# Drigg, Burnt Mound, Cumbria: Project Design for Post-Excavation Assessment (Execution Stage 1)


**Oxford Archaeology North**

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# SUMMARY

This report was produced at the request of English Heritage. It was originally written in 2000 prior to publication of *Management of Research Projects in the Historic Environment* (*MoRPHE*) (English Heritage 2006) and *Strategic Framework for Historical Environment Activities and Programmes in English Heritage* (*SHAPE*) (English Heritage 2008). However, the report has been redrafted in the spirit of both *MoRPHE* and *SHAPE*.

It presents the results of archaeological evaluation at the site of a putative Bronze Age hearth or burnt mound at Drigg, West Cumbria (SD 0450 9860), undertaken in October 2000 by Oxford Archaeology North (OA North). The work was commissioned by English Heritage following concerns raised by the Cumbria County Archaeologist and members of the Cumberland and Westmorland Antiquarian and Archaeological Society (hereafter CWAAS), regarding accelerated erosion of the site.

The site lies within a designated Site of Special Scientific Interest, approximately 400m to the north of a minor road between the coast and Holmrook railway station, and is exposed in the west-facing sea cliff. Significant peat deposits, preserved beneath dune sands, are visible in the *c*4m high cliff section, which presents a simple stratigraphic succession of boulder clay overlain by peat and other organic material, including well-preserved wood, and dune sands of varying depth. Features of archaeological interest lie within or immediately below the peat layer. The site was first described by Cherry (1982) as a 'hearth' in association with a large (possibly man-made) timber structure, interpreted as a platform, both of which were within the peat. Several flint implements were found indirectly associated with the complex, and it was noted that the 'hearth', first seen in 1966, had been substantially affected by erosion. Radiocarbon assay of charcoal from the 'hearth' gave dates suggesting its use in the late Neolithic or early Bronze Age.

In July 1999 and June 2000, the site was visited by OA North at the invitation of the Cumbria County Archaeologist, at which times the various elements of the site were still visible in section, although continued collapse at the base of the sea cliff demonstrated significant ongoing erosion. As a result, an evaluation sponsored by English Heritage was undertaken in early October 2000, when it was discovered that most of the exposed timbers visible in June 2000 had been destroyed by a rapid acceleration of coastal erosion, although the burnt layer still appeared significant. Two large fallen blocks from the cliff face were excavated and fully recorded. A stretch of cliff face, including the ‘hearth’ and a putative palaeochannel noted to the north, was cleaned and recorded by total station survey, supplemented by semi-rectified photography. The surrounding topography was surveyed using GPS and a further putative hearth was discovered exposed in the cliff face some 65m to the north of the evaluation site, although no excavation was undertaken on this feature. A geophysical survey was undertaken over the dunes to the north of the exposure to investigate the potential for further hearths, but this identified no anomalies of possible archaeological interest.

Two trenches were also excavated to establish the surviving extent of the archaeological deposits, Trench A examining the deposit of burnt stone visible in the section, and Trench B one of the extant timbers. All archaeologically significant deposits were sampled extensively for bulk plant macrofossil assessment, and arthropod and palynological assessment, and monolith samples were taken for radiocarbon dating. A large timber encountered during excavation was left *in situ*, having been protected by geotextile and re-buried.

 

This report represents the completion of the works to order the archive and assess the material detailed in an earlier project design; it presents a summary of the extant dataset, and an assessment of its further archaeological potential conducted in accordance with *MAP 2* guidelines (English Heritage 1991). It sets out proposals for the further analysis of aspects of that dataset, and a scheme for the publication of the results.

Having assessed the significance of the results, it is clear that the material warrants some further analysis, and publication, in order to present the implications of these results within the context of the archaeological landscape of the West Cumbrian coastal plain.

 

# ACKNOWLEDGEMENTS

Thanks are extended to the Cumbria County Archaeologist and members of the Cumberland and Westmorland Antiquarian and Archaeological Society (CWAAS), whose concerns, and continued monitoring of the site, prompted this programme of work. Particular thanks are extended to the staff of English Heritage, especially Tony Wilmott, for their invaluable advice. Thanks also go to Bill Harpur of the CWAAS, and also to Dennis Wooley, who organised help for the backfilling on the final day and who provided much interesting insight and background information on the area. All CWAAS members and local residents who took the time to come and help are gratefully thanked, particularly Mr Mouncey, who helped us out at such short notice.

Dr Sue Stallibrass (EH North West Regional Scientific Advisor) advised on the palaeoenvironmental work, and Dr Alex Bayliss and Dr Peter Marshall (EH Ancient Monument Laboratory) provided guidelines for radiocarbon dating. The geophysical survey was undertaken by Geophysical Surveys of Bradford.

The topographical survey was undertaken by Daniel Elsworth; the excavation and sea-cliff section recording was carried out by Daniel Elsworth and Matthew Town, with advice from Christine Howard-Davis; environmental analysis was by Elizabeth Huckerby. This assessment has been compiled by Matthew Town, Christine Howard-Davis and Elizabeth Huckerby; the drawings were produced by Daniel Elsworth and John Griffiths. *Appendix 1* was written by Peter Marshall, lately of English Heritage, Elizabeth Huckerby and Gordon Cook of SUERC. The report was edited by Jamie Quartermaine and Rachel Newman; the project was managed by Jamie Quartermaine.

 

# 1. INTRODUCTION

## 1.1 PROJECT BACKGROUND

1.1.1 The project is known as Drigg Burnt Mound, and has the English Heritage (EH) number 2779.

1.1.2 ***West Cumbria:*** the earliest settlement of Cumbria seems to have been concentrated on the lowland fringes, and the concentration of Mesolithic sites near the estuarine confluence of the rivers Irt, Mite, and Esk suggests that they were a major factor in attracting migratory and semi-sedentary groups to an area rich in marine and terrestrial resources. Relatively large amounts of fieldwork have taken place around the Esk Estuary (Bonsall 1981; Bonsall *et al* 1991; 1994), which have examined the Mesolithic development of the area. These place strong emphasis on the succession of marine incursions which dominate and to an extent dictate the archaeological record for the Mesolithic and early Neolithic periods, with the maximum incursion, in the mid-sixth millennium cal BC, resulting in a shoreline between one and one and a half kilometres inland of the present coast (Hodgkinson *et al* 2000, 66). At Eskmeals, on the southern side of the estuary of the Esk, it can be seen that the known Mesolithic settlement sites and lithic scatters relate to this former shoreline, and thus lie up to 1km inland, and there is an apparent progression westwards as the shoreline withdrew towards its present position, with Mesolithic/Neolithic assemblages generally closer to the present shore, and those of the Bronze Age closest (J Cherry *pers comm*, cited in LUAU 1996a). The latter are now suffering active erosion as a result of a growing level of storm damage, which is perhaps attributable to global warming, although other factors may well be playing a major part. The migration of the shoreline on the north side of the estuary is not so well documented, but its history is likely to have been similar.

1.1.3 ***Drigg:*** the site at Drigg (SD 0450 9860) is located to the north of the estuary of the rivers Esk, Mite and Irt (Fig 1). Evidence for prehistoric activity near Drigg was first identified in 1954, when flint nodules and flakes were noted on the sea shore at the foot of the cliff. Subsequent field examination of erosion patches within the dunes recovered microliths, and other flint tools, establishing Mesolithic and later activity in the area (Nickson and MacDonald 1955). Further work demonstrated concentrations of worked flints north and south of the Esk Estuary (Cherry 1965; Cherry 1982), producing a range of tools dating from the late Mesolithic to at least the early Bronze Age.

1.1.4 In the mid 1960s Cherry noted an 'organic band', evident in the cliff face at Drigg, for the first time. Vertical soil samples were taken for pollen analysis by Pennington, who published a pollen diagram (Pennington 1965), but the sequence was not dated absolutely. Almost 20m to the north of where Pennington took her samples, a layer of large tree branches or trunks was noted at the base of the cliff, and interpreted as the remains of forest submerged at the time of the maximum marine transgression, *c*4000bc. Pollen analysis suggested, on the basis of low levels of *Ulmus* pollen, that formation of the buried soil may have coincided with the Elm Decline, and thus it was possible that it was contemporary with the onset of the Neolithic period. Above the organic band, intercalated layers of sand and dark humus were taken to represent the encroachment of blown sand and the replacement of the forest by dunes.

 

1.1.5 The principal investigation of the site was published by Cherry in 1982. It was this work that first described the 'hearth', and a large timber structure, interpreted as a platform, which lay within the associated peat. At the time, TGE Powell and JWP Corcoran expressed the opinion (in Cherry 1982, 3-4) that the timber structure was man-made, although they stated clearly that there was no evidence for toolmarks. A single core, probably of Bronze Age type (*op cit,* fig 2.1), was found 'lying on the horizontal timber'; three other flint artefacts found within the peaty layer, but below the structure, would seem to be of Mesolithic date. A radiocarbon assay of charcoal from the 'hearth' gave dates of 2900-2507 cal BC (4135±55 BP; UB-906) and 2456-2039 cal BC (3780±55 BP; UB-905; Pearson 1979), suggesting its use in the late Neolithic or early Bronze Age.

1.1.6 ***Condition and Threat:*** Cherry (Cherry 1982, 5) had noted that the 'hearth' and the platform, which were first seen in 1966, had been substantially affected by erosion in the intervening years, exposing and thus damaging and ultimately destroying the surviving archaeological deposits. Following on from the publication of Cherry's work in 1982, the site was monitored by individual members of the Cumberland and Westmorland Antiquarian and Archaeological Society (CWAAS), but was not otherwise investigated. Monitoring at this time was restricted to establishing whether any further erosion of the 'hearth' or the associated timber structure had occurred, and photographing and measuring any detrimental change (D Wooley *pers comm*). A few further artefacts were recovered during this period, and a Neolithic leaf-shaped arrowhead is reported to have been recovered from the interface between the glacial clay and the peat (D Wooley *pers comm*).

1.1.7 The site was visited by Lancaster University Archaeological Unit (now OA North) in 1996 in the course of works commissioned by BNFL, but no particular change in the remaining elements of the site was noted (LUAU 1996a). A second visit in 1997, in the course of fieldwork for the North West Wetlands Survey (Hodgkinson *et al* 2000, 77), challenged the interpretation of the hearth, raising for the first time the possibility that it was actually a burnt mound.

1.1.8 Following the unusually high spring tides of 1999, representatives of CWAAS alerted the Cumbria County Archaeologist to the increasingly rapid deterioration of the site. As a response, in July 1999, the site was visited by OA North prehistoric and palynological specialists (Christine Howard-Davis and Elizabeth Huckerby) in conjunction with Dennis Wooley (CWAAS), during which visit it was confirmed that the site was under severe and imminent threat.

1.1.89 At that time, the various elements of the site described by Cherry (1982) were still visible in section, although widespread collapse at the base of the sea cliff made it clear that there had been a very recent episode of erosion. The cliff face, *c*4m high, presented a simple stratigraphic succession of boulder clay, overlain by peat and other organic material including well-preserved wood, and by dune sands of varying depth. Field observations suggested that the area of archaeological interest stretched approximately 65m northwards from the southern edge of the 'hearth' to a second charcoal deposit and putative hearth identified in the cliff section (Fig 2). No excavation work was undertaken on this second feature. The peat deposit was visible for some distance southwards from the known archaeologically sensitive area; to the north it appeared to have come to an end within 10-15m of the northernmost element of the archaeologically significant area.

 

1.1.10 In the course of the July 1999 visit, a single palaeoecological monolith was taken from the exposed section, to the south of the 'hearth', at the interface between the sand and peat. A very limited palaeoecological assessment of the monolith was undertaken to establish the level of survival of pollen within the peats; this was able to confirm the potential for further ecological work.

1.1.11 ***Monitoring of Coastal Erosion:*** the exposure in section of the 'hearth' in an actively eroding sea cliff, vulnerable at high tide and during storms, made it clear that its survival was limited, especially in view of accelerated erosion in recent years. To monitor this erosion, in November 1999, Dennis Wooley (CWAAS) placed a marker peg *c*3m in from the cliff edge, in order to continue monitoring erosion of the sea-cliff over the winter period. By 18th January 2000, the winter high tides had removed a further 1.5m from the cliff face (D Wooley *pers comm*).

1.1.12 Further inspection of the site by OA North in June 2000 confirmed continuing erosion of the cliff section. This apparent acceleration is possibly associated with the removal of a pipeline to the north, which acted as a breakwater for this stretch of beach (D Wooley *pers comm*), but there is also a likelihood that rising sea-levels combined with storm damage are having a secondary effect. By this time, erosion had resulted in the collapse of two large blocks of cliff deposits (*c*1.5 x 1 x 1.25m), incorporating parts of the 'hearth', which were inverted but otherwise intact, at the base of the cliff section. Their original provenance could be established with a reasonable degree of confidence, and there was potential to excavate these blocks in reverse stratigraphical order. A series of timbers observed in the section in July 1999 had been removed by the sea by June 2000.

1.1.13 Following the work documented in this assessment, continued monitoring of the cliff face resulted in a second phase of fieldwork by Sharon Croft (Croft *et al* 2002) in 2002 at the same location as the work reported here. This work identified further traces of unmodified timber and the 'cobbled surface' (*Section 1.3.5*, Elements 3 and 5).

## 1.2 PROJECT DESIGN

1.2.1 In response to the identified threat to the site, a project proposal (LUAU 1999) for an archaeological evaluation of the site was submitted to English Heritage. In response, English Heritage invited OA North to submit a project design for such an evaluation to investigate the surviving extent and quality of the resource and thereby establish the requirements for an appropriate mitigative response (LUAU 2000). The programme of fieldwork was undertaken in October 2000 before the start of the autumnal high tides and storms.

1.2.2 With reference to English Heritage's own agendas and research programmes, the report was originally written in 2000 prior to publication of *Management of Research Projects in the Historic Environment* (*MoRPHE*) (English Heritage 2006) and *Strategic Framework for Historical Environment Activities and Programmes in English Heritage* (*SHAPE*) (English Heritage 2008). However, the report has been redrafted in the spirit of both *MoRPHE* and *SHAPE*.

1.2.3 *SHAPE* (ibid) established the principle that all projects implemented or commissioned by English Heritage must meet at least one of the organisation's corporate aims and

 

objectives (*op cit*, 9), as set out in *Making the Past Part of Our Future*, English Heritage's corporate strategy for 2005-2010 (English Heritage 2005). The proposed Drigg publication project has the potential to address Corporate Objective 1A (English Heritage 2005; 2008), which seeks to ensure that research addresses the most important and urgent needs of the historic environment. Therefore, Corporate Objective 1A will be the Primary Driver of the project and the principal Activity Type required to deliver the project, as defined by *SHAPE* (*op cit*, 9), is Research. Specifically, the project is categorised as Sub-Programme Number 11113.110: *Realising the research dividend from past unpublished historic environment investigations* (*op cit*, 29).

## 1.3 SITE DESCRIPTION

1.3.1 ***Topography:*** the site lies on the coast, and had been exposed in section in the sea cliff at Drigg, some 400m to the north of the road providing access to the coast from Holmrook railway station (Fig 1). The location is typical of the western coastal strip, with the drift geology comprising low boulder clay cliffs, capped with dune sands and stabilised by low grassy vegetation. The underlying solid geology consists of New Red Sandstone (Geological Survey of Great Britain 1978).

1.3.2 The land is generally low and slightly undulating, with occasional shallow freshwater pools held by undulations in the underlying boulder clay. Sand dunes adjacent to the beach reach a maximum height of *c*4m, diminishing to the landward. Within 50-70m from the cliff edge there are extensive erosion patches which have exposed the weathered surface of the boulder clay. The upper part of the beach is made up of cobbles and sand, and, at normal high tide, the surf line reaches to within 10m of the foot of the cliff. Erosion and collapse, seen at the base of the cliff, demonstrate that spring tides and storm surges have brought the surf line to the cliff face.

1.3.3 The area is currently designated as an SSSI, primarily to protect a number of rare invertebrates. Public access is, however, unrestricted, with well-used paths running behind and through the dunes; cattle are grazed unfenced on the landward side of the cliffs. Further inland access is restricted by the presence of a BNFL low-level nuclear waste depository.

1.3.4 ***Site Description:*** all the features of archaeological interest lay within or below the peat. These were described in the course of the July 1999 visit, and from south to north were as follows:

- ***Element 1, The Hearth/Burnt Mound***: this was seen as a 3-4m long lens of greyish material (possibly burnt granite) with about 20% small fragments of charcoal. Most of the charcoal appeared to be comminuted wood, from ring-diffuse species; no other identifiable plant remains were noted. The deposit was clearly much reduced from that recorded by Cherry (1982), reaching a maximum thickness of *c*200mm. It lay largely within the peat, and its edges were clearly sealed by peat growth, but the highest part of the surviving lens lay directly below dune sands, as was noted by Cherry (1982, 5);
- ***Element 2, Timber structure***: this was represented by a single substantial timber lying horizontally within the peat, but close to its base. The surviving badly weathered timber was *c*2m long but there was no sign of any vertical pegs like those described by Powell and Corcoran (Cherry 1982, 4);

 

- ***Element 3, Unmodified timber within the peat***: earlier observers made no mention of the substantial band of ostensibly unmodified timber within the peat, which comprised baulks up to 150mm in diameter, with some brushwood;
- ***Element 4, Palaeochannel:*** immediately to the north of the timber (Element 3) was a steep-sided channel, apparently filled by peat. A deposit of large cobbles (Element 5) flanked the northern side of this feature;
- ***Element 5, Unmodified timber (?) and cobble deposit***: to the north of the palaeochannel, the cliff juts westwards in a narrow spur, not more than 2m across and *c*4m long, before falling back into a shallow embayment. A band of unmodified timber lay directly above the boulder clay in this area and was topped by an intermittent band of large cobbles, similar to those to the south. All were sealed by peat. Close examination of the timbers showed no sign of modification, but the presence of cobbles directly above them might imply human activity.

1.3.5 ***Preliminary Assessment:*** Element 1 was provisionally interpreted as a burnt mound, as there was burnt stone in association with it; however, morphologically there is considerable variance, in both size and form, of those identified elsewhere in both the county and the country (Nixon 1990; Ehrenberg 1991; Banks 1998-9; J Hodgson *pers comm*), and this identification could not be confirmed at that stage. Element 2, the timber 'platform', was clearly man-made but its function and original form were uncertain. Elements 3 and 5 of the group were less likely to be man-made, but there was an initial suggestion that these may have related to trackways (LUAU 1999).

1.3.6 The preliminary palaeoecological assessment of a monolith taken through the cliff section to the south of Element 2 pointed to there being an abundant, well-preserved pollen with extremely good potential for dating the structure and contributing to its interpretation.

 

# 2. ORIGINAL RESEARCH AIMS

## 2.1 AIMS

2.1.1 ***Evaluation Aims:*** the original aims for the evaluation were necessarily limited but addressed the following:

- to evaluate the extent, condition, and survival of the archaeological remains, particularly that of the 'hearth' (Element 1);
- to evaluate Elements 2 and 4 to establish origin, period, survival, and significance;
- to establish the stratigraphic development of the site;
- to establish a general chronology for the site;
- to set the archaeological features within their contemporary topographical and environmental context.

