Crownhill Down, Hemerdon, Sparkwell, Devon

SX568593

Results of an archaeological trench evaluation

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On behalf of:
Wolf Minerals Ltd

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archaeology

CROWNHILL DOWN, HEMERDON, SPARKWELL, DEVON (CENTRED ON SX568593)

Results of an archaeological trench evaluation

CONTENTS

Summary

An archaeological trench evaluation was undertaken within specific areas of land at Crownhill Down, Hemerdon (NGR SX568593) by AC archaeology during April to June 2010. The total site area covers approximately 264 hectares, which has existing planning permission for the extraction of tungsten, tin and china clay and the tipping of waste. A number of previous archaeological surveys have been undertaken associated with the scheme, which have identified possible stone cairns, prehistoric roundhouses and linear ditches, as well as earthwork remains in the form of banks and ditches associated with leats, field systems and enclosures.

The evaluation comprised the machine and hand-excavation of 17 trenches, positioned to investigate some of the above features. The work has established that many of the previously recorded features are variations within the underlying complex geology. Possible prehistoric buried soils, were, however, recorded beneath later banks, although no artefacts were recovered from any trench.

1. INTRODUCTION

1.1 An archaeological trench evaluation undertaken within specific areas of land at Crownhill Down, Hemerdon, was undertaken by AC archaeology during May and June 2010. The work was commissioned by Groundwork Archaeology Ltd on behalf of Wolf Minerals Ltd, and was carried out following consultation with Devon County Council Historic Environment Service. The location of the site is shown on Fig. 1.

1.2 The Hemerdon Mine has planning consent (ref. 9/42/49/0542/85/3, granted in 1986) for the extraction of tungsten, tin and china clay and the tipping of waste on Crownhill Down. Conditions attached to the planning permission require 'a work programme for comprehensive archaeological investigation and recording before and during the course of development' (Section 1: condition 10(g) as well as the determination of 'methods to be adopted for the safeguarding of archaeological sites within the permission area, but not directly affected by the development' (Section 1: condition 10(h). It is the intention of Wolf Minerals Ltd to commence mining and waste dumping operations in a permitted area (the site) on and around Crownhill Down and Hemerdon Ball.

1.3 The total site area covers approximately 264 hectares and the majority of it is situated on Crownhill Down, an area of open moorland covered with a mixture of close-cropped turf and dense concentrations of gorse and bracken. To the south, the site incorporates the upland area of Hemerdon Ball, which includes the disused buildings of Hemerdon Mine and former areas of mining and tipping, surrounded by enclosed agricultural fields. The site lies between 90m and 220m OD and the underlying solid geology mainly comprises Upper Devonian Slate, although there are small areas of Igneous Granite on the extreme eastern edge of the site, and at Hemerdon Ball in the southernmost part.

2. ARCHAEOLOGICAL AND HISTORICAL BACKGROUND

2.1 The proposed overall scheme area has been subject to various surveys and assessment since 1979 (see Bonnor 2010, section 5.1). The have included detailed earthwork surveys, transcriptions of aerial photographs and Lidar mapping, assessments and surveys of the post-medieval mining remains and an assessment of buildings within the overall permission area.

2.2 A plan of the known archaeology upon the Down is presented as Fig. 2 in Bonnor (2010). A summary of these archaeological features is presented below.

- Two scheduled prehistoric cairn/barrow cemeteries DV1027, DV761 (including hut circles) and a single barrow DV759 (Fig. 2 ref. F & K).
- An area of earthwork mounds, possibly barrows and/or hut circles of probable prehistoric date and associated earthwork boundaries (ref. H)
- Earthwork remains forming a series of linear stones and banks (stone lines) of unknown date but interpreted as either prehistoric stone rows or medieval cultivation (ref. D).
- Earthwork remains, stretching from the top eastern area of the Down to the Tory Brook, of tin streaming, and more widely of leats, reservoirs, prospection pits, lode-back pits bound markers processing areas, whim platform, shafts, settling tanks, caches and other features possibly related to tin prospection, extraction and processing. Date ranges from medieval to post-medieval.
- Various linear earthwork boundaries and enclosures of most likely medieval date (ref E).
- Groups of enclosures in the southern and north-western areas of the Down and two enclosures within the central northern area of the Down. All are considered on current evidence to be either prehistoric or medieval in date (ref. H, G & I).
- An area containing one and possibly more earthwork hut circles adjacent to the north-western enclosures (ref. P)
- A single earthwork barrow/cairn (ref. J).
- A collection of domestic and agricultural buildings of medieval to modern date along the Smallhanger Brook in the southern area of the development site, south of the Down and the standing remains of the Hemerdon Ball Tungsten Mine on the extraction site along with earthwork remains of clay extraction.

3. AIMS

3.1 The main aim of this phase of trial trenching was to obtain information for the development of a Feasibility Study as required by the Client in order to help assess the requirements of future archaeological work ahead of and during development.

4. METHODOLOGY

4.1 The investigations were undertaken in accordance with a project design prepared by Groundwork Archaeology (Bonnor 2010) and subsequent method statement by AC archaeology (Valentin 2010). Both documents were approved by Devon County Historic Environment Service prior to commencement on site.

4.2 The work comprised the machine and hand-excavation of 17 trenches (Fig. 1). For the machine-dug trenches all overburden deposits were removed using a 1.6m wide toothless bucket under the control and direction of the Site Archaeologist. Stripping ceased at the level at which natural subsoil or archaeological deposits were exposed.

4.3 All deposits revealed were recorded using the standard AC archaeology pro-forma recording system, comprising written, graphic and photographic records, and in accordance with AC archaeology's *General Site Recording Manual, Version 1*. Detailed sections or plans were produced at a scale of 1:20 or 1:50. All site levels relate to Ordnance Datum.

5. RESULTS

5.1 Introduction

A number of the trenches contained no evidence for archaeological features or deposits and are described in tabulated form only in Appendix 1. Where archaeological remains were present in trenches these are described in more detail below. Relevant plans and sections are included as Figs 2 to 4 and photographs as Plates 1 to 8.

5.2 Trench 1 (Plan Fig. 2a, section 2b; Plate 1)

This trench was positioned to investigate the potential for archaeological features or deposits within a rectilinear banked enclosure, as well as targeting a linear anomaly identified from Lidar. It was excavated into natural subsoil (context 101), which comprised a light grey clay with large stone inclusions and gravel patches, present at a depth of 0.2m directly below a dark grey/black loam topsoil (100). The trench contained a single northeast to southwest aligned linear feature (F103), which was located towards the northwest end and corresponded with the location of the Lidar anomaly.

Probable ditch F103 was visible on the surface as a linear depression and was used as an animal track cutting through the bank of the surrounding rectilinear enclosure. It was 1.19m wide and 0.3m deep with a gradual sloping northwest side, a steep southeast side and concave base. A single dark grey sandy silt fill was present (102), which contained abundant pea grit. No finds were recovered.

5.3 Trench 2 (Plan Fig. 2c, section 2d; Plate 2)

This trench had plan dimensions of 4.6m x 2m and was positioned across the location of a NNE to SSW aligned possible leat, which includes a banked feature visible on the surface.

The trench was excavated onto a light brownish-grey stony silty clay natural subsoil (206), present at a depth of 0.19m below current ground level.

Cut into the natural subsoil was a NNE to SSW aligned linear feature (F203), which was 1.6m wide and 0.15m deep, with a shallow concave profile. This probable ditch contained a basal fill of mid brown silty clay (202), below a mid greyish-brown silty sand upper fill with abundant pea grit inclusions (201). The WNW side of the ditch profile extended over a 0.25m high deposit of mid greyish-brown silty sand banked material (205), which in turn was below a 0.03m thick deposit of light greyish-brown silty sand (204), with abundant gravel and pea grit inclusions. This was below a dark grey/black silty clay topsoil (200). No finds were recovered.

5.4 Trench 5 (Plan Fig. 2e, section 2f; Plates 4 and 5)

This trench had dimensions of 4.4m x 3m and was positioned across a northeast to southwest aligned probable leat. The trench was excavated onto natural subsoil (514), present at a depth of 0.4m below ground level. Above the natural subsoil were two equivalent buried soil layers (512 and 513), both mid grey silty loams.

Layer 513 was cut by a 0.5m wide and 0.3m northeast to southwest aligned linear feature (F504). This probable ditch was 1m wide and 0.41m deep, with moderately steep sloping sides and a concave base. The southeast side of the ditch was formed of a layer of mid yellowish-grey silty clay redeposited natural subsoil (510), which sealed buried soil layer 512. The northwest side was lined by a mid yellowish-grey silty clay (508), which was also redeposited natural subsoil. To the northwest of F504 enhancing the depth of the feature and sealing buried soil layer 513, was a sequence of banked deposits, which comprised a layer of greyish-brown silty clay (507), below a 0.2m thick deposit of mid greyish-brown silty sand with abundant pea grit and small gravel inclusions (506). Sealing this was a layer of

mid greyish-brown silty clay (505), which contained staining likely to represent the location of turf sections.

F504 contained three fills, comprising a basal deposit of light greyish-brown sandy silt (503), which was below a dark greyish-brown silty sand (502) with abundant pea grit and small gravel inclusions. The upper fill was a homogenous dark greyish-brown silty sand (501). A final layer of dark grey/black silty clay topsoil and turf (500) overlay upper ditch fill 501 and sealed the upper layers and deposits in the trench. No finds were recovered from this trench.

5.5 **Trench 8** (Plan Fig. 3a, section 3b; Plate 7)
This trench was positioned to investigate the area to the east of a possible roundhouse feature. It was excavated onto natural subsoil (802), composed of a mixed grey to greyish-grey clay, present at a depth of 0.26m below ground level. This was sealed by a weathered subsoil of mid brownish-grey silty clay (801) and then a dark grey/black silty clay topsoil (800). The trench contained a single north to south aligned linear feature (F804).

Probable gully F804 was 0.24m wide and 0.09m deep, with moderately steep sloping sides and a concave base. It contained a single mid greyish-brown silty loam fill (804), sealed by weathered subsoil layer 801. No finds were recovered.

5.6 **Trench 10** (Plan Fig. 3c, sections 3d-e)
This trench was located to the southeast of a likely roundhouse structure and was positioned across a northeast to southwest-aligned linear anomaly identified from Lidar. Natural subsoil (1001) was present at a depth of 0.27m under root-disturbed dark greyish-brown clay silt topsoil (1000), and was cut by three northeast to southwest aligned small linear features (F1002, F1004 and F1006).

F1002 and F1004 were located towards the northwest end of the trench, with the former visible on the surface as a linear depression that corresponded with the location of the Lidar anomaly. F1002 was 0.61m wide, 0.12m deep and had a shallow concave profile. It contained a mid brown clayey silt fill (1003) and no finds were recovered.

F1004 was located to the southeast of F1002 and was 0.14m wide and 0.06m deep, with moderately steep sloping sides and a concave base. It contained a mid greyish-brown clayey silt fill (1005) and no finds were recovered.

F1006 was located towards the southeast end of the trench and was 0.18m wide and 0.14m deep, with steeply sloping sides and a concave base. It contained a mid brown clayey silt fill (1007) and no finds were recovered.

5.7 **Trench 15** (Plan Fig. 4a, section 4b; Plate 8)
This trench was positioned across an east to west aligned section of a banked enclosure system, as well as a stony mound thought to be a potential prehistoric cairn. The trench was excavated onto a mid brownish-yellow gravelly clay natural subsoil (1505), present at a depth of 0.44m below a mid to dark brown silty clay weathered subsoil (1501) and then a dark grey/black silty clay topsoil (1500).

The bank feature was located towards the centre of the trench and was 3.63m wide. It sealed a thin dark grey sandy silty clay buried soil layer (1504), which was below the core of the bank feature (1502). The core of the bank was 2.36m wide and 0.32m high, and consisted of granite rubble and blocks. The southwest portion of bank 1502 showed some indication that it was roughly faced with larger granite pieces. Overlying 1502 was an accumulation deposit of dark brown silty loam (1503), which contained large stone inclusions likely to represent tumble from the core matrix. No finds were recovered from the deposits forming the bank feature.

The mound feature located towards at the northeast end of the trench (1506) comprised a 0.46m thick deposit of dark brownish-grey silty clay, with abundant poorly sorted granite and gravels. The deposit contained large voids throughout and no finds were recovered. The feature is more like a spread/dump of stones rather than a cairn and may relate to the later mining activity in the area.

5.8 **Trench 16** (Plan Fig. 4c, sections 4d-f)
This trench was positioned to investigate a large, roughly circular raised area visible on the surface. It was excavated through a dark grey/black silty clay topsoil (1600) and a mid brownish-black silty clay weathered subsoil (1601), onto natural subsoil (1602), present at a depth of 0.31m below ground level

The raised area visible on the surface comprised a natural break in slope of the underlying natural subsoil. Towards the southeast end of the trench was a single discrete feature (F1604). This was 1.5m long and 0.22m deep, with an irregular shape in plan, gradually sloping sides and a irregular flattish base. The feature contained a mid brown silty clay fill (1603) and no finds were recovered. The irregular plan shape and profile indicates that this feature is a natural tree throw.

