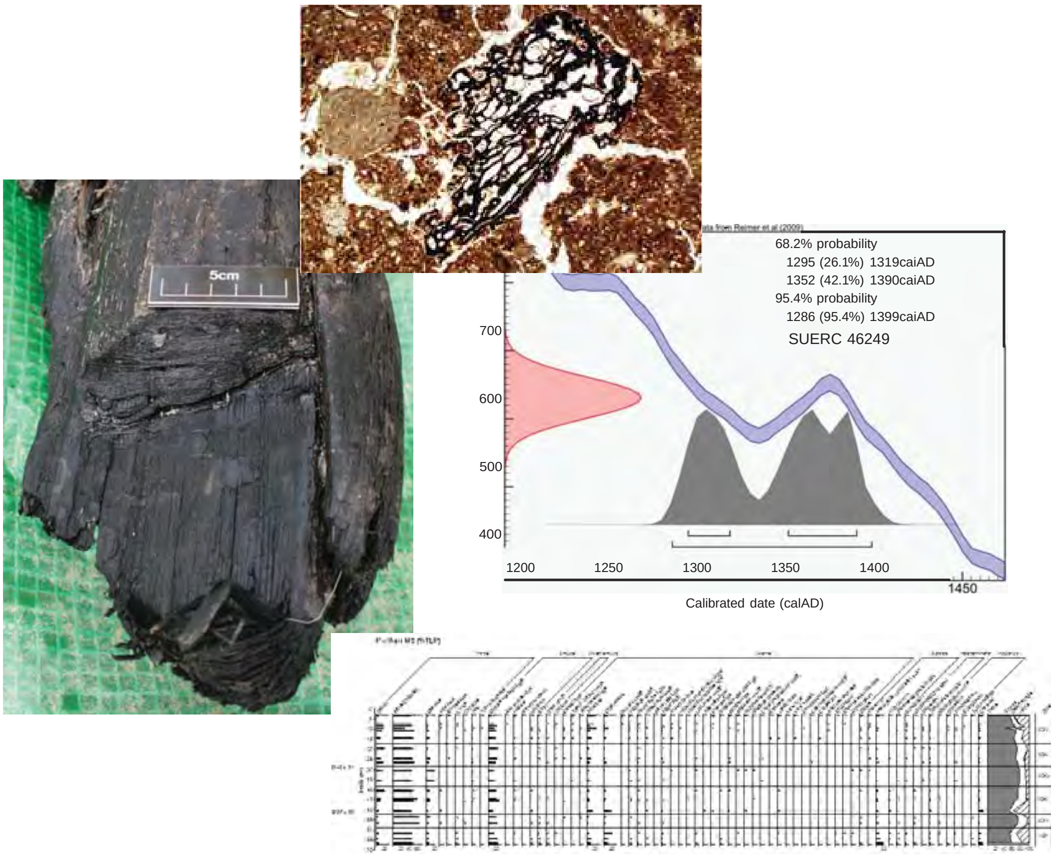
Gas Pipeline Replacement: Pwllheli to Blaenau Ffestiniog

Report on archaeological mitigation
Volume II: specialist reports



Ymddiriedolaeth Archaeolegol Gwynedd
Gwynedd Archaeological Trust

Gas Pipeline Replacement: Pwllheli to Blaenau Ffestiniog

Report on archaeological mitigation
Volume II: specialist reports

Project No. G2148

Report No. 1136

Prepared for : RSK Environment Ltd on behalf of Wales and West Utilities

July 2013

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Contents

GAS PIPELINE REPLACEMENT: PWLLHELI TO BLAENAU FFESTINIOG

Report on Archaeological Mitigation (G2148) Volume II
Full Specialist Reports

1. INTRODUCTION

All finds and ecofacts were assessed before full analysis was carried out on those that justified the work. The assessment reports are included in the assessment of potential report (GAT unpublished report 1020). The aim is to bring all the information together here so where no further work was done assessment reports are also included here. Where further work was carried out significant information from the assessment has been included in the final report as presented in this volume.

Names and addresses of the specialists involved are listed below.

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3. POST MEDIEVAL POTTERY WITH COMMENTS ON LEATHER ITEMS

3.1. Summary

Post medieval pottery was recovered from three plots. These were initially assessed in house by Kevin Cootes and the most interesting assemblage was sent for assessment by Jon Goodwin of Stoke-on-Trent Museum. The pottery is mostly from the 19th century. No further work is recommended.

3.2. Initial assessment

Kevin Cootes

Results

Plot 3/20 Context 320009: fill of drain 320008. Finds number 030.

Two fragments of Black Glazed Ware were recovered. The nearest major producers of these ceramics were at Buckley, although Staffordshire pottery's produced these too. The quality of the two sherds is relatively fine, being even and relatively thin walled, suggesting a date in the first half of the 19th century, or even possibly the closing decades of the late 18th century. Later wares of this type tend to be thicker and less finely made. The Buckley kilns last firing was in 1944.

1 – Rim sherd of a Black Glazed Ware vessel.

2 – Body sherd of a Black Glazed Ware vessel with wheel coils.

Plot 6/22 Context 622001: midden deposit. Finds number 033

Fifteen sherds were recovered from a midden, representing a minimum of 11 vessels, and a maximum of 15.

1 – Base and partial lower body sherd of a Stone Ware Marmalade jar. Transfer print with the legend 'ONLY PRIZE MEDAL FOR MARMALADE. LONDON. 1862'

2 – Rim fragment of a glazed dish with decoration under glaze.

3 – Partial base of a Stoneware vessel. Probably 19th century.

4 – Glazed Lid fragment for jar. 19th century.

5 – Partial rim and body fragment of a salt glazed Stone Ware jar. Glazed both inside and out. Designed to hold some form of liquid.

6 – Decorated Salt Glaze body fragment, with stamped decoration. 19th century.

7 – Rim fragment from a glazed 19th/20th century bowl.

8 – Body fragment of a glazed cup with decoration under glaze. 19th Century.

9 – Partial rim fragment of Lid from 19th century soup bowl.

10 – Two fragments (partial rim and partial base) from a 19th/early 20th glazed mixing bowl.

11 – Three fragments from 19th century chamber pots, all glazed. One consists of a partial rim and body sherd, with transfer print decoration inside and out. The second piece is a rim and body fragment from an undecorated vessel. The final fragment consists of a moulded handle.

12 – Body sherd from a moulded vessel. 19th/20th Century.

Plot 9/6 Context 96001: Topsoil. Finds number 025.

Ceramics consist of six sherds of glazed 19th/20th century ceramic from five separate vessels.

1 – Marmalade stoneware jar fragment. Rim and partial body sherd. Broken into two pieces. This vessel type was common in the first two decades of the Twentieth Century.

2- Transfer print ware dish, rim fragment. Common navy blue decoration. Most commonly dates to the final decades of the 19th century, although continues into the early 20th.

3 – Base of a late 19th/early 20th century Cream ware vessel. Probably from a cup.

4 – Partial base fragment of an early-mid 19th century transfer print cup, depicting Chinese scene.

5 – Rim fragment from a glazed mixing bowl. Late 19th or more probably early 20th century.

6 – Glazed rim of a cup with purple/red banding. Late 19th/20th century.

3.3. Assessment of pottery and leather items from plot 6/22

Jon Goodwin

Fifteen sherds of at least twelve ceramic vessels were retrieved from context 622001 (see table 3.1). These represent the typical wares and forms available to most households during the mid-late 19th century (perhaps with a bias towards the end of this period). They comprise a mix of refined, but affordable tea and table wares (some decorated), and more utilitarian forms. Only one item (a redware teapot cover) may be of an earlier date, although this is by no means certain. At least some of the material probably stems from the Stoke-on-Trent potteries, although other items come from Newcastle-upon-Tyne and Nottinghamshire and/or Derbyshire.

Also collected from the midden in plot 6/22 were parts of several shoes, particularly leather soles. There seems to be a minimum of two pairs of adult shoes (although small - size 5 or 6) and one possibly belonging to a child. Based on the pottery that was found with them, the shoes date to the mid-late 19th century (probably more 'late' than 'mid') and appear to be typical of that period.

Conclusions and recommendations

The majority of ceramics recovered from the Gwynedd pipeline date from the 19th century. The ceramics themselves are unremarkable in type, form and context, and the assemblages are not large enough to be particularly informative. No further analysis is recommended and it is proposed that the pottery is discarded as not sufficiently important to justify museum storage. The leather shoe pieces would no doubt require remedial conservation if they were to be stored in a museum and it is also proposed that these be discarded.

References

Godden, G. A. 1991. Encyclopaedia of British Pottery and Porcelain Marks. London: Barrie & Jenkins.

Table 3.1: Pottery from plot 6/22, context 622001, SF033
The following abbreviations/contractions have been used: *e'ware* – earthenware; *C18* – 18th century; *C19* – 19th century.

Ware/fabric type	Vessel form	Component	No. sherds	Date	Notes
undecorated white e'ware	tureen/dish	lid	1	late C19	Moulded form.
undecorated white e'ware	dish/basin	rim/body	1	mid-late C19	Moulded decoration on rim.
undecorated white e'ware	jug/ewer	handle	1	mid-late C19	Moulded form.
transfer-printed white e'ware	dish	rim/body	1	mid-late C19	'Asiatic Pheasants' print in blue.
transfer-printed white e'ware	plate	rim	1	late C19	Foliate print in blue.
transfer-printed white e'ware	cup(?)	body	1	late C19	Blue print.
redware	teapot cover	rim/body	1	late C18/early C19?	Glazed redware cover, similar in form to 18th-century examples, although it is not clear if this is of such an early date.
transfer-printed white e'ware	preserve jar	Base/body	1	c.1890+	Marmalade jar of James Keiller & Sons, produced by C.T. Maling & Sons Ltd. of Newcastle-upon-Tyne, (1890-1963) (Godden 1991, 409-10).
glazed stoneware	jug	body	1	mid C19	Fragment of large ornate jug with moulded decoration on

Ware/fabric type	**Vessel form**	**Component**	**No. sherds**	**Date**	**Notes**
					exterior.
yellow ware	bowl	base & rim	2	late C19	Large mixing bowl with white slip beneath glaze on interior, moulded decoration on exterior. A product of T & G Green's Derbyshire factory?
brown stoneware	bowl	base, body & rim	3	mid-late C19	Nottinghamshire/Derbyshire stoneware with moulded decoration on exterior.
grey stoneware	jar	rim/body	1	mid-late C19	Preserve jar?
Total number of sherds: 15					

4. FLINT AND QUARTZ ARTEFACTS

George Smith

4.1. Introduction

These comprise only seven artefacts and consist of pieces of worked flint and quartz from five different Plot areas on the route of the pipeline. The objects were studied briefly for the assessment (Kenney 2012). The objects were studied by hand-lens and described in more detail for this report, recorded on standard forms and then entered on a database. The objects are summarised in Table 4.1. The objects are described and discussed below by plot. Four pieces are isolated finds from different areas of the route. The other three pieces came from the same location but from different contexts. The provenance of the objects is summarised in Table 4.1.

4.2. Summary of objects

The objects are summarised in Table 4.1. One piece is probably a modern import from elsewhere in Britain. The remainder are made on locally available glacial pebble flint. There are no retouched pieces and so none properly diagnostic of date. However, two pieces are probably utilised blade segments, possibly from composite edge cutting tools and potentially diagnostic of Neolithic activity. They come from two different sites, one from a site (3/2) with possible Medieval and Iron Age activity and one from beneath a burnt mound complex (site 6/29.4). One other non-diagnostic waste piece came from another burnt mound deposit (Site 6/33).

Table 4.1: Summary of the flaked stone pieces

Plot Area	*Find No*	*Context No*	*Dimensions (mm)*			*Description*	*Provenance*
			L	*B*	*D*		
3/2	19	32026	(25)	11	4	Utilised flint blade segment	Burrow near medieval corn drier
3/2	64	32016	15	9	2	Small quartz crystal flake	IA/RB pit fill
3/2	66	32018	11	10	2	Small flint flake	Medieval corn drier
6/24.9	23	4128	(25)	12	4	Utilised flint blade segment	Buried soil beneath burnt mound
6/33	67	633004	(6)	5	2	Flint chip fragment	Burnt mound deposit
7/13	24	713001	70	56	31	Large, battered edge flake of imported flint	Modern topsoil
14/17	32	Unstrat.	24	30	7	Short, broad flint flake	Unstratified, adjoining river

L Length. B Breadth. D Depth. ( ) incomplete (broken) flake dimension

4.3. Description of aretfacts

Plot Area 3/2

This was an area of pits of Iron Age date and a corn-drier of medieval date. There were three objects from this area, two of flint and one of crystal quartz.

One flint and the crystal quartz fragment were found in the fill of pits of Iron Age date. The quartz fragment (SF 64) is a thin chip from the face of a large crystal of rock quartz and, as no more of this crystal or of this material was found, it is probably an accidental chip and a chance inclusion. The flint piece (SF66) is a small tertiary waste flake of dark grey flint and was found during soil sieving. It may have derived from preparation of an edge-flaked tool and is presumably residual from Bronze Age or Later Neolithic activity in the area.

One piece of flint (SF19) was found in an animal burrow adjoining the medieval corn drier. It is a small tertiary blade of yellow-brow flint with the butt end snapped off. It has micro-chipping on one long straight edge indicating utilisation as a cutting tool (Volume I, plate 13). It may have been mounted in a wooden handle as part of a composite cutting tool and is probably of Earlier Neolithic date and residual from earlier activity in the area.

Plot Area 6/29.4

This was an area of burnt mound activity, dated to the late 3rd millennium BC. One flint piece was found, from the buried soil beneath a burnt mound.

The flint piece (SF23) was a small tertiary blade of yellow-grey flint with the tip end snapped off. It has micro-chipping on one long straight edge indicating utilisation and may have been mounted in wood, with other similar pieces to create a composite cutting tool. It is not easily datable but is probably of Earlier Neolithic date and belongs with activity on the site long predating the burnt mound activity.

Plot Area 6/33

This area contained two burnt mounds and a pit. One flint piece (SF67) was found, from within a burnt mound deposit.

It is a very small tertiary chip of mid-grey flint and is not dateable. It could be accidental but could also indicate that some flint tool edge-shaping took place nearby.

Plot Area 7/13

This was single chance find (SF24) from topsoil during a watching brief. It is a large thick flake of fresh, dark grey flint with unweathered or rolled cortex of chalk flint type and has several edge removals from heavy impact. This is almost certainly a Post-medieval import and could derive from ship's ballast dumping. Chalk flint was also imported to be ground for use in pottery manufacture.

Plot Area 14/7

A single chance find made during topsoil stripping.

This is a short, broad secondary waste flake of light grey flint with pronounced bulb and a partially rolled cortex. It is very fresh and is possibly an accidental e.g. plough-struck flake from a naturally occurring glacial cobble.

4.4. Discussion

Raw material: One flint piece is probably a modern import from a chalk flint area of southern England. The remainder of the flint pieces are made on locally available glacial pebble flint. There are no retouched pieces and none are closely diagnostic of period. However, two pieces are probably utilised blade segments, possibly from composite edge cutting tools and come from two different sites, one from Plot area (3/2) on Morfa Abererch with possible Medieval and Iron Age activity and one from Plot area 6/29.4 close to Pentrefelin, beneath a burnt mound complex. These pieces are probably of Mesolithic or Earlier Neolithic date and a useful indication of activity in this area. Similar small flakes and blades have been found in cliff-top exposures around Llŷn and Bardsey, deriving from Later Mesolithic/Earlier Neolithic hunter-gatherer activity (Smith 2001) and the yellow-staining seems to be typical. Domestic activity in this area in the earlier Neolithic period has so far only been presumed because of the presence of several chambered tomb funerary monuments on Llŷn, the closest to the present project at Cist Cerrig on the slopes of Moel-y-gest, at Four Crosses, at Cefn –isaf (Llanystumdwy) and at Ystum Cegid Isaf (Llanystumdwy). It is not possible to make reliable identifications on the basis of flake shape and size comparisons alone and such blades could be found in assemblages of Mesolithic or earlier Neolithic date. A bevelled end, utilised pebble was also found at Plot area 6/29.4, near to the flint blade SF23. Such pebbles, of uncertain function, are frequently found in association with Later Mesolithic coastal activity and so could be associated with the flint blade (see Stone artefacts, below). The size and proportions of the blades are also comparable to those of utilised flint blades found at the Early Neolithic site of Tattershall Thorpe, Lincolnshire, where use-wear analysis showed that cutting of a variety of materials was indicated (Healey 1993 and Bradley 1993). The lack of polish on the pieces from the pipeline project shows that they were probably used on soft material such as wood and only used briefly, which could indicate use at a transitory camp site.

4.5. References

Bradley, R. 1993. The Microwear Analysis. In R. Bradley *et al Excavations on Redgate Hill and at Tattershall Thorpe.* East Anglian Archaeology 57, Norfolk Museums Service.

Healey, F. 1993. Struck Flint. In R. Bradley *et al Excavations on Redgate Hill and at Tattershall Thorpe.* East Anglian Archaeology 57, Norfolk Museums Service.

Kenney, J. 2012. *Gas Pipeline Replacement: Pwllheli City Gate PI to Blaenau Ffestiniog PRI, Archaeological Assessment*, GAT Rep. No. 1020.

Smith, G. 2001. *North-West Wales lithic scatters project*, GAT Rep. No. 357.

5. OTHER STONE ARTEFACTS

George Smith

5.1. Introduction

19 objects were retained, of which all but three came from one location, Plot area 3/2, on the pipeline route. The objects were studied by hand lens and described in detail for this report, recorded on standard forms and then entered on a database. The objects are summarised in Table 5.1 and described and discussed below by Plot area.

The provenance of the objects is shown in Table 5.1. Two objects came from Plot area 0/3 which was a small part of a pit or ditch of uncertain period with some burnt material. Plot area 3/2 was an area with two pits identified as of Iron Age date, presumed to be part of so far unidentified occupation nearby. Plot area 6/29.4 was an area of burnt mound activity, dated to the late 3rd millennium BC and the one find came from a soil buried beneath a burnt mound.

Both the objects from Plot area 0/3 were sub-rounded natural, non-utilised cobbles deriving from the local from the boulder clay and are not described further. There were 16 objects from Plot area 3/2. Of these, eight were natural small sub-angular cobbles, boulders or boulder fragments some of which were burnt and are not described further. The other eight were all manufactured or utilised objects. There was one utilised pebble object from Plot area 6/29.4.

5.2. Summary of objects

The objects are summarised in Table 5.1. Some are manufactured objects and some simply utilised. The objects are of a variety of materials but predominantly tough igneous rock and using glacial boulders or cobbles. Some are coarse and others finer and this relates to their type of use.

The earliest object (SF22) is an isolated find but from beneath a burnt mound. It is a pebble of which the tip has been utilised creating bevelled facets. This type of tool is commonly associated with Mesolithic activity.

Two objects (SF55) are probably unused natural cobbles.

The rest of the objects include two saddle querns, one broken, fragments of two other saddle querns, a saddle quern rubber, a facetted edge utilised pebble rubbing stone and a worn cobble. There are also some pieces of broken boulder that may have been part of broken querns. Most of these objects have been burnt and seem likely to have been utilised in some later activity, perhaps in creation of a fire-pit or oven. The objects are all domestic and the type of objects associated with later Iron Age settlement. The concentration of objects indicates that such settlement was very close by. The re-use of the items in later activity may have been chronologically separate or could have been a continuation in a changed usage of the site. One of the querns, although massive and not greatly worn down has been broken in two, so probably deliberately. It is of a neat oval form, a developed type that could be expected to be late in the occurrence of such objects. Rotary querns are believed to have come into use in north Wales in the late first century BC or first century AD, but saddle querns did continue in use later.

Table 5.1 Summary and provenance of the stone objects

Plot	*Context*	*Find No*	*Quantity*	*Provenance*	*Description*
0/3	3004	55	2	Pit/gully fill	Natural, unused glacial cobbles
3/2	32010	9	1	IA/RB pit fill	Broken saddle quern
3/2	32012	10	1	IA/RB pit fill	Facetted pebble rubbing stone
3/2	32012	12	1	IA/RB pit fill	Cobble with one worn surface
3/2	32012	13	1	IA/RB pit fill	Small broken natural boulder
3/2	32012	14	1	IA/RB pit fill	Saddle quern fragment
3/2	32012	18	8	IA/RB pit fill	1 broken saddle quern rubber, 2 frags of a broken saddle quern, 4 frags of burnt natural cobbles,

					1 natural cobble. All burnt
3/2	32017	7	1	IA/RB pit fill	Saddle quern
3/2	32017	8		IA/RB pit fill	Small boulder, probably unused
3/2	32017	11	1	IA/RB pit fill	Small broken boulder, unused
3/2	32019	20	1	IA/RB pit fill	Thin slab with smoothed surface, probable working slab
6/29.4	6294096	22	1	Buried soil beneath burnt mound	Utilised, bevelled pebble

5.3. Description of artefacts

Plot area 3/2
Pit 32003, Context 32010
SF9 Saddle quern. Almost complete, but broken. Made on a small sub-rounded boulder of coarse sandstone and of a flattened oval outline, 540mm long x 300mm wide (incomplete) x 205mm deep. It has a natural convex base but the top has an almost flat worn face. The quern was probably created by splitting a boulder, which was then hammered and heavily pecked to its symmetrical oval outline. The grinding face may also have been pecked to prepare it, although that cannot be seen now. The quern has broken neatly in two, so was perhaps broken *in situ*. A thin area of one side has also broken off.

Pit 32003, Context 32012
SF10 Facetted rubbing stone. Made from a sub-spherical or ovoid pebble of coarse sandstone, 93mm diameter x 51mm deep. It has been worn in a series of angled facets or bevels on two angles, for most of it perimeter creating a flat thick disc. The wear is in a series of joining facets so the shape seems to have been created as a by-product of use, rather than just shaping as such. The size suggests it was hand-held. The rock is coarsely abrasive and so its use must have been in smoothing or shaping some firm material such as bone or wood and one where a narrow abrading surface was required.

SF12 Possibly utilised working slab. A flat sub-rounded oval cobble of coarse sandstone rock, 210mm long x 160mm wide by 66m deep. Two flakes have been broken off one end, perhaps accidental. Both flat faces are quite smooth, but with no wear signs and no faceting suggesting that the stone was used as a working slab.

SF14 Saddle quern fragment. Made on a small sub-rounded boulder of medium grained sandstone, of oval outline, 103mm long (incomplete) x 152mm wide x 96mm deep. It has a natural convex base but the top has an almost flat worn face. This joins with SF18.1.

SF18.1 Saddle quern fragment. Made on a sub-rounded boulder of medium grained sandstone. Two joining fragments from a quern of ovoid outline. The quern had a natural concave base and a slightly concave worn face. It was about 100mm deep and with SF14 joined to these pieces the complete stone appears to have been over 260mm long and about 150mm wide. The stone is reddened, probably from burning.

SF18.2 Saddle quern rubber. Made from a split cobble of medium grained sandstone, of oval outline, 230mm long x 178mm wide and 57mm deep. Its worn face is slightly convex. The rubber is complete but broken into five fragments so probably shattered *in situ* by burning.

Pit 32003, Context 32017
SF7 Saddle quern. Complete, made on a small sub-rounded boulder of coarse igneous stone, of ovoid outline, 450mm long x 240mm wide x 180mm deep. It has a natural convex base but the top has a deep worn concavity. It is possible that this made use of a pre-existing natural concavity.

Pit 32014, Context 32019
SF20 Possible working or rubbing slab. A thin flat angular slab of fine-grained hard igneous rock. It may have been split from a larger boulder of ovoid outline. One edge is a natural face but the other edges are broken, perhaps subsequent to its use. One face has two natural split facets. The other is almost flat and smooth. The rock is too fine for use as a quern or rubber and although it clearly appears

to be worn smooth there are no wear signs visible at low magnification. It is different to the other sub-rounded cobbles and boulder fragments in the pit so is likely to have been selected for use as a working slab.

Most of these objects are querns and therefore entirely domestic and, being quite large and not easily portable are likely to have come from some a settlement close by. Saddle querns were in use from the Early Neolithic period on suitable but random-shaped boulders but the more regular types here, with the oval rubbing stone, may be the product of specialist stone-workers and are more likely to be Iron Age. Types of rotary quern first appeared in the Late Iron Age in Southern Britain but did not come into use in north Wales until the late first century BC or first century AD. However, despite the presence of such improved technology, saddle querns continued to be used during the first centuries AD in North Wales. For instance, one was found at the enclosed Iron Age and Romano-British settlement of Cefn Graeanog II, south of Caernarfon, in a context that suggested that it was still in use near the end of the occupation in the 4th century AD (Mason and Fasham 1998). The facetted rubbing stone is a rather developed variation on a type of pebble rubbing tool that occurs quite widely in north-west Wales on both Bronze Age and Iron Age settlements, where examples tend to be just simple sub-rounded pebbles with some faceting wear, e.g. at the Mellteyrn Uchaf Middle Bronze Age settlement, Llŷn (Ward and Smith 2001) but sometimes used in a way that develops into a more regular disc shape, e.g. in Iron Age contexts at The Breiddin hillfort, Shropshire (Musson 1991, 154-6). The function of these tools is unknown except that the use was in abrasion and that they are found inside houses in a domestic context.

The interpretation of these apparent caches of broken querns may be more meaningful than their dating and original use. Broken querns or quern fragments sometimes occur at the site of Iron Age settlements even though, like these, being heavy and non-portable would be unlikely to have been broken by accident. This suggests that they may have been deliberately broken, either as concluding activity connected with the abandonment or destruction of a house, for instance after death, or displacement e.g. after conquest or even simply as discard of outdated technology. A number of excavations of Iron Age roundhouses have discovered single querns, still *in situ* embedded in the floors of the houses, showing that each house would probably have only one quern. The discovery of fragments of four querns close together here suggests that something unusual was happening. The querns, fragments and quern rubbing stone, along with natural cobbles, were packed in two pits and seem to have been burnt *in situ* .The stones seem to have been re-used in a functional way in the pits as part of some process involving burning, perhaps just as hearthstones but not within a house, since there was no evidence of a surrounding structure. The advantage of laying such large pieces of stone as a hearth, over a simple clay hearth is that they would retain heat and so could have been used in roasting or drying, such as processing grain.

Plot Area 6/29.4
Soil layer Context 4096, buried beneath Burnt Mound.
SF22 End facetted pebble. A sub-rounded thick oval pebble probably of fine quartzite, 115mm long x 73mm wide x 45mm deep. The slightly pointed tip has been worn on two sides creating small bevelled facets. The main faces of the pebble are also very smooth suggesting some additional use for polishing. The bevelled facets are not smooth but not peck-marked suggesting use for coarse rubbing rather than light hammering. The pebble has also been used for light hammering on the opposite end. There are also two small areas of fine pecking on the face of the pebble, possibly from use as an anvil for flint pebble splitting.

A similar type of facetted pebble tool is found widely across western Britain, from Cornwall to Scotland, in association with Later Mesolithic flint assemblages and mainly in coastal locations (Jacobi 1979). Pebble tools of that period are most frequently longer and narrower than this example so it may belong with a later period of use. Their function has not been identified by association or by experiment. Use as flint knapping tools is a strong possibility as they have some similarities to flint retouching tools, which are blunt rods of flint with heavily worn ends, although not bevelled. Typically these tools have only a small area of faceting, suggesting that their use was only light and that they were abandoned before any heavier wear took place (Roberts 1987, 135). The facetted pebble here was found in the same plot as a utilised flint blade, for which an Early Neolithic date has been suggested (above).