2.1.2 ***Overall Research Perspective:*** the results of the evaluation are set within the context of the following research questions for the West Cumbrian coastal plain:

- to what extent is there any continuity from earlier periods?
- what is the relationship between the 'hearth', the palaeochannel, and the associated wetlands?

## 2.2 OBJECTIVES

2.2.1 The primary objectives of the evaluation were as follows:

1. to record the general stratigraphy of the site;
2. to evaluate the surviving extent of the 'hearth' (Element 1) by geophysical survey;
3. to evaluate the stratigraphic context of Element 1;
4. to evaluate the detached blocks of strata from Element 1;
5. to evaluate the timber 'platform' (Element 2);
6. to complete the evaluation of the palynological potential of the site;
7. to evaluate the potential of the site for macrofossils and arthropods;
8. to investigate the local context of Element 1;
9. to date the principal elements of the site;
10. to assess the results according to MAP2 for their archaeological potential and make recommendations for further work as appropriate.

# 3. METHODOLOGY

## 3.1 FIELDWORK METHODS

3.1.1 A programme of evaluation was designed and undertaken to assess the survival, archaeological significance, and archaeological potential of the site. This section outlines the methodology of the work undertaken.

3.1.2 ***Survey of the Cliff Section:*** a *c*200m length of the coastline, encompassing all exposed elements of the site, was mapped using Global Positioning System (GPS) techniques to locate and record the features; this technique achieved an accuracy of better than ± 0.25m. The survey data were superimposed upon a rasterised 1:10,000 map image within a CAD system in order to provide a general site map (Fig 2).

3.1.3 That part of the cliff section in which the monument was exposed was recorded in some detail. The section was firstly cleaned and straightened manually to reveal an undisturbed vertical face; the stratigraphy was then recorded digitally using a total station (Plate 1). The digital data were output at a scale of 1:20, for use as a template for further manual annotation, thereby providing a level of detail greater than that originally proposed in the project design (LUAU 2000a). The control for the total station survey was located with respect to the OS National Grid using GPS.

3.1.4 In addition to the methodology defined in the project design, the section was recorded by digitally rectified photography. A series of control points was established on the exposed section by means of the total station survey and the section was then photographed in a near vertical plane. These semi-rectified photographs were then subject to digital correction using ARCHIS software, in order to produce a composite rectified photographic record of the cliff section. The results are presented as Plate 2.

3.1.5 ***Geophysical Survey:*** a rapid magnetometer scan was undertaken of a larger area, extending over 2ha, to attempt to identify similar sites in the wider vicinity. This was followed by a detailed magnetometry survey over areas identified as having potential by the magnetometry scan (Fig 3). The survey was considerably inhibited by the topography of the sand dunes and as a consequence it was not possible to undertake a detailed survey immediately adjacent to the evaluation site. Instead, the detailed survey was undertaken to the north of the site on more level ground and examined 0.25ha using a sample interval of 1 x 0.25m.

3.1.6 The survey areas were tied into the overall topographical survey using GPS techniques. The results are presented below (*Section 4.6*), and will be submitted to the Centre for Archaeology for incorporation in the English Heritage Geophysical Survey Database.

3.1.7 ***Identification of a suitable palynological site:*** the initial palynological assessment in September 1999 of peat between Elements 1 and 2 identified the survival of pollen within the peat, and therefore established the potential for further palynological work. Four monoliths and associated pollen samples were taken for further analysis in September 1999 and October 2000 (*Section 3.2.4*). In addition, further pollen samples were taken by Croft in 2002 (Croft *et al* 2002, 15), although no further work has been completed on these samples. Further analysis would be needed, however, to place the local sequence, defined with respect to the 'hearth', within a broader vegetational sequence for the locale. As this could be achieved solely on the basis of samples taken

from the site and needed to involve comparison with a local (within 1km) basin mire, a rapid appraisal of the surrounding landscape was undertaken to establish whether deep peats survived in the vicinity.

3.1.8 ***Evaluation Trenching:*** after the section was cleaned and recorded, two trenches were subject to manual excavation: Trench A (2 x 1m) investigated Element 1 and Trench B (2 x 1m) investigated Element 2, the surviving timber structure. To minimise disturbance and destabilisation of the dune sands and their vegetation cover, both trenches were excavated 'inwards' from the cliff face (Plate 3). Because of the unstable nature of the upper sand deposits it was necessary to support the upper half of the trenches; Trench A was widened by a further 0.3m on the north and north-east sides, and a further 0.6m on the south and south-east sides, in order to incorporate sandbags. Trench B was also widened by a further 0.3m on all sides, to incorporate the sandbags. Including the steps, Trenches A measured 1.3m by 2.6m, and Trench B 1.3m by 2.3m; the actual excavated area in both trenches was 2m by 1m, as specified in the Project Design (LUAU 2000a). The marker placed by Dennis Wooley in 1999 was maintained within a baulk immediately to the east of, and central to, Trench A.

3.1.9 Excavation of both trenches was undertaken in accordance with the techniques laid out in the OA North fieldwork manual (LUAU 1998, section 3). It utilised a variety of manual techniques to suit differing conditions, from rapid cleaning to excavation. Following removal of the sand overburden, the newly exposed surface of the peat deposit was cleaned to clarify any recognisable archaeological features, facilitate efficient stratigraphic excavation, and to produce a clear plan of the site. Deposits were then removed in reverse order of deposition. All deposits were extensively sampled for palaeoenvironmental analysis and as a check on artefact recovery.

3.1.10 All timbers exposed were examined *in situ* by an experienced wood specialist, in order to determine whether they were worked or otherwise modified. Where appropriate, exposed timbers were sampled for dendrochronological and radiocarbon dating.

3.1.11 The original positions of the detached blocks of deposits could be determined with reasonable confidence and, as the archaeologically sensitive deposits were essentially intact, it was deemed appropriate to evaluate one of them. Therefore the larger of the two (*c*2 x 1m) was excavated; as it was inverted, the stratigraphic units were investigated in reverse order.

3.1.12 ***Recording:*** all elements of the work were recorded in accordance with current English Heritage guidelines (*Management of Archaeological Projects, 2nd edition* 1991) and the best practices formulated by English Heritage's Centre for Archaeology; recording procedures are defined within the OA North fieldwork manual (LUAU 1998, section 3). The stratigraphy of the two evaluation trenches was cross-matched where possible and the sequence of the deposits is discussed below (*Section 4.3*). The positions of Trenches A and B are shown on Figure 2.

3.1.13 A detailed photographic record was compiled, recording both individual contexts and general views of the site taken from standard viewpoints at all stages of the excavation. Archivable black and white print film and colour transparency film was used, both in 35mm format. A photographic index was maintained using standard OA North *pro-forma* sheets. In addition, a digital camera was used to provide an instant record of the site.

 

3.1.14 ***Reinstatement:*** following the evaluation, the site was reinstated in accordance with the requirements of English Nature, in order to minimise further erosion. The evaluation trenches were backfilled by hand in sequential order, stratigraphic units having been preserved in separate spoil heaps to avoid contamination of the deposits. The western cliff-side edge of each trench was sand-bagged to produce a wall against which the deposits could be placed; it is envisaged that once the deposits have stabilised it will be possible to remove the sandbags, though this may take some time. The sand deposits were stabilised using a geotextile membrane, suitably pinned, and the turves were reinstated across the tops of the trenches. Despite this level of reinstatement, it was anticipated that the area of the trenches would have been lost to coastal erosion within six to twelve months, and indeed this proved to be the case (Croft *et al* 2002).

## 3.2 ASSESSMENT METHODS

3.2.1 ***Stratigraphic Assessment:*** all stratigraphic records have been entered on a database. These have been processed using the ArchEd matrix generator and editor. From these, a site narrative has been produced setting out the stratigraphic sequence of the site, and linking the disparate elements. The archive is presently held at OA North offices in Lancaster.

3.2.2 ***Finds Processing:*** finds recovery was in accordance with current best practice (current IFA guidelines for finds work) and are defined within the OA North fieldwork manual (LUAU 1998, section 14). No typologically significant or closely datable finds were recovered. All ecofacts were handled and stored according to standard practice (following current IFA guidelines), to minimise deterioration.

3.2.3 ***Environmental Assessment:*** environmental sampling and assessment was undertaken by OA North in-house specialists, using the procedures encouraged by Dr Sue Stallibrass (English Heritage North West Regional Scientific Advisor).

3.2.4 ***Palynological Methodology:*** in September 1999, a 0.50m monolith, from the interface of the lower sand and the organic/peat, was taken 0.44m south of the horizontal wood. Four samples, at 0.10m, 0.20m, 0.25m and 0.30m above the base of the monolith, were taken for pollen analysis. The samples were prepared chemically using the standard techniques of sodium hydroxide, hydrofluoric acid and acetolysis (Faegri and Iversen 1989). The samples were then mounted in silicone oil and examined with an Olympus BH-2 microscope using x400 magnification routinely and x1000 for critical grains. Counting continued until a sum of at least 150 grains had been reached on two or more complete slides. This was done to reduce the possible effects of differential dispersal under the coverslips (Brooks and Thomas 1967).

3.2.5 ***Plant Macrofossils Methodology***: bulk samples of at least 30 litres were taken from Element 1 and all adjacent peat deposits, as well as from a layer of humified material within the band of intercalated layers of sand and humified material. Samples of ten litres each from six of these bulk samples, from above the 'hearth', the burnt layer itself, and the peat layer beneath, and also from above and below the worked wood in Trench B, were floated and the flot collected on a 500µm mesh. A small representative sample from each of the very large organic flots was examined with a low power Wild/Leitz stereozoom microscope to assess for plant macrofossils: these are recorded on a scale of 1-5, of which 1 = rare and 5 = very abundant. The nature of the matrix of

 

the flots was recorded. The results from this evaluation are shown in Table 1 (*Section 5.3.5*).

3.2.6 Two 0.50m monoliths of the peat (organic layer) were taken immediately adjacent to the southern edge of the burnt layer. One of these was subsampled in contiguous 0.05m samples of approximately 25ml volume. These samples were wet sieved through 500µm and 2mm sieves and then allowed to dry before examination with a low power Wild/Leitz stereozoom microscope to record the nature of the matrix and the abundance of any plant macrofossils preserved in the samples. The plant material was identified using OA North's reference collection; the processing and presentation of macrofossil data was achieved using Tilia software (Grimm 1991).

3.2.7 ***Arthropods and insects:*** initial site inspection suggested that arthropods and insects would be present and that therefore formal assessment was not necessary (H Kenward *pers comm*). Three samples of 1kg were therefore taken from each significant context and these will be subject to analysis as part of the post-excavation programme.

3.2.8 ***Radiocarbon Dating:*** radiocarbon dating was proposed as the principal means of establishing an absolute chronology for the site. In recognition of the close proximity of the site to the Sellafield reprocessing plant and the neighbouring low-level radio-active waste storage facilities at Drigg, precautions were taken to assess the contaminant impact. On the advice of Dr Gordon Cook (Scottish University and Research and Reactor Centre (SURRC) at East Kilbride), two samples, each of two litres, of ground water were collected during the excavation to monitor levels of radiocarbon in case they are higher than normally expected and as a consequence could cause anomalous radiocarbon dates.

3.2.9 It was proposed that a sequence through the mound and associated features be tightly dated to provide as accurate a chronology as possible. To achieve this, accurately placed samples, surveyed using a total station, were taken from each significant layer using clean implements; these were double-bagged and placed in darkness in a sealed ten litre sample bucket.

3.2.10 The samples from the various contexts and types of organic remains, including wood samples, were sub-sampled in the laboratory under the guidance of Alex Bayliss and Peter Marshall of the Ancient Monuments Laboratory of English Heritage. These were submitted to English Heritage, together with two samples of ground water. In total, 11 samples were submitted (*Appendix* 1).

3.2.11 ***Dendrochronological Dating:*** samples of wood collected for dendrochronological analysis or, if inappropriate, radiocarbon dating were also submitted to the Ancient Monuments Laboratory for assessment. Additionally, subsequent storms in 2002 broke off a piece of timber tentatively identified as [19/1020] (*Section 4.5*) (Croft *et al* 2002, 23), which was submitted to Cathy Grove of Sheffield University, and is currently held by Nigel Nayling of Lampeter University.

 

# 4. SUMMARY OF FIELDWORK

## 4.1 TOPOGRAPHICAL SURVEY

4.1.1 A topographical survey of approximately 1ha of the surrounding landscape was undertaken, using GPS techniques. These provide an accurate record of the coast-line environs of the site and allowed assessment of the degree of truncation of the sea-cliff by continued coastal action (Fig 2).

4.1.2 To the north of the evaluation site, the peat deposits dipped sharply towards the present beach level at approximately 30°, ultimately disappearing as the deposits were obscured by wind-blown sand and beach cobbles. The sudden sharp slope has been tentatively interpreted as the edge of a possible palaeochannel or relatively small basin (Element 4, peat 37 in Fig 4). The area around the site was entirely covered by wind-blown sand stabilised by dune vegetation, but the palaeochannel still formed a shallow valley cut through the glacial deposits, and functioned as a drain for the land to the east, as witnessed during excessively heavy rains. The palaeochannel marked the northern extent of the area formally investigated in the course of this evaluation, but approximately 5m further to the north the land rose again as low (*c*10m) cliffs of reddish brown glacial sand and boulder clay. In a position probably coincident with the northern edge of this postulated channel or basin, approximately 4m above beach level, further degraded deposits of charcoal and burnt stone were noted, spreading in a band down the erosion slope, perhaps indicating another hearth. This deposit appears to correspond to that identified as 'Site A' in the original surveys conducted by Nickson and Macdonald in 1954, who described the site as being north of a 'shallow valley' and at the top of a cliff (Figs 2 and 4). Most of the finds recovered at the time were described as of Mesolithic date (Nickson and Macdonald 1955).

4.1.3 The southern edge of Element 4 was overlain by woody peat, above which was a layer of large water-worn pebbles, in a gritty orangey-red sand matrix, in a band approximately 0.2-0.3m thick. This layer ran north-eastward from the end of the recorded section, disappearing to the east where it was buried by dune sands. It was initially interpreted as a possible trackway and a close examination of the deposit did not absolutely counter this. Other examples of such trackways are known; for example, one of an early Bronze Age date has been recorded in Ireland (Mitchell 1990, 25). Previously, the cobble band was explained as evidence of a storm beach, with the cobbles thrown onto a peat exposure some time after its development (LUAU 1999), but the close association between the cobbles and the peat would seem to militate against this interpretation. An alternative explanation for the band of stones is that it formed as a result of the waterborne movement of stones down a river course.

4.1.4 Examination of Element 5 produced evidence of burning from between the cobbles, in the form of highly localised small deposits of bright red ashy material, possibly generated by the use of peat as a fuel. This must presumably offer evidence for the use of the cobbled area by man, if not for its original deposition. The section examined also demonstrated that the area of cobbles was limited in extent, running only 2-3m back from its cliff-face exposure. The extremely homogeneous nature of the deposit was clarified, with the marked consistency in size of cobble suggesting deliberate selection, and thus reducing further the likelihood that the deposit was the result of a natural event.

 

4.1.5 To the east of the site, the landscape comprised low undulating dunes, stabilised by dune vegetation, and with numerous small erosion patches revealing the underlying glacial deposits. Several small freshwater ponds were visible, particularly to the east of the main footpath (Fig 1), which are probably the accumulation of water above impermeable glacial deposits. Nickson and Macdonald (1955) and Cherry (1965) both highlight a number of flint findspots within this area, their recovery generally reflecting breaks in the ground-cover caused by weathering or animal action. Survey identified a number of hollows, which appear to be the result of human activity, perhaps quarrying for sand, supported by the depiction of sand pits on the Ordnance Survey (OS) 1st (1867) and 2nd (1899) edition maps. Those hollows directly associated with the site were recorded. Dennis Wooley (*pers comm*) has noted that the peat was also removed for use as fertiliser, and therefore there is an alternative genesis for the depressions; Jefferson's *History and Antiquities of Allerdale Ward* (1842, 109) describes how 'cartloads' of peat were recovered, and records that 'at low water, extensive plots of vegetable soil or peat moss are visible', giving some indication of the former extent of the peat deposits.

## 4.2 THE CLIFF SECTION

4.2.1 The section of the sea-cliff (Fig 2) directly associated with the 'hearth' (Element 1) and timber structure (Element 2) was recorded in some detail. At its maximum height, the section measured approximately 3.8m from beach level to the top of the dune cover; the area recorded was approximately 25m in length (Plate 2).

4.2.2 Natural glacial clay [18], which consisted of a series of laminated bands of sand and clay ranging between green and pink in colour, extended beneath the whole section, as well as continuing to north and south of the section subject to detailed recording (Fig 4). The earliest peat deposits in the sequence were noted at the northern end of the section, where (north to south) layers [37], [32], and [20] overlay the boulder clay and were probably in essence the same deposit; peat [37] appeared to follow the sloping sides of the putative palaeochannel. The entire deposit produced no evidence of anthropogenic interference and can thus be identified as a completely natural accumulation of peat. There was some variation, with [32] and [20] containing appreciably more wood (up to 95%) than deposits further north. Earlier work has identified it as a remnant of a relict forest within the peat, submerged at the time of maximum marine transgression *c*4000 cal BC (Pennington 1965). Layers [32] and [20] were obviously badly eroded by the percolation of groundwater through the basal peats. A small lens of yellow clay, [33], was noted within peat [32].

4.2.4 Above peat [37], at the northern end of the section, lay [36], a dense accumulation of wood. Three distinct bands could be seen within the deposit, the top and bottom elements consisting of very woody humified peat, whilst the centre was densely packed wood with large branches and other obviously unmodified timber within it. Its similarity to layer [20] suggests that it, too, was essentially part of the same deposit. Such dense accumulations of wood are not usual in peats along this stretch of coast. Three mechanisms might account for its presence: a natural accumulation on the edge of a watercourse; trees inundated by the natural progression of peat growth; or, as it lies close to the edge of a possible palaeochannel, a deliberately laid platform.

4.2.5 Further to the south, boulder clay [18] was sealed by [17], a layer of clayey peat, nutty brown in colour and containing *c*1% wood fragments, which was up to 0.25m thick. It appeared undisturbed, and lacked the element of charcoal seen in some of the upper deposits of peat, suggesting that it was free from human interference. Toward the centre of the recorded section, it was seen to overlie deposit [20], thus establishing the stratigraphic relationship. Further north, clayey peat [35], which overlay wood [36], is probably equivalent to [17], and must establish wood [36] as considerably older than 'hearth' deposit [15] (see below, *4.2.7*). Between deposits [17] and [36], the stratigraphic succession was less clear, with a confused group of lenses, [24] - [29], appearing to represent layer [17] and layer [14], which overlay it. It seems likely that one of these, [26], represents a continuation of [17], overlying layers [20] and [32].

4.2.6 Towards the centre of the recorded section there were several patches of humified peat [19], which were slightly lighter (orangey brown) in colour than layer [17] and contained large amounts of wood; timber [19/20] protruded from the section within one of these deposits; this was excavated in Trench B and is discussed in *Section 4.5*. It was unclear as to whether or not the origins of this concentration were anthropogenic, as it was badly water-eroded. The present-day hydrology means that ground water from the east drains over and through many of the deposits.