6. ASSESSMENT OF THE BULK SOIL SAMPLES

6.1 Bulk soil samples were collected from a series of features and deposits under the guidance of retained specialist Dr M J Allen and Vanessa Straker of English Heritage. Processing was by flotation and the residues were retained on 0.5mm mesh and residues fractionated into >5.6mm, >4mm and >0.5mm elements. The flots and residues have been sorted, with the results set out in Table 1 below.

Table 1. Results from bulk soil samples

Sample	Trench	Context	Reason for sample	Sample volume	Processed volume	Charcoal	Seeds	Insects	Finds
1	1	102	Dating of ditch	10 litres	10litres	8 (<0.5g)	1	0	0
2	5	513	Preserved buried soil horizon beneath bank	10 litres	10 litres	0	2	0	0
3	15	1504	Preserved buried soil horizon beneath bank	30 litres	10 litres	20 (<0.5g)	15	0	0

6.2 All samples contained frequent intrusive woody rootlets within the flots. Where palaeoenvironmental remains are recorded, these were mainly in the flots and are in very small numbers. The charcoal fragments are all very small in size (< 5mm). Because of the low counts recorded, species identification has not been undertaken for the purposes of this report.

7. DISCUSSION

7.1 The evaluation across the non-scheduled area at Crownhill Down was aimed at establishing the nature, date and importance of a number of features identified during earlier survey work, as well as in areas where archaeological remains have not been previously recorded. In many of the trenches largely negative results have been recorded, with features previously identified shown to be natural variations in a complex underlying geology or natural stone outcropping (see Allen in Appendix 2,Scrivener in Appendix 3 and 7.2 below), in particular what were originally thought to be prehistoric stone rows. Where features were recorded no associated finds were recovered and, with the exception of the pollen results from the buried soil in Trench 5, there appears to be only limited palaeoenvironmental potential.

7.2 Crownhill Down contains a complex geology of extensive clitter fields composed of boulder-size blocks, with these thought to have been formed as a result of periglacial activity in the Pleistocene period (Ball and Goodier 1968), where successive episodes of freeze/thaw have naturally sorted the boulders into distinct microrelief comprising stripes, runs and other patterns. These features, although naturally formed, have the appearance of ancient and eroded man-made linear structures such as walls, field boundaries and stone rows, for example what were thought to be features of this type in Trenches 3, 4, 6, 7 and 17. Examination of these features, where exposed in archaeological trenches, by Dr Mike Allen and Richard Scrivener (Consultant Geologist) confirmed that the majority were natural phenomena, showing no clear construction techniques, no former land surfaces, and with the geotechnical investigations confirming that many surface exposures continued to great depth into brecciated Head deposits.

7.3 The suspected prehistoric cairn or barrow targeted by Trench 15 was shown to be a probable more recent loose spread or dump of stones rather than a mound structure. There were also no associated features in trenches excavated in the vicinity (11-13) of possible cairns or barrows as recorded during earlier survey work.

7.4 Where trenches were excavated in the environs of what are currently thought to be prehistoric roundhouses, either negative results were recorded (Trench 9), or undated linear features were present (Trenches 8 and 10), which could belong to any period. This indicates that there is only limited potential for archaeological activity associated with the wider areas external to the roundhouses.

7.5 Within the small enclosure investigated by Trench 1, which is thought to be medieval in date, only a single linear feature was identified and there was no evidence for internal settlement or industry. The shallow and irregular profile of the ditch may be as a result of more recent animal impact and water channelling.

7.6 Excavations across leat features in Trenches 2 and 5 established the presence of surviving banks and ditches of these probable post-medieval features. In Trench 5, an interesting sequence of deposits associated with the leat was identified. There are two banks present, located on both the upslope and downslope sides, with the one on the southeast (downslope) side possibly an earlier prehistoric boundary, with the pollen evidence from the sealed buried soil beneath indicating that this could be Bronze Age in date (see Allen in Appendix 2).

7.7 The stone bank recorded in Trench 15 is certainly part of a field system currently thought to be medieval in date. It was not possible to obtain a sample for pollen from this deposit (see Allen Appendix 2), but the characteristics of the sealed buried soil perhaps indicates an earlier, possibly Bronze Age date.

8. CONCLUSIONS

8.1 The results from the evaluation indicate that the landscape of Crownhill Down has been less utilised than previously thought. Although archaeological features have been identified in some trenches, many of these would now be considered of lower importance, for example what was thought to be a cairn in Trench 15 is probably a later spread of stones associated with mining. It is also now possible to say with some certainty that many of the surveyed features investigated by trenches are naturally formed (eg the stone rows) and consequently, some of those not targeted are equally likely to be non-archaeological. There were also no artefacts recovered from any trench.

8.2 The investigation has, however, provided some archaeological interest, including the earthwork leats, banks and surviving, possibly prehistoric, buried soils. It has also confirmed that the complex geology of Crownhill Down means that it is clearly difficult to interpret and date surface features by non-intrusive methods alone.

9. ARCHIVE AND OASIS

9.1 The paper and digital archive and finds are currently held at the offices of AC archaeology Ltd, at 4 Halthaies Workshops, near Exeter, Devon, EX5 4LQ. They will be deposited at Plymouth City Museum and Art Gallery, Plymouth under the accession code AR.2010.7, along with any archive generated by subsequent work on the site. The OASIS (Online AccesS to the Index of Archaeological InvestigationS) number for this project is 80749.

10. ACKNOWLEDGEMENTS

The evaluation was commissioned on behalf of Wolf Minerals Ltd by Jim Bonnor of Groundwork Archaeology Ltd. The site trial trenching was carried out by Simon Hughes, Chris Caine, Marc Cox, Kerry Dean, Stephen Robinson and Pete Smith. The illustrations for this report were prepared by Sarah Cottam and Cain Hegarty. The advice and collaboration of Stephen Reed, Devon Archaeology Officer, is duly acknowledged.

11. REFERENCES

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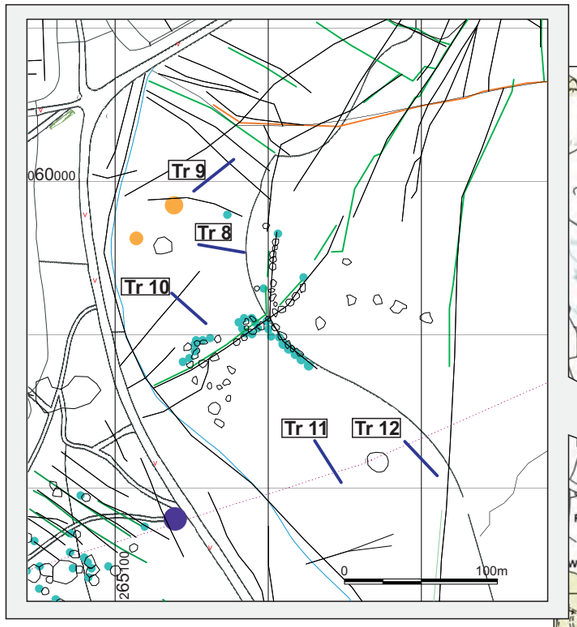
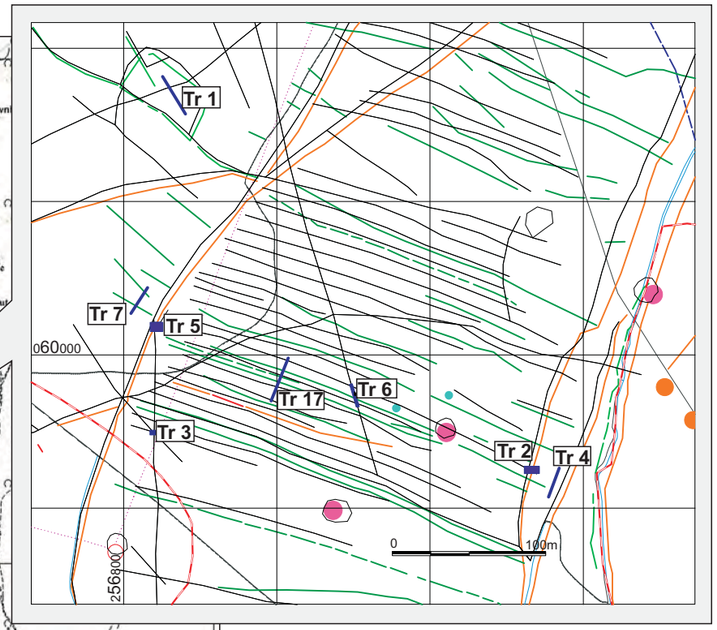
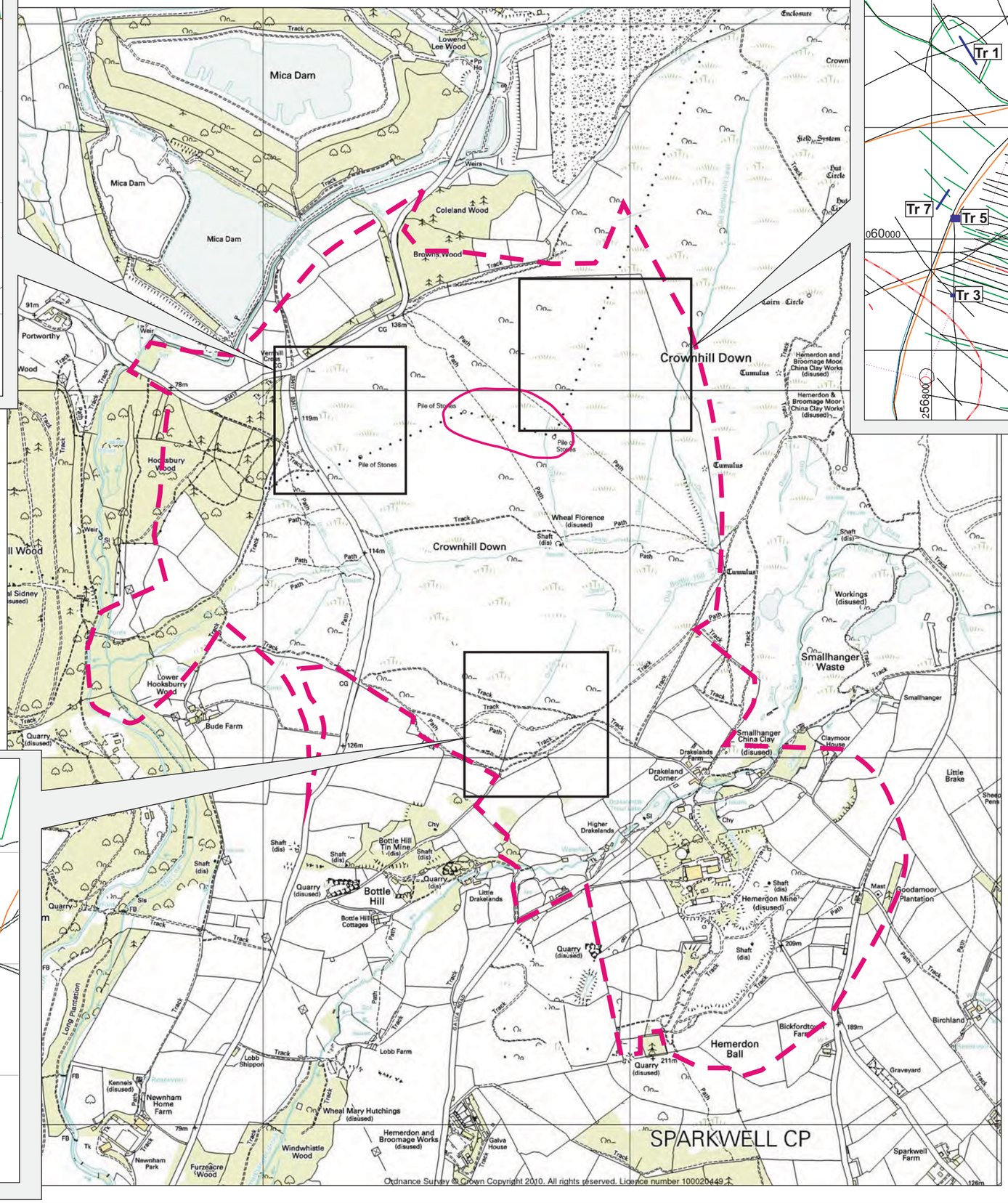
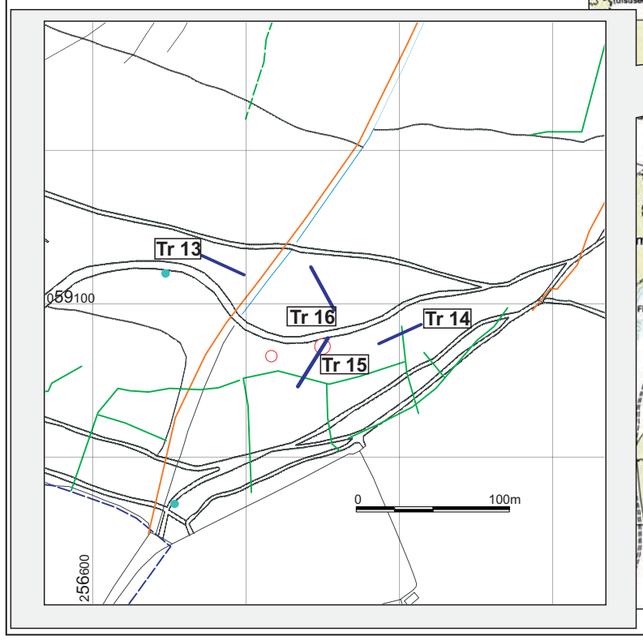








