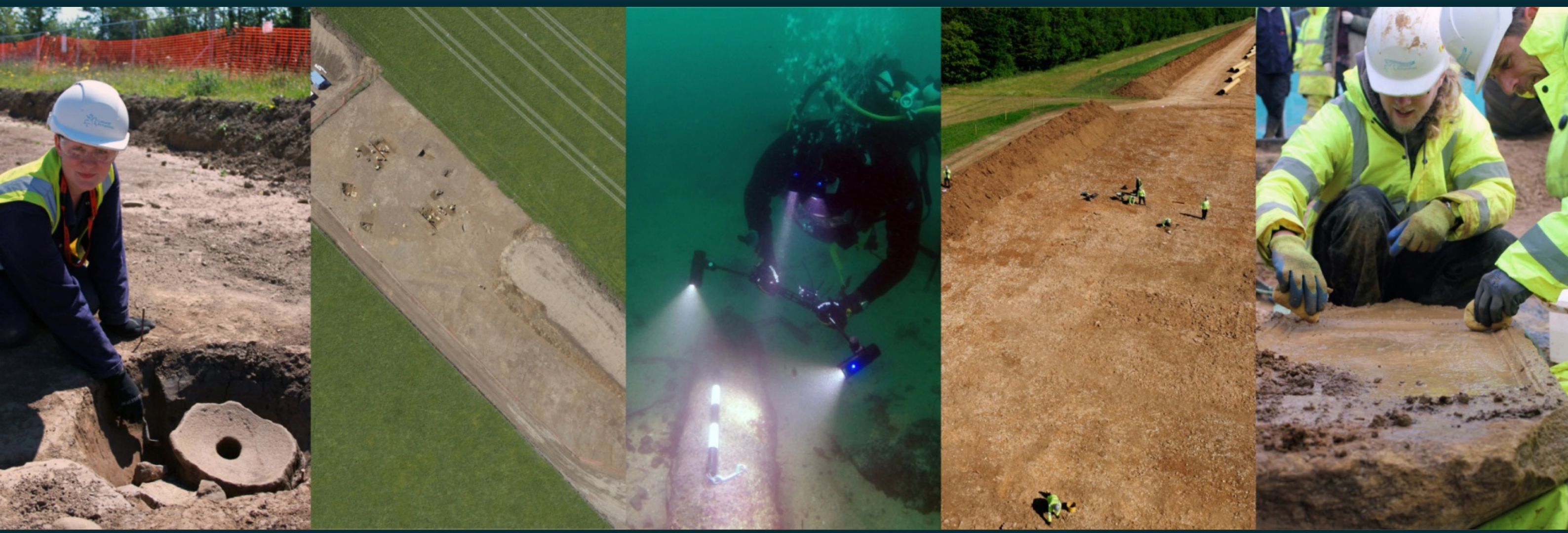
Cotswold Archaeology

Land at Dunkeswell Airfield
Dunkeswell
Devon

Archaeological Strip, Map and Sample Excavation Report



for

Conergy West Sussex Ltd

CA Project: 4986
CA Report: 14418
RAMM 14/44

May 2015

Conergy West Sussex Ltd

Andover Cirencester Milton Keynes

Land at Dunkeswell Airfield
Dunkeswell
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SUMMARY

Project Name:	Land at Dunkeswell Airfield
Location:	Dunkeswell, Devon
NGR:	ST 1367 0817
Type:	Strip, Map & Sample Excavation
Date:	21-29 July 2014
Planning Reference:	13/1954/MFUL
Location of Archive:	Royal Albert Memorial Museum, Exeter
Accession Number:	RAMM: 14/44
Site Code:	DUNK14

An archaeological strip, map and sample excavation was undertaken by Cotswold Archaeology in July 2014 at Land at Dunkeswell Airfield, Devon, whereby Areas 1, 2, 3 and 4 were machine excavated.

The strip, map and sample excavation identified an extensive series of sixteen pits and a ditch within Areas 1 and 3, likely to have been excavated for the extraction of iron ore nodules which are known to occur within the natural clay with flint and chert, having been previously identified on sites elsewhere within the Blackdown Hills. These features remain undated.

No archaeological features or deposits were found within Areas 2 and 4. Area 4 was extended approximately 1 metre west within the north-west of the trench in order to fully investigate a linear feature found within. The linear feature was identified to be a modern land drain.

The Site had recently been ploughed and a suspect Second World War UXO was identified approximately 10m east of Area 3. The suspect UXO was identified as a non-explosive practice bomblet and deemed safe for removal and removed safely by Royal Navy Bomb Disposal Unit Plymouth.

1. INTRODUCTION

1.1 In July 2014 Cotswold Archaeology (CA) carried out an archaeological strip, map and sample excavation of land at Dunkeswell Airfield, Dunkeswell, Devon (centred at NGR: ST 1367 0817) at the request of Conergy West Sussex Ltd, hereafter referred to as the Site (see Figure 1).

1.2 Planning permission for a solar farm development was granted by East Devon District Council (EDDC), (13/1954/MFUL).

1.3 Stephen Reed, Archaeologist, Devon County Council Historic Environment Team (DCCHET), the archaeological advisor to East Devon District Council (EDDC), specified that, following a programme of archaeological surveys carried out within the Site, including a *Heritage Desk-Based Assessment* (CA 2013) and a magnetometer survey (Archaeological Surveys Limited 2013), a strip, map and sample excavation was required in four selected areas, targeted on features revealed in the geophysical survey (see Figure 2).

1.4 The excavation was carried out in accordance with a detailed *Written Scheme of Investigation* (WSI) produced by CA (2014) and approved by Stephen Reed (DCCHET). The fieldwork also followed the *Standard and Guidance for Archaeological Excavation* (IfA 2009), the *Management of Archaeological Projects* (English Heritage 1991) and the *Management of Research Projects in the Historic Environment (MORPHE): Project Manager's Guide* (English Heritage 2006).

The site

1.5 The proposed development encloses an area of approximately 6.2ha and occupies an arable field adjacent to Dunkeswell Airfield in East Devon, approximately 430m north-west of the village of Dunkeswell. The Site had recently been ploughed and is located on land that historically formed part of the Second World War Dunkeswell Airfield (Jarrett *et al*, 2010). The airfield retains an operational runway, on land immediately south of the Site. The main runway extended north into the Site and is still present as hardstanding on the eastern side of the Site.

1.6 The Site is located within the Blackdown Hills Area of Outstanding Natural Beauty (AONB), at the northern end of a flat topped, linear upland plateau. The topography, typical for Blackdown Hills, comprises steep, wooded scarps falling away from the plateau into narrow stream cut valleys. The topography within the Site is generally level, but rises slightly from *c.* 246m above Ordnance Datum (AOD) to the west to approximately 250m AOD to the east.

1.7 The British Geological Survey (BGS) maps the site as lying on the Clay-With-Flints Formation which dates to the Neogene–Quaternary period 23.8 million years ago to the present. The Clay-With-Flints comprises an unbedded orange-brown sandy clay with angular chert clasts derived from the dissolution and decalcification of the underlying Upper Greensand Formation. The Upper Greensand Formation is of Albian to Cenomanian Age (111 My-93Mya) and dates to the Cretaceous period. This bedrock Formation is composed of unconsolidated glauconitic sands, chert, sandstone, gravel bodies, shell and thin clay beds. Griffith and Weddell's (1996) survey of the Blackdown Hills suggests that iron nodules are found in the Upper Greensand Formation and have been worked since the Roman period.

Archaeological background

1.8 The archaeological and historic landscape baseline information is contained within the desk-based assessment (DBA) prepared by Cotswold Archaeology (CA 2013) for the proposed development with additional information contained within the *Magnetometer Survey Report* (Archaeological Surveys Ltd 2013). A summary only of these assessments is presented below.

1.9 The DBA (CA 2013) stated that although prehistoric settlement and ritual activity is recorded within the wider landscape, the Site, due to its location on high, exposed ground, would not have been a favourable location for settlement. The DBA (CA 2013) established that there is a potential for buried remains associated with iron extraction, of Romano-British or later date, to be present within the Site, based on previous investigations undertaken within the wider surroundings of the Site.

1.10 The Site formed part of an agricultural landscape from the medieval period onwards. In the 20th century, the Site became a part of the Second World War Dunkeswell Airfield, completed in 1942 and remained in operational use until the end of the war. During the war it became the only US Navy airfield operational within the UK and US Liberator bombers were task to patrol the sea areas traversed by U-boats en-route between their bases in France and their hunting sites in the North Atlantic. Joseph. P. Kennedy, brother of the former US President, John. F. Kennedy was stationed at the airfield between 1943 and 1944 (Jarrett *et al*, 2010). The airfield remained in use in the post war period and is now an active aviation airfield with two of the wartime runways still in use. The bulk of the airfield site, with its runways, perimeter track and hardstandings, have survived as a very rare example of a substantially complete Second World War airfield site (English Heritage 2014). The original (now disused) north end of one of these runways is still extant within the eastern part of the Site (see Figure 12).

1.11 The magnetometer survey located a number of well-defined clusters of discrete positive anomalies. These features were identified during the strip, map and sample excavation to be associated with iron stone mineral extraction (Archaeological Surveys Ltd 2013).

1.12 Other features revealed in the geophysical survey, included positive linear anomalies, one of which could have been associated with a former boundary or agricultural activity. A former road removed during the construction of the airfield was also identified. To the north of the former road, a small number of patches of magnetic debris were revealed; however, it was not possible to determine the origin of this thermoremnant material.

Archaeological objectives

1.13 The objectives of the fieldwork were to provide information about the archaeological resource within the Site, including its presence/absence, character, extent, date, integrity, state of preservation and quality. In accordance with the *Standard and Guidance for Archaeological Excavation* (IfA 2009), the excavation has been designed to be minimally intrusive and minimally destructive to archaeological remains. The information gathered will however be sufficient to enable Stephen Reed, the archaeological advisor to East Devon District Council (EDDC) to identify and assess the particular significance of any heritage asset, consider the impact of the proposed development upon it, and to avoid or minimise conflict between the heritage asset's conservation and any aspect of the development proposal, in line with the *National Planning Policy Framework* (DCLG 2012).

Methodology

1.14 The archaeological strip, map and sample targeted features revealed in the geophysical survey, as agreed through consultation with Stephen Reed (DCCHET).

1.15 The fieldwork was undertaken within four areas (Area 1 – 4) as shown on Figure 2. Area 1 measured 10m x 10m and was targeted on possible pits within the northern part of the Site. Area 2 measured 5m x 5m and was targeted on a curvilinear feature to the south of the Site. Area 3 measured 5m x 10m and was targeted on linear anomaly and possible pits within the southern possible pit cluster. Area 4 measured 15m x 2m and was targeted on an anomaly containing thermoremnant material of unknown origin. The trench was extended approximately 1 metre west within the north-west of the trench in order to fully investigate a linear feature found within. The linear feature was identified to be a modern land drain.

1.16 All excavated trenches were set out on OS National Grid (NGR) co-ordinates using Leica GPS. The final completed trench survey was recorded using Leica GP in accordance with CA Technical Manual 4 *Survey Manual*.

1.17 Due regard for known services was undertaken prior to, during excavation and upon completion of the work at the Site. All work was undertaken in accordance with *Safe Systems of Work for – Avoiding Overhead Services & Underground Services*.

1.18 All trenches (Areas 1 - 4) were excavated by mechanical excavator equipped with a toothless grading bucket. All machine excavation was undertaken under constant archaeological supervision to the top of the first significant archaeological horizon or the natural substrate, whichever was encountered first. Where archaeological deposits were encountered they were excavated by hand in accordance with CA Technical Manual 1: *Fieldwork Recording Manual*.

1.19 The Site had recently been ploughed and a suspect Second World War UXO was identified approximately 10m east of Area 3 and dealt with accordingly under the Health & Safety at Work Act 1974 – Section 3 (Bactec, 2015), whereby all work was stopped immediately and Devon & Cornwall Police Authority notified, who in turn secured and cordoned the Site and notified the Royal Naval Bomb Disposal Unit, Plymouth (RNBD). The suspect UXO was identified as a non-explosive practice bomblet and deemed safe for removal and removed safely by RNBD (see Figures 2 & 11). In May 2013, an unexploded bomb was discovered and destroyed in a controlled explosion on Dunkeswell Airfield by RNBD (Exeter Express & Echo, 2013).

1.20 Deposits were assessed for their palaeoenvironmental potential in accordance with CA Technical Manual 2: *The Taking and Processing of Environmental and Other Samples from Archaeological Sites* (2003). Artefacts were processed in accordance with CA Technical Manual 3 *Treatment of Finds Immediately after Excavation (Appendix C)*.

1.21 A monolith sample was taken by Cotswold Archaeology during the evaluation at the request of Stephen Reed, archaeological advisor to East Devon District Council (EDDC), and was assessed by ARCA, University of Winchester, Hampshire (see Appendix D).

1.22 Iron ore nodule samples were taken by Cotswold Archaeology during the evaluation at the request of Stephen Reed, archaeological advisor to Est Devon District Council (EDDC), and were assessed by GEOARCH, Caerphilly, Wales (Appendix E).

1.23 The archive and artefacts from the fieldwork are currently held by CA at their offices in Andover. Subject to the agreement of the legal landowner the artefacts will be deposited with Royal Albert Memorial Museum, Exeter, under accession number reference RAMM: 14/44, along with the site archive. A summary of information from this project, set out within Appendix

F, will be entered onto the OASIS online database of archaeological projects in Britain.

2. RESULTS (FIG 1 - 12)

2.1 This section provides an overview of the excavation results; detailed summaries of the recorded contexts are contained within **Appendix A**.

2.2 Archaeological features were identified within **Areas 1** and **3** (see Figures 2, 3 & 6). No archaeological features or deposits were found within **Areas 2** and **4** (see Figure 2, 9 & 10).

2.3 **Area 4** was extended approximately 1 metre west within the north-west of the trench in order to fully investigate a linear feature found within. The linear feature was identified to be a modern land drain (see Figure 2 & 10).

2.4 Natural substrate **103** within **Area 1** consisted of a dark orange brown, silty clay with rare sub-angular flint nodules to moderate small sub angular flint nodules located at a depth of up to 0.35m from the existing ground surface. Above the natural substrate, subsoil/colluvium **101** consisting of mid orange brown, friable sandy silty clay and charcoal fleck inclusions and a thickness of deposit of up to 0.1m was identified. Topsoil **100** consisting of a mid brown friable silty clay with moderate sub-angular flint inclusions and a thickness of up to 0.25m was identified above. A small quantity of natural iron stone nodules was observed within natural **101** (see Figures 2 & 3).