5.4. References

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6. PETROLOGICAL ANALYSIS OF STONE OBJECTS

David Jenkins

6.1. Introduction

The querns stones and related used and unused stones from the pits in from plot 3/2 and the hammerstone from plot 6/29.4 were studied to identify their petrology. They have been examined macroscopically with a hand lens and, where possible, under a stereozoom binocular microscope. However, many lacked freshly fractured surfaces making petrological examination difficult and some would require thin-sectioning for positive identification if needed. Although rock types are identified generally, to interpret this in terms of provenance would require detailed field experience of both the solid geology and that of the superficial glacial deposits in the locality.

6.2. Results

The following 8 samples have been examined, (a-g) from plot 3/2, and (h) from plot 6/29.4.

Context:	32010	32012	32017	6294096
Find No.:	(a) 9	(b) 10 (c) 12 (d) 14 (e) 18	(f) 7 (g) 20	(h) 22

(a) Context 32010, Find No.9 *(broken saddle quern)*
Morphology: two adjoining fragments of a large sub-rounded equant cobble with a planar joint surface showing patchy polishing
Petrology: medium-coarse (2-10mm) sub-angular quartz grains showing slight bedding; massive, well cemented with medium/low porosity. A distinctive sandstone – Lower Palaeozoic rather than basal Carboniferous?

(b) Context 32012, Find No.10 *(facetted pebble rubbing stone)*
Morphology: small rounded cobble with polished planar surfaces
Petrology: medium coarse grained (2-8mm) well cemented/low porosity quartz sandstone – provenance not obvious

(c) Context 32012, Find No.12 (*cobble + one worn surface*)
Morphology: small well-rounded cobble with planar surfaces showing moderate polishing
Petrology: medium-coarse (2-8mm) moderate to well-cemented sandstone of no distinctive provenance

(d) Context 32012, Find No.14 (saddle quern fragments)
Morphology: rounded cobble with flat polished surface; grey-brown/brown with some fire-reddening.
Petrology: dense, homogenous but with a suggestion of bedding. Medium grain size sandstone (1-5mm); distinctive angularity to grains, provenance not obvious

(e) Context 32012, Find No.18
(*(i) 1 fragment of saddle quern rubber*)
Morphology: sub-angular/rounded cobble with flat polished surface
Petrology: dense, homogenous but with suggestion of graded bedding parallel to polished face. A medium grain-size sandstone (1-5mm), distinctive angularity to grains; provenance unknown

(*(ii) 2 fragments of broken saddle quern*)

Morphology: brown-grey brown sub-angular to sub-rounded fragmented cobbles with paler planar joint faces showing some polishing
Petrology: medium-fine (1-5mm) angular grains with suggestion of graded bedding parallel to the polished face. A distinctive sandstone but of unknown provenance

(*(iii) 5 burnt natural cobbles*)
Morphology: rounded cobbles showing crazed fracturing and some reddening due to fire, but no other signs of usage.
Petrology: grey medium to coarse grained igneous rock of intermediate composition, with large (10mm) prismatic feldspars phenocrysts and irregular quartz in a finer grained matrix also containing quartz and a ferro-magnesian (pyroxene?). Possibly diorite(?) of unknown provenance but likely to be local.

(f) Context 32017, Find No.7 (*saddle quern*)
Morphology: large dark greenish-grey rounded/subrounded stone, with grey-brown weathered surface 2-5mm detaching crust. Pecked concave surface showing some polishing
Petrology: medium-fine grained with a mesh of plagioclase feldspar laths and dark ferromagnesian grains (pyroxene?) – a Palaeozoic dolerite which is common in local Snowdonian glacial deposits

(g) Context 32017, Find No.20 (*thin slab with worked surface*?)
Morphology: slab defined by a well developed planar joint surface and perpendicular edge, the former showing possible polishing, and a sub-parallel slightly convex surface; pale buff/grey
Petrology: medium to fine grained (1-5mm) igneous with white and pink feldspars, (with some white feldspar porphyritic - 8mm), quartz and fine magnetite/ilmenite: a microgranite/granite

(h) Context 6294096, Find No.22 (*utilised beveled pebble*)
Morphology: well-rounded ovoid pebble, mottled white/pale buff, with battered edges, one end and 2 patches on one face
Petrology: very fine grained (<1mm), dense, homogenous white rock with possible vague banding (bedding/flow-banding?) no distinguishing sedimentary or igneous features visible under high power microscope. Silicic igneous (rhyolite) or quartzite ?, possibly from Snowdonian or Irish Sea glacial deposits.

6.3. General comments

The morphology observed for these samples and signs of their usage agree with that already described by George Smith. It has been difficult to establish petrology in the soil-stained samples which often lack fresh fracture surfaces and are difficult to examine microscopically due to size, *etc*. However, their apparent petrology falls into several groups:

petrologies favoured for querns and rubbing stones because of their hardness and texture
- (a, b, c): medium grain-size sandstone of non-distinctive nature
- (d, e-(i), e-(ii)): medium grain-size sandstone with distinctive angular grains

- (f): a dolerite, less suitable but also showing signs of usage,
- (g): a microgranite, less suitable but also showing possible signs of usage
- (h): a “chance” fine rhyolite/orthoquartzite probably used as a hammer

apparently chosen as kerb stones in a firing process, but not for grinding
- (e-(iii)): hard, massive cobbles of intermediate coarse igneous rock (diorite?)

It would be informative if the provenance of d, e-(i) & e-(ii) could be established, and also of the cobbles used in e-(iii), but this would involve fieldwork in the local area, based on accounts of the local solid and superficial geology such as that by Howells (2007).

6.4. Reference

Howells, M.F. (2007) British Regional Geology, Wales   British Geological Survey, Nottingham.

7. ASSESSMENT OF THE METAL ARTEFACTS

Jon Goodwin

7.1. Summary

Five iron and copper-alloy items were assessed and found to be unexceptional and poorly preserved. Two items that could be approximately dated are from the 18th or 19th centuries and two nails could have been used at any time within the medieval or post-medieval period. The corroded mass of iron from the pit or ditch terminal 03005 could not be dated or its form identified.

7.2. Introduction

A total of five iron and copper-alloy items and fifteen post-medieval ceramic finds were recovered by Gwynedd Archaeological Trust during work on the Pwllheli to Blaenau Ffestiniog pipeline, Gwynedd, North Wales. These finds have been assessed by context and a description of each find, or group of finds, along with a provisional date is presented in the tables below.

7.3. Results

The metal finds are unexceptional and poorly preserved, particularly the item from context 03003. Dating the material is difficult - only one find, the button from 320002, can be dated even to a specific century; the other more diagnostic finds, specifically the nails from 320005 and 320009, represent items that retained a consistent form throughout the medieval and post-medieval periods.

Table 7.1: Metal objects
The following conventions have been used in the table for material types: *Cu* – copper alloy; *Fe* – iron. Abbreviations have also been used for dating: *M* – medieval; *PM* – post medieval; *C18* – 18th century; *C19* – 19th century.

Context	SF no	Item	Material	Date	Notes
03003	001	corroded mass	Fe	?	Form undiagnostic.
314005	003	plate	Cu	C18/C19?	Plate fragment <1mm thick. Tapers at one end to rounded terminal. Two lateral, sub-circular perforations (in addition to those clearly the result of damage/corrosion), at least one of which may have been used to mount the item. Function unknown – furniture or strap fitting/mount?
320002	028	button	Cu	C19	Circular button, 20mm in diameter, slightly flattened. Cast (?) with soldered looped wire shank. Front has relief decoration although very worn.
320005	027	nail	Fe	M/PM?	Corroded fragment of a nail with square (?) head - large in relation to shank. Nails of similar form recovered from Sandal Castle were classified as 'tack nails', used to fasten battens or window casements (Long & Long 1983, 280; Fig. 13: 26). The nail is also comparable to short, square-headed examples from Basing House described as general carpentry nails (Moorhouse 1971, 49; Fig. 22: 96). Such nails featured heads that would remain exposed and act as a form of decoration. Both forms are long-lived and were in use throughout the medieval and post-medieval periods.
320009	029	nail	Fe	M/PM?	Long square-sectioned, tapering shank, square head with lip on one side; a total of 10.4cm long. This is an example of a common carpentry nail known as a 'sprig', which was produced in a range of sizes (Moorhouse 1971, 51; Fig. 22: 101-107.

7.4. Recommendations

No further work is recommended on these items, with the exception of SF001. If this feature is dated to an early period x-ray to identify the form of this item may be worthwhile and this may lead to a requirement for conservation or further study.

7.5. References

Long, A. and Long, E. 1983. 'Nails', in Mayes, P. and Butler, L. A. S., *Sandal Castle Excavations 1964-1973*. Wakefield Historical Publications, 279-280.

Moorhouse, S. 1971. 'Finds from Basing House, Hampshire (*c*.1540-1645): Part Two'. *Post-Medieval Archaeology* 5, 35-76.

8. ASSESSMENT OF ARCHAEOMETALLURGICAL RESIDUES

Tim P. Young

8.1. Summary

The materials from many sites were either natural or fired clay of uncertain origin. There was evidence for metallurgical activity at two sites:

Site 3/2 produced a single piece of a smithing hearth cake, presumably indicative of ironworking (smithing) somewhere in the general area, but the piece was recovered from a corn drier.

Site 3/14 had a cut feature which was very likely to have been a floor level smithing hearth and which contained a deposit including hammerscale and other smithing fines. The deposit also yielded two fragments of copper alloy, suggesting some working of copper alloys was undertaken too. The forging of both iron and copper alloys tends to be a feature seen on late medieval and post-medieval sites, but the assemblage is not strictly datable.

8.2. Methods

All materials were examined visually with a low-powered binocular microscope where required. As an evaluation, the materials were not subjected to any high-magnification optical inspection, not to any form of instrumental analysis. The identifications of materials in this report are therefore necessarily limited and must be regarded as provisional. The summary catalogue of examined material is given in Table 8.1.

8.3. Results

Site 0/3
This site produced two very small fragments of reduced fired clay, tempered with organic material. This material is not necessarily indicative of metallurgical activity.

Site 3/2
This site produced a substantial fragment from a highly vesicular smithing hearth cake. This piece contained no surviving fuel clasts, but a maroon-brown superficial colour on the upper surface would be most compatible with a coal-fuelled hearth (although this is not certain conclusion). The lower surface of the cake was formed by a thin crust with a finely dimpled face – but again the nature of the fuel producing the dimples was uncertain.

A single piece of oxidised fired clay (32018) possessed a temper including both rounded quartz grains and coarse angular grit. This material is not necessarily indicative of metallurgical activity.

Site 3/14
This site produced a small quantity of ironworking (smithing) residues from two contexts (c314005 and c314035).

The majority of material from c314005 comprised well-preserved isolated elements of smithing fines (though mostly too coarse to be termed microresidues), including a variety of slag blebs, slag droplets, slag flats and fragments of vitrified hearth ceramic. A single small fragment of thin copper alloy sheet was recovered from c314005. The piece was slightly curved and had two small indentations or nicks on one face. This context yielded a single piece of vitrified hearth ceramic, which showed evidence for coarse grit temper as well as an organic temper with the appearance of chopped straw.

The material from find #60 (also c314005), in contrast, comprised microresidues cemented by the corrosion products of weathered iron fragments. Three of the pieces actually contained corroded iron, the other 7 appeared to be smithing pan, rich in flake hammerscale, slag fragments and fine charcoal debris. These pieces show that the deposit was probably richer in hammerscale than the isolated samples would suggest, but that the hammerscale assemblage is preserved here with balls of corrosion product around rusting iron debris.

Site 3/27

Context 327003 at this site produced some thirty fragments, of which all but one were probably natural materials. Twenty four of the pieces were of a lime-cemented lithology with poorly sorted rounded pebbles. This was probably a natural conglomerate (such as a cemented raised beach deposit), but an alternative interpretation as degraded pieces of pebble-rich mortar is possible but unlikely. The assemblage also contained five pieces of natural red-brown siltstone and one small piece of possible oxidised fired clay.

Site 6/10

The single submitted piece from this site was a weathered rock fragment.

Site 6/29.4

The material submitted from this site included four fragments of natural rock, two of which were slightly reddened and might have been burnt.

8.4. Interpretation

Site 0/3 (03003) produced tiny fragments of burnt clay, which adds little to current site interpretation.

Site 3/2 yielded a significant piece of a smithing hearth cake (32005) and a single piece of burnt clay (32018). The burnt clay might be derived from the use of the corn drier, but the smithing slag may simply have been dumped as part of the fill. If the slag was coal-fuelled, then it would be most likely to have post-medieval age – but the fuel is not certain.

Site 3/14 produced significant evidence of metalworking from pit fill (314005). This included fines from ironworking (slag, lining slag, flake hammerscale, smithing pan, iron debris) as well as pieces of copper alloy. The smithing pan (a concreted mass of hammerscale and other fines formed by cementation by secondary iron minerals from corroding iron) pieces suggest that the pit fill probably contained much more fine hammerscale that was not recovered.

The presence of these materials in the burnt fill of a shallow pit means that it is moderately likely, although not certain, that the pit was actually a floor-level smithing hearth. Unfortunately the material is not itself closely datable. In general, to find copper alloy debris (as offcuts or other forged waste, rather casting waste) associated with ironworking, tends to indicate a younger (i.e. late- or post-medieval) rather than older age, but this need not necessarily be the case.

Site 3/27 produced materials that were probably natural, apart from one piece of probable fired clay of uncertain, and not necessarily metallurgical, origin.

Material from site 6/10 was natural.

Site 6/29.4 produced materials that were natural rock fragments, but reddened and possibly burnt.

8.5. Evaluation of potential and recommendations

The material possessed little potential to yield further information through detailed metallurgical study. The metalworking evidence from site 3/14 is interesting and the date of this activity would be useful.

Table 8.1: Catalogue of archaeometallurgical residues

Site	*Context*	*Sample*	*Find #*	*Number*	*Weight (g)*	*Notes*
site 0/3	03003		072	2	4.21	2 pieces of reduced fired clay with moulds of organic temper, including c3mm diameter rods
site 3/2	32005		004	1	138	fragment from rather deep, highly vesicular SHC with micro dimpled base - very shiny - good fresh slag. Upper parts have deep maroon surface layer, the fuel is uncertain – the maroon colour hints at coal, but no clasts survive.
site 3/2	32007		068	2	0.34	large piece is natural rottenstone, small piece is burnt bone
site 3/2	32018	8	078	1	0.75	small fragment of oxidised fired clay, temper of rounded sand grains and larger (4mm) angular grit
site 3/2	32020		077	1	3.74	brown gritty material with foliation. Probably a natural sandstone or tuff
site 3/14	314005		060	10 (+ bits)	184	7 fragments of very rusty smithing pan (FHS, slag, grit, charcoal) and 3 pieces of concretion around iron.
site 3/14	314005		061	1	6.31	fragment of oxidised fired ceramic with deeply vitrified convex surface with black glassy slag (weathering greenish). Ceramic has coarse grit and probable 'chopped' straw temper. Probably iron hearth or furnace lining. The convexity might just suggest this could be tuyère fragment, but this is very tentative.
site 3/14	314005	10	065	1	0.11	tiny fragment of thin curved copper alloy sheet, concave face has two small parallel indentations.
site 3/14	314005		069	assemblage	56	assemblage of small slag pieces, mainly irregular droplets and slag flats, but also one piece of lining, lining slag blebs, fired clay (+ one piece of cherty rock)
site 3/14	314005		076	10	2.66	8 fragments of oxidised fired clay with dark glassy slag, one unvitrified reduced fired clay piece and one probably burnt stone
site 3/27	327003	13	075	7	1.79	5 pieces or red-brown natural siltstone, 1 piece of grey cemented coarse sand/rounded grit (cf. #71 below), 1 piece possible oxidised fired clay
site 3/27	327003		071	23	42.13	pieces of rounded pebbles and grit cemented by calcareous material. Not absolutely certain if this is a natural calcrete or mortar – but probably natural.
site 6/10	61002		074	1	0.92	small grain of brown material with coarse pale and dark minerals - probably a highly weathered granitic rock
site 6/29.4	6294002		070	1	16.56	pale grey to buff material with rounded cavities (vesicles), probably weathered igneous rock
site 6/29.4	6294011		073	3	20.64	three highly weathered rock fragments, two reddened but not certainly burnt

9. ASSESSMENT OF SOIL SAMPLE RESIDUES

James Rackham and John A. Giorgi

9.1. Introduction

The excavations as part of this project resulted in a total of 117 samples from fourteen archaeological sites. The sampled sites included excavations of a series of burnt mounds (sites 3/10, 6/6, 6/21, 6/29.4 and 6/33), a corn drier and pits (site 3/2), pits with smithing evidence (site 3/14), a ditch (site 3/20), two sites with pits (sites 0/3 and 6/10), a Bronze Age cremation burial (3/27), a shell midden (site 7/1) and a possible former riverbank (site 14/7), and a possible shoreline (site 6/51). An assessment of all the samples was carried out. The results of the assessment of charcoal and charred plant remains are incorporated into the following section. This section presents the recovered archaeological artefacts, bone and shell and also the assessment of bone and shell recovered by hand on site.

9.2. Methods

The soil samples were processed in the following manner. Sample volume and weight was measured prior to processing. The samples were washed in a 'Siraf' tank (Williams 1973) using a flotation sieve with a 0.25mm mesh and an internal wet-sieve of 1mm mesh for the residue. Both residue and flot were dried, and the residues subsequently re-floated to ensure the efficient recovery of charred material. Some samples were refloated a second time owing to the quantity of charcoal remaining in the residue. The volume and weight of the residue was recorded and the dry volume of the charred element of the flots was measured after removal of roots and mineral material. Five samples included waterlogged remains. The wet first flot was measured wet, and not dried, but the residue was dried and refloated. The dry second flot was measured and recorded separately (see appendix 9.1)

The residue of each sample was sorted by eye, and environmental and archaeological finds picked out, noted on the assessment sheet and bagged independently. A magnet was run through each residue in order to recover magnetised material such as hammerscale and prill. This was repeated until little or no further magnetic material was recovered. The fine residue was then discarded and the coarse and medium residues retained for post-excavation study. The flot of each sample was studied under a low power binocular microscope. The presence of environmental finds (i.e. snails, charcoal, carbonised seeds, bones etc) was noted and their abundance and species diversity recorded on the assessment sheet.

The individual components of the samples have been preliminarily identified and the results are summarised below in appendix 9.1. Hand excavated animal bone and shell was identified and counted and the data are presented in appendix 9.2.

9.3. Results

Plot 0/3

A small undated pit or gully was sampled in this plot. Unfortunately no dating evidence was recovered from the sample, although the presence of eight flakes of hammerscale in the residue and a few spheroids of hammerscale in the flot, as well as the iron small find would suggest later prehistoric or a more recent date. The residue was composed of mixed angular and pebble stone, shalley water rolled mud or siltstone with occasional quartz and fired earth or siltstone. The residue included nearly half a kilogramme of firecracked pebbles.

Table 9.1. Finds from plot 0/3

	Feature type	Fill of pit or gully
	Feature number	3005
	Context number	3003
	Sample number	1
Finds		
Hammerscale	Flakes + spheroids	8+
Fired earth	in g.	4.2
Firecracked pebbles	in g.	434

Plot 3/2

Nine samples were taken from this plot from a medieval corn drier and Iron Age two pits. Four of the samples derive from deposits associated with the corn drier, and two fills from each of the pits were sampled.

The residue of the samples comprised rounded shale and pebble gravel, with a little mudstone, slate and occasional flint and quartz, with the flint component somewhat higher in sample <6>. Heat affected or fire-cracked stone was present in all the samples. The magnetic component produced hammerscale from the corn drier and pit 32003, but the fills of pit 32014 produced the highest densities, suggesting some iron smithing in the area.

The fire-cracked stone and magnetised sediment in the corn drier samples is likely to reflect the heating of stone and sediment in the firepit and flue, while the burnt stone in the Iron Age pits may derive from cooking fires, the relative lack of magnetised material suggesting this is secondary deposition, since burning in the pits might be expected to generate a greater magnetic component. Hammerscale flakes move easily through the soil during bioturbation but the higher counts from pit [32014] are suggestive of contemporary smithing nearby in the mid Iron Age.

Two of the corn drier samples produced unidentifiable calcined (burnt) animal bone, and three small quantities of fired earth, or possibly ceramic building material in sample <9>. A few fragments of calcined bone were recovered during excavation at this site. Although none were identifiable to species (appendix 9. 2) a small ungulate rib fragment, at least two fragmented sheep sized long bones (one probably a femur), and one fragment of cattle size long bone, probably a metatarsus shaft fragment were recorded.

Table 9.2. Finds from the samples from Plot 3/2

sample	context	sample vol. l.	residue vol. ml	Flint wt. g	mag. wt g.	hammer-scale no.	fired earth wt g.	fired stone wt g.	bone wt g.	comments
Medieval corn drier 32009										
2	32002	9.25	3250		3	1		156	0.2	Indet. calcined bone
3	32018	20.25	8500	0.2	7.8	1		35	0.1	Indet. calcined bone
8	32018	9.25	4200		5.8		0.5	19		
9	32020	9.5	4000				4	591		
Mid Iron Age pit 32003										
4	32016	7.5	2200		0.8	2		341		
5	32012	5.75	2000		1.6			584		
Mid Iron Age pit 32014										
6	32013	5.75	1900		0.6	9		33		
7	32019	11.25	4000		0.6	15		209		
11	32021	7	1500		0.1		1.4	260		

Plot 3/10

This site comprised two burnt mound troughs from which three environmental samples were collected. Two samples were collected from the fills of trough 31001, and one from trough 31007. The residues from all three samples comprise mud or silt stone, with sandstone, shale and pebbles. Much of the stone residue appears heat affected, and some of the silt/mudstone is clearly heavily burnt, being much reddened. No archaeological finds were recovered from any of the samples.

Table 9.3. Finds from the samples from Plot 3/10

Feature type	Burnt mound material from trough fills		
Feature number	31001		31007
Context number	310003	310004	310010
Sample number	16	17	15
Sample volume l.	10	9	7
Residue volume ml.	6500	3200	1500
Burnt stone wt g.	7049	2398	1461
Burnt siltstone wt g.	1381	303	

Plot 3/14

Two pits of possible medieval or post-medieval date were excavated at this site and a single sample, <10> taken from context 314005. Finds of slag and vitrified furnance lining suggested iron smithing and a radiocarbon date on charcoal from <10> produced a 12th-13th century AD date for the fills.

The residue of the sample was largely composed of small pebbles, with a little sandstone and concreted material. This latter probably derives from the large quantity of magnetic concreted iron rich lumps that were extracted with the magnet. The magnet also recovered thousands of flakes of hammerscale. Observation of the concreted lumps under the microscope indicates that they include large quantities of hammerscale and small slag concreted together. These are reminiscent of the hard concreted layers that develop on the floor of a smithy and with nearly 3.5 kilogrammes of magnetic material present, in an 8.5kg soil sample, indicate a very high concentration of smithing debris. On the basis of this evidence one might suggest that the large oval pit was actually part of the smithy.

Table 9.4. Finds from the samples from Plot 3/14

	Phase	Medieval
	Feature type	Black charcoal rich fill of 314002-smithy
	Context number	314005
	Sample number	10
	Sample volume l.	8.5
	Residue volume ml.	1400
	Fired stone wt g.	17
Finds		
Slag	wt g.	56
Magnetic fraction	wt g.	3480
Hammerscale	no. flakes	1000’s
Fired earth/daub	wt g.	3.4

Plot 3/20

This site was a large undated ditch or erosion channel. Three samples were taken from the fills of this large feature and are thought to represent the erosional infilling of the feature from the surrounding slopes.

The large sample residues comprised mud/siltstone, shale, pebbles, occasional sandstone and quartz and slate, much of it water rolled. Archaeological finds were limited to a little heated affected stone, a little vitreous slag, and a few flakes of hammerscale.

Two shells of limpet (*Patella vulgata*) were recovered by hand from context 320011, in association with late post-medieval pottery.

Table 9.5. Finds from the samples from Plot 3/20

	Feature type	Large ditch or channel		
	Feature number	320004		
	Context number	320006	320007	320012
	Sample number	112	113	114
	Sample volume l.	11.25	7.75	17
	Residue volume ml.	7000	5000	11000
	Burnt stone wt g.	265		810
Finds	Flot volume ml.	2	1	3
Slag	wt g.		0.5	
Magnetic component	wt g.	3.6	0.2	0.2
Hammerscale	no. flakes	6		1

Plot 3/27

The site is this plot was represented by a small circular pit [327001] and a small shallow hollow [327002]. Both features contained burnt bone and were sampled (Table 9.6). Cremated human bone was recovered from the samples and indicates that both features are likely to represent disturbed cremation burials. Radiocarbon dates obtained on the human bone have dated the features to the middle Bronze Age.

The residues of both largely comprised sub-rounded mud/siltstone, with occasional slate, sandstone and shale, and some fired earth or siltstone. Two small fragments were tentatively identified as pottery from 327003, which also included some heat affected stone and a single flake of hammerscale. Both samples produced calcined bone.

In both samples the calcined bone is fragmented, but both include fragments which appeared to be human cranium suggesting that both features may be cremation burials. These samples were studied and proved to be human as reported in section 10 (below).

Table 9.6. Finds from the samples from Plot 3/27

	Feature type	Cremation burial?	Cremation burial?
	Feature number	327001	327002
	Context number	327003	327004
	Sample number	13	14
	Sample volume l.	14.5	0.55
	Residue volume ml.	3400	100
	Burnt stone wt g.	426	
Finds	Flot volume ml.	828	66
Fired earth/daub	wt g.	1.8	
Magnetic component	wt g.	20.4	0.2
Hammerscale	no. flakes	1	
Burnt (calcined) bone	wt g.	52.4	8.6
Cremated human cranium		+	+

+ = present in small quantities

Plot 6/6

The site at Plot 6/6 was a burnt mound of probable Bronze Age date. The site consisted of an arc of burnt stone and two intercutting pits. No archaeological finds were recovered from the bulk samples although tiny fragments of vitreous slag, possibly fuel ash slag, and a few magnetised small stones were recorded. Neither sample included any identifiable burnt stone.

Table 9.7. Finds from the samples from Plot 6/6

	Feature number	Pit 66011				
	Feature type	charcoal spread	pit fill	charcoal – spot samples		
	Context number	66004	66010	66010	66010	66010
	Sample number	19	20	26	27	35
	Sample volume l.	11.25	9.5			
	Residue volume ml.	210	1900			
Finds						
Slag	wt g.	<0.1	<0.1			
Magnetic component	wt g.	0.1	0.3			

Plot 6/10

The site at this plot was a figure of eight shaped feature, 610001, interpreted as a corn drier of medieval date. A single bulk sample was taken from context 610002, a charcoal rich fill of the feature. Very few archaeological finds were recovered from the sample, a very little fired earth and just three flakes of hammerscale. The 11g of magnetic material composed of small stones suggests heating of this mineral element in a hearth or fire.

Table 9.8. Finds from the sample from Plot 6/10

	Site	Plot 6/10
	Feature number	610001
	Feature type	pit / corn drier
	Context number	610002
	Sample number	18
	Sample volume l.	6
	Residue volume ml.	800
Finds		
Fired earth	wt g.	1
Magnetic component	wt g.	11

Hammerscale	no. flakes	3

Plot 6/21
This site is a burnt mound spread and an oval pit of probable Bronze Age date. Four bulk samples were collected, three from the spread (621003, 621004 and 621007), and one from the fill of the underlying pit (621009). Samples <64> and <65> produced some heat affected stone, while all produced some magnetised stones, but no finds were recorded.