4.2.7 Layer [15] consisted of a dark brown-black, very gritty peaty matrix containing approximately 20% charcoal, 20% comminuted granite and 50% fire-crazed granite pebbles. Below this 'hearth' layer was a thin layer of charcoal-rich peat, [16], which overlay peat deposit [17]. The wood within layer [16] was similar to that within layer [19], which may suggest these were both essentially the same layer. If this were the case, then the 'hearth' material, [15], must be later than both; however, the layer containing timbers, [19], appears to be at the same stratigraphic level as layer [15]. In the main erosional section (Fig 4), the relationship between these was not clear and they appear to be contemporary. However, subsequent excavation of Trench A (*Section 4.4*) made their relationship much clearer.

4.2.8 'Hearth' [15] and woody peat [19] were both overlain by dark, firm browny-black clayey peat [14], which clearly developed over the 'hearth' after it had gone out of use. The confused stratigraphy of the central part of the recorded section meant that peat [14] could not be followed across the entire section. It seems likely, however, that it is represented by some or all of layers [23] - [25], and [27] - [30]. Above [14] there was a regular band of intercalated layers of sand and dark organic material, [13], representing the intermittent encroachment of blown sand over the organic soils; deposit [12], a mid-orangey brown soft sand and stone layer above [13], can probably be included within this horizon. The main deposit ran northwards for 11.8m from the southern end of the recorded section before disappearing into an area of disturbance where the stratigraphy was confused. An apparently identical horizon, [34], reappeared at the northern end of the section. Deposits between the two, [31] and [21], both showed similar, but much more ephemeral, banding.

4.2.9 The entire extent of the recorded section was sealed by a layer of mid-orange yellow soft wind-blown sand, [11], up to 0.8m in depth, which was noticeably looser towards the turf-line. Within this sand were a number of modern plastic objects. This layer was stabilised by dune vegetation.

### 4.3 EXCAVATION OF THE BLOCKS

 

4.3.1 The two intact blocks of strata (Fig 2), incorporating parts of Element 1 and inverted but otherwise intact at the base of the cliff section, were fully recorded by section drawing and photography, and excavated stratigraphically, albeit in reverse order to normal excavation practice. The blocks were numbered 1 and 2 (Fig 5); Block 2 lay closest to the section from which they had fallen. Block 1 showed the most complete stratigraphic sequence, incorporating all the elements visible on the cliff face between the turf line and the natural glacial clay, whilst Block 2 only displayed strata between the intercalated layers of sand and dark organic material and the natural glacial clay. For ease, the strata from both blocks were numbered identically, as it was possible to see where the two had originally joined.

4.3.2 The natural, glacial sand deposit, [1] (equivalent to [18]), was quite truncated. It was overlain by [4], a nut-brown woody peat, and [3], a dark blackish brown fibrous peat, which appear to relate to layers [17] and [19] respectively in the cliff section, and are probably naturally derived. Above these, a deposit of charcoal-rich clay peat, [5], which corresponds to layer [16] in the cliff section, was overlain by [2], a burnt stone layer, identical to 'hearth' [15], and this consisted of greyish black gritty sandy clay, containing a high percentage of heat-fractured granite pebbles, grit and charcoal (Plate 4). The layer was excavated carefully, but yielded no finds. The percentage of burnt stone encountered there was, however, far greater than that recovered later from the main trenches (*Sections 4.4 and 4.5* below).

4.3.3 Mid-orange brown firm clay peat, [6], which appears similar to layer [14] in the cliff section, sealed the 'hearth' material, and contained some evidence of charcoal within it. Above this were bands of pale yellowish sand, [7], containing lenses of peaty clay, and bands of purply orange soft clay peat, [8], containing bands of sand. These have been recognised as identical to, and part of, layer [13] in the cliff section. This was overlain by [9], a pale yellowy white sand, which occurred as a thick band in Block 1, and relates to the windblown sand deposit, [11], seen in the cliff section. Layer [10] was a thin band of clay containing fibrous material, which is thought to be equivalent to the present-day turf-line. No finds were encountered during the excavation of either block.

## 4.4 TRENCH A

4.4.1 Trench A was positioned to the south of the section, immediately overlying Element 1 (layer [15]; Fig 2). Where contexts could be clearly defined, context numbers used for the recording of the section were continued in this trench. This trench was not excavated to natural glacial clays, [18], but was ceased at layer [17], interpreted in the cliff section as undisturbed naturally accumulated peat. Above peat [17], and directly underlying 'hearth' [15], was a layer of charcoal-rich peat, [16] (Fig 5; Plate 5). This was sampled for arthropod, insect and general palaeoenvironmental assessment, and monolith samples were also taken for radiocarbon dating and palynological assessment. Several of the obviously unmodified pieces of wood, [16/1024], were encountered lying within deposit [16] and on its interface with [17], the underlying natural peat (Fig 7). Lying firmly within [16] were two slender pieces of possibly worked timber, [16/1023], one of which had originally protruded from the section (Plate 6). This piece was aligned approximately east/west, with the other timber lying directly upon it at its eastern end, at right-angles, visible only in the section. Both pieces appeared modified, although this was confined to occasional worn tool facets, indicating where side branches had been removed. The close association of peat [16]

 

with burnt stone layer [15] raises the possibility that these were relatively contemporary, and that the timbers preserved in the underlying peat might represent some sort of simple structure, perhaps the remnants of a trough or platform.

4.4.4 'Hearth' [15] lay directly above charcoal-rich peat [16], forming a very shallow mound which appeared to be petering out to the north and east (Fig 8), where it was only about 15mm in depth (Plate 5). The stone within the deposit was very diffuse, though grit and charcoal related to it could be seen pushed into peat [16]. This deposit was bulk sampled, with 80% of the layer removed for sieving and assessment. The nature of the material suggests that the trench examined the surviving periphery of an originally considerably larger 'hearth' deposit, with by far the greatest part of it now having been washed into the sea.

4.4.5 Layer [15] was again overlain and effectively sealed by peat [14], as seen in the cliff section. This was sampled for arthropod, insect and other assessment, and monolith samples were taken for radiocarbon dating and palynological assessment. Above it, layer [13] was a band of intercalated layers of peat and sand; a bulk sample was also taken from the largest band of peat.

4.4.6 The overlying dune sand [11] was removed fairly rapidly by hand, and produced no finds except modern plastic.

## 4.5 TRENCH B

4.5.1 Trench B was to the north of Trench A (Fig 5), immediately overlying Element 2 (the timber structure within deposit [19]). The trench was again not excavated to natural glacial clays, [18], but was ceased at layer [17], interpreted in the cliff section as undisturbed naturally-accumulated peat. A small section of [17] was excavated and parts of the deposit immediately associated with the wood within it were sampled for arthropod, insect and other analysis; monolith samples were taken for radiocarbon dating and palynological analysis.

4.5.3 Directly above [17], but probably more closely associated with overlying layer [19], was a massive baulk of wood, [19/1020], which had been seen partially protruding from the section (Fig 7). It lay on a north-east/south-west alignment across the entire trench, and was at least 2.05m long, and roughly square in section, 0.25m by 0.25m (Plate 7). The timber was firmly seated on deposit [17], and appeared to have been placed deliberately, perhaps as a simple walkway across boggy ground. The wood appeared to have been stripped of bark and showed evidence of the removal of side branches. The gently rippled upper surface suggested that it had been dressed using a bladed tool, although the wood was not well-enough preserved to confirm this. The timber was left *in situ* pending further investigation; it was wrapped in a geotextile membrane prior to the trench being backfilled. Subsequent fieldwork by Croft (*et al* 2002, 24) suggested that the timber was in fact not worked. However, it is hyptohesised that attrition within the sea may have removed the evidence for dressing.

4.5.4 Above layer [19], peat [14] was again recognised (Fig 9). Otherwise featureless, it was sampled for arthropod, insect and other analysis, and monolith samples were taken for radiocarbon dating and palynological assessment (the monoliths were taken directly over the timber structure, through layers [14] and [19]). No 'hearth' deposit was encountered, other than very occasional burnt stones within layer [14]. Within and at

the base of this were several concentrations of unmodified wood, mainly birch, which appeared closely related to deposit [19]; these may relate to the wood encountered in Trench A. A sample of this wood was retained for assessment.

4.5.5 Peat [14] was again sealed by [13], intercalated layers of peat and sand; a bulk sample was taken from the largest band of peat as a precautionary measure. Layer [13] was sealed by wind-blown sand [11].

## 4.6 GEOPHYSICAL SURVEY

4.6.1 ***Magnetometry Scanning:*** the undulating terrain of the duned area behind the site meant that in places workable data could not be acquired, and large areas of the defined 2ha survey area were not suitable for examination. However, scanning was undertaken in all areas with a gentle gradient and in places where there were topographical highs. The scanning indicated a generally low level of response except in the vicinity of obviously modern features such as drains, indicated by manhole covers and wires protruding from the ground. Burnt sites (such as hearths or burnt mounds) tend to exhibit a ferrous type of response similar to modern ferrous material, and thus the presence of considerable amounts of iron across the site restricted any identification of burnt sites.

4.6.2 ***Detailed Magnetometric Survey:*** the original area chosen for geophysical survey proved unsuitable for magnetometry as the terrain was too undulating. A second area was investigated to the north (0.25ha; Fig 3); this was selected as the closest coastal area to the site, yet with sufficiently gentle topography to allow magnetometric survey. The data are dominated by a broad zone of ferrous disturbance in the north of the survey area, which was due to an underground pipe, indicated by manhole covers. In the south of the area, a linear ferrous response was noted which was potentially part of a further underground service. All other anomalies are likely to be of modern origin, and none of archaeological significance was identified.

## 4.7 PALYNOLOGICAL SURVEY

4.7.1 A rapid appraisal of the locality was undertaken to establish whether sites appropriate for palynological coring existed within the locality; these could provide comparative data to that from the evaluation site. This appraisal failed to identify the survival of accessible deep peats within 1km of the site, although intercalated peats may be preserved beneath the sand dunes. An earlier soil survey indicated that peat deposits may be preserved less than 1km to the east of the site in an area which is now used for the storage of low-grade nuclear waste (J Quartermaine *pers comm*). The ground within this area, however, has been excavated to considerable depth for the nuclear storage facility and there will be little if any usable peat surviving.

# 5. QUANTIFICATION AND ASSESSMENT

## 5.1 INTRODUCTION

5.1.1 A statement of the significance of the results from each element of the archive is given below. These statements are based on the assessment work undertaken, related to the original academic themes expressed in the project design (LUAU 2000a).

5.1.2 The primary archive is presently held at OA North offices in Lancaster. The existing archive consists of three main categories:

- Paper archive
- Artefact archive
- Environmental archive.

## 5.2 STRATIGRAPHIC DATA

5.2.1 ***Quantification:*** the site was recorded as several areas (see above *Section 4*). Within these, where identical horizons were identified, a single context number was issued; this has inevitably led to some distortion of the quantification below. The context record has been divided by area:

| | **No of contexts** |
|---|---|
| Block 1 | 8 (6 in Block 2 also) |
| Block 2 | 8 (6 in Block 1 also) |
| Trench A | 8 (in cliff section also) |
| Trench B | 8 (in cliff section also) |
| Cliff Section | 28 (only in cliff section) |
| Total number | 38 |

5.2.2 These contexts can be divided into the following classifications:

| | Block 1 | Block 2 | Trench A | Trench B | Section |
|---|---|---|---|---|---|
| Wind-blown sand | 1 | 0 | 1 | 1 | 1 |
| Turf-line | 1 | 0 | 0 | 0 | 0 |
| Burnt stone layer | 1 | 1 | 1 | 1 | 1 |
| Peat layers | 3 | 3 | 0 | 0 | 0 |
| Peat with wood | 1 | 1 | 3 | 3 | 3 |
| Wood peat | 0 | 0 | 1 | 1 | 4 |
| Sand / stone lens | 0 | 0 | 0 | 0 | 1 |
| Sand / peat intercalation | 0 | 1 | 1 | 1 | 4 |
| Peat intercalation | 0 | 1 | 0 | 0 | 0 |
| Peaty sand lens | 0 | 0 | 0 | 0 | 6 |
| Sand lens | 0 | 0 | 0 | 0 | 4 |
| Clay peat | 0 | 0 | 0 | 0 | 1 |
| Natural glacial sand | 1 | 1 | 1 | 1 | 1 |
| Palaeochannel peat | 0 | 0 | 0 | 0 | 1 |
| Discontinuity | 0 | 0 | 0 | 0 | 1 |

 

5.2.3 ***Archive:*** overall, the records are complete and are contained within numbered files.

5.2.4 ***Paper Records:*** sequential numbering sequences are used in the photographic records. An index of all plans and elevations has been produced, cross-referencing the paper and digitally-archived material. The following quantities of site records have been noted within the archive:

| | |
|---|---|
| 2 | Trench Record Sheets (inked) |
| 2 | Context Index Sheets (inked) |
| 38 | Context Record Sheets (inked) |
| 1 | Section Index Sheet (inked) |
| 1 | Plan Index Sheet (photocopy) |
| 1 | Matrix Sheet (computer-generated with inked annotation) |
| 1 | Object Index Sheet (inked) |
| 6 | Object Record Sheets (inked). |

5.2.5 ***Digital Data:*** in conjunction with the paper archive, the site drawings and rectified photographic survey data have been created in AutoCAD (Release 14). This has resulted in 40 AutoCAD (.dwg) files being created, along with 28 .dxf files (raw data accumulated from the initial survey work) and 106 raw GPS data files. All of these files form part of the digital aspect of the archive.

5.2.6 There are 48 .jpg files created by digital camera taken during the fieldwork. One file comprises the computer-generated matrix and ten .doc files form the site reports.

5.2.7 ***Plans and Elevation Records:*** the plans and sections were mostly recorded in pencil on draughtsman tracing film. In some cases, the pencil is faint and some of the drawings are liable to become unclear, accelerated by frequent handling. This does not present a problem, however, as there are digital copies of all of these drawings. The following site drawings are incorporated within the archive:

| *Quantity* | *Scale* | *Description* |
|---|---|---|
| 6 | 1:10 | Section drawing on draughtsman tracing film in pencil; |
| 1 | 1:20 | Section drawing on draughtsman tracing film in pencil; |
| 1 | 1:25 | Sketch plan on draughtsman tracing film in pencil; |
| 3 | 1:10 | Plans on draughtsman tracing film in pencil. |

5.2.8 It should be noted that Sheet 1 contains Section drawings 1-4; Sheet 2, Section drawing 5; and Sheet 7, Sections 6 and 7. The plans are divided onto four sheets: Sheet 3 contains Plan 1; Sheet 4, Plan 2; Sheet 5, Plan 3; and Sheet 6, Plan 4.

5.2.8 ***Photographic Record:*** the photographic record is in good order. There are indices for both the colour slide and monochrome films in sequential numerical order, although the various films would need to be checked against the individual indices for cross-checking purposes. The photographic sheets in general denote the orientation and description of the individual photographs. There are 97 black and white images, 99

 

colour slides, and 48 digital photographs, which refer to the various aspects of work carried out during the fieldwork.

5.2.9 ***Evaluation:*** the site has a single-phase stratigraphic sequence of relatively simple formation, focusing on an anthropogenically-formed deposit of charcoal and burnt stone, [15]. This is set between naturally deposited layers of peat, [14] and [16], the upper of which is overlain by deposits of windblown sand. The burnt stone forms a fairly broad spread (being at least 4m in diameter) and is associated with a water source. As the deposit was set entirely within peat, the stone had to have been imported to the site and there must have been sufficient need to warrant this effort. Such evidence suggests that this formed part of a burnt mound, but the deposit is relatively thin and the absolute volume of burnt stone is very low in comparison with confirmed burnt mounds elsewhere, which can extend up to 2.5m in height (LUAU 1995; LUAU 2000b; Heawood and Huckerby 2002). The differences may simply indicate that the site at Drigg was a burnt mound that had a short operational life, limiting the build-up of stone. Of course, this may simply reflect the fact that, at the time of excavation, the majority of the mound had already been eroded away, with only the thinner outer fringes surviving. Indeed, the north-facing section of Trench A (Fig 8) clearly indicates that [15] became thinner landwards from the eroded face. Alternatively, the feature may have been constructed specifically as a hearth, in which case it is unusually large, but it is unclear what function would have warranted the establishment of such a large structure, and what the function of the imported stone was. The interpretation of the feature remains, therefore, slightly uncertain. The weight of argument is at present biased in favour of this being a burnt mound.

5.2.10 The large baulk of riven timber, in excess of 2m long, uncovered in Trench B, [19/1020], had the characteristic rippled surface created by surface dressing with an axe or adze. This would seem to confirm the conclusions, drawn by Powell and Corcoran in 1967, that there was a man-made platform associated with the hearth (Cherry 1982, 4). However, subsequent fieldwork by Croft (*et al* 2002, 24) has thrown some doubt onto this interpretation, suggesting that the timber derived from natural sources, although attrition caused when the timber was in the sea may have smoothed the original worked surface, removing all traces of dressing.

5.2.11 It was reaffirmed that the wood in Element 3 was unworked; however, there is uncertainty as to the taphonomic process that might have resulted in its deposition at the edge of the palaeochannel / basin (Element 4), and there remains the possibility that wood was deliberately piled in this location.

5.2.12 The site has a defined stratigraphic association with a palaeochannel / basin, on the other side of which is a further 'hearth', some 65m to the north of Element 1. The site therefore appears to relate to a much broader area of activity which is seemingly centred on the basin. Without absolute dating, however, the level of significance cannot be assessed, nor the dataset placed fully within its regional context.

5.2.13 The original research design laid out a number of objectives for the fieldwork. The stratigraphical dataset has fulfilled Objective 1, having provided a comprehensive record of the stratigraphy within the vicinity of Element 1. It also fulfilled Objectives 3, 4, 5, 8 and 10. Only Objective 2 was not fully met, in part because of the undulating terrain, but also because of considerable modern ferrous material within the area, which disguises burnt anomalies.

5.2.14 ***Continuing Threat:*** this evaluation has confirmed the fragile and transient nature of the monument. It has been visited intermittently over the last 30-35 years, and has, during this period, demonstrably diminished in size and its preservation has deteriorated. This is clearly visible in photographs which have been taken of the site since the 1960s which show the thickness and extent of the burnt stone layer decreasing rapidly, and a slow, if continuous, loss of exposed timbers from the section.

5.2.15 The topographical survey has served to provide a clear indication of the speed of erosion, with approximately 6m of deposits removed from the cliff edge in places since the last Ordnance Survey mapping (1978). Erosion has recently accelerated rapidly on this previously relatively quiescent section of coast, particularly at the spring and autumn high tides. Although it must remain a subjective opinion for the time being, the acceleration is possibly related to the removal of a pipeline to the north which acted as a breakwater for this stretch of beach, and also increased storm damage that may be linked to global warming. Thus its exposure in an actively eroding sea cliff, vulnerable at high tide and during storms, makes it clear that the prolonged survival of this monument is limited. It is now obvious that the putative burnt mound itself has sustained considerable damage in the last few years, and its survival was questionable. In response to this, a programme of further evaluation has been undertaken by Sharon Arrowsmith (Croft), on behalf of the South-Sest Regional Group of the Cumberland and Westmorland Antiquarian and Archaeological Society; the report on this work is currently being prepared (Croft *et al* 2002).