2.5 Natural substrate **202** within **Area 2** consisted of a mid orange brown silty clay with angular flint nodule inclusions located at a depth of up to 0.4m from the existing ground surface. Above the natural substrate, a subsoil **201** consisting of a light brown silty clay with angular flint nodules and charcoal fleck inclusions and a thickness of deposit of up to 0.2m was identified. Topsoil **200** consisting of a mid brown friable silty clay with moderate sub-angular/sub-rounded flint and rounded pebbles and a thickness of up to 0.2m was identified above. A small quantity of natural iron stone nodules was observed within natural **202** (see Figure 2 & 9).

2.6 Natural substrate **302** within **Area 3** consisted of a mid orange brown silty clay with angular flint nodule inclusions located at a depth of up to 0.4m from the existing ground surface. Above the natural substrate, a subsoil **301** consisting of a light brown silty clay with angular flint nodules and charcoal fleck inclusions and a thickness of deposit of up to 0.2m was identified. Topsoil **300** consisting of a mid brown friable silty clay with moderate sub-angular/sub-rounded flint with a thickness of deposit of up to 0.2m was identified above. A small quantity of natural iron stone nodules was observed within natural **302** (see Figures 2 & 6).

2.7 Natural substrate **403** within **Area 4** consisted of a mid orange brown silty clay with rare angular flint nodule inclusions located at a depth of up to 0.4m from the existing ground surface. Above the natural substrate, a colluvium/subsoil **402** consisting of a mid yellowish brown sandy silty clay with moderate sub-angular flint nodule inclusions and a thickness of deposit of up to 0.1m was identified. Subsoil **401** consisting of a mid brown friable silty clay with rare stone inclusions and a thickness of up to 0.2m was identified above. Topsoil **400** consisted of a mid greyish brown friable silty clay with moderate sub-angular flint nodules and a thickness of up to 0.2m completed the sequence. A small quantity of natural iron stone nodules was observed within natural **403** (see Figure 2 & 10).

Area 1 (Fig 2, 3 to 6)

2.8 **Area 1** was targeted on a series of anomalies identified during the geophysical survey. Thirteen archaeological features were found within the trench, eight of these features corresponded to the location of the geophysical anomalies identified. Six features, **Pits 104**, **106**, **108**, **124**, **126** and **128** were excavated and interpreted as iron ore extraction pits. **Pits 110**, **112**, **114**, **116**, **118**, **120** and **122** were not excavated. All the archaeological features cut subsoil **101** (see Figure 3).

2.9 **Pit 104** was located to the north of **Area 1** (see Figure 5). The feature was circular in plan and comprised a U-shaped profile, steep sloping sides and a flat base - the base of the pit was higher on the south side. The feature contained a primary fill **136**, a secondary fill **137** and an upper fill **105** respectively. The primary and secondary fills showed evidence for deliberate infilling of re-deposited natural. The upper fill showed evidence for natural weathering and erosion. Fired clay, iron slag and burnt flint were recovered from upper fill **105** which also contained small amounts of poorly preserved oak and alder/hazel charcoal. A single worked chert flake was recovered from subsoil **101** which also contained small amounts of poorly preserved oak and alder/hazel charcoal. The artefactual and ecofactual evidence is indicative of discarded firing debris but interpreted as residual finds and wind-blown hearth/furnace debris.

2.10 **Pit 106** was located in the south of **Area 1** (see Figure 5). The feature was circular in plan and comprised a U-shaped profile, steep sloping sides and a flat base - the base of the pit was higher on the north side. The feature contained a primary fill **138**, a secondary fill **139** and an upper fill **107** respectively. The primary and secondary fills showed evidence for deliberate infilling of re-deposited natural. The upper fill showed evidence for natural weathering and erosion. Worked and burnt flint was recovered from fill **139** and two small iron ore nodules were recovered from fill **107**. The artefactual evidence is indicative of industrial waste but interpreted as residual finds.

2.11 **Pit 108** was circular in plan and comprised a U-shaped profile, with steep sloping sides and a flat base (see Figure 5). The feature contained a primary fill **141** and an upper fill **109** respectively. The primary fill showed evidence for deliberate infilling of re-deposited natural. The upper fill **109** showed evidence for natural weathering and erosion and thirteen small *ferruginous boxstone* iron nodules were recovered and three chert fragments from it (Appendix E).

2.12 **Pit 124** was sub-circular in plan and comprised steep sides, a flat base and contained a primary fill **135**, a secondary fill **134** which during excavation was thought to consist of a palaeosol, and an upper fill **125** respectively (see Figure 4). **Pit 124** was cut by **Pit 126** located immediately north-east. All three fills showed evidence for deliberate infilling of re-deposited material. Six small to medium sized iron ore nodules of *ferruginous boxstones* were recovered from fill **135** and twenty-one mainly small iron nodules of *ferruginous boxstones* and nine natural stones and rocks were recovered from the upper fill **125** (Appendix E). It is likely that a monolith sample taken from secondary fill **134** from **Pit 124** identified a re-deposited topsoil contemporary with mining activity of the pits within **Area 1** (Appendix D).

2.13 **Pit 126** cut **Pit 124** located immediately to the south-west. **Pit 126** was sub-circular in plan and comprised steep sides, a flat base and contained a primary fill **133**, a secondary fill **127** and an upper fill **140** respectively (see Figure 4). All three fills showed evidence for deliberate infilling of re-deposited natural. Fired clay and burnt flint was recovered from fill **140** which also contained small amounts of poorly preserved oak charcoal. The artefactual evidence is indicative of industrial waste but interpreted as residual finds and wind-blown hearth/furnace debris. Three small iron ore nodules were recovered from fill **133** and nineteen small iron ore nodules of *ferruginous boxstone* and eight natural flints were recovered from fill **127** (Appendix E).

2.14 **Pit 128** cut **Pit 126** located immediately to the south-west. **Pit 128** was sub-circular in plan and comprised gradual to steep sloping sides, a flat base and contained a primary fill **132** and an upper fill **129** respectively (see Figure 4). The primary fill showed evidence for deliberate infilling of re-deposited natural. The upper fill showed evidence for natural weathering and erosion. Two small iron ore nodules were recovered from fill **132** and three small iron ore nodules of *ferruginous boxstone* and two natural flints were recovered from fill **129** (Appendix E).

Area 3 (Fig 2, 6 to 8)

2.15 **Area 3** was targeted on a series of anomalies identified during the geophysical survey. Four archaeological features were found within the trench, three of these features, a ditch (**3A**) and two pits (**314** and **316**), corresponded to the location of the geophysical anomalies identified, **Pit 311** did not. All four features were hand excavated. Two interventions were hand excavated within a linear feature interpreted as a ditch, recorded as **Ditch 3A**, and three further features were hand excavated and interpreted as iron ore extraction pits. All the archaeological features cut subsoil **301** (see Figure 6).

2.16 **Ditch 3A** was orientated east/west and corresponded to an anomaly identified during the geophysical survey. Two interventions were excavated within **Ditch 3A**, **Slot 1** and **Slot 2**. **Slot 1/303** comprised a U-shaped profile, gradual sloping sides and a flat base and contained a primary fill **304**, a secondary fill **305**, and an upper fill **306** (see Figure 7). A single worked chert flake was recovered from fill **306**. **Slot 2/307** comprised a U-shaped profile, gradual sloping sides and a flat base and contained a primary fill **308**, a secondary fill **309** and an upper fill **310**. Burnt flint was recovered from fill **310** and the fill also contained a single poorly preserved possible couch onion seed and a small amount of poorly preserved alder/hazel and oak charcoal. The artefactual and ecofactual evidence is indicative of industrial waste but interpreted as residual finds and wind-blown hearth/furnace debris. Four iron ore nodules of *ferruginous boxstone* were recovered from primary fill **304** (Appendix E). **Slot 2/307** comprised a similar sequence of deposition to **Slot 1/303** of natural weathering and erosion.

2.17 **Pit 311** was located centrally within **Area 3** (see Figure 8). The pit did not correspond to anomalies identified during the geophysical survey. **Pit 311** was circular in plan and comprised gradual to steep sloping sides, a flat base and contained a primary fill **312,** from which two small iron nodules were recovered, and an upper fill **313** respectively. The primary fill showed evidence for deliberate infilling of re-deposited natural. The upper fill showed evidence for natural weathering and erosion. A single iron ore nodule of *ferruginous boxstone* was recovered from primary fill **312** (Appendix E).

2.18 **Pit 314** was located centrally within **Area 3** and was circular in plan and comprised steep sloping sides, a flat base - the base of the pit was higher on the south side, and contained a primary fill **315**, from which two small iron ore nodules were recovered, a secondary fill **318** and an upper fill **320** respectively (see Figure 7). The primary and secondary fills showed evidence for deliberate infilling of re-deposited natural. The upper fill showed evidence for natural weathering and erosion. Worked and burnt flint was recovered from upper fill **320** which is indicative of industrial waste but interpreted as residual finds. A single hazelnut shell and a small amount of poorly preserved charcoal identified as oak was found within upper fill **320** originating from wind-blown hearth/furnace debris. Three iron ore nodules of *ferruginous boxstone* were recovered from primary fill **315** (Appendix E).

2.19 **Pit 316** was located to the south-west of **Area 3** and was circular in plan and comprised steep sides and a flat base, and contained a primary fill **317**, a secondary fill **319**, and an upper fill **321** respectively (see Figure 8). All three fills showed evidence for deliberate infilling of re-deposited natural. A single worked chert was recovered from fill **317**. The limited artefactual evidence is indicative of industrial waste but interpreted as a residual find.

2.20 A suspect Second World War UXO was identified approximately 10m east of Area 3 and dealt with accordingly under the Health & Safety at Work Act 1974 – Section 3 (Landmark, 2015), (see Figure 2 & 11).

3. THE FINDS

3.1 Artefact evidence was recovered from **Areas 1**, **2**, **3**. Finds from the evaluation included worked flint and Greensand chert, fired clay and slag, the majority of which were recovered from bulk soil samples. These may be residual finds, a culmination of extensive iron ore extraction, later historic agricultural farming practices and Second World War levelling of the Site.

Slag

3.2 Bulk soil sampling of pit fill **105** within pit **104** (sample **504**) produced four fragments of indeterminate iron-working slag.

Worked chert

3.3 Single pieces of worked Greensand chert were hand-recovered from subsoil/colluvium **101**, upper fill **306** within **Ditch 3A**, **Slot 1/303** and primary fill **317** within pit **316**. The artefacts recovered from subsoil **101** and fill **306** were both unretouched flakes: that from fill **317** was a spurred piece made on a chunky flake, with the spur formed from semi-abrupt retouch at the dorsal distal end.

3.4 A total of five worked flints (flakes and chips) and 24 pieces of burnt, unworked flint (the latter weighing 75g) were recovered from bulk soil sampling of five deposits. None of the lithics can be dated more precisely than to the prehistoric period.

4. GEOARCHAEOLOGICAL AND PALAEOENVIRONMENTAL EVIDENCE

Introduction

4.1 A monolith column sample (**505**) of deposits **135**, **134** and **125** was taken from pit **124** within Area 1 at the request of Stephen Reed, archaeological advisor to East Devon District Council (EDDC), and was assessed by ARCA, University of Winchester, Hampshire (Appendix D)

4.2 The assessment of the monolith was intended to address the following aims:

1. To determine the manner in which the stratigraphic units exposed in the monolith sample were formed with special reference to context 134;
2. To assess the archaeological and palaeoenvironmental potential of the units encountered in the monolith sample;
3. To provide recommendations for analytical work that could usefully be undertaken to better understand the archaeological stratigraphy and palaeoenvironments on the site.
4. To identify whether there is any material present within the sample suitable for radiocarbon dating.

4.3 In addition a total of seven bulk environmental samples (242 litres of soil) were retrieved; one from a ditch fill within Area 3, one from a subsoil/colluvium deposit within Area 1 and the other five from pit fills within both Area 1 and Area 2 with the intention of recovering evidence of industrial activity and material for radiocarbon dating.

Methodology

Monolith 505

4.4 Monolith sample 505 was described according to standard geological criteria (Tucker 1982, Jones et al. 1999, Munsell Color 2000).

4.5 The sample details were as follows:

Code:	Dunk 14
Sample:	505
Contexts:	125, 134, 135

Interpretation: Ironstone mining pit 124

Date: Undated

Depth (m)	Unit (Context)	Description
0-0.20	1 (**125**)	7.5 YR 5/6 Strong brown, very compact silt/clay with frequent 5 YR 4/3 Reddish brown iron oxide staining and rare very fine sand-sized mineral grains. Occasional granular to fine pebble-sized angular chert clasts. Rare fine pebble-sized haematite nodule. Sharp horizontal boundary to:
0.20-0.38	2 (**134**)	10 YR 3/3 Dark brown compact silt/clay with rare very fine sand-sized mineral grains. Rare fine pebble-sized, sub angular chert clast. Diffuse and irregular boundary to:
0.38-0.50	3 (**135**)	10 YR 4/4 Dark yellowish brown grading to 7.5 YR 5/6 Strong brown very compact silt/clay with frequent 5 YR 4/3 Reddish brown iron oxide staining and occasional black manganese? sand-sized grains. Rare fine pebble-sized, angular chert clast and haematite nodule. Biotubated top boundary with occasional fissures, root holes and possible earthworm galleries.

Bulk environmental samples

4.6 The bulk environmental samples (242 litres of soil) were fully processed by standard flotation procedures using a 250 micro sieve to capture the flot and 1mm mesh to retain the heavy residue. The residue was dried and sorted by eye, the floated material scanned and seeds identified using a low power stereo-microscope (Brunel MX1) at magnifications of x10 to x40. Identifications were carried out with reference to images and descriptions by Cappers et al. (2006), Berggren (1981) and Anderberg (1994). A selection of charcoal fragments were fractured by hand and identified under an epi-illuminating microscope (Brunel SP400) at magnifications from x40 to x400. Identifications were carried out with reference to images and descriptions by Gale and Cutler (2000) and Schoch et al. (2004) and Wheeler et al. (1989). Nomenclature of species follows Stace (1997). Full results are outlined in Appendix C.

Discussion

Monolith 505

4.7 The basal Unit [3, context (**135**)] of the monolith sample is composed of compact strong brown silt/clay. It has been interpreted by the excavators as redeposited Clay-With-Flints derived from extending the workings and depositing the spoil into the base of the worked pit [**124**]. This is consistent with the sediment from Unit 3 in the monolith sample.

