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# Investigation of charcoal burning platforms at Barbon Park, Barbondale, Cumbria

Zoë Hazell and Vicky Crosby

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# BARBON PARK
# BARBONDALE
# CUMBRIA

## Investigation of charcoal burning platforms at Barbon Park, Barbondale, Cumbria

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with contributions from Peter Marshall and Karla Graham,
and illustrations by John Vallender and Andrew Lowerre

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SUMMARY
In October 2013 small-scale archaeological investigations were undertaken on a selection of charcoal burning platforms (CBPs) at Barbon Park, Barbondale, Cumbria, that had been identified from aerial survey as part of Historic England's *National Archaeological Identification Survey (NAIS): Upland pilot* project (Oakey et al. 2015). The work (Project 6304_Barbon Park) involved test pitting and obtaining short sediment cores from some of the CBPs; environmental samples were taken for charcoal analysis and identification of material suitable for radiocarbon dating.

ACKNOWLEDGEMENTS
This work was undertaken by Historic England, formerly known as English Heritage. Thanks to the additional colleagues at Historic England who contributed to the research as follows: Marcus Jecock and Rebecca Pullen for the field survey, and Matthew Oakey for the aerial mapping and interpretation, all of who also provided useful discussions and helped on-site; Paddy O'Hara (formerly of Historic England) for his excavation skills and interpretations on-site; Claire Tsang for providing help and advice on archiving throughout; Andrew Lowerre (formerly of Historic England) for the production of the platform slope profiles.

Many thanks to the Kay-Shuttleworth Estate and to Natural England for granting permission to carry out the fieldwork. Thanks too to the tenants Mr Pedley, Mr Hughes and Mr Boyd. Thanks also to Tom Gledhill (Historic England) and Rob Jarman (University of Gloucestershire) for help with the fieldwork and for useful topical discussions, and to Andy Roy (formerly Historic England) and James Pearce (Historic England) for logistics and facilities planning. Many thanks to Jean Norgate for permission to reproduce the *Lakes Guides* map excerpts in Figure 6. Thanks are extended to the respective owners/curators of the original maps. The 1760 map by Bowen and Kitchen is part of the *Farmer Collection at The Armitt* (Ambleside), and is included courtesy of the Armitt Collection.

ARCHIVE LOCATION
The physical archive is currently stored with Historic England, Fort Cumberland, subject to discussions with the local museum. The digital archive will be deposited with the Archaeology Data Service (ADS).

DATE OF RESEARCH
Fieldwork was carried out on 7–10 October 2013 and the research followed during 2014–2015.

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Cover image: Looking eastwards across the Lune Valley to the western edge of the Yorkshire Dales plateau; showing Barbondale in the centre, in deep shadow. [Dave MacLeod © Historic England Archive, 28366_041 11-DEC-2012].

 21-2023

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# 1. INTRODUCTION

## 1.1 Project background

Historic England's '*National Archaeological Identification Survey: Upland Pilot*' Project (6304) was commissioned as part of the National Heritage Protection Plan (English Heritage 2012; 2013) Activity 3A4 '*Identification of terrestrial assets via non-intrusive survey*' (for more detail see Oakey et al. 2015). Overall, the project covered an area arching from Carnforth to Kirkby Lonsdale via Kendal (see Oakey et al. 2015, fig. 1). During the project's first phase – mapping the area's historic environment features from aerial survey sources (photographs and lidar[1] data) – multiple features interpreted as charcoal burning platforms (CBPs) were recorded at the very eastern edge of the project area; at Barbon Park, Barbondale, Cumbria (Fig. 1) (see Hazell et al. (2017) for the aerial mapping methodology). In particular, this consisted of two groups:

- one of more well-defined features to the east of Barbon Wood on open, grazed slopes (Fig. 2), and
- the other of more subtle features to the west of Barbon Wood in an area of open parkland.

In order to investigate the features further (as well as validate the results of the aerial mapping), a series of rapid, small-scale interventions (test pits and short cores) was proposed on a selection of the CBPs (Pr6304_Barbon Park; see Hazell (2013)). In October 2013 three CBPs from the eastern group were subject to rapid, focussed, small excavations (test-pits) and two CBPs from the western group were subject to sediment coring. An interim summary (Hazell et al. 2014) was produced for the 2014 annual fieldwork reports compiled by the Society for Post-Medieval Archaeology.

[1] Lidar = light detection and ranging.

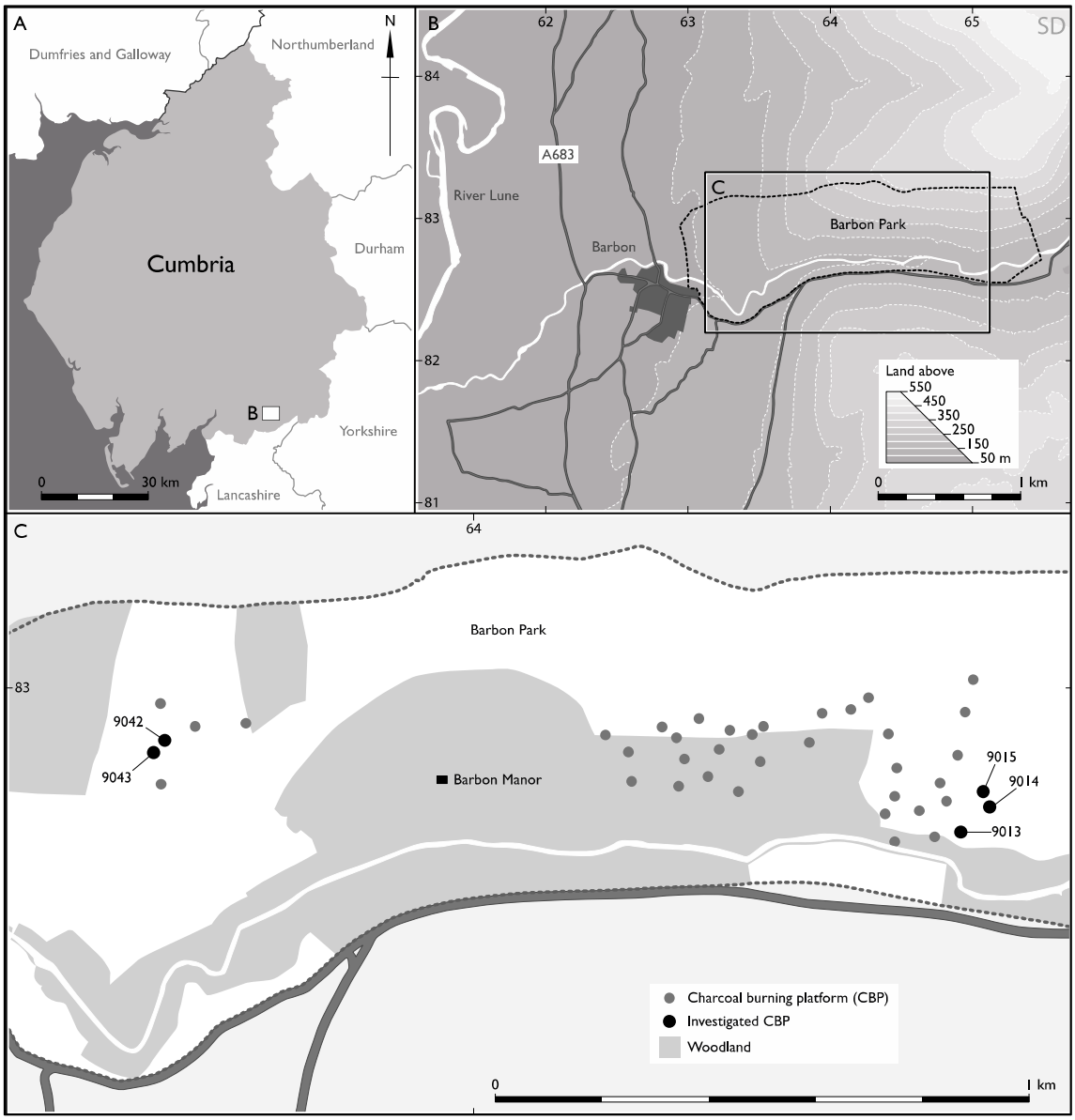



*Figure 1. Maps showing the location of: Barbon within NW England (A), Barbon Park relative to Barbon village (B), and the CBPs at Barbon Park (C).*

*Figure 2. Looking eastwards along Barbondale, across the bracken covered slopes on which the eastern group of CBPs is located. (5 September 2013, Photo: Z. Hazell) © Historic England.*

## 1.2 Aims and Objectives

The investigations were designed to address the following aims and objectives:

### *1.2.1 Aims*

A1: To establish whether the features identified as 'charcoal burning platforms' from aerial survey and mapping, have been/can be identified reliably as such;

A2: If so, to obtain information on the likely use of the charcoal produced e.g. iron or gunpowder making;

A3: To determine what information their rapid excavation (through test-pitting) can provide as to their usage history e.g. identifying a site as single- or multi-use;

A4: To establish – using radiocarbon dating – what period/s of use the features represent;

A5: To compare the wood charcoal remains with the characteristics (e.g. extent, species and approximate ages) of the modern woodland cover in the immediate area. To see if indications of previously-used woodland

management methods e.g. coppicing, are still evident and whether this is seen/recognisable in the charcoal itself.

### *1.2.2 Objectives*

O1: How does the form of the CBPs (size, shape) compare with others excavated within the British Isles?

O2: How do the results compare with other analysed CBPs in the region; NW England (Lake District)?

O3: Specifically, what is the condition and abundance of the charcoal remains? Is it well preserved? Is it vitrified?

O4: Which taxa are present? How can this help inform on a) preferred wood selection for charcoal making, b) whether this can be related to specific industrial use, c) past woodland composition, and d) evidence of woodland management techniques (coppicing)?

O5: How do the radiocarbon dates align with the documentary source indicating the presence of a medieval bloomery in the locality (Cumbria HER; SMR no. 15986)? Interestingly, based on the shape and form of the Barbon CBP features, John Hodgeson (pers. comm. via Matthew Oakey) has suggested that they could be post-medieval; targeted dating will help resolve this.

## 1.3 Subsequent publication

The main results of this project, in particular the charcoal analysis and radiocarbon dating, have since been published by Hazell et al. (2017), where possible uses for the charcoal are also discussed. It was published as part of the conference proceedings of the 6th International Anthracology meeting, held in Freiburg, Germany, in 2015 (https://www.anthraco.uni-freiburg.de/). It is an Open Access article, at: https://doi.org/10.1016/j.quaint.2017.05.025.

The radiocarbon dates were calibrated using IntCal13 which has been superseded by IntCal20. Note that in Hazell et al. (2017, 197) there is an error in a reported Highest Posterior Density interval range for one of the modelled durations of use (see below in Section 6.2).

# 2. SITE SETTING AND DESCRIPTION

Although not at the time of excavation, Barbon is now located within the Yorkshire Dales National Park[2] (see http://www.yorkshiredales.org.uk).

## 2.1 Location and geological setting

The Barbon area is situated on the boundary of '*National Character Area 19: South Cumbria Low Fells*' (underlain predominantly by Silurian silt-, mud- and sand-

[2] The area of the park was extended on 1 August 2016.

stones) (see Natural England (2013a)) and the limestone (karst) area of '*National Character Area 21: Yorkshire Dales*' (see Natural England (2013b)). This landscape boundary forms a sharp transition from a) the lower-lying, gently undulating broad valley of the River Lune in the west, to b) the rapidly-rising upland limestone hills and plateaux of open peat-covered moorlands, dissected by the more sheltered partially tree-covered 'dales', in the east.

Barbon Park itself is located <1.5km east of Barbon village, Cumbria, at the westerly limit of Barbondale (see Fig. 1B), a typical 'dale' (valley), that runs between the higher ground of Middleton Fell to the north and Barbon Fell to the south. Flowing along the floor of Barbondale is a small river – Barkin Beck – that changes name to Barbon Beck where it passes Barbon Park. As well as being crossed by a series of fault lines, Barbon Park sits between the two more-significant faults of: a) the Barbon Fault (which runs along the eastern margin of the Lune Valley) and b) the Dent Fault (some of which follows part of Barbondale itself) (see Figure 3). Geological mapping of the area by Furness (1965) shows the region to consist primarily of Bannisdale Slates ("interbedded banded siltstones and unbanded mudstones") and Coniston Grits ("fine grained 'greywackes' and banded siltstones" (Furness 1965, 13)). These are both part of the Ludlow Series, which in turn is part of the Silurian System.

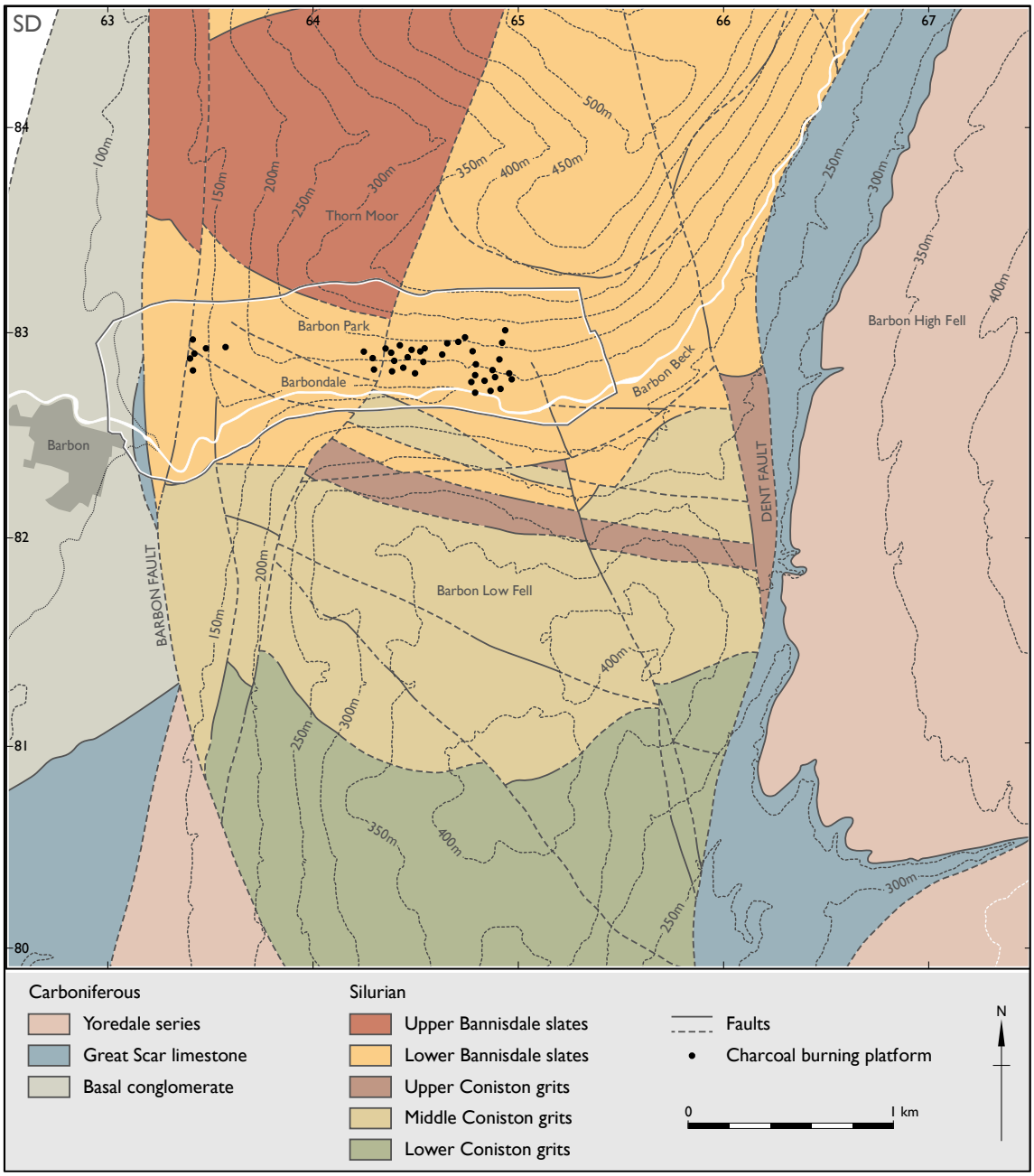



*Figure 3. Map showing the geology of the slopes around Barbon Park (redrawn from Furness (1965)) with the locations of the CBPs.*

More-detailed study of the area to the east of Barbon Park by Furness (1965) (which he refers to as 'Whiskey Gill' after the brook there) mapped Lower Bannisdale Slates on the upper slopes and Upper Coniston Grits on the lower slopes (Fig. 4). Immediately east of Barbon Woods, the slopes on which the Eastern Group of CBPs themselves rest consist of beds of the Upper Coniston Grits (UCG); the lower seam UCG2 (a graptolitic siltstone) sits at the base of the slope, with UCG3 (a greywacke) further upslope[3] (see Furness (1965)).