5.2.16 Whilst the mound itself is now effectively lost to archaeology, and the remnants of the associated timber structures cannot survive much longer, survey of an extended stretch of the cliff section has demonstrated the potential for other related monuments in the immediate area, as yet less threatened by the receding shoreline. Similarly, the presence of a possible cobbled surface implies access to the mound from the east, and thus the potential for related archaeological deposits in that direction.

## 5.3 PALAEOECOLOGICAL ASSESSMENT

5.3.1 ***Quantification:*** the programme of palaeoenvironmental sampling produced the following numbers and types of samples:

| **Sample type** | **Number** |
|---|---|
| Bulk + wood | 18 |
| Monoliths | 4 (2 x 1999, 2 x 2000) |
| Arthropod and insect | 6 (included in bulk) |
| Radiocarbon | 20 |
| Groundwater | 2 |

5.3.2 ***Palynological Assessment (1999):*** the four samples examined all contained abundant well-preserved pollen, predominantly composed of trees and shrubs, but with some evidence of herbaceous species. This indicates that the landscape was well wooded. The high values of alder pollen (45-51%) suggest a local alder carr with some birch and oak. Because the values of elm pollen are low, it is tentatively suggested that the

deposits were formed after the Elm Decline and therefore originated in the Neolithic or early Bronze Age. It is unlikely that the deposit is later than the early Iron Age, as clearance is likely to have been more extensive by then (Hodgkinson *et al* 2000).

5.3.3 The deposit does not appear to be identical to that analysed by Pennington in the 1960s (Pennington 1965), although it may be from a similar period. The material assessed then was less thick and was probably a raw humus, rather than a peat. Pennington (*op cit*, 82-5), analysing material at Drigg from a hearth recorded by Cherry (1965), described the organic deposit as mor humus on the grounds that no recognisable plant remains could be identified. If the site excavated by OA North in 2000 is the same one, this recent study has found this not to be the case, as wood fragments, seeds and insect remains were all recorded.

5.3.4 The original research design laid out the objective to evaluate the potential for palynological analysis of site. Objective 6 has been fully achieved.

5.3.5 ***Bulk Samples and Monoliths:*** plant macrofossils from six bulk samples were identified and recorded with the aim of defining the possible use of Element 1. Although only a small representative sample from each flot was assessed, it provided evidence of the preservation of identifiable plant macrofossils in all samples (Table 1). All samples contained wood fragments, amorphous organic material, charcoal, sand, and modern roots from marram grass (*Ammophila arenaria*). The abundance of each component varied in the individual samples. Charcoal was very abundant in burnt layer [15] but least so after the abandonment of the burnt mound/hearth (layers [14] - [12]). Conversely, amorphous plant material dominated the assemblage above layer [15]. In samples from deposits earlier than the burnt layer, wood was more abundant. Bark, probably from birch, was recorded in layers [15] and [16] but less was seen at other levels. Charcoal, as expected, was more abundant in the burnt layer and included oak (Q*uercus*), and probably other species. The heavy fraction from the burnt layer was checked for artefacts and hammerscale, but neither were identified. No remains of animal bones were identified in any samples during the evaluation.

5.3.6 The assemblage of identifiable plant macrofossils from burnt mound/hearth [15] and the layer immediately below it, [16], appreciably differed from layer [14] above. A sample from below the worked wood in layer [17] contained hazelnuts (identified in the field but not in the laboratory) and occasional seeds, but fewer than those in layers [15] and [16].

5.3.7 Within layers [15] and [16], blackberry (*Rubus*) seeds were frequent to abundant, as were those of rushes (*Juncus*), together with some records of sedges (*Carex* and *Eleocharis*), knotweed (*Polygonum*), and fat hen-type (*Chenopodium*). Knotweed and fat hen-type are weed types that are found growing either as ruderals, amongst arable crops, and on fallow ground (Behre 1981). The assemblage from layers [15] and [16] suggests that the plant community was fairly open. Most British rush species, except *Juncus effusus*, grow in damp open conditions, whilst blackberries grow and fruit best in sunny or partially shaded places in a variety of habitat conditions. The few other seed types recorded also support the possibility of open conditions. Above the burnt layer, the samples from [14] contained abundant fungal sclerotia and fewer identifiable plant remains; this was related to a high degree of humification of the deposit.

 

| **Context no** | | **14** | **14** | **15** | **15** | **16** | **17** |
|---|---|---|---|---|---|---|---|
| Sample no | | 1005 | 1006 | 1008 | 1010 | 1014 | 1017 |
| Trench | | A | B | A | A | A | B |
| Volume processed (l) | | 10 | 10 | 7.5 | 10 | 10 | 10 |
| Amorphous organic matte | | 5 | 5 | 5 | 3 | 3 | 3 |
| Charcoal fragments | | 1 | 1 | 5 | 5 | 2 | 1 |
| Wood fragments | | 3 | 3 | 3 | 3 | 5 | 5 |
| Bark | | | | 2 | 2 | 1 | |
| Insect fragments | | 1 | 1 | 1 | 1 | 1 | 1 |
| Coarse sand and gravel | | 4 | 4 | 4 | 4 | 2 | 3 |
| Modern roots | | 4 | 4 | 3 | 3 | 3 | 3 |
| Fungal sclerotia | | 5 | | | | 1 | |
| Hazelnuts identified in field | *Corylus avellana* | | | | | | 3 |
| Blackberry seeds | *Rubus* | | | 3-4 | 3-4 | 2 | Thorn |
| Rush seeds | *Juncus* | | | 3 | 5 | 3 | 3 |
| Trig sedge seeds | *Carex* | | | | | 1 | 1 |
| Spike-rushes | *Eleocharis palustris* | | | 1 | | | |
| Fat hen-type | *Chenopodium* | | | | | | |
| Knotweed | *Polygonum* | | | 1 | | 1 | 1 |
| Selfheals | *Prunella vulgaris* | 1 | | | | 1 | |
| Sedge family | Cyperaceae | | | | | 1 | |
| Buttercup | *Ranunculus* sp | 1 | | | | | |
| Sorrel | *Rumex* | 1 | | | | | |
| Unknowns | | | 1 | | | 1 | |

*Table 1: the abundance of remains from the bulk samples from the excavation (1 being rare and 5 very abundant)*

5.3.8 ***Plant Macrofossils from Monolith Sample:*** it was hoped to be able to reconstruct the local vegetation of the area around the burnt mound/ hearth during the period of its use, prior to it, and after its abandonment by recording the plant macrofossils from the monolith samples. The results (Fig 10) provide corroborative evidence to that from the bulk samples, except for the large numbers of undifferentiated grass seeds (J Huntley *pers comm*), which were not recorded in the bulk samples. It is of interest to note that these were more abundant whilst the burnt mound/hearth material was accumulating, and thus support the possibility that the vegetation in the area was more open at that time than subsequently.

5.3.9 It is assumed that unworked wood in the organic deposits is *in situ*, but the absence of seeds from any woody taxa except blackberry and hazelnuts (identified in the field) is unexpected. Birch bark was recorded, but although birch produces prolific and very distinctive seeds, which are generally well preserved in waterlogged conditions, none were identified in the small samples assessed. This absence may indicate one of several circumstances: that the trees were already dead when the peat developed; that the current sample size is too small and full analysis will add to the data; or that the wood was in fact brought to the site by an outside agency. At this stage, further speculation is not valid. It is, however, of note that, as at other burnt mound sites in the north of England (in Cumbria (LUAU 2000b) and Northumberland (Topping 1998)), the range and quantity of charred plant remains at Drigg are disappointing.

5.3.10 The evaluation of the plant macrofossils from the burnt layer and peat (organic material) suggests that there are real differences in the vegetation of the area, which are shown in assemblages accrued before, during, and after the monument was in use. The presence of blackberries, grasses and rushes indicate the possibility of a local clearance when the worked wood and burnt mound/hearth were being used. At this stage in the analysis, the only evidence of food sources are wild ones, namely hazelnuts, found in layer [17] above the clay deposits, and the blackberries from layers [16] and [15].

5.3.11 The original research design laid out objectives to evaluate the site for the potential of plant macrofossils and to understand the site better within the local context (Objectives 7 and 8). Objective 7 was fully achieved but Objective 8 was only partially achieved.

5.3.12 ***Arthropods and insects:*** initial assessment of the samples suggested that preservation of arthropods was unlikely. Assessment of this class of material was therefore deferred until assessment of other palaeoenvironmental samples had been completed. The botanical assessment (*Sections 5.31–5.3.11*) demonstrated that the potential for arthropod, particularly insect, analysis was reasonable, but timetabling issues made a full assessment for arthropods impossible.

5.3.13 The original research design laid out objectives to evaluate the site for the potential of arthropods and to understand the site better within the local context. The relevent of Objective 7 was was deferred with the agreement of English Heritage.

5.3.14 ***Radiocarbon dating:*** 11 samples taken were suitable for radiocarbon assay and these have now been processed, dated and subjected to combination analysis through the OxCaL (V 3.5) with the results presented in *Appendix 1*. However, in summary, the analysis and modelling of the combined radiocarbon dates (Figs 11 and 12) indicated that activity associated with the use of the burnt mound (deposition of charcoal [15-1010] and [15-1008]) dates to *2460-2230 cal BC (95% probability; GU-5884)* and *2480-2280 cal BC (95% probability; GU-5885*). The burnt mound was sealed by peat layer [14] by *2310-2130 cal BC (95% probability)*. Thus, Objective 9 has been met.

5.3.15 ***Dendrochronology:*** the assessment of this dataset was deferred by English Heritage. No dendrochronological work was therefore undertaken, attention being focused on radiometric dating. Subsequent erosion of the site broke off a piece of timber tentatively identified as [19/1020]. An assessment of this material by Sheffield University revealed that it could not be dated reliably (Croft *et al* 2002, 14).

# 6. STATEMENT OF POTENTIAL

## 6.1 STRATIGRAPHICAL DATA

6.1.1 The stratigraphy reflects essentially a single phase of activity and forms a relatively simple sequence; therefore the potential for further analysis is limited. All three elements of excavation and recording have been merged, providing a framework, in the form of a relative chronology, for palaeoenvironmental analysis. The site is potentially of considerable significance, however, and therefore the provision of absolute dating is essential in order to assess the level of importance of the dataset both locally and within a regional context. Considering the unusual nature of the site, there is a need to acquire comparative data from elsewhere in Britain to inform the function and form of the activity. The survival of the organic deposits within the context of both the putative burnt mound and the palaeochannel provide considerable potential for undertaking further scientific analysis.

6.1.2 Wood from the site was not well enough preserved for more detailed consideration of toolmarks or other technological evidence; the large timber left *in situ* might prove an exception to this, if it still survives. The significance of the assemblage lies in the recognition that it appears to have been modified by man.

6.1.3 The area where evaluation took place in 2000 has been much reduced in area by coastal erosion. The evaluated hearth was further investigated in 2002 by Sharon Arrowsmith on behalf of the South-West Regional Group of the Cumberland and Westmorland Antiquarian and Archaeological Society, and as a result of this work and the ensuing erosion there is now nothing left of the hearth in the section. However, the second 'hearth' site, some 65m to the north, is on top of more resilient deposits and consequently this site has had a greater chance of survival over the ensuing years.

## 6.2 PALAEOECOLOGICAL DATA

6.2.1 As the deposits sampled are, demonstrably, very closely associated with a man-made structure, they are of exceptional importance, offering the opportunity to place the mound and its associated features within its contemporary environmental context.

6.2.2 ***Palynological Potential:*** the palynological assessment of the organic deposit has provided evidence for excellent pollen preservation, which would allow for full palynological analysis. This would provide a picture of the landscape during the life of the monument, at the Neolithic/Bronze Age interface, although this date remains tentative. On the basis of this assessment, full palynological analysis of the monolith samples taken in 1999 and 2000 is recommended, in order to complement the plant macrofossil, arthropod and insect examination, thus adding potentially significant information about the function of the 'hearth' and possible land usage around the site before and after occupation.

6.2.3 ***Plant Macrofossil Potential:*** the evaluation of the plant macrofossils from the burnt layer and peat (organic material) suggests that there are real differences in the vegetation of the area, which are shown in assemblages accrued before, during, and after the monument was in use. It must be stressed that, despite the very small samples of the contexts examined for this assessment, possible differences in the plant assemblages

were noted. It is, therefore, suggested that full analysis of the plant macrofossils, together with that of arthropod and insect analysis of the bulk samples collected during the excavation, will add significant information about the possible function of the site.

6.2.4 ***Arthropod and Insect Potential:*** discussions between OA North and the Department of Archaeology, University of York, suggest that the potential for recovery of significant arthropod and insect remains is good. Therefore, it is likely that strategic analysis linked to botanical work would produce meaningful results that would add to the understanding of the site. It is suggested that six samples should be analysed for invertebrate remains as well as plant macrofossils. As no formal assessment was undertaken, it is not possible to quantify the costs of the analysis in detail, so an upper price limit is given for the assessment and analysis of the six samples. If, following the assessment, less work is required, the cost will drop accordingly.

6.2.5 ***Radiocarbon Dating:*** the absolute dates obtained (see *Appendix 1*) from the site are critical to the interpretation of the site, and will add immensley to our understanding of the site.

## 6.3 OVERALL POTENTIAL OF THE SITE

6.3.1 There is considerable ecological potential in the site, despite the fact that there is physically little of the structure left, following substantial erosion of the coast. The programme of work has demonstrated that the evaluation site is in fact part of a much wider landscape, of which some elements are at great risk of erosion, whereas others are likely to be further inland and therefore not yet threatened. Thus, whilst there is little potential for further fieldwork without substantial impact upon the cliff, the investigation of the landscape can be substantially enhanced by a programme of palaeoecological analysis and dating integrated with the stratigraphical dataset. The understanding of the landscape as a result of this overall programme should not only inform the local context but will contribute to the wider debate.

## 6.4 CONTRIBUTION TO REGIONAL AND NATIONAL AGENDAS (BUSINESS CASE)

6.4.1 On the basis of the present evidence, it is considered that the most likely interpretation for Element 1 is that it was a burnt mound. Burnt mounds are a controversial monument type, subject to much discussion in the late 1980s and early 1990s as to their form and function (summarised in Garrad 1999). Whatever their function, the common factors seem to be the presence of a large amount of fire-cracked stone within a dark charcoal-rich matrix ('burnt mound material'), the identification of a 'trough' of some kind, and a close association with water. In 1990, Barber attempted to develop a fourfold division of sites associated with 'burnt mound material', but drew no conclusions as to function, beyond reiterating those current: wet or dry cooking places, or some form or sauna/steam bath. A majority, but by no means all, of those with reliable dating, can be placed within the Bronze Age.

6.4.2 Burnt mounds are thought to have a predominantly western distribution within the British Isles. They are common in Ireland, with, in Cork alone, an estimated density of one per 3.7km$^2$ (Ehrenberg 1991, 3; presumably more have been added since this date). In mainland Britain, there appear to be clusters in west Wales, and the English Midlands, and they are well-known from the Western and Northern Isles of Scotland.

Ehrenberg (1991, 42) has suggested, probably rightly, that, with enigmatic monuments such as these, the known distribution is to some extent an artefact of the distribution of informed fieldworkers and, with time, it has become clear that the monument type is considerably more widespread than previously thought. Numerous examples have been reported in recent years from the Isle of Man where, in places, they have a density in excess of ten per square kilometre (Garrad 1999, fig 1), the valleys of Yorkshire Dales (J Quartermaine *pers comm*), Cumbria (J Hodgson *pers comm*), and south-western Scotland (RCAHMS 1997, 100-2). Indeed, as the form is increasingly recognised, one would expect the numbers identified to continue to increase.

6.4.3 To date, this example is only the third to be examined by controlled excavation in the North West, the others being in the grounds of Garlands Hospital near Carlisle (LUAU 1996b; Neighbour and Johnson 2005) and at Sparrowmire Farm, Kendal (LUAU 2000a; Heawood and Huckerby 2002). Burnt mounds from a survey context are more common in Cumbria and are often found in upland areas, near cairnfields or areas of Bronze Age activity: for example, a group of burnt mounds has been recorded on Torver Low Common to the west of Coniston Water (LUAU 1995). The west Cumbrian coastal strip, within which the current site lies, is one of the most intensively studied parts of the county, with a rich potential for prehistoric archaeological remains (Hodgkinson *et al* 2000, 83); this might suggest that the lack of burnt mounds reported in the area represents a genuine absence. It has, however, become clear from work elsewhere that 'the rarity of burnt mounds in low-lying agricultural areas... might relate more to visibility than to a genuine absence' (Banks 1998-9, 28), and both the Garlands Hospital and the Sparrowmire examples were found in the course of archaeological investigation for other reasons. The recently published *Research Framework* for the North West (Brennand 2007), notes the need for more work to be undertaken on burnt mounds (Hodgson and Brennand 2007, 46). Specifically, Initiatives 2.49, 2.50 and 2.51 deal with the need for more identification, survey, excavation, radiocarbon dating and palaeoenvironmetal work on burnt mounds (*ibid*). The work at Drigg will significantly contribute to our understanding of burnt mounds in Cumbria. In addition, the *Research Framework* considers that the publication of currently unpublished material is a high priority, and highlights the need to bring into the public domain unpublished work, both in general (Chitty and Brennand 2007, 18-19), and specifically for the prehistoric period (Hodgson and Brennand 2007, 33). The proposed work has the potential to advance study at both a local and regional level.

6.4.4 The archaeology and palaeoenvironmental history of the Drigg area has most recently been summarised and reassessed by Hodgkinson *et al* (2000), clearly indicating that the Drigg burnt mound complex must be considered within a rich, if currently ill-defined, prehistoric context, with well-attested human activity dating back to the late Mesolithic period. Certain parts of the coastal strip were reoccupied on numerous occasions, illustrating their continued attraction to human groups, with particular concentrations of lithic finds associated with the succession of raised beaches recorded on the plain (*ibid*). The *Research Framework* for the North West (Brennand 2007), highlights the need for more palaeoenvironmental work in the North West, both in general (Chitty and Brennand 2007, 22-3), and specifically for the prehistoric period (Hodgson and Brennand 2007, 36). The proposed work has the potential to advance study at both a local and regional level.

6.4.5 Detailed analysis of the radiocarbon dates (*Appendix 1*, Figs 11 and 12) indicates that the activity associated with the use of the putative burnt mound (deposition of charcoal [15-1010] and [15-1008] is dated as *2460-2230 cal BC (95% probability; GU-5884)* and *2480-2280 cal BC (95% probability; GU-5885*) in the model provided). The burnt mound would have gone out of use by *2310-2130 cal BC (95% probability)*, when it was sealed by peat layer [14]. These dates are slightly at variance with the dates recovered by Pearson in 1979 (2900-2507 cal BC (4135±55 BP; UB-906) and 2456-2039 cal BC (3780±55 BP; UB-905)), although not significantly enough to cause concern. Both ranges of dates are supported by numerous flint finds from weathered mineral soil exposures in the surrounding dunes (Cherry 1965). Recent work (Banks 1998-9) has begun to explore more fully the relationships between burnt mounds and their environs, as originally advocated by Ehrenburg in 1991. It appears to indicate that, rather than being isolated monuments (*cf* the original view of Irish *fulachta fiadh*), burnt mounds are often firmly embedded within a complex social and ritual landscape. Banks (1998-9, 1) notes their proximity to cultivatable land, and to contemporary burial cairns, and a cairn was noted in close proximity to the mound at Sparrowmire Farm (LUAU 2000b, 6). At Birstall, Leicestershire, the mound excavated was in close proximity to a wooden bridge of probably contemporary date, and provided potential evidence for ritual behaviour in the form of two human skulls, one apparently bearing cut marks (Ripper 1997, 3).