Table 9.9. Finds from the samples from Plot 6/21

	Feature type	Burnt mound spread	Upper burnt mound spread	Upper layer of burnt fire cracked stone	Pit 621008
	Context number	621003	621004	621007	621009
	Sample number	62	63	64	65
	Sample volume l.	5.5	11	5.5	7.5
	Residue volume ml.	1300	2100	3250	1200
Finds					
Magnetic component	wt g.	0.4	1.2	7.4	0.6
Burnt stone	wt g.			1247	196

Plot 6.29.4
The site in this plot was a large Bronze Age burnt mound complex with pits, other features and natural hollows. This was the most extensive of the burnt mounds excavated along the pipeline and the most heavily sampled with 52 bulk soil samples collected.

Very little archaeological material other than burnt stone was recovered from any of the samples (see Rackham and Giorgi 2012, Table 2). Even burnt stone, heat reddened or black, was not very abundant and many samples produced none that was identifiable, although the very high >7mm stone residue (op cit.) is a clear indication of the high concentrations of mud and siltstone in the deposits, most of which may have been heated although it was not obviously heat reddened or black. The stone content of the samples varied from less than 1% to over 70% by weight. In the burnt mound deposits between 41 and 68% of the deposit comprised stone over 7mm. The fills of several features – 4033, 4111, 4003, 4002, 4101, 4143 – have a high stone density (48-68% >7mm), while other features – 4213, 4146, 4087, 4103 – produced less than 20%. The sampled buried soil and natural hollows generally also have lower stone content. Interestingly only one of the fifty two samples produced any magnetic material which suggests that the deposits contained very little ‘hearth material’ (the fire results in the magnetisation of the iron rich mineral elements in the soil or hearth), so presumably only the burnt stone was being dumped here.

A tiny fragment of possible mussel shell was recorded from context 4088.

The very variable concentrations of charcoal and burnt stone across the samples from this site may reflect some pattern of contemporary activity, such as the location of the fires and primary dump areas for the ash and stones. Feature 4087, a ‘hollow’ in the natural clays beneath the horizon interpreted as a buried soil contains charred hazel nutshell in two of its samples and relatively high concentrations of charcoal, but little fired stone and only small proportions of unfired stone. This would appear to be an archaeological feature, but may predate the earliest burnt mound activity. The tertiary and quaternary fills of channel 4170 (samples 95 and 100) also suggest archaeological activity which might predate the burnt mound.

Table 9.10. Summary of sample data from plot 6/29.4

	sample no.	**context**	**samp vol.**	**% x10 charcoal vl**	**%>7mm residue**	**% fired stone**	
Burnt mound	102	4151	`26	4.1	41.1	0	
Burnt mound	66	4049	21	14.3	50	0.37	
Burnt mound	106	4192	42	7.6	42.1	2.5	
Burnt mound	53	4071	26	21.2	48.9	0	
Burnt	70	4129	9	33.6	56.7	0.21	LBA/EIA date. barley

mound							
General burnt mound activity							
4033	91	4156	11	7.3	58.3	0	nutshell
4033	87	4152	1. 5	3.7	41.9	7.3	Upper fills (91, 87) burnt mound debris
4033	88	4153	0.75	16	9.4	0	Lower fills with little evidence of burnt mound debris, with just a little charcoal, burnt stone and stone
4033	94	4169	0.1		9.6	0	
4033	93	4167	0.1	30	12.4	0	
4033	92	4165	1	10	15	0.43	
4053	56	4054	19	7.9	16.7	0.27	Late Neo. Could predate burnt mound?
4111	59	4112	3.75	24	59.9	2.8	LNeo/EBA pit. Upper and lowest fills suggestive of burnt mound debris with charcoal rich layer in between
4111	60	4115	1. 5	60	17	0	
4111	61	4116	7.5	13.3	31.7	3.3	
4105	57	4106	5.75	26.8	16.3	0.24	barley
4105	68	4106	6. 7	7.5	61.7	2.8	Variable layer but suggestive of burnt mound debris
4105	82	4106	8. 5	29.4	29.8	1.8	
4003	47	4011	5.5	43.6	49	1.1	Late Neo pit with upper fill of burnt mound debris
4003	47*	4011	28	35.7	60.7	1.9	
4003	46	4010	2	1.5	12.3	0	
4003	46 *	4010	21.5	20.5	57.5	1.9	
4002	45	4006	3.75	20	41.4	0.21	Pit with burnt mound debris in fill
4002	45 *	4002	31	5.6	25.2	2.7	
Buried soil and natural hollows							
4099	78	4099	2	1.5	15.4	0	Buried soil – little evidence for archaeological activity
4099	79	4099	2	0.5	31.7	0	
4118	67	4117	13	1.8	29	0.29	Nutshell – some archaeological evidence
	83	4070	11	1.8	3	0	Buried soil – very little evidence for activity
4022	58	4023	10	8.5	13.9	1.1	Definitely archaeological, possibly but not conclusively associated with burnt mound
4022	71	4023	2	92.5	2	0	
Natural deposits and features							
4170	95	4172	3. 75	18.7	31.2	0.96	Large charcoal flots & nutshell indicate archaeological activity, pre burnt mound?
4170	100	4171	9. 25	13.4	28.4	0	
4101/4098	54	4100	4			0	Little charcoal and no burnt stone; clasts sub-rounded suggesting some rolling – could it be a natural channel?
4101/4098	55	4102	20.75	2.4	50.6	0	
4031	96	4183	1. 75	0.57	53.9	0	probably largely natural with little charcoal incl
4184	101	4032	1. 5	10	14.9	0	Natural hollow group A little charcoal and burnt stone indicates inclusion of material from human activity but concentrations are low except 4179 and upper fill 4032 – could predate burnt mound
4184	89	4032	8	0.5	23.3	0	
4184	90	4142	4		57	0	
4184	97	4179	3	7	37.1	3.9	
4184	99	4177	8	1.5	29.3	0	
4184	98	4176	1	4	14.6	0	
4143	84	4145	1. 5	2.7	11.6	0	higher charcoal content in upper fill, but density low – could be largely natural sediment
4143	85	4144	2. 5	0.4	67.6	0	
4205	105	4206	4	10	22.3	0	charcoal suggests some activity, pre burnt mound?
4146	86	4147	3. 5	0.86	13	0	Probably largely natural sediment
4133	77	4140	11.25	8.9	5.5	0	Sufficient charcoal to suggest local activity
4087	72	4088	5. 5	5.5	0.9	0.69	nutshell;
4087	73	4088	2. 5	32	0.1	0	nutshell;
4087	74	4088	7	14.3	0.45	0.47	Possible pre-burnt mound feature archaeological not natural, burnt stone and charcoal suggesting local fire/hearth
4087	75	4134	3. 75	0.26	2.3	0.42	
4087	76	4134	4	2.5	0.54	0	
4103	69	4104	5. 25	57.1	21	0	Relatively large charcoal flot & a little burnt stone in lower sample; lower sample with organics
4103	81	4131	1.75		4.8	0.56	

Highlights – charcoal concentration above 1% of total sample
Highlights – stone content above 7mm greater than 30% of whole sample
Highlights – burnt stone content above 1% of total sample (based on our original assessment data
All percentages based on proportion of original unwashed sample volume (but multiplied by ten for the charcoal figures.

Plot 6/33
This site produced two burnt mounds of probable Bronze Age date and a pit (633010). A total of six samples were collected from mound 633012 - including one from a posthole, four from mound 633015 – including samples from pits 633028 and 633034, and one sample from pit 633010 some 26m from mound 633015.

One sample, <37>, from mound [622012] produced a tiny chip of flint, and other than this and some fired or heat affected stone in most of the samples (see Rackham and Giorgi 2012) there were no finds.

Table 9.11. Finds from samples from plot 6/33

		Neolithic			Neo.	Medieval?	Med.
	Feature number	633012			633010	633015	633028
	Feature type	Burnt mound spread	Burnt mound spread	Burnt mound spread	Fill of pit	Burnt mound spread	Fill of pit 633028
	Context number	633005	633021	633020	633010	633024	633029
	Sample number	38	49	50	43	42	48
	Sample volume l.	8	9.75	7	16	11.25	5.5
	Residue volume ml.	7500	7800	2500	10500	7500	1400
Finds							
Burnt stone	wt g.	12	1544	195	0	661	203
Punctum pygmaeum	snail					+	

Plot 6/51
A six litre sample was collected from a clay deposit in Plot 6/51 where shells were visible. The deposit was not associated with any archaeology but was thought to possibly reflect a former shoreline and possible salt marsh deposits. A small sample of shells was also collected from the same context, 651001.

The bulk sample produced an organic flot, with wood, waterlogged seeds, numerous herbaceous stems, moss and leaf fragments, snail shells, insects and a little charcoal. The wood includes roundwood and small stems, while moss and leaf fragments, grass and birch (*Betula* sp.) seeds are present with a few beetle fragments. The mineral residue of the sample is composed of waterworn shalley slate.

The mollusc shells (Table 9.12) include tellens, small cockles, rough winkle (*Littorina saxatilis*), flat winkle and *Hydrobia ulvae*, the latter in thousands. All these taxa are of marine or brackish water habitats and none are of economic value. *Hydrobia ulvae* is common in estuaries and salt marshes and is washed up in millions along the strand line. Its abundance in this sample with the small winkles and cockles, and the tellen *Scrobicularia plana* which is common burrowing in the mud of salt marsh channels and estuaries, suggests a former saltmarsh environment, and potentially on the basis of the shell density, a former strand line. The sample of shells collected on site (Table 9.12) from context 651001 is dominated by the tellens, but also includes a cockle (*Cardium edule*) and a periwinkle (*Littorina littorea*).

Table 9.12. Finds from samples from plot 6/51

Context	651	651001
Sample no.	111	110
Find no		062
Sample volume l.	6	
Sample residue ml	200	
Flot volume ml.	40 (wet)	
Shell weight g.	133	
Shells		
Scrobicularia plana	50	27
Cardium edule		1
Cockle sp. indet.	+	
Littorina littorea		1
Littorina saxatlis	+	
Hydrobia ulvae	1000's	

On the basis that the mollusc shells give a convincing interpretation of this location lieing close to a former marine strand line no work was undertaken on the waterlogged plant and insect remains. It clearly indicates an earlier coastline, prior to the reclamation of Traeth Mawr; although the date of this coastline remains unclear it could just predate the reclamation of the Traeth.

Plot 7/1

A single soil sample was collected from a small shell midden deposit in Plot 7/1, and a collection of shells made during excavation of the deposit, which has been dated by radiocarbon analysis to the early to middle Iron Age. The deposit overlies a possible hearth or fire site. The sample residue is largely composed of plated and angular shale with a little mud/siltstone and small shell fragments. The residue included a little fired/heated stone but no other archaeological finds.

The most abundant finds in the sample are marine shells, mainly cockle (*Cardium edule*). Nearly 6 kilogrammes of shell were sorted from the 27.75 litre sample. Approximately 4.5kg were cockles, 340g were periwinkles (*Littorina littorea*), 9.2g of oyster (*Ostrea edulis*), a couple of grammes of rough winkle (*Littorina saxatilis*) and the rest fragmented shell not further identified. A further twenty five shells of cockle were collected during excavation (Table 9.13).

A few terrestrial snails are present including *Discus rotundatus, Oxychilus cellarius, Punctum pygmaeum*, Clausilidae and *Aegopinella* sp.. These suggest a shaded or woodland environment (Evans 1972; Davies 2008).

The site appears to be an Iron Age shell processing site where the shells were probably boiled, but on the basis of the organic component and the terrestrial snails, and its height at about 5m OD it was set back from the coast, perhaps in local woodland at the northern foot of Moel-y-gest fringing the western edge of the bay before reclamation of Traeth Mawr.

Table 9.13. Finds and shells from the sample from Plot 7/1 and hand collected marine shell.

Context	71002	71002
Sample no.	44	
Find no		034
Sample volume l.	27.75	
Residue volume ml	20000	
Finds		
Fired stone wt g.	168	
Terrestrial snails		
Discus rotundatus	+	
Oxychilus cellarius	+	
Punctum pygmaeum	+	
Aegopinella sp	+	
Clausilidae	+	
Marine Shells		
Cardium edule, common cockle	1100+ (+frags) (4500 g)	25
Littorina littorea, periwinkle	157 (340 g)	
Littorina saxatlis, rough winkle	2 (2 g)	
Ostrea edulis, oyster	2 (9.2 g)	
Mytilus edulis, common mussel	2 frags	

Plot 14/7

The deposits at Plot 14/7 reflected alluvial floodplain sediments but a silt deposit rich in preserved timber, branches and hazelnuts was identified at a depth of 1.1m below the modern ground surface. At the eastern end of the plot part of the posterior cranium of a cow was recovered along with two rib bones (Table 9.14). The skull fragment, broken in two comprised the posterior frontal bones with intact horn cores of medium length (Armitage and Clutton-Brock 1976) and the horns themselves still surviving although degrading. The skull is relatively small with the horns pointing slightly upwards and forwards on the skull. Their conformation and size is consistent with a medieval animal, but also could be a small recent breed, such as a Welsh White.

Table 9.14. Bones from Plot 14/7

Plot	**14/7**
Context	

Find no	035
Cattle ribs	2
Cattle skull with horns cores and horns	1
Cattle size lumbar vertebra-water worn or eroded	1

Notes on smithing
Apart from the medieval smithy, iron smithing is suggested in the middle Iron Age at Plot 3/2 by the small numbers of hammerscale flakes recovered from the pit fills. Smithing is also suggested at the undated site in Plot 6/10 where a few flakes were recovered from the sample. This site appears to lie remote from any recent habitation or activity and it is therefore difficult to suggest that these few flakes could derive from more recent activity. A few flakes in the corn drier at Plot 3/2 also suggest contemporary smithing. At all these sites the density of flakes in the samples is very low, in contrast the sample from Plot 3/14, but they indicate smithing somewhere in the vicinity of the sampled features.

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9.4. Bibliography

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9.5. Appendices

Appendix 9.1: Summary of finds from the processed samples in site order.

site	sample no.	context no.	Sample vol. in l.	sample wt kg.	residue vol. * (ml)	residue wt. g. *	residue wt >7mm	flint no/wt.	pot no/wt.	slag wt. g.	mag. wt. g.	ham'scale no.	fired earth/ daub wt. g.	fired stone wt. g.	bone wt g.	shell wt g.	comment
Plot 0/3	1	03003	9.25	12.75	3000	4221	2858				22.4	8	4. 2	433.8			Coarse residue reserved
Plot 3/2	2	32002	9..25	16	3250	5123	983				3	1		156			Coarse and medium residue reserved
Plot 3/2	3	32018	20.25	30.25	8500	1306	1057	1/0. 2			7. 8	1		35.2	0.2		Coarse and medium residue reserved, flint chip
Plot 3/2	4	32016	7..5	14	2200	3807	3807				0. 8	2		341.2			Coarse and medium residue reserved 1 x charred grain in with charcoal occ coal; quartz flake (0.5g)
Plot 3/2	5	32012	5.75	12	2000	3277	1166				1. 6			584. 2			Coarse and medium residue reserved
Plot 3/2	6	32013	5.75	11	1900	4110	564				0. 6	9		33			Coarse and medium residue reserved
Plot 3/2	7	32019	11.25	16.25	4000	6587	659				0. 6	15		209.2			Coarse and medium residue reserved
Plot 3/2	8	32018	9.25	18	4200	6756	601				5. 8		0.5	19.4	0. 1		Hazelnut and burnt bone
Plot 3/2	9	32020	9. 5	17.25	4000	6741	1316						4	591.4			Coarse and medium residue reserved; fired earth or CBM?
Plot 3/2	11	32021	7	9.75	1500	2883	547.6				0. 1		1. 4	259.6			Coarse and medium residue reserved
Plot 3/10	15	310010	7	7	1500	2698	1853							1461			Coarse and medium residue reserved Occ fired earth in residue
Plot 3/10	16	310003	10	13	6500	9119	8430						1381 (siltstone?)	7049			Coarse and medium residue reserved
Plot 3/10	17	310004	8. 5	9	3200	4734	3556				2		303 (siltstone?)	2398			Coarse and medium residue reserved

site	sample no.	context no.	Sample vol. in l.	sample wt kg.	residue vol. * (ml)	residue wt. g. *	residue wt >7mm	flint no/wt.	pot no/wt.	slag wt. g.	mag. wt. g.	ham'scale no.	fired earth/ daub wt. g.	fired stone wt. g.	bone wt g.	shell wt g.	comment
Plot 3/14	10	314005	6	8. 5	1400	2331	445.6			55.6	3480	1000's	3. 4	16.6			fired earth includes tuyere fragments as does slag; smithing debris; 0.2g of a green stone; Hazelnut - smithing floor!
Plot 3/20	112	320006	11.25	22	7000	13339	7892				3. 6	6		265			Coarse and medium residue reserved
Plot 3/20	113	320007	7.75	15.75	5000	10046	7391			0.5	0. 2						Coarse and medium residue reserved; possibly fuel ash slag
Plot 3/20	114	320012	17	32.75	11000	15870	9197				0. 2	1		810			Coarse and medium residue reserved
Plot 3/27	13	327003	14. 5	20.25	3400	5378	3330		2/1		20.4	1	1. 8	425.8	52.4		Coarse and medium residue reserved Mortared pebbles 42g; pot very degraded; and waterlogged seed
Plot 3/27	14	327004	550	0.98	100	163.5	52				0. 2				8. 6		Coarse and medium residue reserved Bone is burnt
Plot 6/10	18	610002	6	7	800	1438	440				11	3	1				Coarse and medium residue reserved

site	sample no.	context no.	Sample vol. in l.	sample wt kg.	residue vol. * (ml)	residue wt. g. *	residue wt >7mm	flint no/wt.	pot no/wt.	slag wt. g.	mag. wt. g.	fired earth/ daub wt. g.	fired stone wt. g.	bone wt g.	shell wt g.	comment
Plot 6/6	19	66004	11.25	12	210	499	230			<0.1	0. 1					Coarse and medium residue reserved
Plot 6/6	20	66010	9. 5	14	1900	2712	1865			<0.1	0. 3					Coarse and medium residue reserved
Plot 6/10	18	610002	6	7	800	1438	440				11	1				Coarse and medium residue reserved; 3x hammerscale
Plot 6/21	62	621003	5. 5	7.75	1300	2240	966				0.4					Coarse and medium residue reserved
Plot 6/21	63	621004	11	12. 5	2100	3708	1909				1. 2					Coarse and medium fraction reserved

site	sample no.	context no.	Sample vol. in l.	sample wt kg.	residue vol. * (ml)	residue wt. g. *	residue wt >7mm	flint no/wt.	pot no/wt.	slag wt. g.	mag. wt. g.	fired earth/ daub wt. g.	fired stone wt. g.	bone wt g.	shell wt g.	comment
Plot 6/21	64	621007	5. 5	9. 5	3250	4650	4026				7.4		1247			Coarse and medium fraction reserved 003 Burnt mound material
Plot 6/21	65	621009	7. 5	6.25	1200	2141	1245				0.6		196.4			Course and medium fraction reserved 004 pit fill
Plot 6/33	37	633004	10	17	9000	12115	11425	1/0.1								Coarse and medium residue reserved; flint chip/broken flake
Plot 6/33	38	633005	8	15.75	7500	10528	9704				2. 4		11.6			Coarse and medium residue reserved
Plot 6/33	39	633009	2	5	1000	1911	1605						105			Coarse and medium residue reserved
Plot 6/33	40	633004	1. 5	3	1200	1835	1628						63.2			Coarse and medium residue reserved
Plot 6/33	41	633024	7. 5	13	6000	8030	7197				3. 2		917			Coarse and medium residue reserved
Plot 6/33	42	633024	11.25	18.5	7500	11385	10534				5. 2		661			Coarse and medium residue reserved
Plot 6/33	43	633010	16	22.25	10500	16500	15198				1. 4					Coarse and medium residue reserved
Plot 6/33	117	633024	2	3	750	900	680				4					Coarse and medium residue reserved
Plot 6/33	48	633029	5. 5	8.75	1400	1482	502						202.8			Coarse and medium fraction reserved
Plot 6/33	49	633021	9.75	17	7800	6589	1775						1544			Coarse and medium fraction reserved High quantity of charcoal 2456 hand picked
Plot 6/33	50	633019	7	13	2500	4316	3198						195.4			Coarse and medium reserved
Plot 6/33	51	633035	19.25	32.25	11500	20231	17386				0. 4		2753			Coarse and medium residue reserved
Plot 6/51	111	651	6	11. 5	200	233	81								133	Coarse and medium residue reserved
Plot 7/1	44	71002	27.75	29	20000	16632	8366						168		5891	Coarse and medium residue reserved Organic 1 x bag flot 1x bag wood

Site	sample no.	context no.	Sample vol. in l.	sample wt kg.	residue vol. * (ml)	residue wt. g. *	residue wt >7mm	flint no/wt.	pot no/wt.	slag wt. g.	mag. wt. g.	fired earth/ daub wt. g.	fired stone wt. g.	bone wt g.	shell wt g.	comment
Plot 6/29.4	45	6294006	3.75	8.5	3400	4292	3522						18.2			Coarse and medium residue reserved
Plot 6/29.4	45 *	6294002	31	42	8500	17348	10599					17	1130			Coarse and medium residue reserved * Charcoal sample
Plot 6/29.4	46	2964010	2	4. 5	900	1359	554									Coarse and medium residue reserved
Plot 6/29.4	46 *	6294002	21.5	36	16000	22941	20715						695			Coarse and medium fraction reserved * Charcoal sample
Plot 6/29.4	47	6294011	5.5	8.25	3500	4683	4041						89.8			Coarse and medium residue reserved
Plot 6/29.4	47*	6294011	28	47.75	25000	31509	29003					21	888			Coarse and medium fraction reserved
Plot 6/29.4	53	4071	26	36	16000	20090	17599*									14g lost while sieving coarse and medium fraction reserved
Plot 6/29.4	54	4100	4	8	5000	8468	5667									Coarse and medium fraction reserved
Plot 6/29.4	55	4102	20.75	40	1800	28500	20257									Coarse and medium fraction reserved
Plot 6/29.4	56	4054	19	27. 5	6200	8078	4583						74.8			Coarse and medium fraction reserved
Plot 6/29.4	57	4106	5.75	8	1450	1993	1305						19			Coarse and medium fraction reserved
Plot 6/29.4	58	4023	10	16	3600	4941	2217						177			Coarse and medium residue reserved
Plot 6/29.4	59	4112	3.75	8	4300	5034	4792						225			Coarse and medium fraction reserved
Plot 6/29.4	60	4115	1. 5	2.25	500	725	426									Coarse and medium fraction reserved
Plot 6/29.4	61	4116	7.5	14.75	4500	6860	4680						487			Coarse and medium residue reserved
Plot 6/29.4	66	4049	21	30	14000	18332	15004				< 1		111			Coarse and medium residue reserved
Plot 6/29.4	67	4117	13	21.5	6400	9059	6247						62.4			Coarse and medium residue reserved
Plot 6/29.4	68	4106	6. 7	13	7000	8980	8024						368			Course and medium fraction reserved
Plot 6/29.4	69	4104	5. 25	9	1400	2325	1892									Course and medium fraction reserved

Site	sample no.	context no.	Sample vol. in l.	sample wt kg.	residue vol. * (ml)	residue wt. g. *	residue wt >7mm	flint no/wt.	pot no/wt.	slag wt. g.	mag. wt. g.	fired earth/ daub wt. g.	fired stone wt. g.	bone wt g.	shell wt g.	comment
Plot 6/29.4	70	4129	9	16	7000	9500	9067						33.2			Coarse and medium fraction reserved
Plot 6/29.4	71	4023	2	2.	200	172	34									Coarse and medium residue reserved
Plot 6/29.4	72	4088	5. 5	8. 75	210	289	81						6			Coarse and medium residue reserved
Plot 6/29.4	73	4088	2. 5	3	23	31.5	4. 4								0.1	Coarse and medium fraction reserved
Plot 6/29.4	74	4088	7	8	160	160.7	36						3. 8			Coarse and medium fraction reserved
Plot 6/29.4	75	4134	3. 75	7	270	481	163						29. 2			Coarse and medium fraction reserved
Plot 6/29.4	76	4134	4	7	25	38. 7	3. 8									Coarse and medium residue reserved
Plot 6/29.4	77	4140	11.25	14	1100	1918	769									Coarse and medium residue reserved
Plot 6/29.4	78	4099	2	3	600	926	461									Coarse and medium residue reserved
Plot 6/29.4	79	4099	2	4. 5	1600	2829	1429									Coarse and medium residue reserved
Plot 6/29.4	81	4131	1.75	2. 5	200	351	120.4						1. 4			Coarse and medium residue reserved
Plot 6/29.4	82	4106	8. 5	19	5500	8750	5663						348			Coarse and medium residue reserved
Plot 6/29.4	83	4070	11	13	750	1054	397									Coarse and medium residue reserved
Plot 6/29.4	84	4145	1. 5	5	800	1220	579									Coarse and medium residue reserved
Plot 6/29.4	85	4144	2. 5	5	2700	4022	3380									Coarse and medium residue reserved
Plot 6/29.4	86	4147	3. 5	4. 25	400	1026	554									Coarse and medium residue reserved
Plot 6/29.4	87	4152	1. 5	3	1100	1644	1256						6. 4			Coarse and medium residue reserved
Plot 6/29.4	88	4153	750	1.75	200	335	164									Coarse and medium residue reserved
Plot 6/29.4	89	4032	8	16	6000	8690	3728									Coarse and medium residue reserved
Plot 6/29.4	90	4142	4	8	6600	6367	4561									Coarse and medium residue reserved
Plot 6/29.4	91	4156	11	13	5000	8497	7574									Coarse and medium residue reserved
Plot 6/29.4	92	4165	1	1.894	600	998	284						8. 2			Coarse and medium residue reserved

Site	sample no.	context no.	Sample vol. in l.	sample wt kg.	residue vol. * (ml)	residue wt. g. *	residue wt >7mm	flint no/wt.	pot no/wt.	slag wt. g.	mag. wt. g.	fired earth/ daub wt. g.	fired stone wt. g.	bone wt g.	shell wt g.	comment
Plot 6/29.4	93	4167	<100	0.209	27	71. 3	26									Coarse and medium residue reserved
Plot 6/29.4	94	4169	<100	0.213	25	52. 3	20. 4									Coarse and medium residue reserved
Plot 6/29.4	95	4172	3. 75	7	2300	3479	2182						67. 4			Coarse and medium residue reserved
Plot 6/29.4	96	4183	1. 75	6	3100	4351	3236									Coarse and medium residue reserved
Plot 6/29.4	97	4179	3	6	2600	3597	2225						232			Coarse and medium residue reserved
Plot 6/29.4	98	4176	1	2	400	652	292									Coarse and medium residue reserved
Plot 6/29.4	99	4177	8	8	4200	6134	2346									Coarse and medium residue reserved
Plot 6/29.4	100	4171	9. 25	13.75	3500	4947	3906									Coarse and medium residue reserved
Plot 6/29.4	101	4032	1. 5	2. 5	700	1192	372									Coarse and medium residue reserved
Plot 6/29.4	102	4151	26	28	10000	14500	11497									Coarse and medium residue reserved
Plot 6/29.4	104	4204	5. 5	10	5800	7709	5228						127			Coarse and medium residue reserved
Plot 6/29.4	105	4206	4	7. 5	1900	3353	1671									Coarse and medium residue reserved
Plot 6/29.4	106	4192	42	59. 5	20000	30426	25068					981 (fired siltstone)	483			Coarse and medium residue reserved

* greater than 1mm residue

Appendix 9.2. Hand collected animal bone, marine shell and nutshell

Plot	**3/2**	**3/2**	**3/2**	**3/20**	**6/51**	**7/1**	**14/7**	**14/7**
Context	**32012**	**32012**	**32018**	**320011**	**651001**	**71002**	**147005**	
Sample no.					**110**		**115**	
Find no	**017**	**006**	**015**	**031**	**062**	**034**	**063**	**035**
Shells								
Scrobicularia plana					27			
Cardium edule					1	25		
Littorina littorea					1			
Patella vulgata				2				
Plants								
Corylus avellana, whole hazelnuts							33	
Bones								
Calcined rib fragment -small ungulate	1							
Calcined long bone shaft-sheep size, fragmented		2+						
Calcined long bone shaft- cattle size – metatarsus?			1					
Cattle ribs								2
Cattle skull with horns cores and horns								1
Cattle size lumbar vertebra-water worn or eroded								1

10. CREMATED BONE FROM PLOT 3/27

Jacqueline I. McKinley

10.1. Introduction

Cremated human bone was recovered from two adjacent features (327001 and 327002) set *c.* 3.7m apart. The nature of the charcoal-rich deposits is uncertain (see below), but it is probable that at least one represents the remains of an unurned burial with redeposited pyre debris. In the absent of any artefactual or stratigraphic dating evidence, bone samples from each deposit were submitted for radiocarbon analysis and returned a Middle Bronze Age date.

