	*%*	*Texture*	*Burning*	*Recovery*
007	004	unid	ui	19									2		1
007	004	unid	ui	22										cal	1
007	004	unid	ui	10										char	1
008	016	sh/g	calc	1	r	2345	u						2		hc
008	016	cow	carp	1	r						C4	90	2		hc
008	016	cow	fem	1	l	2356789AB	u	u	neo		epi-meta		2		hc
008	016	cow	fem	1	l	2678							2		hc
008	016	cow	horn	4							frags, one in 2 pieces		2		hc
008	016	goat	horn	1	l						base, male		2		hc
008	016	cow	hum	1	l	789AB	u	u	neo				2		hc
008	016	cow	hyo	1								50	2		hc
008	016	cow	isoteeth	3							3 unworn pd mand				hc
008	016	horse	isoteeth	1							unworn PM/M fragment				hc
008	016	pig	isoteeth	1							i				hc
008	016	sh/g	isoteeth	1							M mand				hc
008	016	unid	isoteeth	5											hc
008	016	sheep	m/c	1	r	12345678		u			epi-meta		2		hc
008	016	sheep	m/t	1	l	1256							2		hc
008	016	sh/g	mand	1	l	2							2		hc
008	016	lm	pel	2									2		hc
008	016	sh/g	pel	1	r	57							2		hc
008	016	sh/g	phal1	2		23	u						2		hc
008	016	cow	phal2	2		123	f						2		hc
008	016	sheep	phal2	1		123	f						2		hc
008	016	sheep	phal3	1		12							2		hc
008	016	mm1	rad	1						c			2		hc
008	016	sh/g	rad	1									2		hc
008	016	sh/g	rad	1	l	56							2		hc
008	016	lm	rib	16									2		hc
008	016	lm	rib	1							prox		2		hc
008	016	mm1	rib	8									2		hc
008	016	mm1	rib	1							prox		2		hc
008	016	unid	rib	1									2		hc
008	016	cow	scap	1	l	12345	f				in 3 pieces		2		hc
008	016	cow	scap	1	r	12	f				little bit charred		2		hc
008	016	cow	scap	1	l	25			neo				2		hc
008	016	cow	scap	1	r	3							2		hc
008	016	cow	scap	1	l	2							2		hc
008	016	lm	scap	2									2		hc
008	016	lm	sha	4					neo				2		hc
008	016	lm	sha	3									2		hc
008	016	mm1	sha	9									2		hc
008	016	mm1	sha	2									2		hc
008	016	unid	sha	1							calf femur?		2		hc

Context	*Sample*	*Species*	*Element*	*NISP*	*Side*	*GT50*	*Prox*	*Dist*	*Age*	*Modifications*	*Notes*	*%*	*Texture*	*Burning*	*Recovery*
008	016	unid	skull	9									2		hc
008	016	cow	tib	1	l	A		u	neo				2		hc
008	016	cow	tib	1	l	5689A		f					2		hc
008	016	sh/g	tib	1	l	89							2		hc
008	016	sh/g	tib	1	l	89A				c			2		hc
008	005	unid	ui	5										cal	1
008	005	unid	ui	2										char	1
008	005	unid	ui	8									2		1
008	016	unid	ui	290									2		hc
008	016	cow	ulna	2	l	E			neo		MNI 2		2		hc
008	016	cow	ulna	1	r	E			neo				2		hc
008	016	mm1	vert	1	b							10	2		hc
009	006	unid	ui	6										cal	1
010	007	unid	isoteeth	11											1
010	007	unid	ui	2										cal	1
011	017	cow	astr	1	l	1234							2		hc
011	017	cow	astr	1	r	1234							2		hc
011	017	cow	astr	1	r	12				c			2		hc
011	017	cow	ax	1	b						dens left side, in 2 pieces	30	2		hc
011	017	horse	fem	1	r	12345	f				caput charred, in 2 pieces		2		hc
011	017	cow	fem	1	r	235678	u	u	neo				2		hc
011	017	cow	hum	1	l	12B	fg				little charring on caput		2		hc
011	017	cow	hum	1	r	789AB	u		neo				2		hc
011	017	sh/g	hum	1	l	789AB	u						2		hc
011	017	cow	hum	1	l	345678		f			heat damage on distal epi		2		hc
011	017	cow	isoteeth	10							pd mand 4 (2 pd 4), M frags 4, i 2				hc
011	017	horse	isoteeth	1							PM/M frag				hc
011	017	lm	lumb	1	b		f	f			right side	30	2		hc
011	017	lm	lumb	1	b					c	in 2 pieces	10	2		hc
011	017	lm	lumb	2	b							10	2		hc
011	017	sheep	m/c	1	l	12345678		u			epi-meta		2		hc
011	017	cow	m/p	1					neo		shaft piece, shaft not fused together		2		hc
011	017	cow	m/p	1					neo				2		hc
011	017	sh/g	m/p	1				u			in 2 pieces		2		hc
011	017	sheep	m/p	1		A		u					2		hc
011	017	cow	m/t	1	l	12345678	u	u	neo		shaft fused, dist epi not fused together		2		hc
011	017	cow	mal	1	r							10	2		hc
011	017	cow	mand	1	l	13AC			neo				2		hc
011	017	cow	mand	1	l	1A			neo				2		hc
011	017	cow	mand	1	l	345			neo				2		hc
011	017	cow	mand	1	r	13AC			neo				3		hc
011	017	cow	mand	1	r	AC			neo				2		hc
011	017	cow	mand	1	r	3			neo				2		hc
011	017	cow	mand	4					neo				2		hc

Context	*Sample*	*Species*	*Element*	*NISP*	*Side*	*GT50*	*Prox*	*Dist*	*Age*	*Modifications*	*Notes*	*%*	*Texture*	*Burning*	*Recovery*
011	017	cow	mand	1	l	27							2		hc
011	017	sh/g	mand	1	r	12A							2		hc
011	017	cow	pat	1	l							90	2		hc
011	017	lm	pel	1									2		hc
011	017	cow	phal1	1		123	f						2		hc
011	017	cow	phal1	1		123	u		neo		epi-meta		2		hc
011	017	cow	phal1	1		23	u						2		hc
011	017	sheep	phal1	3		123	u				epi-meta		2		hc
011	017	sheep	phal1	1		23	u						2		hc
011	017	cow	phal2	1		123	u				epi-meta		2		hc
011	017	cow	phal2	1		23	u						2		hc
011	017	sheep	phal2	1		123	u						2		hc
011	017	sheep	phal2	3		23	u						2		hc
011	017	cow	phal3	1		12			neo				2		hc
011	017	cow	phal3	1		12							2		hc
011	017	sheep	phal3	1		12							2		hc
011	017	cow	rad/uln	1	l		f	f			radius 1,2,3,4,5,6,7,8,9,K ulna E,F,G,H,J, in 3 pieces, radius charring on prox end and heat damage on anterior shaft		2		hc
011	017	lm	rib	1					neo				2		hc
011	017	lm	rib	7							one with heat damage		2		hc
011	017	lm	rib	1									2		hc
011	017	mm1	rib	1									2		hc
011	017	mm1	rib	1									2		hc
011	017	cow	sac	1	b					c	third or fourth vert		2		hc
011	017	cow	scap	1	l	2345			neo				2		hc
011	017	cow	scap	1	l	45			neo				2		hc
011	017	cow	scap	1	r	45			neo				2		hc
011	017	lm	sha	3					neo				2		hc
011	017	lm	sha	1									2		hc
011	017	cow	tib	1	r	123456789A	f	f		c			2		hc
011	017	cow	tib	1	r	123478	f			c			2		hc
011	017	cow	tib	1	l	5		f					2		hc
011	008	unid	ui	11										cal	1
011	017	unid	ui	110									2		hc
011	017	unid	ui	2										char	hc
012	009	unid	ui	32										cal	1
012	009	unid	ui	2										char	1
012	009	unid	ui	2									2		1
013	018	cow	fem	1	r	6							2		hc
013	018	pig	hum	1	l	789A							2		hc
013	018	cow	isoteeth	1							M max				hc
013	018	unid	isoteeth	1											hc
013	018	lm	lumb	1	b							10	2		hc
013	018	cow	m/c	1	r	3478		f			some heat damage		2		hc