6.4.6 Neolithic and Bronze Age settlement activity is not widely recognised on the West Cumbrian coastal plain, probably because the intensive and prolonged exploitation of the light, fertile soils has masked or destroyed its remains. Air photography has identified a number of sites, such as the putative henge at Bootle (J Quartermaine *pers comm*), which seem, on morphological grounds, to comprise part of a complex Neolithic landscape, about which little is known. The extensive settlement remains on the slopes of adjacent uplands, however, attest to a relatively large and sophisticated population during the Bronze Age and after (Quartermaine and Leech forthcoming). Occasional finds of fragments of Beaker pottery from further south, for example at Walney Island (Clough 1968, 1), and further north, from the cairn at Mecklin Park (Fletcher 1957, 11), imply a resident population from the earliest Bronze Age. Burials from Ravenglass and from Grey Croft stone circle, Seascale (Fletcher 1958), among others, reinforce the level of early to middle Bronze Age activity in the vicinity. Indeed, the circle at Grey Croft, when considered with others to the south, at Gutterby, Lacra, and Millom (known to have been destroyed in the course of eighteenth-century land improvement (Hodgkinson *et al* 2000)), make it clear that the coastal plain was not only sufficiently densely inhabited to supply the necessary social impetus to encourage the construction of such monuments, but that the range of social and ceremonial activity was of a richness comparable if not superseding other parts of the region, such as the Eden Valley, to the east. Although considerable survey data exist for the area, there is still only a limited understanding of the Bronze Age landscape of the Cumbrian coastal plain. This evaluation has demonstrated considerable potential, when all elements of the site and methods are considered together, to further understanding of this uncharacterised period of prehistory in Lowland Cumbria.

# 7. CURATION AND CONSERVATION

## 7.1 ARCHIVE

7.1.1 The results of the evaluation have been ordered to create a site archive, in accordance with current English Heritage guidelines (1991, appendix 3). The complete archive, which will include records, plans, both black and white and colour photographs, ecofacts and sieved residues, will be prepared following the guidelines set out in the UKIC's G*uidelines for the preparation of excavation archive for long term storage* (1990).

7.1.2 Arrangements will be made for the deposition of the paper archive with the Whitehaven Office of the Cumbria Record Office. The artefactual assemblage is not suitable for long-term curation and therefore it is recommended that, prior to the deposition of the archive, the samples are discarded.

## 7.2 CONSERVATION

7.2.1 The ecofactual assemblage has no conservation requirements as it is proposed that it should be discarded prior to deposition of the archive.

 

# 8. REVISED OBJECTIVES

## 8.1 INTRODUCTION

8.1.1 The programme of evaluation and field recording undertaken at Drigg has established the nature of the monument, identifying it as a putative burnt mound, probably of Bronze Age date. It has also established that it lies within a wider archaeological landscape of significance.

## 8.2 RESEARCH OBJECTIVES

8.2.1 Assessment of the data from the site has established that the palaeoenvironmental record has considerable potential to illustrate the contemporary vegetational landscape in the vicinity of the monument, as well as providing information about the wider landscape.

8.2.2 This assessment has established that, by means of a focused programme of analysis, the stratigraphic and palaeoenvironmental record can illustrate the development of the monument and its environmental context, placing them within a securely dated stratigraphic framework. As a result, the specific objectives which the data can address have been narrowed and made more specific:

**1** to examine the stratigraphic succession demonstrated in the cliff section and in the evaluation trenches in order to provide a secure relative chronological framework for the development of the monument and an understanding of its contemporary environment;

**2** to incorporate the results of the radiocarbon assay with the archaeological stratigraphy so as to date the site and its context securely;

**3** to characterise the environment and the monument by analysis of the plant macrofossils;

**4** to provide the vegetational context and examine the changes taking place before, during, and after the time when the monument was in use by analysis of the palynological record;

**5** to provide a vegetational context and examine changes taking place before, during, and after the time when the monument was in use by analysis of the insect and arthropod record;

**6** to bring the analysis and synthesis of data from the site to publication within an appropriate journal.

 

# 9. METHOD STATEMENT

## 9.1 INTRODUCTION

9.1.1 The following section sets out the methods of organisation, analysis and report preparation which will complete these phases and meet the aims and objectives defined in *Section 8*.

## 9.2 START-UP

9.2.1 ***Task 1*:**
to facilitate all objectives.

9.2.2 At the outset of the project, a team meeting will be established to define and co-ordinate the analytical process.

## 9.3 STRATIGRAPHIC ANALYSIS AND PRODUCTION OF SITE NARRATIVE

9.3.1 ***Task 2*:**
to achieve Objectives 1 and 2.

9.3.2 Analysis of the stratigraphic succession is effectively complete, but will require review in light of the absolute dating provided by radiocarbon assay. The data will be reviewed and a structured site narrative will be compiled, taking into account the absolute dates. This will be used as the basis for the publication text. A rapid search of published material will be made in an effort to establish comparisons for the unusual nature of the hearth/burnt mound.

## 9.4 PLANT MACROFOSSIL ANALYSIS

9.4.1 ***Tasks 3, 4 and 8*:**
to achieve Objective 3.

9.4.2 The remainder of the samples collected will be subject to analysis of plant macrofossils, using methods following the guidelines and recommendations of the Association of Environmental Archaeologists (1995).

9.4.3 Ten samples collected during the excavation will be wet sieved and a representative sample from each context will be analysed. The data will be recorded on *pro forma* sheets and presented in tabular form for the report.

## 9.5 PALYNOLOGICAL ANALYSIS

9.5.1 ***Tasks 5 and 8*:**
to achieve Objective 4.

9.5.2 Samples from one of the two soil/peat monoliths (either that taken in September 1999 or October 2000, both of which were adjacent to the mound/hearth) will be analysed using palynological techniques. The sample with the best preservation will be selected

 

for analysis. From this, a record will be made of the vegetational changes which took place before, during, and after the period of use of the monument. It is hoped to provide some assessment as to how the vegetational changes recorded at Drigg compare with the wider regional picture.

9.5.3 The methods that will be utilised are:

i the monolith will be sub-sampled at regular intervals throughout its length (0.50m);

ii these samples will be prepared chemically for pollen analysis using the standard techniques outlined in Faegri and Iversen (1989);

iii the data obtained from this will be recorded on *pro forma* sheets, stored digitally and manipulated with the computer programme TILIA/TILIAGRAPH (Grimm 1991);

iv the data will be presented as a pollen diagram or diagrams and interpreted in the report;

v these data will be compared with the work of Richard Tipping at Williamson's Moss, south of Drigg (Tipping 1994), and other palaeoecological research in West Cumbria (summarised in Hodgkinson *et al* 2000), in an attempt to provide a context for the work.

## 9.6 INSECT AND ARTHROPOD ASSESSMENT AND ANALYSIS

9.6.1 ***Tasks 6 and 7*:**
to achieve Objective 5.

9.6.2 While at the time, when this report was first submitted to English Heritage, it was felt extremely likely that all samples would contain insect and arthropod remains, given the timescale involved and the potential for sample degradation, it is felt prudent to conduct a formal assessment first. The costs quoted assume the maximum price for assessment and analysis of six samples; if less work is required, the cost will drop accordingly. A detailed methodology for this element can be found in Kenward *et al* (1980; 1986).

## 9.7 ILLUSTRATION

9.7.1 ***Task 9*:**
to facilitate all objectives .

9.7.2 While basic stratigraphic drawings have been prepared for this *Project Design,* it is anticipated that additional drawings will be required to illustrate the various completed analyses. These will prepared as illustrator (ai) files, for east incorporation into the published report.

## 9.8 COMPILATION OF REPORT

9.8.1 ***Task 10*:**
to facilitate all objectives.

9.8.3 At the completion of all analyses all the specialist reports will be combined with the stratigraphic section to produce a draft report, as per *Section 9.10*.

## 9.9 QUALITY ASSURANCE AND REVISIONS TO TEXT

9.9.1 ***Tasks 11 and 12*:**
to facilitate all objectives.

9.9.2 Following the production of the draft text, the entire report will be subject to a rigorous edit by an experienced Copy and Content Editor. All revisions will be incorporated into the finished text before submission to English Heritage for approval.

## 9.10 PUBLICATION SYNOPSIS

9.10.1 ***Introduction:*** it is proposed that the Drigg evaluation and palaeoenvironmental analysis should be published as an article in the *Transactions of the Cumberland and Westmorland Antiquarian and Archaeological Society*.

9.10.2 The report will address the research objectives of the project, presenting an integrated synthetic overview of the various analyses and, where appropriate, précis of the environmental reports will be included, but more detailed data will remain in archive or, if considered academically necessary, they will be subject to separate publication in a suitable scientific journal. It is anticipated that the report will amount to approximately 6-8000 words, including bibliography, with approximately five line drawings and two plates. Word and figure counts are intended to act as an approximate guide. The report will address the following:

***Introduction and excavation background***
(300-500 words)

***Natural, archaeological and palaeoenvironmental background***
(500-700 words)

***The stratigraphic and palaeoenvironmental record***
(2000 words)

***Summaries of plant macrofossil, palynological and insect/arthropod evidence***
(1500 words)

***Dating***
(500 words)

***The regional prehistoric context***
(1000 words)

***Discussion and conclusion***
(1500 words)

***Bibliography.***

# 10. RESOURCES AND PROGRAMMING

## 10.1 NAMED PROJECT TEAM

10.1.1 The team consists of a combination of OA North staff, with input from external consultants. The project will be managed by Murray Cook with the Project Executive role performed by Rachel Newman.

| Name | Organisation | Tasks |
|---|---|---|
| Alex Bayliss | EH | Radiocarbon advice |
| Christine Howard-Davis | OA North | Report Production |
| Project Supervisor | OA North | Report Production |
| Project Archaeologists | OA North | Sample Processing |
| Elizabeth Huckerby | OA North | Palaeoenvironmental Analysis |
| Harry Kenwood | York University | Arthropod Analysis |
| Sandra Bonsall | OA North | Sample Processing |
| OA North Illustrator | OA North | Illustrations |
| Rachel Newman | OA North | Project Executive/Quality Assurance |
| Murray Cook | OA North | Project monitoring / Report Editor |

## 10.2 MANAGEMENT STRUCTURE

10.2.1 OA North operates a project management system. The team is headed by Project Executive, who assumes responsibility for the implementation and execution of the project design, and the achievement of performance targets, be they academic, budgetary, or scheduling. The Project Executive will define and control the scope of the post-excavation programme. Day to day management of the programme will be undertaken by the Project Manager.

10.2.2 Communication between all concerned in the post-excavation programme is of paramount importance and it is essential that comparable data are obtained. To this end, there will be regular communication between team members to review progress and coordinate the programme.

## 10.3 LIST OF TASKS

10.3.1 The programme has been broken down into a series of summary tasks which are set out in the accompanying Task List and Gantt Chart. In addition to the tasks outlined, there is some time allocated to general project monitoring and management. As the tasks are ongoing and are not allocated to any specific days, they do not appear on the accompanying gantt chart.

 

10.3.2 ***Management Tasks:*** the management and monitoring allocations are:

| | |
|---|---|
| Project Management | advice and coordination |
| | problem solving |
| | organising project meetings |
| | Liaison with specialists. |

## 10.4 FINANCIAL BREAKDOWN

10.4.1 See accompanying sheet. The total cost of the analysis and the preparation of the draft publication text is **£13520.13** at 2009/2010 levels.

 

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# TASK LIST

| Task No | Task Name | Days RN | Days MC | Days CHD | Days EHu | Days PS | Days Draught | Days PA | Days HK/York Uni |
|---|---|---|---|---|---|---|---|---|---|
| | Management | 0.5 | 1.5 | | | | | | |
| 1 | Start up | | 1 | | | | | | |
| 2 | Stratigraphic Analysis/ Site Narrative | | | 2 | | 3.5 | | | |
| 3 | Plant Macrofossil Processing | | | | | 2.5 | | 1 | |
| 4 | Macrofossil Analysis | | | | 4 | | | | |
| 5 | Palynological Analysis | | | | 9 | | | | |
| 6 | Insect and Arthropod Sample Assessment | | | | | | | | 3 |
| 7 | Insect and Arthropod Analysis (HK) | | | | | | | | 7.5 |
| 8 | Palaeoenvironmental Report | | | | 3 | | | | |
| 9 | Illustrations | | | | | | 3 | | |
| 10 | Compilation of Report | | | 6 | 1 | | | | |
| 11 | Quality Assurance | 0.5 | 1 | | | | | | |
| 12 | Revisions to Text | 0.5 | 0.5 | | 1 | | | | |
| **Total** | | **1.5** | **4** | **8** | **18** | **6** | **3** | **1** | **10.5** |

# FINANCIAL RESOURCES

| **Unit Staff** | **Grade** | **Per day** | **Days** | **Cost** |
|---|---|---|---|---|
| RMN | Project Exectuive | 281 | 1.5 | 421.5 |
| MC | Project manager | 211 | 4 | 844 |
| CHD | Finds Manager | 170 | 8 | 1360 |
| EHu | Project Officer | 154 | 18 | 2772 |
| Tba | Project supervisor | 108 | 6 | 648 |
| Illust | Illustrator | 121 | 3 | 363 |
| Tba | Assistant | 90 | 1 | 90 |
| | | | | |
| Total salary costs | | | | 6498.5 |

**EXTERNAL CONSULTANTS**

| | **Day Rate** | **Days** | **Cost** |
|---|---|---|---|
| Arthropod Assessment | 470 | 3 | 1410 |
| Arthropod Analysis | 470 | 7.5 | 3525 |
| | | | |
| Total Specialists | | | **4935** |

| | |
|---|---|
| Unit overheads @ 25% | 1624.63 |
| Overheads on Specialists @ 10% | 462.00 |
| | |
| Total Overheads | **22086.63** |
| | |
| **Total Costs** | **13520.13** |

# RISK LOG

| Risk | Description | Probability | Impact | Countermeasures | Owner |
|---|---|---|---|---|---|
| 1 | Loss, damage to, or disorganisation of environmental materials requiring assessment or analysis, rendering it useless for assessment and analysis | Medium | High | Ensure organised working environment, with materials clearly labelled and supporting documentation completed, including forms for removal, receipt and return of material for specialist examination. | Elizabeth Huckerby |
| 1 | Failure of external specialist to produce report on time | Medium | High | Leave sufficient time in schedule to allow for reasonable periods of sickness | Murray Cook |
| 2 | Illness of key team members/specialists, leading to set-back of timetable | High | Medium | Leave sufficient time in schedule to allow for reasonable periods of sickness | Murray Cook |
| 3 | Competition with other projects, leading to set-back of timetable | Medium | Medium | Post-excavation Programme manager to timetable staff appropriately | Murray Cook |

# GANTT CHART

see accompanying sheet

# ILLUSTRATIONS

## FIGURES



## PLATES



# APPENDIX 1: RADIOCARBON ANALYSIS

A1.1 Eleven samples from the Drigg burnt mound were submitted for radiocarbon analysis at the Scottish Universities Reactor Research Centre (SURRC) in 2002. They consisted of two samples of ground water, two of charcoal, five of wood, and three peat samples from the burnt mound itself.

A1.2 The principal aims of the dating programme were to:

- ascertain whether the Drigg Nuclear Fuel storage dump *c* 500m to the east of the site could affect the radiocarbon analysis of archaeological material,
- establish a chronology for the site,
- date the use of the burnt mound.

## A1.2 SAMPLING – I

A1.2.1 Given the potential technical problems arising from the proximity of the site to the Drigg Nuclear Fuel storage dump, a modern water sample was taken from a surface pond a few metres inland from the excavation. If water percolating through the site had enhanced levels of radioactivity due to the Nuclear Fuel storage dump, which could cause anomalous measurements on the archaeological material, then the dating of the site could have been jeopardised.

A1.2.2 ***Results - Ground Water samples:*** the two groundwater measurement (AA-43497 and AA-43498) made on dissolved inorganic carbon (114.2 ± 0.6 PMC) and dissolved organic content (119.6 ± 0.5 PMC) both showed evidence of $^{14}C$ enrichment, probably due to atmospheric nuclear weapons testing. The current ambient measurement is about 110%, although in AD 1963 it was about 200%! As there is no evidence of enrichment due to leakage from the nearby Nuclear Fuel storage dump, it was felt we could have confidence in radiocarbon measurements made on archaeological material submitted from excavation of the burnt mound.

## A1.3 SAMPLING II – BURNT MOUND

A1.3.1 The first stage in sample selection was to identify short-lived material which was demonstrably not residual in the context from which it was recovered. The taphonomic relationship between a sample and its context is the most hazardous link in this process, since the mechanisms by which a sample came to be in its context is a matter of interpretative decision rather than certain knowledge. Material was selected only where there was evidence that a sample had been put fresh into its context. The main categories of material which met these taphonomic criteria were:

- charred wood remains from the burnt mound itself - it was assumed that these related to the use of the feature;
- waterlogged wood from the structure (?trough or platform) under the mound;
- waterlogged wood from the putative walkway.

A1.3.2 In addition, a series of 'bulk' peat samples from above and below the burnt mound were taken to help refine its dating and provide chronological markers for future palaeoenvironmental work. Humin and humic acid fraction measurements were made on all these samples to test the homogenity of the peat.

A1.3.3 Once a group of potentially suitable samples had been identified, models were built, simulating the results of the dating programme (Fig 11). Radiocarbon results were simulated using the R_Simulate function in OxCal, with error terms estimated on the basis of the material available and the type of measurement to be commissioned (in this case all radiometric dates).

## A1.4 RADIOCARBON ANALYSIS AND QUALITY ASSURANCE

A1.4.1 The samples processed by SURRC were prepared using the methods outlined in Stenhouse and Baxter (1983) and measured using liquid scintillation spectrometry (Noakes *et al* 1965). The ground water samples were prepared in East Kilbride using the methods outlined in Stenhouse and Baxter (1983) and converted to graphite using the method of Slota *et al* (1987). They were measured by the University of Arizona AMS facility, as described by Donahue *et al* (1997).

A1.4.2 The laboratory maintain continual programmes of quality assurance procedures, in addition to participation in international comparisons (Rozanski *et al* 1992; Scott *et al* 1998). These tests indicate no significant offsets and demonstrate the validity of the precision quoted.

## A1.5 RESULTS

A1.5.1 The results, given in Table 2, are conventional radiocarbon ages and percent Modern (Stuiver and Polach 1977), and are quoted in accordance with the international standard known as the Trondheim convention (Stuiver and Kra 1986).