Trench
SAM Area
Lidar Feature
Bank Prehis
Bank and Ditch, Med
Mank, Med
Stone Line
Leat
Streamwork
Hut Circle
Cairn
Pit/shaft
Bomb Crater
Stone
Site Boundary

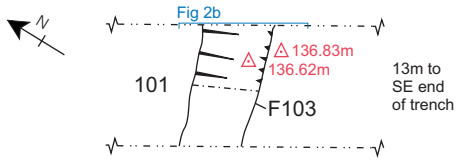
PROJECT
Crownhill Down, Hemerdon - Non-Scheduled area

TITLE
Fig 1: Site and trench locations

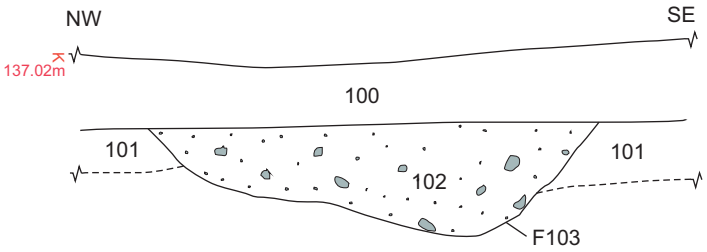
AC archaeology

Trench 1

a) Plan

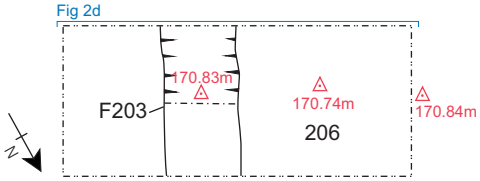


b) Section, F103

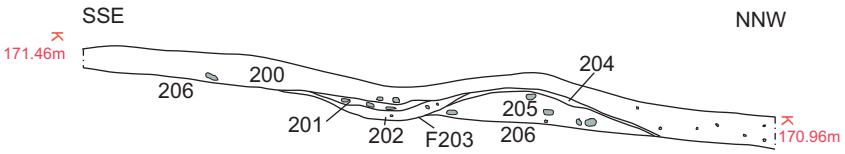


Trench 2

c) Plan

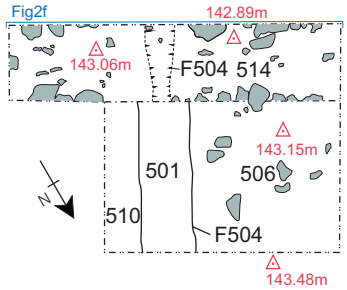


d) NE facing section



Trench 5

e) Plan



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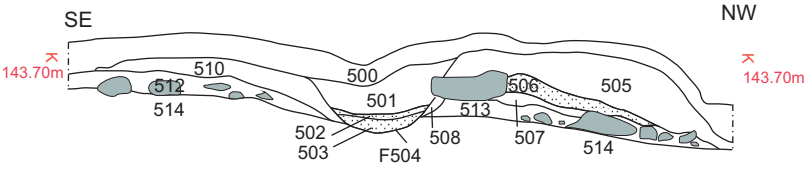
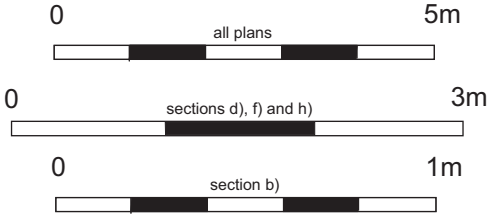




Key

Stone

Sand

AC archaeology

PROJECT

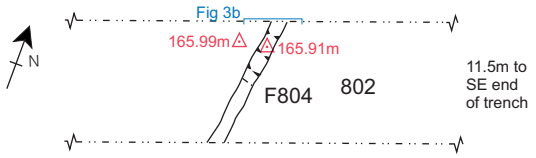
Crownhill Down, Hemerdon - Non-Scheduled area

TITLE

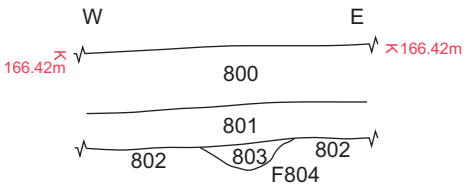
Fig. 2:
Plans and sections, Trenches 1, 2, and 5

Trench 8

a) Plan

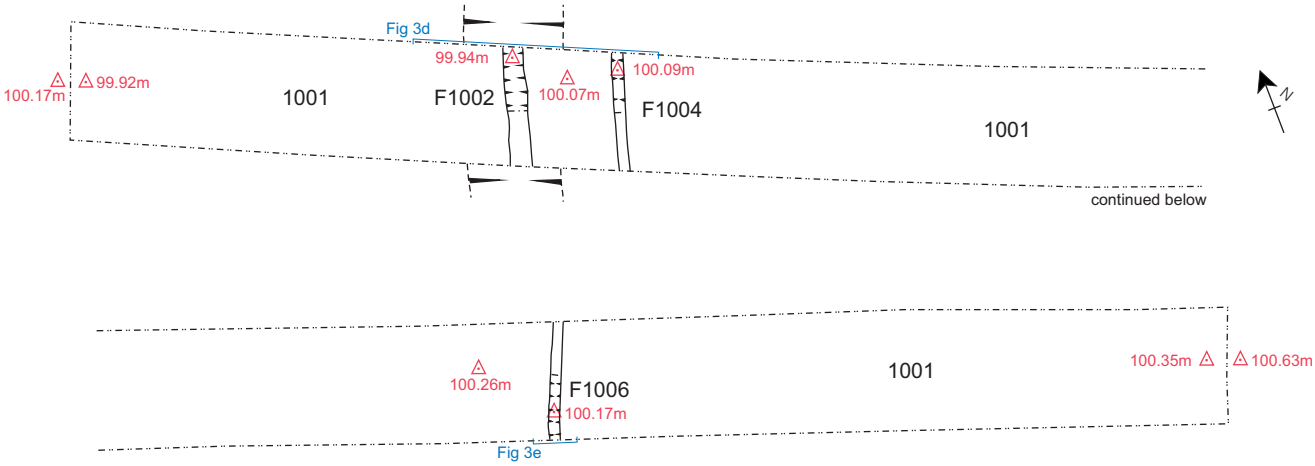


b) Section F804



Trench 10

c) Plan



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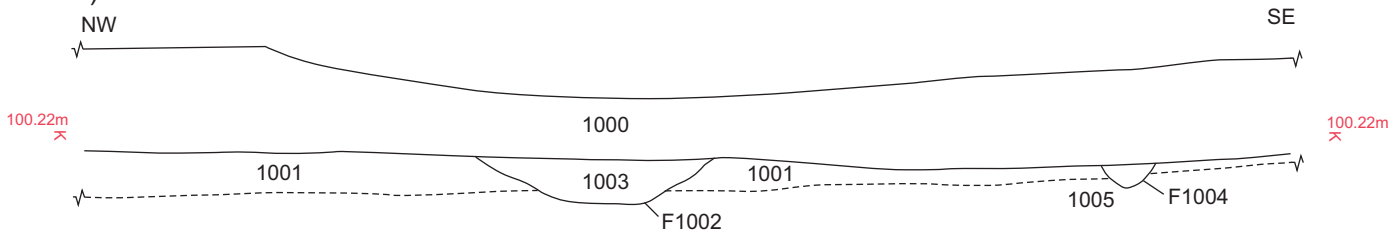

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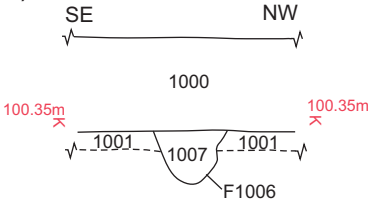


0 5m
all plans

0 1m
section b)

PROJECT

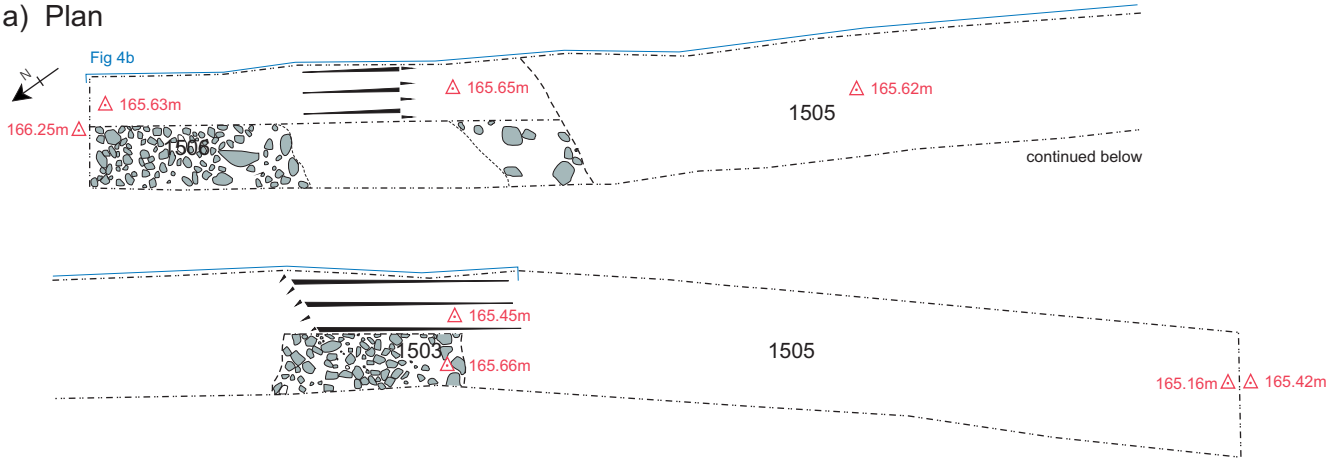
Crownhill Down, Hemerdon - Non-Scheduled area

TITLE

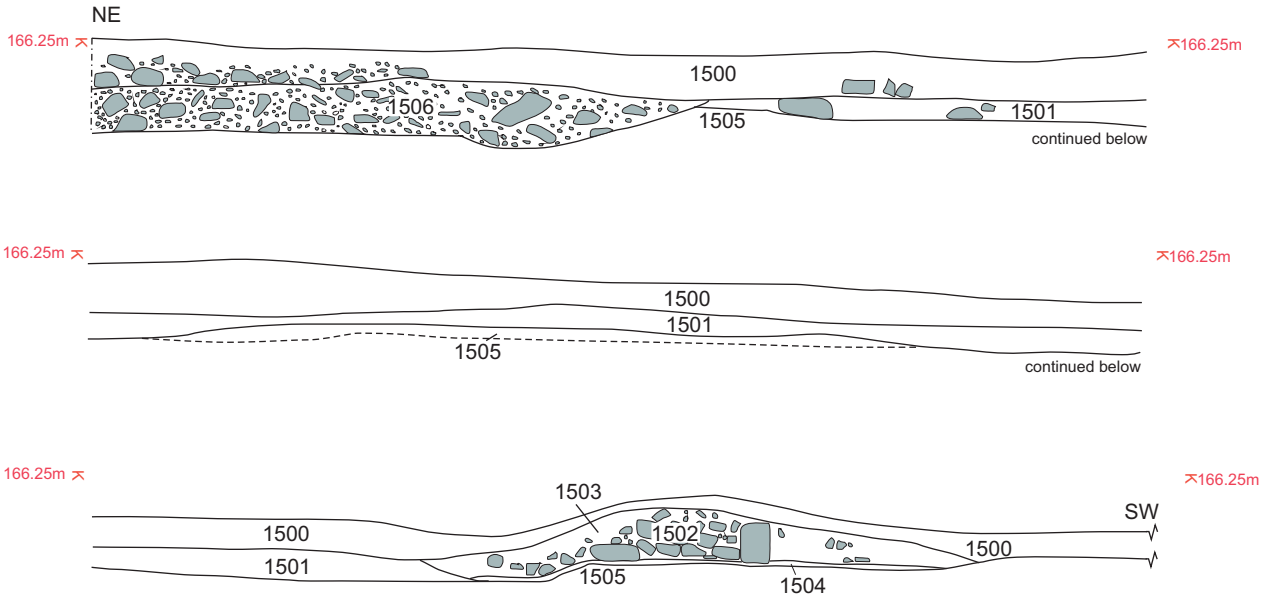
Fig. 3:
Plans and sections, Trenches 8 and 10