Context	*Sample*	*Species*	*Element*	*NISP*	*Side*	*GT50*	*Prox*	*Dist*	*Age*	*Modifications*	*Notes*	*%*	*Texture*	*Burning*	*Recovery*
013	018	cow	m/t	1	l	1256							2		hc
013	018	cow	mand	1	r	156AC			neo		in 2 pieces		2		hc
013	018	cow	pel	1	l	7							2		hc
013	018	cow	phal2	2		123	f						2		hc
013	018	cow	phal2	1		123	f			c			2		hc
013	018	cow	rad	1	r	567	u		neo				2		hc
013	018	cow	rad/uln	1	l		f	f		c	radius complete, ulna B,CD,E,F,G,H,J no epi, in 2 pieces		2		hc
013	018	lm	rib	1									2		hc
013	018	cow	sac	1	b		f			c	first epi, no ala	30	2		hc
013	018	lm	sha	1									2		hc
013	018	cow	skull	1	r						fossa mand, little bit charred		2		hc
013	018	cow	skull	1	l						piece of maxilla and premaxilla		2		hc
013	018	unid	skull	9									2		hc
013	018	unid	skull	1									2		hc
013	018	lm	thor	1	b					c		10	2		hc
013	018	lm	thor	1	b					c		10	2		hc
013	018	lm	thor	2	b								3		hc
013	018	cow	tib	1	l	12	f			c			2		hc
013	018	cow	tib	1	l	6		f					2		hc
013	018	cow	tib	1	r	56A		f		c			2		hc
013	018	lm	tib	1									2		hc
013	018	unid	ui	30									2		hc
013	018	lm	tib	1									2		hc
013	018	unid	ui	30									2		hc
013	018	unid	ui	20									2		hc
013	018	unid	ui	2										cal	hc
013	018	lm	vert	1	b							10	2		hc
016	013	unid	ui	1										char	1
016	013	unid	ui	3										cal	1
019	003	unid	isoteeth	2											1
019	014	unid	isoteeth	1											1
019	003	unid	ui	2										cal	1
019	003	unid	ui	2										char	1
040	023	cow	hum	1	l	6		f					2		hc
040	023	lm	sha	1									3		hc
040	023	unid	ui	220									3		hc
044	022	cow	astr	1	r	1234							2		hc
044	022	cow	at	1	b						in 3 pieces	50	2		hc
044	022	cow	ax	1	b			fg			in 2 pieces	70	2		hc
044	022	cow	cacc	5	l						cr, ci, cu, c4, c2+3	90	2		hc
044	022	cow	calc	1	r	12345	f						2		hc
044	022	cow	calc	1	r	12345	f						2		hc
044	022	cow	carp	5	r						cr, ci, cu, c4, c2+3	90	2		hc
044	022	cow	carp	1							Ca	90	2		hc

Context	*Sample*	*Species*	*Element*	*NISP*	*Side*	*GT50*	*Prox*	*Dist*	*Age*	*Modifications*	*Notes*	*%*	*Texture*	*Burning*	*Recovery*
044	022	cow	caud	4	b		f	f			these are from the beginning of the tail but not the first one	90	2		hc
044	022	cow	caud	1	b		f					30	2		hc
044	022	cow	caud	11	b		f	f				90	2		hc
044	022	cow	cerv	4	b		f	fg				90	2		hc
044	022	cow	cerv	1	b			fg			upper epi missing	70	2		hc
044	022	cow	fem	1	r	123456789AB	f	f					2		hc
044	022	cow	fem	1	l	123456789AB	f	f					2		hc
044	022	cow	hum	1	l	123456789AB	fg	f					2		hc
044	022	cow	hum	1	l	123456789AB	fg	f					2		hc
044	022	cow	hyo	3									2		hc
044	022	cow	isoteeth	9							these do not belong to the skeleton, 1 M mand, 1 pd mand, 7 M frag				hc
044	021	unid	isoteeth	1											1
044	022	cow	lumb	1	b		f	fg				90	2		hc
044	022	cow	lumb	1	b		fg	fg				90	2		hc
044	022	cow	lumb	1	b		fg	fg				50	2		hc
044	022	cow	lumb	17	b							10	2		hc
044	022	cow	m/c	1	r	12345678		f					2		hc
044	022	cow	m/c	1	l	12345678		f					2		hc
044	022	cow	m/p	1					neo	c			2		hc
044	022	cow	m/t	1	r	12345678		f					2		hc
044	022	cow	m/t	1	l	12345678		f					2		hc
044	022	cow	m/t	1	l	12345678		f					2		hc
044	022	cow	mal	2								90	2		hc
044	022	cow	mand	1	l	124567BCDE					in 4 pieces		2		hc
044	022	cow	mand	1	r	123456BCDE					in 4 pieces		2		hc
044	022	lm	mand	1							little bit charred		2		hc
044	022	cow	pel	1	r	123456789B					in 4 pieces		2		hc
044	022	cow	pel	1	l	123456789AB					in 4 pieces		2		hc
044	022	cow	phal1	6		123	f						2		hc
044	022	cow	phal2	6		123	f						2		hc
044	022	cow	phal3	4		12							2		hc
044	022	cow	phal3	1		1							2		hc
044	022	cow	rad/uln	1	r		f	f			radius complete, ulna B, C, D, E, F, G, H, J. in 2 pieces, Radius GL 295		2		hc
044	022	cow	rad/uln	1	l		f	f			radius complete, ulna B, C, D, F, G, H, J E missing as send to C14 dating. Ulna epi open, in 2 pieces		2		hc
044	022	cow	rib	23							prox		2		hc
044	022	cow	rib	75									2		hc
044	022	lm	rib	2							these might belong to cattle skeleton		2		hc
044	022	unid	rib	4							calf ribs?		2		hc
044	022	cow	sac	1	b		fg				in 2 pieces	70	2		hc
044	022	cow	scap	1	r	1234567	f				in 2 pieces		2		hc

Context	*Sample*	*Species*	*Element*	*NISP*	*Side*	*GT50*	*Prox*	*Dist*	*Age*	*Modifications*	*Notes*	*%*	*Texture*	*Burning*	*Recovery*
044	022	cow	scap	1	l	1234567	f				in 2 pieces		2		hc
044	022	cow	ses	8								90	2		hc
044	022	cow	skull	1	b						This is a complete cattle skeleton. Skull in pieces, horn core broken: BC 217, large oval base.		2		hc
044	022	cow	st	6	b								2		hc
044	022	cow	tar	2							T2+3	90	2		hc
044	022	cow	tcen	1	r							90	2		hc
044	022	cow	tcen	1	l							90	2		hc
044	022	cow	thor	10	b		fg	fg			corpus	50	2		hc
044	022	cow	thor	2	b		u	u			corpus	50	2		hc
044	022	cow	thor	17	b							10	2		hc
044	022	cow	tib	1	r	123456789A	fg	f					2		hc
044	022	cow	tib	1	l	123456789A	fg	f					2		hc
044	021	unid	ui	97									2		1
044	021	unid	ui	50										cal	1
044	021	unid	ui	12										char	1
044	022	unid	ui	4									2		hc
044	022	unid	ui	1										cal	hc
044	022	lm	vert	1	b				neo			10	2		hc
054	025	unid	isoteeth	7											1
054	025	unid	ui	25										cal	1
054	025	unid	ui	1										char	1

Table 7 – Complete list of animal bones

Key to complete list of animal bones:

Species
cow = cattle
lm = large mammal
mm1 = medium mammal (sheep, goat, pig)
sh/g = sheep/goat
unid = unidentified

Elements
Mammals:
astr = astragalus
at = atlas
ax = axis
cacc = accessory (pisiform) carpal
calc = calcaneum
carp = carpal
caud = caudal vertebrae
cerv = cervical vertebrae
fem = femur
horn = horncore
hum = humerus
hyo = hyoid
isoteeth = isolated teeth
lumb = lumbar vertebrae
mand = mandible
mal = malleolus
m/c = metacarpal
m/p = metapodial
m/t = metatarsal
pat = patella
pel = pelvis
phal1 = phalanx 1
phal 2= phalanx 2
phal3 = phalanx 3
rad = radius
rad/uln = radioulna
sac = sacrum
scap = scapula
ses = sesamoid
sha = shaft
st = sternum
tar = tarsal
tcen = central tarsal
thor = thoracic vertebrae
tib = tibia
ui = unidentified mammal
vert = vertebra

Side
r = right

l = left
b = both

GT50
For mammal and bird diagnostic zones, the York System (Harland et al. 2003) follows the Environmental Archaeology Unit's (EAU) recording protocol (Dobney, Jaques and Johnstone 1999) with minor re-coding.

Fusing proximal and distal
f = fused
u = unfused
fs = fusing

Age
neo = neonatal
j = juvenile

Modification
c = carnivore gnawing

Texture
1 = excellent
2 = good
3 = fair
4 = poor

Burning
cal = calcified
char = charred

Recovery
hc = hand-picked
1 = sieved with 1 mm sieve

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Appendix 9 – Final report on the human remains from Ballymount, Co. Kildare (E2876)
By: Carmelita Troy MA

Summary

This report details the results for the post-excavation treatment and analysis of human remains retrieved from Ballymount, Co. Kildare E2876. Full archaeological resolution on this site revealed remains of four pits, a possible slag pit furnace, a posthole and three ditches (Doyle and Frykler 2009). Evidence of human remains consisting of a disarticulated skull fragment, which came from fill (008) of a possible domestic pit (006).

