The Landscape Research Centre

The Landscape Research Centre
The Old Bridge Barn
Yedingham
North Yorkshire
YO17 8SL
www.landscaperesearchcentre.org
Registered Charity No. 326710
Registered Company No. 01852824

Investigation of Boltby Scar Promontory Fort SM26932
North York Moors National Park

Updated Research Design 2011

Prof. Dominic Powlesland FSA

21/03/2010

Table of Contents

Boltby Scar Excavation: Updated Research Design 2011 3
The 2009 Excavation and its implications 3
Revised Excavation Objectives 2011 5
Extend and complete the examination of the entrance. (Trench 517AD) 6
Recover high precision environmental evidence and lift *lackfilm* section for display in the visitor centre (Trench 517AB and extension) 6
Excavate a sample area within the enclosure to test for the presence of internal features relating to the use of the monument and determine whether the whole of the interior was levelled. (Trench 517AE) 7
Environmental sampling and analysis 7
Overview and excavation policy 8
Offsite assessment and sampling. 9
The Cleave Dyke and Roulston Scar Hill fort 9
Timing 10
Post excavation arrangements 10
Organisation 10
Staff 11
External Specialists 11
Health and Safety and Insurance 11
Appendix I 12
Introduction 12
Research approach 13
Results from the individual trenches 14
Trench 517AA 14
Trench 517AB 17
Trench 517AC 19
Interim Conclusions 21
Appendix II 22
Boltby Scar: Pollen analysis of the enclosure ditch sediments 22
References 24
Appendix III 25
Radio Carbon Dates 25
Laboratory Code 25
Radiocarbon Age BP 25
Laboratory Code 1
Radiocarbon Age BP 1
Laboratory Code 1
Radiocarbon Age BP 1

Boltby Scar Excavation: Updated Research Design 2011

The 2009 Excavation and its implications

Excavation of Boltby Scar Promontory fort, undertaken throughout September 2009, was intended to identify and characterise the nature of the surviving evidence relating to the defences of this important site which were sadly levelled by bulldozer in 1961. The excavation was run as a community project and was intended to secure evidence that would allow the past excavations, which are poorly documented, to be reassessed, to contribute towards the long term management of the site within the context of the North York Moors National Park, and to enhance the visitor appreciation of the site as a key feature within the park. The excavation programme drew upon the evidence gathered through the geophysical survey undertaken by the LRC and the detailed topographic study undertaken by English Heritage. The excavation was focussed upon the excavation of three ditch sections designed to assess the impact of the 1961 bulldozing, assess the quality and integrity of the surviving features, and to secure environmental and dating evidence.

These objectives were admirably achieved and are discussed in detail in the interim report attached as appendix I.

Since the release of the interim report we have received a pollen assessment report from Dr. C Langdon and Dr. R Scaife of the University of Southampton, and three radiocarbon dates processed by the Scottish Universities Environmental Research Centre, included as appendices II and III.

In short, the returns from the excavation have outstripped our preliminary expectations and it is clear that Boltby holds answers to questions regarding the developing environment of the National Park, the evidence for which may not have survived in any other location. The few sherds of 'non-diagnostic' pottery recovered from the ditch fills during 2009 failed to provide secure dating evidence; however, the Radio-Carbon dates tell an interesting story. A single carbonised hazelnut shell from the primary fill of the ditch returned an Early Bronze Age date within the range 1970BC to 1760BC at 95.4% probability; we need to be aware that a single date like this may not be reliable on its own and that the hazelnut shell may be residual. That there was activity on Boltby Scar at this period is known from the discovery of a Beaker period hair ornament in Wilmott's excavations in the 1950's, and it is likely that the two Barrows known to have been contained within the ditched enclosure are of this general date. Whilst a Beaker date for the enclosure is attractive, we would need further dates to confirm this. Within the ditch fill three well preserved turf lines overlay peat deposits which hold an unparalleled environmental record; the upper turf line, which was still green on exposure, was buried when the ditch was backfilled in 1961. Two dates were returned from the lower desiccated turf deposits in the ditch fills; both are post-Roman, with the lower turf horizon giving a date in the range AD590 to AD670 (95.4% probability) and the middle turf horizon giving a date in the range AD900 to AD1120 (95.4% probability). Pollen evidence indicates that the Boltby Scar enclosure was situated in an open grassland environment and that the heathland that was a characteristic of the landscape prior to 20th century agricultural improvements became established in the post-Roman period. After the filled ditch had stabilised, periods of increasing wetness reflected by peat formation were interspersed with dry phases when the turf horizons formed. Further work will be necessary to add detail and further chronological information to the post-Roman environmental sequence; however, it is already clear that the site holds evidence which will allow a detailed picture of climate and environmental change from the Roman to Medieval periods to be identified. Although the post-Roman environmental sequence does not obviously relate to the construction and use of the Boltby Scar enclosure the discovery of Anglo-Saxon peat is exceptional since the environmental record for this period is so limited both regionally and nationally; we are not aware of any similar deposits surviving elsewhere in rural England.

The results of the excavation demonstrated that the bulldozer had severely truncated the surface along the line of the ditch and removed all but a very small fragment of any worn surfaces that had existed in the entrance. The limited size of the trenches meant that it was not possible to determine whether the rampart had been reinforced with timbering or deployed a box-rampart construction; in one small area where the bulldozer had clearly been avoiding impact on the remaining upstanding round barrow in the interior of the enclosure a fragment of turf rampart base had survived. Any hopes that we may have had that the bulldozer had simply pushed in the upstanding rampart and counterscarp bank were over-ambitious and thus a proposal to re-establish a representative bank by extracting the 1960's backfill cannot be sustained. Requests sent out through the volunteers to find anyone who was there at the time the monument was levelled

revealed that both the landowner and the bulldozer driver were no longer alive. However, it remains unclear as to whether the levelling was confined to the rampart and ditch or extended over the whole of the interior of the monument.

Whilst the 2009 excavations, despite their limited scale, satisfied the primary objectives identified in the research design, the assessment identified further questions and opportunities that could greatly enhance our understanding of the site and its setting (Powlesland 2009). The excavation was also successful at developing a volunteer base which was a key objective in terms of community engagement within the national park.

In order to build upon the initial results a second season of excavation should be undertaken. Now that the level of truncation resulting from the 1961 levelling has been established with reference to the enclosing ditch and ramparts, excavation strategies can be developed which reflect the fact that the scheduled monument has already been seriously compromised. Physical damage by the bulldozer is the most obvious aspect influencing excavation strategy; on a more subtle level the identification of a magnificent environmental record needs to be set against the gradual decay of this resource which is reflected by ongoing desiccation of the peat deposits in the filled ditch as a consequence of current climate change. This has led to shrinkage of peats in the ditch fills and the formation of subtle depressions over the ditch, identified in the English Heritage topographic survey. This process of desiccation and shrinkage is very recent but will continue leading to the loss of the extraordinary environmental story. The environmental research instigated as part of the excavation was undertaken to establish the environmental potential rather than to recover the full environmental story, which would require a more comprehensive programme of sampling and dating. The staged process developed here is entirely appropriate in the context of Boltby Scar where there was no prior understanding of the environmental potential.

Following discussions with NYMNP and English Heritage at the close of the 2009 excavation it was agreed that, given the condition of the site and the need to develop an enhanced information base both for the NYMNP visitor centre and for potential on-site signage, that a second season of excavation, run on the same community basis, should be contemplated once the results of the environmental and dating programmes had been returned.

The levels of damage resulting from the combined actions of bulldozing and subsequent intensive ploughing have left the monument in an exceptionally poor state. Only open area exposure can hope to provide the much needed detail required to understand the form, date range and nature of the activity at this site. Whilst the fact that the site is damaged may limit the amount of surviving in-situ evidence it does mean that we are able to examine larger areas than would be appropriate had the site been better preserved, and thus this should be seen as a rare opportunity to investigate a class of monument that is rare in Yorkshire and see if it can correctly be termed a Promontory Fort.