10.2. Methods

Osteological analysis followed the writer's standard procedure for the examination of cremated bone (McKinley 1994, 5-21; 2000a), except that the small fraction residues were not available for scanning. Age was assessed from the stage of skeletal and tooth development (Scheuer and Black 2000), and the general degree of age-related changes to the bone (Buikstra and Ubelaker 1994). Sex was ascertained from the sexually dimorphic traits of the skeleton (*ibid.*; Gejvall 1981). Full details are held in the archive.

10.3. Results and Discussion

The features survived to depths of 0.18m and 0.06m respectively. The charcoal-rich fills were evident at machine surface level suggesting some degree of truncation had occurred, but it is not clear if bone was also exposed at this level. Consequently, there can be no confident statement regarding the potential loss of bone from the features as a result of disturbance. It is pertinent to note, however, that clearly undisturbed remains of unurned cremation burials have been observed within the lower 0.05-0.06m of graves elsewhere (e.g. figures 36-38 Egging Dinwiddy and Schuster 2009; McKinley forthcoming).

The bone is very worn and chalky in appearance, a characteristic of cremated remains recovered from an acidic burial environment such as that prevalent across much of this section of the pipeline route (sandy silt; McKinley 1997, 245; Nielsen-Marsh *et al.* 2000). It is probable that some (if not most) of the trabecular bone (that comprising most of the axial skeleton and articular surfaces of the long bone) would have been lost via this mechanism.

The very small quantities of bone recovered (51.6g from pit 327001 and 8.6g from pit 327002) are not, however, a direct consequence of either of these mechanism. At the time of excavation, both features reportedly contained ‘large quantities of bone’. Some bone (an unknown proportion), apparently collected by hand has subsequently been mislaid and that available for osteological analysis appears to have derived from that recovered as a ‘sample’ (but possibly not all of it since no small fraction residues exist).

The bone represents the remains of a minimum of one subadult/adult *c.* 15-40 yr. of indeterminate sex. The absence of most of the bone from both deposits and lack of detail regarding the distribution of the archaeological components within the fills (obtained by quadranted whole-earth recovery of the fill, and where necessary by spit, enabling the retrieval of details of the formation processes in osteological analysis (McKinley 1998; 2000b; in press)) renders interpretation of the deposit types difficult and inconclusive. A variety of deposit types and features may be associated with the cremation rite, and the product of one cremation may be distributed between several features and fills of similar appearance. Here, where the two pits lay in such close proximity and there is no observable duplication of skeletal elements, it is possible that both deposits derived from the same cremation, one representing the burial remains (with redeposited pyre debris, a common characteristic of the rite), and the other a ‘formal’ deposit of pyre debris.

No pathological lesions were observed. No evidence for pyre goods of any form was seen. In view of the partial nature of the assemblage, no meaningful comment regarding aspects of pyre technology and the cremation rite can be proffered other than to say all the bone subject to examination is white in colour indicative of full oxidation (Holden *et al.* 1995a and b).

Table 10.1. Detailed record of cremations

Context	**327003**	**327004**
Cut	327001	327002
Deposit type	Cremated	Cremated
Total weight (g)	51.6	8.6
10mm weight (g)	13.8	5.3
% total weight	26.74	61.63
5mm weight (g)	35.6	1.7
% total weight	68.99	19.77
2mm weight (g)	2.2	1.6
% total weight	4.26	18.60
1mm residue (g)	?	?
Maximum fragment size	28mm	43mm
Identifiable weight (g)	21.6	5.9
% total weight	41.86	68.60
Skull weight (g)	9.6	0.5
% total weight	44.44	8.47
Axial weight (g)	0.1	
% total weight	0.46	0.00
Upper limb weight (g)	0.4	0.1
% total weight	1.85	1.69
Lower limb weight (g)	11.5	5.3
% total weight	53.24	89.83

10.4. References

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10.5. Appendix: Cremated Bone Archive Report

See Table A1 for bone weights and percentage distributions by sieve fraction and identifiable skeletal element, and maximum fragment sizes.

context 327003

Single fill of pit 327001 (0.52m diam., 0.18m deep); colour indicates charcoal-rich. ‘Large amount of burnt bone’ recorded on site (not apparent in photos. & now shown in plan, no distribution given) - apparently bone was collected by hand but has subsequently gone missing, how amount available for analysis was recovered is unclear; basically have no proper quantification
SKULL: 2 small fragments petrous temporal. ?articular tubercle fragment.
Vault; 32 small fragments, sutures open-1/2 fused. 1a = 3.6mm
AXIAL SKELETON: Rib shaft fragment.
UPPER LIMB: Radius shaft fragment.
LOWER LIMB: Fragments femur (9) & fibula (4) shaft.
Talus fragment.
AGE: subadult/adult c. 15-40 yr.
SEX:?
CONDITION: Very worn & chalky
COMMENT: 2x 2.1g bone (femur shaft) taken for C14 analysis. MBA

context 327004

Single fill of 327002 (0.22m diam., 0.06m deep). Charcoal-rich. Site records state ‘large amount of bone’ - can see some in photo., none shown in drawings, distribution not stated. This too is likely to have contained large fragments subsequently missing in post-excavation.
SKULL: Fragments min. 1 petrous temporal.
Vault; 2 small thin scraps
UPPER LIMB: Radius shaft fragment.
LOWER LIMB: Femur 2 fragments shaft
AGE: subadult/adult >12 yr.
CONDITION: Very worn & chalky
COMMENT: 1.7g (femur & tibia shaft) taken for C14 analysis. MBA

11. ANALYSIS OF CHARCOAL AND CHARRED PLANT REMAINS

Dana Challinor, John Giorgi and James Rackham

11.1. Introduction

The excavations as part of this project resulted in a total of 117 soil samples from fourteen archaeological sites. The samples were processed and assessed (Rackham and Giorgi 2012) and recommendations made for the detailed analysis of the charred plant remains from site plot 3/2 and the cremation burial excavated in plot 3/27, and the analysis of the charcoal assemblages in a selection of thirty one samples from twelve of the excavations. The results from each sampled excavation site are presented below utilising both the results obtained during the assessment and those resulting from the detailed post-excavation analyses. Some additional information has been added to the assessment data for samples that were selected for radiocarbon dating but not for further environmental study.

The assessment (op cit.) noted four principle areas for further work:
1. The radiocarbon dating of the sites
2. The analysis of the plant macrofossils from the medieval and Iron Age features in Plot 3/2
3. A study of the burnt bone and charred plant remains from the possible cremations in Plot 3/27
4. A detailed study of the charcoal from the sites along the whole route, including the burnt mounds - Plots 3/10, 6/6, 6/21, 6/29.4 and 6/33; the cremations from Plot 3/27; the medieval corn drier and Iron Age pits from Plot 3/2; the pits from Plots 0/3 and 6/10; the medieval smithy from Plot 3/14; and the Iron Age shell midden from Plot 7/1.

The following report includes the results from points 2 and 4 above, and the analysis of the charred plant remains from Plot 3/27.

11.2. Methods

The soil samples were processed in the following manner. Sample volume and weight was measured prior to processing. The samples were washed in a 'Siraf' tank (Williams 1973) using a flotation sieve with a 0.25mm mesh and an internal wet-sieve of 1mm mesh for the residue. Both residue and flot were dried, and the residues subsequently re-floated to ensure the efficient recovery of charred material. Some samples were refloated a second time owing to the quantity of charcoal remaining in the residue. The volume and weight of the residue was recorded and the dry volume of the charred element of the flots was measured after removal of roots and mineral material. Five samples included waterlogged remains. The wet first flot was measured wet, and not dried, but the residue was dried and refloated. The dry second flot was measured and recorded separately.

The flot of each sample was studied under a low power binocular microscope. The presence of environmental finds (i.e. snails, charcoal, carbonised seeds, bones etc) was noted and their abundance and species diversity recorded on the assessment sheet. Many of the charred flots from the burnt mound sites were large and a proportion (normally 50% of each flot over 250ml or 25% over 600ml) was first sorted and if no identifiable charred material other than charcoal was recorded the remainder was bagged and labelled unsorted, otherwise the remainder was sorted. The flot and finds from the sorted residue constitute the material archive of the samples.

For summary of remains from all samples see appendix 11.2.

Charred plant remains

The assessment showed the presence of charred plant remains (other than charcoal) in 28 samples from 11 of the sites, cereal grains in 15 samples, cereal chaff in five, wild plant/weed seeds in 21, and *Corylus avellana* (hazel) nut shell fragments in 15 samples. Only nine samples within Plot 3/2, however, produced significant quantities of charred plant material to merit further analysis. The charred plant remains from a possible medieval cremation deposit in Plot 3/27 were also recommended for further study.

The remaining productive samples from the other nine sites produced only traces or very small amounts of charred plant material, often poorly preserved and/or unidentifiable. These were identified during the assessment and are considered below by site. There were occasional un-charred seeds in many of the samples which are probably intrusive although small ‘waterlogged’ plant assemblages from four locations may be contemporary with the sampled features; from Plot 6/51 (a shoreline deposit of unknown date), Plot 6.29.4 (a burnt mound complex) of Late Neolithic and Bronze Age date, Plot 7/1 (an Iron Age shell midden), and Plot 14/7 (a medieval wood layer on an alluvial floodplain). The limited identifiable remains in these samples were broadly similar, with the presence of *Betula* (birch), *Corylus avellana* (hazel), *Rubus* (brambles), *Ajuga reptans* (bugle), *Ranunculus* (buttercup), Cyperaceae (sedges etc) and Poaceae (grasses), suggesting damp grassland/woodland environments.

The dried flots from the ten samples recommended for analysis from Plots 3/2 and 3/27 were divided into fractions using a stack of sieves for ease of sorting and all quantifiable charred plant remains extracted and identified using a binocular microscope (with a magnification of up to x40) together with modern and charred reference material and reference manuals (Cappers *et al* 2006; Jacomet 2006). All the charred plant remains were counted except for un-sorted and unquantifiable items which included indeterminate cereal grain fragments (generally smaller than 2mm), hazel nut shell fragments, stem, thorn fragments, and charcoal. The frequency of these remains was estimated using the following rating system: + = 1-10; ++ = 11-50; +++ = 51-150; ++++ = 151-250; +++++ = >250 items.

Taxonomic order for the wild plants follows Stace (2005), which was also used for ecological data together with Hanf (1983) and Wilson *et al* (2003). The results from Plot 3/2 form the basis of the discussion by period of the charred plant remains from the pipeline although assessment data from the other locations has been used when appropriate.

The Wood Charcoal

Charcoal >2mm in transverse section was considered suitable for identification, although some of the smaller fraction proved difficult to identify owing to poor condition. The flots (or portion of flots if very large) were scanned at low magnification (up to x45) and a representative number of fragments (between 30 and 50, depending upon abundance and taxonomic diversity), were fractured and sorted into groups according to patterns in transverse section. Identifications were then confirmed by examination in longitudinal sections at high magnification using a Meiji incident-light microscope at up to x400 magnification, and with reference to appropriate keys (Schweingruber 1990; Gale and Cutler 2000; Hather 2000) and modern reference material. This method provides a broad characterisation for each sample, showing patterns of dominance and major taxonomic composition, but minor components of assemblages may not have been detected. Observations on maturity or condition were made as appropriate. Maturity and growth ring analysis is only reliable on larger fragments (at least >4mm, preferably larger) and was not comprehensively viable on this sample set. For this reason, an indication of maturity is provided in the tables, or discussed in the text, rather than provided as a quantified dataset. Classification and nomenclature follow Stace (1997).

11.3. Results

Summary charcoal results

The results are presented with individual site summaries below (Tables 1-15). More than 1500 fragments were identified. Charcoal was abundantly preserved, but there was a notable variation in condition, with some sites along the pipeline producing very poor material with high levels of iron staining and infusion of sediment. Nine taxa were positively identified, all consistent with native species. Where appropriate, it has been assumed that the native species is represented, although it is rarely possible to identify wood beyond genus level on anatomy alone.

Fagaceae:
Quercus spp., oak, large tree, two native species, not distinguishable anatomically.

Betulaceae:
Betula spp. (birch), trees or shrubs, two native species, not distinguishable anatomically.
Alnus glutinosa, Gaertn., alder, tree, sole native species. *Corylus* has a very similar anatomical structure to *Alnus* and can be difficult to separate especially in poor material.
Corylus avellana L., hazel, shrub or small tree, sole native species.

Salicaceae:

The genera *Salix* spp. (willow) and *Populus* spp. (poplar) are rarely possible to separate. Both are trees although there is variation within the genera.

Rosaceae:
Prunus spp., trees or shrubs, including *P. spinosa* L. (blackthorn), *P. avium* L. (wild cherry) and *P. padus* L. (bird cherry), all native, which cannot always be distinguished, but *P. spinosa* was positively identified on the basis of wide ring widths.
Maloideae, subfamily of various shrubs/small trees including several genera, *Pyrus* (pear), *Malus* (apple), *Sorbus* (rowan/service/whitebeam) and *Crataegus* (hawthorn), which are rarely distinguishable by anatomical characteristics.

Fabaceae:
Cytisus/Ulex, broom/gorse, shrubs, several native species, not distinguishable anatomically

Aceraceae*:*
Acer campestre L. field maple, tree, sole native species.

Oleaceae:
Fraxinus excelsior L. ash, tree, sole native species.

Plot 0/3
A small undated pit or gully fill (3003) was sampled in this plot. Unfortunately no dating evidence was recovered from the sample, although the presence of hammerscale and an iron object would suggest later prehistoric or a more recent date. The feature was not deemed important enough to radiocarbon date so remains undated although the charcoal assemblage was studied. A few fragments of unidentifiable cereal grain, hazelnut, grass (*Bromus* sp.) and dock (*Rumex* sp.) seed were identified among the charred plant remains, but afford little interpretive value.

The charcoal was abundantly and well preserved and a single taxon predominated; *Quercus* sp. (oak). The oak had characteristically split down the rays, leaving thin slivers from which it was difficult to determine maturity. Nonetheless, some clear evidence for both sapwood and heartwood was noted and no evidence for ring curvature recorded. Interestingly, three fragments were observed which appeared to exhibit evidence of wood working. This is somewhat tentative in charred material, but the fragments appeared to be rounded in a manner not caused by usual taphonomic processes (Plate 11.1). The presence of hazelnut shell fragments and cereal grains suggest domestic refuse. Beyond the suggestion that the charcoal derived from an artefact or worked wood, it is not possible to speculate further on the origin of the material.

Table 11.1. Charcoal and charred plant remains from Plot 0/3

	Feature type	Fill of pit or gully
	Feature number	3005
	Context number	3003
	Sample number	1
Flot volume	in ml.	390
Charcoal		
Quercus sp.	oak	30sh?w
Charred plants		
Cerealia indet.	Grain fragments	+
cf Bromus	Brome, grass	1
Rumex sp.	Dock sp.	1
Corylus avellana	Hazel nutshell	2

r=roundwood; h=heartwood; s=sapwood

Plate 11.1. Probable worked wood from Plot 0/3

Plot 3/2
A dumb-bell shaped stone lined feature [32009] interpreted as a corn drier was excavated in this plot and apparently associated with two pits, [32003] and [32014]. Radiocarbon dating has identified the pits as of middle Iron Age date, and the corn drier of medieval date. Four samples were collected from the corn drier; sample <9> from the fill (32020) of the WNW chamber and samples <2> from fill 32002 and <3> and <8> from fill 32018. The remaining five samples were collected from the fills of Iron Age pits [32003] and [32014]; samples <4> and <5> from fills (32016 and 32012 respectively) of [32003], and sample <11> from the lining deposits (32021) of pit [32014], and samples <6> and <7> from the fills (32013 and 32019 respectively).

The nine samples from this plot produced over two thousand (2226) quantified charred plant items, and the bulk (83%) of these remains was from the two fills of Iron Age Pit [32003], with most of the remaining material being from three fills of the medieval corn drier [32009] and only a very small amount of material from the two fills and lining of the other Iron Age Pit [32014].

The Mid Iron Age
The radiocarbon dates from the two pits indicate a 3rd-4th century BC date for these features. The charred plant assemblages are presented in Table 11.2.

Pit [32003] fills [32012] and [32016]
Both fills, [32012] and [32016], produced rich charred plant assemblages with 1156 and 700 items respectively (Table 2), and high item densities of 154 and 121 per litre of processed soil. The composition of the two assemblages was broadly similar, consisting almost entirely of cereal grains with very little chaff and wild plant/weed seeds. Fill [32016] contained 87% grains, 10% chaff and 3% weed seeds, while fill [32012] produced an even higher percentage of grains (97%) with only traces of chaff (2%) and weed seeds (1%). The proportion of grains would have been even higher had it been possible to quantify the large number of indeterminate grain fragments in both samples.

The cereals
Preservation of the grains was very variable and while around 40% of the grains in both samples were not identifiable a large number were very well-preserved allowing identification to species.

Triticum (wheat) was the best represented grain, a large number of the very well-preserved grains showing *Triticum dicoccum* (emmer) to be the main cereal, the identification of which was supported by the identifiable hulled wheat chaff (glume bases and spiklelet forks) most of which belonged to emmer. There was possible evidence for *Triticum spelta* (spelt wheat) with a very small number of emmer/spelt grains in both samples and traces of spelt chaff in fill [32016]. Two rounded grains from fill [32012] were tentatively identified as *Triticum aestivum* type (free-threshing wheat). A smaller number of *Hordeum vulgare* (barley) grains included fairly similar numbers of both naked and hulled barley, with twisted hulled grains showing the presence of six-row hulled barley. A few barley rachis fragments were also identified in fill [32016]. A single *Avena* (oat) grain in fill [32016] may be from a wild or cultivated species although it is generally considered to have been a weed before the Roman period.

Emmer was the main wheat grain cultivated in the earlier prehistoric period in Britain but appears to have been largely replaced by spelt during the 1st Millennium BC particularly in southern England although the current archaeobotanical evidence suggests that this may not have always been the case in Wales. Emmer was identified at a number of hill forts in north Wales, for example being the dominant grain at Dinorben Hill Fort, while it was the main cereal in a 3rd to 2nd-century BC occupation deposit at Breiddin Hill Fort and at the prehistoric/Romano-British enclosure at Collfryn, both sites close to the border with England (Caseldine 1990, 75-6). There was also a good amount of emmer chaff in a late Iron Age/early Romano-British sample from the site of Cefn Du in Anglesey (Ciaraldi 2012, 227). The only evidence for this cereal from the other pipeline sites was traces of emmer chaff in a sample from a fire pit or oven in Plot 6/10. Barley has also been recorded at a number of Iron Age sites in north Wales (eg. Caseldine 1990) while one other location (Plot 6.29.4) on the pipeline recorded traces of barley grain in two samples from contexts provisionally dated to the Bronze Age.

Emmer does not produce good leavened bread but produces flour of very good quality with higher protein content than modern bread wheat (Jones 1981, 106) and, together with barley, could have been used for making unleavened loaves, made into porridge or gruel or added to stews or soups (Renfrew 1985, 15). Barley may have also been used as animal fodder. There were no germinated grains to suggest the use of any of the cereals for brewing beer.

Wild food remains

There were a few charred fragments of hazel nutshell in fill [32012] which could represent the residues of collected and consumed wild food; traces of charred hazelnut shell fragments were also recorded from a number of other sites along the pipeline route in sampled contexts provisionally dated as Bronze Age from Plots 6/6, 6/21, 6.29.4 and 6/33. A sample from Plot 6/33 also contained a charred *Rubus* (blackberry/raspberry) seed. Archaeobotanical evidence suggests that wild fruits and nuts played a role in the food economy of prehistoric sites in Wales, for example, fragments of hazelnut and blackberry seeds in late prehistoric enclosures at Erw-wen and Moel y Gerddi, just south of the pipeline (Caseldine 1990, 76).

Table 11.2. Plot 3/2 Iron Age pits 32003 and 32014. Charred plant remains

	cut number	32003		32014		
	feature type	Fill	Fill	Fill	Fill	Lining
	context number	32016	32012	32013	32019	32021
	sample number	4	5	6	7	11
	vol sample (l)	7.5	5.75	5.75	11.25	7
	vol flot (ml)	84	65	12	17	14
LATIN_NAME	ENGLISH					
Cereal grains						
Triticum dicoccum Schubl.	emmer wheat	275	108			
T. cf. *dicoccum*	?emmer wheat	52	28			
T. dicoccum/spelta	emmer/spelt wheat	10	6		1	
T. cf. *aestivum* type	?free-threshing wheat		2			
Triticum sp(p).	wheat	97	114			
cf. *Triticum* sp(p).	?wheat	66	98			
Hordeum vulgare L.	barley, naked	50	2			
H. vulgare L.	barley, hulled twisted	3	3			
H. vulgare L.	barley, hulled straight	3				
H. vulgare L.	barley, hulled	16	30			
H. vulgare L.	barley, indet	18	15			
cf *H. vulgare*	?barley		6			
Avena sp(p).	oat	1				
Cerealia	indet. cereal grains	409	267	2	3	3

Cerealia	indet cereal fragments <2mm	++++	++++	+	+	++
Cereal chaff						
Triticum dicoccum Scubl.	emmer wheat glume base	38	5		1	
T. dicoccum Scubl.	emmer spikelet forks/bases	19	3			
T. spelta L.	spelt glume bases	2				2
T. spelta L.	spelt spikelet forks/bases	2				1
Triticum spp.	wheat glume bases	41	3			2
Triticum spp.	wheat spikelet forks/bases	10				4
Hordeum spp.	barley rachis	5				
Other plant/weed seeds						
Corylus avellana L.	hazel nut shell fragments		+			
Chenopodium sp.	goosefoots etc.	1				
Spergula arvensis L.	corn spurrey	1				
Persicaria maculosa Gray	redshank		1			
P. lapathifolia (L.) Gray	pale persicaria	2				
Persicaria sp(p).	knotgrasses	6	2			1
Fallopia convuluvulus (L.) A Love	black bindweed	1	1			
Rumex sp(p).	dock			1		
Prunella vulgaris L.	self-heal	1				
cf. *P. lanceolata*	?ribwort plantain			2		
Carex sp.	sedge		1			
Cypercaeae indet			1			
Bromus sp(p).	brome	1				
Danthonia decumbens (L.) DC	heath grass	6				
Poaceae indet.	grasses (small seeds)	20	4			
indeterminate	wood charcoal	+++++	+++++	+++++	+++++	+++++
indeterminate	items	+	+	+		++
	TOTAL	1156	700	5	5	13
item density (per litre of processed soil)		*154.1*	*121.7*	*0.9*	*0.4*	*1.9*

Item frequency: + =1-10; ++ = 11-50; +++ = 51-150; ++++=151-250; +++++ = 250+items

The wild plants/weed seeds and crop husbandry

There were few charred wild plant/weed seeds in the two Iron Age samples, with a very limited range of species, mainly represented by single or very small numbers of seeds. Most of these remains are probably from arable weeds given their presence as minor components in generally large cereal assemblages. A number of the weed seeds in both samples (Table 11.2), were identified to species that suggest the cultivation of sandy acidic soils; *Spergula arvensis* (corn spurrey) and *Fallopia convolvulus* (black bindweed) are both found largely on well-drained sandy soils, and *Persicaria lapathifolia* (pale persicaria) and *Persicaria maculosa* (redshank) often grow on damper sandy loams. Damp soils may also be suggested by occasional seeds of *Carex* (sedges). Regarding the two main cereals from the Iron Age pit, emmer can grow in a wide range of soil and climatic conditions (Barker 1985, 44) while barley can grow on both heavy and light soils except where the drainage is poor (Jones 1981, 105).

Danthonia decumbens (heath grass), represented by a small number of seeds in fill [32016], is another plant found in acidic soils, growing in sandy or peaty often damp soils mostly on heaths, moors and mountains. In the past, however, it may have been a common arable weed, being found in charred cereal assemblages from other prehistoric sites in Wales, persisting as a perennial weed because of tilling by ard and only being eradicated as a cereal weed with the later introduction of the more efficient mould board plough (Hillman 1981, 146). Its presence could therefore point to the use of the ard rather than the mould board plough for tillage at this time.

The use of acidic sandy soils for cultivation during the Iron Age has been suggested on the basis of similar weeds from a number of other late prehistoric sites in north Wales. *Danthonia decumbens* is often found together with cereal remains, for example being a common weed in Late Iron Age Cefn Graenog (Gwynedd) (Hillman 1981, 146) and together with *Spergula arvensis*, in Late Iron Age/early Romano-British deposits at Cefn Du, Anglesey (Ciaraldi 2012, 223). *Spergula arvensis* was also found in late prehistoric enclosures at Erw-wen and Moel y Gerddi (Caseldine 1990, 76).

The paucity of weed seeds makes it difficult to comment on other aspects of crop husbandry. Emmer and barley may be both spring and autumn sown although *Spergula arvensis* and *Fallopia convolvulus* suggest the spring-sowing of cereals. There is also limited evidence for harvesting methods although the presence of occasional low-growing weeds, such as *Spergula arvensis*, could point to the cutting of cereals low on the straw. There were twining weeds, such as *Fallopia convulvulus* but no culm bases in these samples to suggest that harvesting of crops by uprooting may have also taken place. A few of the wild plants, *Prunella vulgaris* (self-heal), represented by a single seed in fill [32016], *Carex* and small grass (Poaceae) seeds in both samples could also indicate damp grassland environments close-by.

The interpretation of the pit fill assemblages

Pit [32003]

The dominance of cereal grains in the two fill samples from this Iron Age pit suggest that the charred remains largely derive from virtually cleaned and de-husked crops of emmer and to a lesser extent barley, the grains being accidentally burnt while being dried before milling and/or as a result of a cooking accident. There is, however, also some evidence for the de-husking of hulled wheat, some of the hulled grains as well as the chaff possibly being accidentally burnt during this process; the separated chaff could also have been used as fuel together with the few weed seeds in the samples.