The Iron Age (SUERC-26402, 360-50 cal BC, 2σ) adult skull (occipital) fragment was in good preservation and displayed signs of porotic hyperostosis (porosity on exterior skull caused by iron-deficiency anaemia) and a perforation that may be a result of trepanation (surgical intervention in which a hole is drilled or scraped into the human skull) or ancient post-mortem modification.

Introduction

This document is submitted as a report on the osteological analysis of human remains recovered during archaeological excavations at Ballymount, Co. Kildare (E2876), a site that revealed remains of four pits, a possible slag pit furnace, a posthole and three ditches (Doyle and Frykler 2009). The human remains consisted of a disarticulated skull fragment recovered during the analysis of the faunal remains which came from fill (008) of a possible domestic pit (006).

Methodology

The disarticulated material was assessed following protocol devised by McKinley (2004); recording all fragments for:

- Element represented
- Preservation level
- Fragmentation
- Ancient modification
- Pathology
- Demographic data
- Metrical assessment

Adult individuals are placed into one of five age categories

- Younger Adult: 18 – 25 years
- Younger Middle Adult: 25 – 35 years
- Older Middle Adult: 35 – 45 years
- Older Adult: 45+ years

Results

Elements represented

There were three occipital cranial fragments (which refit to one individual piece) (Plate 1) recovered during the faunal analysis of the animal bone from fill (008) of possible domestic pit (006).

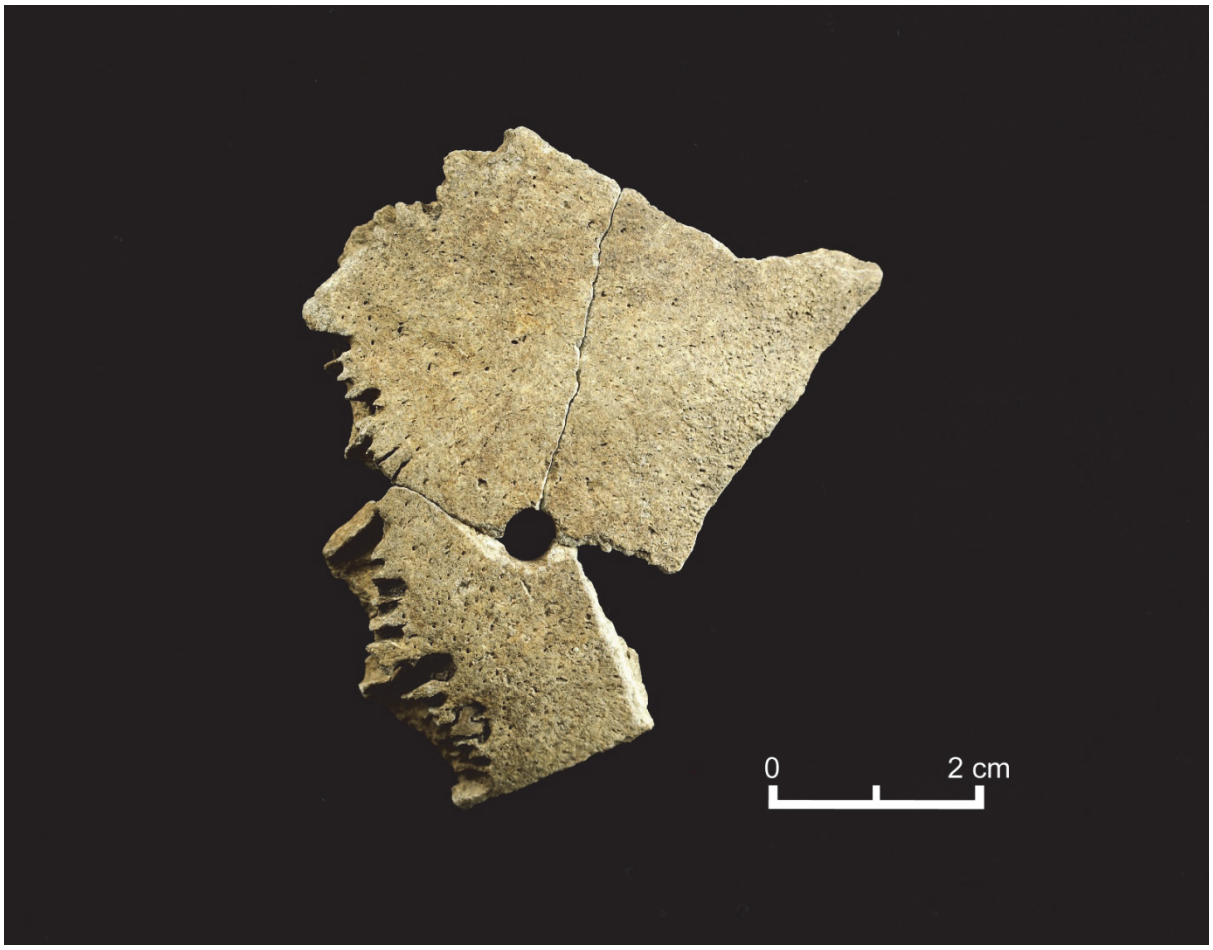

Plate 1 – Occipital fragments displaying a perforation and porotic hyperostosis

Preservation

Skeletal preservation depends upon a number of factors, including the age and sex of the individual as well as the size, shape and robusticity of the bone. Burial environment, post-depositional disturbance and treatment following excavation can also have a considerable impact on bone condition. Preservation of human remains is assessed subjectively, depending on the severity of bone surface erosion and post-mortem breaks, but disregarding completeness.

Preservation is assessed using a grading system of three categories: poor, moderate and good. Good preservation implies little or no bone erosion and very few or no post-depositional breaks. Material classed as 'moderate' maintains its general morphology and allows for a detailed level of analysis, but has suffered some erosion and fragmentation, whereas poor preservation indicates complete or almost complete loss of the bone surface due to erosion and severe fragmentation.

The preservation of the cranial fragments from Ballymount was in good condition and the bone was fragmented post-mortem.

Ancient modification

The condition of the bone, particularly from prehistoric assemblages, is often key to understanding the formation processes affecting the assemblage and, thereby, interpretation of the rituals attendant on the associated mortuary rites. The material may also reflect multi-behavioural manipulation of a complex and changing nature associated with wider social and cultural activities (McKinley 2004).

Modification of the occipital bone from Ballymount includes a possible drilled perforation measuring 5 × 5 mm (Plate 1). The absence of healing suggests that this perforation was carried out perimortem or else at a postmortem stage.

Demographic data

A count of the 'minimum number of individuals' (MNI) recovered is carried out as standard procedure during osteological assessments of inhumations in order to establish how many individuals were represented by the articulated and disarticulated human bones (without taking the archaeological defined graves into account). The MNI is calculated by counting all long bone ends, as well as other larger skeletal elements, such as the hip joints and cranial elements. The largest number of these is then taken as the MNI. The MNI is likely to be lower than the actual number of skeletons, which would have been interred on the site, but represents the minimum number of individuals, which can be scientifically proven to be present.

The occipital bone from Ballymount indicates that it is the remains of one individual with unfused sutures indicating a young/middle adult (18-34 years).

Pathology

Palaeopathology is the study of diseases of past peoples and can be used to infer the health status of groups of individuals within a population as well as indicate the overall success of the adaptation of a population to its surrounding environment. Pathologies are categorised according to their aetiologies, e.g. congenital, metabolic, infectious, traumatic, neoplastic, joint disease and dental. Any pathological modifications to the bone and teeth are described. The size and location of any lesion is also noted.

The analysis of skeletal manifestations of disease can provide a vital insight into the health and diet of past populations, as well as their living conditions and occupations.

Metabolic disorders – iron-deficiency anaemia: Certain porotic lesions of the eye orbits and skull vault are readily identifiable as specific pathological lesions due to the process of their formation. The cranial pathological processes – referred to as porotic hyperostosis – and the orbital lesions – referred to as cribra orbitalia – are taken to be indicative of a metabolic disorder relating to an iron-deficiency. This condition occurs when, as a result of a deficiency in iron, the body's marrow attempts to increase its output of iron (Mays 1998). The middle layer of bone expands and there is corresponding thinning of the outer surface of the bone. This can result in the somewhat diagnostic appearance of small holes or foramina on the outer surface of the bone (Plate 1). Although it is frequently assumed that these lesions are indicative of iron deficiency anaemia, recent studies suggest that when the body is under stress from an invading organism, the system increases its output of iron in order to counteract stress. Thus this pathological process may actually be a sign of a healthy defense system (Stuart-Macadam 1991; Roberts and Manchester 1995).