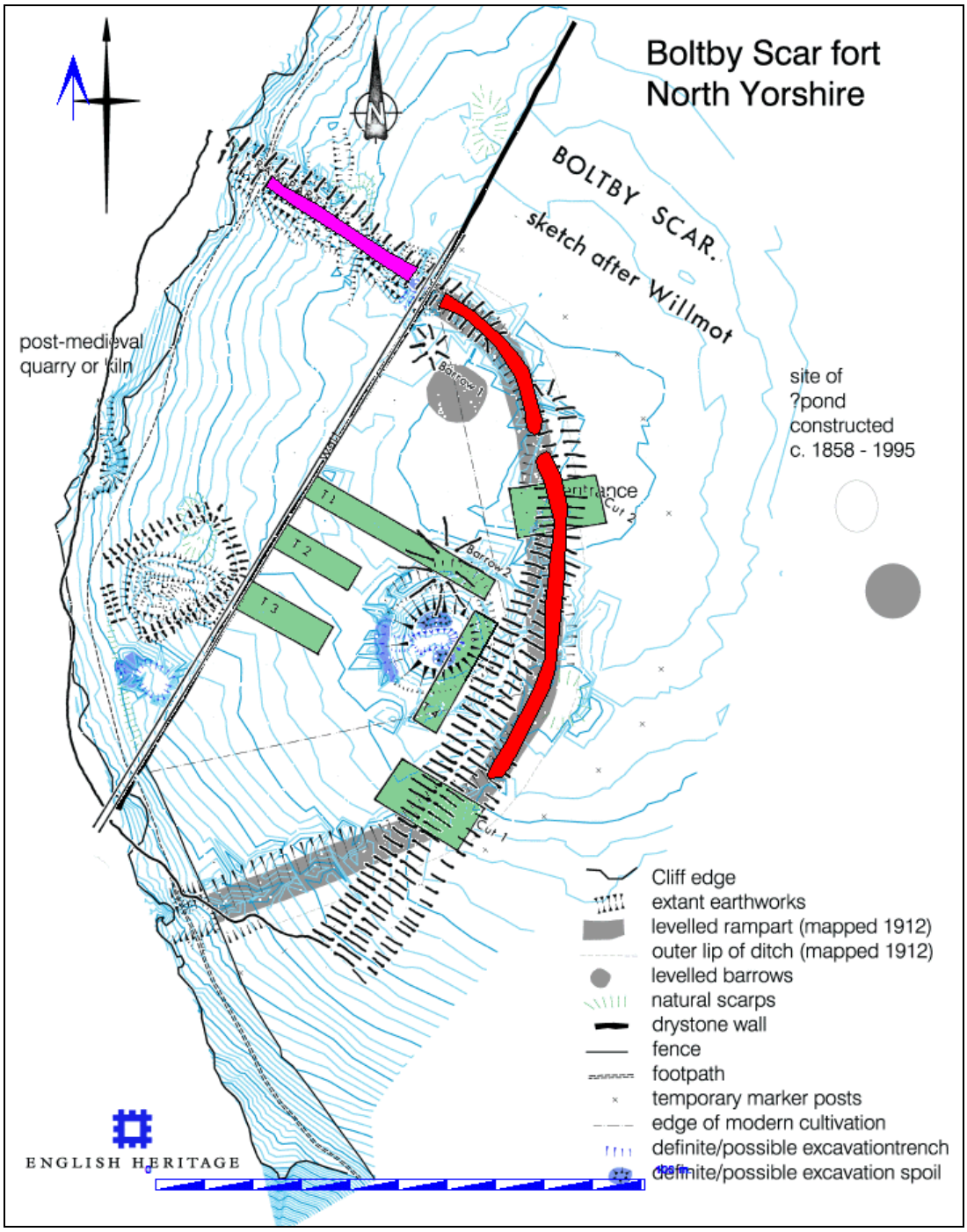


Figure 1: Combined and overlaid plans incorporating the EH topographic survey, the LRC geophysical plot of the ditch and the Willmot sketch plan positioned employing a best fit. (clearly there are problems with the Willmot plan!)

Revised Excavation Objectives 2011

In response to the results of the 2009 excavation season we have identified a range of objectives that will allow us to refine and expand on the results of the preliminary assessment. Excavation will be targeted towards the examination of three areas, the eastern entrance, an area of the interior of the enclosure with an extension into the extant and upstanding barrow, designed to secure environmental and dating evidence and a small extension to trench 517AB into the same barrow mound to further examine the buried soil and relationship to the bulldozed rampart fragments identified in 2009.

The 2009 excavation proved very successful in terms of community engagement and volunteer training. In 2011 we have been lucky enough to establish an agreement with the University of York to take up to 30 undergraduates for fieldwork training, combined with local volunteers, we expect to be able to deploy a team of nearly 50 for the first three weeks of the excavation. This will enable us to approach larger areas than were originally envisaged and improve the excavation experience for all involved.

Extend and complete the examination of the entrance. (Trench 517AD)

The examination of the western side of the entrance to the enclosure (Trench 517AA) was constrained by the needs to minimise damage to potentially preserved old ground surfaces associated with the ramparts and the entrance passage into the monument. Multiple bulldozer tracks both parallel to the ditch and extending across the entrance confirmed that the area of the entrance had been truncated, removing both the base of the rampart and any surfaces that had existed in the entrance itself. Examination of the filled northern ditch terminal both in plan and in quarter section suggests that the surface may have been truncated by up to .2m. The ditch in this area exhibited the same filling sequence as in trench 517AB, on the eastern side of the monument, with exceptionally well preserved but desiccating sequences of turf-capped peat deposits which offer the potential to enhance the results of the preliminary environmental assessment. The trench was too limited in area to confirm whether the entrance had been marked by a timber gateway and whether the rampart had employed box section construction techniques. It is proposed to extend the trench to cover the whole of the entrance, empty both ditch terminals completely with a review to recovering further close sample environmental samples and further dating material. By extending the trench into the interior of the enclosure we hope to determine whether there are any internal features surviving which might enhance our understanding of the function of the enclosure. It is proposed to strip and clean a large area onto the bulldozed surface in the hope of identifying evidence that may confirm the location of 'Barrow 1' (see Figure 1) identified in early maps and Willmot's excavation plan; this will also allow us to determine if there is any surviving evidence indicating the use of timbering in the rampart. The rampart at Roulston Scar employed a timber box-rampart construction in one phase at least and, given the likelihood that the two forts are contemporary, we need to test for the use of timbering in the rampart. As the area is so truncated we can expose a large area but confine excavation to limited areas within the stripped trench.

Recover high precision environmental evidence and lift *lackfilm* section for display in the visitor centre (Trench 517AB and extension)

The excavation objectives at Boltby Scar combine public outreach, working with a team of local volunteers and public display through open days, with research into the nature of the site with a view to enhancing visitor experience on site and through displays at the Sutton Bank National Park Centre. As far as we are aware the LRC is the only organisation in Britain to have lifted archaeological soil sections using the *lackfilm* technique, employed as standard practice for museum displays in Germany, Holland and Scandinavia. The extraordinary visual quality of the sections in trenches 517AA and 517AB, and the detailed environmental and chronological stories that they tell, make these the perfect candidate for lifting and display. Rarely do we see archaeological sections that are so easy to interpret and present. By impregnating the standing sections with acetate lacquer as exposed, the section can be preserved before natural decay affects the extant peat and turf deposits, and lifted for suspension on the wall as part of the public display. Trench 517AB was lined with Terram geo-textile prior to backfilling to facilitate its reopening as there was not time to secure the chemicals necessary to lift a section in 2009.

The environmental assessment of the ditch fills in this trench, combined with the Carbon 14 dates extracted from the turf deposits in the ditch, confirmed that the conditions are suitable for a high resolution pollen sampling programme which would greatly enhance the already exciting environmental history of the site; even the lower ditch fills, which were not subjected to intensive sampling in 2009, appear to preserve pollen well giving the potential for reconstructing a full environmental sequence from the period of construction to the present day. It is also proposed to extend the trench so that further samples can be recovered from any surviving land surface beneath the upstanding 'Barrow 2' within the interior of the monument. Early photographs indicate that the 19th century robbing of the barrow had included dumping of spoil between the Barrow and the ramparts, so the presence of any surviving buried old ground surface could be tested here, causing minimum impact on the upstanding monument.

This aspect of the project would not only secure an important resource for display in the visitor centre but also engage volunteers in generating that resource; it may be of some additional value to document the process of recovering the section on video, including discussion of its importance to support the display in the visitor centre.

We propose to commission a site artist to work on site for 5 days to generate pictures of the work in progress and then develop reconstruction drawings, incorporating the volunteers both in the in progress images and again in the reconstruction drawings.

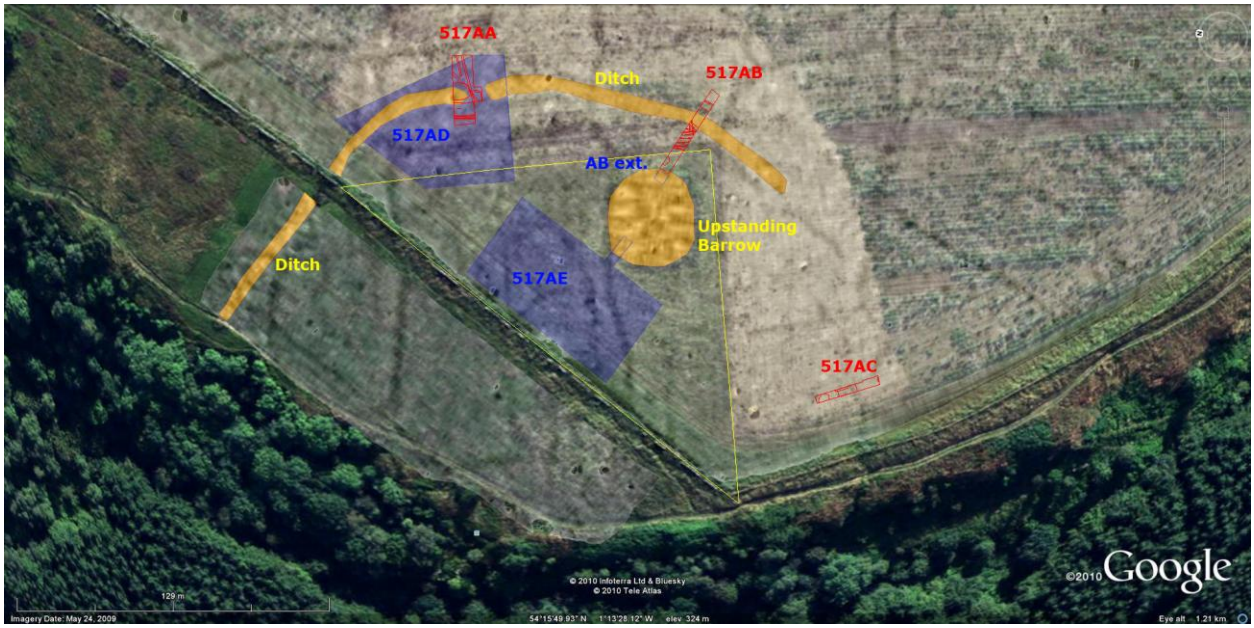


Figure 2 Boltby Scar viewed in Google Earth with the geophysical anomalies and extant barrow shown in orange, 2009 trench locations in red and proposed 2011 trenches in blue. The yellow triangle identifies the area that may not have been levelled by bulldozer.