A1.5.2 ***Calibration:*** the radiocarbon determinations have been calibrated with data from Stuiver *et al* (1998), using OxCal (v3.5) (Bronk Ramsey 1995; 1998). The date ranges have been calculated according to the maximum intercept method (Stuiver and Reimer 1986), and are cited in the text at two sigma (95% confidence). They are quoted in the form recommended by Mook (1986), with the end points rounded outwards to ten years. The probability distributions are derived from the usual probability method (Stuiver and Reimer 1993; van der Plicht 1993). Those ranges printed in italics in the text are derived from mathematical modelling of archaeological problems.

A1.5.3 The two groundwater samples date to after AD 1950 and therefore cannot be calibrated with data from Stuiver *et al* (1998).

## A1.6 ANALYSIS AND INTERPRETATION

A1.6.1 The calibrated dates (Table 2) are accurate estimates of the dates of the samples, although, in archaeological terms, they are not exactly what we want to know. Of much greater interest and potential importance are the dates of the archaeological events represented by those samples. Absolute dating information in the form of radiocarbon measurements on the charcoal, wood, and peat samples can be combined with the relative information provided by stratigraphic relationships between samples to provide estimates of the dates of this activity. These *posterior density estimates* are not absolute, but are interpretative estimates, that can and will change as further data become available, and as other people choose to model the existing results from different perspectives.

A1.6.2 The methodology used to combine these different sorts of information is a form of Markov Chain Monte Carlo sampling, and has been applied using the program OxCal v3.5 (http://units.ox.ac.uk/departments/rlaha/), which uses a mixture of the Metropolis-Hastings algorithim and Gibbs sampler (Gilks *et al* 1996; Gelfand and Smith 1990). Details about the algorithims used by OxCal can be accessed from the on-line manual or in Bronk Ramsey (1995; 1998). The specific algorithims used in the models described below can be derived from the structures in Figure 12, or from the chronological query language files which are contained in the project archive.

A1.6.3 In the analyses undertaken, we have chosen to impose a uniform prior distribution on the spread of dates, while assuming that the dated samples represent independent events and a random sample of a relatively constant level of human activity (see Bronk Ramsey (2000) for further details of its implementation). Such an approach has been used because, when radiocarbon dates are constrained by relative dating information, it has been shown that there is a danger that the posterior density distributions may be spread evenly across a plateaux in the calibration curve, irrespective of the actual age of the material dated (Steier and Rom 2000). This is due to the fact that the statistical weight of a group of measurements naturally favours longer overall spans.

A1.6.4 ***The Sequence:*** the basal sample from the sequence was a 10-20mm thick slice of wood peat, containing some small birch twigs from layer [17]. The measurements on the humic acid and humin fragments from the peat (GU-5888; 4980±50 BP and GU-5889; 4980±50 BP) are not statistically consistent (T'=5.8; ν=1; T'(5%)=3.8; Ward and Wilson 1978). Given it can be assumed there is a fairly acidic environment for the peat, thus discounting the possibility of a downwards migration of humic acids, as is often the case in alkaline conditions (Dresser 1970), the difference in the measurements is perplexing. It is also worth noting that no systematic difference between the fractions is apparent in the other two pairs of results on peat samples from the site. The comparability of 'humic acid' and 'humin' fractions has been observed by Shore (1988), and so the difference may be an example of the one in twenty cases where the measurement error on the sample does not include its true date.

A1.6.5 Directly above the peat [17-1016], but below the burnt stones of the mound, was a sample of unworked wood [17-1024]. This lay on top of a worked timber [17-1023] and is thought to represent some sort of simple sturcutre, perhaps the remnants of a trough or platform. The wood [17-1024] was identified as *Quercus* sp and comprised the outer ?10+ rings of a piece of roundwood. The next sample in the sequence was a 10mm thick slice of woody peat from directly below the burnt stone layer. The measurements on the humin acid and humic fractions from this sample are statistically consistent (T'=1.6; ν=1; T'(5%)=3.8; Ward and Wilson 1978) and give a weighted mean of 3899 ± 38 BP. Two charcoal samples from mound [15] (containing the burnt stones) were submitted; [15-1010] contained *Alnus* sp, *Betula* sp, and *Corylus* sp, and [15-1008] contained *Alnus* sp, *Betula* sp and Pomoideae. Although single-entity dating of charcoal samples is usually recommended (Ashmore 1999), it was felt justifiable in this case to 'bulk' together the charcoal, because it had a direct functional relationship to its context, *ie* we assume that it represents fuel from the use of the burnt mound (Crowson and Bayliss 1999). The two measurements are statistically consistent (T'=0.7; ν=1; T'(5%)=3.8; Ward and Wilson 1978) and could therefore be of the same actual age.

A1.6.6 Two pieces of wood from layer [19] were submitted: (1022A) the outer ten rings of a piece of *Quercus* sp roundwood, and (1022B), a piece of compressed *Betula* sp roundwood with bark *in situ*. These samples were initially thought to come from layer [16], *ie* below burnt stones [15], but, following interrogation of the site archive, it became apparent that they actually came from layer [19], and their relationship to the burnt mound was thus less secure than at first thought. The two samples were, however, recovered in association with a massive plank of wood [19/10202], and appeared to have been placed deliberately, perhaps as a simple walkway across boggy ground. The plank itself was too large to be removed during the excavation, although subsequent erosion of the cliff face at Drigg has resulted in its removal and dendrochronological analysis (C Groves *pers comm*). The sample did not match any reference chronologies and therefore cannot be dated.

A1.6.7 The humic acid and humin fractions from a 10mm slice of dark firm browny-black clayey pea, directly overlying the burnt mound [14-1007], are statistically consistent (T'=0.7; ν=1; T'(5%)=3.8; Ward and Wilson 1978) and give a weighted mean of 3770 ± 35 BP. The last sample from the sequence, a piece of Salicaceae wood, also came from layer [14], but was stratigraphically above the peat sample. It came from one of several concentrations of unmodified wood in the context, none of which was conclusively identified as being anthropogenic in origin; thus it is possible that the wood is redeposited.

A1.6.8 ***The Model:*** we have chosen to use the measurement made on the humic fraction of peat sample 17 (1016) (Fig 12). This is because the humin fraction (GU-5889) would seem to represent reworked material inwashed when the basal peat formed, and thus GU-5888 is more likely to represent the date when the peat first formed. The model shows good agreement between the stratigraphy and radiocarbon results (*A=96.1%*) and provides an estimate for the start of peat initiation on the site of *3810-3650 cal BC (75% probability, GU-5888).* The

activity associated with the use of the burnt mound (deposition of charcoal [15-1010] and [15-1008]) is estimated as *2460-2230 cal BC (95% probability; GU-5884)* and *2480-2280 cal BC (95% probability; GU-5885*). The burnt mound would have gone out of use by *2310-2130 cal BC (95% probability)*, when it was sealed by the peat layer [14].

A1.6.9 ***Conclusions:*** the dating programme has been successful in meeting all of the objectives outlined above, and in particular providing a precise estimate for the date of the burnt mound.

| LAB NO | **Sample Ref** | **Material** | **% Modern** | **Radiocarbon Age (BP)** | **$\delta^{13}C$ (‰)** | **Weighted Mean** | **Calibrated date range (2σ)** | ***Posterior density estimate (at 95% probability)*** |
|---|---|---|---|---|---|---|---|---|
| GU-5819 AA-43497 | | Groundwater DIC | 114.2 0.6 | | -23.1 | | | |
| GU-5820 AA-43498 | | Groundwater DOC | 119.6 0.5 | | -30.3 | | | |
| GU-5884 | 15 (1008) | Charcoal: *Alnus* sp (8g), *Betula* sp (4g) and Pomoideae (3g) (R Gale) | | 3900 50 | -26.2 | | 2560-2200 cal BC | *2460-2230 cal BC* |
| GU-5885 | 15 (1010) | Charcoal: *Alnus* sp *(8g) Betula* sp (6g) and *Corylus* sp (1g) (R Gale) | | 3960 50 | -26.9 | | 2580-2300 cal BC | *2480-2280 cal BC* |
| GU-5886 | 14 (1007) | Peat: humic acid | | 3800 50 | -29.0 | 3770 35 BP (T'=0.7; ν=1; T'(5%)=3.8; Ward and Wilson 1978) | 2300-2040 cal BC | *2310-2130 cal BC* |
| GU-5887 | 14 (1007) | Peat: humin | | 3740 50 | -29.8 | | | |
| GU-5888 | 17 (1016) | Peat: humic acid | | 3980 50 | -28.7 | | 3940-3650 cal BC | *3940-3850 cal BC (20%) or 3810-3650 cal BC (75%)* |
| GU-5889 | 17 (1016) | Peat: humin | | 5150 50 | -28.8 | | 4050-3800 cal BC | - |
| GU-5890 | 16 (1011) | Peat: humic acid | | 3940 50 | -28.9 | 3899 38 BP (T'=1.6; ν=1; T'(5%)=3.8; Ward and Wilson 1978) | 2480-2200 cal BC | *2560-2530 cal BC (3%) or 2500-2350 cal BC (92%)* |
| GU-5891 | 16 (1011) | Peat: humin | | 3840 60 | -29.3 | | | |
| GU-5892 | 16 (1024A) | Wood: *Quercus* sp roundwood | | 4410 50 | -25.9 | | 3340-2900 cal BC | *3340-3210 cal BC (18%) or 3190-3150 cal BC (3%) or 3130-2900 cal BC (74%)* |
| GU-5893 | 16 (1024B) | Wood: *Quercus* sp roundwood, outer ?ten rings (R Gale) | | 4420 60 | -26.0 | | 3350-2900 cal BC | 3340-2910 cal BC |
| GU-5894 | 16 (1022A) | Wood: *Betula* sp narrow roundwood (diameter 25mm), *c* five growth rings (R Gale) | | 3990 70 | -28.0 | | 2840-2290 cal BC | 2860-2810 cal BC (3%) or 2690-2290 cal BC (92%) |
| GU-5895 | 16 (1022B) | Wood: *Betula* sp | | 4030 60 | -28.1 | | 2860-2400 cal BC | 2870-2800 cal BC (8%) |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | compressed roundwood (70 x 30mm), bark *in situ* (R Gale) | | | | | | or 2760-2720 cal BC (2%) or 2700-2450 cal BC (83%) or 2430-2400 cal BC (2%) |
| GU-5896 | 14 (1021) | Wood: Salicaceae (R Gale) | | 3790 50 | -28.0 | | 2410-2030 cal BC | 2270-2030 cal BC |