Trench 15

a) Plan

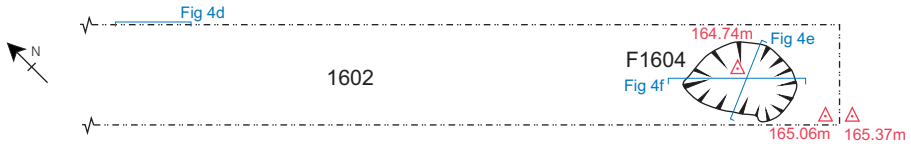


b) Section

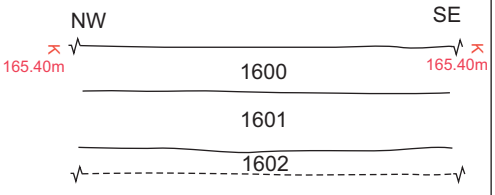


Trench 16

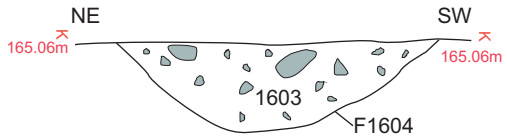
c) Plan



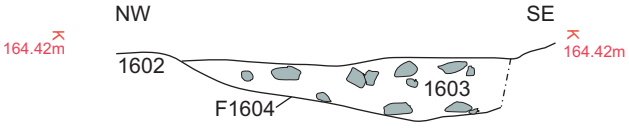
d) Representative section

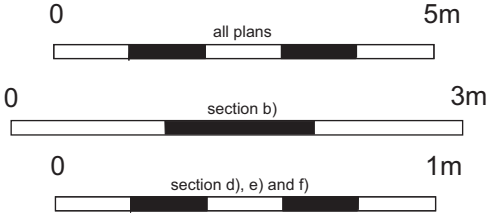


e) NW facing section, F1604



f) SW facing section, F1604





AC archaeology

PROJECT

Crownhill Down, Hemerdon - Non-Scheduled area

TITLE

Fig. 4:
Plans and sections, Trenches 15 and 16

Plate 1: Linear feature F103, Trench 1, view to northeast (scale 1m)

Plate 3: Natural outcropping (stone stripes) in Trench 4, view to northeast (scale 1m)

Plate 2: General view of Trench 2, looking southwest (scale 1m)

Plate 4:
View to southwest along leat investigated by Trench 5

Plate 5: Leat feature F504, Trench 5, view to southwest (scales 2 x 1m)

Plate 6: Natural outcropping (stone stripes) in Trench 7, view to northeast (scale 1m)

Plate 7:
Linear feature F804, Trench 8, view to south (scale 1m)

Plate 8: Section across bank 1502, Trench 15, view to north (scale 1m)

Appendix 1:
Descriptions of negative trenches

Appendix 1: Descriptions of negative trenches

Trench 3			**Length** 3m	**Width** 3m	**Alignment** N/A
Reason for position and outcome Targeting the position of three linear features identified from Lidar. These were established as being large stone inclusions protruding from the natural subsoil					
Context	**Description**	**Depth**	**Interpretation**		
300	Dark grey friable silty loam	0-0.18m	Topsoil		
301	Light grey silty clay with large stone boulder and frequent gravel inclusions	0.18m+	Natural subsoil		

Trench 4 (Plate 3)			**Length** 20m	**Width** 1.6m	**Alignment** NE-SW
Reason for position and outcome To investigate extrapolated line of recorded stone line feature. Stone feature encountered interpreted as a geological stone stripe					
Context	**Description**	**Depth**	**Interpretation**		
400	Mid grey firm silty loam	0-0.28m	Topsoil		
401	Dark brown firm clayey silt	0.28-0.4m	Weathered soil horizon (A)		
402	Mid red to light greyish-yellow clay with dense gravel and stone rubble inclusions	0.4m+	Natural subsoil		

Trench 6			**Length** 20m	**Width** 1.6m	**Alignment** NW-SE
Reason for position and outcome Targeting linear anomalies identified from Lidar and location of recorded stone line. No features exposed					
Context	**Description**	**Depth**	**Interpretation**		
600	Dark grey compact silty loam	0-0.27m	Topsoil		
601	Mid grey clay with gravel inclusions	0.27m+	Natural subsoil		

Trench 7 (Plate 6)			**Length** 20m	**Width** 1.6m	**Alignment** NE-SW
Reason for position Targeting position of recorded stone lines. Geological stone stripe exposed comprising stone protruding from natural subsoil					
Context	**Description**	**Depth**	**Interpretation**		
700	Mid grey firm silty loam	0-0.14m	Topsoil		
701	Dark brown firm clayey silt	0.14-0.26m	Weathered soil horizon (A)		
702	Mid to light grey clay with dense gravel and stone rubble inclusions	0.26m+	Natural subsoil		

Trench 9			**Length** 30m	**Width** 1.6m	**Alignment** NE-SW
Reason for position and outcome In environs of potential roundhouse and targeting linear anomaly identified on Lidar. No archaeological features exposed					
Context	**Description**	**Depth**	**Interpretation**		
900	Mid brown friable silty loam	0-0.12m	Topsoil		
901	Mid brown friable silty clay	0.12m-0.3m	Weathered soil horizon (A)		
902	Mid yellowish-red firm clay	0.3m+	Natural subsoil		

Appendix 1: Descriptions of negative trenches

Trench 11		**Length** 30m	**Width** 1.6m	**Alignment** NW-SE
Reason for position and outcome To investigate environs of cairn feature. No archaeological features exposed				
Context	**Description**	**Depth**	**Interpretation**	
1100	Dark greyish-brown friable silty clay	0-0.15m	Topsoil	
1101	Mid brown friable silty clay	0.15-0.25m	Weathered soil horizon (A)	
1102	Yellow firm clay with common poorly sorted stone inclusions	0.25m+	Natural subsoil	

Trench 12		**Length** 30m	**Width** 1.6m	**Alignment** NW-SE
Reason for position and outcome To investigate environs of cairn feature. No archaeological features exposed.				
Context	**Description**	**Depth**	**Interpretation**	
1200	Dark greyish-brown friable silty clay	0-0.15m	Topsoil	
1201	Mid brown friable silty clay	0.15-0.25m	Weathered soil horizon (A)	
1202	Yellow firm clay with common poorly sorted stone inclusions	0.25m+	Natural subsoil	

Trench 13		**Length** 30m	**Width** 1.6m	**Alignment** NW-SE
Reason for position and outcome 'Control' trench in area where no archaeological features were recorded				
Context	**Description**	**Depth**	**Interpretation**	
1300	Dark grey compact silty loam	0-0.16m	Topsoil	
1301	Mid brownish-grey friable silty clay	0.16-0.32m	Weathered soil horizon (A)	
1302	Mixed grey to yellowish-red silty clay with frequent poorly sorted stone inclusions	0.32m+	Natural subsoil	

Trench 14		**Length** 30m	**Width** 1.6m	**Alignment** NE-SW
Reason for position and outcome Positioned over extrapolated line of banked enclosure system. No archaeological features exposed				
Context	**Description**	**Depth**	**Interpretation**	
1400	Dark greyish-brown friable silty clay	0-0.36m	Topsoil	
1401	Mixed grey to yellowish-red silty clay with frequent poorly sorted stone inclusions	0.36m+	Natural subsoil	

Trench 17		**Length** 30m	**Width** 1.6m	**Alignment** NE-SW
Reason for position and outcome Positioned across series of recorded stone lines. Some bands of concentrated gravels with large stone inclusions protruding from the natural subsoil. No archaeological features present				
Context	**Description**	**Depth**	**Interpretation**	
1700	Dark greyish-brown friable silty clay	0-0.22m	Topsoil	
1701	Mid brownish-grey friable silty clay	0.22-0.32m	Weathered soil horizon (A)	
1702	Light reddish-brown to yellowish-grey firm clay with common poorly sorted stone inclusions	0.32m+	Natural subsoil	

Appendix 2: Geoarchaeological and palaeo-environmental assessment

Crownhill Down, Hemerdon, Sparkwell, Devon (ACD 157 Scheduled Monument DV1027 and ACD 155); *geoarchaeological and palaeo-environmental assessment*

by ***Michael J. Allen, PhD, MIFA, FLS, FSA***

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27th July 2010

for:-
Wolf Minerals Ltd

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Crownhill Down, Hemerdon, Sparkwell, Devon (ACD 157 Scheduled Monument DV1027 and ACD 155); geoarchaeological and palaeo-environmental assessment

Hemerdon Down lies on the south west margins of Dartmoor and the solid geology mainly comprises Upper Devonian Slates and mudstones, although there are small areas of Igneous Granite on the extreme eastern edge of the study area. The area was beyond the influence of glaciations but was subjected to prolonged periglacial activity during the Quaternary, with two major periods of formation of Head Deposits. A lower, Main Head may be of Wolstonian age and solifluction during this period has been proposed for the exposure of the Tors and upland rock outcrops, while the Upper Head of Devensian age was responsible for extensive blockfields or clitters (Stephens 1970; Charman & Newnham 1996, 11; Bennett *et al.* 1996; Harrison e*t al.* 1996). Today the area supports thin humic rendzinas and podzolic brown earths and is mapped as typical brown earths of the Denbigh 1 Association and typical brown podzolic soils of the Manod Association.

This report provides a comment on the Quaternary origin of the stone-strewn landscape, and on the current soils as background to the geoarchaeological potential (including soil micromorphology potential) and the palaeo-environmental (pollen) potential.

The sites at Crownhill Down, Hemerdon, were visited on 28th May and 2nd July 2010. A number of trenches and key archaeological features were examined with Chris Caine (AC Archaeology) and Jim Bonnor (Groundwork Archaeology). Advice on the deposits, and in particular of the definition and recording criteria of natural clitter and stones, versus man-made cairns or enhancement of natural geological arrangements/outcrops was given. Sampling and palaeo-environmental significance were discussed with the AC Archaeology team (especially Chris Caine), Phil Mcmahon (English Heritage Inspector of Ancient Monuments), Vanessa Straker (English Heritage Scientific Advisor), Stephen Reed (County Archaeological Officer), Richard Scrivener (geologist) and Jim Bonnor (Consultant, Groundwork Archaeology). Several locations were described in full and samples taken. This report provides the assessment of the geoarchaeology and pollen of the samples taken.

GEOARCHAEOLOGY

Preliminary geoarchaeological assessment of stone piles and stone rows

The area of Crownhill Down clearly has extensive clitter fields, that is boulder sized blocks, often with well defined joint surfaces, the surface morphology of such clitter spreads often reveal distinct microrelief comprising ‘stripes, runs and other patterns (Green & Gerrard 1977, 31). Clitter lines, superficially look like old denuded man-made linear structures such as walls, field boundaries and land divisions. A number of stone arrangements had been considered to be cairns, barrows or stone rows/banks and contributed to the character of this landscape and to the reason for the area being defined a Scheduled Ancient Monument. The definition of the background Quaternary geology is therefore important in clarifying the

geological or anthropogenic origin of these features. Preliminary examination in the field with Richard Scrivener (geologist) considered that a number of these, where they had been exposed in archaeological trenches, were natural phenomena.

Trial pits by Geotechnical Engineering Ltd, revealed typically 2-3m of subangular fine to coarse gravel, cobbles and boulders of metadolerite and schist, with in places thicknesses in excess of 4.5m Where trial pits revealed the contact, these gravel, cobbles and boulders overlay very weak very narrowly foliated greenish grey mottled light whitish grey phyllite recovered as angular and subangular slightly silty gravel and cobbles. The upper of these probably relates to deeply weathered and periglacially altered deposits mantling the solid geology, which has been subjected to surface alteration. The fact that many clitter spreads are not the mass waste products of geological tor demolition, but are related to *in situ* macrogelifraction of deep head deposits (see Harrison *et al.* 1996) such has have been demonstrated to occur on Crownhill Down, adds weight to their geological rather than anthropogenic origin. Further, archaeological examination defined no clear construction techniques, no former land surfaces, and confirmed that many surface exposures continued to great depth into brecciated Head deposits. It is possible that some of the natural features may have been anthropogenically enhanced, however, there was no positive evidence to confirm this.

A range of criteria was provided to the archaeological teams to ensure objective archaeological recording of such stone deposits and aid in the differentiation between, and definition of, 'natural' and human accumulations of stones (Appendix 1). In general, most of the piles of stones observed in the field, and discussed with Richard Scrivener (geologist) were considered to be a part of a relict periglacial landscape and created by processes of freeze-thaw (stone stripes), cryoturbation and solifluction. Field consideration that the solifluction deposits could be several, to many, meters deep, and blanket the landscape of which only the surface is exposed is demonstrated by the trial pits by Geotechnical Engineering Ltd.

Full discussion of the stones can be found in the geoarchaeological reporting of the site visit, including information derived from the borehole logs, combined with geological observations reported by Richard Scrivener (Appendix 4).

The soils of the area

Following discussion with English Heritage (V. Straker), a series of six natural soil profiles exposed in a number of trenches (Trenches 2, 10, 20 and 23) were described to aid in the characterisation of the present soils and to aid in defining the developing soil and land-use history. These descriptions are provided in Appendix 2.