Excavate a sample area within the enclosure to test for the presence of internal features relating to the use of the monument and determine whether the whole of the interior was levelled. (Trench 517AE)

Whilst the excavated ditch sections have provided some dating evidence and allowed us to identify the environmental potential, other evidence which could indicate the function of the enclosure has not been forthcoming; the few sherds of pottery are un-diagnostic and, with only a single Carbon Fourteen date from the primary ditch fill, the construction date is not securely fixed. In trench 517AB there was an indication that the rampart may have been constructed using turf stripped from the interior, but the area exposed was too limited. It is not clear whether the levelling of the site in the 1960's extended over the whole of the interior of the monument and therefore it is proposed that an area be opened within the centre of the enclosure to identify whether the whole area was bulldozed and to test for the presence of internal features that might indicate how the enclosure was utilised; this may also hold further dating evidence. The handful of sherds recovered from the three excavated ditch sections are not diagnostic and provide neither a secure date for the construction of the promontory fort/enclosure nor any insight as to whether the enclosure provided either short term refuge or longer term domestic settlement.

If we are to enhance visitor information and place Boltby within a broader context it is essential to try and secure evidence of function and the period or periods of active use. In terms of the future management of the site it is important to determine the extent of the bulldozer damage and whether there is any in-situ evidence surviving in the interior of the enclosure.

The presence of the upstanding 'Barrow 2' surrounded by robbers' spoil dumps provides the potential for recovering further key environmental evidence from the old ground surface beneath the barrow as well as areas covered by 19th century spoil heaps that were neither bulldozed nor subsequently ploughed. If the interior of the enclosure was not characterised by relief features then one is tempted to suggest that the area in the interior, a triangular area with the apex defined by the extant Barrow, may not have been levelled. The rest of the monument, to the south-east of the boundary wall, has been intensively ploughed and it is important to determine whether this has left any intact and in-situ features in order to inform the scheduled status of the monument as well as our understanding of form and function. It is therefore provisionally proposed to open an area measuring c.35 x 20m within the centre of the monument with a 2m wide extension linking the open area to the area of dumped spoil around 'Barrow 2'. The extension would not only provide an opportunity to examine sealed deposits beneath the Barrow robbers' spoil-heaps but also to secure environmental evidence beneath the barrow mound, which we assume to be of Early Bronze Age (EBA) date, to compare with the evidence from the primary ditch fill for which we have an EBA C^{14} date.

Environmental sampling and analysis

The archaeological excavation, pollen analysis and radiocarbon dating of the ditch deposits proved to be much more interesting than might have been expected. The deposits in the enclosure ditch appear to span the Early Bronze Age to the Saxon period. The initial pollen sampling of the ditch section was primarily designed to

establish the survival and quality of the pollen evidence. In the event, pollen was found to be very well preserved throughout the deposits, from the basal fills to the top of the organic sediments. These latter deposits appear to have built up during the Saxon period and afford an unusual sequence for this location.

Since the initial analyses targeted deposit types and did not sample the whole sequence in the fills this work and the radiocarbon dates have shown that both a prehistoric sequence and presumably a late Roman and Saxon sequence certainly survive in the ditch fills. There may be a hiatus in the sequence in the later prehistoric and Roman periods when little sediment build up occurred in the ditch, but the pollen data shows a major change in the local vegetation on the site which may well be related to climatic changes during the 1st millennium AD. It is therefore recommended that the ditch sequence is re-examined and sampled much more intensively to recover a dated sequence of pollen samples from the prehistoric and historic sequence so that questions concerning climate influence, vegetation changes and the impact of human pastoral and arable activities can be more closely analysed and tied in to the local archaeological history of the area.

The ditch depth is 90cm and at the usual sampling interval of 4cm this would necessitate 23 pollen samples. The initial results indicated that further dates should be obtained for this sequence from at least three, and probably four locations up the section in order to define more precisely the periods represented by the deposits and the chronology for the vegetational changes the initial pollen study has illustrated.

Additional areas of work that need to be extended to establish the actual date of the original construction of the ditch, and the palaeoenvironmental evidence that could be gained from study of any buried soils associated with the barrow on the site, include the bulk sampling of the lower fills of the enclosure ditch and detailed sampling of the palaeosoils for micromorphological and pollen analysis.

Overview and excavation policy

The three areas to be examined are identified in Figure 2; the area over the northern part of the ditch (517AD) would be stripped and cleaned and only very selectively examined in more detail beyond the entrance area. Precise positioning of the trenches should follow discussion with the NYMNPA archaeologists and EH. The larger trench in the interior of the monument (517AE) will be treated in a similar way with plough-soil stripped from a large area which can be cleaned and then selectively excavated.

In all three trenches the plough-soil would be removed by machine, using a back-actor and toothless ditching blade. Following the removal of the plough-soil each trench would be fully cleaned, paying particular attention to any surviving old ground surfaces and any exposed features.

As this is a research excavation, we will rely upon the skills of the excavators rather than employ a metal detector, particularly on a site that is both in public view and part of a community project. We do not promote the use of metal detectors in any form as this simply encourages treasure hunting with little consideration of the wider context.

We do not consider small finds in isolation from any other and thus we would 3-dimensionally document, individually retrieve, process and record all finds and samples to the same level.

We would employ high-precision Kinematic RTK GPS equipment and a Total Station to gather all spatial data and to provide drawing reference; only in this way can we ensure a precise match with the survey data and reference information which can be precisely revisited in the future.

We would use both a Hassleblad 35mm camera with transparency film and a high resolution digital camera, printing the results as archive quality prints to support the film archive. Digital cameras have a far greater dynamic range than film and can record more in difficult conditions than would be possible with film. We would also hope to record some action on digital video to support delivery of the project on the Web.

All plans and sections would be drawn at appropriate scales on drawing-film, then digitised for use within the site GIS at the post excavation stage when they can be viewed in 3D with the finds distributions. It should be noted that the LRC has an international reputation for the development both of excavation techniques and the digital recording of archaeological evidence. All context, finds and environmental evidence would be integrated within the site GIS, which could be exported into the NYMNPA GIS; much of this data resource

could also be presented in formats and map projections suitable for display in Google Earth as part of an online resource.

Although we would normally work a five day week, arrangements will be put in place to ensure that on at least one weekend the site would be open to the public with staff on hand to offer site tours on both the Saturday and Sunday, this in addition to dealing with pre-arranged site visits at other times.

Figure 3: Boltby Scar showing the relationship with the Cleave Dyke, situated to the east of two upstanding barrows in the field to the south of Boltby Scar as shown through geophysics and air photography (Note rotated to North West)

Offsite assessment and sampling.

The Cleave Dyke and Roulston Scar Hill fort

The Promontory Fort at Boltby Scar, if indeed that is what it is, does not exist in isolation. This is most obvious when the position is considered relative to the Cleave Dyke, originally established as a pit-alignment of possible Neolithic or Bronze Age date (if the alignment on pre-existing EBA barrows gives a correct relative date), which appears to have been transformed at a later date when the individual pits appear to have been cut through to form a continuous ditch; this is a sequence recognised in the case of early pit alignments both on the Yorkshire Wolds and the Vale of Pickering. The Cleave Dyke terminates to the south-west of Boltby Scar and resumes again to the north of the fort. Observed both through air-photography and through geophysical survey, the break in this long distance landscape boundary deserves some explanation (Figure 3). Whilst we can suggest a Neolithic or Bronze Age date for the creation of the Dyke this requires verification and, although dating linear boundaries is notoriously difficult, the terminal areas offer the best potential for the recovery of dating evidence. Perhaps no less important is the potential to recover further environmental evidence which we have shown survives well in the local environment. When combined with the environmental evidence from beneath the extant 'Barrow 2' at Boltby Scar we have the potential to precisely document environmental change from the Neolithic to Medieval period and thus establish an environmental setting for the fort and an environmental and climatic sequence relevant to the western part of the National Park at least. It is proposed that the terminal of the Cleave Dyke be identified through excavation, that the relationship between the pit alignment and any later re-cuts be defined in plan, and that a section be cut through the ditch and underlying pit-alignment to recover dating and environmental evidence; attempts should also be made to identify whether there is any surviving bank material or buried soils associated with the monument on either side.

Although past excavations and detailed survey have given insight into the nature of the very much larger Roulston Scar Hill Fort, with its timber-laced rampart and interior radically altered to facilitate its use as an airfield, this hillfort is not securely dated and was excavated at a time when environmental sampling as a discipline was in its infancy. Clearly the excavation of a single new ditch section could greatly enhance our understanding of this important site, with the potential for the recovery of dating and environmental evidence, as well as to resolve questions regarding the development of the monument raised in the English Heritage Topographic survey. It is proposed to excavate a single 2m wide ditch section on the eastern side of

the monument in a location to be defined by the NYMNP archaeologist in agreement with English Heritage following a site visit, to identify appropriate locations. The ditch section will be extended into the toe of the rampart with a view to recovering environmental evidence from any underlying buried land surface and from the rampart itself whilst causing the minimum impact of the upstanding monument; if we are fortunate this trench may also produce material that can be used for radio-carbon dating.

Although significant lengths of the ramparts were levelled in order to open up the airfield runway, we have little information regarding the interior of the fort. There is potential, through negotiation between the NYMNP and the Yorkshire Gliding Club, who manage the site, for investigation of the interior through geophysical survey. It is proposed that the interior of the Hillfort be examined using a Foerster GPS linked survey trolley, producing a geomagnetic survey with a resolution of .1x.25m, the programming of this work will have to be managed on a day-by-day basis so that survey can be conducted when the airfield is not operational.