Pit [32014] fills [32013], [32019], [32021]

The three fills from the other Iron Age pit produced only a small amount of charred plant remains consisting of a few grains including one of emmer/spelt wheat, an emmer glume base in fill [32019] and a few spelt chaff fragments in fill [32021]. A few charred weed seeds included possibly *Plantago lanceolata* (ribwort plantain), a plant of meadows and pastures. Little comment may be made on the basis of such few remains other than confirming the presence of hulled wheat during this period, the remains probably representing background debris from crop-processing activities (including the de-husking of hulled wheat) taking place on the site.

The medieval period

Corn drier [32009] fills [32002], [32018](2 samples),[32020]

The four samples from the fills of the corn drier [32009], radiocarbon dated to between the mid 11th and mid 13th-century, produced just over 700 quantified items (Table 3), mainly from the basal fill [32018] sample 3 of the feature with the other three samples containing much smaller assemblages of charred plant remains. Cereal grains accounted for 71% of the quantified remains (just over half of which, however, could not be identified), most of the remaining material consisting of wild plant/weed seeds (29%) with only traces of cereal chaff in fill [32018] (sample 3).

The cereals

Oat was the best represented cereal in all four assemblages, accounting for the majority (88%) of the identifiable grains. There were also small numbers of grains of wheat, mainly from free-threshing species, *Secale cereale* (rye) and barley, including evidence for six-row hulled barley. A few free-threshing rachis fragments in fill [32018] (sample 3) were too poorly preserved to establish the presence of hexaploid and/or tetraploid wheats.

Oat was one of the four main cereals (along with free-threshing wheat, hulled barley and rye) cultivated in the post-Roman period in Britain (Greig 1991, 315). Archaeobotanical evidence from other medieval sites in Wales suggests that oat was an important grain during this period, for example, being the main cereal in 13th –century deposits at Cefn Graenog (Gwynedd) in north Wales, in a 15th-century corn drying kiln (along with some free-threshing wheat grains) at Collfryn, Llansantffraid (Powys) in central Wales (ibid. 323), and in earlier medieval samples (along with some barley) from a kiln or corn drier at Cefn Du, Anglesey (Ciaraldi 2012, 230-1). Along the route of the pipeline, at Plot 3/14, a single charred oat grain was found in a deposit associated with a smithy and dated to the medieval period. Oats may have been used together with the other cereals for bread or in pottage as well as for animal fodder (along with barley). None of the grains had sprouted to suggest a use for brewing.

A small number of legume seeds were found in the corn drier fills, one of which was identified as *Vicia sativa* (common vetch) in fill [32018] (sample 3); this legume was possibly used as animal feed, with both historical and archaeobotanical evidence suggesting the increased cultivation of vetches in the later medieval period (Greig 1991, 323; Campbell 1988). There were also occasional charred hazelnut fragments in three of the sampled fills which suggests that nuts continued to be gathered as a wild food resource into the medieval period.

The wild plants/weed seeds and crop husbandry

The medieval corn drier samples produced a fairly good range of wild plant/weed seeds, mainly in fill [32018], with fewer weed seeds in fills [32002] and [32020]; these seeds are again probably mainly from cereal weeds given their association with a large grain assemblage. The weed seeds suggest that different soil types may have been used for growing crops. *Chrysanthemum segetum* (corn marigold), well represented in the corn drier, grows on fairly acid sandy soils and loams with *Persicaria maculosa* and *Fallopia convolvulus* suggesting the use of similar soils. On the other hand, a small number of seeds of *Galium aparine* (cleavers), *Anthemis cotula* (stinking mayweed) and *Lapsana communis* (nipplewort) may point to the use of clays as well as loam soils for growing crops.

Table 11.3. Plot 3/2 Medieval corn drier [32009]. Charred plant remains

	period	EARLY MEDIEVAL (11th-13th C.)			
	feature	CORN DRIER 32009			
	feature type	FILL	FILL		FILL
	context number	32002	32018		32020
	sample number	2	3	8	
	vol sample (l)	9.25	20.25	9.25	
LATIN NAME	vol flot (ml)	120	255	97	LATIN NAME
Cereal grains					Cereal grains
T. aestivum type	free-threshing wheat	1	7		*T. aestivum* type
T. cf. *aestivum* type	?free-threshing wheat	1	3		*T.* cf. *aestivum* type
Triticum sp(p).	wheat	1	4		*Triticum* sp(p).
cf. *Triticum* sp(p).	?wheat		3	1	cf. *Triticum* sp(p).
Secale cereale L.	rye		3		*Secale cereale* L.
cf. *Secale cereale*	?rye		6		cf. *Secale cereale*
H. vulgare L.	barley, hulled twisted	1			*H. vulgare* L.
H. vulgare L.	barley, hulled		1		*H. vulgare* L.
H. vulgare L.	barley, indet		2		*H. vulgare* L.
cf *H. vulgare*	?barley	1			cf *H. vulgare*
Avena sp(p).	oat	7	67	5	*Avena* sp(p).
cf. *Avena* spp.	?oat	5	109	3	cf. *Avena* spp.
Cerealia	indet. cereal grains	24	208	20	Cerealia
Cerealia	indet cereal fragments <2mm	+++	++++	+++	Cerealia
Cereal chaff					Cereal chaff
Triticum spp.	free-threshing wheat rachis		3		*Triticum* spp.
Other plant/weed seeds					Other plant/weed seeds
Corylus avellana L.	hazel nut shell fragments	+	++	+	*Corylus avellana* L.
Chenopodium sp.	goosefoots etc.			2	*Chenopodium* sp.
Atriplex/Chenopodium spp.	orache/goosefoots etc		2		*Atriplex/Chenopodium* spp.
Persicaria maculosa Gray	redshank	1	2		*Persicaria maculosa* Gray
Persicaria sp(p).	knotgrasses	1	1		*Persicaria* sp(p).
Fallopia convolvulus (L.)	black bindweed		3		*Fallopia*

A Love					*convolvulus* (L.) A Love
Rumex sp(p).	dock		3		*Rumex* sp(p).
Vicia sativa L.	common vetch		1		*Vicia sativa* L.
Vicia/Lathyrus sp(p).	vetch/tare/vetchling	1	6	1	*Vicia/Lathyrus* sp(p).
Medicago/Trifolium sp.	medicks/clovers		1		*Medicago/Trifolium* sp.
Fabaceae indet	large fragments/cotyledons		1	1	Fabaceae indet
Fabaceae indet	small rounded legumes			5	Fabaceae indet
cf. *P. lanceolata*	?ribwort plantain	1			cf. *P. lanceolata*
Galium aparine L.	cleavers	1	3		*Galium aparine* L.
Lapsana communis L.	nipplewort		3		*Lapsana communis* L.
cf. *L. communis*	?nipplewort		2		cf. *L. communis*
Anthemis cotula L.	stinking chamomile		12	2	*Anthemis cotula* L.
Chrysanthemum segetum L.	corn marigold	4	68	11	*Chrysanthemum segetum* L.
Asteraceae indet			1		Asteraceae indet
Carex sp.	sedge		1		*Carex* sp.
Cypercaeae indet			1		Cypercaeae indet
Poa sp.	meadow-grasses		1		*Poa* sp.
Bromus sp(p).	brome		6		*Bromus* sp(p).
cf. *Bromus* spp.	?brome		2		cf. *Bromus* spp.
Poaceae indet.	grasses (large seeds)	11	4		Poaceae indet.
Poaceae indet.	grasses (small seeds)		6	1	
indeterminate	wood charcoal	+++++	+++++	+++++	+++++
indeterminate	items	+	++	+	+
	TOTAL	61	546	52	49
item density (per litre of processed soil)		*6.6*	*27*	*5.6*	*5.2*

Deep loams and clay loams would have suited the cultivation of both oats and free-threshing wheat although oats can also tolerate acid and infertile soils (Jones 1981, 108). It is possible that the oats may have been growing on acidic sandy soils, similar to those used in the Iron Age period of the site, while free-threshing wheat was cultivated on deeper loams and clay soils. As noted above, barley can grow on a range of soils except where the drainage is poor. Rye can also tolerate acidity and low soil fertility and often grows on sandy soils.

Chrysanthemum segetum and *Fallopia convolvulus* are usually associated with spring sown crops and *Galium aparine* with the autumn sowing of cereals. Both oats and free-threshing wheat may be sown in both periods but oats, being less frost hardy than wheat and barley, are better suited to spring sowing while bread wheat is usually winter-sown. There was again little evidence to suggest any particular harvesting method was being used although the weeds in the samples suggest that the grain was probably being cut fairly low on the straw; there were again occasional twining weeds, for example, *Fallopia convolvulus*, *Galium aparine,* but no culm bases to suggest harvesting also by uprooting.

The interpretation of the corn drier assemblages

The grains in the corn drier may have been accidentally burnt while being dried before milling and/or storage. Oat was the principal grain while the other cereal grains may have been left over from previous use of the drier or may have been weeds of the oat crop from past use of the same fields. The smaller weed seeds, which would have been separated by sieving, may have been used as fuel although the weed seeds of a similar size to the grain, for example *Bromus* (brome), may have persisted as part of the cereal crop and could have only been successfully separated by hand-sorting.

Charcoal analysis
Five samples from plot 3/2 were chosen for charcoal analysis, comprising material from the two Iron Age pits, [32003] and [32014], and the corn drier 32009. Three of the samples produced abundant identifiable charcoals, but the two samples from pit [32014] were much less rich, with very small fragments. The condition of the charcoal was soft and prone to crumbling, especially in the samples from the corn drier. Five taxa were positively identified: *Quercus* sp. (oak), *Alnus glutinosa* (alder), *Corylus avellana* (hazel), *Populus/Salix* (poplar or willow) and *Cytisus/Ulex* (broom or gorse) (Table 11.4).

Iron Age Pit 32003
The assemblage from this feature was notable for the large quantity of roundwood pieces, which was dominated by *Corylus avellana* (hazel), with a lesser presence of *Quercus* (oak). The charcoal was small in diameter (3-5mm), with some pieces exhibiting pith and bark. The age ranged from 1-3 years in age, with several pieces at 2 years which probably represented fragments from a single twig or small branch. Estimates of shrinkage suggest that the uncharred wood could have been up to 40% larger but there is intra-species variability.

The analysis of the charred plant remains (see above) showed a rich assemblage of emmer wheat and it is likely that the charcoal represents small hazel brushwood being used as a fuel in association with the crop drying or cooking activities.

Pit 32014
The two samples from this pit produced few, small fragments of charcoal which were difficult to identify and did not merit quantification. The presence of hammerscale in this pit suggests that iron-working was taking place in the vicinity although the hammerscale density is much to low to suggest that the charcoal could derive from this activity, although oak was commonly used as charcoal fuel for iron-working activities. The paucity and size of the charcoal suggests that it could have been wind-blown or dispersed material and could therefore include charcoal from different origins in the assemblage. Three taxa were identified; *Quercus* (oak), *Corylus avellana* (hazel) and *Cytisus/Ulex* (broom or gorse). The latter indicates the presence of heathland type habitats.

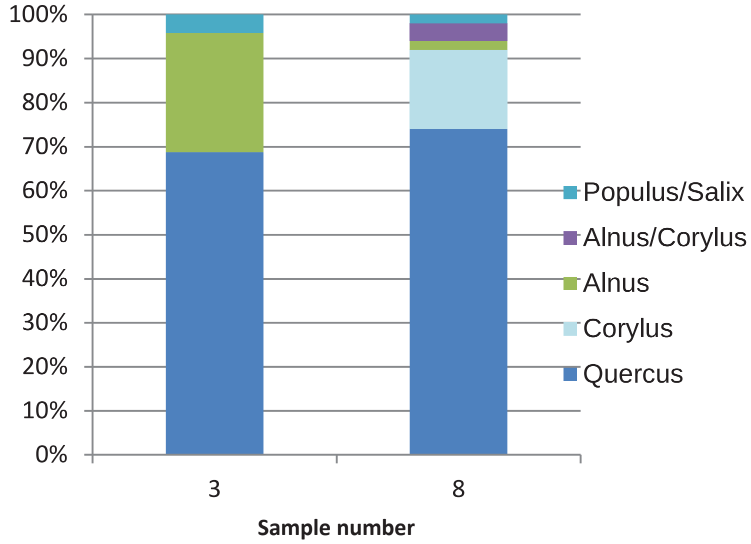
Table 11.4. Charcoal from Iron Age and medieval samples from Plot 3/2

		Mid Iron Age			Medieval	
Feature		Pit 32003	Pit 32014	Pit 32014	Corn drier 32009	
Context number		32016	32019	32021	32018	32018
Sample number		4	7	11	3	8
Quercus sp.	oak	9r	+	+	33hs	37hs
Alnus glutinosa Gaertn.	alder				13	1
Corylus avellana L.	hazel	41r		+		9r
Alnus/Corylus	alder/hazel		+	+		2
Populus/Salix	poplar/willow				2	
cf. *Populus/Salix*	poplar/willow					1
Cytisus/Ulex	broom/gorse		+			
Indeterminate					2b	

r=roundwood; h=heartwood; s=sapwood; b=burrwood; +=present

Corn drier 32009
The two samples from this feature both came from context 32018. It is apparent that *Quercus* (oak) was the dominant species of both assemblages and presumably represents the main fuelwood used to stoke the drier. There is a difference in the composition of the two assemblages in the quantities of *Alnus* (alder) and *Corylus* (hazel) (Figure 1). Sample 3 produced almost 30% alder with 0% hazel, compared to 2% alder and 18% hazel in sample 8. Hazel nutshells were recorded in both samples (Table 3), but it would be rash to suggest a correlation between the wood and nuts, which are most likely to have arrived on the site independently as fuel and food, although an association is possible. The charcoal shows that oak, including some mature wood (heartwood) was the preferred fuel, but that wet ground trees (alder and willow or poplar) were also being exploited.

Figure 11.1: Taxonomic composition of the charcoal from corn drier 32009 (based upon fragment count)



Discussion
The samples from this site divide into two groups belonging to the mid Iron Age (3rd-4th C. BC) and medieval (11th-13th century AD) periods, allowing some consideration of changes in crop husbandry through time in this area. The charcoal is less likely to reflect any changes in availability because the fuels used in the corn drier are likely to have been selective.

The Iron Age charred plant remains, largely from pit [32003], suggest that emmer was the main grain cultivated at the time with some barley (both naked and hulled varieties). Ploughing by ard may have been carried out with probably spring-sowing of the crops on acidic sandy soils including damper ones. Current archaeobotanical evidence also suggests that emmer was still an important grain during the Iron Age in north Wales. The medieval corn drier [32009] samples show that oat was the principal grain at the site during the 11th to 13th centuries AD, with limited evidence for free-threshing wheat and barley. The site lies on freely draining slightly acidic loamy soils which afford suitable conditions for the cereals and most of the weed species identified from both periods, although sandier soils occurring to the south along the coastal strip could also have been used, particularly for the rye, and possibly spring-sown oats, in the medieval period. The free-threshing wheat recovered from the medieval corn drier was perhaps being autumn sown on the heavier loams around the site. The presence of charred hazelnut shell and occasionally *Rubus* seeds suggest that the exploitation of wild food resources continued throughout both periods.

Hazel roundwood was the dominant fuel in the mid Iron Age samples with oak also present. Charcoal of broom or gorse suggests some local heathland, possibly on coastal sandy heaths, in the Iron Age. The dominance of oak in the medieval samples almost certainly reflects selective collection of oak for fuelling the corn drier, and this assemblage is unlikely to reflect the available wood fuel resources at this period. Hazel roundwood and alder, with a little poplar/willow indicate other tree sources, the alder and poplar/willow suggesting locally available stream side or marsh habitats.

The few hammerscale flakes recovered from the fills of mid Iron Age pit [32014] are certainly suggestive of iron smithing being carried out at the site.

Plot 3/10
This site comprised two burnt mound troughs from which three environmental samples were collected, two from the fills of trough [31001], and one from trough [31007]. Although the flots from the samples were dominated by charcoal (Table 11.5) two charred cereal grains were recovered from 310004, but were in too poor a condition to identify beyond wheat/barley (*Triticum/Hordeum*), and the very few charred weeds seeds and rare fragments of charred herbaceous stem were in too poor a condition to identify.

The charcoal was abundant in quantity but in a very poor condition and heavily infused with iron staining which obscured diagnostic characteristics. Five taxa were recorded (Table 11.5); *Quercus* (oak), *Alnus glutinosa* (alder), *Corylus avellana* (hazel), Maloideae (hawthorn group) and *Ilex aquifolium* (holly). Alder was dominant in two of the contexts (310003 and 310010), while context 310004 produced a more mixed assemblage with oak and hazel present in greater quantities than the others. Most of the wood had little or no ring curvature, with a few moderately curved fragments from 310004. Some oak heartwood was observed in the same sample.

The use of alder, sometimes exclusively, in burnt mound deposits has been recorded at other sites in Wales, notably at the A487 Felindre Farhog site (Challinor 2008), Troedrhiwgwinau (Caseldine and Murphy 1989) and Nant Farm, Porth Neigwl (Caseldine and Griffiths 2009). Alder is considered a poor wood fuel, but may have been readily available as burnt mounds are often located near to water sources, which provide an ideal environment for alder to flourish as it prefers wet ground. Holly will tolerate all except the wettest soil conditions, but the oak and hazel are likely to have come from drier ground.

Table 11.5. Charcoal and other charred plant remains from the samples from Plot 3/10

	Feature type	Burnt mound material from trough fills		
	Feature number	31001		31007
	Context number	310003	310004	310010
	Sample number	16	17	15
	Sample volume l.	10	9	7
Charcoal	Flot volume ml.	161	99	55
Quercus sp.	oak	6	13hr	2
Alnus glutinosa Gaertn.	alder	29r	14r	37
Corylus avellana L.	hazel		14r	
Alnus/Corylus	alder/hazel	8	6	7
Maloideae	hawthorn group	1		2
Ilex aquifolium L.	holly	1	3	
Indeterminate charcoal		5		2
Charred plants				
Triticum/Hordeum	Wheat/barley grain		2	
Indet. charred seed			+	+
Indet. charred herbaceous stems			+	

r=roundwood; h=heartwood; s=sapwood, + = present

Plot 3/14

Two pits of probable medieval date were excavated at this site and a single sample, <10> taken from context 314005 from large oval pit [314002]. Finds of slag, vitrified furnance lining and large quantities of hammerscale suggested iron smithing and a radiocarbon date on charcoal from <10> produced an 12th-13th century AD date for the fills.

As well as a reasonably large charcoal component a single oat grain, grass seed and a fragment of uncharred hazelnut shell were recovered (Table 11.6).

The charcoal assemblage was dominated by *Quercus* sp. (oak), of which most came from heartwood, with some evidence of slow growth. A single fragment of *Alnus glutinosa* (alder) was noted. The archaeological evidence indicates that the feature is associated with a smithy and the use of oak would be appropriate for such an activity. Iron smithing required the use of charcoal as fuel in order to achieve the high heat necessary, at least until coke became commonly used in the eighteenth century (Goffer 2007, 174), so most of this assemblage is likely to have been acquired from local charcoal burners, with only small amounts of wood being used as kindling to light the fire in the smithing hearth.

Table 11.6. Finds and charcoal from the sample from Plot 3/14

	Phase	Medieval
	Feature type	Black charcoal rich fill of

		314002-smithy!
	Context number	314005
	Sample number	10
	Sample volume l.	8.5
	Flot volume ml.	153
Charcoal		
Quercus sp.	oak	29h
Alnus glutinosa Gaertn.	alder	1
Charred plants		
Avena sp.	Oat grain	1
Poacae, small	Small grass seed	1
Others		
Corylus avellana	Hazel, uncharred nutshell	1
Punctum pygmaeum	Snail	1

r=roundwood; h=heartwood; s=sapwood

Plot 3/20

This site was a large undated ditch or erosion channel. Three samples were taken from the fills of this large feature and are thought to represent the erosional infilling of the feature from the surrounding slopes. Archaeological finds were limited to a little heat affected stone, a little vitreous slag, and a few flakes of hammerscale.

The environmental remains were even more limited, with very small flots, each producing a little charcoal, but with no further potential.

There is nothing from any of the samples that gives any clue as to the date of the feature, and none of the charred material was secure enough to be suitable for radiocarbon dating.

Table 11.7. Charcoal from the samples from Plot 3/20

	Feature type	Large ditch or channel		
	Feature number	320004		
	Context number	320006	320007	320012
	Sample number	112	113	114
	Sample volume l.	11.25	7.75	17
	Flot volume ml.	2	1	3
Charcoal		+	+	+

+ = present in small quantities

Plot 3/27

The site is this plot was represented by a small circular pit [327001] and a small shallow hollow [327002]. Both features contained burnt bone and were sampled . Cremated human bone was recovered from the samples and indicates that both features are likely to represent disturbed cremation burials. Radiocarbon dates obtained on the human bone have dated the features to the middle Bronze Age.

Table 11.8. Charred plant remains and charcoal from the samples from Plot 3/27

	Feature type	Cremation burial?	Cremation burial?
	Feature number	327001	327002
	Context number	327003	327004
	Sample number	13	14
	Sample volume l.	14.5	0.55
	Flot volume ml.	828	66
Charred plant			
Hordeum vulgare L.	Barley, hulled twisted	2	
H. vulgare L.	barley, hulled	8	
H. vulgare L.	barley, indet	4	
cf *H. vulgare*	?barley	36	
Cerealia	indet cereal grains	42	
Cerealia	Indet. cereal fragments <2mm	+++	
Corylus avellana	hazel nutshell fragments	+	1 (uncharred)

Atriplex/Chenopodium spp.	orache/goosefoots etc	1	
Spergula arvensis L.	corn spurrey	9	
Rubus fruticosus agg.	blackberry	50	
R. fruticosus/idaeus	blackberry/raspberry	20	
Prunus spinosa L.	blackthorn	2	
Prunus spp	shell fragments	+	
Vicia/Lathyrus sp(p).	vetch/tare/vetchling	1	
Fabaceae indet	small rounded legumes	4	
Plantago lanceolata L.	Ribwort plantain	7	
Fruit stone?	Indeterminate fragments	2	
Indeterminate seeds		++	+
Indeterminate	Herbaceous stems	+	+
indeterminate	herbaceous basal nodes/tuber fragments	++	
Indeterminate	Thorn fragments	+	
	TOTAL	157	
item density (per litre of processed soil)		10.8	
Charcoal			
Quercus sp.	oak	Xhr	Xr

X=dominant; h=heartwood; r=roundwood; + = present in small quantities
Item frequency: + =1-10; ++ = 11-50; +++ = 51-150; ++++=151-250; +++++ = 250+tems

Cremation [327001] fill [327003]
This sample produced a very large amount of charcoal and a small charred plant assemblage (157 quantified items). The charred plant remains consisted largely of cereal grains (40% of the counted items) poorly preserved and mainly unidentifiable but including evidence for six-row hulled barley, and *Rubus* seeds (45%), all the well-preserved *Rubus* seeds being identified as *Rubus fruticosus* (blackberry). There were other potential wild food residues represented by occasional hazel nutshell fragments and *Prunus spinosa* (sloe/blackthorn) fruit stones, possibly indicative of woodland/hedgerow/scrub vegetation close-by. The few wild plant/weed seeds included examples of the grassland plant *Plantago lanceolata* and the weed *Spergula arvensis*, the latter perhaps pointing to the use of well-drained sandy acidic soils for cultivation and the spring-sowing of crops. Other charred debris included a few herbaceous stem, basal node, tuber and thorn fragments.

Assuming the interpretation of the deposit as a cremation is correct, then there is a little debris to could indicate food offerings, although the few remains could perhaps have been incidentally incorporated into the deposits from background food processing activities.

Nothing of note other than the human remains and charcoal (appendices 9.1 and 11.2) was recorded from the small sample from hollow [327002].

Charcoal
The context for these two samples suggests that the charcoal and cremated human bone represents pyre debris. The charcoal was abundant in both samples, especially in sample 13, and the assemblages were entirely composed of *Quercus* sp. (oak) (Table 8). Thirty fragments were examined by fracturing in order to confirm maturity, but the whole assemblage was scanned which showed all of the charcoal appeared to derive from oak. The assemblage from sample 13 contained many tyloses, indicating that the wood came from heartwood and many fragments exhibited narrow growth rings, indicating slow growth. The charcoal from sample 14 was less well preserved, with smaller pieces which had characteristically fragmented along the rays into thin slivers and this made the examination of maturity less clear. A few roundwood fragments were recorded, with faint to moderate ring curvature.

Discussion
The use of oak in middle Bronze Age cremations is well attested at other sites. The apparent exclusive presence of oak in both samples (on the basis of the observed fragments, although other taxa may occur among the unstudied material) supports the inference that this charcoal derives from a pyre. Certainly, oak would provide the high calorific value required for efficient cremation and the use of slow grown heartwood indicates that mature wood was used, rather than young, coppice stems. The roundwood and charred herbaceous stems and thorns could derive from material used to light the fires.

The charred plant remains are a little more problematic, but the absence of charcoal of other species in the samples might argue against this material being background material from nearby food processing activities, since ‘domestic’ charcoal (ie more diverse in species composition) might also have been expected. The dominance of the food species in the charred plant assemblage (Table 11.8) with charred grain, hazel nutshell, blackberry seeds and sloe (blackthorn) stone and stone fragments could indicate feasting at the site in association with the funeral and/or food offerings thrown onto the pyres.

Plot 6/6
The site at this plot was a burnt mound of probable Bronze Age date and consisted of an arc of burnt stone and two intercutting pits. A spot charcoal sample (<21> from 66012) was taken from the earlier pit [66013], while the later pit [66011] fill (66010) and an overlying spread (66004) were bulk sampled, and a series of fourteen spot charcoal samples (<22> to <36>) taken from context 66010.

No archaeological finds were recovered from the bulk samples with the exception of fuel ash slag. One fragment of charred hazelnut shell was recovered from sample <19>. The large flots were dominated by charcoal.

Two of the analysed spot samples, <27> and <35>, were fragments of slow grown *Quercus* (oak) heartwood, and the third was *Corylus avellana* (hazel). The latter taxon dominated the abundant assemblage of charcoal from the bulk sample from the same context (66010, sample <20>). Some very large fragments, >30mm in size, were recorded from this sample and from sample <19> (context 66004) with minimum ages of 10+ years. There were no complete roundwood stems, but many of the fragments from 66004 exhibited moderate to strong ring curvature and the oak fragment identified (Table 9) was clearly immature with between 3 and 5 years growth. Infusion of sediment and iron staining inhibited further examination. It is notable that the assemblage from 66004 was taxonomically more diverse than 66010, with additional taxa such as *Alnus glutinosa* (alder), *Populus/Salix* (poplar/willow), Maloideae (hawthorn group) and *Ilex aquifolium* (holly). This indicates that a wet ground habitat was being exploited for fuel, in addition to drier woodland. However, the condition of the charcoal from 66004 prevented reliable differentiation between alder and hazel so the relative quantities of each genus are uncertain.