In this case, discernable porosity was displayed on the occipital fragments along the suture's border i.e. porotic hyperostosis (porosity on exterior skull caused by iron-deficiency anaemia) (Plate 1).

Dating

A 1 g sample of bone was submitted to SUERC, Scotland for radiocarbon dating. The results (Table 1) indicate that the human remains at Ballymount dates to the Iron Age.

Lab Code	Context ID	Material	δ13C	Radiocarbon age BP	Calibrated Age Ranges (95.4%)	Relative probability
SUERC-26402	c.008 s.016	Human bone	-21.5	2135 +/- 35	360-290 cal. BC 230-50 cal. BC	17.4% 78.0%

Table 1 – Radiocarbon dates

Discussion

The Iron Age, adult occipital bone was the only human bone recovered from Ballymount but it was in a disarticulated state located in a possible domestic pit with a large amount of animal bone, including cattle, sheep, goat, pig and horse (see Appendix 8). No burial pit was recovered during the excavation of Ballymount (E2876) and the nearest site on this road scheme containing human remains is at Ballymount, Co. Kildare (E2873), located *c*. 600 m southwest of this site, which contained an Early Bronze Age (1940-1750 cal. BC (2σ) (SUERC-24992)) single crouched inhumation (McCarthy 2009).

The presence of porotic hyperostosis on the cranial vault may suggest that this was caused by anaemia, specifically iron-deficiency anaemia. However, palaeopathological investigations have established that such morphological changes could also have been caused by various diseases (inflammatory, hemorrhagic, tumorous processes, dietary disorders and genetic causes) (Ortner 2003). Therefore, it is impossible to determine the exact cause of the porotic external surface of the skull vault.

Also on the Ballymount cranial bone, a perforation was noted without any evidence of healing. Merbs (1989) provides a comprehensive overview of the possible aetiologies for cranial perforations, which includes weapon wounds, genuine and practice surgery and various taphonomic processes. It can, however, be extremely difficult to interpret the cause of a particular cranial perforation and unhealed trepanations, for example, may be confused with other phenomena.

Weapons producing piercing injuries such as a cranial perforation would include daggers, spears, javelins and arrows; also included would be sling pellets if small enough and driven with enough velocity to pierce the skull (Merbs 1989). Cranial perforations can also be produced by taphonomic processes such as rock abrasion or the action of acid in the grave or by the activities of organisms; however, they are more likely to resemble lesions as opposed to the straight-sided perforation in the Ballymount example.

The perforation may have been drilled at a perimortem stage as there was no evidence of healing which may be evidence of an antiquated surgery in relation to cranial trepanation, which is a medical intervention in which a hole is cut or scraped into the human skull, in order to treat health problems related to intracranial diseases. Although there have been reports of trepanations from prehistoric contexts in Ireland, according to Ó Donnabháin (2003) all of the confirmed cases date to the historic period. The methods utilised included scraped, gouged (alternatively referred to as push-plough), drilled, sawn, or bored and sawn (Roberts and McKinley 2003). The cranial perforation from Ballymount measured 5 × 5 mm. Small trepanation holes such as this, ranging in maximum diameter from 5 to 14 mm have been reported by Sankhyan and Weber (2001). Also the St. Michael le Pole trepanation in Dublin measured 5 mm wide (Ó Donnabháin 2003). This trepanned bone came from a disturbed context which dates from either the early or later medieval periods. Trepanations have been

reported on all of the bones of the skull, the most common location is the anterior portion of the left parietal (Ó Donnabháin 2003). The Ballymount perforation was located on the superior lateral aspect of the cruciate eminence (the internal surface of the occipital bone is deeply concave and divided into four fossae by a cruciform eminence) of the right occipital bone, 13 mm from the lambdoid suture (joint on the posterior aspect of the skull that connects the parietal (skull) bones with the occipital bone).

Seeing as there was no healing evident on the Ballymount skull, it is also possible that the perforation was carried out after death, possibly for ritual or trophy purposes. The hole may have been cut to secure a roundel of bone for a talisman. Holes found cut into a cranium could also have served merely to hang it from something. Trophy skulls often exhibit defleshing cutmarks, drilled perforations, grinding and polishing (Quigley 2001, 156). Traditionally, trophy skulls may have been the bones of a relative preserved through devotion or custom, the remains of a slain enemy retained through pride or revenge, the remains of an individual with desirable qualities or spiritual power the owner hoped to possess, or bones used for magical purposes (Nawrocki 1997).

Conclusions

The Iron Age skull fragment from Ballymount (E2876) may be one of the few reported examples of trepanned skulls from prehistoric Ireland, however as it cannot be ruled out that the bone was modified post-mortem, it is impossible to establish this as a confirmed case of trepanation. As the cranial bone did not exhibit any incisions marks from the cutting of the scalp it is less likely to be an example of trepanation and more likely to be a post-mortem modification.

There is no evidence that the adult occipital fragments displaying porotic hyperostosis and a perforation, were ritually deposited within the domestic pit (006). However whenever human remains are associated with a context, ritual practices is always a possibility. There is a tradition stretching back to the Neolithic of the unburnt human skull being treated and deposited in special ways and purposes (Cooney and Grogan 1999, 147). Human skulls are a potent symbol of fertility in antiquity, embracing secondary aspects of agriculture, sex and death (Wilson 1999). It is thought that the skull was viewed as carrying the essence of an individual and may therefore have warranted special treatment or care after death (Cleary 2005)

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Radiocarbon dates

Lab Code	Context ID	Material	δ13C	Radiocarbon Age BP	Calibrated Age Ranges (1δ)	Relative probability	Calibrated Age Ranges (2δ)	Relative probability	Period
SUERC-26402	c.008 s.016	Human bone	-21.5	2135 +/- 35	350-320 cal. BC 210-100 cal. BC	22.9% 45.3%	360-290 cal. BC 230-50 cal. BC	17.4% 78.0%	Iron Age

Appendix 10 – Radiocarbon dates and certificates

E-Number	SUERC-Number	Lab code	Sample ID	Material	δ13C	Radiocarbon age BP	Calibrated Age Ranges (1σ)	Relative probability	Calibrated Age Ranges (2σ)	Relative probability
E2876	SUERC-26402	GU-19942	sample#16, context 008	Human bone	-21.5	2135 +/- 35	350 - 320 cal BC	8.0	360 - 290 cal BC	17.4
							210 - 100 cal BC	60.2	230 - 50 cal BC	78.0
E2876	SUERC - 25294	GU-19282	bone sample #022, context 044	cow bone	-21.6	1980 +/- 30	40 - 30 cal BC	3.7	50 cal BC - cal AD 80	95.4
							20 - 10 cal BC	5.6		
							5 cal BC – 60 cal AD	58.9		

Scottish Universities Environmental Research Centre
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RADIOCARBON DATING CERTIFICATE

18 November 2009

Laboratory Code	SUERC-26402 (GU-19942)
Submitter	Carmelita Troy Headland Archaeology (Ireland) Ltd Unit 1 Wallinstown Business Park Little Island, Co. Cork Ireland
Site Reference	Ballymount, E2876
Context Reference	008
Sample Reference	016
Material	Human bone : Human
$\delta^{13}C$ relative to VPDB	-21.5 ‰
Radiocarbon Age BP	2135 ± 35

N.B.

1. The above ^{14}C age is quoted in conventional years BP (before 1950 AD). The error, which is expressed at the one sigma level of confidence, includes components from the counting statistics on the sample, modern reference standard and blank and the random machine error.