Clearly investigation of the Cleave Dyke and Roulston Scar would add value to the past and proposed work on Boltby Scar; however, to undertake investigation at all three sites at the same time would add plant and staff costs and potentially impact our ability to achieve the primary excavation targets on Boltby Scar. It is felt that these two areas might best be examined in a future short excavation season, drawing upon the established volunteer base for a two week season operating both sites simultaneously.

Timing

We estimate that the fieldwork at Boltby Scar would take place over a four week period, three weeks for primary excavation and recording, and one week to cover environmental sampling, additional recording and site re-instatement. Rather than try and carry out excavations in three locations at the same time it is proposed that Boltby Scar be examined in May and the trenches examining the Cleave Dyke and Roulston Scar be excavated in the beginning of June; the combined excavation programme will cover a 6 week period.

We are fortunate that the University of York have agreed to use the project within the undergraduate training programme, providing a volunteer resource of up to 30 for 14 days in the field between 28th. April and 20th. May. The dates for the fieldwork are thus defined as:

Boltby Scar 28th April 2011 to 30th May 2011 (main open days 29th and 30th May)
Cleave Dyke and Roulston Scar 31st May 2011 to 10th June 2011 (Open weekend at Roulston Scar only June 4th/5th)

Post excavation arrangements

Following the completion of the excavation, the primary paper and digital archive would be compiled and copies provided in digital form with the materials for distribution to specialists. The scale of the MAP 2 assessment can only be established once the results of the fieldwork are known; regardless of this the lithics and environmental assemblages would need to be processed and materials such as dating material isolated and prepared for delivery to the C^{14} laboratory once their secure context has been confirmed. Continued liaison with the NYMNPA archaeologists should be maintained during the assessment phase to confirm dating and specialist arrangements. Environmental processing and analysis and dating tend to take several months to complete and thus, although the core team post-excavation component could be completed in 4 weeks, we would expect to work on the basis that primary post excavation, specialist analyses and archiving work should be completed within six months of the completion of the fieldwork.

Organisation

The Landscape Research Centre has been engaged in excavation and survey work in the Vale of Pickering for more than 30 years, including more than 30Ha of excavation and well over 1000Ha of geophysical survey integrated with many years of airborne remote sensing data. Working as a research trust, primarily funded on a project by project basis from English Heritage Commissions, the LRC has established a national and international reputation for quality and innovation reflected in its fieldwork and associated research. We have excavation experience in the archaeology of every period with the exception of the Palaeolithic and Post-Medieval periods. Our documentation and recording system, which has been established for more than 25

years, has been used as a model by other organisations and is currently being introduced within publicly funded excavation projects in Germany as part of the process of developing a unified and nationally standardised recording system for the Romische Germanische Kommission, the German equivalent of English Heritage. Our publications include major multi-period excavation reports, papers on archaeological methods and the use of technology, the archaeology of key periods, and materials for schools and the general public. We have created museum displays, designed our own publications, featured in both print and film media, and delivered hundreds of public lectures at every level in Britain and abroad.

We have a core staff of three and employ external consultants to cover areas in which we have a skills or facilities shortage such as, in the case of the Boltby Scar project, the environmental archaeology and lithics analysis specialists. We have engaged an additional team member for the duration of this project giving us the same team that successfully completed the fieldwork and training programme in 2009.

Staff

The core staff are:

Professor Dominic Powlesland BA, DUniv, FSA, Director
Christine Haughton MA MNIMH MCPP FRSH, Assistant Director, Finds Specialist and Administrator
James Lyall MA, MSC, Site Supervisor and Digital Data Generation
Gigi Signorelli BA, MA, who proved a very able assistant and communicator with reference to the volunteers and general public during the 2011 excavation season.

External Specialists

James Rackham, Environmental Archaeology Consultants
James is one of the most respected individuals in environmental archaeology having set-up the Environmental Archaeology Unit in York and then at the Museum of London before establishing an independent unit. He handles the whole environmental 'package' and brings in recognised external specialists as required.

Ann Clark MA, Lithics Analyst
Ann is a well established stone tools specialist who, although based in Scotland, has extensive local experience having undertaken the analysis and reporting on the lithic materials from various LRC excavations including West Heslerton and, most recently, the Ebberston Moor, Givendale Head exploratory well head site.

Health and Safety and Insurance

The LRC has a good health and safety record and holds a very extensive Health and Safety policy, as is correctly required by all organisations in receipt of English Heritage funding.

The LRC carries very extensive public (£5 million per occurrence) and employers' liability (£2 million per occurrence) insurance.

Copies of the Health and Safety and Insurance Policy can be provided if required.

Having more than three decades of experience of working with volunteers we are acutely aware of the training needs that go hand in hand with running an excavation which cover everything from the correct and appropriate use of all excavating equipment, observation and many aspects that might in the past have been simply considered common sense. All volunteers will be given instruction in methods of excavation and also in how to work for their own and everyone else's safety.

Appendix I

The Landscape Research Centre

Archaeological Investigations on Boltby Scar 2009

Interim Report

October 2nd 2009

Boltby Scar during excavation

Introduction

Excavations and associated investigations of Boltby Scar promontory fort were undertaken by the Landscape Research Centre (LRC) during September 2009, on behalf of the North York Moors National Park (NYMNP), as part of the 'Lime and Ice Project'. The fieldwork was designed to identify and characterise the nature of the surviving evidence relating to the defences of this important site which were sadly levelled by bulldozer in 1961 despite the fact that the monument was a known and scheduled monument.

The excavation relied on a small but dedicated team of volunteers, without whom the project could not have been undertaken. We are grateful to all the volunteers for their contribution to the excavation, sense of humour, determination and understanding. In the first week when there was driving rain or later when the

constant wind proved very tiring everyone made the journey to site and got on with the tasks in hand with an attitude that made the whole excavation a joy.
Although excavations have taken place on Boltby Scar on at least two occasions in the past, virtually no information from these activities survives: a sketch plan and some notes relating to George Willmot's excavations, undertaken in the 1930's; a pair of Beaker ear-rings/hair-clips found by Willmot, now held by the British Museum, and various claims as to the antiquity of the site which are unsupported by detailed evidence.

The current project is intended to recover new evidence which will allow the condition and nature of the site to be assessed, as well as recover dating and environmental evidence which can form the basis of a detailed interpretation of the site in its context; contributing to resources designed to inform the public about the archaeology of the national park.

The current excavation represents the first stage in a project designed both to secure new evidence and identify the potential for reconstruction of aspects of the monument to improve public understanding of this and similar monuments within the national park.

Research approach

Although Boltby Scar was bulldozed in 1961 the site remains a scheduled ancient monument protected by the state; the excavation programme undertaken in accordance with agreements between English Heritage (EH), NYMNP and LRC included a combination of auger sampling and trial excavations in three locations within the bulldozed area of the monument.

Geophysical surveys undertaken by LRC and a detailed topographic survey undertaken by EH provided the basis for the selection of the three trench locations. A series of auger transects running across the likely location of the former rampart and ditch were designed to gather information on the general scale of the defences and identify any areas where evidence of the rampart might survive.

Surviving photographs taken in 1958 show the defences prior to their levelling (Figure 4, Figure 5). At first sight these give a false impression of the scale of the monument on account of the fact that they were taken from an elevated position on the top of the bank, but it appears that the bank stood not much more than a metre high at the time.

Figure 4: The Entrance to the hill-fort photographed in 1958

Figure 5: The defences of Boltby Scar visible in 1958

Three locations were selected for excavation on the basis of the geophysical survey results (Figure 6). The magnetic contrast on Boltby Scar is poor, the most dominant features visible in the survey are the 'grykes', polygonal fissures in the underlying bedrock; about two thirds of the filled ditch of the fort shows as a broad curving dark line in Figure 3. The trenches were positioned to examine the entrance (517AA), to examine the ditch and any evidence of a bank where it may have been protected by the eroded base of a round barrow (517AB) and to identify and examine the ditch where it was not visible in the geophysical survey results (517AC).

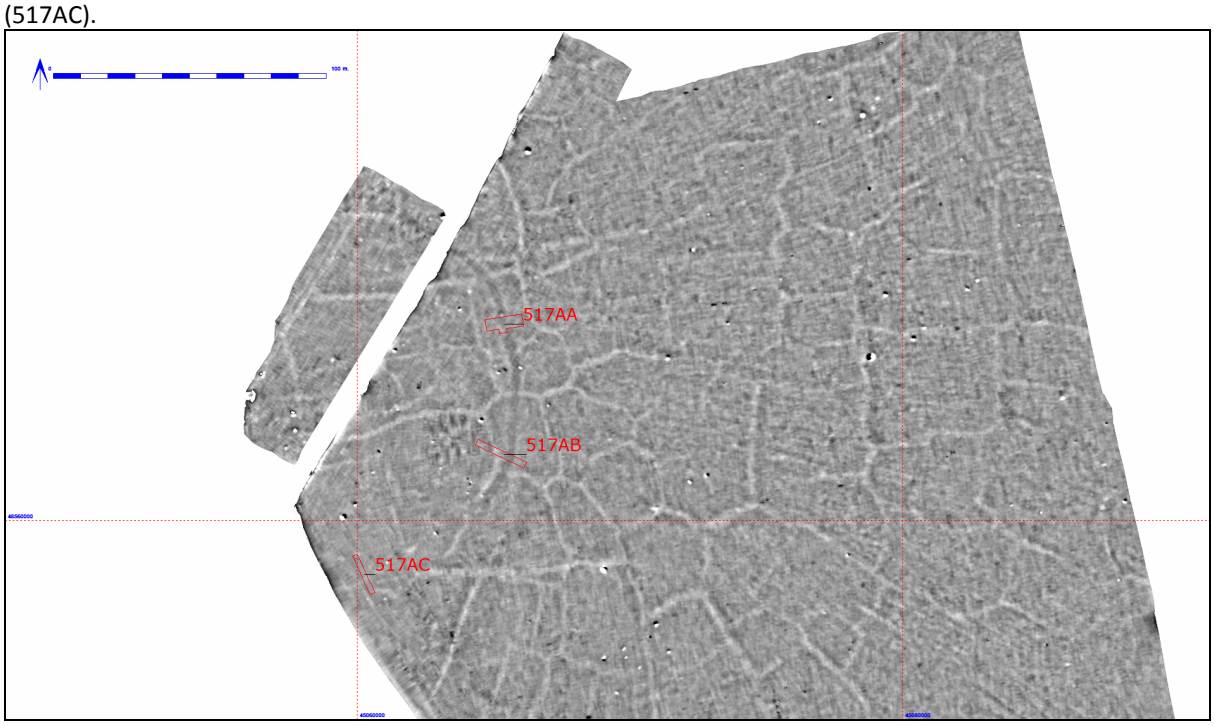


Figure 6: Boltby Scar Geophysical survey results overlain with the trench locations