Table 11.9. Charred plant remains and charcoal from the samples from Plot 6/6

	Feature number	Pit 66011				
	Feature type	charcoal spread	pit fill	charcoal – spot samples		
	Context number	66004	66010	66010	66010	66010
	Sample number	19	20	26	27	35
	Sample volume l.	11.25	9.5			
	Flot volume ml.	522	357			
Corylus avellana	hazel nutshell		1			
Herbaceous stems	charred	+				
Punctum pygmaeum	snail		1			
Charcoal						
Quercus sp.	oak	1r	3		1h	1h
Alnus glutinosa Gaertn.	alder	8r				
Corylus avellana L.	hazel	1r	24r	1		
Alnus/Corylus	alder/hazel	9r	3			
Populus/Salix	poplar/willow	4r				
Maloideae	hawthorn group	3				
Ilex aquifolium L.	holly	1r				
Indeterminate		3				

r=roundwood; h=heartwood; s=sapwood

Plot 6/10
The site at this plot was a figure of eight shaped feature [610001], initially interpreted as a corn drier but re-assessed as an oven or fire pit. A single bulk sample was taken from context 610002, a charcoal rich fill of the feature. Very few archaeological finds; only three flakes of hammerscale. Although there

are no firm indications of date the hammerscale, if contemporary, and the emmer chaff (although only one fragment) might suggest a later prehistoric or Roman date.

The large charcoal rich flot included a single fragment of emmer wheat chaff, charred seeds of ribwort plantain, small seeded grasses, bramble/raspberry, medick/clover (*Medicago/ Trifolium* sp.), sedge (*Carex* sp.), cinquefoil (*Potentilla* sp.) and bugle (*Ajuga reptans*), with charred tubers and herbaceous stems. Most of these plants are indicative of damp grassland and may reflect the collection of herbaceous material for use as fuel or perhaps even the burning of animal dung. The only cereal evidence from this feature was a single emmer glume base, a cereal usually associated with the prehistoric period. The bulk of the flot is charcoal, with roundwood particularly abundant.
This charred plant assemblage is not typical of a corn drier in that there is no charred grain and very little chaff, but if the sample derives from the fire area/stoke hole, rather than the drying area, then this absence need not be contradictory.

Table 11.10. Charred plant remains and charcoal from the sample from Plot 6/10

	Site	Plot 6/10
	Feature number	610001
	Feature type	pit / corn drier
	Context number	610002
	Sample number	18
	Sample volume l.	6
	Flot volume ml.	455
Charred plants		
Triticum dicoccum	emmer chaff	1
Plantago lanceolata	ribwort plantain	+
Rubus sp.	blackberry/raspberry	+
Medicago/Trifolium sp.	medicks/clovers	+
Potentilla sp.	cinquefoil	+
Ajuga reptans	bugle	+
Poacea, small	small grasses	+
Carex sp.	sedge	+
Charred tubers and herbaceous stems		+
Charcoal		
Corylus avellana L.	hazel	1
Populus/Salix	poplar/willow	40r
Prunus sp.	cherry type	1
Ilex aquifolium L.	holly	4
Indeterminate	bark	4

r=roundwood; h=heartwood; s=sapwood; + = present

The sample produced abundant charcoal, with some large fragments. The assemblage was dominated by *Populus* (poplar) or *Salix* (willow), with the characteristic of heterocellular rays suggesting *Salix* is represented. The distinction between the two genera is not always considered reliable, especially in archaeological material (Gale & Cutler 2000). Rare specimens of additional taxa included *Corylus avellana* (hazel), *Prunus* sp. (cherry type) and *Ilex aquifolium* (holly). The *Prunus* appeared to have narrow rays of 1-3 cellular width, consistent with *P. avium* (wild cherry), but a confirmed identification to species level was not made as the fragment was small and not enough rays could be counted for certainty. Several of the *Populus/Salix* fragments exhibited moderate to strong ring curvature, including one with bark (but no pith) of 10 years growth. There were also several separate bark fragments.

The apparent dominance of a single taxon, willow/poplar, suggests a focussed selection of fuelwood, although this could reflect local availability. Willow is associated with wet ground habitats and stream side situations, and some species are easily propagated and grow rapidly, making it an easy resource for fuelwood. The associated charred plant assemblage is indicative of damp pasture, rather than 'wet' ground and the location of the site just 22m east of a stream could account for both the charred plant assemblage and the dominance of willow/poplar charcoal.

Plot 6/21

This site is a burnt mound spread sealing a small sub-circular pit [621008] of probable Bronze Age date. Four bulk samples were collected (Table 11.11), three from the spread (621003, 621004 and 621007), and one from the fill of the pit (621009). No finds were recorded. Apart from one fragment of charred hazelnut shell in sample <64> the relatively small flots produced only charcoal.

Two of the samples were selected for charcoal analysis but one of these (from context 621004) contained only a small amount of poorly preserved, small-sized charcoal fragments and was scanned but not analysed. This suggested that it was similar in character to the sample from context 621007, which was dominated by *Quercus* (oak), with some *Corylus avellana* (hazel). Two fragments of *Ilex aquifolium* (holly) were also recorded. The oak included some heartwood and fragments exhibiting slow growth.

Table 11.11. Charcoal from Plot 6/21

	Feature type	Burnt mound spread	Upper burnt mound spread	Upper layer of burnt fire cracked stone	Pit 621008
	Context number	621003	621004	621007	621009
	Sample number	62	63	64	65
	Sample volume l.	5.5	11	5.5	7.5
	Flot volume ml.	6	13	180	25
Corylus avellana	Charred hazel nutshell			1	
Indeterminate snail			+		
Charcoal					
Quercus sp.	oak		+	30hr	
Corylus avellana L.	hazel			18	
Alnus/Corylus	alder/hazel		+		
Ilex aquifolium L.	holly			2	

r=roundwood; h=heartwood; s=sapwood

The results are comparable to the burnt mound deposits from Plot 6/6, though with less evidence for the use of wetland species. Whether this is significant is difficult to judge on the basis of so few samples. Both sites lie close to modern canalised ditches or channelled streams which were probably former stream channels in prehistory. Of greater interest is the use (both here and in other Plots) of oak heartwood and the indications of slow growth. The laying down of tyloses to form heartwood can be variable but usually occurs in British oaks between 10 and 46 years (see English Heritage 2004). This suggests that the wood came from older, mature trees and not young coppiced stems. Additionally, the slow growth exhibited in the growth rings is not characteristic of coppiced stems. While the evidence must remain somewhat speculative, it suggests that the wood was sourced from un-managed woodland.

Plot 6/29.4

The site in this plot was a large burnt mound complex with pits, other features and natural hollows. This was the most extensive of the burnt mounds excavated along the pipeline and the most heavily sampled with 52 bulk soil samples collected and one charcoal sample (see Rackham and Giorgi 2012, Table 1). The radiocarbon results indicate that the site has an extended period of activity from the late Neolithic to the early Bronze Age, and with the fill of trough [4127] producing a late Bronze Age/early Iron Age date.

Very little archaeological material other than burnt stone was recovered from any of the samples and even burnt stone was not very abundant. Feature 4087, a 'hollow' in the natural clays beneath the horizon interpreted as a buried soil contained charred hazel nutshell in two of its samples and relatively high concentrations of charcoal, but little fired stone and only small proportions of unfired stone. This would appear to be an archaeological feature, but may predate the earliest burnt mound activity. The tertiary and quaternary fills of channel 4170 (samples 95 and 100) also suggest archaeological activity which might predate the burnt mound.

The flots indicate charcoal volumes varying between 1 and 1000ml, although generally less rich than the other burnt mounds sampled. Six of the 52 samples produced a fragment of charred cereal grain or hazelnut shell, with barley (*Hordeum vulgare*) being identified from two samples, one of these dating to the Late Bronze Age. Three samples produced some waterlogged plant remains with little apart from wood and bark surviving, although context 4140 produced seeds of birch, goosefoot, Cyperaceae, buttercup family and bugle, context 4142 produced uncharred hazelnut shell and birch seeds and context 4131 produced wood and a few insect fragments. Two other samples produced uncharred birch seeds that may have been contemporary.

Charcoal was abundant in all samples and in generally good condition, though quite fragmented. Sixteen of the larger charcoal assemblages were studied in detail. These included various burnt mound spreads, pit and trough fills, palaeochannels and tree hollows (Tables 11.12 and 11.13). The spreads and other deposits yielded a taxonomic range including *Quercus* (oak), *Betula* (birch), *Alnus* (alder), *Corylus* (hazel), *Prunus spinosa* (blackthorn) and Maloideae. Although this represents a higher diversity than recovered from other burnt mound sites, such as at Parc Bryn Cegin, Bangor (Schmidl *et al.* 2008), it is apparent from both fragment count analysis (Figure 11.2) and ubiquity analysis (Figure 11.3) that three taxa dominate the assemblages: oak, hazel and alder.

The pits from the site produced very little artefactual material or remains other than burnt stone suggesting that they also derived from the same activity as the burnt mound spreads. It is therefore not surprising that the assemblages are very similar, although with additional taxa, *Populus/Salix* (poplar/willow) and *Ilex aquifolium* (holly). Ubiquity analysis (Figure 11.3) shows a more marked use of alder in the burnt mound spreads.

Table 11.12. Charcoal from burnt mound deposits and other features from Plot 6/29.4

	Date								LBA-EIA
	Feature no.			4150	4195	4090	4118	4170	4127
	Feature type	Burnt mound spread	layer, S side	Burnt mound deposit	Burnt mound spread	Burnt mound deposit	tree hollow	Palaeochannel	Burnt mound trough
	Context no.	4049	4032	4151	4192	4071	4117	4171	4129
	Sample no.	66	101	102	106	53	67	100	70
Charred plants									
Hordeum vulgare	barley grain								1
Cerealia	Indet. grain frg								+
Corylus avellana	hazel nutshell								
Indeterminate seed									+
Charcoal									
Quercus sp.	oak	2r	15hr	5	10h	13hr	7	8rh	8h
Betula sp.	birch								3
Alnus glutinosa Gaertn.	alder	2	2	9	16r	32r		22r	19r
Corylus avellana L.	hazel	10r	12r	24r	18r	1	9		
Alnus/Corylus	alder/hazel	5		9	6	4	4		
Prunus spinosa L.	blackthorn			3r					
Maloideae	hawthorn group	11r							
Indeterminate			1						

r=roundwood; h=heartwood; s=sapwood; b=bark; +=present

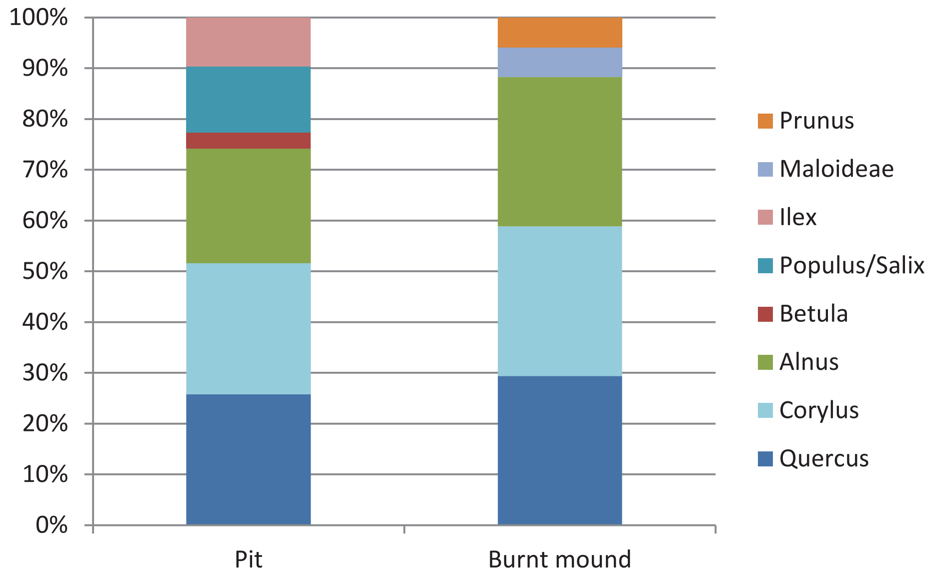


Figure 11.2. Taxonomic composition of pits and burnt mound deposits from Plot 6/29.4, based upon fragment count.

Other notable characteristics of the charcoal from this site included some evidence for high levels of vitrification in oak and alder, especially in burnt mound 4150 and pit 4103. Recent research suggests that vitrification in charcoal is not the result of burning at high temperature (McParland *et al.* 2010, 2686), but may relate to the state of the wood prior to combustion or specific conditions of combustion (Marguerie and Hunot 2007, 1421).

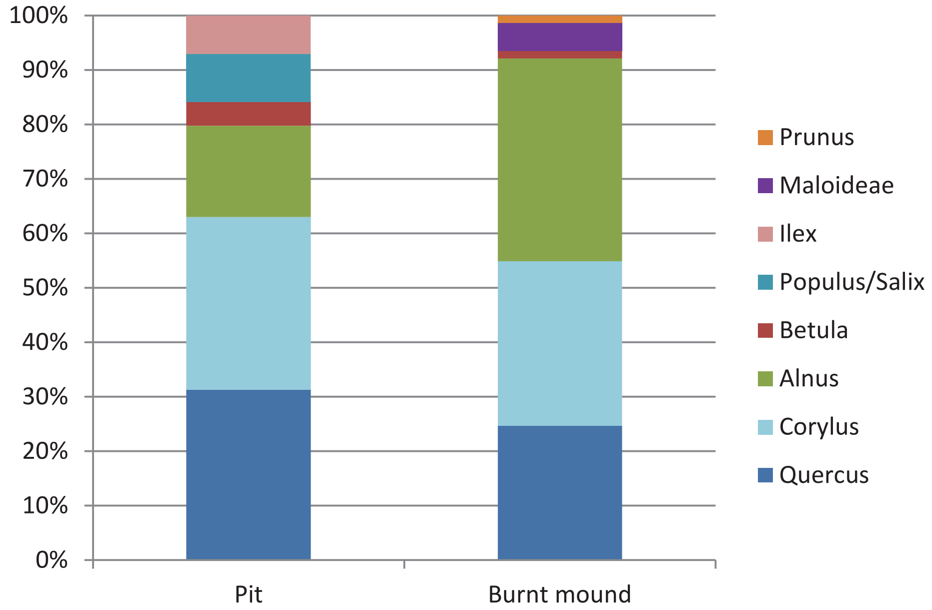


Figure 11.3. Taxonomic composition of pits and burnt mound deposits from Plot 6/29.4 based upon ubiquity analysis

Oak heartwood was recorded in many samples, with evidence of very slow growth in contexts 4151, 4071 and 4185. Moderate to strong ring curvature (roundwood) was noted in many samples, usually in a few fragments, with the exception of context 4023 from pit 4022, which produced many small diameter roundwood and bark fragments. Whole stems (with bark and pith) measured either as small twigs of 3-6 years at 4-8mm in diameter, or as slightly larger stems of 9-12mm and 5-14 years. Firewood of this size would produce a fast burn and it is interesting that little oak was recovered, perhaps suggesting a different activity for this deposit. A relative absence of stone in this sample (only

2% >7mm), the absence of burnt stone and its assignment to the ‘buried soil horizon’ perhaps supports this and could even indicate a date earlier than the burnt mound.

Table 11.13. Charcoal from pits from Plot 6/29.4

	Date	LNeo			LNeo			LNeo/EBA	
	Feature no.	4003		4022	4053	4103	4105	4111	
	Feature type	Pit	Pit	Pit	Pit	Pit	Pit	Pit	Pit
	Context no.	4010	4011	4023	4054	4104	4106	4112	4185
	Sample no.	46	47	71	56	69	57	59	116
Quercus sp.	oak	5h	1	1r	11hsr	29hr	7h	10h	7h
Betula sp.	birch								10
Alnus glutinosa Gaertn.	alder	20	3	2r	5	1	3	4	
Corylus avellana L.	hazel	3	19r	10r	11r	3	13r	10	3
Alnus/Corylus	alder/hazel	2	5		1	2	3	3	
Populus/Salix	poplar/willow		2r		2	14r		2	
Ilex aquifolium L.	holly			11r		1	4		
Indeterminate				6b				1	3b

r=roundwood; h=heartwood; s=sapwood; b=bark

In addition to the pits and burnt mound deposits, samples from two other features were recorded: a tree hollow (4118) and a palaeochannel fill (4170). The tree hollow contained only small fragments of charcoal, with *Quercus* (oak) and *Corylus* (hazel) positively identified, while the palaeochannel fill produced mainly *Alnus glutinosa* (alder). Some waterlogged roots of alder were also identified from the lower fill of pit 4103 (context 4131), confirming that the tree must have grown close by.

The pollen results from two studied sequences at the site (Grant 2013) probably start a little after the earliest burnt mound evidence but clearly show an oak and hazel woodland with a strong local alder element and some birch. The alder probably growing along the banks of the stream that runs to the east of the burnt mound and around the area of wet ground where peats have developed. The local availability of alder almost certainly accounts for its fairly high concentrations in several of the samples, and the stream side habitat was probably also a source for the willow/poplar wood. All the major wood species identified from the charcoal are represented in the pollen data, except for blackthorn and Maloideae although these could be accounted for by the undifferentiated Rosaceae pollen, so there is little indication that the fuel resources used for the hot stone technology were selective.

Plot 6/33

This site revealed two burnt mounds and three pits. One of the mounds [633012] has been radiocarbon dated to the late Neolithic, while a pit [633028] associated with mound [633015] has been dated to the early medieval period. A total of six samples were collected from mound [633012] - including one from a posthole, four from mound [633015] – including samples from pits [633028] and [633034], and a sample from pit [633010] some 26m east of mound [633015].

One sample, <37>, from mound [622012] produced a tiny chip of flint, and other than this and some fired or heat affected stone in most of the samples (see Rackham and Giorgi 2012) there were no finds. The flots were generally relatively large and almost exclusively charcoal (op cit.). Two samples produced one or two charred seeds, including a bramble/raspberry in posthole <39>. Sample <41> from mound 633015 produced two fragments of charred hazel nutshell. Seven of the samples with the larger charcoal assemblages were selected for detailed study (Table 14) including the early medieval pit, sample <48>.

This site produced the most abundant quantities of charcoal with several containing thousands of fragments and large pieces (>25mm in size). The condition was variable with some heavy iron staining. The Neolithic burnt mound assemblages are dominated by *Quercus* (oak) and *Corylus avellana* (hazel), with *Alnus glutinosa* (alder) dominating in one sample. If the medieval date for pit

[633028] is secure, it is interesting to note that *Corylus avellana* (hazel) and *Alnus glutinosa* (alder) continued to be utilised, but no *Quercus* (oak) was recorded. In general a similar range of taxa was identified as in the other burnt mound sites, including *Quercus* (oak), *Betula* (birch), *Alnus glutinosa* (alder), *Corylus avellana* (hazel), *Prunus spinosa* (blackthorn) and Maloideae, *Ilex aquifolium* (holly) and *Fraxinus excelsior* (ash).

Table 11.14. Charcoal from the samples studied for charcoal Plot 6/33

		Neolithic			Neo.	Medieval?		Med.
	Feature number	633012			633010	633015		633028
	Feature type	Burnt mound spread	Burnt mound spread	Burnt mound spread	Fill of pit	Sondage 1 in 633015	charcoal	Fill of pit 633028
	Context number	633005	633021	633019	633010	633024	633024	633029
	Sample number	38	49	50	43	42	117	48
	Sample volume l.	8	9.75	7	16	11.25	2	5.5
	Flot volume ml.	280	3000	504	150	615	1000	1200
Charcoal								
Quercus sp.	oak	33hs		29h	12hr	1rs		
Betula sp.	birch	2						
Alnus glutinosa Gaertn.	alder		1r	1	1	28r	3	7r
Corylus avellana L.	hazel	14	22r		14	12r	24r	21r
Alnus/Corylus	alder/hazel		5			5		16
Prunus spinosa L.	blackthorn		1					3r
Maloideae	hawthorn group							1
Ilex aquifolium L.	holly	1			2	4r		
Fraxinus excelsior L.	ash				1			
Indeterminate			1b				3b	2

r=roundwood; h=heartwood; s=sapwood; b=bark

The assemblages from spread 633012 exhibit some differences which merit discussion (Figure 11.4). Context 633019 was almost exclusively composed of oak, which also dominated context 633005. Some of the oak from context 633019 was highly vitrified, with narrow growth rings noted in the heartwood (of which many fragments were noted). In contrast, 633021 comprised mainly hazel or alder (probably hazel). The apparent absence of oak in this deposit would seem to be unusual, and it may be explained if it is considered that this represents an individual dump of spent firewood, i.e. in contrast to other burnt mound spreads (as at Plot 6/29.4) which may represent multiple burning events.

The single fragment of *Fraxinus* (ash) from pit [633010] is noteworthy as this was the only identification of this taxon anywhere along the pipeline plots. Ash is considered a colonising tree and associated with open areas, often in clearances. Since it makes an excellent fuelwood, it seems unlikely that it can have been very common in the oak-hazel dominated landscape.

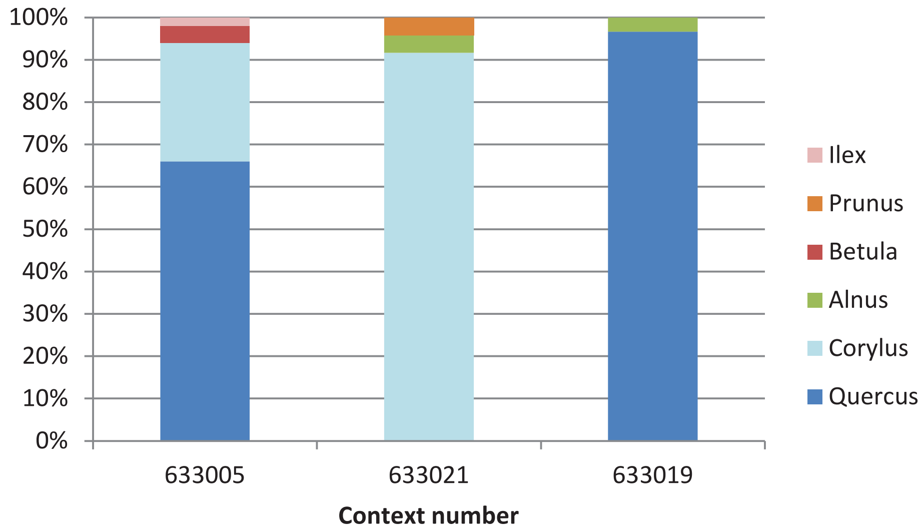


Figure 11.4. Taxonomic composition of assemblages from burnt mound spreads 633012 (based upon fragment count)

Plot 6/51

A six litre sample was collected from a clay deposit in Plot 6/51 where shells were visible. The deposit was not associated with any archaeology but was thought to possibly reflect a former shoreline and possible salt marsh deposits. A small sample of shells was also collected from the same context, 651001.

The bulk sample produced an organic flot, with wood, waterlogged seeds, numerous herbaceous stems, moss and leaf fragments, snail shells, insects and a little charcoal. The wood includes roundwood and small stems, while moss and leaf fragments, grass and birch (*Betula* sp.) seeds are present with a few beetle fragments. The mineral residue of the sample is composed of waterworn shalley slate. The snail and mollusc shells include tellens, small cockles, rough winkle (*Littorina saxatilis*), flat winkle and *Hydrobia ulvae*, the latter in thousands. On the basis that the mollusc shells give a convincing interpretation of this location lying close to a former marine strand line no work was undertaken on the waterlogged plant and insect remains.

Plot 7/1

A single soil sample was collected from a small shell midden deposit in Plot 7/1, and a collection of shells made during excavation of the deposit, which has been dated by radiocarbon analysis to the early to middle Iron Age. The deposit overlies a possible hearth or fire site, and shells from the site suggest that it was a shell processing site.

The first flot included some organic debris and was kept wet, although only wood, birch and bramble/raspberry seeds have been recorded uncharred. Bramble/raspberry was also recorded charred. Charcoal is present in both flots. A few terrestrial snails are present including *Discus rotundatus, Oxychilus cellarius, Punctum pygmaeum*, Clausilidae and *Aegopinella* sp.. These suggest a shaded or woodland environment (Evans 1972; Davies 2008).

Table 11.15. Charred plant remains from the sample from Plot 7/1.

Context	71002
Sample no.	44
Sample volume l.	27.75
Flot volume ml	100+40wet
Charred plants	
Rubus sp. blackberry/raspberry	+
Charcoal	+
Waterlogged remains	
Wood	+
Betula sp. birch seed	+

Rubus sp. blackberry/raspberry	+
Charcoal	
Quercus sp. - oak	16h
Corylus avellana L. - hazel	29r
Alnus/Corylus - alder/hazel	5

The shell midden contained some waterlogging, with the preservation of small rootwood, some identified as *Prunus* sp. (blackthorn/cherry). Charcoal was also preserved, although the material was quite fragmented. Two taxa were identified: *Quercus* sp. (oak) and *Corylus avellana* (hazel). Some of the oak exhibited tyloses and moderate to strong ring curvature was observed in some of the hazel fragments. The description of this deposit as a shell midden, and the presence of a few plant remains suggests that the charcoal derived from spent domestic fuelwood. Clearly, this had been sourced from local oak-hazel woodland.

The site appears to be an Iron Age shell processing site where the shells were probably boiled, but on the basis of the organic component and the terrestrial snails, and its height at about 5m OD it was set back from the coast, perhaps in local woodland at the northern foot of Moel-y-gest fringing the western edge of the bay before reclamation of Traeth Mawr.

Plot 14/7

The deposits at Plot 14/7 reflected alluvial floodplain sediments of the Afon Dwyryd, but a deposit composed largely of preserved timber and branches was excavated at a depth of between 0.9 and 1.1m below the modern ground surface. Although no samples of the deposit were collected a selection of wood and timber pieces, several worked, and a small collection of 33 hazelnuts was gathered by hand during excavation. All bar one of the nutshells are intact, and the single broken shell appears to have broken naturally possibly during or since excavation. The site was dated to the medieval period, at which time it is very unlikely that hazel woodland would have been growing on the river flood plain, the nuts are therefore unlikely to have fallen into the naturally river and collected amongst the timber. It is therefore more probable that the hazelnuts were brought in on cut branches used in the structure. The branches are likely to have been cut on the slopes of the valley sides and the presence of the nuts suggests that they were cut in autumn, but early enough in autumn that the nuts and the leaves were still on the branches. Branches with leaves would help to make a reasonable temporary surface for a trackway.

The character of the recovered wood pieces suggests that this deposit may have been laid, rather than the natural infilling of a palaeochannel, and late 13th-14th century AD radiocarbon dates perhaps indicate a foundation for a routeway across the floodplain to the river in the medieval period.

11.4. Discussion and synthesis

The environmental evidence from the archaeological sites along the pipeline was fairly limited, largely due to the character of the archaeology, but also in part a product of the local soil conditions and the survival of the evidence. Animal bone was only recovered from two situations; a few calcined fragments of animal bone survived due to their burning on Plot 3/2 in association with Iron Age settlement activity and a medieval corn drier, and an unburnt cow cranial fragment and two rib fragments were recovered on the floodplain of the Afon Dwyryd. Soil conditions were generally unsuitable for bone survival along the whole pipeline route but it may be that many of the sites, particularly the burnt mounds, had little or no bone deposited on them anyway. The survival of unburnt bone on the floodplain at Plot 14/7 perhaps indicates a relatively recent date for this material.

The bulk samples produced very few charred plant remains with the exception of a few rich assemblages from Plot 3/2 and one of the cremation samples from Plot 3/27. These two sites produced samples from the middle Bronze Age, the mid-Iron Age and the medieval period, while occasional identified cereals and weed species from the other sites afford a little data to broaden the picture. These data do not allow any in depth analysis, but do show some changes of crop type through time. The charcoal affords the greatest potential for considering any changes through time and additionally the functional selection of fuel resources.