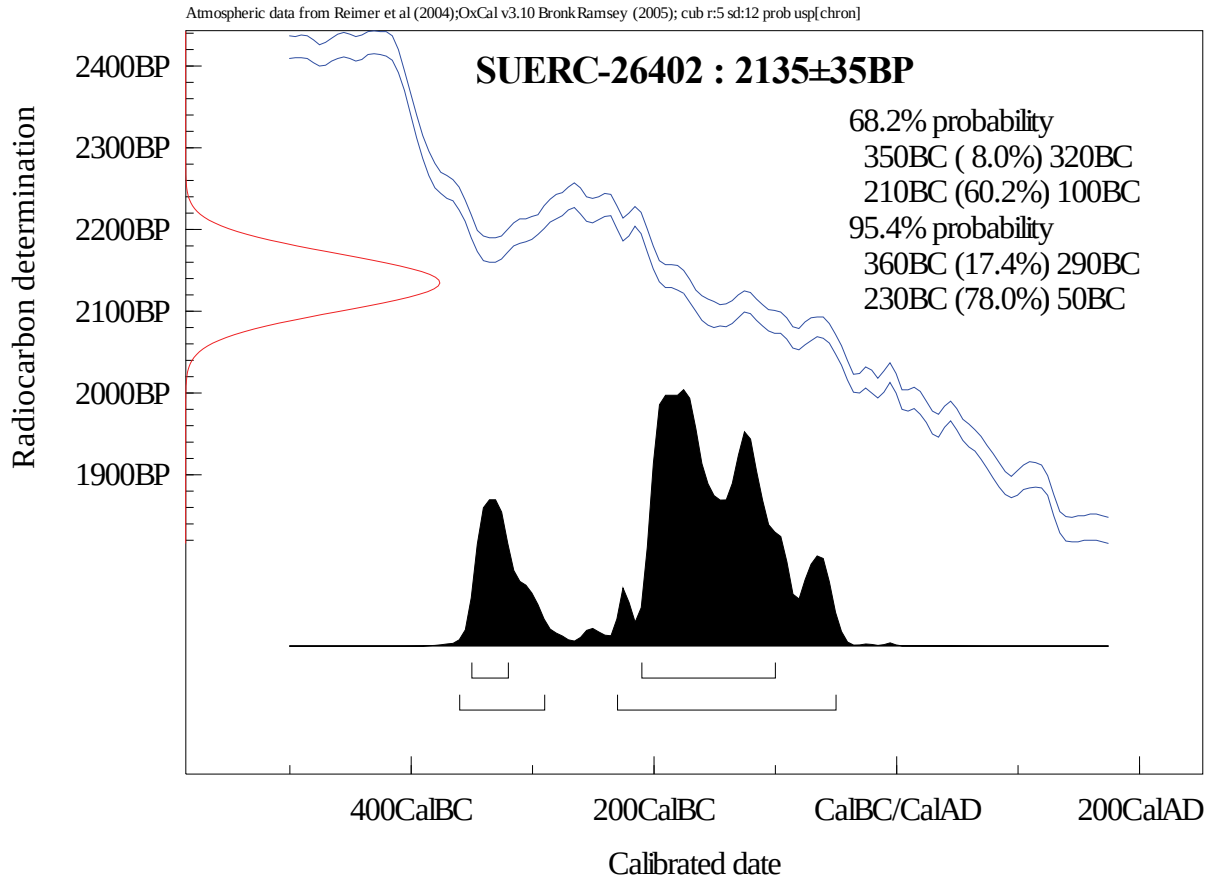
2. The calibrated age ranges are determined from the University of Oxford Radiocarbon Accelerator Unit calibration program (OxCal3).

3. Samples with a SUERC coding are measured at the Scottish Universities Environmental Research Centre AMS Facility and should be quoted as such in any reports within the scientific literature. Any questions directed to the Radiocarbon Laboratory should also quote the GU coding given in parentheses after the SUERC code. The contact details for the laboratory are email g.cook@suerc.gla.ac.uk or Telephone 01355 270136 direct line.

Conventional age and calibration age ranges calculated by :- Date :-

Checked and signed off by :- Date :-

Calibration Plot



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RADIOCARBON DATING CERTIFICATE

18 September 2009

Laboratory Code	SUERC-25294 (GU-19282)
Submitter	Karen Stewart Headland Archaeology (Ireland) Ltd. Unit 1 Wallingstown Business Park Little Island Co. Cork, Ireland.
Site Reference	KCK06 E2876
Context Reference	44
Sample Reference	22
Material	unburnt bone : cattle
$\delta^{13}C$ relative to VPDB	-21.6 ‰
Radiocarbon Age BP	1980 ± 30

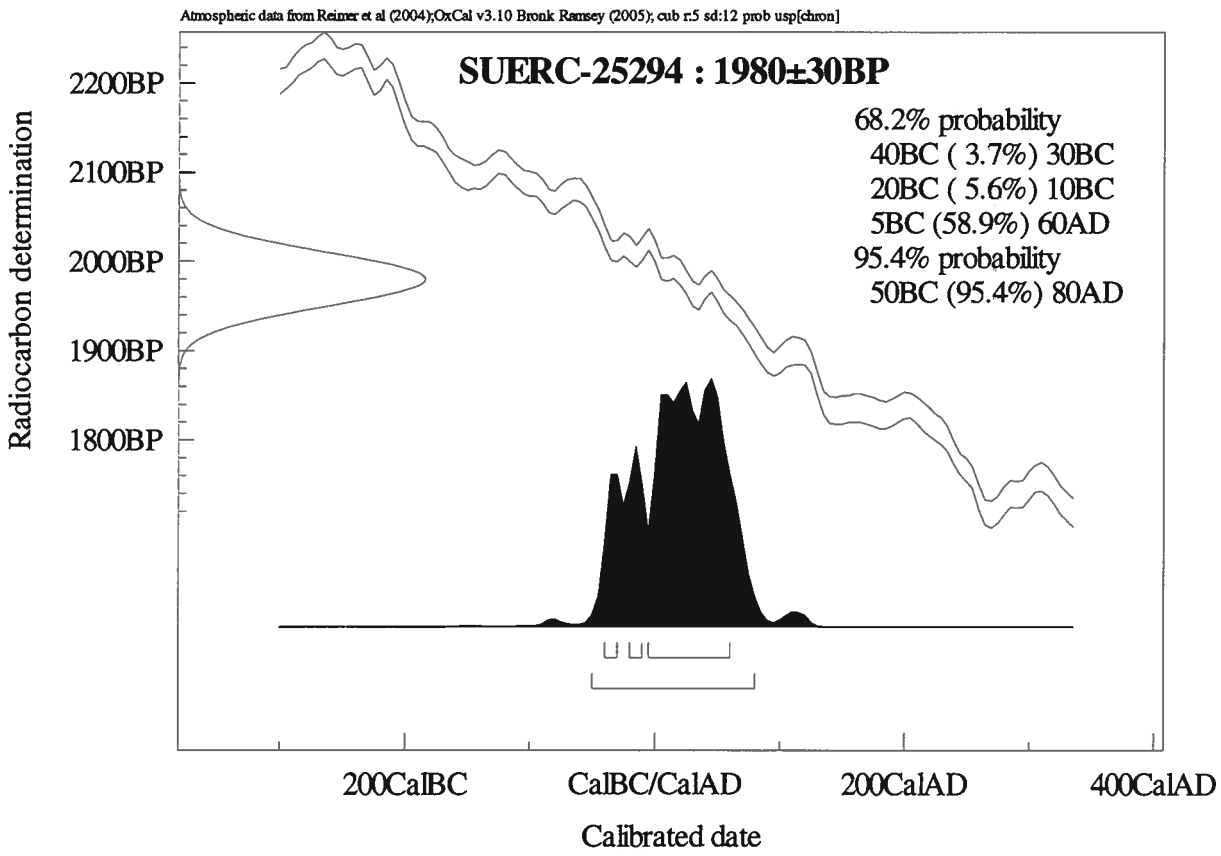
N.B.

1. The above ^{14}C age is quoted in conventional years BP (before 1950 AD). The error, which is expressed at the one sigma level of confidence, includes components from the counting statistics on the sample, modern reference standard and blank and the random machine error.
2. The calibrated age ranges are determined from the University of Oxford Radiocarbon Accelerator Unit calibration program (OxCal3).
3. Samples with a SUERC coding are measured at the Scottish Universities Environmental Research Centre AMS Facility and should be quoted as such in any reports within the scientific literature. Any questions directed to the Radiocarbon Laboratory should also quote the GU coding given in parentheses after the SUERC code. The contact details for the laboratory are email g.cook@suerc.gla.ac.uk or Telephone 01355 270136 direct line.

Conventional age and calibration age ranges calculated by :- P. Naysmith Date :- 18/9/09

Checked and signed off by :- G. Dunbar Date :- 18/9/09

Calibration Plot



Appendix 11 – The prehistoric pottery assemblage from Ballymount, Co. Kildare (E2876) By: Eoin Grogan and Helen Roche

Summary

The site at Ballymount produced three sherds (plus three fragments and seven crumbs, weight: 50.25g). These represent a single Middle to Late Bronze Age domestic vessel and unidentifiable prehistoric pottery.

Context

The pottery came from fill (044) of pit (050), fill (019) of pit (003), fill (010) of pit (006) and fill (038) of ditch (034) (Doyle and Frykler 2009).

Middle to Late Bronze Age domestic vessel

A single plain and poorly made vessel is represented by three worn bodysherds (plus 1 fragment, weight: 44 g) from the fill (044) of pit (050). Although there are no feature sherds the fabric and inclusions suggest this is a domestic vessel and probably towards the latter end of the period (*c*. 1300–1000 BC).