4.8 Overlying Unit 3 is a compact brown silt/clay [Unit 2, context (**134**)] with a compressed granular crumb structure. The boundary between Unit 3 and Unit 2 is irregular and diffuse with occasional bioturbation in the form of vertical granular-sized root holes and /or earthworm galleries. The colour of the sediment in the boundary zone (dark yellowish brown) is intermediate between the colours of the units above and below (a possible B horizon) and is consistent with some mixing through bioturbation.

4.9 The interpretation recorded by the excavators for the formation of Unit 2 is that it is a redeposited topsoil derived from the excavation of a new mining pit. On the basis of the limited sample of monolith <**505**>, the prima facie evidence described above (the lithology and lower boundary characteristics) suggests the unit to be a palaeosol rather than redeposited topsoil. There are three pieces of circumstantial evidence, too, that support this hypothesis:

1. First, the unit has a blanket-like morphology and is consistently found above the primary fill of redeposited Clay-With-Flints in the majority of the excavated pits which implies that it has developed within that unit. Were it a redeposited topsoil then it could occupy the base of a pit and / or occur mixed, or not, with other units at different stratigraphic levels.

2. Secondly, it would seem unlikely that in an industrial environment any backfilling taking place would discriminate between the types of spoil – topsoil and Clay-With-Flints – and that the spoil would, as a consequence, be mixed to varying degrees. That is to say, two discrete deposits would not occur.

3. Thirdly, the pitted topography that would result on the abandonment of mining would provide propitious micro-environments to engender pedogenesis within the redeposited Clay-With-Flints culminating in the formation of a topsoil horizon

4.10 For a mature topsoil to develop there must be a prolonged period of stabilisation after the cessation of mining activity on the site during which paedogenesis takes place. The date therefore of the overlying deposit [Unit 1, context **125** is crucial for a correct interpretation of Unit 2.

4.11 The uppermost deposit in the monolith sample [Unit 1, context **125**] is a compact silt/clay most probably derived from the Clay-With-Flints stratum. The Unit has an unconformable boundary (it is sharp and horizontal in nature) with Unit 2 which records a depositional hiatus. This observation concurs with an onsite interpretation which suggests that Unit 1 may be the result of levelling when the airfield was built; a hiatus of many hundreds of years. However, Unit 1 is cut by **126** which implies that it is earlier in date to the building of the airfield, and is perhaps the result of further mining activity; an interpretation also provided for by the excavation personnel. If this latter hypothesis is the case, and Unit 1 was deposited in quick succession over Unit 2, then Unit 2 may in fact be a spread of redeposited topsoil, because insufficient time would have elapsed for an in situ topsoil to form

4.12 In conclusion, there is evidence to suggest that Unit 2, context **134**, may be a palaeosol that has developed within the redeposited Clay-With-Flints, the primary fill of mining pit **124**. An alternative interpretation is that Unit 2 is a redeposited topsoil contemporary with the mining activity. At present, there is no dating evidence that would help in distinguishing between these two possible modes of formation although the former mode is the preferred one.

Bulk environmental samples

4.13 Samples were taken from upper fill **320** of pit **314** (sample 502), upper fill **105** of pit **104** (sample 504), upper fill **140** within pit **126** (sample 507), secondary fill **139** within pit **106** (sample 506), secondary fill **319** within pit **316** (sample 503) and colluvium deposit **101** (sample 508). A single hazelnut shell and a small amount of poorly preserved charcoal identified as oak was found within fill **320**. In addition deposits **105**, **140** and **101** contained small amounts of poorly preserved oak and alder/hazel charcoal. Fills **139** and **319** contained no plant remains or identifiable charcoal. Samples were recovered from upper fill **310** of ditch **3A** Slot **2/307** (sample 501). All these features remain currently undated. Ditch **3A** fill **310** contained a single poorly preserved possible couch onion seed and a small amount of poorly preserved alder/hazel and oak charcoal

4.14 The poor preservation of the small amount of material retrieved is residual, most likely originating from wind-blown hearth/furnace debris during natural silting and palaeosol development process within the pits. In addition the large number of roots within both samples suggests a high level of contamination from bioturbation. No further work is recommended.

Potential for further work and radiocarbon dating

Bulk environmental samples

4.15 Since the material within these features has been deposited via natural siltation, weathering and erosion, the origin of this material cannot be confirmed, and will not relate to the pit activity. This together with the large number of roots and association bioturbation that would have occurred means that radiocarbon dates will not provide an accurate or reliable date for the excavation and/or use of these pits and as such scientific dating is not recommended.

Monolith 505

4.15 The derivation of **Unit 1**, context **125**, and **Unit 3**, context **135**, is the Clay-With-Flints which is a geological stratum, and therefore these units have no palaeoenvironmental potential.

4.16 **Unit 2**, context **134**, is also ultimately derived from the Clay-With-Flints but through the course of the formation of the Unit pollen grains will have become trapped within the soil matrix. It is possible that such siliceous pollen grains will be preserved because of the decalcified nature of the parent sediment, the Clay-With-Flints; **Unit 2** therefore has a moderate to low palaeoenvironmental potential.

4.17 However the high amount of bioturbation and evidence of modern roots through the monolith and all the bulk samples suggests that there is high risk of contamination and as such no additional microanalyses such as pollen or molluscs are recommended.

4.18 None of the Units contain material suitable for carbon 14 dating.

5. ANALYSES OF IRON ORES AND RESIDUES

5.1 Iron ore nodule samples and a single block of unstratified bloomery iron smelting slag (probably tapped slag) were recovered during the course of the investigation. The assessment and analysis of these samples was undertaken by Dr Tim Young of GEOARCH, Caerphilly, Wales and detailed in Appendix E.

5.2 The iron ores are high-grade boxstones, with laminated cavity linings of 95-96% slightly hydrated iron oxide-hydroxide (perhaps goethite). The ores are characterised by both high phosphorus (P2O5 contents of 0.6 to 1.1 wt%) and manganese (MnO contents of 0.3 to 1.0 wt%).The silica content of the ores is less than 2 wt%.

5.3 The trace element content of the ores is generally low. The rare earth elements (REE) shows marked depletion of the light REE compared with the Upper Crust standard. The total of the REE is low, at 27 to 59 ppm. The uranium to thorium ratio is in the range of 2 to 5.6, with very low thorium contents.

5.4 The block of smelting slag shows chemical characteristics broadly compatible with derivation from ores of the type found on the site. It is very iron-rich (at the upper limit of iron content for the medieval smelting slags from nearby Hemyock), suggesting a limited degree of interaction with the furnace wall. Concentrations of both phosphorus and manganese are also at levels elevated little, if at all, above those of the ore. The REE profile is similar to, but slightly flatter than, those of the ores, with a REE of 86ppm. These features, if representative, all suggest a very low iron yield from the smelt. Tentative modelling of the likely mass balance indicates a possible yield as low as 20% of the available iron.

5.5 The properties of the Dunkeswell materials were compared with those from two sites in Hemyock: Culmstock Road (HCR) and Churchills Farm (HCF). The three sites are all distinct. HCF produced a single piece of ore, morphologically similar to some from Dunkeswell, and with somewhat similar chemical composition, except for elevated copper and zinc. The apparent ore samples from HCR were of different lithology to those of the other sites, probably deriving from the Upper Greensand. The chemical composition of the HCR slags, although broadly similar to those of the other sites

6. DISCUSSION

6.1 The strip, map and sample excavation has identified an extensive series of pits, likely to have been excavated for the extraction of iron ore nodules which are known to occur within the natural clay with flint and chert, having been previously identified on sites elsewhere within the Blackdown Hills for example at Broadhembury (Reed 1997) and North Hill Common (Griffith and Weddel 1996) and more recently during excavations of an 8th - 12th century iron smelting sites at Hemyock to the west of this site Reed (pers comm).

6.2 The pits at Dunkeswell Airfield remain undated with the only finds recovered from the features comprising possible worked chert, burnt flint and debitage. However, given that chert artefacts also occur within the topsoil it may be that these are residual finds within the pits. It is likely that the fills within the pits are the same material that was excavated from them. On completion of a pit having been dug through topsoil and underlying natural clay with flint, and the iron ore nodules having been collected, either directly by hand or through sieving of the iron ore bearing natural, the excavated material would then have been backfilled into the pit. Any artefacts that may have been present within the excavated topsoil would then have been redeposited back into the pit during backfilling. Later historic agricultural farming practices and Second World War levelling of the Site by contractor George Wimpey in 1941 to construct Dunkeswell Airfield may well have further contributed to the residual nature of the artefacts recovered (Jarrett *et al* 2010).

6.3 Although horizons of soil development are indicated within the pits it is unclear whether this is a rapid event with pits being fully backfilled soon after excavation or whether soil horizons (palaeosoils) have been allowed to build up over a longer period of time with the pits having being left partially open. Processing of the environmental soil samples has shown that it is likely that much of the environmental material identified is likely to be residual, originating from wind-blown hearth debris during possible natural silting up processes within the pits. Later historic agricultural farming practices and Second World War levelling of the Site to construct Dunkeswell Airfield may well have further contributed to the residual nature of the environmental evidence recovered.

6.4 Both the soil and monolith samples have shown that material suitable for C14 dating cannot be obtained. There is very clear evidence of bioturbation including earthworm galleries, fissures and root holes: all features that encourage the introduction of extraneous charcoal or mix any that may be there. In addition, as the pits were filled by natural sedimentological processes the provenance of the charcoal is unreliable.

6.5 The rarity of the charcoal fragments also means the fragments are highly unlikely to represent *in-situ* burning or the deliberate deposition of burnt material - situations in which dating charcoal fragments might yield meaningful dates.

6.6 For these reasons radiocarbon dating of this material is not recommended as there would be no way of establishing the chronological relationship between the charcoal and the pit fills.

6.7 Analysis of the iron stone at the Dunkeswell Site has shown the high grade properties of the iron ores present in the clay with flints in this part of the Blackdown Hills. As well as the quarrying of ore as shown elsewhere in the region, some smelting of the ore had taken place in the area. Slag was recovered from an undated context from the Site. The site at Churchills Farm was exploiting a similar ore, but with an apparently elevated copper content which possibly suggests an increased role of sulphides in the concretions. In contrast, the site at Culmstock Road had smelted an entirely different ore from the Upper Greensand.

6.8 An east/west orientated ditch excavated within Area 3 and further indicated on the geophysical survey may define a boundary to encompass an area of extensive pitting directly to the south, within which three pits were investigated during the course of the excavation. The ditch, however, like the pits remains undated. The artefactual evidence recovered, again may be of a residual nature. No evidence for a comparable ditch defining a possible specific pitting area was identified within Area 1 or in the geophysical survey. It is possible that the ditch is acting as a property boundary to define land ownership for the purpose of iron ore extraction.

6.9 The bulk of the airfield site, with its runways, perimeter track and hardstandings, has survived as a very rare example of a substantially complete Second World War airfield site (English Heritage 2014). The very real nature of wartime airfield activity was identified during the course of the excavation due to modern ploughing activity, with the discovery of a non-explosive practice bomblet. In 2013 an unexploded bomb was discovered and destroyed in a controlled explosion on Dunkeswell Airfield by RNBD (Exeter Express & Echo, 2013).

7. CA PROJECT TEAM

Fieldwork was undertaken by CA Project Leader Matt Nichol, assisted by CA site personnel Colin Forrestal. The report was written by Matt Nichol. The illustrations were prepared by CA illustrator Leo Heatley. The archive is currently being compiled and prepared for deposition by Jennie Hughes. The project was managed for CA by CA Project Manager Damian De Rosa, who also edited this report.

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APPENDIX A: CONTEXT DESCRIPTIONS

N.B. All archaeological features and deposits highlighted are in bold.

Area 1					Dimensions		10m x 10m
Trench No.	Context No.	Type	Context interpretation	Description	L (m)	W (m)	Depth/ thickness (m)
1	100	Layer	Topsoil	Mid brown, friable silty clay with moderate sub-angular flint.	10.10	10.05	0.25
1	101	Layer	Subsoil/colluvium	Mid Orange brown, friable sandy silty clay.	10.10	10.05	0.1
1	102	Void	---------------				
1	103	Layer	Natural	Dark orange brown, silty clay with rare sub-angular flint nodules and moderate small sub angular flint.	10.10	10.05	0.1+
1	**104**	**Cut**	**Pit**	Circular in plan, round sharp corners, concave sides flat base SE/NW alignment.	1.3	1.3	0.35
1	**105**	**Fill**	**Of 104**	Mid grey brown with friable silty clay natural mottling throughout charcoal inclusions.			0.34
1	**106**	**Cut**	**Pit**	Circular in plan round corners steep concave sides undulating base.	1.2	1.2	0.51
1	**107**	**Fill**	**Of 106**	Dark grey brown friable silty clay rare iron stone and sub-angular flint.	0.67	0.67	0.12
1	**108**	**Cut**	**Pit**	Circular in plan rounded corners steep concave with minimal undulation.	1.17	1.15	0.32
1	**109**	**Fill**	**Of 108**	Mid grey brown friable silty clay iron stone and subangular flint inclusions .	1.17	1.15	0.18
1	**110**	**Cut**	**Pit**	Ovoid rounded corners E/W alignment. Not excavated.	0.9	0.7	n/a
1	**111**	**Fill**	**Of 110**	Mid grey brown friable silty clay iron stone and sub-angular flint inclusions.	0.9	0.7	n/a
1	**112**	**Cut**	**Pit**	Circular in plan round corners not excavated	1.3	1.3	n/a
1	**113**	**Fill**	**Of 112**	Mid grey brown friable silty clay iron stone and sub angular flint inclusions.	1.3	1.3	n/a
1	**114**	**Cut**	**Pit**	Circular in plan, rounded corners, not excavated.	1.2	1.2	n/a
1	**115**	**Fill**	**Of 114**	Mid grey brown friable silty clay iron stone sub-angular flint inclusions.	1.2	1.2	n/a
1	**116**	**Cut**	**Pit**	Circular in plan rounded corners not excavated.	1	1	n/a
1	**117**	**Fill**	**Of 116**	Mid grey brown friable silty clay iron stone sub-angular flint.	1.2	1.2	n/a
1	**118**	**Cut**	**Pit**	Oval in plan rounded corners not excavated.	1.2	1.2	n/a
1	**119**	**Fill**	**Of 118**	Mid grey brown friable silty clay iron stone sub-angular flint inclusions.	1.2	1.2	n/a
1	**120**	**Cut**	**Pit**	Sub circular in plan rounded corners not excavated.	1.5	1.1	n/a
1	**121**	**Fill**	**Of 120**	Mid grey brown friable silty clay ironstone fragments and sub angular flint.	1.5	1.1	n/a
1	**122**	**Cut**	**Pit**	Irregular partially exposed rounded corners moderate concave unexcavated base NW/SE alignment.	1.8	1.4	0.36
1	**123**	**Fill**	**Of 122**	Mid grey brown friable silty clay iron stone fragments and sub angular flint.	1.8	1.4	0.32