Results from the individual trenches

Trench 517AA

The most northerly of the three trenches was positioned to expose part of the entrance into the monument and the butt-end of the northern ditch segment. Machine stripping of the ploughsoil, a dark and organically rich very stony loamy clay, exposed the ditch terminal as identified in the geophysical survey. The natural

subsoil appeared to have been truncated when the site was bulldozed and a small extension was made to check the state of the natural by carefully removing the base of the ploughsoil by hand. The hoped for worn surfaces that we would anticipate finding in the entrance to a hill fort were not encountered and it appeared that the bulldozer had truncated the entrance area by an estimated 25cm. Bulldozer track marks in the natural showed how the bank had been levelled by driving along the line of the bank and others showed the bulldozing in multiple directions across the entrance. The lack of surviving surfaces in the entrance, with the exception of some small areas of iron-pan, which extended beyond the limit of excavation, was somewhat depressing. The nature of the filled ditch was, however, quite the opposite. The 1961 backfill was clearly visible in the top of the ditch where it overlay multiple layers of preserved turf horizons and peat; what had been lost in terms of physical and structural evidence was in part countered by the survival of deposits with a very high potential for the recovery of environmental evidence.

Figure 7: Boltby Scar work in progress removing the lower fill of part of the ditch north of the entrance.

Figure 8: Boltby Scar the linear half section of the ditch north of the entrance prior to backfilling

Figure 9: Boltby Scar excavation in progress

After the trench was cleaned, washed out and cleaned again, the soils oxidised on exposure revealing what appeared to be the truncated base of the turf beneath the rampart as an area of bleached and leached soil. There was no evidence to indicate stone revetting nor any apparent post-holes that might help interpret the construction of the fort and its entrance; it is quite possible given the limitation in the scale of the trench that any gateway structure lay beyond the limits of the excavated area. Any attempt to extend the trench with the objective of identifying post-holes associated with the entrance would have compromised our ability to complete the work in hand at it was felt that such objectives could be addressed properly at some future time. The leached subsoil can be seen in the foreground in Figure 9 where two partially excavated bulldozer track marks can be seen in the lower right corner of the trench.

The excavation of the ditch in this area was concentrated on removal of a single half segment of the ditch to allow us to examine the fills both in cross-section but also through a linear section; in contrast with the section examined in 517AB the primary fill of the ditch contained a considerable quantity of rough rubble. It became clear that whilst the linear section positioned at the surface did not follow the centreline of the ditch the evidence recovered would satisfy our primary research objectives and the rubble layer in the base would be better approached in plan; there was no time for this and the total excavation of this segment should be an objective in future work. It became very clear that the fragile peats that fill the top of the ditch decay very rapidly on exposure. It is also likely that the subtle topographic changes that reveal the position of the ditch on the surface result from desiccation of the buried peat deposits in the ditch fill. Re-examination and further excavation in the entrance ditch sections may help us assess the future survival of the environmentally rich deposits in the face of global warming.

Trench 517AB

Figure 10: Boltby Scar trench 517AB after cleaning but washed out by rain

As in the case of 517AA, the second trench revealed clear evidence of bulldozer activity with some truncation of the top of the ditch. In addition to the damage inflicted by the bulldozer, subsequent ploughing had left plough marks cut into natural and through the surviving evidence. The positioning of this trench next to a surviving, although robbed, round barrow in the hope of finding better evidence appears to have been a correct decision as part of the former turf rampart had survived despite aggressive ploughing. It seems that some of the spoil generated when the barrow was robbed had sealed the rampart and left the area slightly elevated, reducing the level of bulldozer truncation.

As in trench 517AA, the 1961 backfill in the top of the ditch had sealed a magnificent sequence of decayed turf and peat layers providing the potential to document climate change since the ditch first filled in. It became clear very quickly that the ditch on the top of the hill had been substantially filled by the time it was backfilled and the material bulldozed in during the 1960's was no more than about 25cms thick.

Given the very limited scale of the excavations and the level of damage that the site had suffered both from the bulldozer and the plough, the results were very good. Although the ditch was partially truncated in this trench several centimetres of the turf rampart had survived intact despite having modern tracks impressed into the surface. It was clear that the base of the rampart comprised turf laid down, turf-to-turf, on the old ground surface; the area behind the rampart in the interior of the enclosure had been stripped, presumably as a source for rampart material. There was no significant berm between the rampart and the ditch and the back of the rampart had been sealed at the base by a layer of eroded turf material.

Figure 11: Boltby Scar part of the section though the turf rampart showing a probable turf interface and large amounts of rampart fragments in the ploughsoil (Scale 20cms)

Having seen the level of damage in area 517AA, the survival of this in-situ fragment of the rampart is remarkable, particularly since the auger transects indicated that this surviving fragment of rampart may only extend for a few metres. As in 517AA, there was no indication that the rampart had incorporated stone revetting, and the very narrow trench was too narrow (with only a one metre segment of the rampart base removed) to provide good evidence as to whether the rampart had incorporated timbering. This question could only be determined through larger trenches than was possible or reasonable within the constraints of this year's excavation.

Whilst the recognition of the base of the rampart was exciting, the ditch section here was both exceptional and remarkable (Figure 12). Very rarely does one see a textbook quality ditch section which gives up its story so we can clearly explain the stratigraphic sequence of filling that is fundamental to all archaeological interpretation. Beneath the 1961 backfill (this included a fragment of natural, bulldozed from the edge of the ditch), the turf survived, and for a few moments was still green before it was affected by the atmosphere; this lay on top of a layer of peat beneath which three further turf lines were visible reflecting a number of drier phases as the ditch had slowly filled. Beneath these organically rich layers, primary and secondary silting run through by a layer of iron-pan indicate that the ditch may have been cleaned out or re-cut on no more than 3 occasions, within a relatively short period. The base of the ditch both in this trench and in 517AC was flat where it reached the surface of bedrock, which, despite the visibility of the grykes in the geophysical survey, was sealed by c.1m of mixed glacially derived clays and gravel.

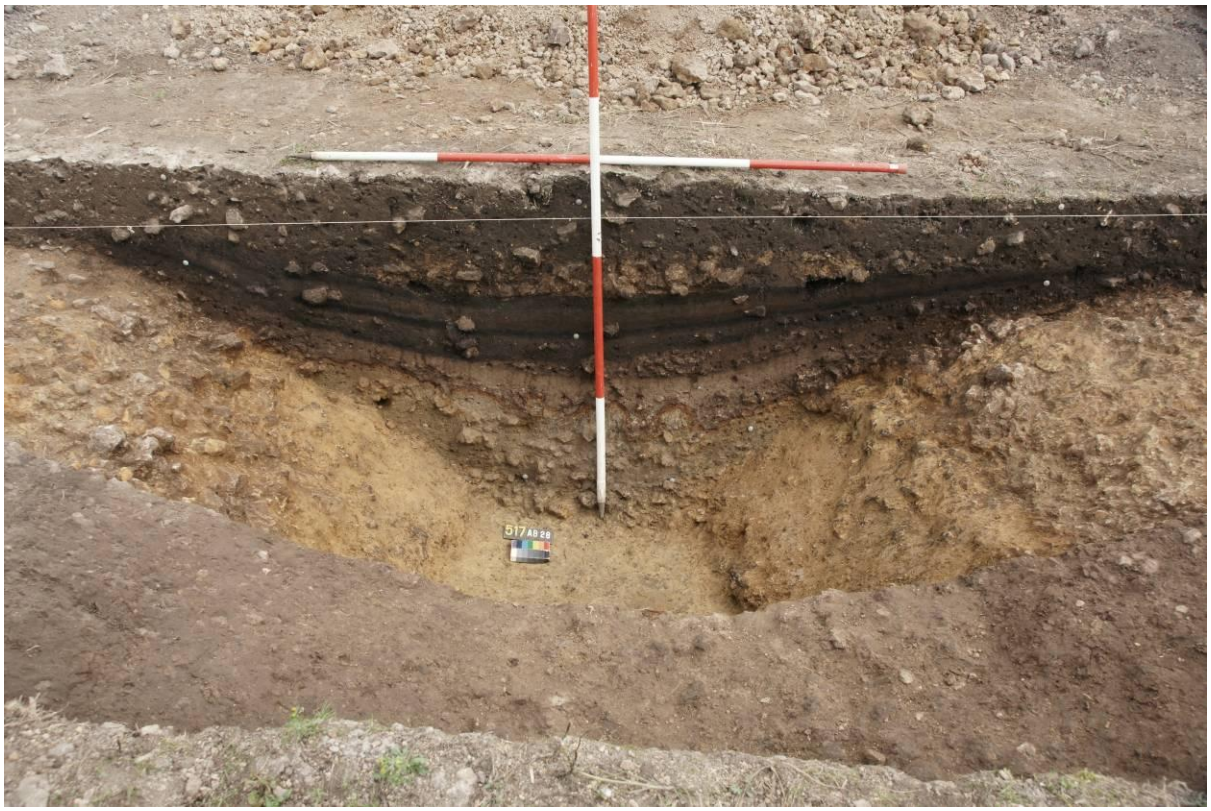


Figure 12: Boltby Scar excavated ditch section in trench 517AB

About a metre beyond the outside edge of the ditch, a small slot (measuring c30cm wide and 20 cm deep and cut at an angle to the line of the ditch) or probable fence trench was clearly visible after initial cleaning. Although of archaeological origin the feature produced no finds and remains undated. It may have held a fence, blocking a gap in the eroded defences to constrain sheep during the last two or three centuries rather than be of prehistoric origin, and it was not visible as a feature in the geophysical survey results.