Although the area is generally mapped as typical brown earths of the Denbigh 1 Association and typical brown podzolic soils of the Manod Association (Findlay *et al.* 1984), most of the soils exposed were thinner (0.4m thick) humic rendzinas or thin humo-podzolic brown earths (see Appendix 2). This provides important information when discussing the possible prehistoric buried soils (ACD 157 Trenches 10 and 30; ACD 155 trench 15), and medieval to post-medieval soils (ACD 155, Trench 5).

Geoarchaeology – the buried soils

A series of four buried soils were described in the field and sampled. All were sampled as small undisturbed soil samples (kubiena samples) of *c.* 80-1600mm × 60-80mm facilitating subsampling for pollen and consideration for manufacture of soil thin sections and subsequent soil micromorphological analyses.

The profiles were all described in the field following terminology outlined in Hodgson (1976), and more detailed description undertaken in laboratory conditions during the subsampling for pollen. The profiles are listed below.

ACD 157;	Trench 30	buried soil under ?ring cairn structure
ACD 157;	Trench 10	buried soil under bank/ditch
ACD 155;	Trench 5	buried soil under leat upcast/bank
ACD 155;	Trench 15	buried soil under ?bank/linear

Later Bronze Age buried soil under possible 'ring cairn' (ACD 157 Trench 30)

The possible ring cairn was sectioned in Trench 30, revealing a buried soil beneath boulders and large stones. Many of the boulders and large stones were heavily impacted upon, and pushed in to the buried soil, some by 20-40mm. The profile was described where the buried soil was best preserved and at its thickest. An undisturbed soil was taken where it was less stony (Fig. 1).

The buried soil was a *c.* 110mm thick humic acid brown earth, with iron panning and incipient gley at the base, possibly indicating the initialisation of podzolistaion from an earlier grassland or brown forest soil of a former woodland environment. Whether the profile had been truncated (deturfed) could not be defined in the field, nor in closer examination of the undisturbed sample (K2). A small 80 × 60mm kubiena tin was, with difficulty, inserted between the overlying stones and natural rocks (Fig. 1) and an undisturbed sample taken facilitating considerations for soil micromorphology and subsampling for pollen. Six samples were removed from the undisturbed sample (K2), see below, and assessed for soil micromorphological investigation (see below).

Figure 1. Buried soil under 'cairn', Trench 30, showing the location of Kubiena sample 2 <K2>.

Trench 30; 'Cairn' (ACD 157)

context	*Depth* (cm)*	*Unit*	*description*
	0-7	Ah	Very dark grey to black (10YR 3/1-2/1) humic silt with abundant fine and medium fleshy and fibrous roots (mat), structureless, under grass, clear to abrupt boundary
	7-19	A/C	Very dark grey to black (10YR 3/1-2/1) humic with common fine and medium fleshy and fibrous roots and common large stones Top of cairn
	19-25	C	Large Stones and boulders of cairn, abrupt boundary
Sample K2	25-36	Buried soil	Very dark brown (10YR 2/2) silty (clay) loam, structureless/massive, with some *Pteridium* roots/rhizomes with evidence of panning/gleying at base at boundary with silty schist. Clear to abrupt boundary Humic or acid rendzina
	36+	bCw	Brecciated schist

Kubiena sample 2 and details of pollen samples

Depth (cm)*	*Unit*	*Pollen samples*	*description*
0-6	bA	0-1cm 1-2cm 2-3cm 3-4cm 4-5cm	very dark grey (10YR 3/6) silt, weak small blocky subangular structure, rare very small qtz grits, with small stones at interface, abrupt boundary Buried soil (bA)
		5-6cm	Transition
6-8	bB/Rw	6-7cm	Brown (10YR 4/3) compact stone-free silty clay – structureless bB/Rw

*= depth in kubiena sample

Buried soil under bank (ACD 157, Trench 10)

A small bank and ditch exposed in Trench 10 was assumed to be a part of the prehistoric landscape. The bank preserved a shallow well-sealed buried soil which is very reminiscent of the prehistoric profile described under the possible ring cairn in Trench 30. The bank was *c.* 0.9m wide was *c.* 0.4m high and the section exposed a buried soil *c.* 10mm thick. The full profile was described and an undisturbed soil sample (K1) was taken of the base of the bank, the buried soil and the top of the weathered parent material ('natural'); seven subsamples were removed for pollen assessment, see below.

Trench 10; ditch and bank (ACD 157)

context	*Depth* (cm)*	*Unit*	*description*
	0-9	Ah	Very dark grey / black (10YR 3/1-2/1) humic stone-free silt loam with strong medium crumb structure under grass, abrupt boundary
	9-18	A	Very dark grey (10YR 3/1) humic stone-free silt loam, small subangular blocky structure, clear boundary
	18-27	bank	Dark greyish brown to dark brown (10YR 4/2 – 5/2) silt loam to silty clay loam, with some small and medium subangular and subrounded stones
Sample K1	27-36	Buried soil	Very dark brown to black (10YR 3/1 – 2/1) humic stone-free with medium moderate blocky structure, clear boundary
	36+	Rw	Fine stony parent material

Kubiena sample 1 and details of pollen samples

Depth (cm)*	*Unit*	*Pollen samples*	*description*
0-2	bank	0-1cm	Loose dark brown (10YR 4/2) silty loam, with few small and medium stones, clear to abrupt boundary Base of bank
2-11	bA	2-3cm 2-4cm 6-7cm 8-9cm 10-11cm	Firm very dark grey (10YR 3/1) stone-free humic silt loam, with some small and medium subangular and subrounded stones
11-13	bA/C or bRw	12-13cm 14-15cm	Loose very dark greyish brown (10YR 3/2) silty loam with common small stones

*= depth in kubiena sample

This is a shallow brown earth soil, and again both field and laboratory examination could not confirm with a high degree of certitude whether the old landscape had been truncated (deturfed). The clear to abrupt boundary with the bank, and the slightly firmer nature and better distinguished crumb structure just below the contact, however, does suggest the presence of a full soil profile.

Undated buried soil under bank/linear (ACD 155, Trench 15)

A thin (*c.* 40mm thick) buried soil clearly sealed beneath the undated bank in Trench 15; this was fully described and four contiguous samples removed for consideration for pollen assessment analysis. The thin nature of the soil and stoniness of deposits above and below prevented removal of an undisturbed sample.

Trench 15 buried soil (ACD 155)

context	*Depth* (cm)*	*Unit*	*description*
	0-35	Bank	Large and medium stones, some pushed into surface of buried soil, abrupt boundary
	35-39	ols	Dark brown stone-free silty humic massive soils (n structure observed), some light yellowish brown inclusions and mottles, with clear to abrupt boundary
	39+	R	Parent material

Medieval – post-medieval buried soil under leat upcast/bank (ACD155, Trench 5)

One of the presumed medieval / post-medieval leats was sectioned in Trench 5. The leat has two banks, that upslope (on the left of the photograph, Fig 2), was a banded yellowish brown coarse sand with common fine subangular and angular 'grits' over a light greyish brown humic massive silt. These are reminiscent of a buried podzolic soil profile sealed by 'grits' and material cleaned out from the leat. In contrast the downslope (right hand side on Figure 2) was marked by a large stone sitting on a dark grey 'greasy' compact humic stone-free buried soil, behind which was a banded deposit of small and very small subangular and angular stones. Overlying this was a well-defined lens of very dark grey/black soft humic silt with weak small-medium crumb structure and few/rare small and very small stones which is assumed to be Ah material and represent a turf.

There are clearly two banks; that upslope is simple and seals a greyish humic podzolic soil profile, presumably contemporary with the leat the soil profile which we assume to have developed as a result of human activity, deforestation and establishment of grass / graze. In contrast that on the downslope side seals a humic rendzina or brown earth and the stone

and bank against which the leat abuts may, therefore be a prehistoric boundary, with the leat constructed with material cast upslope, and later cleanings cast on the downslope side. Re-cutting of the leat may be indicated by the turf over the buried soil, and the bank of grits on the downslope side (Fig. 2). The leat itself contained fine stones and grits.

Figure 2. The leat in Trench 5, showing the buried soil on the left sealed by grit, and the laminated sandier yellowish brown deposits cut from the leat on the right.

The buried soil was sampled in a small (80mm 60mm) kubiena tin, sample K3 (see Fig 3b), and described. Four samples were removed for pollen assessment. The undisturbed sample is very fragile, and loose, and is not suitable for soil micromorphological examination.

Figure 3a. The buried soil, and 3b) showing the undisturbed sample K3.

Kubiena sample 3 and details of pollen samples

Depth* (cm)	***Unit***	***Pollen samples***	***Description***
0-1.5cm	bank		small stones in humic matrix as below base of bank
1.5-8cm	Buried soil	1-2cm 2-4cm 5-6cm 7-8cm	Black (10YR 2/1) compact, almost greasy, humic silt loam, with some very small qtz grits, many fine fibrous and few flesh roots, weak small blocky subangular/large crumb structure bA

*= depth in kubiena sample

Soil micromorphology assessment

Three kubiena samples were taken from buried soils discussed above (Table 1). The buried soil exposed in ACD 155 Trench 15 was undated, and the stoniness precluded sampling.

The samples can potentially address a number of questions ranging from the monument/ feature specific, to the wider development of the soil history as a consequence of long-term land-use and human activity. Examination of the buried soil may be able to define the initiation and cause of podzolisation and identify activities such as deforestation, tillage and the presence of former cremation or funerary pyres, not detectable in the normal archaeological record. Thus the following series of questions can be postulated and addressed, via soil micromorphology, of the buried soils.

1) Possible ring cairn

i) Was the soil de-turfed for construction of the feature (and if so where was the turf re-deployed)?

ii) Is there evidence for pre-construction activity possibly relating to its construction such as trampling?

iii) To aid the determination of the function of the feature.

2) Land-use history and landscape development as a consequence of human activity

iv) Is there evidence of former soils and environments (i.e. brown forest soils of former woodland)?

v) Is there evidence of deforestation, e.g. burning and fine charcoal coatings?

vi) In which buried soils is there evidence of podzolisation (and heath formation)?

vii) When is podzolisation initiated?

viii) Was podzolisation an indirect consequence of human activities? And if so can this be identified i.e. deforestation, tillage etc., or is it natural development that has been accelerated by human action and activities?

ix) Is there evidence of tillage in any of the profiles, either in physical disruption, or by the presence of agricutans (dusty coatings) etc?

x) From examination of the three soils can a developmental history of human activity and its consequence to the development of the present day heathland be defined?

xi) On the basis of a postulated history of the development from woodland soils to brown earths (grassland) and podzolic soils (heathland), is it likely that the buried soil on the downside of the leat (ACD 157 trench 5) is prehistoric or post-medieval in date?

Location	***description***	***Sample and size***	***Dispatched for soil thin section manufacture***
ACD 157, T30	Buried soil under ?cairn	K2: 80 × 60mm	✓
ACD 157, T10	Buried soil under ?prehistoric bank	K1: 160 × 80mm	✓
ACD 155, T5	Buried soil under medieval/ post-medieval leat bank	K3: 80 × 60mm	×

Table 1. List of kubiena samples

It is clear that the most pertinent questions relate to the land-use and landscape development and for which dated and less ambiguous soils are needed. The most significant

sequences in this respect are clearly the soil beneath the possible cairn (K2) and that beneath the presumed prehistoric bank (K1), and these samples are being prepared as soil thin sections (Table 1). Sample K3 was loose and unsuitable for thin section manufacture and soil micromorphological examination.

Geoarchaeology/Soils discussion

There is clearly a developmental history of the soil here, and pre acid podzolic heathland soils are present beneath the possible ring cairn and banks, with ditches representing boundaries and local land division. Soils beneath banks and cairns are weakly podzolic brown earths of humic rendzinas, suggesting that deforestation and removal of thicker brown forest soils or argillic brown earths had occurred and soils developed under grassland become established Some podzolisation is present indicating the possible start of this process by the time the possible ring cairn was constructed. Soils under the later leat are clearly podzolic, and humic podzols exist further afield on Crownhill Down. The soils on the slopes are today, however, thinner acid brown earths and humic (gleyic) podzols. These changes relate in part to local topography, but the longer term changes relate to the long history of activity leading to the indirect creation of the heathland. The archaeological investigations here have the potential to, in part, document that change, and the human role in the development of the current landscape. It also has a profound implications on the nature of the past landscape resources and range of human prehistoric and historic activities.

PALAEO-ENVIRONMENT

Palaeo-environmental sample suite

Three undisturbed soil samples were taken, and subsamples from these and in the field yielded 37 pollen samples (Table 2). A small series of bulk samples were taken from dated archaeological features and buried soils by the excavators.