1	**124**	**Cut**	**Pit**	Oval in plan round concave corners vertical sharp at top flat base E/W alignment.	1.7	0.3	0.95
1	**125**	**Fill**	**Of 124**	Orange brown friable silty clay moderate sub angular flint.	1.4	0.3	0.4
1	**126**	**Cut**	**Pit**	Sub oval in plan rounded corners sharp top steep/vertical concave sides, sharp break of slope with a stepped base NE/SW alignment.	2.41	1.3	0.94
1	**127**	**Fill**	**Of 126**	Mid Brown with orange mid grey mottling friable silty clay iron stone, small and large sub angular flint.	2.41	1.3	0.53
1	**128**	**Cut**	**Pit**	Oval in plan rounded corners sharp top steep concave sides.	1.33	1.32	0.4
1	**129**	**Fill**	**Of 128**	Mid grey brown friable silty clay iron stone and sub angular flint.	1.21	1.32	0.18
1	**130**	**Void**	**-------------------**				
1	**131**	**Void**	**-------------------**				
1	**132**	**Fill**	**Of 128**	Mid orange brown friable silty clay spares iron stone and rare sub-angular flint inclusions.	1.34	1.32	0.35
1	**133**	**Fill**	**Of 126**	Dark orange brown silty clay moderate iron stone rare sub angular flint.	2.41	1.3	0.5
1	**134**	**Fill**	**Of 124**	Dark grey brown friable silty clay rare sub angular flint.	1.9	0.3	0.24
1	**135**	**Fill**	**Of 124**	Mid orange brown with mid grey brown mottling friable silty clay iron stone and sub angular flint.	1.7	0.3	0.54
1	**136**	**Fill**	**Of 104**	Mid orange brown friable silty clay rare iron stone, sparse sub-angular flint.	0.97	1.3	0.8
1	**137**	**Fill**	**Of 104**	Light yellow brown friable silty clay.	n/a	0.33	0.4
1	**138**	**Fill**	**Of 106**	Mid brown friable silty clay rare small sub angular flint and iron stone.	n/a	0.5	0.5
1	**139**	**Fill**	**Of 106**	Mid orange brown friable silty clay	n/a	1.07	0.38
1	**140**	**Fill**	**Of 126**	Orange brown friable silty clay small sub-angular stones.	1.15	1.3	0.28
1	**141**	**Fill**	**Of 108**	Mid orange brown friable silty clay sub angular silty clay.	1.0	1.0	0.18
1	**142**	**Fill**	**Of 122**	Light orange brown silty clay.	n/a	0.45	0.1

Area 2					**Dimensions**		**5m x 5m**
Trench No.	**Context No.**	**Type**	**Context interpretation**	**Description**	**L (m)**	**W (m)**	**Depth/ thickness (m)**
2	200	Layer	Topsoil	Mid brown silty clay subangular/subrounded flint and rounded pebbles.	5.7	5.3	0.2
2	201	Layer	Subsoil	Light brown silty clay with inclusions of angular flint and charcoal flecks.	5.7	5.3	0.2
2	202	Layer	Natural	Mid orange brown silty clay with angular flint.	5.7	5.3	0.4+

Area 3					**Dimensions**		**10m x 5m**
Trench No.	**Context No.**	**Type**	**Context interpretation**	**Description**	**L (m)**	**W (m)**	**Depth/ thickness (m)**
3	300	Layer	Topsoil	Mid brown silty clay.	11	5.2	0.2
3	301	Layer	Subsoil	Light brown silty clay with angular flint and charcoal fleck inclusions.	11	5.2	0.2
3	302	Layer	Natural	Mid orange brown clay with angular flint.	11	5.2	0.4
3	**303**	**Cut**	**Ditch**	Linear in plan gradual sides concave to flat base E/W orientation u shaped profile.	1	1.3	0.55
3	**304**	**Fill**	**Of 303**	Mid orange brown compact friable silty clay angular flint inclusions.	1	0.9	0.3
3	**305**	**Fill**	**Of 303**	Mid orange brown friable clayey silt angular flint inclusions.	1	0.3	0.25
3	**306**	**Fill**	**Of 303**	Mid orange brown friable silty clay angular flint inclusions.	1	1.3	0.34
3	**307**	**Cut**	**Of Ditch**	Linear in plan, gradual to steep sides concave to flat base E/W alignment.	1	1.2	0.5
3	**308**	**Fill**	**Of 307**	Mid orange brown compact to friable silty clay angular flint inclusions.	1	0.9	0.3
3	**309**	**Fill**	**Of 307**	Mid orange brown friable clayey silt.	1	0.4	0.2
3	**310**	**Fill**	**Of 307**	Mid orange brown friable silty clay angular flint inclusions.	1	1.2	0.25
3	**311**	**Cut**	**Of Pit**	Circular in plan gradual to steep sides flat uneven base.	1	1	0.4
3	**312**	**Fill**	**Of 311**	Mid orange brown compact to friable clayey silt angular flint	1	1	0.2
3	**313**	**Fill**	**Of 311**	Mid greyish brown friable silty clay angular flint inclusions.	1	1	0.2
3	**314**	**Cut**	**Of pit**	Circular in plan steep sides concave uneven base.	1.2	1.2	0.95
3	**315**	**Fill**	**Of 314**	Mid greyish orange friable loose sandy silt angular flint inclusions.	0.78	0.78	0.3
3	**316**	**Cut**	**Of pit**	Circular in plan steep sides flat base.	1.15	1.15	0.85
3	**317**	**Fill**	**Of 316**	Dark orange brown friable silty clay chalk fragments and angular flint inclusions.	1.08	1.08	0.35
3	**318**	**Fill**	**Of 314**	Mid orange brown compact friable silty clay angular flint and chalk fragment inclusions.	1.15	1.15	0.6
3	**319**	**Fill**	**Of 316**	Dark orange brown compact friable silty clay chalk and flint inclusions.	1.15	1.15	0.4
3	**320**	**Fill**	**Of 314**	Mid greyish brown friable silty clay angular flint inclusions.	1.2	1.2	0.35
3	**321**	**Fill**	**Of 316**	Mid greyish brown friable silty clay.	1.15	1.15	0.25

Area 4					**Dimensions**		**15m x 2m**
Trench No.	**Context No.**	**Type**	**Context interpretation**	**Description**	**L (m)**	**W (m)**	**Depth/ thickness (m)**
4	400	Layer	Topsoil	Mid grey brown friable silty clay with moderate sub angular flint nodules	15.3	2.64	0.2
4	401	Layer	Subsoil	Mid brown friable silty clay with rare stone inclusions	15.3	2.64	0.2
4	402	Layer	Colluvium	Mid yellowish brown sandy silty clay inclusions of mid brown silty clay	15.3	2.64	0.1
4	403	Layer	Natural	Orange brown silty clay with rare large flint nodule inclusions	15.3	2.64	0.2

APPENDIX B: THE FINDS

Finds concordance

Context	Description	Count	Weight(g)	Spot-date
101	Worked chert: flake	1	11	Prehistoric
105 Sample <504>	Fired clay	*c*. 200	53	-
Sample <504>	Slag	4	104	
Sample <504>	Burnt flint	4	19	
139 Sample <506>	Worked flint: chips	2	<1	Prehistoric
Sample <506>	Burnt flint	2	<1	
140 Sample <507>	Fired clay	58	13	-
Sample <507>	Burnt flint	6	34	
306	Worked chert: flake	1	12	Prehistoric
310 Sample <501>	Burnt flint	7	13	-
317	Worked chert: spurred piece	1	52	Prehistoric
320 Sample <502>	Worked flint: flakes, chip	3	3	Prehistoric
Sample <502>	Burnt flint	5	9	

APPENDIX C: THE PALAEOENVIRONMENTAL EVIDENCE

Plant macrofossil identification

Context number				310	320	319	105	139	140	101
Feature number				307	314	316	104	106	126	-
Feature entity				Ditch 3A						
Sample number (SS)				501	502	503	504	506	507	508
Flot volume (ml)				45	60	3	50	24	24	86
Sample volume processed (l)				37	30	27	40	36	36	36
Soil remaining (l)				0	0	0	0	0	0	0
Period				U/D	Pre	U/D	U/D	Pre	U/D	U/D
Plant macrofossil preservation				Poor	Moderate	N/A	N/A	N/A	N/A	N/A
Habitat	**Family**	**Species**	**Common Name**							
HSW	Betulaceae	*Corylus avellana* L.	Hazelnut shell		+					
P/D	Poaceae	*Arrhenatherum elatius* (L.) P. Beauv. ex J. & C. Presl	Possible False Oat-grass	+						

Charcoal identification

Context number			310	320	319	105	139	140	101
Feature number			307	314	316	104	106	126	-
Feature entity			Ditch 3A						
Sample number (SS)			501	502	503	504	506	507	508
Flot volume (ml)			45	60	3	50	24	24	86
Sample volume processed (l)			37	30	27	40	36	36	36
Soil remaining (l)			0	0	0	0	0	0	0
Period			U/D	Pre	U/D	U/D	Pre	U/D	U/D
Charcoal quantity			++	+++	+	+++	++	+++	++++
Charcoal preservation			Poor	Poor	Poor	Poor	Poor	Poor	Poor
Family	**Species**	**Common Name**							
Betulaceae	*Alnus glutinosa* (L.) Gaertn./*Corylus avellana* L.	Alder/Hazel	3			1			
Fagaceae	*Quercus petraea* (Matt.) Liebl./*Quercus robur* L.	Sessile Oak/ Pedunculate Oak	2	6		2		6	10
		Indeterminate	5	4	1	7	2	4	
		Number of Fragments:	5	6	0	3	0	6	10

Key
+ = 1-4 items; ++ = 5-20 items; +++ = 21-49 items; ++++ = 50-99 items; +++++ = 100-500 items; ++++++ = >500 items
Pre = prehistoric
U/D = undated

APPENDIX D: GEOARCHAEOLOGICAL ASSESSMENT OF MONOLITH SAMPLE

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DUNKESWELL AIRFIELD, NR. HONITON, DEVON: GEOARCHAEOLOGICAL ASSESSMENT OF MONOLITH SAMPLE

Nick Watson
August 2014

Introduction

This document reports on the stratigraphy of a monolith collected from an archaeological excavation carried out by Cotswold Archaeology at Dunkeswell Airfield, Nr Honiton, Devon NGR: ST 1367 0817. A single monolith sample measuring 0.50x0.10x0.10m was taken through the primary, secondary and tertiary fills of an undated pit. The site was levelled to form an airfield in 1942. A geophysical survey revealed several hundred discrete positive responses which upon excavation of a sample area were discovered to be pits. These pits are interpreted as having been dug to extract iron ore present in the unlithified bedrock. The geoarchaeological work outlined here was commissioned by Cotswold Archaeology. The report is intended to address the following aims:

1. To determine the manner in which the stratigraphic units exposed in the monolith sample were formed with special reference to context (134);
2. To assess the archaeological and palaeoenvironmental potential of the units encountered in the monolith sample;
3. To provide recommendations for analytical work that could usefully be undertaken to better understand the archaeological stratigraphy and palaeoenvironments on the site.
4. To identify whether there is any material present within the sample suitable for carbon14 dating.

Geology

The British Geological Survey (BGS) map the site as lying on the Clay-With-Flints Formation which dates to the Neogene –Quaternary period 23.8 million years ago to the present. The Clay-With-Flints comprises an unbedded orange-brown sandy clay with angular chert clasts derived from the dissolution and decalcification of the underlying Upper Greensand Formation. The Upper Greensand Formation is of Albian to Cenomanian Age (111 My-93Mya) and dates to the Cretaceous period. This bedrock Formation is composed of unconsolidated glauconitic sands, chert, sandstone, gravel bodies, shell and thin clay beds. Griffith and Weddell's (1996) survey of the Blackdown Hills suggests that iron nodules are found in the Upper Greensand Formation and have been worked since the Roman period. Extraction of the nodules was by the digging of multiple pits.

Methodology

The monolith sample <505> was delivered to the ARCA laboratory at the University of Winchester on 14 August 2014 by Jennie Hughes of Cotswold Archaeology. It was described according to standard geological criteria (Tucker 1982, Jones *et al*. 1999, Munsell Color 2000) and then stored pending decisions on analytical works that might be carried out.

Monolith stratigraphy

The sample details were as follows:

Code:	Dunk 14
Sample	<505>
Context	Cut [103]
Interpretation:	Ironstone mining pit [124]
Date	Undated

Depth m	Unit (Context)	Description
0-0.20	1 (125)	7.5 YR 5/6 Strong brown, very compact silt/clay with frequent 5 YR 4/3 Reddish brown iron oxide staining and rare very fine sand-sized mineral grains. Occasional granular to fine

		pebble-sized angular chert clasts. Rare fine pebble-sized haematite nodule. Sharp horizontal boundary to:
0.20-0.38	2 (134)	10 YR 3/3 Dark brown compact silt/clay with rare very fine sand-sized mineral grains. Rare fine pebble-sized, sub angular chert clast. Diffuse and irregular boundary to:
0.38-0.50	3 (135)	10 YR 4/4 Dark yellowish brown grading to 7.5 YR 5/6 Strong brown very compact silt/clay with frequent 5 YR 4/3 Reddish brown iron oxide staining and occasional black manganese? sand-sized grains. Rare fine pebble-sized, angular chert clast and haematite nodule. Biotubated top boundary with occasional fissures, root holes and possible earthworm galleries.

Discussion:

The basal Unit [3, context (135)] of the monolith sample is composed of compact strong brown silt/clay. It has been interpreted by the excavators as redeposited Clay-With-Flints derived from extending the workings and depositing the spoil into the base of the worked pit [124]. This is consistent with the sediment from Unit 3 in the monolith sample.

Overlying Unit 3 is a compact brown silt/clay [Unit 2, context (134)] with a compressed granular crumb structure. The boundary between Unit 3 and Unit 2 is irregular and diffuse with occasional bioturbation in the form of vertical granular-sized root holes and /or earthworm galleries. The colour of the sediment in the boundary zone (dark yellowish brown) is intermediate between the colours of the units above and below (a possible B horizon) and is consistent with some mixing through bioturbation.