*Table 2: Radiocarbon results*

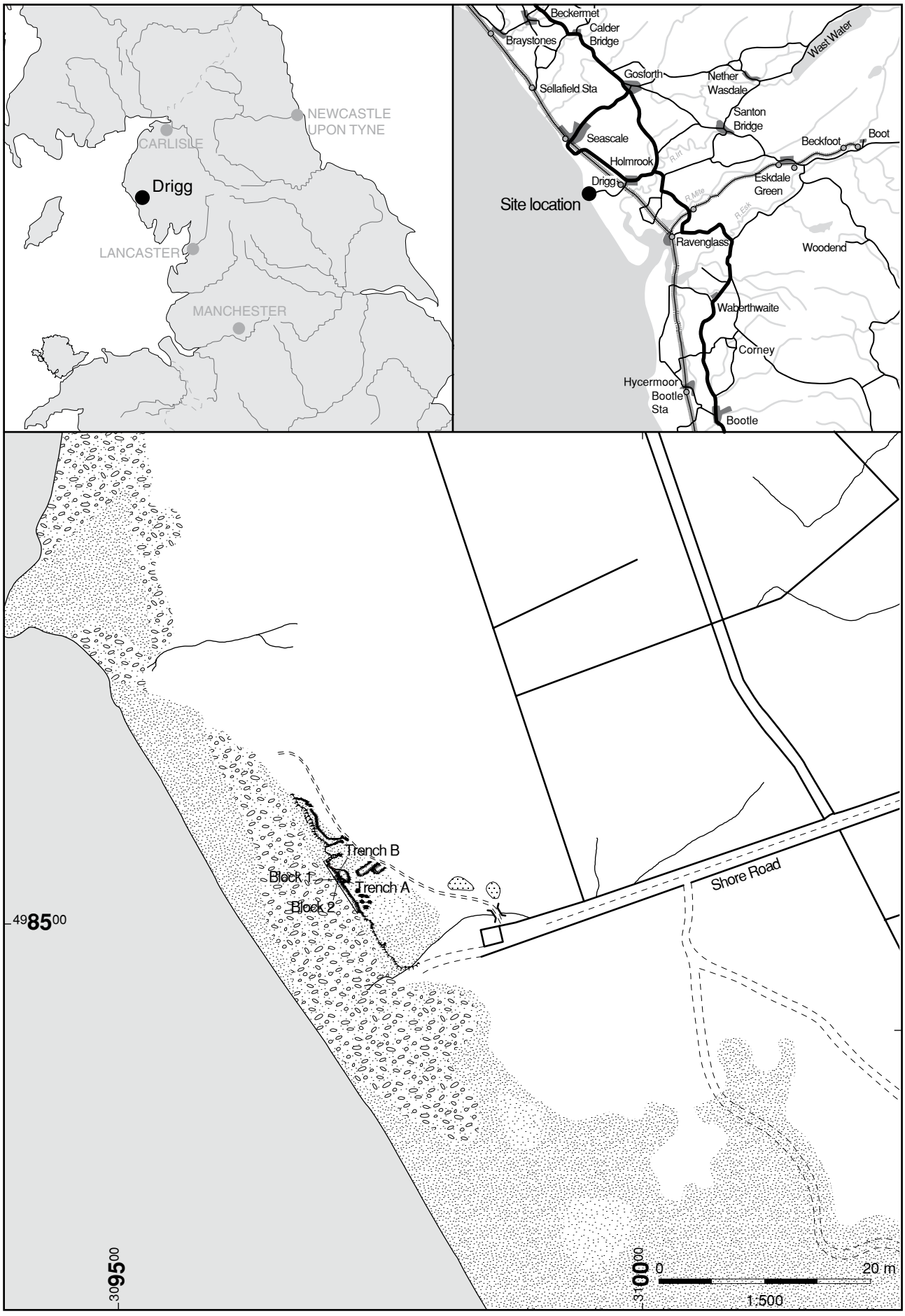



Figure 1: Site location

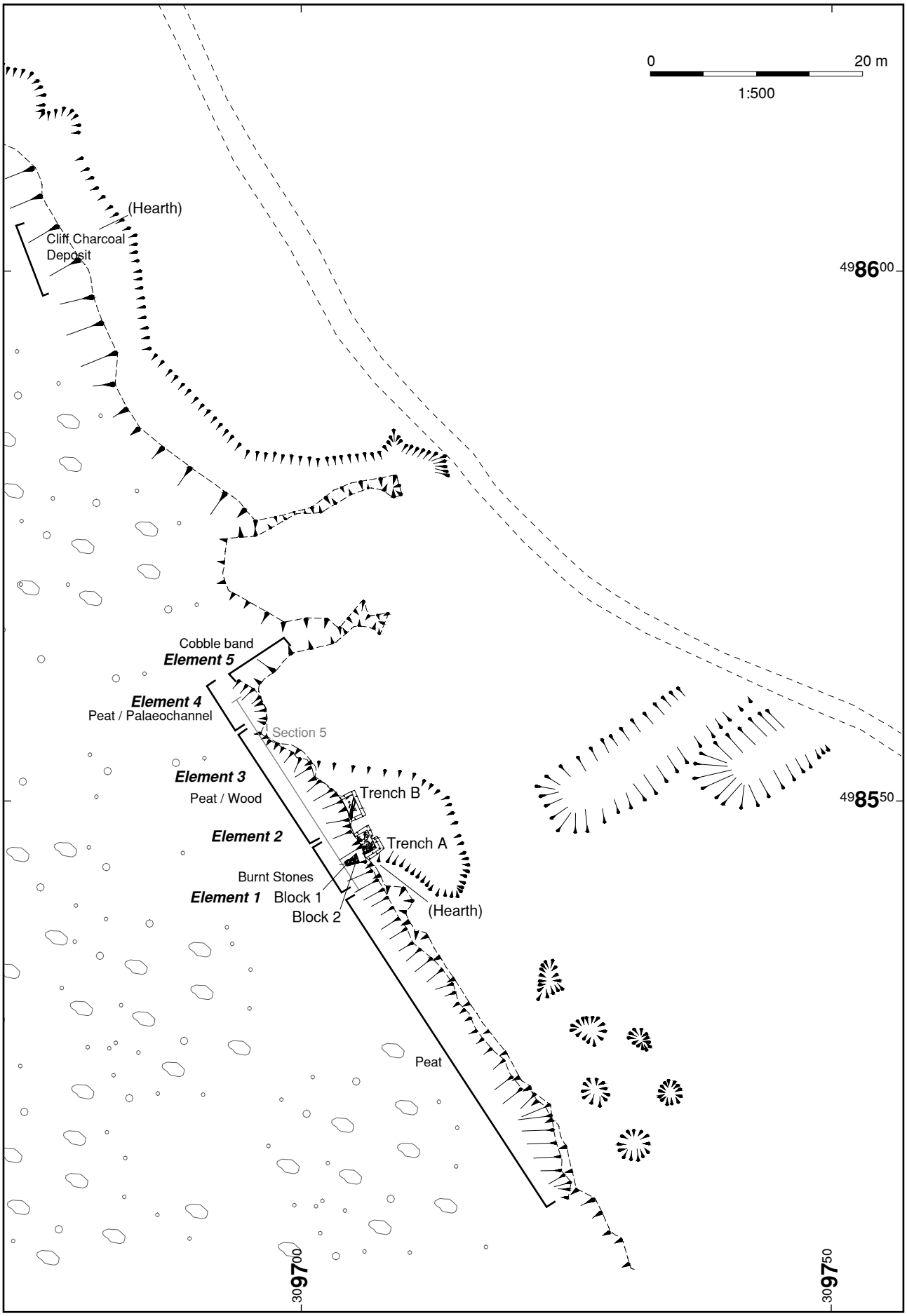



Figure 2: Site plan

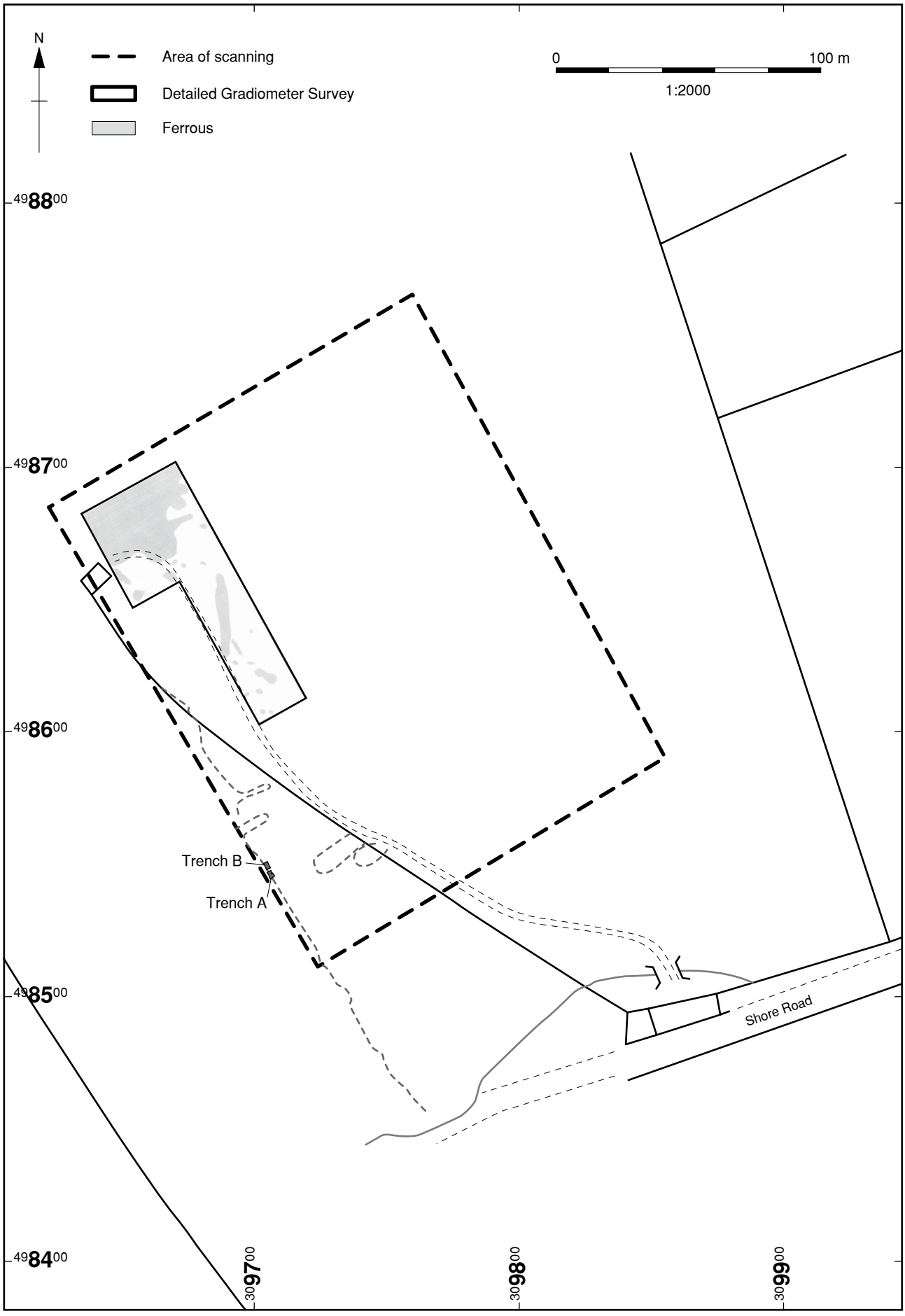



Figure 3: Location and results of geophysical survey

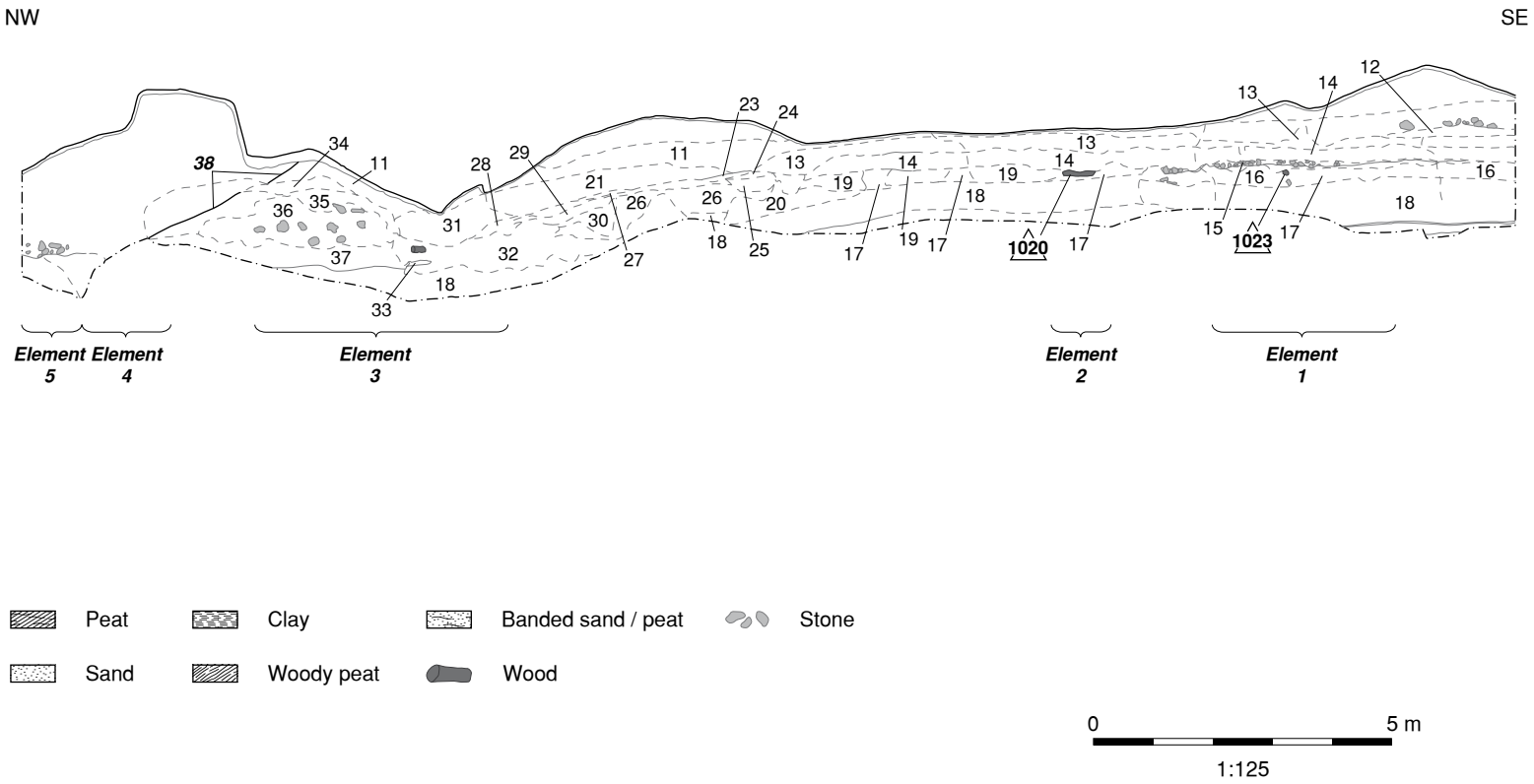



Figure 4: Section along cliff face

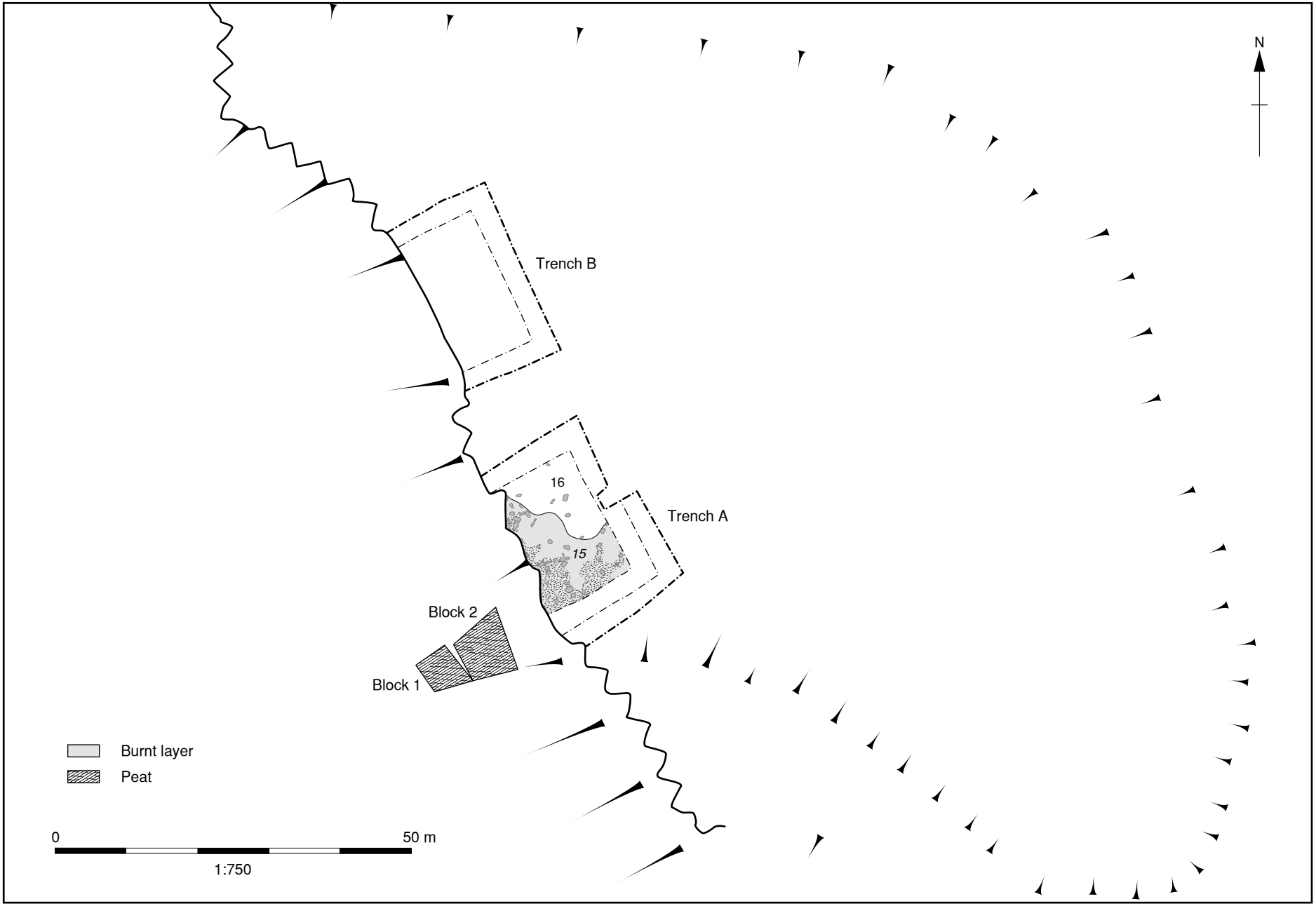



Figure 5: Hearth [15] plan

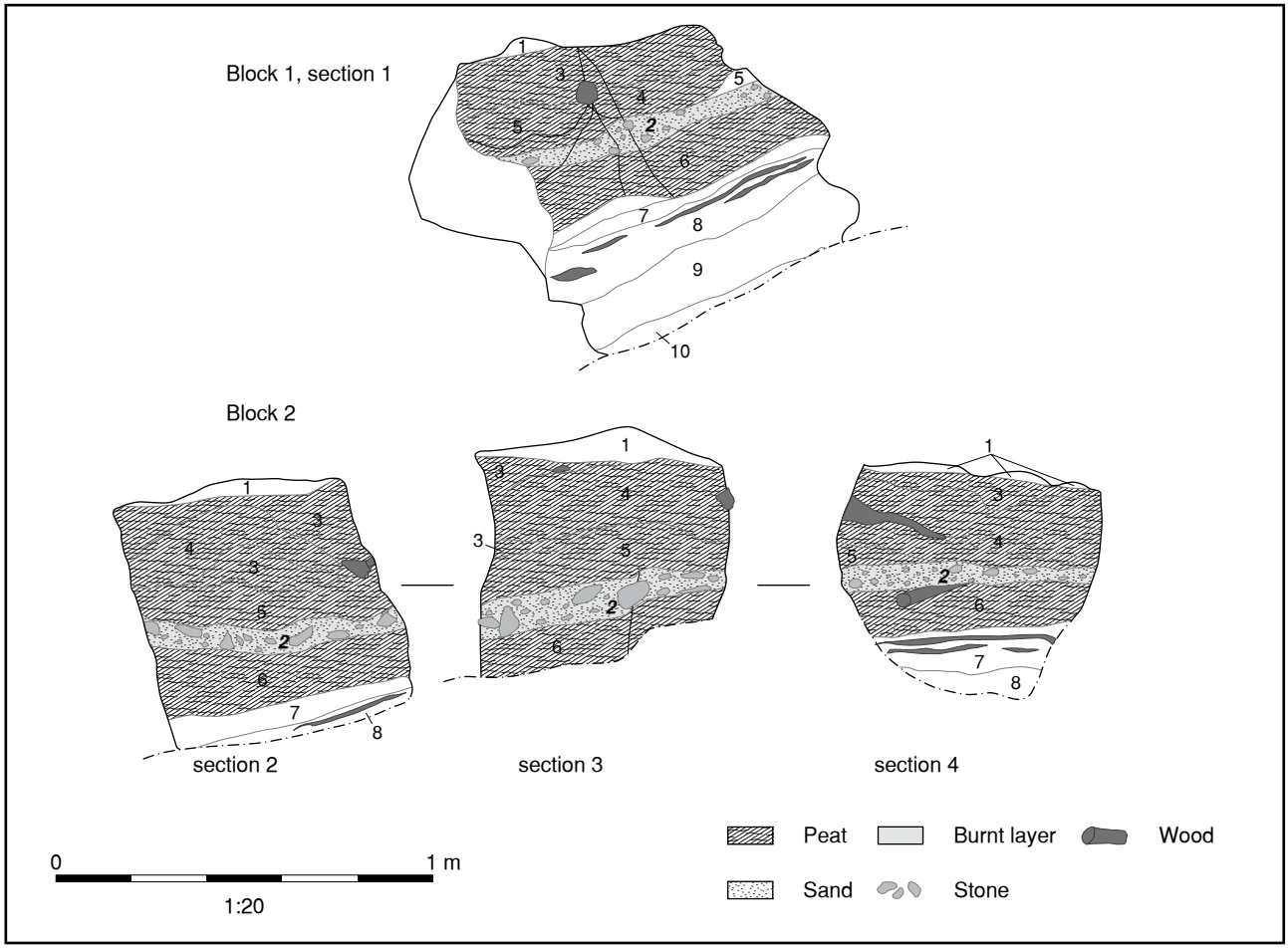



Figure 6: Sections of detached blocks

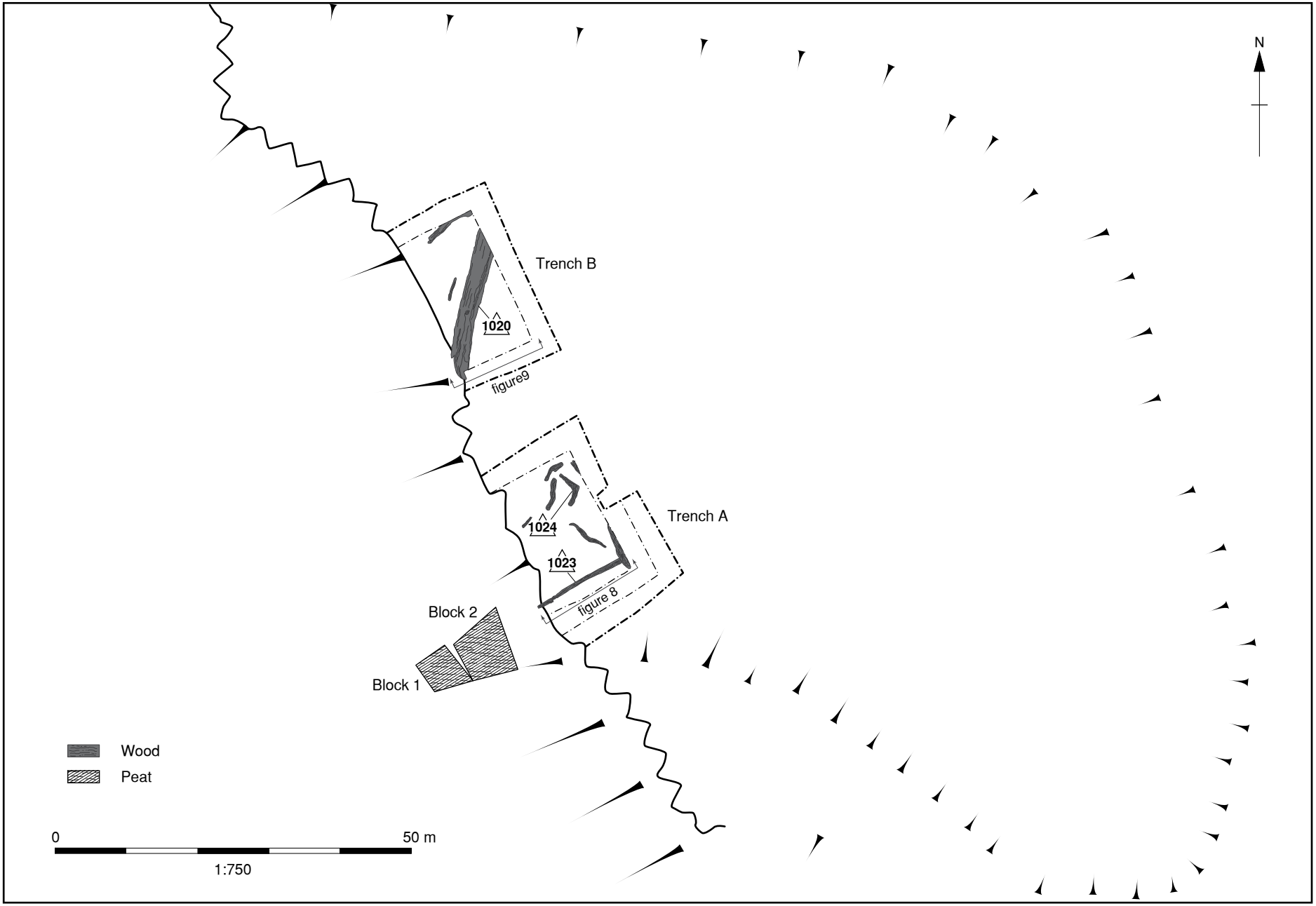



Figure 7: Layer [17] trench plans

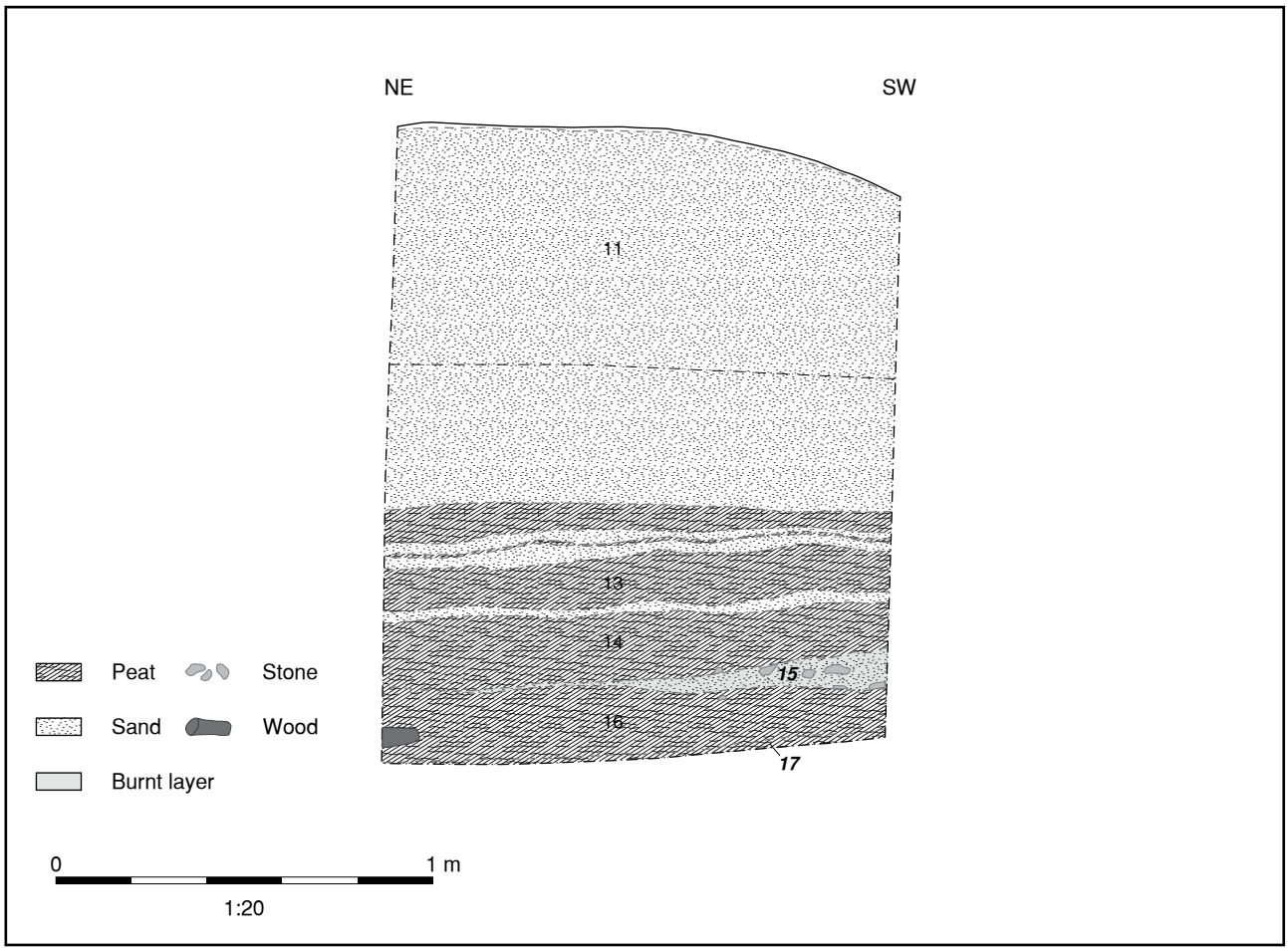



Figure 8: North-facing section of Trench A

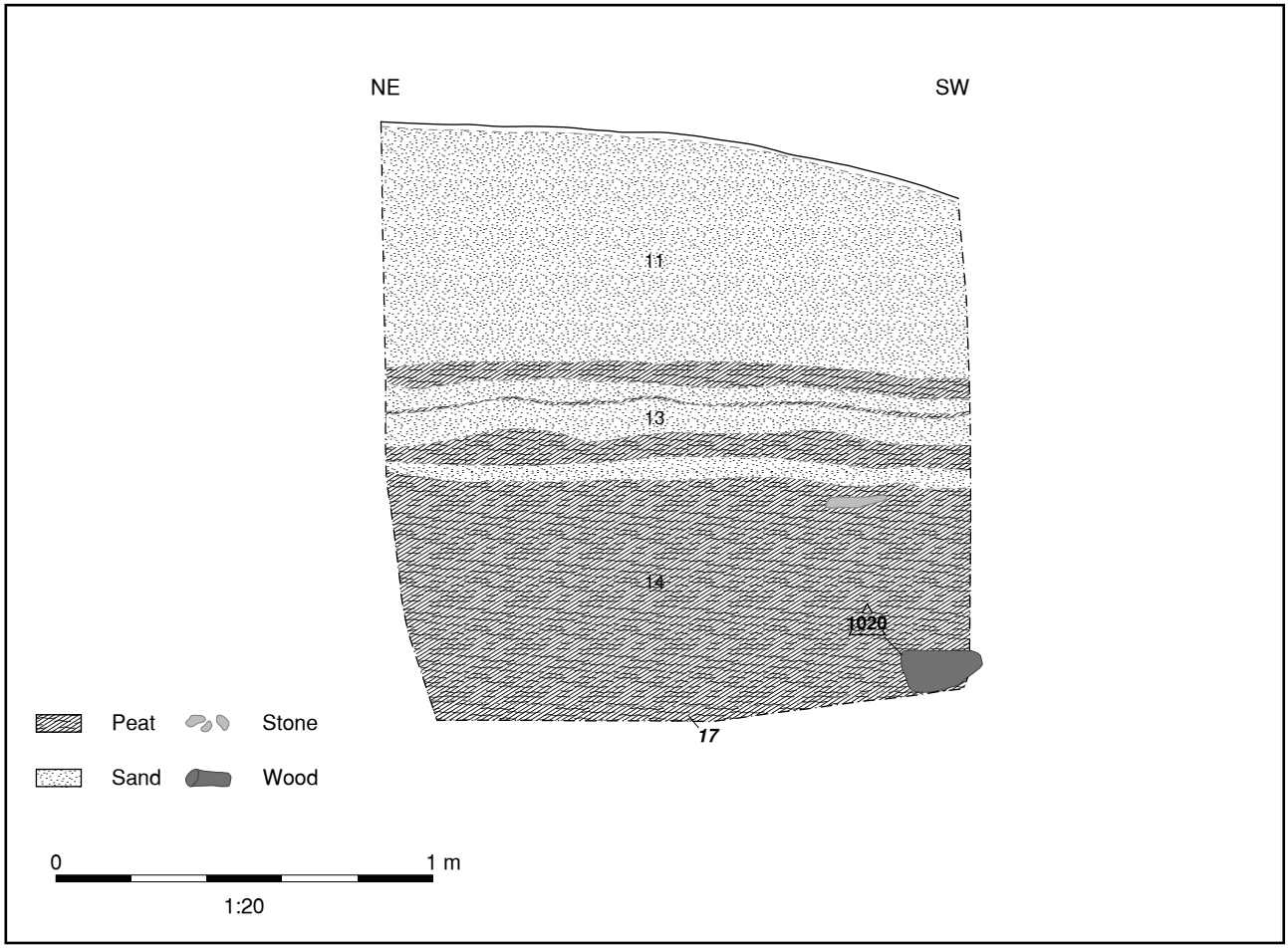



Figure 9: North-facing section of Trench B

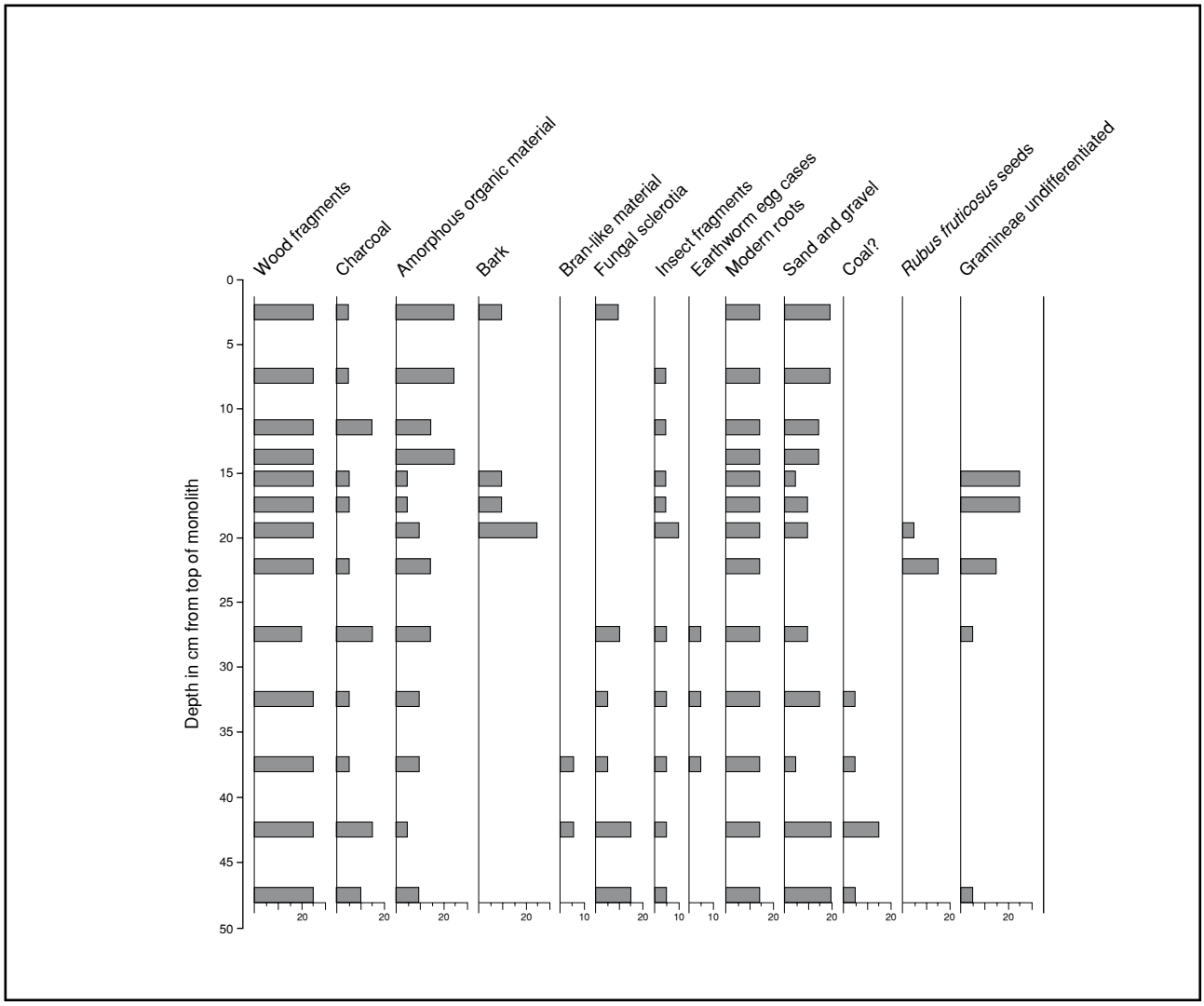
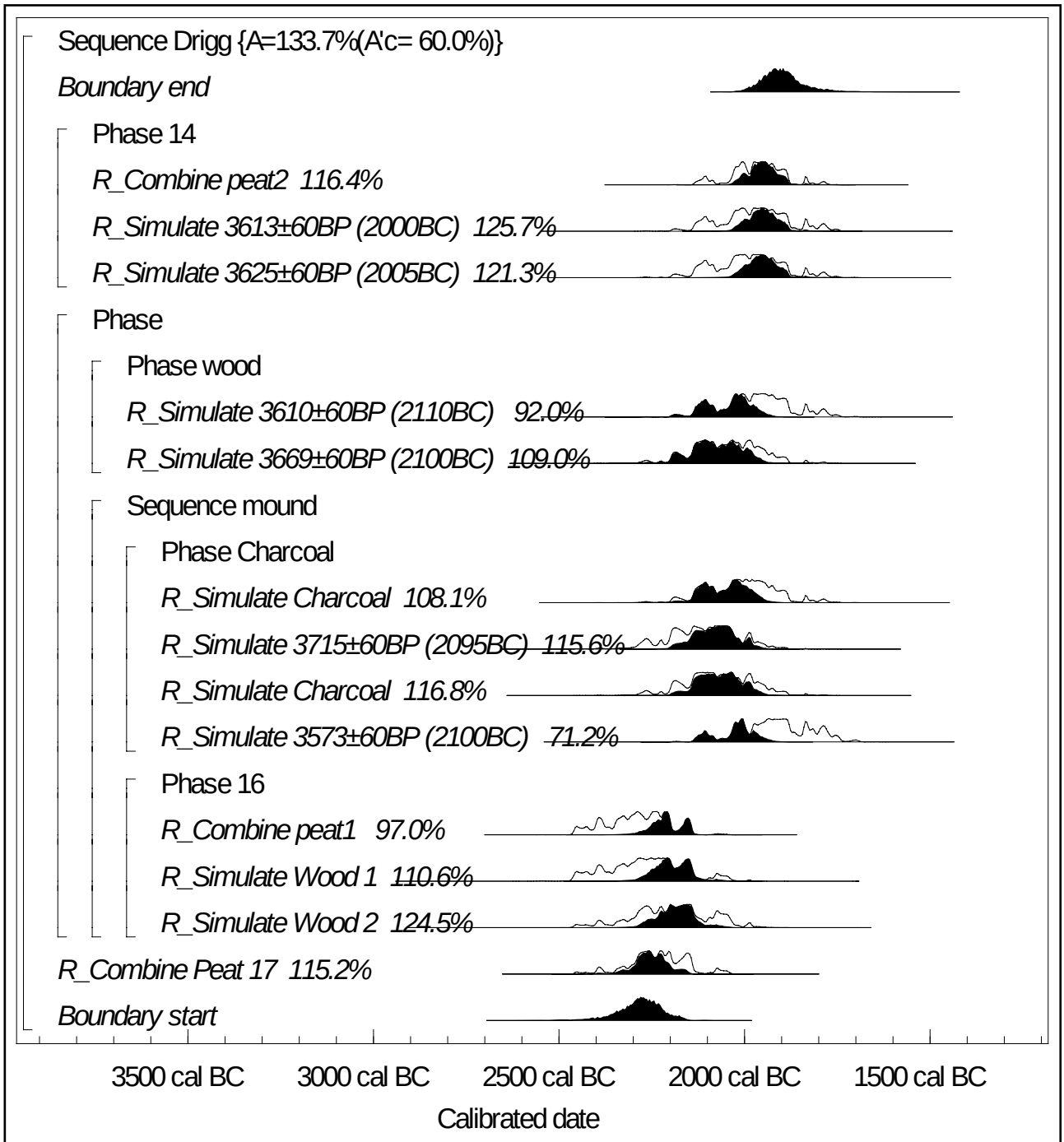
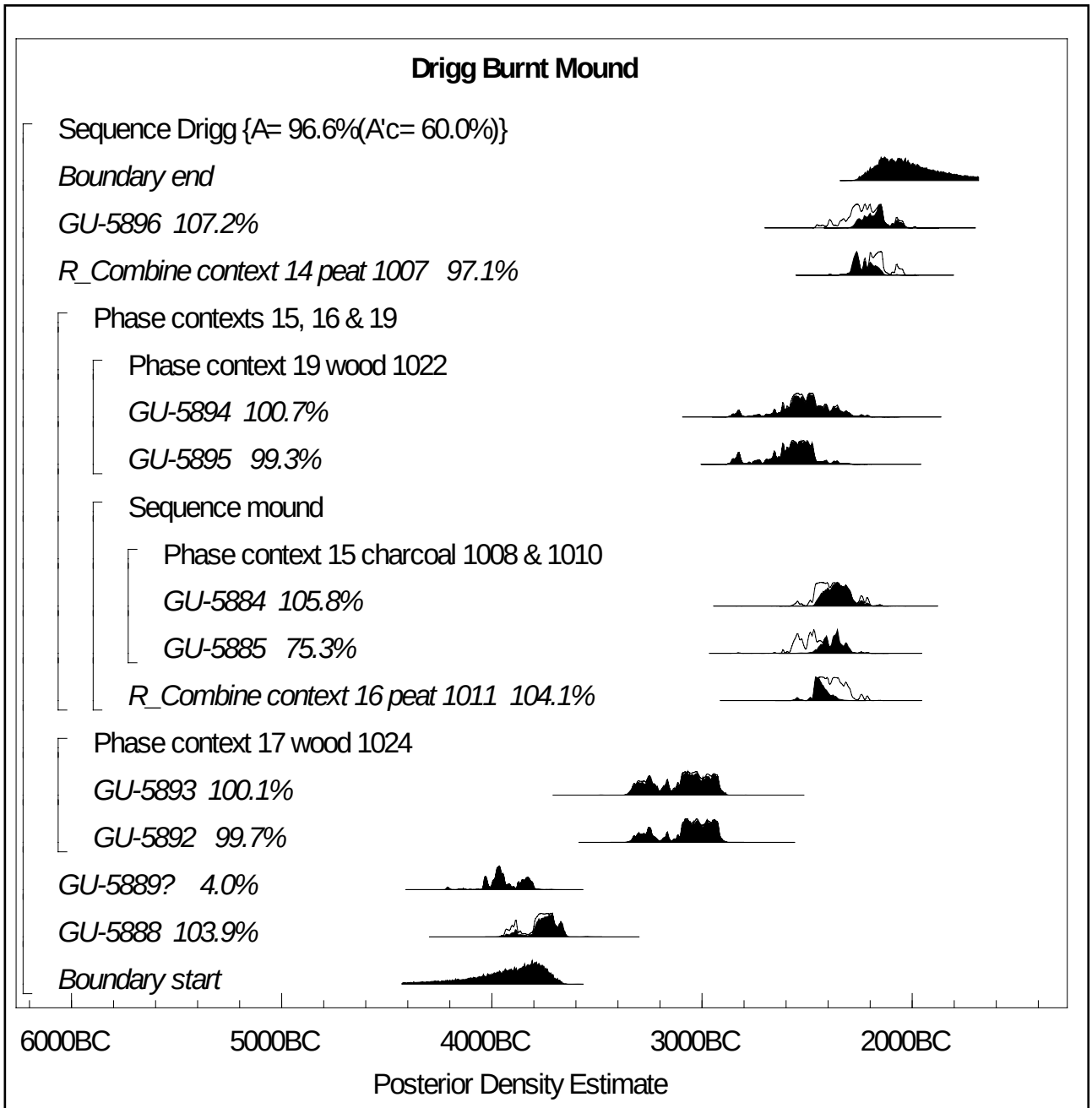



Figure 10: Macrofossil diagram from the Drigg ‘hearth’ monolith




Each distribution represents the relative probability that an event occurred at some particular time. For each of the simulated radiocarbon measurements, two distributions have been plotted, one in outline, which is the result of simple radiocarbon calibration, and a solid one, which is based on the chronological model used. The large square brackets down the left hand side along with the OxCal keywords define the overall model exactly.

Figure 11: Probability distributions of simulated dates model




Each distribution represents the relative probability that an event occurred at some particular time. For each of the simulated radiocarbon measurements, two distributions have been plotted, one in outline, which is the result of simple radiocarbon calibration, and a solid one, which is based on the chronological model used. The large square brackets down the left hand side along with the OxCal keywords define the overall model exactly.

Figure 12: Probability distributions of simulated dates model

Plate 1: Surveying the cliff section

Plate 2: Section along sea-cliff, showing all deposits


Plate 3: View of trenches from the east

Plate 4: Burnt stone layer [2] exposed in Blocks 1 and 2

Plate 5:  Burnt stone layer [15] in Trench A

Plate 6: Timber in Trench A (timber [1023] to rear)

Plate 7: Timber [1020] *in situ* within Trench B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