Despite the extensive evidence for Bronze Age activity, and especially Early Bronze Age burials, in the area later domestic pottery has not previously been recorded. Some Early to Middle Bronze Age material came from another site in Ballymount (E2873) (McCarthy 2009; Grogan and Roche 2009a) and to the south at Inchaquire (E2867) (McCarthy and Hanbidge 2009; Grogan and Roche 2009b).

Other pottery

Fragments and crumbs of pottery came from the fills (019), (010), (038) of two pits, (003) and (006), and a ditch (034). Although prehistoric no further identification is possible.

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Catalogue

The excavation number E2876 is omitted throughout: only the context number, in **bold**, followed by the find number is included (*e.g*. **44**:7). Numbers in square brackets (*e.g*. **44**:[5–6]) 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 pots. Group numbers (Roman numerals) refer to sherds of distinctive fabric from a vessel where the overall form is not identifiable principally due to the absence of sufficient feature (rim/ neck/ shoulder) sherds. Individual sherds that could not be definitely ascribed to either category are described separately; these may come from further pots that are not, however, included in the calculations of minimum and maximum numbers of vessels. The inclusions were examined using simple magnification and in some cases attribution reflects probable, rather than certain, identification. Fragments are small sherds (generally less than 10mm square) where only one surface has survived while crumbs are very small pieces (≤ 5 x 5mm) generally without surviving surfaces. The inclusions were examined using simple magnification and in some cases attribution reflects probable, rather than certain, identification.

Worn: some wear damage to surfaces and edge breaks much worn: considerable wear damage
Abraded: very considerable wear resulting in loss of surfaces
Inclusions: low content: less than 15%, medium: 15–25%, high: more than 25%
R. rimsherd N. necksherd Be. Bellysherd N/A measurement not possible D. decorated

Middle to Late Bronze Age domestic vessel

*Fill **44** of large sub-oval pit **50***
Vessel 1. This is represented by 3 worn bodysherds (**44**:[5–6], 8; 1 fragment: **44**:7) from a poorly made vessel of red-buff fabric with blackened internal surface. Both surfaces are uneven and even allowing for the wear to the fine external slurry finish the vessel would have appeared crude and functional. There is a medium to high content of dolerite, sandstone and occasional quartzite inclusions (occasionally up to 13.15 x 10.2mm). Body thickness: 9.6mm; weight: 44g.

Other prehistoric pottery

*Fill **19** of pit **3***
This produced 3 tiny crumbs (**19**:1, 3–4); weight: < 0.25g. This appears to be prehistoric.

*Upper fill **38** of ditch **34***
This produced a single fragment (**38**:1; 4 crumbs: **38**:2–5); weight: 4g. This is prehistoric pottery but is not further identifiable.

*Fill **10** of pit **6***
This produced a single fragment (**10**:1) with a medium content of dolerite inclusions; thickness: N/A; weight: 2g. This is prehistoric pottery but is not further identifiable.

Vessel No.	Context/feature	Number of sherds	Rimsherds	Necksherds	Base-	Shouldersherds	Bodysherds	Fragments	Crumbs	Inclusions	Vessel size (cm)	Weight (g)	Pottery type	Burnished/ decorated
1	44	3	0	0	0	0	3	1	0	D S Q	-	44	M-LBA domestic	-
Other	19	0	0	0	0	0	0	0	3	-	-	0.25	Prehistoric	- -
Other	38	0	0	0	0	0	0	1	4	-	-	4	Prehistoric	- -
Other	10	0	0	0	0	0	0	1	0	D	-	2	Prehistoric	- -
Total		***3***	***0***	***0***	***0***	***0***	***3***	***3***	***7***			***50.25***		

Q quartzite S sandstone sg sandgrade D dolerite Sh shale I igneous
c cordoned **b** burnished ■ decorated S small Me medium L large
Table 1 – Details of pottery including individual vessels from Ballymount, Co. Kildare E2876.

Appendix 12 – Report on a Glass Bead from Site E2876 at Ballymount Townland, Co. Kildare

By: Miriam Carroll and Annette Quinn, Tobar Archaeological Services

The Assemblage

One glass bead fragment (E2876:044:001) was recovered from the fill of a pit (050) at Ballymount, Co. Kildare. The surviving remains consist of just less than one half of the bead which has been split longitudinally. The bead may have originally been yellow or white in colour and is decorated with a series of evenly spaced blue dots. The dots are not raised which would suggest that the decoration was applied when the glass was still molten. Glass beads are relatively common in the archaeological record from the Iron Age into the early medieval period. Iron Age beads are commonly found associated with burial deposits rather than in domestic contexts including a presumed burial site at Loughney, Co. Down (Jope and Wilson 1957a after O'Kelly 1989, 280) and an Iron Age cremation deposit at Deerpark, Co. Galway (Site E2438, Headland Archaeology (Ireland) Ltd). Conversely, beads dating to the early medieval period are more likely to be recovered on settlement sites such as Carraig Aille I and II, Co. Limerick (Ó Ríordáin 1949, 89-91) and Garryduff, Co. Cork (O'Kelly 1963, 68-72). A radiocarbon date of 50 cal BC – 80 cal AD had been returned for the pit fill (044) from which the bead was recovered. In this regard, and in the absence of any further dating material, the bead is likely to be Iron Age in date.

Glass bead: KCK06 E2876:044:001. *Glass*. L. 7.5 mm, W. 7.7 mm, Th. 3 mm, Wt. 0.3 g. Incomplete. Fragment of yellow/white glass bead decorated with blue dots. Possibly originally spherical, flattened at one pole. Straight-sided perforation, probably originally circular.

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Appendix 13 – Report on Ferrous Artefacts from Site E2876 at Ballymount Townland, Co. Kildare
By: Miriam Carroll and Annette Quinn, Tobar Archaeological Services

The Assemblage

Two ferrous objects (E2876:044:003 and E2876:044:004) were recovered from the excavations at site E2876, Ballymount, Co. Kildare. Both are highly corroded and incomplete and therefore have been listed under miscellaneous. The function of both items is unknown. The objects came from the fill of a pit (050).

Miscellaneous: KCK06 E2876:044:003. *Fe*. L. 15 mm, W. 12.2 mm, Th. 1.95 mm, Wt. 1.2 g. Incomplete. Highly corroded fragment of iron object. Undiagnostic.

Miscellaneous: KCK06 E2876:044:004. *Fe*. L. 56.7 mm, W. 6.3 mm, Th. 3.9 mm, Wt. 4.6 g. Incomplete. Highly corroded fragment of bar or rod. One end oval in section, opposing end possibly triangular in section. Function unknown.

Appendix 14 - The knapped and ground stone assemblage from Ballymount, Co. Kildare (E2876)
By: Maria Soledad Mallia-Guest

Introduction

Three lithic artefacts have been retrieved during archaeological resolution and post-excavation processing of the soil samples retrieved at site E2876 (Ballymount, Co Kildare) in advance of the N9/N10 Kilcullen to Waterford Scheme Phase 3 roadworks. The site consisted of several pits, one presenting with metallurgical waste, a posthole and ditches that were part of the field boundaries. The lithic finds were recovered from deposits within pits (003), (006) and (053). A possible bead was also retrieved from a stratified context as well as a single post-medieval pottery sherd from topsoil (Doyle and Frykler 2009). A fragment of a polished stone-axe was also identified within a sub-rectangular pit during archaeological testing of the area (Bayley *et al*. 2006).

Methodology

A macroscopic analysis of the components was carried out based upon a techno-typological approach following categories developed by Inizan *et al.* (1999). Further contextual background is provided by Woodman *et al*. (2006).

The artefacts were visually examined with the aid of an 8x hand lens, recorded and catalogued using Microsoft Excel 2003. No minimum size criterion was applied for artefact discard; therefore, any other lithic material that may have been retrieved during sample processing was incorporated to contribute to the assemblage integrity. The variables recorded include: overall metric attributes (length, width and thickness); type of raw material; fragmentation; and artefact condition to determine if post-depositional, manufacture or use-damage was present.

In addition, when macroscopic evidence of use-wear was present, subsequent basic high-power micro-wear analysis was carried out using a reflective microscope at 200x magnification. The presence/absence of use traces such as micro-polish, motion striation and edge-scarring/rounding were also recorded.

The ground stone finds were also visually examined with the aid of a stereomicroscope at 40x magnification. In addition to the metric attributes and weight, raw material, artefact condition and any evidence of manufacture through abrasion, polish or impact present was also recorded and discussed along with any signs of wearing and use motion. Categorisation and overall contextual background discussion for these implements is based on Cooney and Mandal (1998).