The interpretation recorded by the excavators for the formation of Unit 2 is that it is a redeposited topsoil derived from the excavation of a new mining pit. On the basis of the limited sample of monolith <505>, the *prima facie* evidence described above (the lithology and lower boundary characteristics) suggests the unit to be a palaeosol rather than redeposited topsoil. There are three pieces of circumstantial evidence, too, that support this hypothesis:

First, the unit has a blanket-like morphology and is consistently found above the primary fill of redeposited Clay-With-Flints in the majority of the excavated pits

(pers.com Damian De Rosa) which implies that it has developed within that unit. Were it a redeposited topsoil then it could occupy the base of a pit and / or occur mixed, or not, with other units at different stratigraphic levels.
Secondly, it would seem unlikely that in an industrial environment any backfilling taking place would discriminate between the types of spoil – topsoil and Clay-With-Flints – and that the spoil would, as a consequence, be mixed to varying degrees. That is to say, two discrete deposits would not occur.
Thirdly, the pitted topography (see Figure 1) that would result on the abandonment of mining would provide propitious micro-environments to engender pedogenesis within the redeposited Clay-With-Flints culminating in the formation of a topsoil horizon.

For a mature topsoil to develop there must be a prolonged period of stabilisation after the cessation of mining activity on the site during which paedogenesis takes place. The date therefore of the overlying deposit [Unit 1, context (125) is crucial for a correct interpretation of Unit 2.

The uppermost deposit in the monolith sample [Unit 1, context (125)] is a compact silt/clay most probably derived from the Clay-With-Flints stratum. The Unit has an unconformable boundary (it is sharp and horizontal in nature) with Unit 2 which records a depositional hiatus. This observation concurs with an onsite interpretation which suggests that Unit 1 may be the result of levelling when the airfield was built; a hiatus of many hundreds of years. However, Unit 1 is cut by [126] which implies that it is earlier in date to the building of the airfield, and is perhaps the result of further mining activity; an interpretation also provided for by the excavation personnel. If this latter hypothesis is the case, and Unit 1 was deposited in quick succession over Unit 2, then Unit 2 may in fact be a spread of redeposited topsoil, because insufficient time would have elapsed for an *in situ* topsoil to form.

In conclusion, there is evidence to suggest that Unit 2, context (134), may be a palaeosol that has developed within the redeposited Clay-With-Flints, the primary fill of mining pit [124]. An alternative interpretation is that Unit 2 is a redeposited topsoil contemporary with the mining activity. At present, there is no dating evidence that would help in distinguishing between these two possible modes of formation although the former mode is the preferred one.

Assessment

The derivation of **Unit 1**, context 125, and **Unit 3**, context 135, is the Clay-With-Flints which is a geological stratum, and therefore these units have **no palaeoenvironmental potential**.

Unit 2, context 134, is also ultimately derived from the Clay-With-Flints but through the course of the formation of the Unit pollen grains will have become trapped within the soil matrix. It is possible that such siliceous pollen grains will be preserved because of the decalcified nature of the parent sediment, the Clay-With-Flints; Unit 2 therefore has a **moderate to low palaeoenvironmental potential**

None of the Units contain material suitable for carbon 14 dating.

Figure1 Aerial view of the iron extraction pits at North Hill Common. An example of what the site may have looked like prior to levelling. From Griffith, F and Weddell, P 1996

Recommendations

It is recommended that no further work be carried out on the monolith sample <505>.

Acknowledgements

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APPENDIX E: ANALYSES OF ORES AND RESIDUES

GeoArch

Report 2014/31

Analyses of ores and residues from Dunkeswell, Devon

Dr Tim Young
Final Version
25th March 2015

Analyses of ores and residues from Dunkeswell, Devon

Dr T.P. Young

Abstract

This project entails description and analysis of iron ore samples from excavations of ore-extraction pits at Dunkeswell, Devon. Some of the ore samples were obtained from in-situ deposits; others were reworked into archaeological deposits. In addition a single block of unstratified bloomery iron smelting slag (probably tapped slag) was also analysed.

The iron ores are high-grade boxstones, with laminated cavity linings of 95-96% slightly hydrated iron oxide-hydroxide (perhaps goethite). The ores are characterised by both high phosphorus (P_2O_5 contents of 0.6 to 1.1 wt%) and manganese (MnO contents of 0.3 to 1.0 wt%).The silica content of the ores is less than 2 wt%.

The trace element content of the ores is generally low. The rare earth elements (REE) shows marked depletion of the light REE compared with the Upper Crust standard. The total of the REE is low, at 27 to 59 ppm. The uranium to thorium ratio is in the range of 2 to 5.6, with very low thorium contents.

The block of smelting slag shows chemical characteristics broadly compatible with derivation from ores of the type found on the site. It is very iron-rich (at the upper limit of iron content for the medieval smelting slags from nearby Hemyock), suggesting a limited degree of interaction with the furnace wall. Concentrations of both phosphorus and manganese are also at levels elevated little, if at all, above those of the ore. The REE profile is similar to, but slightly flatter than, those of the ores, with a Σ REE of 86ppm. These features, if representative, all suggest a very low iron yield from the smelt. Tentative modelling of the likely mass balance indicates a possible yield as low as 20% of the available iron.

The project has reviewed the evidence for the ore source for the early medieval smelting at the nearby smelting centre at Hemyock. The properties of the Dunkeswell materials were compared with those from two sites in Hemyock: Culmstock Road (HCR) and Churchills Farm (HCF). The three sites are all distinct. HCF produced a single piece of ore, morphologically similar to some from Dunkeswell, and with somewhat similar chemical composition, except for elevated copper and zinc. The apparent ore samples from HCR were of different lithology to those of the other sites, probably deriving from the Upper Greensand. The chemical composition of the HCR slags, although broadly similar to those of the other sites.

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Methods

The materials were examined visually (with a low-powered hand lens or microscope when required) and given a rapid assessment. A catalogue of the examined materials from Dunkeswell is presented in Table 1.

The analytical programme was developed to address the characterisation of the iron ore, with a particular view to examining whether such ores might have supported the early medieval iron smelting industry in nearby valleys (particularly at Hemyock). Analysis of the iron smelting slag specimen was undertaken to investigate compatibility with the iron resources of the site and also for comparison with slags from the Hemyock sites. The scale of the investigation was limited to these aims, rather than a full geological investigation of the ores, and accordingly a programme of works was developed entailing bulk chemical analysis of a suite of materials ad excluding petrographic investigation.

The selected samples, four samples of ore (DUNK1-4) and one smelting slag (DUNK5) were slabbed on a diamond saw and subsamples were crushed for preparation of whole-sample chemical analyses.

Chemical analysis was undertaken using two techniques. The major elements (Si, Al, Fe, Mn, Mg, Ca, Na, K, Ti, and P) were determined by X-Ray Fluorescence using a fused bead on the Wavelength-Dispersive X-Ray Fluorescence (WD-XRF) system in the department of Geology, Leicester University (this also generated analyses for S, V, Cr, Sr, Zr, Ba, Ni, Cu, Zn, Pb and Hf). Whole-specimen chemical analysis for thirty six minor and trace elements (Sc, V, Cr, Co, Ni, Cu, Zn, Ga, Rb, Sr, Y, Zr, Nb, Mo, Sn, Cs, Ba, La, Ce, Pr, Nd, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu, Hf, Ta, Pb, Th, U) were undertaken using a sample in solution on the ThermoElemental X-series Inductively-Coupled Plasma Mass Spectrometer (ICP-MS) in the School of Earth and Ocean Sciences, Cardiff University (this also generates lower quality results for Fe, Mn, Ti, P that are used mainly for QA purposes). The results of the chemical analyses are presented in full in the archive appendix (Appendix A), with the key data presented as tables in the body of the report.

This project was commissioned by Damian De Rosa of Cotswold Archaeology.

Background

The material described in this report derives from excavations in an area of intensive pitting for iron ore to the NE of Dunkeswell airfield (centred on ST137082).

The site lies on high ground (250m OD) in an area in which the ‘clay with flints’ overlies the Upper Greensand. The site lies 5km south of the village of Hemyock, where there have been two recent excavations of early medieval bloomery complexes which have provided evidence for ore provenance.

Previous detailed investigation of the resources exploited in the Blackdown Hills is largely restricted to excavation of ore pits at North Hill, Broadhembury (ST09900675; Reed 1997). These excavations produced two 14C dates (here recalibrated to current standards) of AD540-660 (charcoal) and AD1-230 (carbonised material in soil), from a deposit (c550) close to the base of the excavated pit.

Results

Iron ores

The ore fragments are pieces of dense boxstone crusts, probably of goethite. The laminated brown crusts are very fine-grained, commonly hard and may demonstrate a convoluted texture. The fragments provide little evidence for the original scale of the boxstone texture, but suggest structures within the range of 50-200mm, and some examples may have been larger. There is no recorded information about the completeness of the boxstone structures within the natural deposits, but the nature of the samples suggests they were fragmented pieces.

There are rare examples of crusts enclosing small white clasts up to a few millimetres across (e.g. from c132). These clasts are soft and may be highly altered lithic clasts, possibly chert. There is no other indication of the nature of the host sediment.

Internally, most boxstone fragments just enclose a pale, almost white, clay, but there are a few examples of somewhat ruddle-like iron oxide rich deposit (e.g. from c315).

Several pieces (e.g. examples from c103, c125) show zones within, or outside, the laminated goethite in which the iron oxide bears small (<0.5mm) cavities. These suggest dissolution of mineral, possibly a carbonate mineral, but perhaps more likely a sulphide.

The chemical composition of the analysed ores approaches that of pure iron III oxide-hydroxide with iron expressed as FeIII oxide plus the loss on ignition totalling 95-96wt%. The loss on ignition (LOI) was measured as 12.22-12.82 wt%, a value that is higher than the LOU of 10.13wt% that is obtained by converting an anhydrous iron oxide-hydroxide (FeO.OH) to iron II oxide (Fe_2O_3). It is likely therefore that a degree of hydration may be present – and may be one of the factors capable of generating the slight colour banding in the ore.

The significant impurities are manganese (with a range of 0.19-0.96wt% MnO) and phosphorus (with a range equivalent to 0.6 to 1.1wt% P_2O_5). The low level of other impurities is reflected, for instance, in a low concentration of the rare earth elements (REE), with total REE of 27-59ppm. As is typical of goethite ores, the thorium content is low (0.4 to 1.1 ppm). The uranium content is higher, but still low (1.5 to 2.2 ppm).

Two of the samples (DUNK1 and 2) show mildly elevated zinc contents (569.6ppm and 142.4ppm respectively), a feature also noted in an ore fragment (sample HCF24) from the Churchills Farm site in Hemyock (Young 2015).

The upper crust-normalised REE profiles (Figure 1a; normalisation after Taylor and MacLennan 1981) show the heavy REE (HREE; Dy and above) to be slightly below parity, but horizontal, whereas there is marked depletion of the light REE (LREE; particularly Eu and below), with marked negative cerium anomaly. The profiles for samples DUNK2, 3 and 4 differ in degree of depletion but are almost parallel, that for DUNK1 is slightly flatter and has a lower degree of depletion.

Iron smelting slag

The single piece of bloomery iron smelting slag (DUNK5) was a 8720g block of very dense tap slag cake, with a neat, strongly convex base, indicating tapping into a small pit; this is probably most of the original slag cake. The cake would have had a roundedly equant shape in plan, 180mm across and 100mm deep, with 70mm of the thickness in contact with the substrate and 30mm as a slightly convex top with flow lobes of very variable width.

The chemical composition of the slag is very iron-rich, with analyses showing 80.9wt% Fe_2O_3 (suggesting approximately 79.5wt% as FeO in the original slag), with 0.84 wt% MnO and 0.87wt% P_2O_5. In general, the elemental composition shows a high degree of similarity with the ores from the site. The REE total 86ppm.

The upper crust-normalised REE profile is horizontal through the HREE (Gd and above), with depleted LREE and a negative cerium anomaly (Figure 1a). Neither the degree of depletion nor the magnitude of the cerium anomaly is as great as in the ore samples, as would be expected as a result of the mixing of the ore and furnace ceramic during smelting.

Interpretation

The nature of the ore

The analysis of the ore specimens clarifies the nature of the resource being exploited (detailing its high grade, variably elevated manganese and elevated phosphorus), but only adds a little to understanding of its geological origin.

The ores recovered during this project are fragments of boxstones – zones of iron enrichment formed when reduced iron released by weathering reactions passes into oxidised zones around joints or the outside of concretions (typically zones influenced by meteoric waters) where the iron II oxidises to insoluble iron III and precipitates. Such textures may form along the joints in a well-jointed rock, or may form around the outside of individual concretions. The fragments present in this study were too small to differentiate these possibilities with any certainty, but Reed (1997) reported on similar ores from a location 4km WSW of the Dunkeswell site and illustrated 'nodules' of up to approximately 400mm and weighing 30kg. The exteriors of the boxstone lacked any adhering rock that might have given a clue as to the context of their formation.

The relatively 'clean' interiors of the boxstones,' would also support a derivation from concretions with a high proportion of cement that has dissolved during weathering. The high iron content of the crusts may indicate that the concretions were originally of siderite (or perhaps ankerite or strongly ferroan calcite). The evidence for zones of cavities suggesting possible minor sulphide mineralisation towards the outside of the concretions may be significant in determining the environment of generation of the concretions.

The origin of the Clay with Flints has been controversial. Gallois (2009) has provided a comprehensive review, demonstrating that large scale dissolution of the Chalk (and locally the calcareous part of the Upper Greensand) has been the major mechanism, which together with subsequent deposition of further sediments during the Late Paleocene to early Eocene produced the Clay with Flints *sensu stricto*. Later, further weathering and deposition during the Pleistocene generated the Clay with Flints *sensu lato*.

Isaac (1981) has produced a detailed study of the Tertiary sedimentary component of the Clay with Flints, and has documented a variety of deposits and environments, including palaeosols and silcretes.

There would appear to be two potential origins for the boxstone ores of Dunkeswell: (1) they were formed from concretionary rocks originally present within the Upper Greensand and left as *remanié* clasts with the Clay with Flints, or (2) they formed diagenetically within the Tertiary component of the Clay with Flints.

Distinguishing with certainty between these two scenarios is not possible on the present evidence. Iron-rich carbonate concretions have not been recorded elsewhere within the Clay with Flints' Tertiary deposits, nor have they been described from the Upper Greensand. Clearly, more geological research is required to establish the precise origin of this significant resource.

The slag from Dunkeswell

There is no dating evidence for the tapslag block (DUNK5), although its equant shape is more reminiscent of some Roman period slags, rather than the more elongate flows usually formed within the tapping channels of typical medieval slag-tapping furnaces.