Location	*description*	*Sample and size*	*Pollen*		*Dispatched for soil thin section manufacture*
			Subampled	*assessed*	
ACD 157, tr 30	Buried soil under ?cairn	K2: 80 × 60mm	✓ 7	✓ 7	✓
ACD 157, tr 10	Buried soil under presumed prehistoric bank	K1: 160 × 80mm	✓ 12	✓ 8	✓
ACD 157, tr 5	Buried soil under medieval/ post-medieval leat bank	K3: 80 × 60mm	✓ 4	✓ 4	×
ACD 155, tr 15	Buried soil under bank	-	✓ 4	×	×

Table 2. List of environmental samples taken and considered in this report. Note the bulk samples taken by the excavators for charred plant and charcoal remains are not considered in this report.

Palaeo-environmental Assessment: Pollen
By Rob Scaife

Three profiles were selected and fully sub-sampled. These were assessed for pollen preservation and the nature of the vegetation history by Dr Rob Scaife. These reports have been edited by M.J. Allen to fit the format of this integrated report.

Samples taken from three buried soils (by Dr. M.J. Allen) have been examined for the presence of sub-fossil pollen and spores. It was anticipated that if present, data on the vegetation and environment of the site prior to construction of the features might be gained. They also provide the potential for reconstruction of the prehistoric landscape in which the features were constructed. Pollen has been recovered and preliminary palaeo-environmental results have been obtained. This report details the data obtained so far. The sequences examined are:- the soil under the possible ring cairn (ACD 157 Trench 30), the soil under the probable prehistoric field/boundary bank (ACD 157 Trench 10) an enigmatic post-medieval or prehistoric soils associated with the leat (ACD 157 Trench 5)

Pollen procedures
Sub-samples of 1-1.5ml were processed using standard techniques for the extraction of the sub-fossil pollen and spores (Moore & Webb 1978; Moore *et al.* 1992). Micromesh sieving (10μm) was also used to aid with removal of the clay fraction in these sediments. The sub-fossil pollen and spores were identified using an Olympus biological research microscope.
Pollen sums of between 150 and 200 pollen grains plus spores of ferns have been counted and pollen diagrams haves been plotted using Tilia and Tilia Graph (Figs 4-6). Percentages have been calculated in a standard way as follows:

Sum **=**	% total dry land pollen (tdlp)
Marsh/aquatic =	% tdlp + sum of marsh/aquatics
Spores =	% tdlp + sum of spores

Taxonomy, in general, follows that of Moore and Webb (1978) modified according to Bennett *et al.* (1994) for pollen types and Stace (1992) for plant descriptions. These procedures were carried out in the Palaeoecology Laboratory of the School of Geography, University of Southampton.

Late Bronze Age land surface underlying possible ring cairn (ACD 157, Trench 30)
A series of seven samples was examined from the old land surface beneath the 'cairn' (Fig 4).

Pollen sample	***Horizon***
0-1cm	
1-2cm	
2-3cm	bA
3-4cm	
4-5cm	
5-6cm	transition
6-7cm	bB/Rw

The following principal points are evident in the interpretation of this profile.

Pollen and spores have been recovered from the entire bA horizon (0-5cm) of this buried soil but was absent in the transition zone (5-6cm) and underlying bB/Rw (6-7cm). Pollen is abundant and preservation is good to moderate, and typical of acid soil profiles. Typical of soil pollen profiles, absolute pollen numbers decline markedly down the profile to absence in the lower bB horizon (Fig. 4).

The pollen assemblages are dominated by herbs and dwarf shrubs (Ericaceae) and shrubs (*Corylus*) with relatively small numbers of larger trees.

Trees and Shrubs: *Corylus avellana* (hazel) is important with values of 27% at the base but reducing in numbers upward to the top of the buried soil. *Alnus* (alder, to 18%) is present throughout except for the uppermost sample (0-1cm). There are generally low values of *Quercus* (oak, av. <10%) and sporadic occurrences of *Betula* (birch) and *Pinus* (pine).

Lower shrubs: Heathland taxa are important with *Calluna* (ling) becoming progressively more important toward the top of the soil (13% increasing to 46%). *Erica* is present sporadically.

Herbs: Overall diversity of types is small. Poaceae are dominant (peak to 60% at 3-4cm). *Plantago lanceolata* (1-3%) is more important in the lower part of the profile (5cm to 2cm). Chenopodiaceae also has greater importance (albeit small) in the lowest levels.

Spores: *Pteridium aquilinum* (av. 20%) and the liverwort *Anthoceras punctatum* (peak to 28% sum plus spores) are most important. The latter is especially important in the lower part of the profile as with Poaceae.

The vegetation and environment

It is clear that the on-site environment immediately prior to construction of the 'cairn' was one of heathland, probably dominated by *Calluna* (ling). Hazel scrub was probably existed locally along with occasional oak. However, these taxa are wind pollinated and records here could come from larger areas of tree growth farther afield.

Prior to the dominant heathland it appears that the site may have been a grassland/pasture as evidenced by the greater importance of Poaceae and *Plantago lanceolata* in the lower part of the profile.

There is no evidence for the habitat (presumably woodland) prior to the grassland and this is probably linked to the absence of pollen in the sub-soil which would have been biologically active brown earth soil.

Conclusion

Initially a wooded environment (not evidenced) cleared for agriculture and establishment structure was constructed on this heathland preserving the soil and its contained pollen. The pollen spectra also show the (ubiquitous in South West England) importance of hazel scrub/woodland.

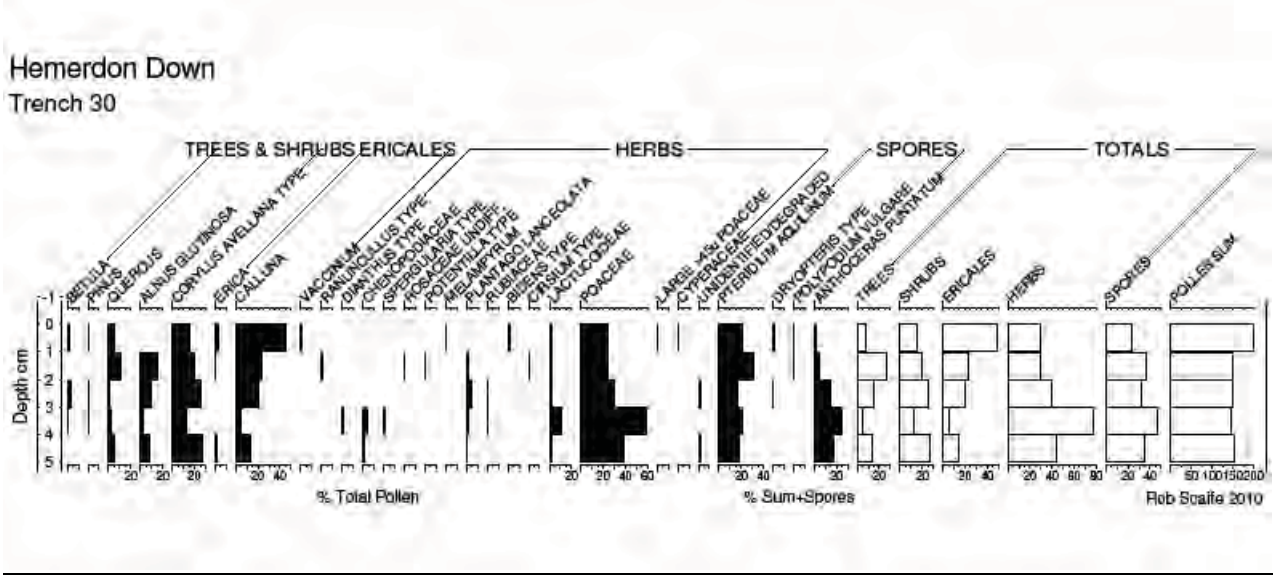

Figure 4. Pollen assessment diagram from the buried soil beneath the possible ring cairn in trench 30

Probable prehistoric land surface under bank (ACD 157, Trench 10)

Eight samples of the 12 taken through the bank, buried old land surface and weathered parent material were prepared and counted for pollen grains plus spores of ferns (Fig. 5)

Pollen sample	***horizon***
0-1cm	bank
2-3cm	bA OLS
4-5cm	
6-7cm	
8-9cm	
10-11cm	
12-13cm	
14-15cm	
9-10cm	
10-11cm	
12-13cm	bRw
14-15cm	

Samples the base of the bank (0-1cm) and preserved buried soil contain moderately abundant quantities of pollen whilst the basal samples from the weathered parent material

(bRw) of the old land surface (12-14cm) are sparse. Sufficient pollen was, however, obtained to produce a pollen diagram from which inferences regarding the prehistoric vegetation and environment prior to the bank construction can be drawn.

Although there are some changes in the pollen stratigraphy these are not considered to be of enough importance to warrant division into local pollen assemblage zones. This might change with additional analysis/counts. Changes where they occur are, however, discussed. The overall character of the sequence is described below.

Overall, the vegetation is dominated by Ericaceous shrubs with *Corylus avellana* type (bog myrtle and/or hazel) and Poaceae (/grasses).

Trees and shrubs*: Corylus avellana* type (hazel and/or bog myrtle) is most important with slightly higher value in the lower levels (to 28% declining to 15-20%). *Alnus glutinosa* (alder) similarly has higher values in the lower soil (bRW) levels (6%). In addition are smaller quantities and occasional occurrences of *Betula* (Birch), *Ulmus* (elm) and *Quercus* (oak; to 5%).

Dwarf shrubs*:* This category is most important with high values of *Calluna* (ling; to 70%) and *Erica* (heather; to 7%) which peak in the old land surface. *Calluna* values are at their minimum in the lowest level of the profile (14-15cm) at 18%.

Herbs*:* Taxonomic diversity is low with only a relatively small number of taxa present. Poaceae (grasses) are dominant with highest values in the lowest level (47%). After a decline corresponding with expansion of heathland taxa (largely *Calluna*) values increase to *ca*. 25% and maintain in to the lowest level of the bank. Other herbs include occasional cereal type especially throughout the buried soil, occasional *Plantago lanceolata* (ribwort plantain) and sporadic occurrences of Asteraceae (daisy/dandelion family) i.e. *Bidens* type, *Anthemis* type and Lactucoideae). There are occasional Cyperaceae (sedges) in the upper profile.

Spores of ferns*: Pteridium aquilinum* (bracken)) is most important although values are not high (to 6%). Also present are occasional monolete forms (*Dryopteris* type; typical ferns) and *Polypodium vulgare* (polypody fern). The latter has higher values in the lowest levels (13-14cm) to12% in the basal sample.

Interpretation

Because the old land surface and buried soil was sealed when the bank was constructed, it is the basic premise that pollen contained within the buried soil will represent the vegetation at and prior to burial of the soil. Clearly, this assumes that no contamination by more recent pollen from root channels or faunal (esp. earthworm) mixing has taken place. Being a soil, the view is also usually held that the pollen obtained derives largely from the vegetation growing on, or in close proximity to the sample site (Dimbleby 1985). With the exception of probable contamination, all of the above factors apply to this sequence/profile which provides useful information on the local prehistoric environment.

These soil pollen data are typical in that they appear to show a change/transitional phase from grassland to heathland with associated areas of intermediate hazel scrub woodland. This phenomenon was originally discussed by Dimbleby (1962; 1985) who demonstrated that anthropogenic activity, largely woodland clearance and subsequent agricultural activity, often resulted in soil degradation on poorer, especially sandy soils. With leaching and soil

acidification, pollen preserving conditions accrue. For this reason, the more base rich soils which would have existed prior to anthropogenic disturbance are not represented in the profile. Here, the only vestiges of the preceding woodland phase are the higher numbers of *Polypodium* fern spores in the basal sample. These spores are extremely robust and may remain in soils long after other (less robust) taxa have disappeared.

The highest grass pollen percentages occur in the basal levels along with hazel and it is likely that this represents pastoral activity after woodland clearance. This was progressively replaced by a dry heathland that was dominated by *Calluna* (ling) with *Erica* (heather) as soils became depleted. Because of the substantial quantities of Ericaceae pollen, it is suggested that this was the on site vegetation community (autochthonous). *Corylus avellana* type has relatively high values. This taxon includes bog myrtle (*Myrica*) as well as hazel (*Corylus*). Since there is little evidence of nearby wetland, it is strongly likely that here we are dealing with hazel scrub (see below).

From the start of this period of local heathland dominance, there is some evidence of cereal cultivation. It is unlikely that this arable activity was taking place actually on the site; soils appear to have been poor. It is more probable that cultivation was in the near region and that some opening of the vegetation on site allowed ingress of pollen from greater distances. Alternatively, this may also represent local intensification of arable cultivation at this time.

It appears that local/on-site woodland had been cleared for agriculture. Hazel (*Corylus*) is, however, relatively important here and although this tree/shrub produces copious quantities of wind disseminated pollen, numbers recorded suggest some local growth. This was, perhaps, growth of secondary scrub after woodland clearance. The only other trees consistently recorded are small numbers of oak (*Quercus*) and Alder (*Alnus*) both of which, because of their small values, are not considered to have been of local significance at this time. The former would have derived from valley mires and fringing streams. Sporadic birch and elm are not regarded as significant.

Summary and Conclusions

The following principal points have been made.

- This buried soil contains sub-fossil pollen and spores in sufficient numbers to provide information on the on-site vegetation and environment prior to construction of the bank.