The investigation of the area between the rampart and the barrow revealed very clearly that the turf had been removed from this area as part of the construction process, and although as a consequence the natural was very dirty, no clear features could be identified. The trench extended to the foot of the still extant barrow mound but there was no sign of any encircling ditch; it is possible that a further aggressive clean of the natural may have revealed slight features but this would have left the surviving rampart fragment proud and increased the risk of further damage. A geo-textile layer of Terram was used to line the excavated ditch sections and the important surfaces prior to backfill to protect the evidence in the short term and facilitate the re-exposure of areas if needed in the future.

Trench 517AC

The third trench was positioned to cross the assumed line of the ditch, which was quickly identified, with further evidence of bulldozer activity where the machine tracks had sunk into the silty clay fill of the ditch and removed much of the 1961 turf evidence as it ploughed through the ditch. In contrast to the two areas opened on the top of the hill the third trench crossed the ditch as it ran down the slope towards the edge of the cliff which bound the site to the west. It was immediately clear that the fills of the ditch here were completely different to those on the top of the hill (Figure 13). The 1960's turf had been truncated and instead of the turf and peat deposits indicating that the main segment of the ditch had remained wet and often filled with water, for much of the past, the sequence here showed a gradual sequence of silting reflecting the way that this segment effectively formed a drainage gully running to the edge of the hill.

Figure 13: Boltby Scar Trench 517AC after initial cleaning

The similarity between the silty clay fills which had washed down and settled in the ditch, and the silty clays of the natural subsoil, made it difficult to identify the edges and sides of the ditch and the organic deposits found in the other trenches were completely absent (Figure 14). The contrast in the levels of organic material in the filled ditch with the other sections is most likely the reason why the other section showed clearly in the geophysical survey.

Although the nature of the fills in the ditch here were quite different to those excavated in the other trenches, the central fill did include a number of sadly non-diagnostic sherds of pottery; without distinguishing features the fabric may indicate a Late Bronze or Early Iron Age date.

Figure 14: Boltby Scar half linear section through the southern part of the ditch after removal of the bulk soil samples.

Interim Conclusions

The defences of the Boltby Scar Promontory Fort were badly damaged and in large areas truncated when they were levelled in 1961. In some areas it seems likely that the surface was truncated by as much as 25cms although - remarkably - adjacent to the surviving upstanding barrow within the monument (another was removed by the bulldozer) a small area of turf rampart and interior surfaces survived. The 1961 backfill alone is of such limited volume that it is clear that that the bank material mixed with natural subsoil was spread extensively over the area.

The ditch, where it showed in the geophysical survey, is currently filled with a gradually desiccating sequence of environmentally very rich deposits which may span the period from the Iron Age to the present day. The level of environmental preservation and survival encountered was quite unanticipated. The rate at which the organic fills in the top of the ditch, and initially described in terms of colour and texture with reference to chocolate, decayed on exposure to the atmosphere was astonishing; it made it very easy to explain for the volunteers and the visiting public the role and fragility of environmental archaeological evidence in the context of climate change.

In all the trenches the number of finds recovered from the ditch sections is negligible, and does little to confirm the date of the monument, but the survival of so much organic material should enable us to secure accurate radio-carbon dates; we have to await the completion of the environmental assessment before material for dating can be identified and submitted. The lithic assemblage is very small and also dominated by very small fragments of debitage, perhaps largely derived from secondary tool re-working rather than primary manufacture. The ceramics assemblage, including only three substantial sherds is equally limited and although the fabrics are characteristic of a Late Bronze/Early Iron Age date none have distinguishing features that confirm the suggested date. It should be appreciated that the total volume of excavated features was very small (less than the equivalent of a single 2m wide ditch section) given the evidence of surface truncation we would not have expected to find much material beyond that contained in features.

There is still much of this story to come from the environmental assessment and C^{14} dating but the results have been far better than expected. As is always the case new questions regarding the levels of survival in the interior of the fort remain; for instance, was it all bulldozed? Was the rampart timber-laced? Was the gateway in any way fortified?

We are grateful to the landowners, the Redheads of Dialstone Farm and the Forestry Commission for permission to undertake the fieldwork and the NYMNP for financial support from the Lime and Ice project.
The excavation was a splendid success made possible by a tremendous team including James Lyall and Gigi Signorelli as supervisors, Christine Haughton administrator and finds management, Jen Smith, Graham Lee, Mags Waughman and the many behind the scenes contributors from the NYMNP, Dr Keith Emerick and Dr Alistair Oswald of English Heritage, James Rackham of Environmental Archaeology Services the National Lottery and other contributors to the Lime and Ice Project, including an unexpected large number of site visitors, the children of Gillamoor primary school and lastly but not least the hard working and dedicated volunteers:
Sheila Ashby, Judy Bradfield, David Chadwick, John & Siriol Hinchliffe, Chris Johnson, Lucy Knock, Christine & Victoria Lucas, Mark Ridout, Geoffrey Rowson, Elizabeth Sanderson, Vera Silberberg, Geoffrey & Helen Snowdon, Robert Stewart, Catherine Thorn and Stephen Toase.
We are grateful to everyone for their contribution and hope to meet up again on that windy hill in the future.

Dominic Powlesland
Director
The Landscape Research Centre
October 2009

Appendix II

Boltby Scar: Pollen analysis of the enclosure ditch sediments

C. Langdon and R. Scaife

School of Geography
University of Southampton
Highfield
Southampton
S017 1BJ

2009

1.) Introduction
Samples for pollen analysis were taken from the fills of a prehistoric ditch section (517AB; south facing). This profile contains the primary ditch fills and a number of upper and more humic stabilisation horizons. Sub-fossil pollen and spores were found to be abundant throughout most of the profile and as such, a vegetation history has been reconstructed.

2.) Pollen Method
Samples for analysis were taken by J. Rackham from the site using box monolith profiles from the excavated trench. Standard pollen extraction techniques were used on samples of 2ml volume (Moore and Webb 1978; Moore *et al.* 1992). Pollen was identified and counted using an Olympus and Nikon biological research microscopes. Total pollen sums of up to 750 grains plus spores per level were identified and counted. A Pollen diagram (figure 1) has been constructed and plotted using Tilia and Tilia Graph. Percentages in figures 1 have been calculated as follows:

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

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

3.) The pollen data and inferred vegetation history
Four local pollen assemblage zones have been recognised. The characteristics of these zones are given in table 1.

The basal sample at 52cm lies within the coarser sediments of the primary fills of the ditch. Although full pollen counts were made, pollen numbers and preservation was poorer than the overlying and more humic horizons. This is due to the more minerogenic character of the sediments and possibly also more rapid accumulation than for pollen in the stabilisation horizons. This basal assemblage is dominated by Poaceae (grasses; 70% total pollen). Also present are *Plantago lanceolata* (ribwort plantain; 6%), Lactucoideae (dandelion types; 3-4% and *Pteridium aquilinum* (bracken; 12%) There are few trees and shrubs with only *Corylus avellana* type (hazel/bog myrtle; 10%) and *Calluna* (ling; 3%) present. The habitat portrayed by this basal assemblage is, therefore, one of grassland, possibly pasture. The taphnomy of pollen in ditch fill sediments is complex and it is possible that these basal fills may derive from soil material which has collapsed in to the ditch shortly after its construction. Thus, there is the possibility of older, reworked pollen. However, if this is the case, the assemblage still shows that the environment was one of largely open grassland/pasture possibly with some localised heath and areas of poor ground with bracken. Hazel probably derives from the region as a whole as this is a wind pollinated and produces copious quantities of pollen. Local stands cannot, however, be discounted.

Zone 4 0 cm to 10 cm Poaceae-Plantago lanceolata	*Calluna* and *Corylus* of zone 3 are much reduced. *Plantago* lanceolata peaks at the base of the zone (30%) to its highest values. As *P. lanceolata* decline upwards, Poaceae becomes increasingly important to the uppermost level (86%).
Zone 3 10 cm to 15 cm Corylus avellana type-Calluna	*Corylus avellana* type expands to a peak of 30%. *Calluna* values decline throughout the zone. *Potentilla* (8%) peaks across the upper zone boundary. Poaceae remain similar to preceding zone 3 (30-35%).
Zone 2 15 cm to 23 cm *Calluna*-Poaceae	*Calluna* peaks (77%) with Poaceae (30-40%) are the dominants. *Plantago lanceolata* is reduced (5%).
Zone 1 23 cm to 52 cm Poaceae-Plantago lanceolata	Poaceae are dominant (to 70% at base of profile) with *Plantago lanceolata* (*ca.* 17%). *Calluna* becomes increasingly important expanding from 3% to 35%. Very few trees and shrubs with *Corylus avellana* type (9%) most important. Monolete spores (*Dryopteris* type) have highest values in the basal sample (15%).

Table 1: Boltby Scar pollen zonation.