[3] Although the sequence of mapped beds continues upslope, it is not described here because it extends beyond the area directly relevant to this study. For more detail see Furness (1965, 45–54).

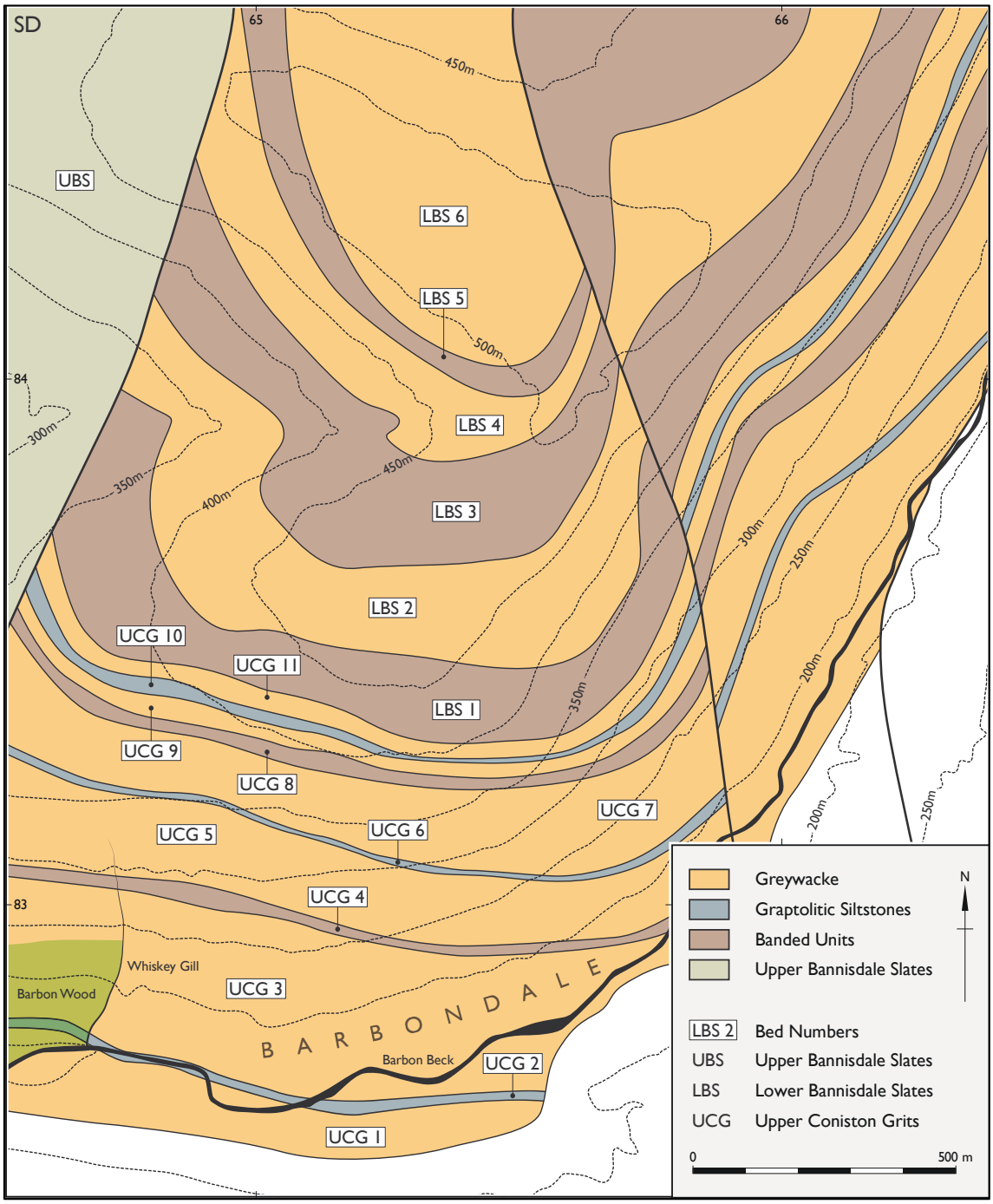



*Figure 4. Map showing the geology of the slopes to the east and northeast of Barbon Park (redrawn from Furness (1965, fig. 3-11)).*

On the slopes further east of the wood, at SD 64999 82707 (just beyond the boundary of the project area) are the remains of an old quarry clearly visible today from the adjacent bridleway (see Fig. 5), and first labelled as 'Gravel Pit' on the *Pre War 'County Series' Historic OS Maps* on i) 1:2,500 Epoch 2 (1891–1921) and ii) 1:10,560 Epoch 3 (1904–39). Based on comparisons with Furness' (1965) geological mapping (redrawn here in Fig. 4) this aligns with bed UCG3.

*Figure 5. The remains of the 'gravel pit' at Barbon Park, looking north from the bridleway. (6 September 2013, Photo: Z. Hazell) © Historic England.*

## 2.2 Barbon Park

For the purposes of this work, the name Barbon Park includes:

- Barbon Wood – in the midst of which Barbon Manor sits – which is now predominantly coniferous plantation used for pheasant rearing,
- land immediately to the west of Barbon Wood, which consists of gently-sloping, westerly-facing open pasture with occasional, solitary parkland trees (at the time of fieldwork it was used for grazing sheep), and
- land immediately to the east of Barbon Wood, which is steeper, bracken-dominated south-facing hillslopes used for rough grazing; at the time of fieldwork, a few cattle were grazing there.

The land is owned by the Kay-Shuttleworth Estate, but is tenant-managed, and includes areas of Open Access land and areas under Environmental Stewardship Agreement.

It is in the two areas either side of Barbon Wood that the sites of charcoal production identified for investigation are located, recorded as the following Historic England Research Records[4]:

- 1574919[5] (eastern slopes, *c.* SD 6485 8279), and
- 1575141 (western parkland, *c.* SD 6345 8285).

Each of these platforms was given a unique suffix identifier; starting at 01. A comprehensive list is presented in Appendix B.

On the assumption that the wood for charcoal production would have been sourced very locally/on-site, it is likely that it would have come from Barbon Wood (which may well have been more extensive in the past).

### *2.2.1 Woodland at Barbon*

Barbon is mentioned in Domesday book (AD 1086) as Berebrune and is recorded on early maps as Barbon/Barobon/Barborn/Barborne with and without Chapel/Chappell. Some of these maps show trees with fence palings in the Barbon area, indicating that the woods were present then (Figure 6).

(a) 

(b) 


*Figure 6. Map excerpts of the Barbon area (from Norgate and Norgate 2012/2022) showing enclosed woodland; from (a) Christopher Saxton's map of Westmorland and Cumberland (AD 1579) [ref. SAX9SD68.jpg] and (b) (probably) A New Map of the Counties of Cumberland and Westmoreland Divided into their Respective Wards by Emanuel Bowen and Thomas Kitchin (AD 1760) [ref. BO18SD68.jpg]. © LakesGuides website [see under the gazetteer entry for 'Barbon Chapel (St Bartholomew, Barbon)']. Excerpt images used with kind permission of J. Norgate. The Bowen and Kitchen map is part of the Farmer Collection at The Armitt (Ambleside).*

[4] Available through the Heritage Gateway https://www.heritagegateway.org.uk/gateway/default.aspx). They are currently listed as Historic England Research Records but will be transferred to the local authority Historic Environment Record (HER) list at a later date.

[5] Note that some of the platforms of this group are located within the woodland itself.

More-recent maps, showing Barbon Park woods more as we would recognise it today, are presented in Appendix D.

## 2.3 Local industries

### *2.3.1 Charcoal production*

The use of charcoal was common to fuel industries such as metal production and gunpowder manufacturing, until coke and coal began to replace it from the 1700s onwards. Charcoal is produced by the incomplete combustion of wood – where wood burns with a restricted oxygen supply so as not to burn down to ash. Charcoal manufacturers (colliers) would construct large domes ('clamps') from wood rods, cover it in turfs or peat in order to keep oxygen out and set it alight. More detail on the process can be found in Armstrong (1978) and Kelley (1986).

Charcoal burning platforms (CBPs)[6] are the sites of such former charcoal production. They are often found within or near woodland that may have been managed (e.g. coppiced, pollarded), and near a water source (for quenching the burn). Certain parts of the British Isles are renowned for them, in particular, the Lake District (Cumbria), Rockingham Forest (Northamptonshire), the Forest of Dean (Gloucestershire) and the Weald (south-east England). Where sites/features have been systematically surveyed, this is not often followed up by excavation, and where excavation is carried out, detailed analysis of the charcoal is rare (see Hazell et al. (2017) for studies where charcoal has been examined). In the discussion of Ecclesall Woods (Sheffield), Rotherham and Ardron (2006, 236) note the difficulties in recognising and interpreting historical industrial woodland features correctly, indicating a tendency for them to be under-reported.

Where they occur on slopes they are often terraced into the hillside; cut back into the slope at the rear and built out above the slope at the front. CBPs are characterised by their circular to elliptical shape; those on gentle slopes are more rounded, and those on steep slopes are more oval. They commonly occur in groups (typically spaced *c.* 40m apart) as colliers would often tend to several at once, staggering the starts of the 'burns'. Some sites of charcoal production also took advantage of abandoned features (e.g. former hut sites) by reusing the already-levelled, circular patches of land; for example, Rennie (1997, 85–7; 137–9).

### *2.3.2 Uses for the charcoal?*

As well as investigating the charcoal production itself, it was hoped that probable use(s) for the charcoal made at the Barbon CBPs could be established. The region is well known for the range of industries and industrial processes that were undertaken, and for which charcoal could have been used: from larger scale iron smelting, lime and gunpowder production, to smaller scale processes, such as the (domestic) wool industry and for use by blacksmiths, and for pigmentation, cleaning, and medicinal (antiseptic) purposes. For a more detailed discussion on

[6] Sometimes known as 'pitsteads', but those can also refer to pits dug into the ground.

these uses, including which of these can reasonably be discounted, see Hazell et al. (2017).

# 3. METHODOLOGY

Fieldwork was carried out from 7–10 October 2013. By this time, in clear contrast to conditions during the site reconnaissance visit on 5 September 2013, the bracken was already starting to die-back considerably. At the first visit the features had been easy to distinguish; bracken grew tall on the slopes but was absent from the flat, platforms themselves. This meant that as the bracken died back, the features were harder to distinguish. Because the pheasant shooting season had started, some of the planned work on preferred features could not be carried out.

The interventions were carried out following the English Heritage Recording Manual (English Heritage 2010) methods and procedures current at the time. Sediments were described using the Munsell® scheme (Munsell® 2000) for colour, and 'Module 3: Deposits and cuts' (English Heritage 2010) in terms of mineral components.

## 3.1 Site selection

During the earlier reconnaissance visit (see Hazell et al. (2013)) 16 of the 32 possible CBP features to the east of Barbon Park woods were visited and two of the six from the western parkland. These were subsequently assessed in terms of their suitability for fieldwork.

Based on the estimate that three CBPs could be test-pitted and sampled during one week of fieldwork, it was planned that at least two of these would be from the eastern slopes, and that one might be from the western parkland, depending on the results of the coring exercise there.

### *3.1.1 Western parkland*

Six possible CBPs had been mapped from aerial sources in this area. Because during the reconnaissance visit they had proved difficult to find on foot (their surface indications were quite subtle) their GPS coordinates were used to locate them for the coring exercise. It was initially planned that all six were to be cored in order to establish the presence or absence of charcoal, and therefore, the likelihood of them being CBPs. However, during fieldwork time was limited (following instructions from estate staff relating to the pheasant shooting considerations) meaning that only two features could be cored. The most appropriate two (9042 and 9043) were selected based on their clearer shape and form and the apparent lack of associated features/disturbance within them.

### *3.1.2 Eastern slopes*

A shortlist of preferred sites had been made based on i) accessibility (proximity to access paths), ii) strength of GPS signal (for site surveying) and iii) shape and form

of the features (clearer, more defined ones were preferred). Those selected initially were: 9003, 9013 and either one of 9014/9015. However, whilst on-site some revision of the final selection had to be made due to restrictions imposed by estate staff (it was not possible to work on 9003 due to its proximity to the woods where pheasants were being raised). Consequently, both 9014 and 9015 were excavated instead as they were both furthest from the woods. The platforms were excavated in the following order: 9013, 9014 and 9015.

### 3.2 Coring: Western parkland

At each feature, three points were cored on an approximately straight-line transect aligned downslope from the back to front of the platform (Fig. 7). They were located:

- just at the inside break of slope at the back of the platform,
- on the inside at the front of the platform, just inside the lip, and
- just on the outside of the front downslope.

A Dutch corer was used as this was a quick way to recover the sediments. However, because it was a rapid exercise to determine the presence/absence of charcoal, the corer used did not recover sediments in a complete, intact core. Due to the limited time available to do this work, small samples were bagged for sediment descriptions to be carried out later (see Appendix C).