The shape of the REE profile is intermediate between those of the ore samples and a horizontal profile that would be characteristic of a furnace ceramic.

Modelling a smelting mixture of an ore of composition equivalent to DUNK4 (the richest of the ore samples) with an idealised ceramic of upper crust composition has a best fit for the REE at 74% ore and 26% ceramic with an enrichment of 1.23. Such a clay-rich mix is plausible (particularly if the ore was not as clean as the analysed samples), but such an enrichment factor is equivalent to the production of no iron metal – merely the dehydration/dehydroxylation of the goethite and reduction to an iron II oxide.

The concentrations of both phosphorus and manganese are also at levels close to those of the ore samples, again suggesting a low iron yield.

If the sample was representative of the smelt as a whole, then it would therefore seem likely that either it was extremely unproductive smelt, or was not produced from ore of precisely the sampled composition, although the exploited resource must have been of very similar type. It is possible, however that the slag sample taken from the margin of the cake was not representative of the bulk composition of the slag from the smelt, but may have been produced early in the reaction when little iron metal was yet being produced.

The resources for smelting at Hemyock

The two recently-investigated sites in Hemyock, Churchills Farm (Young 2015) and Culmstock Road (Young 2014; Rainbird and Young in prep.) each produced internally coherent suites of slags, with some associated ore. The REE profiles are illustrated in Figure 1b (Culmstock Road) and 1c (Churchills Farm). In each case the grey tone on the figure shows the range of composition of the slags and the ore samples are shown as black lines.

For the later 9th-11th century site at Churchills Farm, the single ore fragment (sample HCF24) recovered gave a REE profile with a shape very close to those of the analysed slags and with an overall REE content at the lower limit of those of the slags. The profiles show a broadly horizontal section across the HREE (with a slight central dip), and depleted LREE and a strong negative cerium anomaly. Such a profile shows some strong similarities with those of the samples from Dunkeswell.

One significant difference with the ores from Dunkeswell, was that analyses of all the materials from Churchills Farm, ore and slags, showed elevated levels of copper (330-480ppm, compared with 18-80ppm for slags from Culmstock Road and only 6ppm for the slag from Dunkeswell). The most likely explanation for raised copper would be the influence of sulphide minerals on the ore composition). Some caution was applied to this observation, for although close to the lower limit of detection analysis of the Churchills Farm samples by WD-XRF failed to show the same enrichment in copper seen in the more sensitive ICP-MS analyses.

The sample of ore (HCF24; see Table 2) was a brown-yellow boxstone with a pale clay fill overlying a thin ruddle layer – all properties of the Dunkeswell ores. There is thus strong evidence that Churchills Farm was exploiting a resource of the same type as that at Dunkeswell (i.e. boxstones from the Clay with Flints).

In contrast, the earlier of the Hemyock sites, the 7th-9th century site in Culmstock Road (Young 2014) produced nine pieces of low-grade ore (Table 2), six of which were pelletal, two fossiliferous and one a micaceous siltstone. Analyses reported on in full by Young (2014) and Rainbird and Young (in prep) were taken from one pelletal piece (sample HCR8) and one apparently roasted pelletal rock (Sample HCR9). The match between the REE profiles of the ores and the slags was less good than for the other material discussed here. The slag profiles show relatively depleted LREE, but a tendency for progressive relative enrichment in the HREE, rather than a plateau. The roasted sample shows strongly elevated REE with a humped profile centred on gadolinium – quite unlike that of other materials discussed here and incompatible with being representative of the bulk composition of the ores employed during the smelting that produced the slags. The raw pelletal rock (HCR8) is a better, but still imperfect match for the slag profiles, having a flatter profile than the slags, but similarly inclined.

It is therefore clear that the site at Culmstock Road smelted ore from a different resource than did the other sites. The ore samples from the site were pelletal and apparently from the glauconitic parts of the Upper Greensand. It is possible that the samples were from iron-rich weathering crusts, rather than the bulk, raw, Upper Greensand glauconitic rocks, that would probably be of rather low grade. A situation in which rocks of Upper Greensand origin occurred in a derived context within the Clay with Flints is plausible, but there is no evidence that this was the case.

In summary, the Dunkeswell site demonstrates the high grade of the iron ores present in the Clay with Flints in this part of the Blackdown Hills. As well as the quarrying of ore, some smelting of the ore had taken place in the area. The site at Churchills Farm was exploiting a similar ore, but with an apparently elevated copper content – possibly suggesting an increased role of sulphides in the concretions. In contrast, the site at Culmstock Road had smelted an entirely different ore from the Upper Greensand.

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Caption

Figure 1: Upper Crust normalised rare earth element profiles (normalisation after Taylor and MacLennan 1981).

(a) samples from Dunkeswell. Ores are shown as black lines, the slag as a pink line.

(b) samples from Culmstock Road, Hemyock. The field of analysed slag compositions is shown in grey tone, analyses of ores as lines.

(c) samples from Churchills Farm, Hemyock. The field of analysed slag compositions is shown in grey, an analysis of an ore as a black line.

Context	Feature	Sample wt (g)	Item wt (g)	Item number	Notes	Sampled as:
u/s			8720		part of a very dense tap slag cake, with neat strongly convex base, indicating tapping into a small pit; this is probably most of the tapped material	DUNK5
103		1255	1175	10	ferruginous boxstone	
			70	1	chert	
			10	1	broken pebble with reddish porous ferruginous, slightly granular material - similar to possible sphaerosiderite material from 125	
109		945	895	13	ferruginous boxstone	
			50	3	chert	
125		3235	3040	21	ferruginous boxstones	DUNK2
			70	5	cherty pale rocks	
			125	4	dense ferruginous rocks, possibly pelletal (one then broken to inspect interior - dense goethite with strings of tiny cavities, near margin shows dark blebs with pale matrix - this might just be oxidised sphaerosiderite or pyrite?)	DUNK4
127		2930	2440	19	ferruginous boxstone	
				8	flint	
129		245	160	3	ferruginous boxstone	
			85	2	flint	
132		220	220	2	boxstone fragments, with one with clastic outer layers apparently including chert fragments	
133		1920	1920	4	rich boxstone fragments. In one the inner botryoidal layer is so black blue it may suggest considerable manganese	
135		1260	1255	3	ferruginous boxstone	
135		1465	1465	3	complex ferruginous boxstones	
302	natural	725	725	1	excellent example of boxstone with convoluted inner coatings	DUNK1
304	ditch 303		960	4	complex ferruginous boxstones	
312	pit 311		475	1	ferruginous boxstone	
315	pit 314	975	100	1	fragment of flinty-textured boxstone with ruddle like botryoidal lining	
			870	2	ferruginous rocks, not certainly true boxstones but involving ferruginous crust-like zones	DUNK3

Table 1: Catalogue of supplied materials from Dunkeswell

sample	context	feature	wt (g)		notes
HCR8			255	after cutting	coarse pelletal rock with pale matrix and large yellow-brown oxide peloids. Ferruginous charcoal/wood rich concretion on one end
HCR9			488	after cutting	red pelletal ore, with oxide lined rounded cavities. Interpreted as roasted weathered greensand, resembles some Tisbury material
HCR unused #1			1845	after cutting	porous yellow brown rock with pale yellow-brown void fills and dark brown crusts - some of the crusts are curved and serrated and may be fossils. This looks like an oxidised and weathered concretion - possibly originally sulphide.
HCR unused #2			275	after cutting	Finely-laminated micaceous ferruginous mudrock with superficial manganese oxides. One margin is a cross cutting crinkled zone, possibly a minor fault or cavity margin
HCR colln of ore			195	as found	coarse pale pelletal rock with pale matrix and yellow-brown iron oxides. The pellets are very soft. Probably a weathered greensand, but could be a pedogenic material.
			180	as found	fine pelletal rock, variably weathered but locally dark green in small areas amongst the dominant yellow brown, some sand. Weathered greensand.
			120	as found	fine, massive, yellow-brown mudrock with ?bioturbation. One broken surface appears to show contact with pelletal lithology
			45	as found	yellow brown, massive yellow brown lithology, with some slightly darker brown crusts around cavities
			10	as found	broken fragment of complex boxstone texture with multiple cavities, dark brown iron rich rims. Possible conglomeratic texture with white inclusion (probably a fossil) on one side. Some yellower patches show a possible weathered pelletal structure on one surface
HCF24	790	Furn 789	70	after cutting	Boxstone with a dark crust with a slight yellowish core; the, interior has a light red ruddle layer a millimetre thick and a void fill of pale clay.

Table 2: Ore samples from sites in Culmstock Road and Churchills Far, Hemyock (see also Rainbird and Young in prep, Young 2014 and Young forthcoming)

Table 3: Major elements by XRF. The shaded column shows the effect of expressing the iron oxide as FeO. The loss on ignition has been included in the total where positive. A negative loss on ignition (i.e. a gain in weight on ignition) has not been included in the expressed total. < indicates the element was below detection.

		SiO_2	Al_2O_3	Fe_2O_3	FeO	MnO	MgO	CaO	Na_2O	K_2O	TiO_2	P_2O_5	LOI	total
DUNK1	good boxstone	1.85	1.13	82.86	74.57	0.58	<0.007	<0.003	<0.010	0.04	0.07	1.096	12.22	*100.02*
DUNK2	boxstone	1.77	0.92	83.24	74.92	0.29	<0.007	<0.003	<0.010	0.03	0.06	0.555	12.73	*99.70*
DUNK3	ferruginous rock with crusts	1.53	1.03	84.03	75.63	0.19	<0.007	<0.003	<0.010	0.04	0.06	0.694	12.47	*100.14*
DUNK4	holes	0.75	1.33	82.74	74.47	0.96	<0.007	<0.003	<0.010	0.00	0.06	1.106	12.87	*99.97*
DUNK5	tapped slag	10.70	3.64	80.97	72.87	0.84	0.15	0.49	0.01	0.36	0.24	0.866	-6.58	*98.47*

Table 4: Major elements by ICP-MS. All values as wt% oxides.

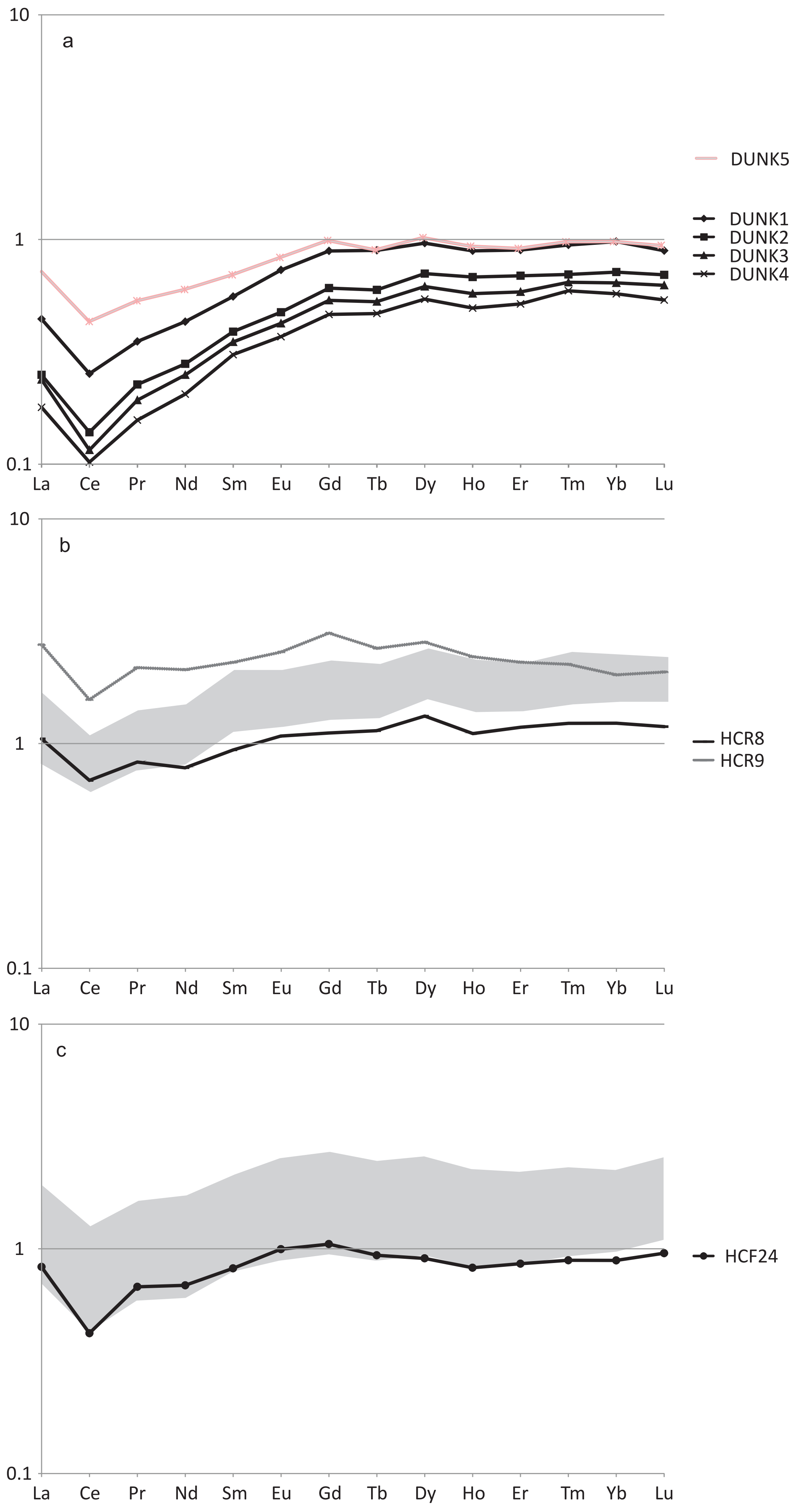
		SiO_2	MnO	FeO	TiO_2	P_2O_5
DUNK1	good boxstone	2.17	1.56	90.11	0.04	1.12
DUNK2	boxstone	2.06	1.57	90.73	0.05	0.54
DUNK3	ferruginous rock with crusts	5.73	1.62	90.78	0.05	0.66
DUNK4	holes	6.99	1.67	87.37	0.04	1.13
DUNK5	tapped slag	1.82	1.55	89.75	0.25	0.84

Table 5: Trace and minor elements by ICP-MS. All values in ppm.