- Pollen counts have been made on 8 samples and a pollen diagram has been constructed.

- It is suggested that woodland clearance was responsible for soil acidification and providing suitable conditions for pollen preservation. i.e. acidification.

- Initially, there is some evidence of grassland, possibly pasture.

- Grassland was progressively replaced by heathland which was dominated by *Calluna* (ling).

- There is some pollen evidence for local cereal cultivation probably in the vicinity, but not on the sample site.

- There are only very small numbers of trees with low levels of oak and alder consistently present and sporadic elm and birch. All are thought to be from regional rather than local sources/tree growth.

- *Corylus avellana* type is suggested as being of hazel rather than bog myrtle and, given the higher pollen values was probably secondary scrub after clearance of more dominant woodland.

- Overall, the sequence of events is typical of that found in many buried soil profiles of prehistoric date, period noted for heathland expansion and discussed by the late Prof. G.W. Dimbleby.

- This site and analysis has provided useful information on the prehistoric environment of the Hemerdon site and would repay some additional work for completion to publication standard.

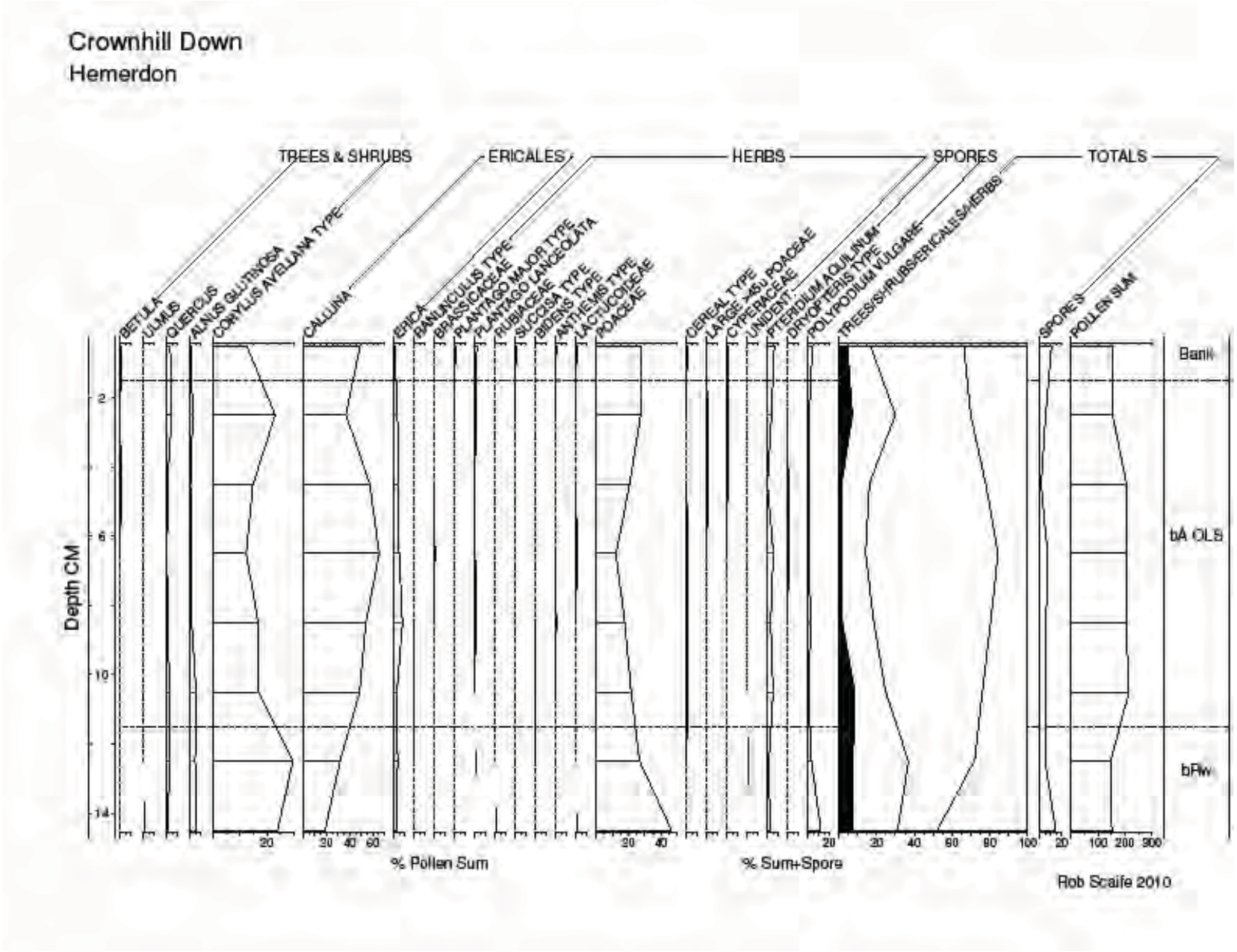

Figure 5. Pollen assessment diagram from the probably prehistoric buried soil in trench 10

Enigmatic post-medieval or prehistoric soils associated with the leat (ACD155 Trench 5)

This buried soil is associated with a post-medieval leat. However an earlier, possibly prehistoric date, has also been mooted as possible (M.J. Allen pers. com.). Pollen analysis is not a technique for dating but can, however, provide some useful indications of age when existing data is available for comparison.

Four samples were examined, all of which contained sub-fossil pollen and spores in substantial numbers (Fig. 6) comparable with the later Bronze Age bA soil horizon examined from ACD157 Trench 30.

Overall, the pollen assemblages are dominated by shrubs (*Corylus avellana* type; to 40% in lowest sample), *Calluna* which has consistently high values (40-55%) and Poaceae (increasing to 23% at top of soil) and along with *Erica* shows an important on-site heathland dominance. There are very few trees with only small numbers of *Quercus* and *Alnus* and sporadic long distance *Pinus* and *Ulmus*. Both the numbers and diversity of herbs are small and there are only small numbers of fern spores (*Pteridium aquilinum,* monolete *Dryopteris* form and *Polypodium vulgare.* The latter has greater numbers in the lower profile.

The medieval or Bronze Age question

As noted, pollen is not a dating technique. Here the later Bronze Age profile beneath the possible ring cairn in Trench 30 can be used as a comparison. In the former, there is evidence that grassland/pasture was replaced by heath as soils became degenerated. Such a transition from grass to heath derived pollen is not seen here and there is a clear dominance of heathland. Other comparisons are the smaller numbers of tree pollen although hazel is broadly comparable. Alder is notably less important in buried soil associated with the leat. This may of course be due to the site being at a farther distance from the river floodplain/wetland source.

Although there are some differences between profiles they are broadly similar when one might consider that medieval and later pollen spectra might be expected to contain a more diverse herb flora with cereal pollen, hemp, flax, for example. For this reason, a Bronze Age date is suspected for this profile. This is, however, extremely tenuous and by no means certain.

In the soil beneath the possible ring cairn (Trench 30) there is a clear change from grassland to heathland with strong deterioration in pollen down the soil profile. In this (Trench 5) section, pollen is present in quantity in the 4 samples analysed. It is probable that samples below 8cm may also contain pollen. These might display a similar change from grassland to heath as exhibited in Trench 30.

This sequence is comparable with the probable prehistoric soil beneath the bank (Trench 10) in showing change from grassland to heathland concomitant with soil deterioration.

Conclusion

This profile shows a dominant ling (*Calluna*) heathland with hazel scrub in the region. Herb diversity and tree numbers and diversity are low. Grasses are the dominant herb but could

derive from a range of plant communities including the on-site heathland. There is no definite evidence of the age of this soil but a prehistoric date is suspected but by no means sure.

Note on dating

There are concerns about the age of these soil profiles. Trench 30 is described as probably prehistoric underlying a possible ring cairn. Trench 5 is possibly prehistoric or medieval or later. For the pollen data to be meaningful, dating is of fundamental importance. In such circumstances, however, this can prove difficult. As noted, the upper levels of these two buried soils are rich in pollen and it might be possible, with a degree of effort, to bulk process for pollen and obtain enough to provide an AMS radiocarbon date/measurement. This would at least confirm suspicions regarding the dates suggested.

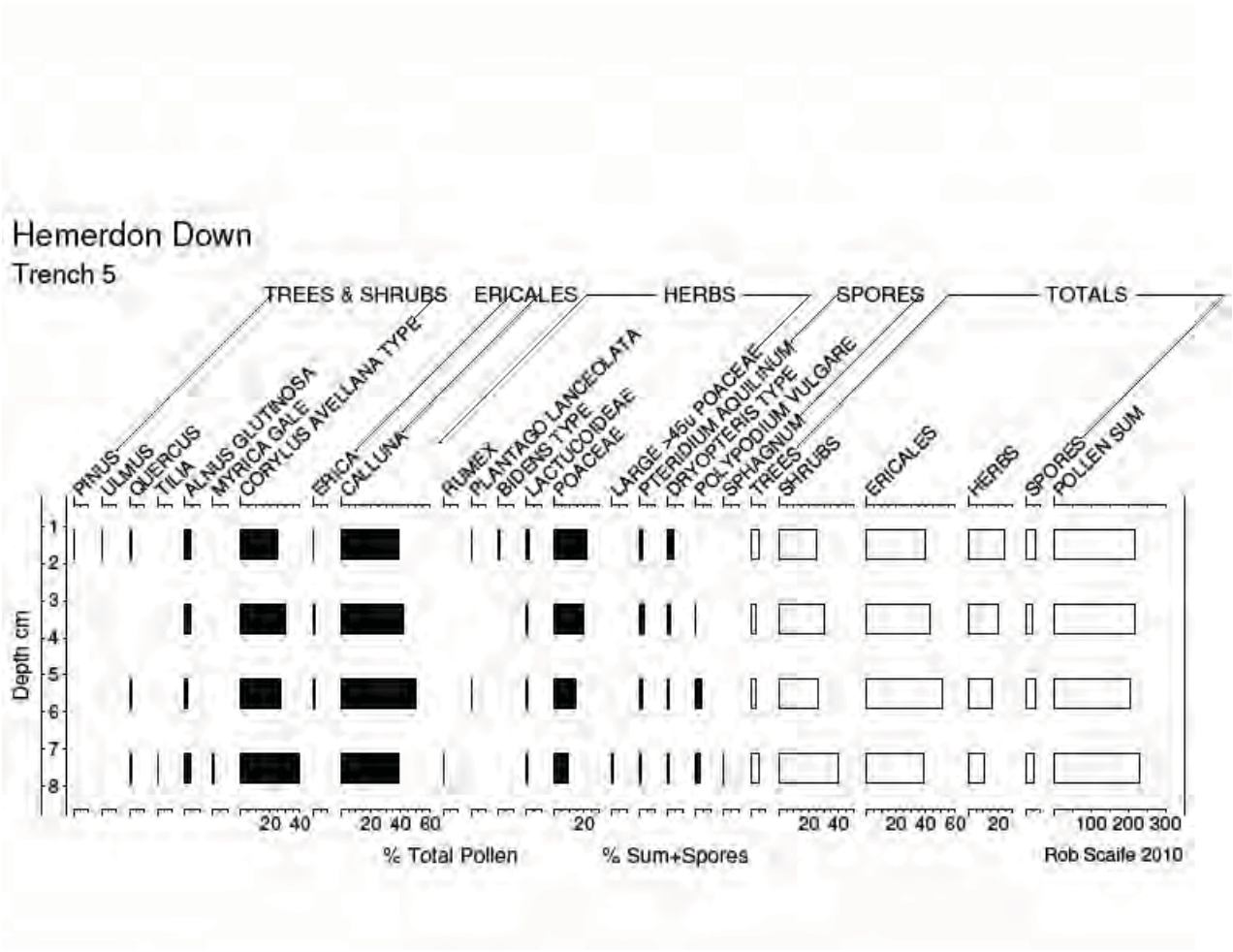

Figure 6. Pollen assessment diagram from the buried soils associated with the leat in Trench 5

PALAEO-ENVIRONMENTAL and GEOARCHAEOLOGICAL SUMMARY

The site visits, geoarchaeological record and assessment and pollen assessment provides some clear indications of the long-term human activity in this landscape. There is clear potential to define the local site histories and the combination of the geoarchaeology, soil micromorphology and pollen to provide a longer term history of the development of the heath. It seems likely that former post-glacial woodlands developed over the area but were removed by the earlier to middle prehistoric, but that evidence of their former existence may

survive as pedo-relicts in the soil microstructure. We can tentatively suggest from both the soils and pollen assessment data that open grassland ensued in the prehistoric period, and that podzolisation and the initialisation of heath occurred in the prehistoric period Whether this was purely due to deforestation, or whether it was instigated or accelerated by other human activities, such as tillage, is not certain but there is the potential to define such events from the soil micromorphology.

Evidence of any pre-cairn activity might be present in the soil microfabrics and thus there is the potential to elucidate construction and preconstruction activity if it existed, or to define that the possible ring cairn fits activity of its type at this location, and was placed in open land.

RECOMMENDATIONS

1. Soil micromorphological analysis is conducted on the samples from the soils beneath the possible ring cairn (ACD 157, Trench 30) and the probable prehistoric bank (ACD 157, Trench 10).