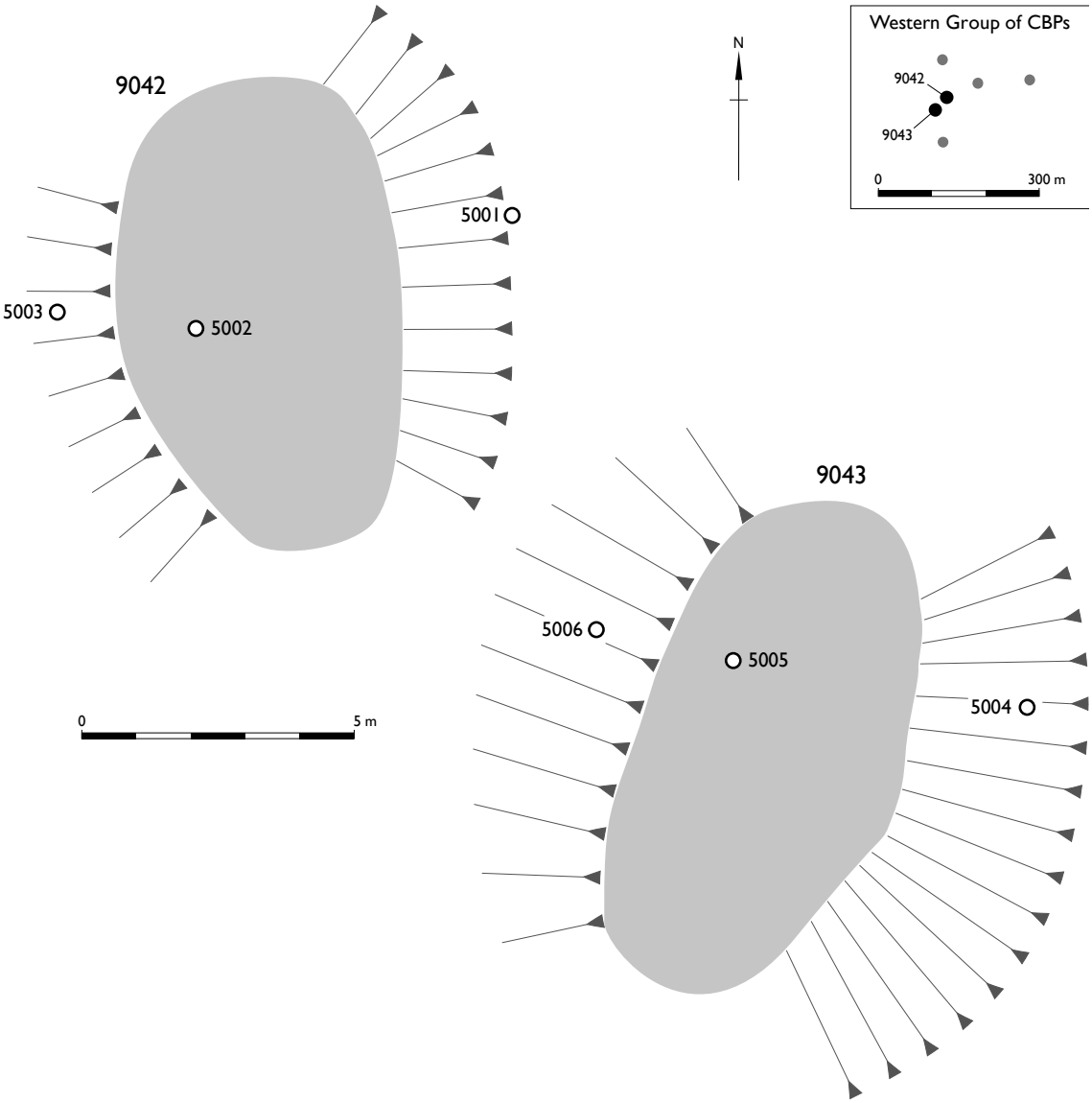



*Figure 7. Plans of the two cored western CPBs (9042 and 9043), showing their shape and form, together with the coring locations.*

### 3.3 Excavation: Eastern slopes

In order to establish the best place(s) for recovering charcoal from a CBP, some 'trialling' early on in the excavations helped inform the locations of subsequent test pits. The total area of permitted excavation was *c.* 2m$^2$ per feature, so the number, size and shape of the test pits changed over the course of the excavation informed by the presence/absence and amount of charcoal recovered previously. Where it became clear on removal of the turfs that there was unlikely to be any charcoal recovered (i.e. an absence of black/darkened soil), the test pit was not excavated and the turfs were replaced.

At each of the three features excavated, a test pit was dug on the outside, downslope front terrace ('apron'). This was because it had been suggested (Tom Gledhill pers.

comm.) to be the most likely place from which to recover charcoal; between burns charcoal makers would have scraped out any charcoal waste left within the platform, out and down over the front slope.

Each of the CBPs is shown in Figure 8, together with all the test pit and sample locations.

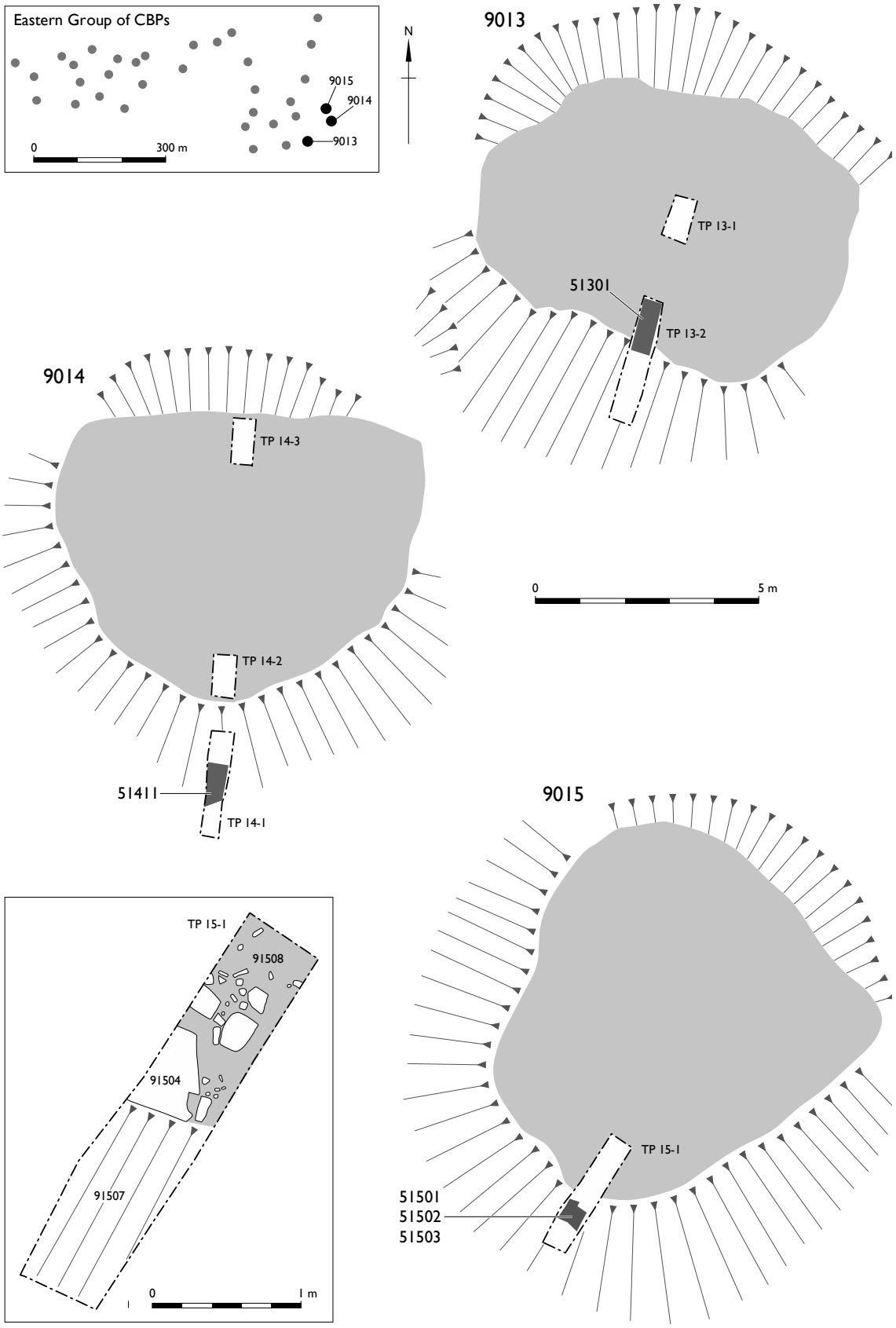



*Figure 8. Plans of the three excavated eastern CPBs (9013, 9014 and 9015), showing their shape and form, together with the test pit and sample locations.*

The sizes of the trenches are reported (below) as “width by length”, relating to the along slope and downslope measurements, respectively.

### *3.3.1 Platform 9013*

Platform 9013 was relatively sheltered, set back within a slight recess of the hillside. It was well-terraced at the front and back of the feature, both with stone revetments that were clearly visible behind the bracken, although the front slopes had bare patches of soil that were eroding. Two test-pits were dug on this feature:

#### 3.3.1.1 Test pit 13-1: 10131

This square 0.5m by 1.0m test pit was the first to be excavated. It was located to establish whether any charcoal could be recovered from the centre of a CBP. No significant amounts of charcoal were seen.

#### 3.3.1.2 Test pit 13-2: 10132

This rectangular 0.5m by 3.0m test pit was aligned with its long axis downslope, starting inside the front rim of the platform, crossing over the front lip and then extending downslope in front of the platform. The aim of this intervention was to determine the best place/s for charcoal recovery; just inside and/or outside the CBP’s front lip. Charcoal was recovered from the section of the test pit just inside the front rim of the platform.

### *3.3.2 Platform 9014*

Platform 9014 was located on the eastern edge of the area of open slope on a more-open and exposed area of hillside. It was perched with a high front terrace. Three test pits were planned. Work on 14-2 and 14-3 ceased when no charcoal or dark soil was seen after turf and topsoil were removed, and 14-1 was extended downslope.

#### 3.3.2.1 Test pit 14-1: 10141

This 0.5m by 2.4m test pit was located with its long-axis running down the front slope of the platform with the aim of finding charcoal that would have been deposited here after clearing out of the platform between burns. When it became clear that no charcoal was present in either of the other two test pits from this platform, this test pit became the focus of excavation and was extended further downslope (beyond the originally anticipated (1 x) 2m) with the hope of increasing the likelihood of encountering charcoal.

#### 3.3.2.2 Test pit 14-2: 10142

This 0.5m by 1.0m test pit was located just inside the front rim of the platform, based on the presence of charcoal at the equivalent location of Test pit 13-2 (on Platform 9013). However, no comparable darkness or blackening to the soil was observed in the deposit below the subsoil, so no further investigation took place.

#### 3.3.2.3 Test pit 14-3: 10143

This 0.5m by 1.0m test pit was dug at the inside, concave slope just inside the back wall of the platform. The aim was to determine whether any charcoal was present in

this area of a CBP. When the turf was removed no dark or blackened soil was seen, so no further work took place and the turf was immediately replaced.

### *3.3.3 Platform 9015*

Platform 9015 was located up-slope from 9014 on the eastern edge of the open slopes. It was similar in setting and character to 9014, located in a more open and exposed area of hillside, and with a steep fronted slope.

3.3.3.1 Test pit 15-1: 10151

Based on the pattern of charcoal recovered from the two other features, it was decided that only one test pit was needed at this platform and that it should cross the front rim of the platform and extend downslope. It was 0.5m by 3.0m and charcoal was recovered from the section of test pit on the front slope.

### *3.3.4 Platform 9007*

This platform is bisected by a public footpath. Although this CBP was not excavated, fragments of charcoal were recovered eroding out of the front downslope 'apron' of the platform; these were later used for radiocarbon dating. The location of the sample (<5071>) relative to the platform is shown on Figure 9.

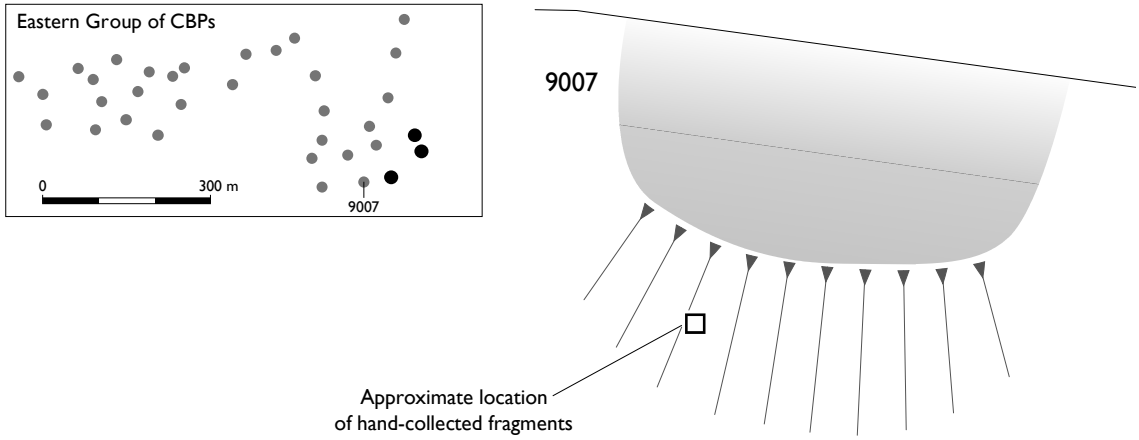



*Figure 9. Plan of Platform 9007 showing the approximate location of the charcoal recovered for radiocarbon dating.*

## 3.4 Site surveying

### *3.4.1 Western parkland*

The coring sites in the western parkland were surveyed in by Rebecca Pullen using a hand-held mapping-grade Trimble GeoXT GPS usually reserved for rapid surveys, and used here due to time restrictions in the field. Although it is only accurate to *c.* 1m, and probably even less so in its altitude readings, the coordinates plot out well relative to each other, and match well with the profile of the platforms as mapped from the aerial photographs.

### *3.4.2 Eastern slopes*

The platforms selected for excavation were surveyed by the excavation team using a Leica CS09/GS09 GPS system with real-time correction via Leica SmartNet, typically achieving accuracies of approximately 20mm 3D error.

An outline plan and profile of these platforms were recorded by surveying:

- around the elliptical margins of the flat platform base, through the concave break of slope at the base of the terrace at the rear of the platform and the convex break of slope at the top of the terrace at the front of the platform. These were sometimes hard to determine.
- along the break of slope that delineated the upper (convex) edge of the terrace at the rear of the platform, and
- along the lower (concave) edge at the base of the terrace at the front of the platform.
- along a line running downslope through the approximate middle of the feature in order to produce a profile.

The platform outline plans, and profiles are shown in Figures 8 and 11 respectively, and their co-ordinates are given in Appendix B.

## 3.5 Site recording

Site recording followed the English Heritage Recording Manual 2010 (English Heritage 2010). Data was entered into the project's Intrasis 2 database, a GIS-based digital recording system for archaeological excavations used by the Excavation and Analysis team since 2008. The database stores attribute and survey data, and image thumbnails with links to the photographs and to the scanned site drawings and sketches.

This was a small-scale excavation, and it was used to try out some new ways of working suited to a small team in an area where vehicle access was limited and no site office could be set up near the test pits. During the working day, the Intrasis project database was available on a laptop on site. In addition to completing paper record sheets, attribute data was entered directly into the database at the side of the test pits. A single GPS 'rover' antenna and pole (see below) was used for survey and this greatly reduced the equipment to be carried to the test pits (compared to the total station theodolite usually used by the team). Survey files were downloaded and imported into the database at intervals during the day. The database was backed up securely to a local network at the end of each day. The only problem encountered was difficulty seeing the laptop screen in bright light. Feedback was provided to the Excavation and Analysis team and the Intrasis team.