	Sc	V	Cr	Co	Ni	Cu	Zn	Ga	Rb	Sr	Y	Zr	Nb	Mo	Sn	Cs	Ba
DUNK1	10.0	53.5	21.4	46.1	55.7	26.2	569.6	2.7	4.4	15.8	34.5	74.8	1.78	0.36	3.26	0.60	61.70
DUNK2	6.4	34.1	14.5	110.1	15.6	24.1	142.4	2.2	3.9	15.6	25.4	71.8	1.68	0.39	2.93	1.35	53.87
DUNK3	13.2	31.2	11.1	24.1	7.2	8.7	69.2	1.1	2.0	18.4	47.7	71.5	0.32	0.14	0.72	0.43	27.82
DUNK4	14.0	39.5	9.4	27.6	17.2	3.4	56.2	1.2	0.7	14.1	39.4	70.1	0.19	0.29	0.60	0.08	28.37
DUNK5	22.3	60.0	39.7	22.8	b.d.	6.5	10.2	2.6	6.6	72.2	73.9	148.4	2.32	0.15	0.44	0.54	67.75

	La	Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	Hf	Ta	Pb	Th	U
DUNK1	13.24	16.14	2.49	11.17	2.50	0.64	3.36	0.57	3.36	0.71	2.06	0.31	2.15	0.28	1.87	0.27	6.58	1.11	2.20
DUNK2	7.47	8.86	1.60	7.25	1.74	0.42	2.30	0.38	2.46	0.54	1.58	0.23	1.57	0.22	1.69	1.10	5.54	0.82	2.02
DUNK3	7.12	7.39	1.37	6.48	1.57	0.37	2.03	0.34	2.15	0.46	1.34	0.21	1.41	0.20	0.82	0.06	2.88	0.58	1.50
DUNK4	5.36	6.53	1.11	5.32	1.38	0.32	1.76	0.30	1.89	0.39	1.18	0.19	1.26	0.17	0.85	0.00	2.43	0.39	2.21
DUNK5	21.52	27.55	3.78	15.54	3.12	0.73	3.75	0.57	3.56	0.74	2.09	0.32	2.15	0.30	1.90	0.24	1.38	1.44	3.15

Figure 1



10
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1
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DUNK2
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DUNK4
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Nd
Sm
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APPENDIX F: OASIS REPORT FORM

PROJECT DETAILS	
Project Name	Land at Dunkeswell Airfield, Dunkeswell, Devon
Short description (250 words maximum)	An archaeological strip, map and sample excavation was undertaken by Cotswold Archaeology in July 2014 at Land at Dunkeswell Airfield, Devon, whereby Areas 1, 2, 3 and 4 were machine excavated. The strip, map and sample excavation identified an extensive series of sixteen pits and a ditch within Areas 1 and 3, likely to have been excavated for the extraction of iron ore nodules which are known to occur within the natural clay with flint and chert, having been previously identified on sites elsewhere within the Blackdown Hills. These features remain undated. No archaeological features or deposits were found within Areas 2 and 4. Area 4 was extended approximately 1 metre west within the north-west of the trench in order to fully investigate a linear feature found within. The linear feature was identified to be a modern land drain. A suspect Second World War UXO was identified approximately 10m east of Area 3. The suspect UXO was identified as a non-explosive practice bomblet and deemed safe for removal and removed safely by Royal Navy Bomb Disposal Unit Plymouth.
Project dates	21-29 July 2014
Project type (e.g. desk-based, field evaluation etc)	Strip, map & sample excavation
Previous work (reference to organisation or SMR numbers etc)	Not Known
Future work	No
PROJECT LOCATION	
Site Location	Land at Dunkeswell Airfield, Dunkeswell, Devon
Study area (M^2/ha)	6.2ha
Site co-ordinates (8 Fig Grid Reference)	ST 1367 0817
PROJECT CREATORS	
Name of organisation	Cotswold Archaeology
Project Brief originator	Devon County Council
Project Design (WSI) originator	Cotswold Archaeology
Project Manager	Damian De Rosa
Project Supervisor	Matt Nichol
MONUMENT TYPE	Ditch and iron ore extraction pits of unknown date
SIGNIFICANT FINDS	See above

PROJECT ARCHIVES	Royal Albert Memorial Museum, Exeter	Content
Paper	Royal Albert Memorial Museum, Exeter	Context sheets, Plans, Survey data
Digital	ADS	Database, digital photos Digital survey data and plans
BIBLIOGRAPHY		

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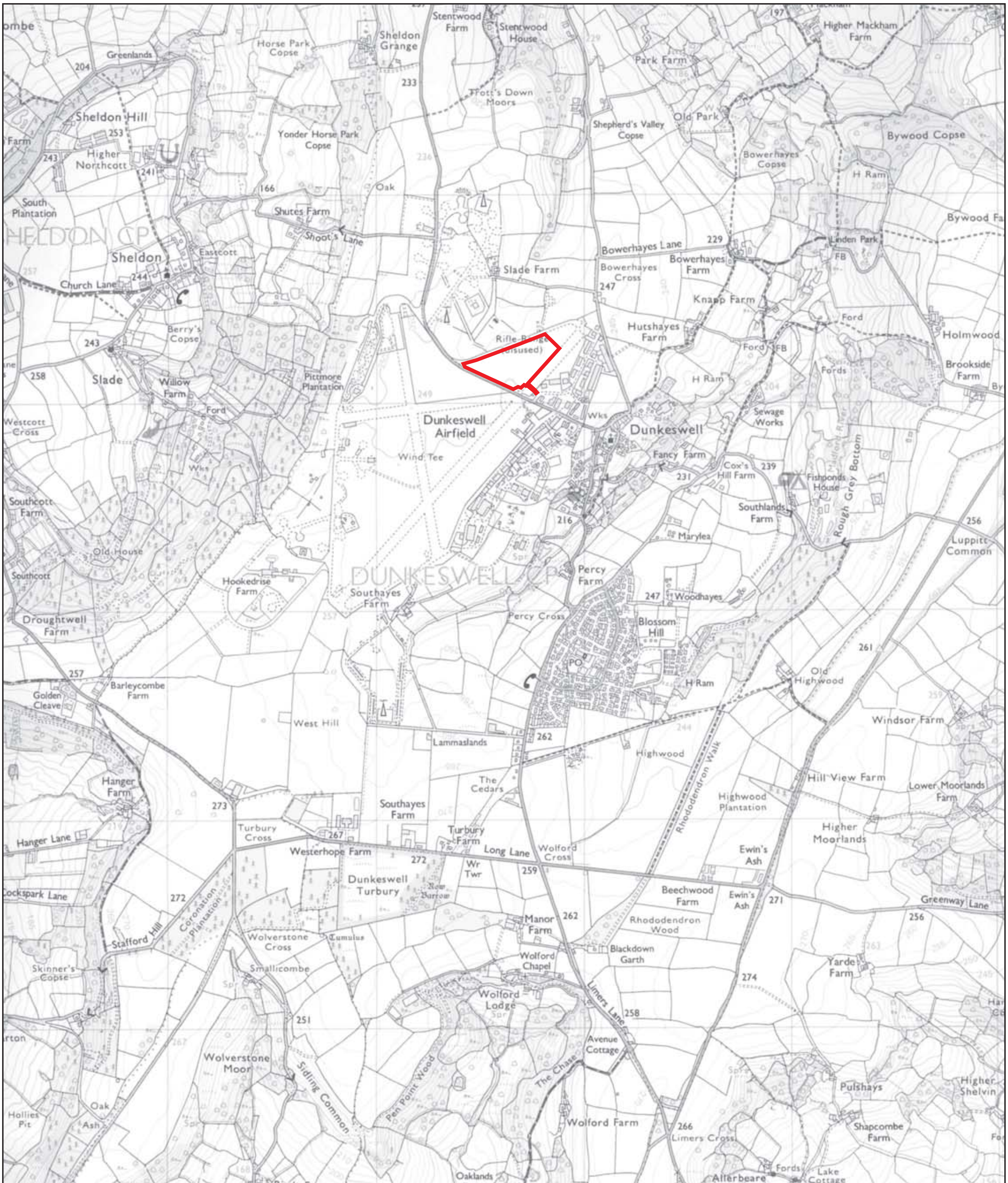
Cotswold Archaeology 2015. Land at Dunkeswell Airfield, Dunkeswell, Devon' Archaeological Strip, Map and Sample' Excavation Report, CA Project: 4986, CA Report: 14418



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0 1km

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PROJECT TITLE

Land at Dunkeswell Airfield, Dunkeswell
Devon

FIGURE TITLE

Site location plan

PROJECT NO.	**4986**	*DATE*	**27-08-2014**	*FIGURE NO.*
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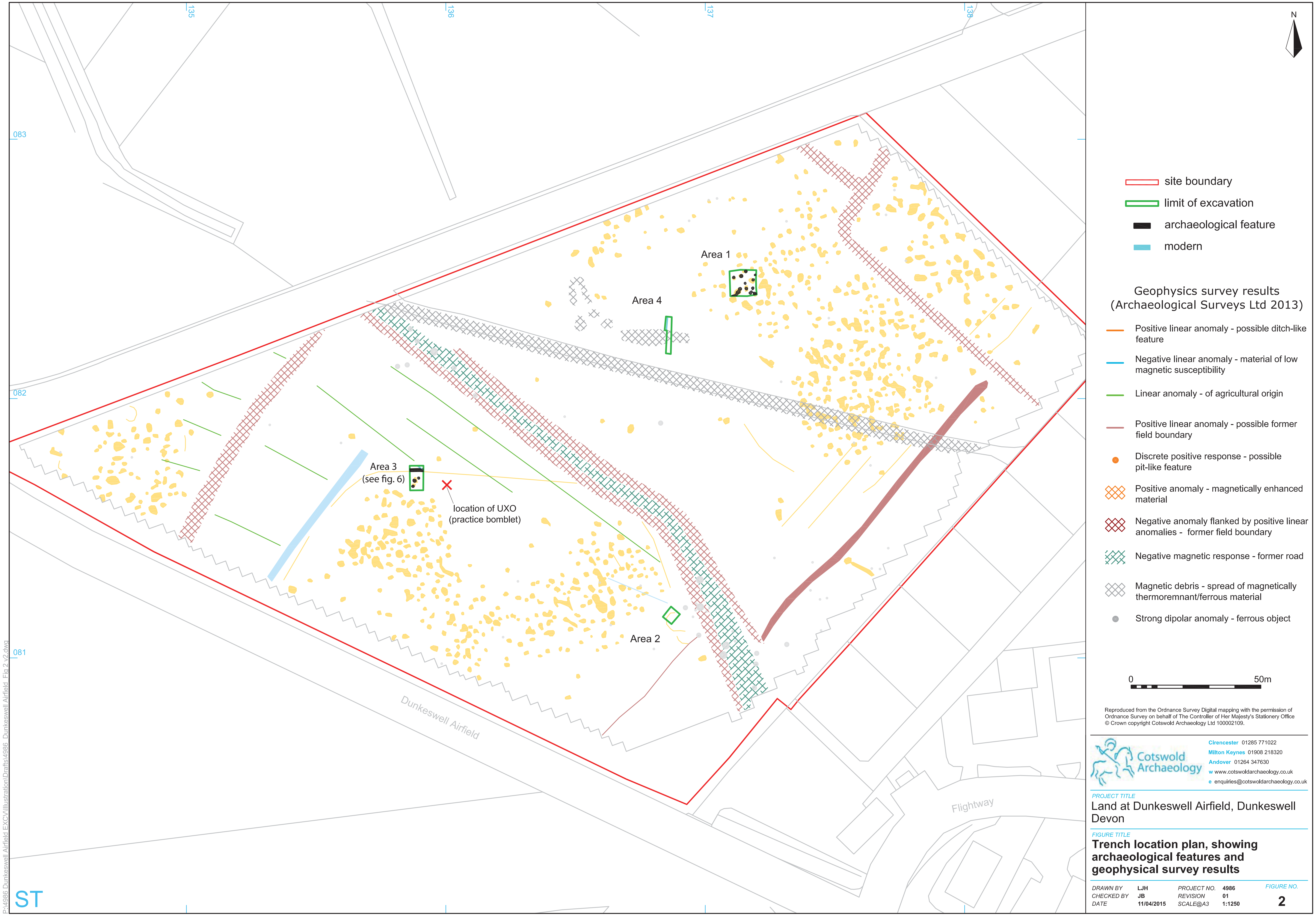
APPROVED BY	**LM**	*SCALE@A4*	**1:25,000**	



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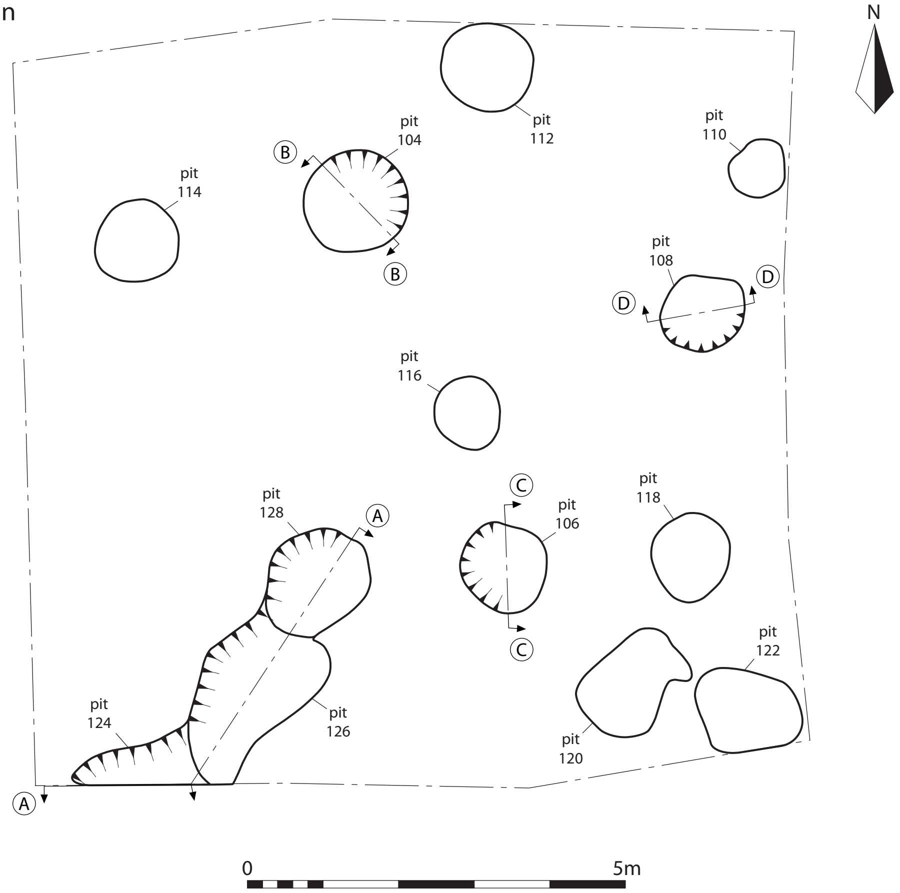
PROJECT TITLE
Land at Dunkeswell Airfield, Dunkeswell
Devon