Late Neolithic and Bronze Age
Deposits of late Neolithic and Bronze Age date produced limited charred plant assemblages. Hazel nutshells were recorded from late Neolithic or Early Bronze Age deposits of the burnt mounds at Plots 6/29.4 and 6/33, the probable Bronze Age burnt mounds at Plots 6/6, 6/10 and 6/21, and the middle Bronze Age cremations in Plot 3/27. Charred barley grain was found in very small numbers at the burnt mound in Plot 6/29.4 and more abundantly in cremation 327003 in Plot 3/27 where hulled barley (*Hordeum vulgare* L.) was specifically identified, and emmer wheat (*Triticum dicoccum*) chaff was recorded at the burnt mound in Plot 6/10, while undetermined cereal grain (*Triticum/Hordeum*) was recovered from the burnt mound in Plot 3/10. Frequent finds of charred blackberry seed and two fruit stones of sloe in the cremation sample raises the possibility of food offerings, or perhaps 'feasting' at the cremation.

Occasional other plant species have been identified from the charred seeds, *Plantago lanceolata* (ribwort plantain), *Rubus* sp. (blackberry/raspberry), *Ajuga reptans* (bugle), *Carex* sp. (sedge), *Potentilla* sp (cinquefoil), *Spergula arvensis* (corn spurrey), *Atriplex/Chenopodium* sp (orache/goosefoot), *Vicia/Lathyrus* sp. (vetch/tare/vetchling), *Medicago/Trifolium* sp. (medick/clover) and occasional small grasses. Uncharred seeds of *Betula* sp. (birch), *Chenopodium* sp. (goosefoot), *Ajuga reptens* (bugle), *Ranunculus* sp (buttercup family) and Cyperaceae are recorded from a waterlogged sample from the burnt mound of Plot 6/29.4. These occur so infrequently and in such low numbers as to allow little interpretation, and apart from suggesting weeds of the cereal crops and pasture give little information.

The charcoal assemblages have proved more useful. The largest assemblages of charcoal from the separate plots along the pipeline were phased to this period. Only a few samples, however, were radiocarbon dated, although it is likely that the majority of the burnt mound features are Late Neolithic/early Bronze Age and middle Bronze Age in date. Analysis comparing the phases was not productive due to the paucity of dated features, so the following discussion relates to the late 3rd and 2nd Millennium BC as a whole, unless specifically stated otherwise. Ubiquity analysis on the 31 samples dating to this period shows the dominance of three taxa: oak, hazel and alder (Figure 5). The dataset has been presented with and without the middle Bronze Age cremation contexts included as these represent 'short-term' deposits which are not considered suitable for environmental reconstruction (Asouti and Austin 2005, 3), although Figure 5 shows that there is little significant change to the overall picture.

According to the criteria set out by Asouti and Austin (2005), the best contexts for examining frequency of taxa within the local landscape are domestic contexts, of which very few are present in the dataset along the pipeline. However, it is quite likely that the burnt mound deposits represent long term deposition although whether they originated from deliberate selection processes is discussed below. In any case, the picture that emerges from this charcoal record is essentially consistent with the regional environmental picture provided by pollen evidence (Caseldine 2011; Grant 2013): oak-hazel woodland, with alder, which would have grown in areas of wet ground conditions, such as adjacent to streams.

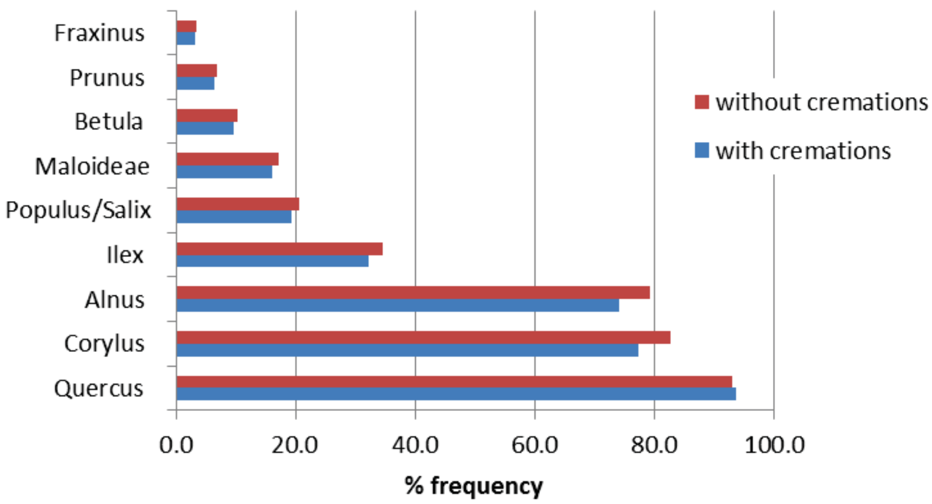


Figure 11.5. Percentage frequency of charcoal taxa for the Late Neolithic and Bronze Age

Cremations
The two middle Bronze Age cremation deposits from Plot 3/27 were composed entirely of oak, including some heartwood fragments. The use of oak in cremations is common in the Bronze Age, and has been recorded at other sites in North Wales, such as Brenig (Keepax 1993). Not only does oak provide the high calorific heat necessary to cremate a human body, the wood is also easy to split for use in pyre structures and/or coffins (Gale and Cutler 2000, 204-5). It has also been suggested that the predominance of a single taxon is of ritual significance and that it may have been that a single tree was purposely felled for such occasions (Thompson 1999, 253). Certainly, the assemblages from Plot 3/27 indicate a deliberate and focussed selection of fuel, especially when compared to the taxonomic composition of other Bronze Age features along the pipeline (Figure 6). This is not a false representation created by the variance in numbers of samples for each feature type, since every one of the non-cremation assemblages produced more than a single taxon (with an average of 3.3 for the burnt mounds and 4 for the pits). It is also interesting that context-related variation was evident at Brenig, where cremated bone deposits were associated with oak but pit deposits contained alder, hazel and birch (Brittain 2004).

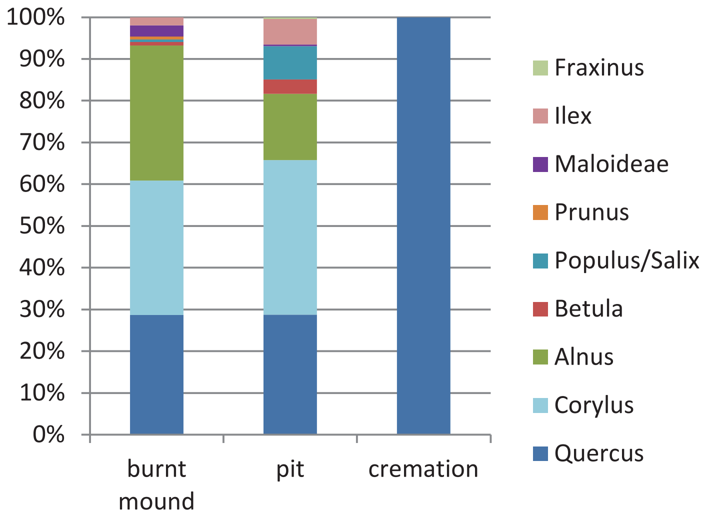


Figure 11.6. Comparison of charcoal assemblages from the Late Neolithic and Bronze Age feature types

Burnt mounds
The common association of burnt mounds with water sources (Barfield and Hodder 1987) may explain the widespread use of alder in the samples along the pipeline. Alder is considered a poor fuelwood unless well-seasoned (Edlin 1949, 158) and there are three possible explanations for the use of this species.

Alder was utilised, in spite of its lower calorific value, because it was easily available (close by and plentiful).
The wood had been converted to charcoal (alder charcoal makes an excellent fuel, as does holly).
The wood was well-seasoned.

A final possibility is that there was some ritual association of hot stone burning with alder. There was less alder present in the pit deposits and none in the cremations (Figure 6), but in the absence of a dataset of domestic fuel, it cannot be adequately compared to other fire types. It may be significant that some burnt mound deposits elsewhere are almost exclusively associated with alder wood (see above for references), which is rare for domestic type assemblages.

Alder is commonly used in areas where other sources of wood are not readily available. For instance, alder-dominated cremations of late Bronze Age date have been recorded in South Hornchurch, Essex (Gale 2000, 347-8) and Dartford, Kent (Challinor 2011, 274). Gale points out that since alder is a lightweight fuel its use indicates a scarcity of other fuel supplies. At the Roman cemetery at

Brougham, Cumbria, it is assumed that the selection of alder was dictated by the availability of local woodland resources and that some birch wood was required to help ignite the slow burning alder (Campbell 2004, 270). The general indications from the charcoal record along the pipeline does not suggest that oak and hazel were in decline, although there may be some differences according to the location of the individual plots (Figure 7). Plot 3/10 which produced a large quantity of alder is lower-lying than the others, but nonetheless in a dry area and some distance from the nearest river. It is possible that less woodland occurred in this locality close to the coast and the woodland fringing the river and any wetland areas near the estuary of the Afon Wen contained more alder. Unsurprisingly, there is a large quantity of alder from the palaeochannel in Plot 6/29.4, and a reasonable amount from the burnt mound there. However, there is no indication of a shortage of oak or that any form of woodland management was taking place.

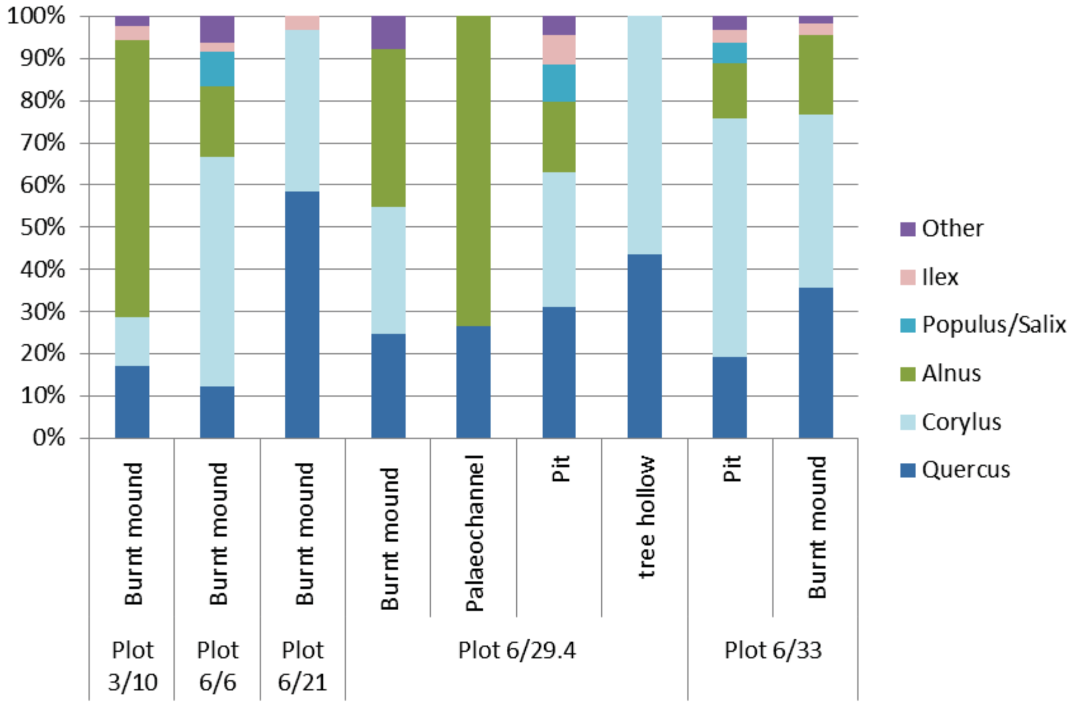


Figure 11.7. Analysis of Late Neolithic and Bronze Age charcoal by plot and feature type (based upon fragment count and excluding cremations; the 'Other' category includes taxa of less than 2%)

The conversion of wood to charcoal is a time-consuming and costly process, unlikely to be employed unless necessary. Evidently, the necessity of using charcoal would depend upon the activity and circumstances. If burnt mounds result from cooking, it is very unlikely that charcoal would have been utilised and the relative absence from the samples of charred food plant remains and their associated taxa suggests that this is not a likely interpretation. The use of hot stones for sweat baths or saunas is perhaps a more plausible interpretation. Modern saunas use charcoal as a heat source to which water is applied directly, but the evidence for the burning of stones does not indicate that this was occurring in the Bronze Age in which case charcoal fuel would not have been necessary.

There are two factors in favour of the idea that the wood was well-seasoned. Firstly, the build-up of burnt mound deposits suggest that this occurred over some time, in which case the need for wood in that location would be anticipated. It may be that there was an aspect of seasonality to both the activity itself and the collection and stacking of firewood. Secondly, the presence of insect tunnels in several of the charcoal fragments indicates that the wood had been sitting around dead for a period prior to burning, although this could also be interpreted as the use of fallen deadwood rather than deliberate seasoning.

Ultimately, a combination of factors probably led to the selection and utilisation of wood taxa in the burnt mound assemblages including, but not limited to, *ad hoc* collection, more deliberate storage and seasoning practices and potentially a ritual association. While we do not know whether the activities conducted at these sites are seasonal or not their ubiquity across the country indicates that the fuel resources needed are likely to have been collected at the most convenient time. Winter harvesting of wood for the burnt mound fires would be preferable to harvesting when the trees are in leaf, and would allow the timber to stand and season (dry out) prior to use, thereby improving the burning quality and heat generation from the fires. Grant's (2013) study of the pollen from Plot 6/29.4 suggests episodes of disturbance and subsequent regeneration of the oak and hazel woodland during the 2nd millennium BC that could be linked in part to the exploitation of the local resources for the burnt mound activities, but these would have to be very substantial to have anything more than a local impact, unlike woodland clearance for agriculture which tends to be cumulative and is rarely followed by episodes of woodland regeneration.

The Iron Age

Only two sampled sites along the pipeline produced evidence for Iron Age activity, two pits of probable domestic character in Plot 3/2 and a shell midden (Plot 7/1) probably located on the edge of woodlands fringing the former estuarine bay of the Afon Glaslyn dated to the early to middle Iron Age. Apart from the marine shells, which reflect a reliance on cockles suggesting easy access to tidal sands in the bay, with limited periwinkle, and even rarer oyster and mussel shell fragments there is little evidence for domestic occupation. A few charred and uncharred *Rubus* seeds (blackberry/raspberry), uncharred birch seed and wood fragments, with a quantity of charcoal and underlying burnt deposits that suggest the cockles were being boiled on site. This may have been a processing site close to the shore rather than a habitation. The terrestrial mollusc shells clearly suggest a woodland habitat while the abundant hazel and oak charcoal suggest a 'typical' oak/hazel woodland fringing the bay.

The middle Iron Age pits in Plot 3/2 included two of the richest deposits for environmental evidence along the whole pipeline route. The charred plant remains, largely from pit [32003], suggest that emmer (*Triticum dicoccum*) was the main grain cultivated at the time with some barley (*Hordeum vulgare*, both naked and hulled varieties). Traces of both spelt wheat (*Triticum spelta*) and possible free threshing wheat (*Triticum aestivum*) occur. Ards may have been used to work acidic sandy soils including damper ones while spring-sowing of crops may have been practiced, although the typical soils in this area, free draining slightly acidic loamy soils typically exploited for arable and grassland at the present day, would be suitable for these crops. Current archaeobotanical evidence also suggests that emmer was still an important grain during the Iron Age in north Wales. A relatively high proportion of chaff in one of the pit fills suggests that the earlier stages of crop processing were being carried out on the site. Occasional hazel nutshell indicates the continued exploitation of this wild resource from the woodlands and hedgerows. The presence of the charred cereals and other remains suggest that the charcoal assemblages derived from domestic type fires in which oak and hazel were commonly utilised.

The charcoal assemblages from these two sites suggest that oak and hazel woodland is still available in the landscape in the middle Iron Age a continuation of the wooded landscape of the Bronze Age, although we have no data that would allow us to assess the extent of the woodland. Grant's (2013) study of the pollen from the site in Plot 6/29.4 suggests declining oak woodland in the later Iron Age, but cycles of woodland disturbance and subsequent regeneration in the second and earlier first millennium BC. These may be local to Plot 6/29.4. It is tempting to speculate that the apparent absence of alder from these two sites lends support to the idea of a ritual association of alder with burnt mounds, but the dataset is really too limited for such an interpretation, which could easily be accounted for by a local lack of alder near both sites.

A third undated site in Plot 6/10, an oven or fire pit, may date to the Iron Age. A single sample from this site produced emmer chaff, and a similar range of weed species to those recorded in the earlier prehistoric deposits (Table 10). The charcoal assemblage is dominated by willow/poplar which differs significantly from the burnt mound assemblage from Plot 6/6 just 250m to the west. The site lies just 22m from a modern stream flowing in a small flat bottomed valley with rough pasture and rushes indicating a damp area which may well have supported willow carr in the past.

A little hammerscale in the samples from Plot 3/2 suggests iron smithing at this site in the middle Iron Age. The few flakes of hammerscale in the sample from Plot 6/10, in a landscape devoid of any recent habitation would indicate smithing at this site too, although whether of Iron Age date or later is not known.

Medieval

Although a number of sites were assigned to the medieval and post-medieval periods only three of these were sampled - the corn drier in Plot 3/2, a smithy in Plot 3/14, and a pit (633028) in Plot 6/33, apparently associated with the burnt mound but not sealed by it, has produced a radiocarbon date placing the fill in the early medieval period.

The corn drier [32009] samples show that oat was the principal grain during the 11th to 13th centuries, at least at this site, with limited evidence for free-threshing wheat, rye and barley. The freely draining slightly acidic loams developed on the silt and clay rich tills along the coastal strip are quite suitable for the cultivation of oats and other cereals, although rye is more often associated with soils prone to droughty conditions. The oats may have been spring-sown, while the free-threshing wheat could have been autumn-sown. Hazel nutshell fragments are present in three of the four samples indicating the continued gathering of this local resource for food. A single seed of common vetch is recorded from the corn drier. This species was cultivated for animal fodder from early medieval times and Campbell (1988) has illustrated its use, based on documentary evidence, across England in the 13th and 14th centuries. The species is native, particularly in coastal areas on heathland, maritime sands and shingle, and its occurrence here along with a number of seeds of smaller legumes and arable weed species suggests that it could have arrived as a weed with the cereals, although cultivation as a fodder crop cannot be ruled out. The corn drier was fuelled predominantly by oak, with alder and hazel roundwood, and occasional poplar/willow, an assemblage similar to those from many of the prehistoric samples.

The large quantity of metal working debris, particularly hammerscale and iron concreted matter, in a sub-rectangular pit in Plot 3/14 indentifies this as directly related to a smithy, which dating has placed in the 11-12th century. A single oat grain and a piece of uncharred hazel nutshell appear consistent with the rich samples from the corn drier, but the charcoal assemblage is completely dominated by oak, with just a single fragment of alder present. This suggests a much greater selectivity in the fuel used in the smithy, which would have traditionally used charcoal rather than wood. The fact that most of the charcoal derived from heartwood supports the interpretation that it arrived as charcoal rather than wood and was presumably supplied by charcoal burners operating in the local woodlands.

There was nothing about the deposit in Plot 6/33 that produced an early medieval date that differed from the neolithic samples at this site. The charcoal assemblage lacks oak, and is dominated by hazel, but this is true of two other samples from the site, including one from the burnt mound spread. With the evidence from other sites along the pipeline the charcoal assemblage could fit quite happily in either the Neolithic or the medieval periods, which serves to illustrate that collectively our evidence shows no apparent change in the woodland composition between the Neolithic and the medieval periods, although selective use of certain species is evident in some contexts and may have occurred in others although we are unaware of why.

11.5. Conclusions

The recorded archaeological sites along the pipeline all lie over mudstone and siltstone bedrock with no sites other than peats and ‘drains’ recorded on the igneous extrusions that cross the route. The burnt mound sites exploited these rocks for their hot stone technology, probably collecting them from the local stream and river beds. The very sparse occurrence of food remains in the samples from the burnt mounds and associated features would argue against any feasting or cooking activities at these sites. The wood fuels used to heat the stones appear to be drawn from the local woodlands, with oak and hazel predominating, but occasional samples dominated by alder, no doubt a common tree along the banks of the streams and rivers near which most of the sites are located. While different samples may be dominated by a single species it is difficult to argue for selectivity of fuel, and it may be that these assemblages reflect the local availability of suitable and harvestable wood. The altitudinal changes between the burnt mounds from 10m OD to 80m OD is not sufficiently great as to influence the composition of the woodland, and an oak and hazel woodland with local stands of alder along river and stream banks, and bordering areas of wetland would fit with the pollen evidence. The frequency and size of many burnt mounds indicates a constant or repeated need for fuel to heat the stones, and whether this activity is seasonal or not, the predictable need for this fuel would surely have led to the wood being harvested in the winter when the trees are leafless and stacked against need later in the year. Harvesting of one tree could produce enough fuel for an ‘event’ at the site and account for the single species assemblages, while lopping, pollarding and coppicing could produce a mixed store.

There was no evidence for woodland management in the samples, but the harvesting need not have been ‘managed’. The occasional occurrence of insect boreholes implies the use of dead wood, although whether lying on the woodland floor or stacked to season and dry we cannot say.

In contrast to the burnt mound assemblages the middle Bronze Age cremation pyres were fuelled by oak heartwood and roundwood, indicating the specific selection of fuel for this activity, and reflecting the need for a fuel that can burn hot enough to cremate a body. The pyre would be more efficient if the wood had been stacked and dried prior to use, but perhaps the unpredictability of death did not allow this. The finds of charred barley grain, hazel nutshells, blackberries and sloe stones in the cremation deposit might indicate food offerings, or perhaps ‘feasting’ at the funeral.

The Iron Age and medieval charcoal assemblages indicate the same range of species, and the same dominance of oak and hazel, suggesting no significant change to the composition of the woodlands. The identification of largely oak in the medieval smithy sample clearly indicates selectivity for these activities, and the dominance of oak heartwood suggests that the fuel was supplied as charcoal. The medieval corn drier was also largely fuelled with oakwood, but a range of other taxa were present.

There are clear indications of the changing importance of cereals through time. Emmer wheat and barley are recorded from the Bronze Age deposits and continue to be dominant into the middle Iron Age, when spelt, free threshing wheat and oats first appear. In the medieval samples oats dominate the cereal assemblages with free threshing wheat, barley and rye making an appearance. This is a pattern found elsewhere in North Wales, with emmer tending to survive later than in England and oats dominating the medieval assemblages. The relatively high chaff content of one of the middle Iron samples from Plot 3/2 suggests crop processing on the site of cereals grown in the immediate locality. The other charred remains allow us little consideration of the husbandry of the crops, although spring and autumn sowing have been suggested. The soils along the southern coastal edge of the Llyn peninsula are fairly well suited to the cultivation of all these cereals, tending to be loamy and freely draining rather than heavy clays.

Two of the sites have given us some clue as to the former coastlines in Traeth Mawr. The undated site at Plot 6/51 clearly has evidence for a strand line, probably marking the extreme western edge of the former saltmarsh zone that must have surrounded this area of reclaimed land. The Iron Age shell midden located at about 5m OD in Plot 7/1, may not mark the contemporary coastline but is unlikely to have been sited very far inland. It occurs at the base of the fairly steeply sloping northern face of Moel-y-Gest and the evidence would suggest that this was probably covered in an oak and hazel woodland.

East of the site in Plot 7/1 the archaeological evidence is minimal and no environmental samples were taken although a few hazel nutshells were collected at Plot 14/7. We therefore have no data for the valley of the Afon Dwyryd or the uplands between Rhyd-y-Sarn and Blaenau Ffestiniog, the whole of the eastern half of the pipeline route.

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11.7. Appendices

Appendix 11.1: Samples taken for environmental analysis, in sample number order.