All features (contexts and samples and the single small find) were surveyed using a Leica CS09/GS09 GPS system with real-time correction via Leica SmartNet, typically achieving accuracies of approximately 20mm 3D error. This worked well most of the time, although there were some issues with loss of the mobile phone connection to SmartNet due to variation in signal strength and proximity to trees.

Every platform, site sub-division (test pit), context, sample, small find and site photograph was allocated a unique identifier. The table of record numbers is in Appendix A1.

Site photographs were taken in both jpeg and raw image formats. They were downloaded and checked daily, and unwanted images were deleted. The images were assigned record numbers and site-specific metadata was attached to each. They were then imported into the project database and related to the features they showed.

At the end of the fieldwork, the site database and images were copied into the project folder on the English Heritage network at Fort Cumberland.

## 3.6 Environmental sampling

### *3.6.1 Charcoal sampling*

In total, six samples (see Table 1) were recovered for wood charcoal analysis and potentially for radiocarbon dating. They were a combination of flotation (bulk sediment) samples, hand-picked fragments and a small surface soil sample.

Bulk samples for flotation were recovered using trowels and/or spades and placed straight into bag-lined 10 litre sample buckets. Where the charcoal was less abundant (e.g. Sample <51301>) the sample size was increased to ensure sufficient charcoal was obtained to be representative of the remains within the deposit. Given the limited vertical depth of the charcoal deposits and that no separate layers were identifiable, it was not considered necessary to sample in multiple layered 'spits'. Whilst taking Sample <51501> the charcoal was seen to be friable and prone to fragmentation. So, to avoid breaking it unnecessarily, a duplicate, Sample <51502>, was recovered by lifting it out as intact sediment blocks.

Individual hand-picked fragments and the surface soil sample were collected by hand and placed directly into small labelled, sealed sample bags. As soon as possible after retrieval, all the samples were put into dark, cold storage (below 4$^{o}$C) at Fort Cumberland, Portsmouth.

*Table 1. Summary of samples recovered for wood charcoal analysis, as recovered on-site. n/a = not applicable*

| Platform | Test pit | Context | Context description and/or interpretation | Sample number | Sample type | Sample size | Processed |
|---|---|---|---|---|---|---|---|
| 9013 | 10132 | (91311) | Deposit from just inside the front edge of the platform, from charcoal production. | <51301> | Bulk (flotation) | 40 litres | ✓ |
| 9014 | 10141 | (91412) | Front apron deposit, from clearing/scraping out the platform downslope. | <51411> | Bulk (flotation) | 10 litres | ✓ |
| 9015 | 10151 | (91503) | Front apron deposit, from clearing/scraping out the platform downslope. | <51501> | Bulk (flotation) | 2 litres | ✗ |
| | | | | <51502> | Bulk (flotation) | 10 litres | ✓ |
| | | (91507) | Mineral soil. Undisturbed natural? | <51503> | Specialist (handpicked fragments) | 3 fragments | n/a |
| 9001 | n/a | n/a | Surface sample | <5011> | Specialist (surface sample) | 175 ml | ✗ |
| 9007 | n/a | n/a | Eroded out of front apron (rabbit digging?). | <5071> | Specialist (handpicked fragments) | 2 fragments | n/a |

### *3.6.2 Pollen sampling*

Because no sealed, undisturbed old land surfaces suitable for pollen analysis were encountered during excavation, no such sampling was carried out.

## 3.7 Radiocarbon dating sampling

The sampling strategy was to date two fragments from each platform; one of a short-lived taxa and one of *Fraxinus* sp. (ash). Using different taxa ensures that the fragments do not derive from the same original individual. Preference was given to *Fraxinus* sp. fragments without tyloses and with bark if possible. The latter was more difficult as bark often was detached (probably during processing).

## 3.8 Small finds recording and archaeological conservation

A unique small finds (SF) number was to be allocated to each individual small find. In fact, only one small find was recovered from the site; a piece of barbed wire (see Section 7). No conservation measures were necessary due to its insignificance. It was subsequently discarded.

## 3.9 Sample archiving

Initially, enquiries were made to deposit the wood charcoal remains with the local museum; Kendal Museum, Kendal, Cumbria. However, they were not considered for accession due to the museum's policy to not receive either i) post-medieval or ii) environmental archaeological remains. As a result, the material is to be retained by Historic England in their Archaeological Archive store, at Fort Cumberland, Portsmouth.

## 3.10 Archival research

In order to investigate possible uses for the charcoal that was produced at Barbon, archives materials – namely documents and maps – were explored at Lancashire Archives, Preston and Kendal Archive Centre, Kendal. Further detail on some of the information gained from these sources can be found in Hazell et al. (2017). A small scoping study into further potential of archive material(s) has since been carried out by Pearson (2019). This work identified a series of documents – including: i) account books of iron furnace and gunpowder works, ii) indentures/articles of agreement of both wood and charcoal supply, and iii) probate and parish records – and collated their catalogue ID numbers, in order that they could be explored further for potential links to the charcoal production at Barbon.

# 4. EXCAVATION RESULTS

## 4.1 Coring: Western parkland

Maximum depths of 0.14m (at 9042) and 0.25m (9043) were reached.
Only the sediment from the core at the back of Platform 9042 contained charcoal fragments, and only the sediment from the cores inside Platform 9043 (back and

front) contained charcoal fragments. In all cases the charcoal fragments were small and infrequent. Initial assessment of the scarcity of charcoal, would seem to suggest that they are unlikely to be CBPs. However, given the less than expected abundance of charcoal at the definite CBPs on the eastern slopes, this inference is not definitive.

## 4.2 Excavation: Eastern slopes

The aims of the excavation (Section 1.2.1 above) were tightly focussed on identifying evidence for charcoal production, and investigating the structure of the platforms themselves was therefore beyond the scope of this project. This meant that only charcoal-rich deposits were fully excavated, and stratigraphic relationships between the structural elements of the platforms were not always demonstrated.

However, Test pits 13-2 and 15-1, which ran across the lip of the platforms, did produce some evidence for their construction. Platform 9015 seems to have had a revetment formed of large stones (91504), and the stony lip (91313) of Platform 9013 may have formed a retaining bank, or (perhaps more likely) a stonier deposit behind a revetment which had since collapsed or been removed in the area of the test pit. Revetment stones were noted within the bracken in places (see Section 3.3.1 above).

In most of the test pits on the flat part of the platforms, removal of topsoil exposed a clean stony soil. At the back of the platforms, this is interpreted as undisturbed subsoil exposed where the platform was cut into the slope, and at the front of the platforms as redeposited subsoil consolidated to form the working surface of the platform. A charcoal-rich deposit on the platform surface itself was noted only on Platform 9013. Overall the quantity of charcoal observed was much less than had been expected based on the results from sites further afield in Germany, but in fact was not dissimilar to that reported from East Sussex, England (see Hazell et al. 2017: section 5.1).

The plans of the investigated platforms and the locations of the test pits are shown on Figure 8. Profiles of the excavated platforms are shown on Figure 13.

The interpretative index of contexts and stratigraphic matrices are presented in Appendices A3 and A4.

### *4.2.1 Platform 9013*

4.2.4.1 Test pit 13-1
A 0.5m by 1.0m test pit, located in the centre of the platform.
Topsoil (91301) overlay a layer of stony silt loam (91302) interpreted as *in situ* or redeposited subsoil forming the surface layer of the platform. No charcoal was noted.

4.2.4.2 Test pit 13-2
A 0.5m by 3.0m test pit, running across the front lip of the platform.

Topsoil (91310) covered a charcoal-rich deposit (91311) immediately behind the front lip of the platform. This is interpreted as burning residue. This overlay the platform surface (91314) which consisted of redeposited subsoil.

Layer (91313) on the lip of the platform consisted of about 40% large/medium stones and cobbles. It may have formed a retaining bank around the front of the platform, but was perhaps more likely to be what remained after the collapse or removal of a stone revetment (noting that the front 0.5m of platform make-up layer (91508) of Platform 9015 contained substantially more and larger stones than the rest of the layer and may represent packing behind the revetment).

A stony layer (91312) downslope is interpreted as undisturbed subsoil underlying the platform construction (91313), but as (91313) was not excavated, the stratigraphic relationship was not demonstrated.

### *4.2.2 Platform 9014*

4.2.2.1 Test pit 14-1
A 0.5m by 2.4m test pit, located on the lower slope of Platform 9014.
Topsoil (91410) overlay deposit (91411), a silt loam with stones forming the front slope of the platform. Charcoal-rich layer (91412) lay at the base of the platform slope, and had a denser charcoal lens at its base. This is interpreted as material scraped or washed off the platform. It overlay undisturbed mineral subsoil (91413).

4.2.2.2 Test pit 14-2
A 0.5m by 1.0m test pit, located on the lip of Platform 9014.
Topsoil layers (91430) and (91432) overlay (91431), a layer of compacted silt clay loam with occasional pebbles which formed the platform surface. No charcoal was noted.

4.2.2.3 Test pit 14-3
A 0.5m by 1.0m test pit, and the back of Platform 9014.
Turf and topsoil layer (91450) was removed, but no charcoal was noted, and there was no further work on this test pit.

### *4.2.3 Platform 9015*

4.2.3.1 Test pit 15-1
A 0.5m by 3.0m test pit running across the front of the platform and part way down the slope.

Topsoil (91501) overlay the platform surface (91505) and (91502), a layer of compact silt loam with pebbles washed or scraped onto the platform slope.

On the slope, (91502) covered a charcoal-rich layer (91503) interpreted as waste material washed or scraped off the platform after its final use. This overlay (91507), redeposited subsoil forming part of the make-up of the platform slope. Charcoal fragments in this deposit indicate some disturbance during or after the use of the platform.

On the lip of the platform, a large stone (91504) formed part of the platform's revetment (retaining wall). This revetment appears to have slipped, probably after the platform went out of use and possibly after some of the stone facing had been removed or collapsed. A clean dark soil (91506) filled the resulting gap between the revetment and platform surface (91505) and the underlying stony make-up (redeposited subsoil (91508)).

No charcoal was noted on the platform surface (91505).
This test pit produced most evidence for platform construction (Figures 10–12), but further investigation of the structure was beyond the scope of this project.

*Figure 10. Platform 9015: View of platform surface (91508) and revetment (91504) from above facing west. Fill (91506) has been removed. Image ref. 4069.*

*Figure 11. Platform 9015: View of face of revetment (91504) and platform slope (91507) facing north. The charcoal rich deposit (91503) has been removed from the slope; it included Samples <51501> and <51502>, of which only the latter was processed. Image ref. 4079.*

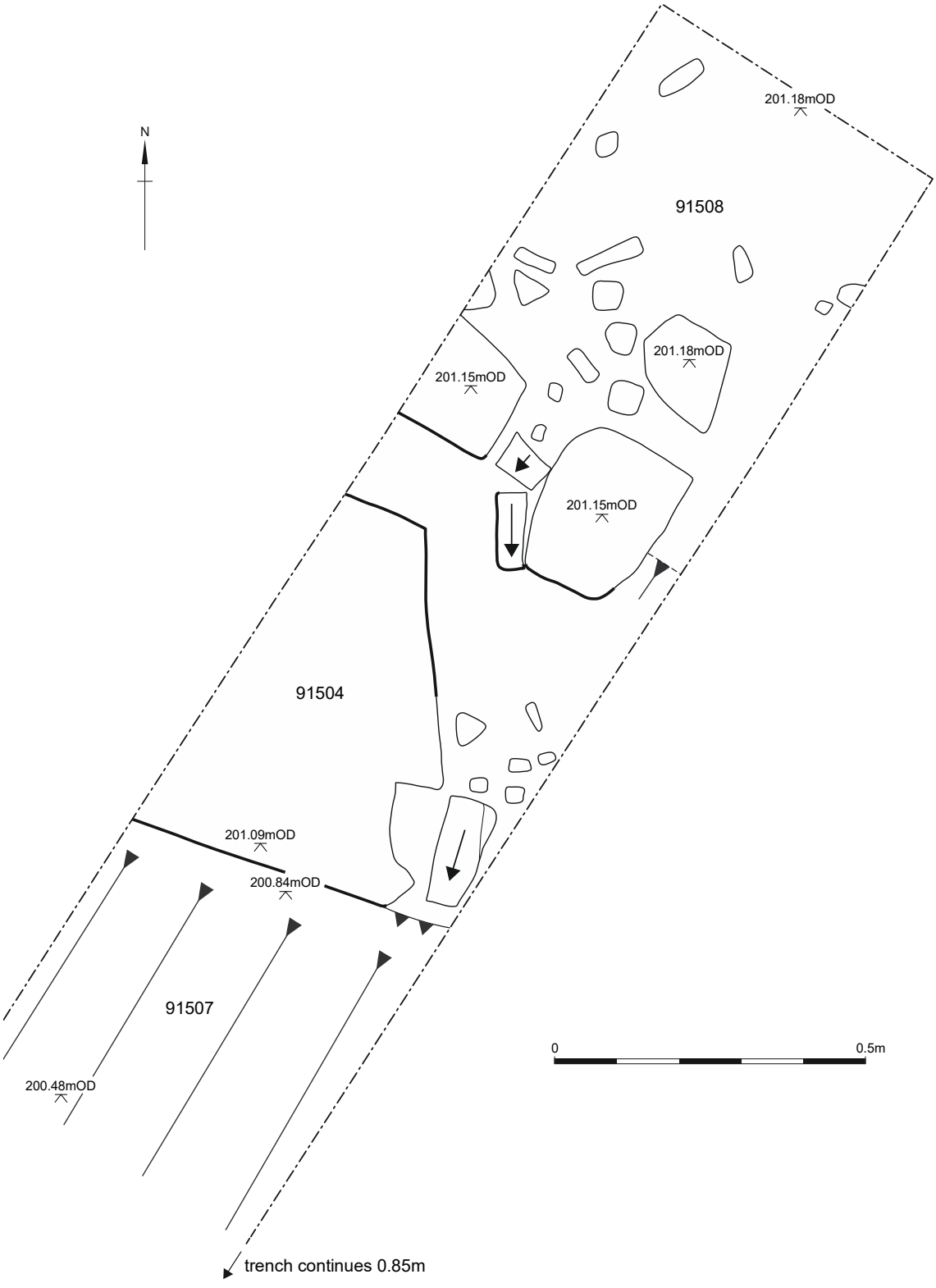
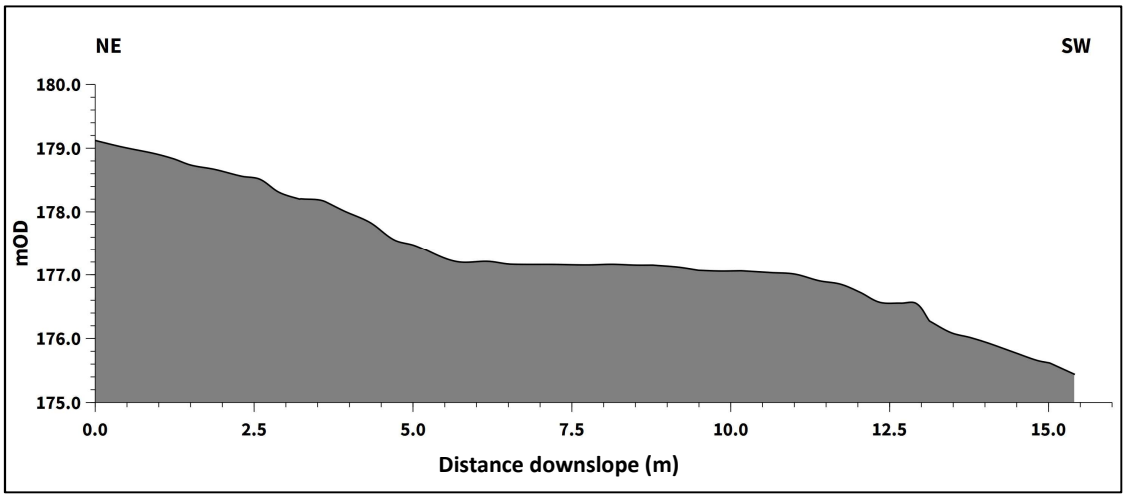
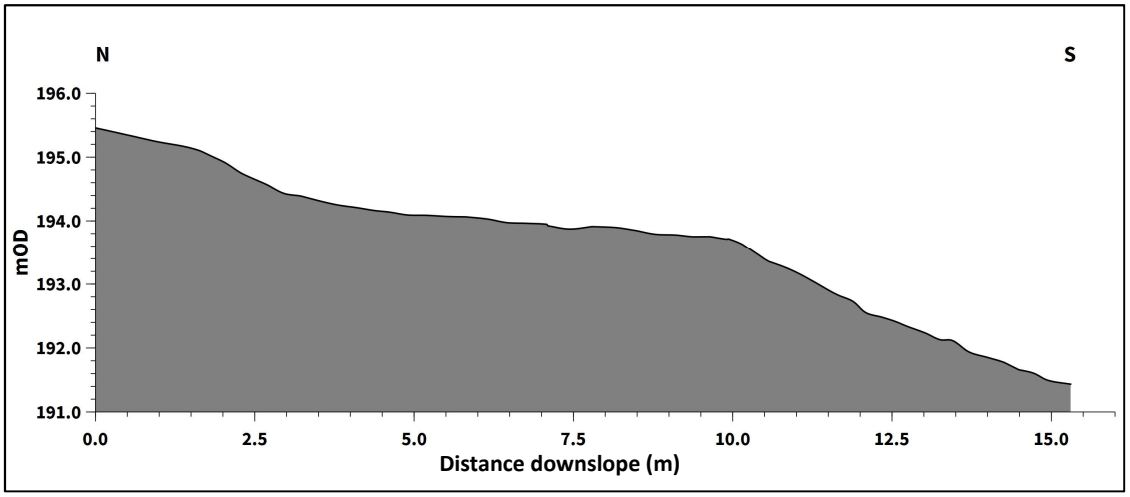