FIGURE TITLE
Trench location plan, showing archaeological features and geophysical survey results

DRAWN BY LJH
CHECKED BY JB
DATE 11/04/2015
PROJECT NO. 4986
REVISION 01
SCALE@A3 1:1250
FIGURE NO. 2

Area 1, plan



Area 1, looking west (2 x 1m scales)

Limit of excavation

Archaeological feature

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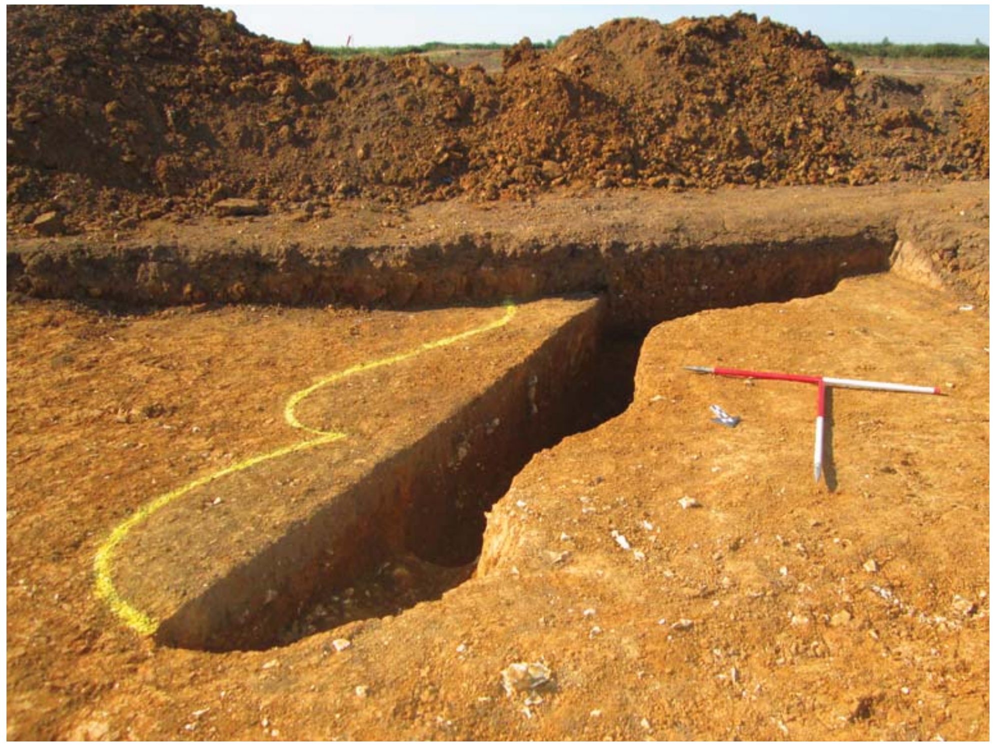
PROJECT TITLE
Land at Dunkeswell Airfield, Dunkeswell Devon

FIGURE TITLE
Area 1: Plan and photograph

DRAWN BY	LJH	PROJECT NO.	4986	FIGURE NO.
CHECKED BY	JB	DATE	10/04/15	**3**
APPROVED BY	DDR	SCALE@A4	1:100	

Section AA



Pits 124, 126 and 128, looking south-west (2 x 1m scales)

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PROJECT TITLE

Land at Dunkeswell Airfield, Dunkeswell
Devon

FIGURE TITLE

Area 1: Section and photograph

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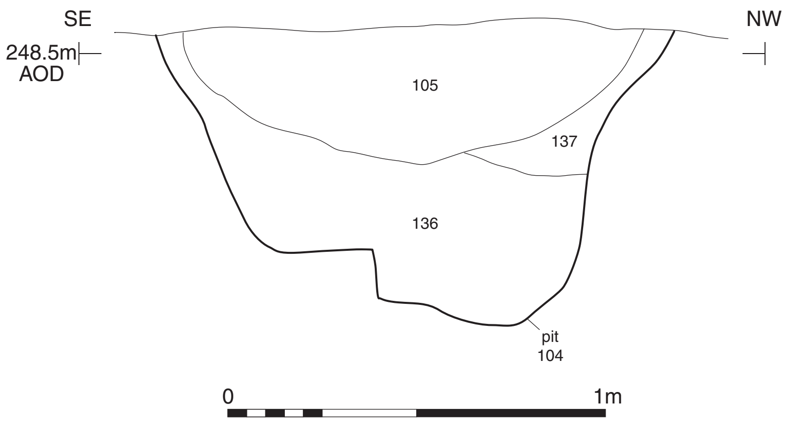
CHECKED BY	**JB**	*DATE*	**08/04/15**
APPROVED BY	**DDR**	*SCALE@A3*	**1:20**

FIGURE NO.

4

Section BB



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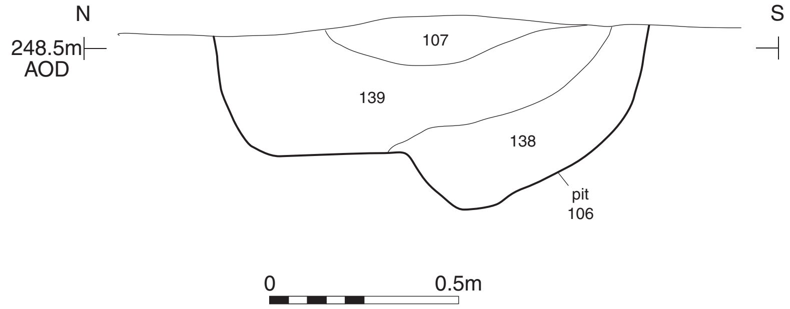
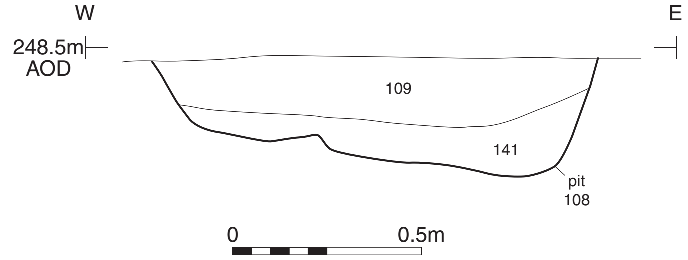


Section DD



Pit 104, looking west (1m scale)

Pit 106, looking east (1m scale)

Pit 108, looking north (1m scale)

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PROJECT TITLE
Land at Dunkeswell Airfield, Dunkeswell Devon

FIGURE TITLE
Area 1: Sections and photographs

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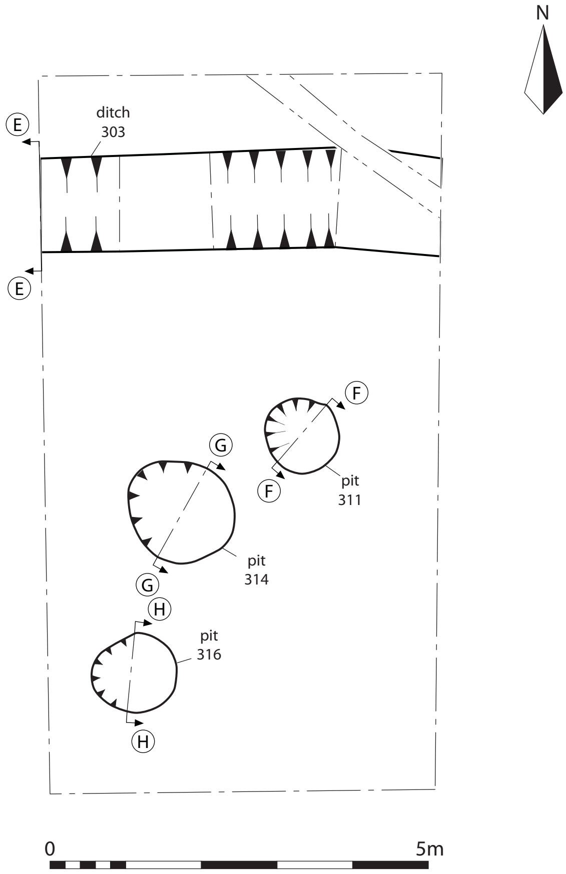
APPROVED BY	DDR	SCALE@A3	1:20	

Area 3, plan



Area 3, looking south-west (2 x 1m scales)

Limit of excavation

Archaeological feature

modern feature

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PROJECT TITLE
Land at Dunkeswell Airfield, Dunkeswell Devon

FIGURE TITLE
Area 3: Plan and photograph

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APPROVED BY	DDR	SCALE@A4	1:100	

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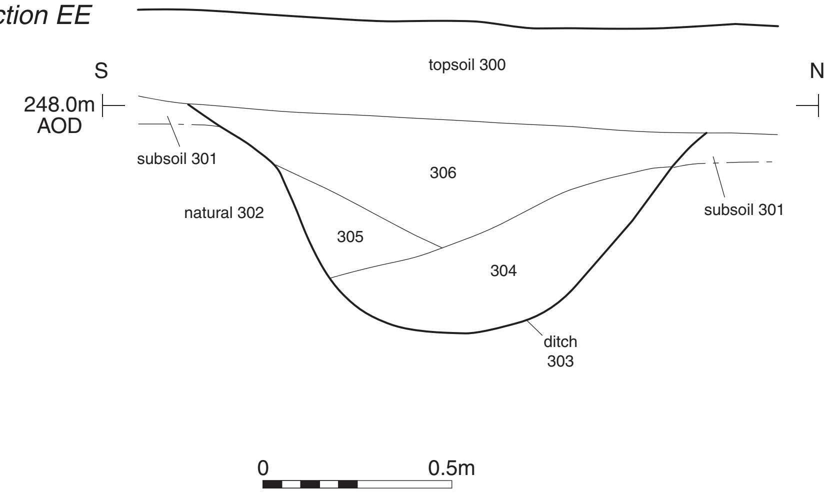

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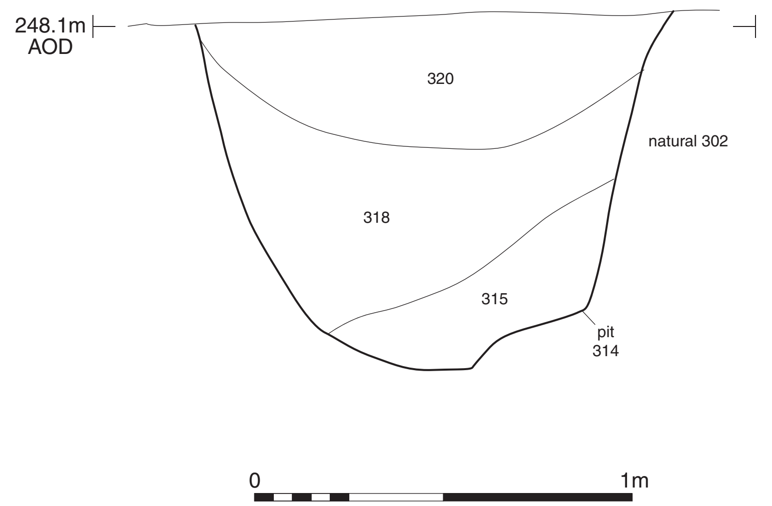

Ditch 303, looking west (1m scale)

Pit 314, looking south-east (1m scale)

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PROJECT TITLE

Land at Dunkeswell Airfield, Dunkeswell Devon

FIGURE TITLE

Area 3: Sections and photographs

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APPROVED BY	**DDR**	*SCALE@A3*	**1:20**	

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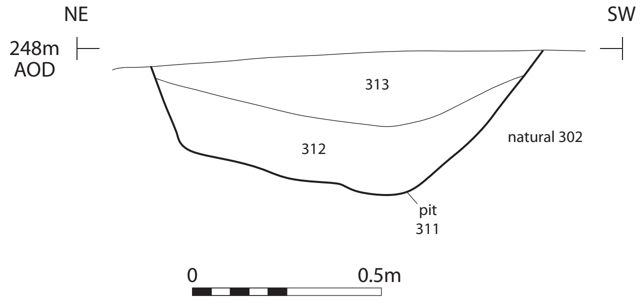

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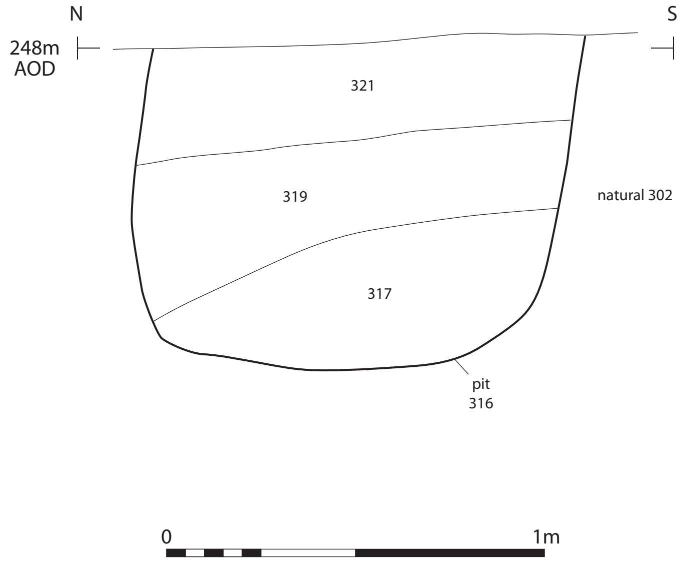

Pit 311, looking south-east (1m scale)

Pit 316, looking east (1m scale)

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PROJECT TITLE
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FIGURE TITLE
Area 3: Sections and photographs

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9

10

9 General view of Area 2, looking north

10 General view of Area 4, looking south

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PROJECT TITLE
Land at Dunkeswell Airfield, Dunkeswell
Devon

FIGURE TITLE
Photographs

DRAWN BY	LJH	PROJECT NO.	4986	FIGURE NOs.
CHECKED BY	JB	DATE	08/04/15	9 & 10
APPROVED BY	DDR	SCALE@A4	n/a	

11

12

11 UXO practice bomblet (located 10m east of Area 3)

12 View north-east of Dunkeswell Airfield, runway located south-east of the site

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PROJECT TITLE
Land at Dunkeswell Airfield, Dunkeswell Devon

FIGURE TITLE
Photographs

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CHECKED BY	JB	DATE	08/04/15	11 & 12
APPROVED BY	DDR	SCALE@A4	n/a	

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