At the top of zone 1, in the upper primary fills at 29cm to 31cm, the pollen assemblages are of similar character. That is, primarily dominated by Poaceae with *Plantago lanceolata* and Lactucoideae. However, there appears to be the start of expansion of *Calluna* with some decrease of Poaceae. However, this may be statistical caused by within sum percentage variations cause by increasing numbers of one taxon resulting in lower percentages of other taxa even though the real growth area may have remained the same. However, the substantial expansion of *Calluna* in subsequent zone 2 suggests that heath was replacing grassland, possibly through soil deterioration, leaching and acidification.

In local pollen zone 2 there is a massive expansion of *Calluna* (to 60%). Poaceae remains important but with reduced values such as discussed above. This undoubtedly shows local development of heath and dominance of *Calluna*. Ling and heather (*Erica*) is present to the base of the sediment profile and it seems likely that it was able to expand rapidly from areas of existing growth when soil conditions became sufficiently acidic to support a heathland community.

Decline of heath occurred and there appears to have been a phase of Corylus expansion, probably hazel scrub. This may not have been on-site as soil conditions, being highly acidic may not have been suitable. Given that this is an anemophilous tree/shrub which produces copious quantities of pollen, it is probable that this peak is from woodland scrub regeneration in the local region. The decline in *Calluna* from the top of zone 2 into zone 3 is, however, more clearly associated with a change from heat the grassland. The uppermost zone 4 has a sharp expansion of Poaceae (to 85%) also initially associated with highest values of *Plantago lanceolata* (28%). This certainly suggests a change in the local environment from heathland to grassland. This may have also have been a change in land use from rough pasture/heathland grazing to grass pasture. It is interesting that there was a short-lived expansion of *Potentilla* (cinquefoils) during the transition. This may have been a response to heath burning prior to grassland/pasture dominance.

Throughout the sequence there is little evidence of cereal cultivation. A single grain only was identified. Large Poaceae are attributed to wild grass varieties.

4.) Summary and Conclusions

The sediment fills of this ditch are extremely rich in pollen. The more humic stabilisation horizons are especially so and show definite phases of environmental development.

The basal, primary fills show an initially grassland/pasture habitat in proximity. This was replaced by locally dominant heath which is attributed to soil deterioration and acidification. This plagioclimax (human maintained) would have been maintained by fire and rough grazing. The most recent phase was a return to grassland. Initially this was probably medium/tall a pasture as indicated by ribwort plantain, knapweeds and buttercups.

References

Bennett, K.D., Whittington, G. and Edwards, K.J. 1994 'Recent plant nomenclatural changes and pollen morphology in the British Isles'. ***Quaternary Newsletter*** 73, 1-6.

Moore, P.D. and Webb, J.A. 1978 ***An illustrated guide to pollen analysis***. London: Hodder and Stoughton.

Moore, P.D., Webb, J.A. and Collinson, M.E. 1991 ***Pollen analysis.*** Second edition. Oxford: Blackwell Scientific.

Stace, C. 1991 ***New flora of the British Isles*****.** Cambridge: Cambridge University Press.

Appendix III

Radio Carbon Dates

The Radio Carbon dating certificates are appended here with discussion of the interpretation made in the text above.

Scottish Universities Environmental Research Centre
Director: Professor A B MacKenzie Director of Research: Professor R M Ellam
Rankine Avenue, Scottish Enterprise Technology Park,
East Kilbride, Glasgow G75 0QF, Scotland, UK
Tel: +44 (0)1355 223332 Fax: +44 (0)1355 229898 www.glasgow.ac.uk/suerc

RADIOCARBON DATING CERTIFICATE

24 February 2010

Laboratory Code	SUERC-27840 (GU-20792)
Submitter	James Rackham Environmental Archaeology Consultancy 25 Main Street South Rauceby Lincolnshire NG34 8QG
Site Reference	Boltby Scar, Yorkshire
Sample Reference	517AC/ Sample 10
Material	Charred Nutshell : Hazel
$\delta^{13}C$ relative to VPDB	-22.9 ‰
Radiocarbon Age BP	3545 ± 30

N.B.

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

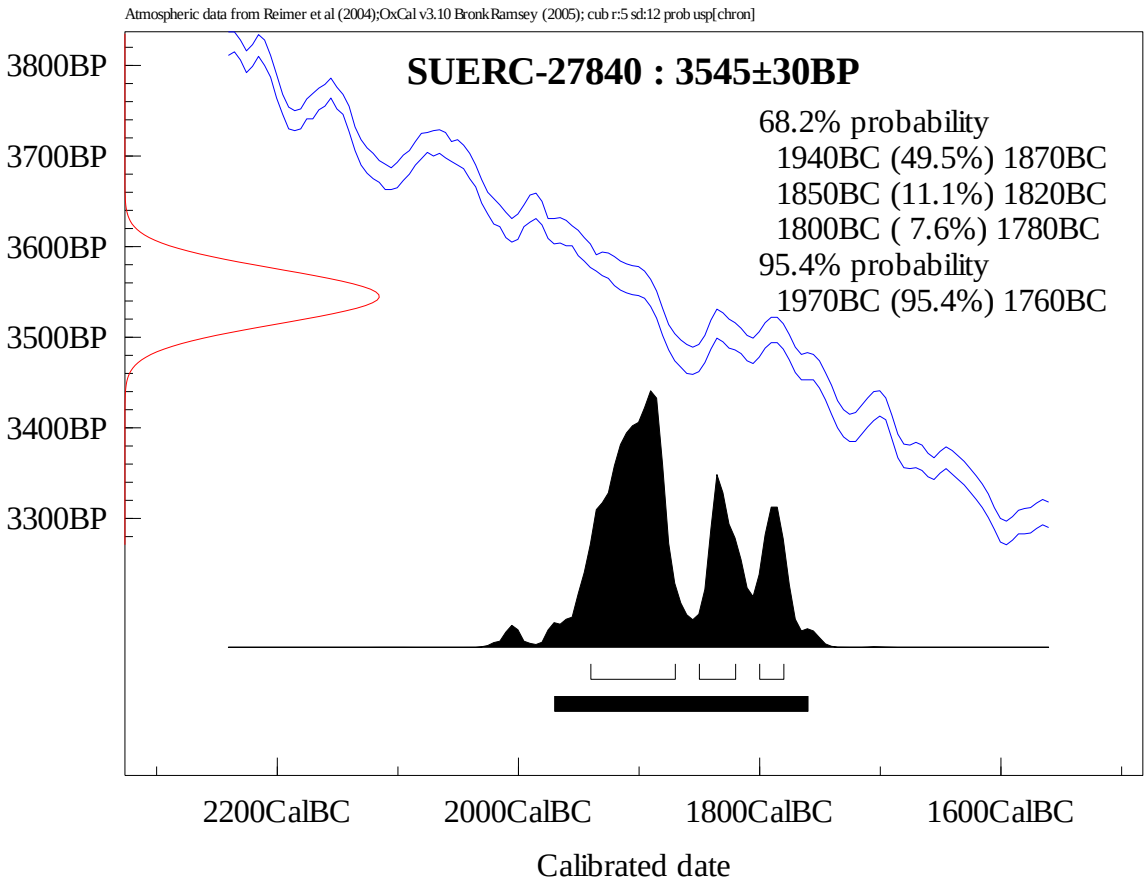
2. The calibrated age ranges are determined from the University of Oxford Radiocarbon Accelerator Unit calibration program (OxCal3).

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

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

Checked and signed off by :- Date :-

Calibration Plot



Scottish Universities Environmental Research Centre
Director: Professor A B MacKenzie Director of Research: Professor R M Ellam
Rankine Avenue, Scottish Enterprise Technology Park,
East Kilbride, Glasgow G75 0QF, Scotland, UK
Tel: +44 (0)1355 223332 Fax: +44 (0)1355 229898 www.glasgow.ac.uk/suerc

RADIOCARBON DATING CERTIFICATE

24 February 2010

Laboratory Code	SUERC-27841 (GU-20793)
Submitter	James Rackham Environmental Archaeology Consultancy 25 Main Street South Rauceby Lincolnshire NG34 8QG
Site Reference	Boltby Scar, Yorkshire
Sample Reference	517AB/14/250
Material	Peat : Humic acid dated
$\delta^{13}C$ relative to VPDB	-29.3 ‰
Radiocarbon Age BP	1020 ± 30

N.B.