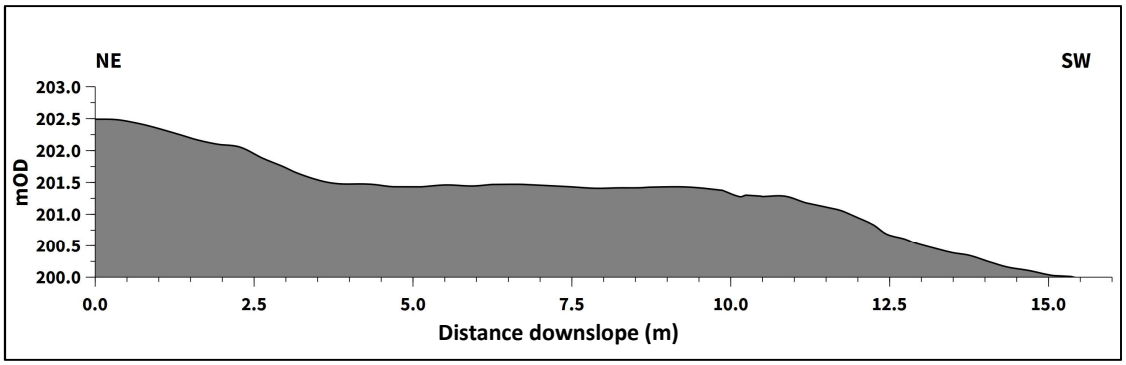

*Figure 12. Platform 9015: Plan of Test pit 15-1.*




*(a). The downslope profile of Platform 9013.*




*(b). The downslope profile of Platform 9014.*




*(c). The downslope profile of Platform 9015.*

*Figure 13. The downslope profiles of the three recorded and excavated CBPs: (a) 9013, (b) 9014 and (c) 9015.*

### 4.3 Other field observations

Whilst field walking in the western block, a possible seventh platform feature (Platform 9047) was identified by Marcus Jecock and Rebecca Pullen.

On the eastern slopes, at the very eastern margin of the project area, Tom Gledhill explored further east (just outside the project boundary) and found more CBPs there, confirming that they extend further along the slopes.

## 5. WOOD CHARCOAL ANALYSIS

### 5.1 Sample descriptions

#### *5.1.1 Platform 9001*

Sample <5011> consisted of mixed topsoil and leaf litter collected from the eroding front slope of Platform 9001 where small charcoal fragments (>10mm) had been seen on the ground surface during field walking. Approximately 150ml was collected in the field. Later, this was measured in the laboratory using a measuring cylinder in order to get a more precise volume (175ml).

This sample has not been analysed.

#### *5.1.2 Platform 9007*

Sample <5071> consisted of two hand-picked charcoal fragments recovered from the ground surface. They had eroded out of sediments on the downslope, front 'apron' area of the platform.

#### *5.1.3 Platform 9013*

Sample <51301> was a bulk sample from Context (91311) (the layer immediately below the topsoil in the upslope half of Test pit 13-2) situated within the front lip of the CBP. The soil was dark coloured (possibly blackened from charcoal dust?) and although charcoal fragments within it were clearly visible in the field, the concentration did not appear to be high. Hence, a *c.* 40 litre sample was taken in order to ensure enough charcoal was recovered for analysis.

#### *5.1.4 Platform 9014*

Sample <51411> was a bulk sample recovered from Context (91412) within Test pit 14-1, from the front, downslope face of the platform. Charcoal was present throughout the layer, but became much more concentrated with depth, with most charcoal at the very base of the layer, resting on the context below. After sampling, a section face was cut through the context and showed a dense part of the charcoal deposit to be concentrated as a lens *c.* 0.07m thick by *c.* 0.20m wide. Given the abundance of charcoal, only 10 litres were sampled.

### *5.1.5 Platform 9015*

Sample <51502> was a bulk sample recovered from Context (91503) within Test pit 15-1, from the front, downslope face of the platform. Charcoal was present throughout but increased in concentration towards the base of the layer, on top of Context (91507) below. The charcoal was very delicate and friable, and given its high abundance a 10 litre sample was considered sufficient.

Sample <51503> consisted of three hand-picked charcoal fragments that were seen in Context (91507) whilst digging down through the layer to investigate these lower sediments. They were recovered 0.40m below the ground surface. Until these charcoal fragments were found it had been inferred that the context was undisturbed mineral soil (the 'natural'). However, the presence of the fragments implies that that was not necessarily the case; either that (91507) was not the natural, or if it was then some mixing had occurred.

Table 2 shows details of the samples recovered for wood charcoal analysis, before and after processing.

*Table 2. Details of the samples recovered for wood charcoal analysis. Quantifications are in millilitres (ml) unless otherwise stated as litres (l) or frags (fragment count). n/a = not applicable, n/r = not recorded. * = before flotation, these samples were placed on a 4mm sieve, and most of the large charcoal fragments were hand-collected. ** = not floated. 'Roots' consists of modern roots, rhizomes and leaf matter.*

| **Sample** | **Context** | **Sample type** | **Estimated sample size (in field)** | **Actual sample size** | **Sample volume (after sieving) (ml)** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Hand-separated (4mm sieve)* | Flot | | | | Residue | | | |
| | | | | | | <2mm | 2–4mm | >4mm | >4mm root | <2mm | 2–4mm | >4mm | |
| <51301> | (91311) | Flotation | 40 litre | 37 litre | n/a | 1750 Roots *c.* 50% | 1250 Roots *c.* 50% | 1100 Roots *c.* 5% | 4600 | n/a | n/a | n/a | |
| <51301B> | (91311) | Refloated residue | n/a | n/r | n/a | 400 Roots *c.* 5% | 450 Roots *c.* 5% | 500 Roots *c.* 5% | n/a | 725 | 570 | 2000 | |
| <51411>* | (91412) | Flotation | 10 litre | 8 litre | 200 | 350 Roots *c.* 25% | 300 Roots *c.* 10% | 450 Roots *c.* 5% | 450 | 430 | 510 | 1400 | |
| <51411B> | (91412) | Refloated residue | n/a | n/r | n/a | 250 Roots *c.* 5% | 300 Roots *c.* 5% | 325 Roots *c.* 5% | 50 | Larger clasts: 900 Smaller clasts: 425 | | | |
| <51502>* | (91503) | Flotation | 10 litre | 7.5 litre | 250 | 450 Roots *c.* 25% | 300 Roots *c.* 10% | 450 Roots *c.* 5% | 650 | 420 | 380 | 1050 | |
| <51503> | (91507) | Handpicked | 3 frags | 3 frags | n/a | n/a | n/a | n/a | n/a | n/a | n/a | n/a | |
| <5011> | n/a | Surface sample** | n/r | 175 ml | n/a | 60 Roots *c.* 80% | 50 Roots 70% | 70 Roots 50% | n/a | n/a | n/a | n/a | |

## 5.2 Summary of the wood charcoal investigations

Details of the sample processing, and of the wood charcoal results are presented in Hazell et al. (2017), and so are only summarised here.

Meshes of 250μm (flot) and 1mm (residue) were used for the flotation, although not all the samples recovered were processed this way. The residues of Sample <51301> and Sample <51411> had to be refloated, as much of the wood charcoal had initially sunk. The large, floated samples then underwent the routine, two-phased analytical approach; an initial Archaeological Assessment, and then a more-detailed Archaeological Analysis.

### *5.2.1 Wood identifications*

Overall at the site, the following wood taxa were identified, all of which are hardwoods (angiosperms) and common woodland types:

eight to genus level:

- *Corylus* sp. (hazel)
- *Fraxinus* sp. (ash)
- *Hedera* sp. (ivy)
- *Ilex* sp. (holly)
- *Ligustrum* sp. (privet)
- *Quercus* sp. (oak)
- *Rosa* sp. (rose)
- *Sambucus* sp. (elder)

and three taxonomic groups:

- Maloideae/*Prunus* (Pomaceous fruits[7]/cherries)
- *Populus/Salix* (poplar/willow)
- Betulaceae (undiff.) (*Alnus* (alder)/*Betula* (birch)/*Carpinus* (hornbeam)/ *Corylus* (hazel))

Of these *Fraxinus* sp. dominated, with Maloideae/*Prunus* type also commonly occurring. *Quercus* is notable by its scarcity.

### *5.2.2 Other characteristics recorded*

- A mix of wood deriving from small and larger tree elements were present, as inferred from the curvature of the growth rings.
- Both *Fraxinus* and *Quercus* sapwood and heartwood were identified from the charcoal material, with sapwood most common overall.

[7] This group includes *Crataegus* (hawthorn), *Cotoneaster* (Cotoneasters), *Pyrus* (pears), *Malus* (apples) and *Sorbus* (whitebeams).

- It was often hard to determine the season of felling, although where this was possible, there was at least some latewood growth present.
- The wood was in good condition – with no evidence of infestation, decay or degradation. It was frequently vitrified to some degree; in particular ray cells were often fused, as seen in the TLS (Tangential Longitudinal Section) plane.
- Some fragments showed evidence of very slow growth rates, where rings were so close together that it was sometimes impossible to differentiate them.

Only one charcoal fragment (*Fraxinus*, from Sample <51411>) showed clear wood working marks, as an obliquely cut plane (Fig. 14).

*Figure 14. Photo of the piece of worked wood (*Fraxinus sp.*) from Sample <51411>. Each small grid square is 1mm. Z. Hazell © Historic England.*

## 6. SCIENTIFIC DATING

### 6.1 Radiocarbon dating

Details of the radiocarbon dating laboratory methods and of the chronological modelling are presented in Hazell et al. (2017).

### *6.1.1 Sample selection*

As the charcoal samples were examined, fragments were selected for radiocarbon dating based on preferences for:

- short-lived, fast growing genera e.g. *Corylus* (hazel),
- parts of a tree with a shorter time-width e.g. obvious twigs (roundwoods) and avoiding oak heartwood (i.e. with tyloses), and
- samples of two different taxa (from the same sample) to be sure that they are not from the same individual.

Table 3 shows details of the individual fragments used for radiocarbon dating.

*Table 3. Details of the wood charcoal fragments from Barbon used for radiocarbon dating.*

| Platform | Sample | Context | Test pit | Sample code | Laboratory code | Fragment details | Weight (g) | Notes |
|---|---|---|---|---|---|---|---|---|
| 9013 | <51301> | (91311) | 10132 | 9013A | UBA-25295 | *Fraxinus* sp. branch: 6 growth rings, inner bark present, no tyloses | 0.797 | From flot |
| | | | | 9013B | SUERC-52447 | *Corylus* sp. twig: 19 growth rings, part of a small diameter roundwood with pith present | 0.408 | From flot |
| 9014 | <51411> | (91412) | 10141 | 9014A | UBA-25296 | *Fraxinus* sp. branch: 11 growth rings, inner bark present, no tyloses | 0.357 | From >4mm handpicked fragments |
| | | | | 9014B | SUERC-52448 | Maloideae twig: 22 growth rings, part of a small diameter roundwood, with pith and outer bark present | 0.628 | From >4mm handpicked fragments |
| 9015 | <51502> | (91503) | 10151 | 9015A | UBA-25297 | *Corylus* sp. twig: 15 growth rings, part of a small diameter roundwood with outer bark present | 0.128 | From flot |
| | | | | 9015B | SUERC-52449 | *Fraxinus* sp. twig: 10 growth rings, part of a small diameter roundwood with pith and outer bark present, no tyloses | 1.050 | From >4mm handpicked fragments |
| 9007 | 5071 | n/a | n/a | 9007A | UBA-25294 | *Fraxinus* sp. twig: 25 growth rings, small diameter roundwood with pith and inner bark present, tyloses present | 1.154 | Only two fragments recovered from eroding platform apron |
| | | | | 9007B | SUERC-52446 | cf. Maloideae twig: 9 growth rings, section of small diameter roundwood (no pith or bark present) | 0.175 | |

### *6.1.2 Radiocarbon dating results*

The radiocarbon dating results (Hazell et al. 2017) are shown here in Table 4.

*Table 4. Radiocarbon and associated stable isotope measurements from CBPs at Barbon.*

| Sample | Context | Sample code | Laboratory code | Radiocarbon age (BP) | $\delta^{13}C_{IRMS}$ (‰) |
|---|---|---|---|---|---|
| <51301> | (91311) | 9013A | UBA-25295 | 136±29 | −26.0 |
| | | 9013B | SUERC-52447 | 237±29 | −26.1 |
| <51411> | (91412) | 9014A | UBA-25296 | 243±32 | −26.0 |
| | | 9014B | SUERC-52448 | 201±29 | −25.3 |
| <51502> | (91503) | 9015A | UBA-25297 | 100±29 | −28.5 |
| | | 9015B | SUERC-52449 | 219±25 | −25.9 |
| <5071> | n/a | 9007A | UBA-25294 | 146±29 | −26.1 |
| | | 9007B | SUERC-52446 | 221±29 | −26.9 |

*IRMS = Isotope-Ratio Mass Spectrometry.*

## 6.2 Chronological modelling

It was possible to refine the chronological model by incorporating a *terminus ante quem* (*TAQ*) of AD 1859, derived from an early OS map that showed a public footpath crossing one of the platforms (Platform 9007).