The knapped stone assemblage

The lithic finds retrieved on site E2876 (Ballymount, Co. Kildare) can be classified as unworked flint knapping by-products or debitage (Table 1). The flakes are small to very small in size measuring less than 25 mm in length and are in fairly good condition. Find (E2876:011:001) is a complete inner angular flake presenting a plain unprepared platform and attributes such a lip on the internal side of the platform as well that can be considered frequent when using soft-hammer percussors for detachment. The find also presents slight patination and post-depositional damage. Flake E2876:019:002 is a naturally (cortex)-backed flake exhibiting 30% of cortex remnant and a non-differentiated bashed proximal end. The find is in good and complete condition and displays a

tabular profile suggesting it could represent a bipolar by-product. A stone axe fragment (E2876:019:005) was recovered from the same fill as this by-product during testing phase.

Finally, find E2876:054:001 is a fragmented angular flake in weathered condition, presenting a plain possibly prepared platform by abrasion with diffuse ripples and bulb of percussion. The flake appears to be a secondary technology by-product.

The ground stone assemblage

The upper portion (butt end) of a stone axe/adze (A021/089:004:001) was recovered from the black brown sandy clay deposit (003) of a sub-rectangular pit during archaeological testing in Ballymount (A021/089-E2876) (Bayley *et al.* 2006). Further resolution of the feature identified deposit (004) from testing as deposit (019) assigning the resolution find number E2876:019:005 to the artefact. The single cortex-backed flake (Table 1) previously discussed was also retrieved from this context.

The axe fragment, which is in rather poor condition, discoloured and weathering is made of a fine argillaceous raw material which was identified as a mid-greenish/brownish grey shale (O'Keeffe 2009). The artefact is transversally fractured presenting a concave-convex in profile fracture and measures 92.7 mm in length by 71.1 mm in width, with a thickness of 31.2 mm and a weight of 282.2 gr. It would appear that it was initially shaped by flaking with later ground and polished faces, exhibiting clear striations. The find shows slightly splayed sides, displaying some scattered flaking as well as polishing, which may be related to hafting (see Details provided by the Irish Stone Project 0'Keeffe 2009). It shows a pointed oval cross-section and a butt shape that appears to be slightly sloped and convex in plan, however damaged. Given the absence of the lower portion no further blade and edge attributes could be determined. Therefore it cannot be suggested if the artefact was likely to have been utilised as an axe (with the working edge parallel to the handle to facilitate chopping and pounding motions) or as an adze (hafted with the working end perpendicular to the handle to facilitate grubbing or pulling motions) (Adams 2002). Morphologically, adzes are normally defined as having a plano-convex cross-section, particularly in the lower part of the object. It is assumed that they have been used for shaping, trimming or digging, as they were hafted with the object mounted transversely in the handle. As already mentioned, depending on the way it is hafted, the same object can function as both an axe and an adze (Cooney and Mandal 1998, 10). It has been suggested that axes within the length range 8-20 cm were mostly used for wood working, with those larger examples used for tree felling and those towards the smaller range used for carpentry (*ibid.* 53).

Discussion

The lithic assemblage retrieved on site E2876 in the townland of Ballymount (Co. Kildare) is dominated by knapping by-products exhibiting very few diagnostic attributes that can be associated with distinctive stages of lithic manufacture. At least one bipolar piece of debitage has been identified suggesting that this technique -which involves the placing and opening of a core on a stationary anvil to produce ready to use flakes -was in use (Whittaker 1994). In addition, a possible secondary technology by-product was also identified suggesting that it was the result of edge trimming/ artefact shaping. Flint is the dominant raw material and it is likely to be derived from secondary sources either locally identified within glacial till or brought to site from coastal localities as beach pebbles (Woodman *et al*. 2006).

In addition, it would appear that soft-hammer percussors such as soft stones, bone/antler as well as wood (Odell 2003) were also utilised. In any case the evidence for lithic manufacture is too scant to

suggest that it was an important component and most of the finds could be residual in nature. This is particularly noticeable when comparing with the nearby sites such as E2873, E2874 and E2875 within the same townland all of them yielding substantial lithic evidence of *in situ* manufacture and use (Mallia-Guest 2009 a).

No chronological framework can be provided given the nature of the assemblage, from a broad perspective the bipolar reduction technique has been recurrent in later prehistoric assemblages since Middle Neolithic onwards (O'Hare 2005, Woodman *et al* 2006) however it has also been identified in earlier Mesolithic contexts (Peterson 1990) and its use is related to the quality, size and availability of raw material.

With regards to the ground stone assemblage, shale and mudstone specimens are among the most common examples of axes retrieved in Ireland. Shales are the largest petrographical group within the sedimentary materials (Cooney and Mandal 1998) with some cases exhibiting extreme patination and weathering. These axes tend to be flaked rather than pecked from cobbles with natural cleavage, with their size commonly ranging from 12 to 14 cm in length. It is plausible however, that the example here presented, would have been classified as large specimen if complete, measuring approximately 20 cm in length.

The western side of the country appears to yield a large concentration of shale axes, particularly in Co. Clare, where a large number was recovered from dredging works at the River Shannon (*ibid*, 95). Substantial quantities are also present in counties Galway, Limerick and Mayo. Furthermore, there is a concentration of mudstone axes in Co. Kildare, spreading through counties Dublin and Meath, Cavan and Westmeath. This distribution contrasts with the low-frequency of shale axes found along the eastern coast from Co. Louth to Co. Wexford.

Raw material provenance for most of the specimens results is difficult given the widespread distribution of these examples and the extension of the Old Red Sandstone and Lower Carboniferous limestone deposits suggesting an important number of potential sources (*ibid).* Sites such as Fisherstreet, at Doolin (Co. Clare) has been considered a potential quarry site, where shale naturally occurs as a result of the contact between the Carboniferous Limestones, the Clare Shales and the Namurian sediments (*ibid*, 94,). In relation to chronology, it has been noted that there was a preference for mudstone and shale stone axes in Later Mesolithic contexts, as well as metamorphic material such as schistose varieties, but these are by no means exclusive of such period. Such preponderance must also be understood in terms of easily procured cobbles from widely spread sources (Cooney 2000, 211). The range of raw material appears to expand during the Neolithic, some of which required an organised production mode, bringing about implication for their social role and also encompassing a number of exchange mechanism at a regional level (*ibid).* Along the N9/N10 road scheme, an additional shale adze/axe was also recovered in the townland of Ballymount (Co. Kildare) at site E2873 in association with a prehistoric occupation spanning from the Early Neolithic to the Early/Middle Bronze Age (Mallia-Guest 2009)

Further Recommendations

It is envisaged that a photograph/illustration of the upper portion of the axe/adze E2876:019:005 (A021/089:004:001) will be required as a complement to this report.

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NMI Number	Raw Material	Type	Category	Length (mm)	Width (mm)	Thickness (mm)	State	Condition	Others	Cortex	Type of flake	Type of Platform	Preparation	Bulb	Ripples	Erailleur scar	Lip	Colour
E2876:019:002	Flint	Cortex backed flake	Debitage	20.2	3	5.5	C	Good	Proximal bashed	30%	Cortex backed-bipolar ?	Non-diff	N/A	ND	D	No	N/A	Light buff-grey
E2876:011:001	Flint	Inner flake	Debitage	24.4	15.2	5.2	C	Fair	Patination and post-depositional damage	No	Inner angular	Plain	No	Pr.	D	Yes	Yes	Light buff
E2876:054:001	Flint	Inner flake	Debitage	6.9	6.1	0.6	F	Fair	Weathered	No	Inner angular	Plain	Yes	D	D	No	No	Buff

Key: C: complete; F: fractured; ND: Non-differentiated; Pr: pronounced; D: diffuse

Table 1 Lithic assemblage from Ballymount, Co. Kildare (E2876)

Irish Stone Axe Project Catalogue

Details supplied by The Irish Stone Axe Project

Friday 6 November 2009

Sequence Number:	21632	**Area:**	
Museum Ref.:	E2876:019:005	**County:**	Kildare
Collection Title:	Unknown	**Map Reference:**	
Current Location:	Headland Archaeology Ltd	**Temp Map Ref.:**	
Townland:	BALLYMOUNT	**NGR X Axis:**	
Barony:	Narragh and Reban East	**NGR Y Axis:**	0
Parish:	Usk	**Ordnance Datum:**	
Discovery Circum.:	Archaeological Excavation	**Object Type:**	Axe/Adze
Hoard:		**Minature:**	No
Context:		**Object Status:**	Incomplete
From Year:	2005 **To Year:** 2005	**If Incomplete:**	Upper Portion
Archaeological Excavation:		**Incomplete Details:**	
Site Type & Details:	Pit discovered during N9/N10 Testing	**If Roughout:**	
		Roughout Details:	
Secure Context:		**Length:**	9.2cm **Width :** 7.2cm
Feature & Context Details:	Pit. C004 was a dark brown/black sandy clay with charcoal flecking and occasional su-rounded stone iinclusions	**Thickness:**	3.1cm **Weight :** 0g
		Face Shape:	
Associated Artefacts:		**Cross Section:**	Pointed oval
		Edge Shape:	Unknown/Damaged
Associated Features:		**Edge Form:**	Unknown/missing
		Profile:	Unknown
		Blade Profile:	Unknown
Dating Information:	Pending	**Butt Shape:**	Damaged/Unknown
		Use & Wear:	Edge missing
Prime Treatment:	Flaked	**Re-use:**	None
		Deliberate Breaking:	No
Secondary Treatment:	☐ Blade Ground ☐ Sides Ground ☑ Faces Ground ☐ Butt Ground ☐ Blade Polished ☐ Sides Polished ☑ Faces Polished ☐ Butt Polished	**Hafting:**	Polish from wear
		Facets:	☐ Facet 1 Right ☐ Facet 1 Left ☐ Facet 2 Right ☐ Facet 2 Left