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

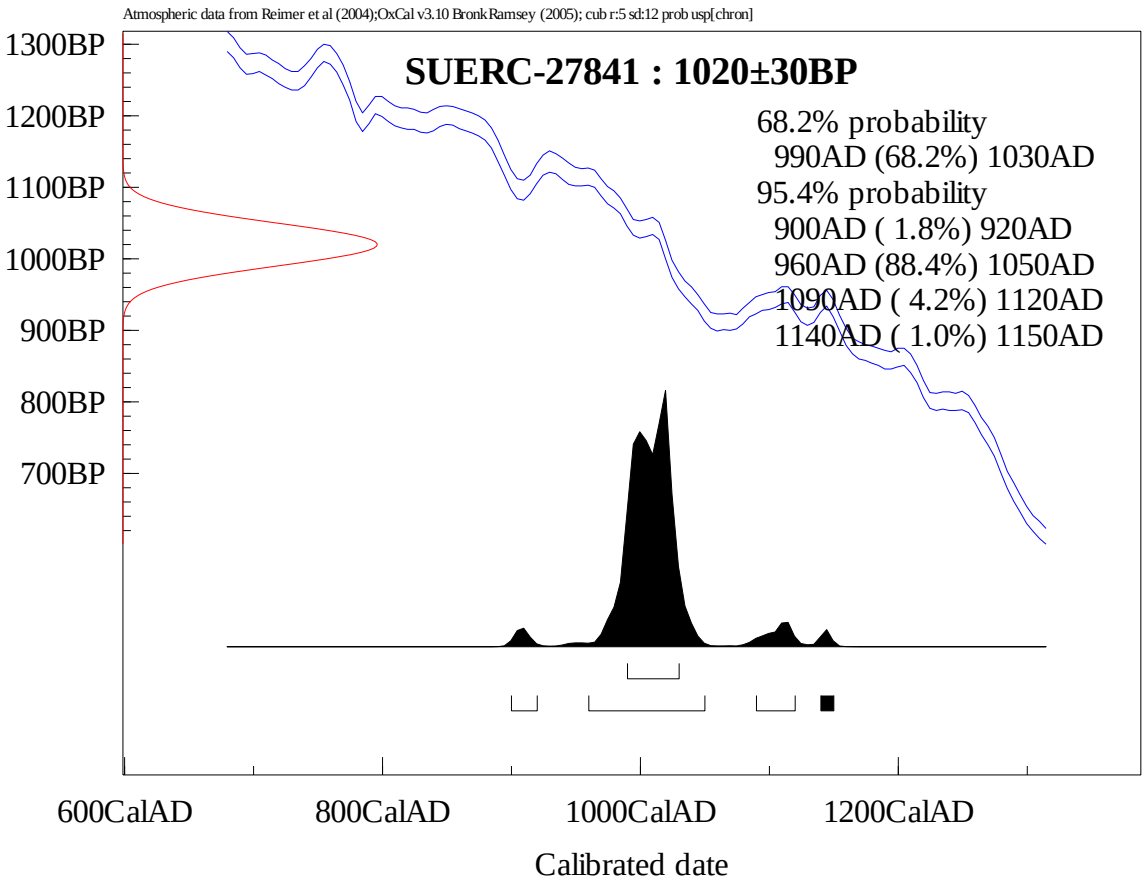
2. The calibrated age ranges are determined from the University of Oxford Radiocarbon Accelerator Unit calibration program (OxCal3).

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

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

Checked and signed off by :- Date :-

Calibration Plot


Atmospheric data from Reimer et al (2004);OxCal v3.10 Bronk Ramsey (2005); cub r:5 sd:12 prob usp[chron]
SUERC-27841 : 1020±30BP
68.2% probability
990AD (68.2%) 1030AD
95.4% probability
900AD (1.8%) 920AD
960AD (88.4%) 1050AD
1090AD (4.2%) 1120AD
1140AD (1.0%) 1150AD
1300BP
1200BP
1100BP
1000BP
900BP
800BP
700BP
600CalAD
800CalAD
1000CalAD
1200CalAD
Calibrated date

Scottish Universities Environmental Research Centre
Director: Professor A B MacKenzie Director of Research: Professor R M Ellam
Rankine Avenue, Scottish Enterprise Technology Park,
East Kilbride, Glasgow G75 0QF, Scotland, UK
Tel: +44 (0)1355 223332 Fax: +44 (0)1355 229898 www.glasgow.ac.uk/suerc

RADIOCARBON DATING CERTIFICATE

24 February 2010

Laboratory Code

SUERC-27842 (GU-20794)

Submitter

James Rackham
Environmental Archaeology Consultancy
25 Main Street
South Rauceby
Lincolnshire NG34 8QG

Site Reference: Boltby Scar, Yorkshire
Sample Reference: 517AB/31/251

Material: Peat : Humic acid dated

$\delta^{13}C$ relative to VPDB: -28.4 ‰

Radiocarbon Age BP

1405 ± 30

N.B.

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

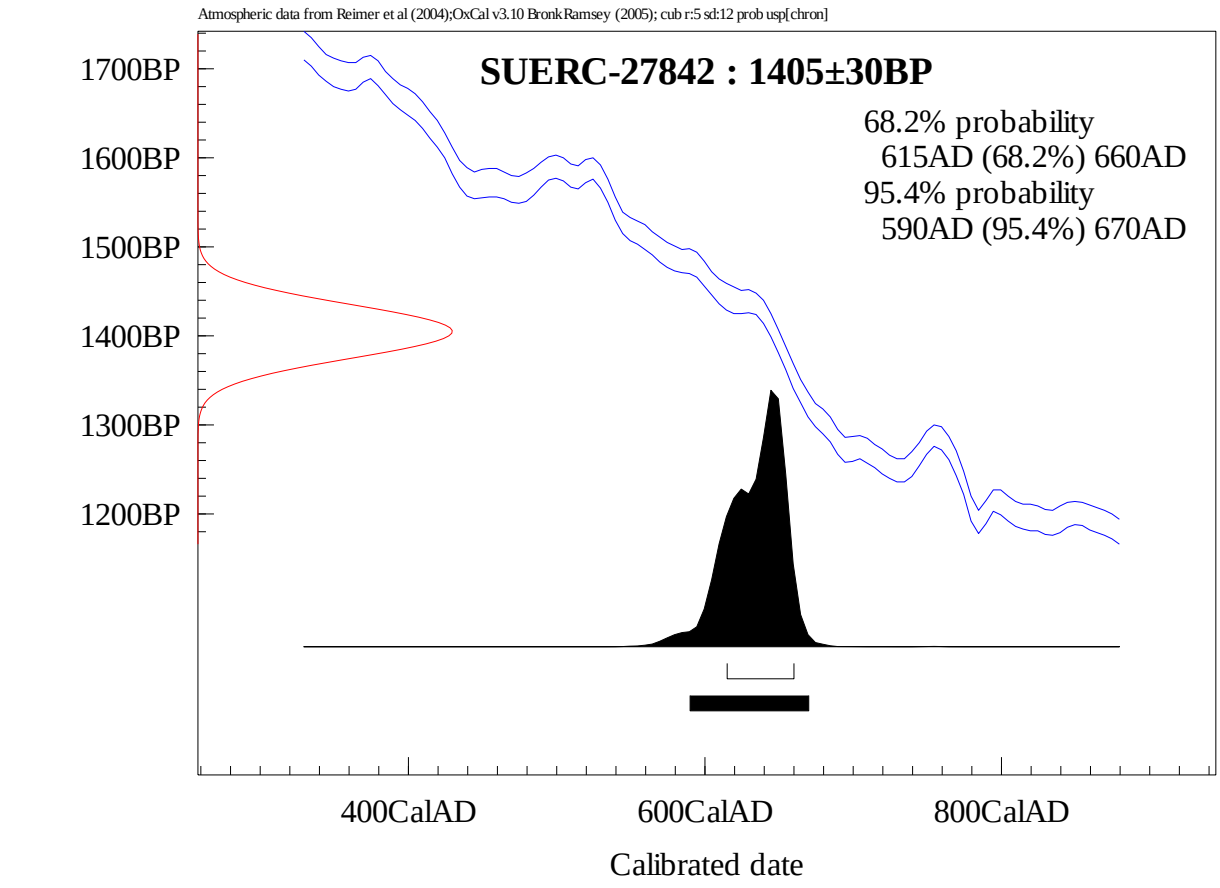
2. The calibrated age ranges are determined from the University of Oxford Radiocarbon Accelerator Unit calibration program (OxCal3).

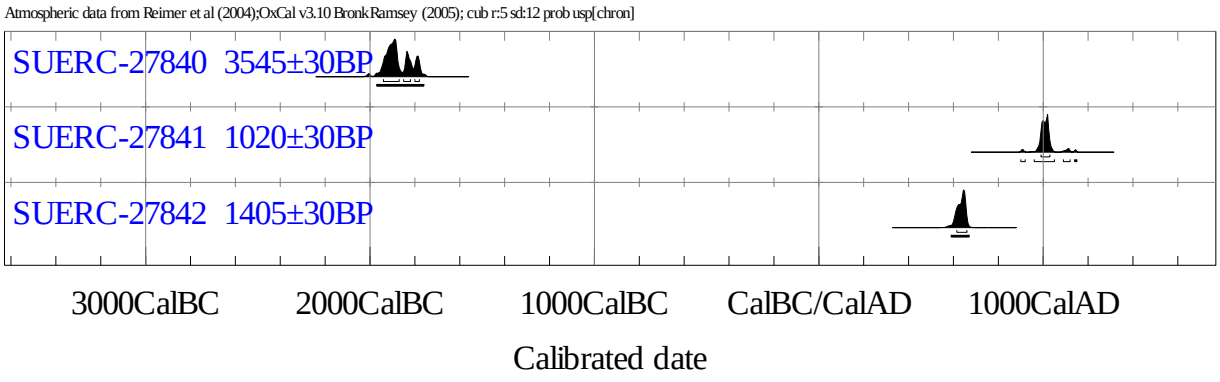
3. Samples with a SUERC coding are measured at the Scottish Universities Environmental Research Centre AMS Facility and should be quoted as such in any reports within the scientific literature. Any questions directed to the Radiocarbon Laboratory should also quote the GU coding given in parentheses after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

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

Checked and signed off by :- Date :-

Calibration Plot


Atmospheric data from Reimer et al (2004);OxCal v3.10 Bronk Ramsey (2005); cub r:5 sd:12 prob usp[chron]
SUERC-27842 : 1405±30BP
68.2% probability
615AD (68.2%) 660AD
95.4% probability
590AD (95.4%) 670AD
1700BP
1600BP
1500BP
1400BP
1300BP
1200BP
400CalAD
600CalAD
800CalAD
Calibrated date


Atmospheric data from Reimer et al (2004);OxCal v3.10 Bronk Ramsey (2005); cub r:5 sd:12 prob usp[chron]
SUERC-27840 3545±30BP
SUERC-27841 1020±30BP
SUERC-27842 1405±30BP
3000CalBC
2000CalBC
1000CalBC
CalBC/CalAD
1000CalAD
Calibrated date