The chronological modelling[8] suggested they were in use for between *1–210 years* (*95% probability*), probably *10–90 years* (*65% probability*) or *130–140 years* (*3%[9] probability*) (Hazell et al. 2017).

# 7. SMALL FIND RESULTS

## 7.1 Small find (SF) 31501

The only small find recovered during the excavation was SF31501; a piece of ironwork recovered from Context (91503), the same context from which charcoal Sample <51502> was taken. It was subjected to x-radiography by Karla Graham at Fort Cumberland (Fig 15), where it was identified as a piece of barbed wire.

[8] Since these radiocarbon dates were calibrated (using IntCal13), a revised radiocarbon calibration curve (IntCal20) has been published (see Reimer et al. 2020).
[9] Note that an error exists in the conclusion section of Hazell et al. (2017) where this figure was published as 68% probability. It should have been reported as 3%.

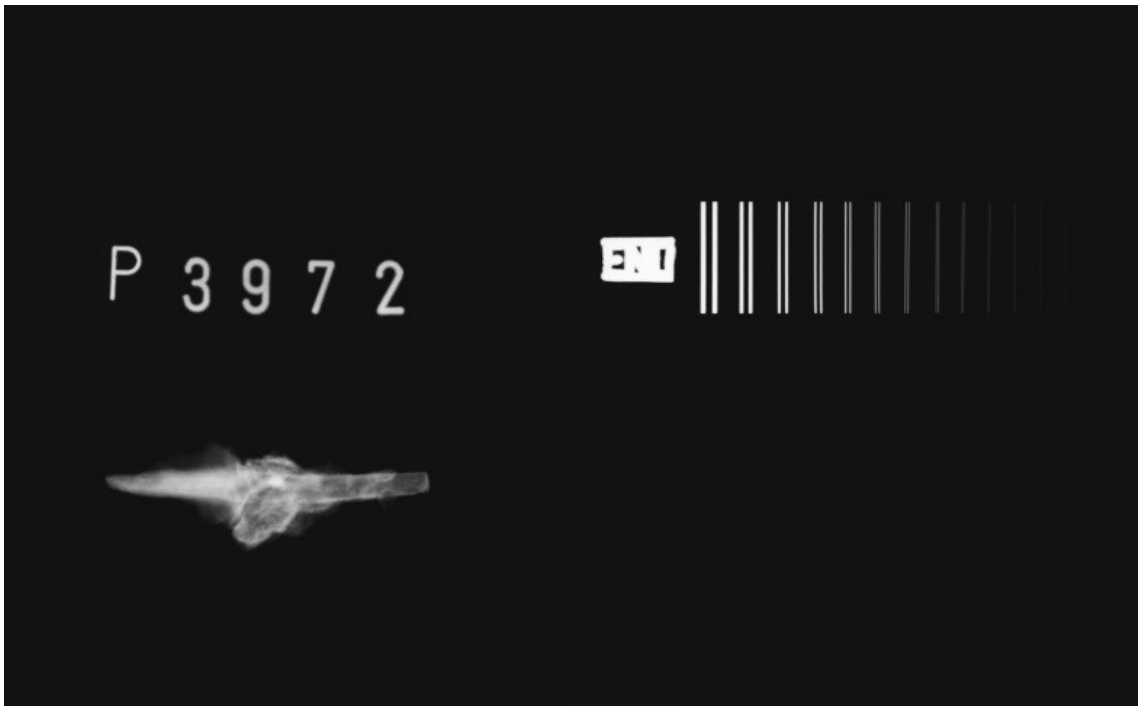


*Figure 15. X-ray of Small Find 31501 – a fragment of barbed wire.*

# 8. SUMMARY AND CONCLUSIONS

The findings of the project are summarised below, referring to the project's aims (A1–A5) (Section 1.2.1) and objectives (O1–O5) (Section 1.2.2) where directly relevant. The broader questions have successfully been addressed, but it has not been possible to produce definitive answers to every question.

## 8.1 Summary of the excavations and wood charcoal results

This work has successfully confirmed the eastern group of features to be CBPs, as identified from the initial aerial mapping interpretations (A1). It has also successfully demonstrated that small-scale excavations on these features can recover adequate material for an in-depth study of wood charcoal (in particular, wood type) and for radiocarbon dating (A3). Determining whether the features were single- or multi-use (also A3) has not been possible. The sediments encountered and the low presence of charcoal at the site overall (O3) suggest this is due to the platforms having been thoroughly cleared of material after use. However, it is possible that more-extensive excavations would reveal stratified deposits resulting from successive burn events. The radiocarbon dating programme has identified the features as post-medieval (A4), and it has been possible to refine the chronological model using documentary evidence in the form of early OS mapping.

Overall, the charcoal condition was well preserved, with fragments from small diameter roundwood present (O3). From the wood types identified (O4) it has been possible to exclude gunpowder production from the list of potential uses of the charcoal itself (A2, O4). Lime production has also been discounted based on records

of the preferred use of coal. Its potential use for local iron production (O5) is less well understood; the HER record for the medieval bloomery is vague and unsubstantiated (see Davies-Shiel 1998), as well as pre-dating the identified phase of charcoal production (as determined from the radiocarbon dating). For more detail on alternative uses of the charcoal (A2, O4), together with information on the condition and quality of the charcoal itself (O3), refer to Hazell et al. (2017).

The woodland at the eastern end of Barbon Wood, closest to the excavated CBPs, is currently coniferous plantation. This relatively recent woodland, therefore, is not contemporaneous with the charcoal production and so precludes comparison. Whilst there were possible hints of past woodland management regimes present in the tree-ring patterns of the archaeological remains, it remains methodologically challenging to ascribe these characteristics in wood charcoal to particular activities (e.g. coppicing/shredding) with certainty. Ideally, a full woodland survey of a wider area would be required to address aim A5, ideally cross-referenced to documentary evidence describing the historical management of the estate's woodland, but this was not possible within the constraints of this work.

As well as recovering the charcoal itself, the excavations have given some insight into the construction of the platforms themselves; in particular the terraced revetments. In turn, this scale and investment of construction implies that the platforms would have been re-used. Despite this likely re-use, charcoal remains were generally low in abundance, and no pottery or other finds associated with the use of the CBPs were recovered.

Although the charcoal was not as abundant as expected (in comparison to comparable sites on mainland Europe) this work was the first in-depth study on mainland Britain of the wood charcoal remains from charcoal burning platforms. Now that the research potential and value of such material has been demonstrated, it is hoped that more comparative studies, such as Lewis (2019), will be undertaken elsewhere.

### 8.2 Suggestions for further research

- Excavation of selected platforms from the western group of features in order to investigate fully their character, form and use.
- Further excavate selected platforms from the eastern group of features in order to investigate and record their construction methods in more detail.
- Carry out a woodland (tree/vegetation) survey of Barbon Wood, looking for evidence of former woodland management techniques, such as coppicing (for example, the area of 'Oak Coppice' near Barbon Manor marked on the early OS map shown in Figure D2 (Appendix D).
- Map the additional CBPs observed to the east, beyond the extent of the project area boundary.
- Carry out light reflectance measurements of the wood charcoal remains to reconstruct the burning temperatures reached during the charcoal production process.

- Explore and test the application of archaeomagnetic dating on the sediments, to complement the radiocarbon ages that have already been obtained.
- Apply archaeomagnetic survey to selected platforms to identify the zone of heat-affected sediments.
- Undertake further archival research with the aim of finding documentary evidence for the use of the charcoal made here at Barbon, now that both lime and gunpowder production have been discounted.
- Undertake tree coring of trees currently growing on platforms, in order to determine those trees' ages and see if it helps refine the (map-derived) *TAQ* for the end of their use.

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# APPENDIX A: SUMMARY OF EXCAVATION RECORDS

## Appendix A1. Record Numbers Used Form.

Monument record entries for 1574919 and 1575141 are available through the Heritage Gateway (https://www.heritagegateway.org.uk/gateway/default.aspx). SSD = Site Subdivision.

| Record Type | Record Numbers | SSD or CBP | Comments |
|---|---|---|---|
| Surface features | 9001–9035 | | Platforms, in Monument 1574919 (eastern group) |
| | 9041–9046 | | Platforms, in Monument 1575141 (western group) |
| Site Subdivisions | 10131–2 | 9013 | Test pits 13/1,13/2 |
| | 10141–3 | 9014 | Test pits 14/1, 14/2, 14/3 |
| | 10151 | 9015 | Test pits 15/1 |
| Contexts | 91301–2 | 13-1 | Numbers assigned in blocks by SSD |
| | 91310–4 | 13-2 | |
| | 91410–3 | 14-1 | |
| | 91430–2 | 14-2 | |
| | 91450 | 14-3 | |
| | 91501–8 | 15-1 | |
| Small Finds | 31501 | 15-1 | Numbers assigned in blocks by SSD |
| Samples | 51301 | 13-2 | 3-D recorded samples. Numbers assigned in blocks by SSD |
| | 51411 | 14-1 | |
| | 51501–51503 | 15-1 | |
| | 5011 | 9001 | |
| | 5071 | 9007 | |
| Samples | 5001–3 | 9042 | Samples or sub-samples, not 3-D recorded |
| | 5004–6 | 9043 | |
| Plans | 1501 | 15-1 | |
| Sections | 21301 | 9013 | Profiles recorded with GPS (not drawn on site) |
| | 21321–2 | 13-2 | |
| | 21401–4 | 9014; 14-1 | |
| | 21501 | 9015 | |
| Drawing Sheets | 1 | 15/1 | File name 6304_sheet1.tif |
| Photographs | 4001–4092 | | |

Appendix A2. Photos and Drawing List

| Context | Photo number | Sketch | Plan |
|---|---|---|---|
| 91301 | 4015; 4018 | | |
| 91302 | 4016–4018 | | |
| 91311 | 4021–4022 | | |
| 91312 | 4021–4024 | | |
| 91313 | 4021–4025 | | |
| 91314 | 4023–4024 | | |
| 91411 | 4036–4037 | | |
| 91412 | 4036–4044 | Sample sheet 51411 | |
| 91413 | 4036–4037; 4042–4044 | Sample sheet 51411 | |
| 91431 | 4045 | | |
| 91503 | 4061–4062; 4064–4065; 4066–4068 | | |
| 91504 | 4061–4062; 4064; 4067–4076; 4078–4079 | Context sheets 91506 and 91508 | Plan 1501 |
| 91505 | 4061; 4063–4064; 4069–4071 | Context sheet 91506 | |
| 91507 | 4076–4077; 4079 | | Plan 1501 |
| 91508 | 4072–4076; 4078 | Context sheets 91506 and 91508 | Plan 1501 |

# Barbon Park (Project 6304): Appendix 3, Interpretative Context Index



| Platform | Test Pit | Context | Interpretative Description | Samples | Length *(as seen in test pit)* | Width | Depth | | Description | Colour | Munsell number | Soil texture | Inclusions |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Platform 9013** | **Test pit 13/1** | 91301 | Topsoil | | 1 metres | 0.5 metres | 0.07 metres | Layer: topsoil | Dark brown friable loamy sand. | Dark brown | 10YR 4/3 brown | loamy sand | Frequent bracken roots. Occasional subangular small stones and pebbles. |
| | | 91302 | Platform surface: stony subsoil, in situ or redeposited. | | 1 metres | 0.5 metres | 0.2 metres | Layer: subsoil | Yellowy brown compact silt loam. | Yellowy brown | 10YR 5/4 yellowish brown | silt loam | Bracken roots. Frequent medium subangular cobbles |
| | **Test pit 13/2** | 91310 | Topsoil | | 3 metres | 0.5 metres | 0.03 metres | Layer: topsoil | | | | | |
| | | 91311 | Charcoal rich layer on platform. | Flotation sample 51301 | 1.30 metres | 0.5 metres | 0.1 metres | Layer | Black friable silt loam. | Black | 10YR 2/1 black | silt loam | Occasional small pieces of charcoal and occasional small subangular pebbles. |
| | | 91312 | Stony layer down slope of platform: in situ subsoil. | | 1.2 metres | 0.5 metres | | Layer | Friable silt loam. | Dark Brown | 10YR 3/3 dark brown | silt loam | Frequent large subangular cobbles. |
| | | 91313 | Stony lip of platform: retaining bank? | | 0.5 metres | 0.5 metres | | Layer | Friable silt loam. | Very Dark Brown | 10YR 2/2 very dark brown | silt loam | 40% subangular larger and medium size boulders and cobbles. |
| | | 91314 | Platform surface: redeposited subsoil | | 1 metres | 0.5 metres | | Layer | Compact silt loam. | | 10YR 4/6 dark yellowish brown | silt loam | Frequent small subangular pebbles. |
| **Platform 9014** | **Test pit 14/1** | 91410 | Topsoil | | 2.6 metres | 0.5 metres | | Layer: topsoil | | | | | |
| | | 91411 | Deposit on platform slope: part of platform construction. | | 0.48 metres | 0.5 metres | | Layer | Compact silt loam | Orangey brown | 10YR 3/6 dark yellowish brown | silt loam | Occasional subangular boulders, and small subangular pebbles |
| | | 91412 | Platform scrapings, with denser charcaol lens at base. | Flotation sample 51411 | 1.1 metres | 0.5 metres | 0.1 metres | Layer | Compact silty clay loam. | Dark Brown | 7.5YR 3/1 very dark gray | silty clay loam | Occasional small charcoal fragments. Occasional medium subangular pebbles, and occasional larger subangular boulders. |
| | | 91413 | Natural mineral soil/subsoil downslope from platform 9014 | | 1.02 metres | 0.50 metres | | Layer | Compact silt loam. | Yellowy mid-brown | 10YR 4/3 brown | silt loam | A single angular large >20cm boulder. Occasional subangular small-medium pebbles/cobbles. |
| | **Test Pit 14/2** | 91430 | Topsoil | | 1 metres | 0.5 metres | 0.08 metres | Layer: topsoil | Friable | | | | |
| | | 91431 | Platform surface | | 1 metres | 0.5 metres | | Layer | Compact silty clay loam. | mottled mid orange mid brown | 10YR 4/4 dark yellowish brown | silty clay loam | Occasional small subangular pebbles. |
| | | 91432 | Lower part of topsoil (same as 91430) | | 1 metres | 0.5 metres | | Layer: topsoil | Friable | | | | |