Description :

Upper portion of stone axe or adze. Left side pointed at butt becoming more rounded near break. Small number of flake scars evident, do not appear recent. Right side pointed with evident polish, possibly related to hafting, small number of slightly irregular areas. Areas between both sides and faces appear unground but have differential polish, possibly related to hafting. Break is perpendicular to long axis of artefact, does not appear intentional. Both faces well ground with some polishing, striae relating to manufacture evident on face 2. Butt is damaged due to a flake removal but was likely sloped in plan. EOK

Comments :

Bibliographies :

Appendix 15 – Assessment of metallurgical remains from E2876 based on visual examination
By: Barry Cosham

Introduction

Excavation at E2876 revealed a small number of features including pits, ditches, a posthole and a possible slag pit furnace (Doyle and Frykler 2009). A moderate quantity of metallurgical waste material was recovered from the site during excavation. A small amount of material was also recovered during the processing of environmental samples in the post excavation phase. The aim of this report is to determine the nature and quantity of these residues and recommend what, if any, further analyses should be undertaken.

Methods

The assemblage had a total weight of 5756 grams and comprised one slag sample that was collected during excavation and a further four that were recovered during environmental processing. A visual examination of the assemblage was undertaken, the remains were quantified and a detailed description compiled. This allowed categorisation and identification with reference to Bachmann (1982) and Bayley *et al* (2001) to be completed. The results and discussion of the assessment are presented below.

Results

The following table (Table 1) presents the results of the visual assessment.

Sample no.	Context no.	Weight (g)	Description	Interpretation
001	005	1156	Large slag block, black, c.15-20cm diameter, high density, frequent charcoal imprints, no clear single cooling surface, frequent blebs and prills visible on outer surface	Iron smelting
		1152	Large slag block, black, c.15-20cm diameter, high density, frequent charcoal imprints, no clear single cooling surface, frequent blebs and prills visible on outer surface	Iron smelting
		413	Smaller slag block, black, c.10-15cm diameter, high density, frequent charcoal imprints, no clear single cooling surface, frequent blebs and prills visible on outer surface	Iron smelting
		1363	Many prill and other fragments exhibiting clear flow structure, black, mostly high density	Iron smelting
002	005	1672	Very large number of tiny fragments of slag, mostly c.1-2cm diameter, many prills and blebs, common large slag spheres, also small quantity of furnace lining, recovered during	Iron smelting

Sample no.	Context no.	Weight (g)	Description	Interpretation
			environmental processing	
002	005	996	Whole retent, very large number of tiny fragments of slag, mostly <1cm diameter, common slag spheres, small quantity of hammerscale both flake and spheroidical, frequent charcoal fragments, also small quantity of furnace lining, recovered during environmental processing	Iron smelting/smithing
004	007	N/A	Single tiny slag fragment, black, recovered during environmental processing	Undiagnostic
026	001	41	Single small fragment, black, slight traces of iron corrosion, some charcoal imprints on all surfaces, no obvious cooling surface	Undiagnostic
027	038	14	Single small fragment, high density, black, largely covered by iron corrosion products	Undiagnostic
	Total:	6807		

Table 1 – Visual assessment of material

The vast majority of the identifiable material within the assemblage was the result of iron smelting. This was indicated by the high proportion of fragments with charcoal imprints on multiple surfaces, and the large amount of prills and other fragments that exhibited flow structure. Although these features can be present in iron smithing slags, generally speaking there will tend to be charcoal imprints on only one surface. Small prills can also form in a smithing hearth but are usually found only in tiny quantities.

A small quantity of hammerscale was noted indicating that some smithing was also taking place.

The 'slag block' and prill fragments support the interpretation given in the preliminary report that the furnace was of the 'slag pit' variety, this is discussed in detail below.

Discussion

The smelting taking place on this site used the bloomery (direct) process, which was the main means of converting ore into usable iron from the Iron Age up to the late 16th century when blast furnace (indirect) technology started being imported from the continent. The bloomery process begins with ore roasting in shallow pits. The iron ore was usually crushed first to increase the surface area (hence reactivity) and then roasted. The roasting in an oxygen rich atmosphere achieved two things; firstly a lot of highly reactive impurities such as sulphur were driven off, and secondly the roasting ensured that the ore was free of moisture. The ore would then be added to the furnace along with charcoal while a continuous 'forced draught' was provided by one or more sets of bellows. The aim was to produce a reducing atmosphere (without oxygen) within the furnace to change the iron compounds in the ore to iron metal. This process required high temperatures, usually within the 1100–1200°C

which while not hot enough to melt pure iron (melting point of approximately 1500°C) allowed the impurities to melt and separate from the iron, forming slag. A variety of possible furnace types can be used but the end product is the same; a spongy lump of iron and slag called the bloom. This has to be refined by further heating and hammering (primary smithing) to drive off the remaining slag impurities, a billet of usable iron is the end product (Henderson 2000).

Approximately 99% of the recovered assemblage came from a single context (005) which was recorded as the fill of a possible slag pit furnace (004). This furnace had a diameter of 0.50 m and a depth of 0.30 m with steep/vertical sides, no evidence of high temperatures affecting the natural was noted (Doyle and Frykler 2009). The absence of *in situ* burning within (004) may be considered unusual for furnaces; however, the pit of a slag pit furnace is rarely subjected to intense burning, the 'hot zone' of the furnace is above the level of the pit. Slag pit furnaces work in much the same way as any other furnace the only difference being that the slag drains into a pit under the furnace forming 'slag blocks' rather than being trapped or clogging up the furnace. This means that the smelter can produce bigger blooms as it takes longer for the furnace to 'clog up' with slag, making it a more efficient technology than the primitive 'bowl furnace'. Although superstructures are rarely found it is assumed that the majority of furnaces would have taken the form of a shaft furnace above the ground level (Tylecote 2001). Slag pit furnace technology is believed to originate in central and northern Europe perhaps as early at the 3rd century BC and was spread by the mass migrations of Angles, Jutes, Saxons *etc*. in the 5th and 6th centuries AD to the British Isles (Pleiner 2000). Slag pit furnaces are fairly common in Anglo-Saxon England and it is likely that the technology was gradually introduced to Ireland from the 7th century onwards. Later Scandinavian settlers may also have brought slag pit furnace technology with them to Ireland.

It appears from the hammerscale that a small amount of iron smithing also took place on the site. It is most likely that some bloom consolidation took place, possibly in the remains of the furnace once the smelt was complete. The lack of diagnostic smithing slags or potential smithing hearths suggests that only a small amount of smithing took place, which corroborates the idea that bloom consolidation took place rather than artefact manufacture which would probably have left more evidence.

Something that should be considered is where the raw materials (ore and charcoal) for the metalworking on this site came from as this can have implications regarding the likes of woodland management and the environment in general. Charcoal and ore are required in a ratio of approximately 10 charcoal to 1 ore for smelting (Tylecote 1986), which means that any potential smelter is likely to look for an area with a good supply of timber suitable for charcoal making over an area that has rich ore. This is particularly true in Ireland where "bog ore" which is formed by the precipitation of iron minerals in bogs and other poorly drained places is abundant.

In summary it can be said that the material from this site relates to an iron smelting operation, possibly representing only a single episode. A small amount of evidence for smithing was found in the form of hammerscale, suggesting that some primary smithing took place on site. The sources of ore and charcoal are unknown, although it is likely that both were obtained in the area surrounding the site.

Recommendations

Further analysis of the assemblage is possible. XRF and other chemical techniques would be able to show the elemental composition of the slag, microstructural examination would be able to show the different phases within the slag indicating what the furnace conditions may have been like, however

these techniques are unlikely to provide any gainful information towards the sites interpretation. It is therefore recommended that no further analyses be undertaken on the material from this site at this time.

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