2. Pollen analytical programme. Clearly, the analysis of Trench 30 has produced the most useful data in terms of vegetation and environmental change prior to construction of the possible ring cairn. With certainty over dating, a full analysis for publication would be recommended. Standard pollen counts of 500-600 grains per sample are required for statistical accuracy. Additional counts might add to the taxonomic/plant diversity although scanning of the slides after counting suggested that the real plant diversity on the site at time of soil formation was in fact small.

   This should however, be conducted from the longer sequences associated with the probable prehistoric bank (ACD 157, Trench 10), and fuller analysis would act as an important useful counterpart to the data from Trench 30.

   Dating of the soils associated with the leat (ACD 155, Trench 5) is important. If this can be achieved, and the soil/sequence is medieval, this would provide a vegetation record for this period. Otherwise, it is not felt that any additional analysis would be required.

3. Geoarchaeology. The history of soil development, which is largely a consequence of prehistoric activities, is derived from the combination of the field record and assessment detailed above, and the proposed soil micromorphological analysis. The field geoarchaeological record therefore will need summarising and reporting for publication – in combination with the soil micromorphological and palynological evidence

4. Palaeo-environmental history. A summary and overview of the results of analyses proposed should be undertaken to provide a palaeo-environmental history, and briefly set it into the known regional and local data. It is likely that this data will make a significant contribution to the understanding of the south-western Dartmoor landscape and role of human actions in its development. We suspect that a potted prehistory and history of human land-use and occupation can be derived from this data, in

combination with the archaeological survey and record from Crownhill Down and the known and published archaeology in the broader area.

Acknowledgements

I would like to thank John Valentin for facilitating this work, Chris Caine for advice and assistance on site, Richard Scrivener for on-site discussion about the geology and Vanessa Straker for her comments and advice during the assessment fieldwork. Discussions in the field with Phil Mcmahon and Stephen Reed were extremely valuable, and the geotechnical trial pit data referred to was provided by Jim Bonnor. Finally I would like to thank Dr. Charly French for discussing and confirming the soil potential.

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APPENDIX 1
Criteria for recording stones

Some Criteria for recording and observing the stones

It is suggested that some of the following criteria may inform observations and objective recording of stones in the field. Here the record of absence of some criteria is important; such as the absence of a buried soil, the absence of any other than local stones etc.

Stone geology (type) – i.e. the clear record of stones that do not seem to form the local outcrops and which may be manuports deliberately brought in. These may include local granites, as well as other exotics

Stone geology (concentration) – the presence of stone-types in concentrations above that perceived to occur naturally. This may include concentrations of deliberately selected, collected and deposited stones such as quartz and stones with quartz veins all of which occur naturally locally

Buried soil – the presence, or absence of a buried soil beneath the deposits

Interface between the stones and parent material – in many places a granular bed of small and medium (i.e. up to c. 15mm diameter) stones was present under the piles of stones, and over the parent material (or 'natural'). This may represent the weathered surface of the exposed rock

Stone size ranges – concentrations of very large stones (i.e. in excess of 0.4m) may be indicative of natural accumulations, unless clearly placed and arranged. A record of the sizes, size ranges and approximate frequencies would be useful in characterising the stony areas; i.e. "mainly very large boulders (greater than 0.4), with few large stones (i.e. greater 20cm)".

Stone Orientation – a record of whether the stones seemed to be random jumbles, stacked, laid, or bedded

Stone angularity – a record of wither the stones are smooth and have rounded edges (rounded) or slightly smooth and slightly rounded edges (subrounded) or are less smooth and worn jagged edges (subangular) or are less weathered and more recently broken and jagged (angular). Most of the stones observed at ACD 157 were large and subangular, while those at ACD 155 creating the small 'cairn' at the northern end on trench 15 were smaller (typically hand size to 25cm) and were subangular.

Matrix – the material within the interstices of, and between, the main stones. These might be voids, humic soil material, smaller rounded stones etc

AEA; 29 May 2010

APPENDIX 2
Modern Soil profiles

Trench 2; modern soil profile 1

context	*Depth* (cm)*	*Unit*	*description*
	0-8	Ah	Very dark brown//black humic stone-free silt loam, with common to abundant fine fleshy roots and fine fibrous roots, well developed moderate medium crumb structure, clear to abrupt boundary
	8-17	A	Very dark brown, silty loam with some fine flesh roots, abrupt boundary into
	17-22	Rw	Loose small subrounded stones in brown to dark brown silty clay
	22-25+	Rw	Tumble of large stones and boulders

Comment: humic rendzina

Trench 2; modern soil profile 2

context	*Depth* (cm)*	*Unit*	*description*
	0-14	Ah	Very dark brown//black humic stone-free silt loam, with common to abundant fine fleshy roots and fine fibrous roots, well developed moderate medium crumb structure, clear to abrupt boundary
	14-32	stone	Stone
	32-34		void
	36-45	A	Very dark brown//black humic stone-free silt loam, with common to abundant fine fleshy roots and fine fibrous roots mat
	45+	C	stones

Comment: humic rendzina

Trench 10; modern soil profile 3

context	*Depth* (cm)*	*Unit*	*description*
	0-9/11	Ah	Very dark brown//black humic stone-free silt loam, with common to abundant fine fleshy roots and fine fibrous roots, well developed moderate medium crumb structure, clear to abrupt boundary
	11-34/6	A	Very dark brown, silty loam with some fine flesh roots, abrupt boundary into
	36+	Rw	Pale brown silty clay with few large and many medium and stones

Comment: humic rendzina

Trench 10; modern soil profile 4

context	*Depth* (cm)*	*Unit*	*description*
	0-11	Ah	Very dark brown//black humic stone-free silt loam, with common to abundant fine fleshy roots and fine fibrous roots, well developed moderate medium crumb structure, clear to abrupt boundary
	11-36	A	Very dark brown, silty loam with some fine flesh roots, abrupt boundary into
	36+	Rw	Pale brown silty clay with few large and many medium and stones

Comment: humic rendzina

Trench 20; modern soil profile 5

context	*Depth* (cm)*	*Unit*	*description*
	0-10	Ah	Very dark brown//black humic stone-free silt loam, with common to abundant fine fleshy roots and fine fibrous roots, well developed moderate medium crumb structure, clear to abrupt boundary
	10-21	A	Dark greyish brown stone-free silty loam to silty clay loam, clear to abrupt boundary
	21-30+	Rw	Pale brown (10YR 6/3-4) silty loam with rare medium and large stones

Comment: humic rendzina

Trench 23; modern soil profile 6

context	*Depth* (cm)*	*Unit*	*description*
	0-9	Ah	Very dark brown//black humic stone-free silt loam, with common to abundant fine fleshy roots and fine fibrous roots, well developed moderate medium crumb structure, clear to abrupt boundary
	9-19	A	Dark greyish brown stone-free silty loam to silty clay loam, clear to abrupt boundary
	19-27	Rw	Pale brown (10YR 6/3-4) silty loam with rare medium and large stones

Comment: humic rendzina

Appendix 3:
Periglacial and other features at Crownhill Down

Periglacial and other features at Crownhill Down, near Hemerdon South Devon, England: a report on a site visit on 28th May 2010

for

Wolf Minerals Ltd.

by

R C Scrivener BSc, PhD, CGeol, FGS

Consultant Geologist,
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Posbury,
Crediton,
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EX17 3QE

28h July 2010

1 Introduction and Background

I have been asked by Mr Jim Bonnor of Groundwork Archaeology Ltd., on behalf of Wolf Minerals Ltd., to examine and comment on features encountered in archaeological excavations on Crownhill Down, near Hemerdon, South Devon. A site visit took place during the morning of 28th May 2010 and this report is a summary of my observations at that time, together with conclusions reinforced by a subsequent desk study.

2 Geology of Crownhill Down

Crownhill Down lies within 1: 50 000-scale British Geological Survey Sheet 349 (England and Wales) (Ivybridge). The original geological survey on the one-inch scale was carried out by Sir Henry T De la Beche between 1832 and 1835, and published as Geological Survey Old Series Sheet 25 in 1839. The six-inch scale geological survey of the district was carried out in the last decade of the 19th Century, and this work was incorporated in the one-inch scale Geological Survey New Series Sheet 349 (England and Wales) (Ivybridge), published in 1899. The site lies within the six-inch County Series Geological Survey Sheet Devon CXVIII SE, which was surveyed by W A E Ussher in 1894 (see frontispiece). There is no modern geological survey of the district, but the 1:63 360-scale map of 1899 was reprinted without revision at the 1:50 000-scale in 1974. Explanatory memoirs for the various surveys were published in 1839 (Report on the Geology of Devon, Cornwall and part of west Somerset, H T De la Beche) and 1912 (Geology of Ivybridge and Modbury, Ussher, HMSO).

The unenclosed part of Crownhill Down is shown, on Geological Survey Sheet 349, to be underlain by late Devonian slate, altered by thermal metamorphism of the nearby Dartmoor Granite. In the Geological Survey memoir (Ussher, 1912) these rocks are described as '*flinty siliceous hornfels'* and on the face of the manuscript geological map (1894) as '*hard, dark grey, quartz veined rock'*.

In the area visited during the site inspection, the last description proved to be accurate, as much of the material exposed in the archaeological trenches consisted of rather angular fragments, up to small boulder size (though mostly smaller), of dense, extremely hard, dark grey siliceous hornfels (thermally metamorphosed slate),

mostly with prominent white quartz veins. Some of the material appeared to have been replaced by fine-grained quartz-tourmaline rock, and some fragments of quartz-tourmaline and quartz-tourmaline-haematite veinstone were noted, but these were not abundant. No exposures of bedrock were seen, and it is considered that, in the absence of any evidence of sediment transportation (apart from local solifluction), that the fragmentary material described above is representative of the local bedrock.

3 Features observed during the site inspection

Although the time available did not permit more than a brief overview, it was evident that the undisturbed surface of the area around the archaeological excavations was similar to that of other high level areas within the metamorphic aureole of the Dartmoor Granite, in that a thin soil layer overlies bedrock at depths not usually exceeding 1.0 m and mostly much less. This soil layer includes locally derived, angular fragments of bedrock, particularly towards the base.

For the excavations I examined a northern group of trenches laid out to intersect linear 'stone row' features and the associated 'barrows'. I noted that the all of these features, when stripped of soil, were composed of locally derived angular to subangular rock fragments of dark-coloured slate and siltstone hornfels, with prominent quartz veining (Plates 1 and 2). The linear features were mostly between about 0.5 and 1.0 m wide and appeared to persist for some tens of metres downslope. The 'barrows' were up to several m in diameter and were composed of the same type of rock fragments as the linear features. In view of the lack of recorded human activity in and around these features, my first impression is that they are representative of 'patterned ground' formed in periglacial conditions and this is discussed further below.

At the southern end of the unenclosed ground, I was shown another mound-like feature. This was constructed from angular rock fragments with very fresh, sharp edges. Included in the pile was some mineralised vein material (quartz - tourmaline and quartz - haematite): there was relatively little interstitial soil material between the rock fragments, and I concluded that this mound was formed from spoil, probably from a mining trial.

4 Discussion and conclusions

'Patterned ground' is the term used to describe accumulations of rock debris in periglacial conditions, where repeated freeze-thaw cycles have sorted the material into distinctive patterns which may be linear as 'stone stripes' (Plate 3), mounds known as 'cryogenic mounds' , circular features and polygons (Plate 4). The processes forming these features are thought to include cracking, frost sorting, differential frost heaving and mass wastage (Durrance and Laming, 1982). Patterned ground is most usually found where hard rocks such as granite and metamorphic rocks (including hornfels) are subjected to prolonged periglacial weathering in tundra-like conditions. Examples have been described from the Dartmoor area, at localities including Staple Tors (Gurney, 1995), Great Mis Tor, Sheeps Tor and Hen Tor. Durrance and Laming (1982) note that '…*it is almost certain that the Devon features are a relic from colder conditions in the past, and that more widespread patterned ground is elsewhere concealed beneath the vegetation mat'.*

The linear features observed during the site visit correspond well with the detailed description of stone stripes at Staple Tors recorded by Gurney (1995) and I think it most probable that they are physical features of natural, rather than anthropogenic origin. They were most probably developed during the last glacial interval in tundra-like conditions, and subsequently buried by the development of the recent soil profile. Whether or not the mounds are of a similar origin is more problematic, but it is likely that the processes responsible for forming stone stripes may also have generated cryogenic mounds, given the large volume of fragmentary rock debris available.

The mound examined at the southern end of the enclosed ground is considered to be formed from mining spoil, probably from a trial for tin.

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Plate 1 Linear feature exposed in Trench 4 (*Photograph courtesy of AC Archaeology)*

Plate 2 Linear feature exposed in Trench 2 (*Photograph courtesy of AC Archaeology)*

Plate 3 Stone stripes on bedrock in Greenland *(Photo Steve D Gurney)*

Plate 4 Stone mounds and polygons in tundra, Greenland (*Photograph Steve D Gurney)*

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