# Barbon Park (Project 6304): Appendix 3, Interpretative Context Index

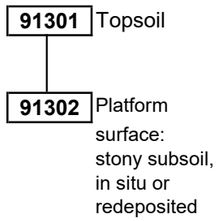


| Platform | Test Pit | Context | Interpretative Description | Samples | Length *(as seen in test pit)* | Width | Depth | | Description | Colour | Munsell number | Soil texture | Inclusions |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Test Pit 14/3** | 91450 | Topsoil | | 1.0 metres | 0.5 metres | | Layer: topsoil | | | | | |
| | | 91501 | Topsoil | | 3 metres | 0.5 metres | 0.1 metres | Layer: topsoil | Friable | | | | Very occasional charcoal fragments. |
| | | 91502 | Layer of material on platform slope, washed or scraped off platform | | 0.5 metres | 0.5 metres | 0.05 metres | Layer | Compact silt loam. | mid yellow brown | 10YR 4/4 dark yellowish brown | silt loam | Occasional subangular medium pebbles. |
| **Platform 9015** | **Test Pit 15/1** | 91501 | Topsoil | | 3 metres | 0.5 metres | 0.1 metres | Layer: topsoil | Friable | | | | Very occasional charcoal fragments. |
| | | 91502 | Layer of material on platform slope, washed or scraped off platform | | 0.5 metres | 0.5 metres | 0.05 metres | Layer | Compact silt loam. | mid yellow brown | 10YR 4/4 dark yellowish brown | silt loam | Occasional subangular medium pebbles. |
| | | 91503 | Charcoal-rich layer on plaform slope. | Flotation samples 51501 and 50102 | 1.1 metres | 0.5 metres | 0.01 metres | Layer | Compact silt loam. | Dark Yellow Brown | 10YR 3/2 very dark grayish brown | silt loam | Occasional subangular small pebbles, and occasional subangular cobbles. Charcoal fragments. |
| | | 91504 | Large stone, part of platform revetment. | | 0.5 metres | 0.5 metres | 0.23 metres | Wall | Hard | | | | |
| | | 91505 | Platform surface | | 0.6 metres | 0.5 metres | 0.2 metres | Layer | Friable silt loam | Yellowish brown | 10YR 5/4 yellowish brown | silt loam | Frequent small subangular stones to 0.1m. |
| | | 91506 | Dark layer/fill behind revetment - infill after revetment slipped? | | 0.8 metres | 0.5 metres | 0.13 metres | Layer | Friable silt loam. | Dark brown | 10YR 4/3 brown | silt loam | None |
| | | 91507 | Disturbed or redeposited subsoil, overlying stony subsoil: part of the build up for platform. | Hand-collected charcoal sample 51503 | 1.5 metres | 0.5 metres | 0.1 metres | Layer | Compact silt loam. | mid yellowly brown | 10YR 4/3 brown | silt loam | Occasional flecks of charcoal. Occasional angular pebbles, and occasional small angular cobbles. |
| | | 91508 | Stony make-up of platform. | | 0.8 metres | 0.5 metres | | Layer | Friable | Yellowish brown | 10YR 5/4 yellowish brown | silt loam | Frequent small stones up to 0.1m, and occasional stones up to 0.25m. |

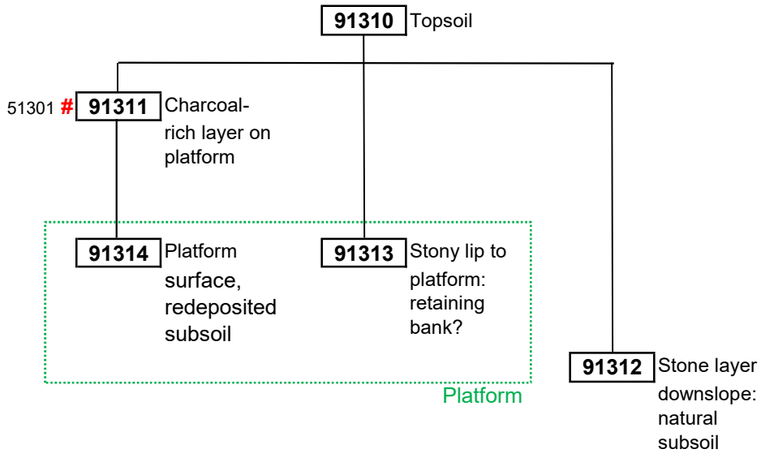
# Barbon Park (Project 6304): Appendix 4, Matrices

## Platform 9013

**Trench 13-1**
(Contexts 91301 - 91302)

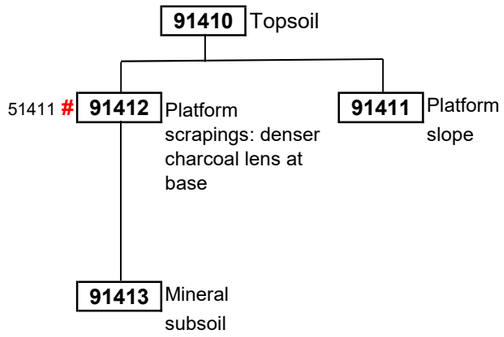



**Trench 13-2**
(91310 - 91314)

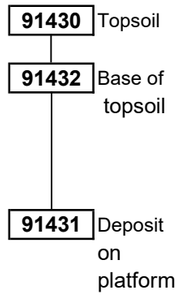



## Platform 9014

**Trench 14-1**
(Contexts 91410 - 91413)

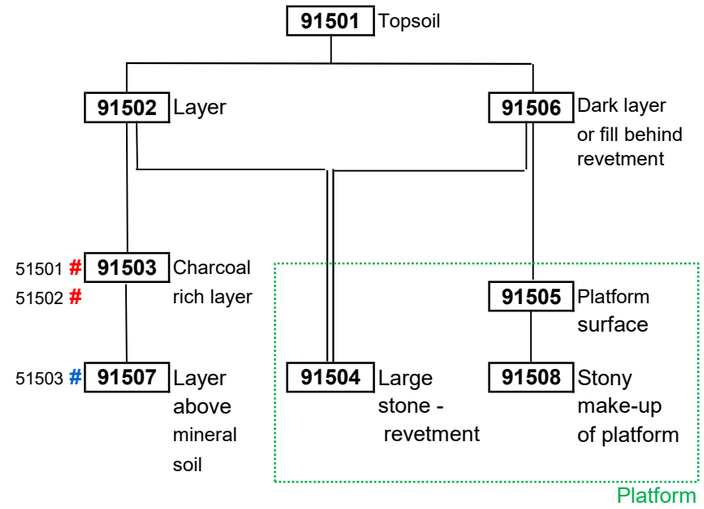



**Trench 14-2**
(Contexts 91430 - 91433)




## Platform 9015

**Trench 15-1**
(Contexts 91501 - 91508)




**Key:**
Samples taken

| | |
|---|---|
| # | Floated |
| # | Hand collected |

# APPENDIX B: ADDITIONAL INFORMATION ON THE PLATFORMS

Table B1. Additional information on the CBPs. [a] = subsequently discounted as being a CBP. [b] = features initially shortlisted for excavation. [c] = an additional feature identified during fieldwork. Bold indicates features that were excavated or cored.

Monument record entries for 1574919 and 1575141 are available through the Heritage Gateway (https://www.heritagegateway.org.uk/gateway/default.aspx). They are currently listed as Historic England Research Records but will be transferred to the local authority Historic Environment Record (HER) list at a later date.

| Platform | Monument number | Former name | Location | Grid reference |
|---|---|---|---|---|
| 9001 | 1574919-01 | E1 | Eastern slopes | SD 64775 82915 |
| 9002[a] | 1574919-02 | E2 | Eastern slopes | SD 64791 82851 |
| 9003[b] | 1574919-03 | E3 | Eastern slopes | SD 64787 82798 |
| 9004 | 1574919-04 | E4 | Eastern slopes | SD 64769 82765 |
| 9005 | 1574919-05 | E5 | Eastern slopes | SD 64787 82713 |
| 9006[b] | 1574919-06 | E6 | Eastern slopes | SD 64833 82771 |
| 9007 | 1574919-07 | E7 | Eastern slopes | SD 64862 82722 |
| 9008 | 1574919-08 | E8 | Eastern slopes | SD 64884 82789 |
| 9009 | 1574919-09 | E9 | Eastern slopes | SD 64872 82823 |
| 9010 | 1574919-10 | E10 | Eastern slopes | SD 64905 82875 |
| 9011 | 1574919-11 | E11 | Eastern slopes | SD 64919 82956 |
| 9012 | 1574919-12 | E12 | Eastern slopes | SD 64934 83017 |
| **9013[b]** | 1574919-13 | E13 | Eastern slopes | SD 64911 82731 |
| **9014[b]** | 1574919-14 | E14 | Eastern slopes | SD 64965 82778 |
| **9015[b]** | 1574919-15 | E15 | Eastern slopes | SD 64953 82807 |
| 9016 | 1574919-16 | E16 | Eastern slopes | SD 64995 82662 |
| 9017 | 1574919-17 | E17 | Eastern slopes | SD 64245 82913 |
| 9018 | 1574919-18 | E18 | Eastern slopes | SD 64288 82881 |
| 9019 | 1574919-19 | E19 | Eastern slopes | SD 64294 82826 |
| 9020 | 1574919-20 | E20 | Eastern slopes | SD 64351 82928 |
| 9021 | 1574919-21 | E21 | Eastern slopes | SD 64378 82908 |
| 9022 | 1574919-22 | E22 | Eastern slopes | SD 64393 82868 |
| 9023 | 1574919-23 | E23 | Eastern slopes | SD 64382 82817 |
| 9024 | 1574919-24 | E24 | Eastern slopes | SD 64420 82944 |
| 9025 | 1574919-25 | E25 | Eastern slopes | SD 64478 82922 |
| 9026 | 1574919-26 | E26 | Eastern slopes | SD 64458 82886 |
| 9027 | 1574919-27 | E27 | Eastern slopes | SD 64437 82835 |
| 9028 | 1574919-28 | E28 | Eastern slopes | SD 64541 82929 |
| 9029 | 1574919-29 | E29 | Eastern slopes | SD 64520 82914 |
| 9030 | 1574919-30 | E30 | Eastern slopes | SD 64535 82863 |
| 9031 | 1574919-31 | E31 | Eastern slopes | SD 64494 82807 |
| 9032 | 1574919-32 | E32 | Eastern slopes | SD 64651 82954 |
| 9033 | 1574919-33 | E33 | Eastern slopes | SD 64628 82899 |
| 9034 | 1574919-34 | E34 | Eastern slopes | SD 64705 82961 |
| 9035 | 1574919-35 | E35 | Eastern slopes | SD 64738 82983 |

| Platform | Monument number | Former name | Location | Grid reference |
|---|---|---|---|---|
| 9041 | 1575141-01 | W1 | Western parkland | SD 63412 82971 |
| **9042** | 1575141-02 | W2 | Western parkland | SD 63420 82904 |
| **9043** | 1575141-03 | W3 | Western parkland | SD 63398 82878 |
| 9044 | 1575141-04 | W4 | Western parkland | SD 63412 82820 |
| 9045 | 1575141-05 | W5 | Western parkland | SD 63476 82928 |
| 9046 | 1575141-06 | W6 | Western parkland | SD 63571 82934 |
| 9047[c] | 1575141-07 | W7 | Western parkland | SD 63311 82858 |

# APPENDIX C: CORING RESULTS FROM THE WESTERN PARKLAND

Table C1. Locations and details of the coring sites across two of the western parkland platforms.

| Platform | Monument number | Core reference | Easting | Northing | Height (m OD) | Location description | Notes | No. of samples |
|---|---|---|---|---|---|---|---|---|
| 9042 | 1575141-02 | 5001 | 363423.34 | 482904.91 | 181.81 | Just on the outside of the front downslope. | Reached 0.14m depth. | 1 |
| | | 5002 | 363417.57 | 482902.86 | 181.14 | On the inside at the front of the platform, just inside the lip. | Reached 0.10m depth. | 1 |
| | | 5003 | 363415.04 | 482903.15 | 180.48 | At the break of slope at the back of the platform, on the inside concave area. | Reached 0.13m depth; lowest deposits contained charcoal fragments. | 2 (upper, lower) |
| 9043 | 1575141-03 | 5004 | 363402.02 | 482879.41 | 177.98 | Just on the outside of the front downslope. | Reached 0.17m depth. The corer was stopped by stones. | 1 |
| | | 5005 | 363396.65 | 482880.26 | 178.02 | On the inside at the front of the platform, just inside the lip. | Reached 0.16m depth. At the bottom of the core a few charcoal fragments were recovered. | 1 |
| | | 5006 | 363394.16 | 482880.83 | 176.99 | At the break of slope at the back of the platform, on the inside concave area. | Reached 0.25m depth; basal sediments were orange ?clays. Middle sample contained a few charcoal fragments. | 3 (upper, middle, basal) |

Table C2. Core sediment details; described using the Munsell® scheme (Munsell® 2000) for colour, and 'Module 3: Deposits and cuts' (English Heritage 2010) in terms of mineral components.

| Platform | Core reference | Sample reference | Sample description | | |
|---|---|---|---|---|---|
| | | | Munsell | Sediment | Other |
| 9042 | 5001 | W2-3 | 10YR 4/2 dark greyish brown | Silty clay loam | Rare rootlets |
| | 5002 | W2-2 | 10YR 3/3 dark brown | Silty clay loam | Moderate rootlets |
| | 5003 | W2-1 (upper) | 10YR 3/2 very dark greyish brown | Silty clay loam | Moderate rootlets |
| | | W2-1 (lower) | 10YR 3/1 very dark grey | Silty clay loam | Occasional flecks subangular pebbles. Also charcoal present |
| 9043 | 5004 | W3-3 | 10YR 3/1 very dark grey | Silty clay loam | Occasional rootlets |
| | 5005 | W3-2 | 10YR 3/1 very dark grey | Silty clay loam | Occasional flecks and occasional small subangular pebbles |
| | 5006 | W3-1 (upper) | 10YR 3/2 very dark greyish brown | Silt loam | Occasional rootlets |
| | | W3-1 (middle) | 10YR 3/2 very dark greyish brown | Clay loam | Moderate flecks and small charcoal fragments. Occasional subangular flecks and small pebbles. |
| | | W3-1 (basal) | 10YR 4/6 dark yellowish brown | Silty clay | Occasional flecks subangular pebbles. Charcoal present (see sample for notable fragment). |

## APPENDIX D: MAPS OF BARBON PARK

Maps showing the change in extent of Barbon Park woods since the 19th century.

'Map Scale' refers to the scale of the original map, not the scale at which they are shown here.

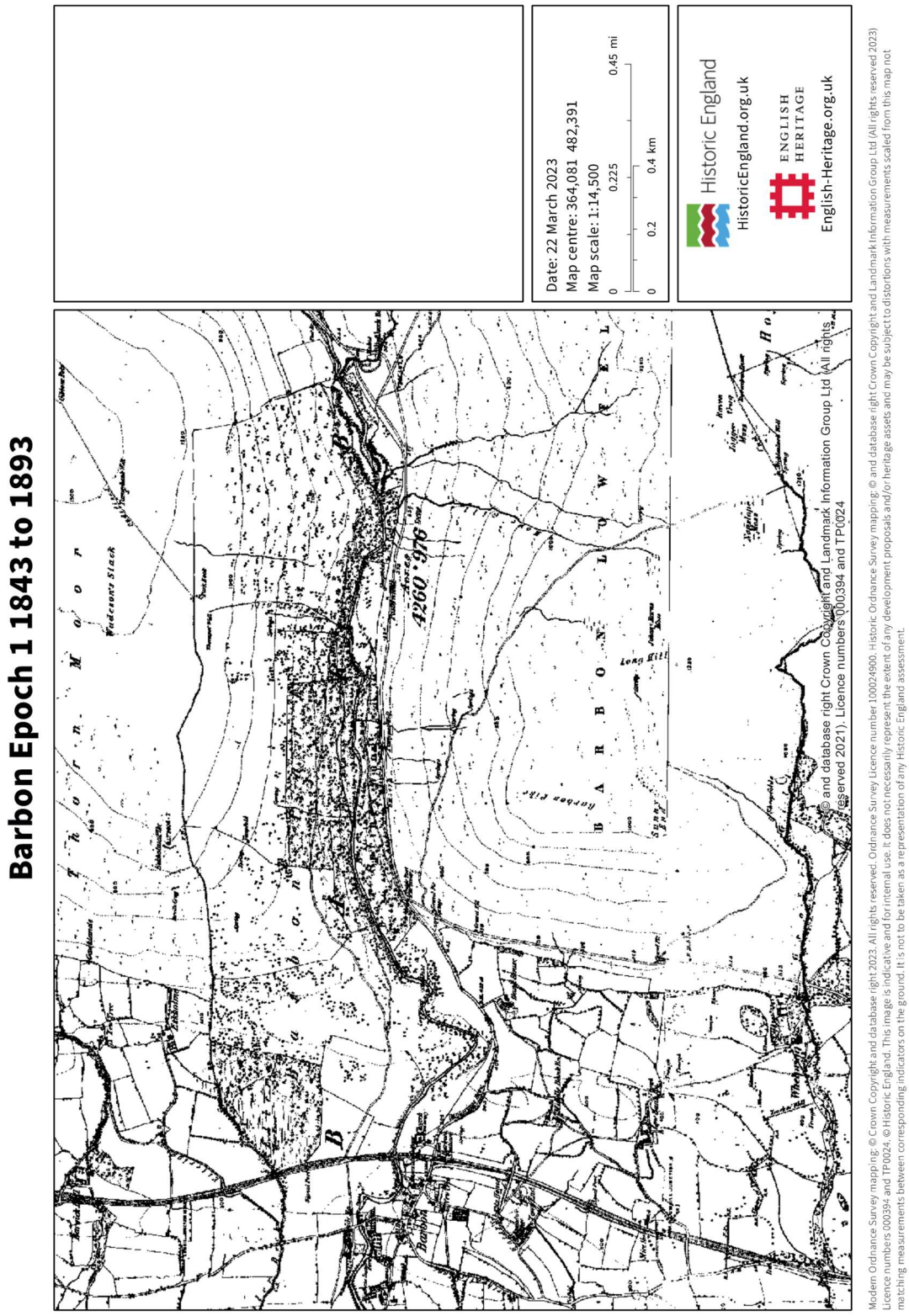



*Figure D1. Epoch 1 1843–1893 1:10,560.* Historic Ordnance Survey mapping: © and database right Crown Copyright and Landmark Information Group Ltd (All rights reserved 2023). Licence numbers 000394 and TP0024.

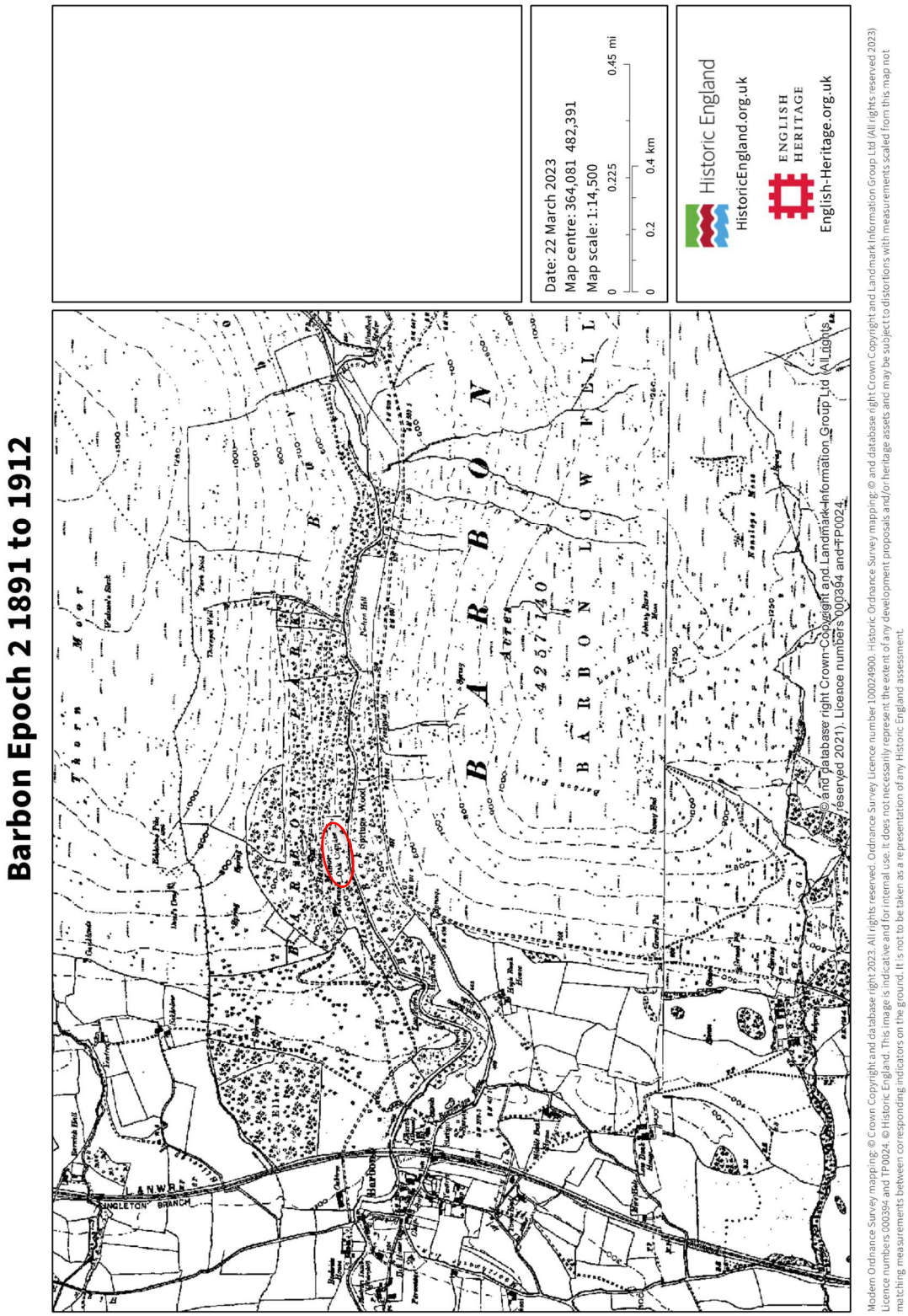



*Figure D2. Epoch 2 1891–1912 1:10,560; note the area labelled 'Oak Coppice' (circled in red) immediately to the south of Barbon Manor*. Historic Ordnance Survey mapping: © and database right Crown Copyright and Landmark Information Group Ltd (All rights reserved 2023). Licence numbers 000394 and TP0024.

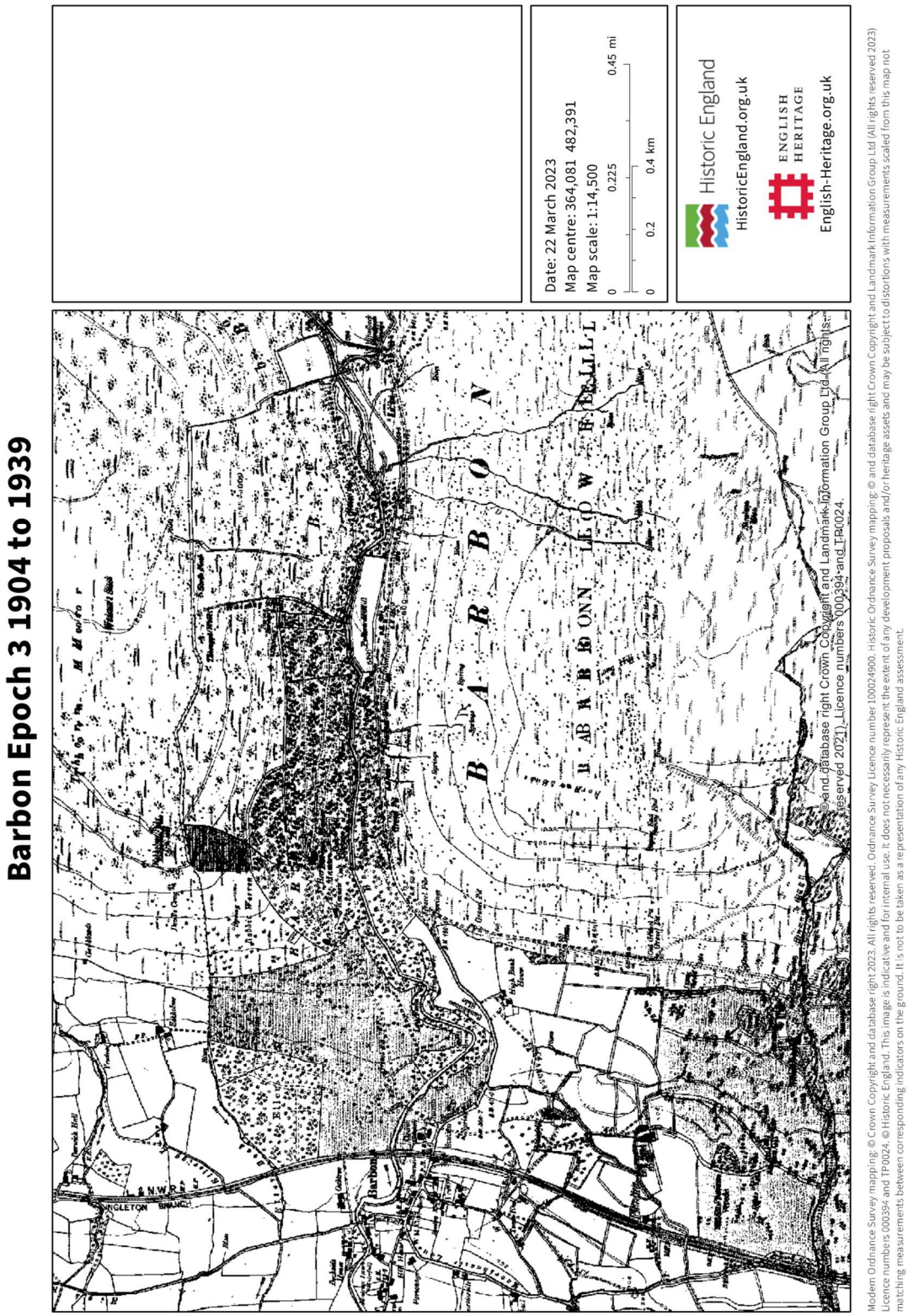



*Figure D3. Epoch3 1904–1939 1:10,560.* Historic Ordnance Survey mapping: © and database right Crown Copyright and Landmark Information Group Ltd (All rights reserved 2023). Licence numbers 000394 and TP0024.

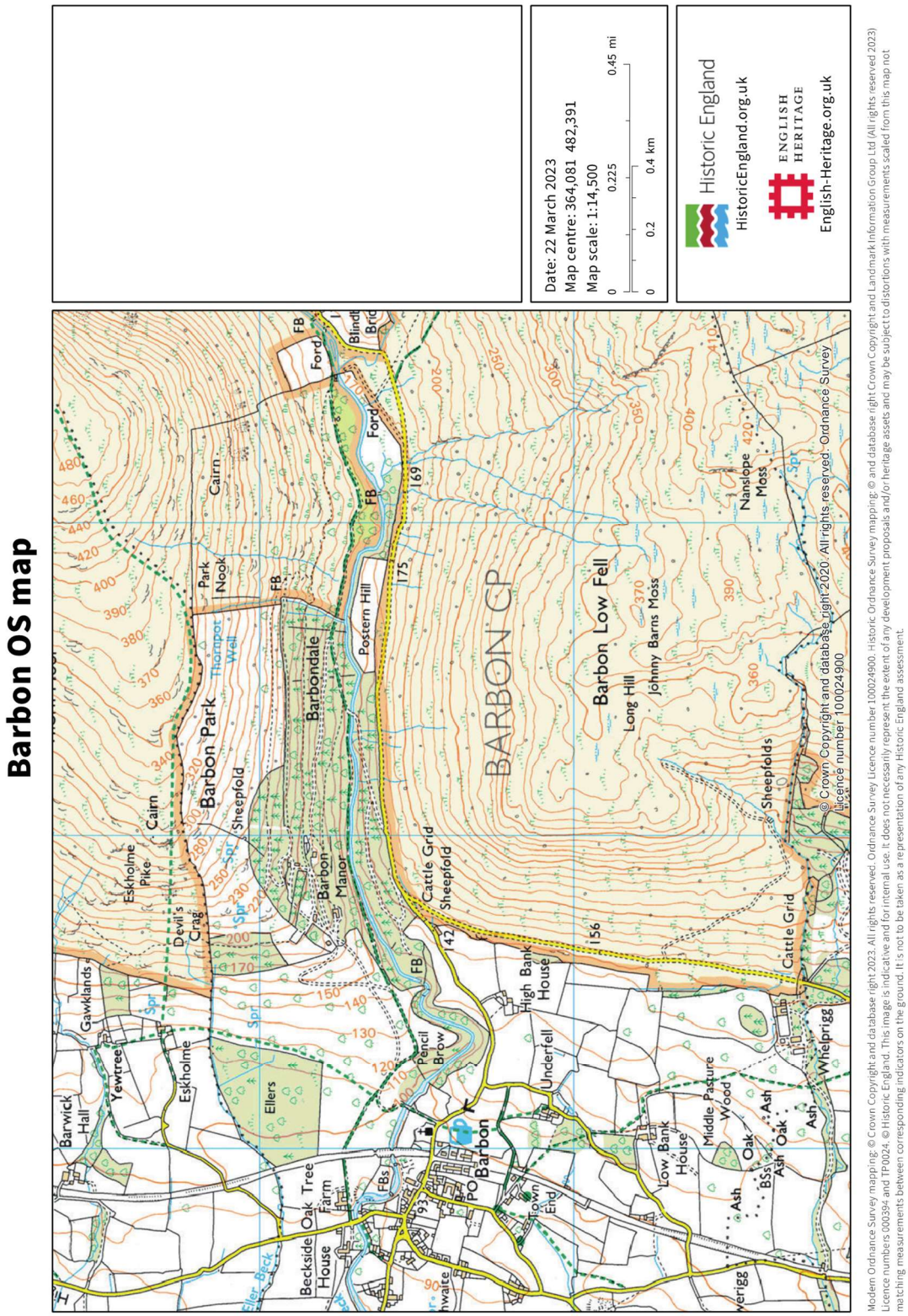
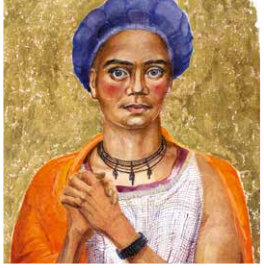



*Figure D4. Modern OS map 1:10,000. © Crown Copyright and database right 2023. All rights reserved. Ordnance Survey Licence number 100024900.*



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