site	sampl e no.	Cont. no.	Sample vol. in l.	Sample wt kg.	feature	prov. Phase	description
Plot 0/3	1	03003	9.25	12.75	03005	ukn	Fill of pit or gully 03/005
Plot 3/2	2	32002	9..25	16	32009	Med	Fill with charcoal – corn drier
Plot 3/2	3	32018	20.25	30.25	32009	Med	Basal fill of corn drier
Plot 3/2	4	32016	7..5	14	32003	Med	Red burned sand in 32003
Plot 3/2	5	32012	5.75	12	32003	Med	Brown fill of 32003
Plot 3/2	6	32013	5.75	11	32014	Med	Check for magnetic residue
Plot 3/2	7	32019	11.25	16.25	32014	Med	Check for magnetic residue
Plot 3/2	8	32018	9.25	18	32009?	Med	Charcoal rich layer in corn drier
Plot 3/2	9	32020	9. 5	17.25	32009	Med	Base of N chamber of corn drier
Plot 3/14	10	314005	6	8. 5	?	Post-med?	Black charcoal rich fill of 314002-smithy?
Plot 3/2	11	32021	7	9.75	32014	Med	Lining deposit in pit 32014
Plot 3/2	12	32022					stone
Plot 3/27	13	327003	14. 5	20.25	327001	Med	Burnt soil and bone - ?cremation
Plot 3/27	14	327004	550	978.4	327002	ukn	Burnt soil and bone - ?cremation
Plot 3/10	15	310010	7	7	31007	BA	Burnt mound material from trough fill
Plot 3/10	16	310003	10	13	31001	BA	Burnt mound material from trough fill
Plot 3/10	17	310004	8. 5	9	31001	BA	Burnt mound material from trough fill
Plot 6/10	18	610002	6	7	610001	Med	Charcoal rich fill of shallow pit 610001, also contains 610003 and 610004, possible corn drier
Plot 6/6	19	66004	11.25	12	66011	BA	Deposit of charcoal spread
Plot 6/6	20	66010	9. 5	14	66011?	BA	Mid grey silt and burnt stone
Plot 6/6	21	66012			66013	BA	Charcoal – spot sample
Plot 6/6	22	66010			66011?	BA	Charcoal – spot sample
Plot 6/6	23	66010			66011?	BA	Charcoal – spot sample
Plot 6/6	24	66010			66011?	BA	Charcoal – spot sample
Plot 6/6	25	66010			66011?	BA	Charcoal – spot sample
Plot 6/6	26	66010			66011?	BA	Charcoal – spot sample
Plot 6/6	27	66010			66011?	BA	Charcoal – spot sample
Plot 6/6	28	66010			66011?	BA	Charcoal – spot sample
Plot 6/6	29	66010			66011?	BA	Charcoal – spot sample
Plot 6/6	30	66010			66011?	BA	Charcoal – spot sample
Plot 6/6	31	66010			66011?	BA	Charcoal – spot sample
Plot 6/6	32	66010			66011?	BA	Charcoal – spot sample
Plot 6/6	33	66010			66011?	BA	Charcoal – spot sample
Plot 6/6	34	66010			66011?	BA	Charcoal – spot sample
Plot 6/6	35	66010			66011?	BA	Charcoal – spot sample
Plot 6/6	36	66010			66011?	BA	Charcoal – spot sample
Plot 6/33	37	633004	10	17	633012	BA	Burnt mound spread
Plot 6/33	38	633005	8	15.75	633012	BA	Burnt mound spread

site	sampl e no.	Cont. no.	Sample vol. in l.	Sample wt kg.	feature	prov. Phase	description
Plot 6/33	39	633009	2	5	633008	BA	Fill of posthole/pit 633008
Plot 6/33	40	633004	1. 5	3	633012	BA	Burnt mound spread
Plot 6/33	41	633024	7. 5	13	633015	BA	Charcoal fill of 633015 – sondage 2
Plot 6/33	42	633024	11.25	18.5	633015	BA	Fill of 633015 sondage 1
Plot 6/33	43	633010	16	22.25	633010	BA	Fill of pit
Plot 7/1	44	71002	27.75	29		ukn	Deposit of shell midden
Plot 6/29.4	45	6294006	3.75	8.5	6294002	BA	Charcoal deposit from pit 6294002
Plot 6/29.4	45 *	6294002	31	42	6294002	BA	Pit fill
Plot 6/29.4	46	6294010	2	4. 5	6294003	BA	Deposit from pit 6294003
Plot 6/29.4	46 *	6294002	21.5	36	6294002?	BA	Pit fill?
Plot 6/29.4	47	6294011	5.5	8.25	6294003	BA	Upper fill of pit 6294003
Plot 6/29.4	47*	6294011	28	47.75	6294003	BA	Upper fill of pit
Plot 6/33	48	633029	5. 5	8.75	633015/633028	BA	Fill of pit 633028
Plot 6/33	49	633021	9.75	17	633012	BA	Burnt mound spread
Plot 6/33	50	633019	7	13	633012	BA	Burnt mound spread
Plot 6/33	51	633035	19.25	32.25	633015/633034	BA	Fill of pit 633034
Plot 0/8	52	0					timber sample
Plot 6/29.4	53	4071	26	36	6294090	BA	Burnt mound deposit
Plot 6/29.4	54	4100	4	8	6294098	BA	Lower fill of pit 4098
Plot 6/29.4	55	4102	20.75	40	6294101	BA	Fill of sub-rectangular pit/trough 4101
Plot 6/29.4	56	4054	19	27. 5	6294053	BA	Fill of pit
Plot 6/29.4	57	4106	5.75	8	6294105	BA	Charcoal rich fill of pit
Plot 6/29.4	58	4023	10	16	6294022	BA	Upper fill of pit 4022
Plot 6/29.4	59	4112	3.75	8	6294111	BA	Main deposit within pit 4111
Plot 6/29.4	60	4115	1. 5	2.25	6294111	BA	Fill in pit 4111
Plot 6/29.4	61	4116	7.5	14.75	6294111	BA	Fill in pit 4111
Plot 6/21	62	621003	5. 5	7.75		BA	Part of burnt mound spread
Plot 6/21	63	621004	11	12. 5		BA	Upper burnt mound spread
Plot 6/21	64	621007	5. 5	9. 5		BA	Upper layer of burnt fire cracked stone
Plot 6/21	65	621009	7. 5	6.25	621008	BA	Fill of pit
Plot 6/29.4	66	4049	21	30		BA	Sub-oval burnt mound spread
Plot 6/29.4	67	4117	13	21.5	6294118	BA	Fill of tree hollow
Plot 6/29.4	68	4106	6. 7	13	6294105	BA	Fill of pit/trough 4105
Plot 6/29.4	69	4104	5. 25	9	6294103	BA	Fill of pit
Plot 6/29.4	70	4129	9	16	6294127	BA	Fill of trough 4127
Plot 6/29.4	71	4023	2	2.	6294022	BA	Upper fill of pit
Plot 6/29.4	72	4088	5. 5	8. 75	6294087	BA	'taken from the middle' sub-oval hollow
Plot 6/29.4	73	4088	2. 5	3	6294087	BA	'taken from end of deposit'?
Plot 6/29.4	74	4088	7	8	6294087	BA	'taken from NW end of the deposit'?
Plot 6/29.4	75	4134	3. 75	7	6294087	BA	Possible clay lining of pit NW end
Plot 6/29.4	76	4134	4	7	6294087	BA	Possible clay lining of pit SE end
Plot 6/29.4	77	4140	11.25	14	6294133	BA	Fill of natural feature
Plot 6/29.4	78	4099	2	3	6294098	BA	Circular hollow fill

site	sampl e no.	Cont. no.	Sample vol. in l.	Sample wt kg.	feature	prov. Phase	description
Plot 6/29.4	79	4099	2	4. 5	6294098	BA	Circular hollow fill
Plot 6/29.4	81	4131	1.75	2. 5	6294103	BA	Lower fill of pit
Plot 6/29.4	82	4106	8. 5	19	6294105	BA	Fill of pit
Plot 6/29.4	83	4070	11	13		BA	Buried soil horizon
Plot 6/29.4	84	4145	1. 5	5	6294143	BA	Small oval feature fill
Plot 6/29.4	85	4144	2. 5	5	6294143	BA	Small oval feature fill
Plot 6/29.4	86	4147	3. 5	4. 25	6294146	BA	Small irregular pit/hollow fill
Plot 6/29.4	87	4152	1. 5	3	6294033	BA	Main filling of pit
Plot 6/29.4	88	4153	750	1.75	6294033	BA	Basal fill of pit
Plot 6/29.4	89	4032	8	16		BA	Layer
Plot 6/29.4	90	4142	4	8	6294158	BA	Small pit/hollow fill
Plot 6/29.4	91	4156	11	13	6294033	BA	Main fill of pit
Plot 6/29.4	92	4165	1	1.894	6294164	BA	Fill of stakehole
Plot 6/29.4	93	4167	<100	209	6294166	BA	Fill of stakehole
Plot 6/29.4	94	4169	<100	213	6294168	BA	Fill of stakehole
Plot 6/29.4	95	4172	3. 75	7	6294170	BA	Charcoal rich fill of palaeochannel
Plot 6/29.4	96	4183	1. 75	6	6294031	BA	Primary fill of pit
Plot 6/29.4	97	4179	3	6	6294178	BA	Sub-circular pit/hollow fill
Plot 6/29.4	98	4176	1	2	6294175	BA	Irregular pit/hollow fill
Plot 6/29.4	99	4177	8	8	6294175	BA	Irregular pit/hollow fill
Plot 6/29.4	100	4171	9. 25	13.75	6294170	BA	Infill of palaeochannel
Plot 6/29.4	101	4032	1. 5	2. 5		BA	layer, S side
Plot 6/29.4	102	4151	26	28	6294150	BA	Burnt mound deposit
Plot 6/29.4	103	4185	?	?	6294185	BA	Charcoal, dating – fill of undulation in natural
Plot 6/29.4	104	4204	5. 5	10		BA	Fill of hollow
Plot 6/29.4	105	4206	4	7. 5	6294205	BA	Small hollow, possibly natural, fill
Plot 6/29.4	106	4192	42	59. 5	6294195	BA	Burnt mound spread
Plot 6/29.4	107	4193				BA	Micromorph/pollen
Plot 6/29.4	108	4193				BA	Micromorph/pollen
Plot 6/29.4	109	4186				BA	Micromorph/pollen
Plot 6/51	110					BA	Sea shells below layer 651001
Plot 6/51	111	651	6	11. 5		BA	Shelly clay-possibly former shoreline
Plot 3/20	112	320006	11.25	22	32004	ukn	Ditch of channel fill
Plot 3/20	113	320007	7.75	15.75	32004	ukn	Ditch or channel fill
Plot 3/20	114	320012	17	32.75	32004	ukn	Ditch or channel fill
Plot 14/7	115	147005				ukn	Slot 14/7 – hazelnuts
Plot 6/29.4	116	4185				BA	Hand collected charcoal from pit fill
Plot 6/33	117	633024	2	3		BA	charcoal

* discrepancies between labels occurred and therefore tubs with the same sample number were washed separately and reported separately

Appendix 11.2: Summary of Environmental finds from the processed samples.

site	sample no.	context no.	samp vol. in l.	flot vol. ml.	charcoal $	char'd grain *	char'd chaff *	char'd seed *	hazel-nut no.	snail */&	Some preliminary identifications
Plot 0/3	1	03003	9.25	390	5/5	1		2	2	2/1	Indet cereal frags; hazelnut (2); lots of spores; *Bromus* sp., *Rumex* sp.; charcoal – lots identifiable fragments; charred thorn and herbaceous stem; snail – *Punctum pygmaeum*
Plot 3/2	2	32002	9..25	92.5	5/5	3		2	4		*Avena* sp., *Triticum aestivum, Hordeum vulgare*; hazelnut x4; *Chrysathemum segetum, Galium aparine*, Fabaceae, lots spores; charcoal - a few id. frags, mainly comminuted; indet. calcined bone
Plot 3/2	3	32018	20.25	255	5/5	4		3	6		*Avena* sp., *T. aestivum, Secale cereale, Hordeum vulgare*; hazelnut, *Fallopia convolvulus, Bromus* sp., *Galium aparine, Lapsana communis, Chrysthamemum segetum*, small Poacaea, *Vicia/Lathyrus*; charcoal – lots identifiable fragments; indet calcined and unburnt bone
Plot 3/2	4	32016	7..5	84	3/5	4	3	2			*Hordeum vulgare, Triticum dicoccum/spelta* grain; *T. dicoccum* chaff, *Bromus* sp., *Fallopia convolvulus*; charcoal – includes roundwood, mainly comminuted
Plot 3/2	5	32012	5.75	65	3/5	4	1	1			mainly *T. dicoccum/spelta*, occ free threshing; *H.vulgare; Triticum* spikelet fork and glume base, *Carex* sp., Poaceae; charcoal – few identifiable frags
Plot 3/2	6	32013	5.75	12	3/4	1		1			Indet cereal; *Rumex* sp.; charcoal – mostly small fragments
Plot 3/2	7	32019	11.25	17	3/5	1	1	1		1/1	Indet grain, *T. dicoccum* glume base; charcoal – a few identifiable fragments
Plot 3/2	8	32018	9.25	97	5/5	2		2	3		*Avena* sp., *Hordeum/Triticum* sp, indet cereal; hazelnut, *Vicia/Lathyrus* sp., small Poaceae, *C. segetum,* cf *Athemis cotula, Chenopodium* sp.; charcoal – several identifiable fragments; indet. calcined bone
Plot 3/2	9	32020	9. 5	20	4/5	2		2			*Avena* sp., cf *Hordeum*, indet grain; *Galium aparine, C. segetum, Vicia/Lathyrus* sp.; charcoal – a few id. fragments
Plot 3/2	11	32021	7	14	3/5	1	1	1			Indet grain; chaff- *T. dicoccum* glume base, *Triticum* sp. glume bases & spikelet forks; indet seeds; charcoal- a few id. fragments
Plot 3/10	15	310010	7	54.5	4/5			1			Indet charred seed; charcoal – lots identifiable fragments
Plot 3/10	16	310003	10	161	5/5						Charcoal – lots identifiable fragments- heavily mineralised
Plot 3/10	17	310004	8. 5	99	5/5	1		1			*Hordeum/Triticum* sp.; charcoal – several id. fragments and couple fragments herbaceous stem
Plot 3/14	10	314005	6	153	5/5	1		1	2	1/1	*Avena* sp.; small Poaceae, uncharred hazelnut x1; charcoal – several large fragments; snail – *Punctum pygmaeum*
Plot 3/20	112	320006	11.25	2	1/2						A little charcoal
Plot 3/20	113	320007	7.75	1	1/3						A little charcoal
Plot 3/20	114	320012	17	3	1/3						A little charcoal
Plot 3/27	13	327003	14. 5	828	5/5	2		3	1		cf *Triticum* sp., *Hordeum* sp., indet grain; *Plantago lanceolata, Rubus* sp., *Vicia/ Lathyurus* sp., hazelnut, thorn, fruit stone (x2); charcoal – lots identifiable fragments, small herbaceous stems; cremated bone - including probable human skull fragments
Plot 3/27	14	327004	550	66	4/5			1	1		Uncharred hazelnut; indet seeds, small herbaceous stems; cremated bone – including probable human skull fragments
Plot 6/10	18	610002	6	455	5/5		1	2			*Triticum dicoccum* chaff; *Plantago lanceolata*, small Poaceae, *Rubus* sp., *Medicago/Trifolium, Ajuga reptans, Carex* sp., *Potentilla* sp. ,charred tubers and herbaceous stems; charcoal – lots fragments >4mm and roundwood

site	sample no.	context no.	Samp. vol. in l.	flot vol. ml.	char-coal $	char'd grain *	char'd chaff *	char'd seed *	hazelnut no.	snail */&	Some preliminary identifications
Plot 6/6	19	66004	11.25	522	5/5						Charcoal – lots fragments.4mm, also occasional small twigs and herbaceous stems
Plot 6/6	20	66010	9. 5	357	5/5				1	1/1	Charcoal- lots fragments >6mm, and lots roundwood; snail – Punctum pygmaeum
Plot 6/21	62	621003	5. 5	6	2/5						Charcoal- all small fragments
Plot 6/21	63	621004	11	13	3/5					1/1	Charcoal – a few fragments >4mm; snail -
Plot 6/21	64	621007	5. 5	180	4/5				1		Charcoal – several fragments >4mm
Plot 6/21	65	621009	7. 5	25	3/5						Charcoal – a few fragments >4mm
Plot 6/33	37	633004	10	180	5/5						Charcoal - 40+ >6mm frags
Plot 6/33	38	633005	8	280	5/5						Charcoal - several larger identifiable fragments – worth looking at
Plot 6/33	39	633009	2	28	3/5			1			*Rubus* sp.; charcoal- a few identifiable fragments; ostracod x 1
Plot 6/33	40	633004	1. 5	36.5	4/5						Charcoal- a few identifiable fragments
Plot 6/33	41	633024	7. 5	305	5/5			1	2	1/1	Hazelnut; Charcoal- several larger identifiable frags- rare very small twig; indet poss seed; snail - *Punctum pygmaeum*
Plot 6/33	42	633024	11.25	615	5/5					1/1	Charcoal- lots fragments >4mm, incl occasional small roundwood; snail – *Punctum pygmaeum*
Plot 6/33	43	633010	16	150	5/5						Charcoal – several larger identifiable fragments-heavily mineralised
Plot 6/33	48	633029	5. 5	1200	5/5						Charcoal – lots of identifiable larger fragments
Plot 6/33	49	633021	9.75	3000	5/5						Charcoal- lots larger fragments but heavily mineralised
Plot 6/33	50	633019	7	504	5/5						Charcoal – several larger identifiable fragments
Plot 6/33	51	633035	19.25	705	5/5						Charcoal – several larger identifiable fragments
Plot 6/33	117	633024	2	1000	5/5						Lots of charcoal >4mm
Plot 6/51	111	651	6	40 wet	1/1					5/2	Uncharred (score 3/2) – moss and leaf fragments, Poaceae florets, Poaceae seeds, *Betula* sp., unidentified seeds (identifiable) *; wood several fragments (score 5) lots of herbaceous stems; snails/molluscs – tellens, cockles, rough winkle, *Hydrobia ulvae*
Plot 7/1	44	71002	27.75	40+100 wet	3/5			1		2/2	Charred *Rubus* sp., Uncharred *Betula* sp. *Rubus* sp.; snails – *Discus rotundatus, Oxychilus cellarius, Punctum pygmaeum, Aegopinella* sp., Clausilidae; cockles (very abundant), oyster, periwinkles, rough winkle – cockle shell midden!

site	sample no.	context no.	Samp. vol. in l.	flot vol. ml.	Flot vol. wet	wood	char-coal $	char'd grain *	char'd chaff *	char'd seed *	Hazel-nut no.	snail */&	Some preliminary identifications
Plot 6/29.4	45	6294006	3.75	75			5/5						Charcoal- several identifiable fragments
Plot 6/29.4	45 *	6294002	31	175			5/5						Charcoal – lots of identifiable fragments
Plot 6/29.4	46	2964010	2	3			2/3						Charcoal- mainly small fragments
Plot 6/29.4	46 *	6294002	21.5	441			5/5						Charcoal – lots of identifiable fragments, rare herbaceous stem fragments
Plot 6/29.4	47	6294011	5.5	240			5/5						Charcoal – several larger identifiable fragments
Plot 6/29.4	47*	6294011	28	1000			5/5						Charcoal – lots of identifiable fragments
Plot 6/29.4	53	4071	26	550			5/5						Charcoal – several larger identifiable fragments
Plot 6/29.4	54	4100	4	1			1/3						Charcoal – small fragments only
Plot 6/29.4	55	4102	20.75	5			2/3						Charcoal – mainly small fragments
Plot 6/29.4	56	4054	19	150			5/5						Charcoal – lots fragments >4mm
Plot 6/29.4	57	4106	5.75	510			5/5	1					*Hordeum* sp. (1); charcoal – lots fragments >4mm
Plot 6/29.4	58	4023	10	85			4/5					1/1	Charcoal – several fragments >4mm; snail -
Plot 6/29.4	59	4112	3.75	90			4/5						Charcoal – several fragments >4mm
Plot 6/29.4	60	4115	1. 5	90			5/5						Charcoal – several fragments >4mm
Plot 6/29.4	61	4116	7.5	100			5/5						Charcoal – several fragments >4mm
Plot 6/29.4	66	4049	21	300			5/5						Charcoal – lots fragments >4mm
Plot 6/29.4	67	4117	13	23			4/5				1		Charcoal – several fragments >4mm; hazelnut
Plot 6/29.4	68	4106	6. 7	50			4/5						Charcoal- several fragments >4mm
Plot 6/29.4	69	4104	5. 25	300			5/5						Lots identifiable material
Plot 6/29.4	70	4129	9	302			5/5	1		1		1/1	*Hordeum vulgare*, indet.; a few frags >4mm
Plot 6/29.4	71	4023	2	185			5/5						Lot of frags >4mm
Plot 6/29.4	72	4088	5. 5	30			4/5			1	1		Hazelnut x1; charcoal mainly small frags
Plot 6/29.4	73	4088	2. 5	80			4/5				1		Charcoal – mostly small charcoal; uncharred – *Betula* sp., moss and leaf fragments
Plot 6/29.4	74	4088	7	100			3/5						Charcoal – several fragments >4mm; uncharred *Betula* sp.
Plot 6/29.4	75	4134	3. 75	<1	30	4	1/2						Wood and bark; charcoal – small fragments only
Plot 6/29.4	76	4134	4	10			3/4						Mainly small charcoal
Plot 6/29.4	77	4140	11.25	100			4/5						Uncharred – *Betula* sp., *Chenopodium* sp., Cyperaceae, *Ajuga repens, Ranunculus* sp.; Charcoal – all <4mm
Plot 6/29.4	78	4099	2	3			2/4						Mainly small charcoal
Plot 6/29.4	79	4099	2	1			2/3						Mainly small charcoal
Plot 6/29.4	81	4131	1.75		550	5	1/3						Uncharred – few insects, lots wood; charcoal – a few fragments >4mm
Plot 6/29.4	82	4106	8. 5	250			5/5						Mainly small charcoal
Plot 6/29.4	83	4070	11	20			3/5						Mainly small charcoal
Plot 6/29.4	84	4145	1. 5	4			3/4						Mainly small charcoal
Plot 6/29.4	85	4144	2. 5	1			1/3						Small charcoal
Plot 6/29.4	86	4147	3. 5	3			2/4						Mainly small charcoal
Plot 6/29.4	87	4152	1. 5	10			3/5						Charcoal – a few fragments >2mm
Plot 6/29.4	88	4153	750	12			3/5						Charcoal – several fragments >2mm
Plot 6/29.4	89	4032	8	4			3/5						Charcoal – several fragments >2mm

site	sample no.	context no.	Samp. vol. in l.	flot vol. ml.	Flot vol. wet	wood	char-coal $	char'd grain *	char'd chaff *	char'd seed *	Hazel-nut no.	snail */&	Some preliminary identifications
Plot 6/29.4	90	4142	4		20	1	0/2					1/1	Uncharred – hazelnut, *Betula* sp.; charcoal – small fragments; snail – *Helicigona lapicida* x1
Plot 6/29.4	91	4156	11	80			4/5				1		Hazelnut x1; several charcoal frags >4mm
Plot 6/29.4	92	4165	1	10			3/5						Charcoal- several fragments >2mm
Plot 6/29.4	93	4167	<100	3			2/5						Charcoal – a few fragments .2mm
Plot 6/29.4	94	4169	<100	2			2/4						Charcoal – a few fragments >2mm
Plot 6/29.4	95	4172	3. 75	70			4/5						Charcoal – several larger identifiable fragments
Plot 6/29.4	96	4183	1. 75	<1			-/2						Charcoal – no larger fragments
Plot 6/29.4	97	4179	3	21			3/5						Charcoal – a few fragments >4mm
Plot 6/29.4	98	4176	1	4			2/3						Charcoal – a few fragments >2mm
Plot 6/29.4	99	4177	8	12			3/5						A few charcoal frags >4mm
Plot 6/29.4	100	4171	9. 25	124			5/5				+		Charcoal – lots fragments >4mm
Plot 6/29.4	101	4032	1. 5	15			3/5						Charcoal several identifiable fragments
Plot 6/29.4	102	4151	26	107			5/5						Several frags >4mm
Plot 6/29.4	104	4204	5. 5	12			3/5						Charcoal – several fragments >4mm
Plot 6/29.4	105	4206	4	40			3/5						Several frags >4mm
Plot 6/29.4	106	4192	42	320			4/5						Uncharred – *Chenopodium* sp.; charcoal – lots large fragments >6mm

* = abundance: 1=1-10, 2=11-50, 3=51-150, 4=151-250, 5=250+; $ = abundance >2mm/abundance < 2mm; */& abundance/diversity – diversity scores - 0=0, 1=1-3, 2=4-10, 3=11-25, 4=26-50, 5=50+

12. ANALYSIS AND RECORDING OF TIMBERS AND WOOD SAMPLES

Nigel Nayling and Roderick Bale

12.1. Summary

This report reviews the recording and analysis of timbers recovered during fieldwork and watching briefs in advance of and during the laying of a gas pipeline in 2011 between Pwllheli and Blaenau Ffestiniog, defined as Gwynedd Archaeological Trust Project G2148. The timbers are derived from seven different find spots. The archaeology was dominated by Bronze Age burnt mounds. Other sites encountered included a corn drier with associated pits and a smithing site. A possible Roman causeway was also discovered on the Dwyryd flood plain.

Timber for assessment and analysis came from the following contexts. Find spot 0/8 consisted of an unworked single timber find from within a peat deposit of unknown age at SH 39047 36352. From find spot 14/1 (SH 66445 40949) a large squared timber was recovered from clay. Tree ring analysis provides a felling date range for this timber of between AD 1272 and AD 1308. Find spot 14/4 consisted of a single cut branch from alluvial clay at SH 66605 41061. Find spot 14/7 (SH 66907 41219) is the site of a possible Roman road and consisted of a thick deposit of branches, some possibly cut, under silt deposits. Find spot 6/29.4 is a large burnt mound complex of Bronze Age date at SH 52254 39574 from which a number of wood fragments were recovered. Find spot 11/3 (SH 61168 39172) is of unknown date with the recovered wood forming a rough layer. Find spot 13/30 (SH 65675 40350) is of unknown date and included two large timbers.

An initial assessment of all recovered timbers by University of Wales Lampeter Archaeological Services (UWLAS) in 2011 identified twenty two individually numbered groups of wood deemed worthy of further analysis.

The analysis follows English Heritage guidance (English Heritage 1998,2010) and comprises annotated sketch drawings for each piece of wood with details on a wood record sheet, photography, tool mark analysis, microscopic species identification (where appropriate), ring width analysis and dendrochronological analysis of suitable samples from all find spots.

12.2. Introduction

The timber that forms the basis of this report was recovered between 16th March 2011 and 22nd September 2011 during watching briefs and excavations on the Pwllheli to Blaenau Ffestiniog Gas Pipeline Replacement Project. The scheme involved the construction of 39 km of a 6” wide gas pipe, within a 20m wide working corridor from Pwllheli to Blaenau Ffestiniog, Gwynedd, between NGR SH 38533597 and NGR SH 70454573.

The text section below is extracted from the Updated Project Design providing a brief overview of the archaeology encountered with particular reference to comments made regarding the wood assemblage (Kenney 2012).

The archaeology was dominated by burnt mounds but other sites were also encountered including a corn drier with associated pits and a smithing site. A possible Roman causeway was also discovered on the Dwyryd flood plain. There were also numerous field boundaries breached during the works. Thirty-nine sites were investigated and recorded during the fieldwork. These range from post-medieval drains of low significance to an extensive and complex group of features related to burnt mound activity of possible Bronze Age date.

The discovery of worked timbers in peat and alluvial deposits, including the possible remains of a Roman causeway, provided an opportunity to study remains not often preserved and to obtain dates more precise than radiocarbon can achieve.
The date of the structure identified in plot 14/7 will be investigated by dating a selection of timbers. It is proposed to date 9 timbers to allow enough dates to potentially pick up any reuse of the structure. As this site is potentially an in situ timber causeway and possibly of Roman date due to its location on the

line of the Roman road its potential importance justifies detailed dating. The timbers found in plots 13/30 and 14/1 are similar in nature but there was no evidence that these came from in situ structures and may have been moved from their original locations. (Kenney 2012).

The recovered wood was delivered to the UWLAS laboratory at the end of September 2011. Assessment of the samples took place and a programme of analysis was agreed outlined in this Updated Project Design. For full assessment report see Kenney 2012, but all significant information in the assessment is also included here. Summary table of wood assessment is included as appendix 9.1.

This report is structured so that each of the main findspots is considered in turn with a brief summary on the nature of the archaeology with which the wood assemblage is associated followed by primary records (text, drawings and photographs, and any wood identifications and dendrochronological analysis) as described in the section on methodology.

12.3. Methods

Timber/wood recording

All timbers/wood were recorded using photography with appropriate scale, including close up photographs of tool marks. Sketch drawings, at various approximate scales appropriate to the timber size were undertaken using wood record sheets. All drawings are annotated with measurements (mm). Where they existed, the dimensions of tool marks were also noted, as was the number of rings, average ring width and conversion method.

Microscopic wood identification

The cell structure of all samples selected for identification was examined in three planes under a high power microscope and identified using reference texts (Schweingruber 1982) and reference slides from an authentic source (Jodrell laboratory, Kew gardens).

The preservation of the waterlogged wood was generally less than perfect and it proved impossible to carry out meaningful analysis of the season of felling in many cases, due to poor preservation of the near bark surface. This is likely to be a result, at least in part, of the extensive period of storage of samples since excavation.

Identification has only been taken as far as genus in cases where there is more than one native species and the cell structure of the wood is not sufficiently different to separate them (eg *Quercus* spp.).

Dendrochronology

Dendrochronological samples were obtained from all suitable samples (ie *Quercus* spp.with more than 50 growth rings) from all find spots, not just the priority find spot (plot 14/7). Samples were hand sawn from wood pieces and surfaced using razor blades so that the ring sequence could be clearly discerned and measured.

Methods employed at the Lampeter Dendrochronology Laboratory in general follow those described in English Heritage guidance (English Heritage 1998). One of the samples recommended was found to contain less than the 50 annual rings necessary for tree ring dating and therefore not measured.
The complete sequence of growth rings in each sample was measured to an accuracy of 0.01mm using a micro-computer based travelling stage (Tyers 2004). Cross-correlation algorithms (Baillie and Pilcher 1973; Munro 1984) are employed to search for positions where the ring sequences are highly correlated against each other. The ring sequences were also tested against a range of reference chronologies from Britain and Northern Europe. The *t*-values reported are derived from the original CROS algorithm (Baillie and Pilcher 1973). A *t*-value of 3.5 or over is usually indicative of a good match, although this is with the proviso that high *t*-values at the same relative or absolute position must be obtained from a range of independent sequences, and that satisfactory visual matching supports these positions. Correlated positions are checked visually using computerised ring-width plots.

12.4. Results

Documentation was provided for a total of 23 individually numbered groups of wood. In some cases, a single find number has been used for several individual pieces of wood collected from the same context. In other cases, two parts of the same timber which appear to have been sawn into two sections during excavation were both issued with the same number (but differentiated by being labelled 1 of 2, 2 of 2 etc). The results of this assessment are provided alongside site descriptions of the relevant plots and contexts as provided by the excavators.

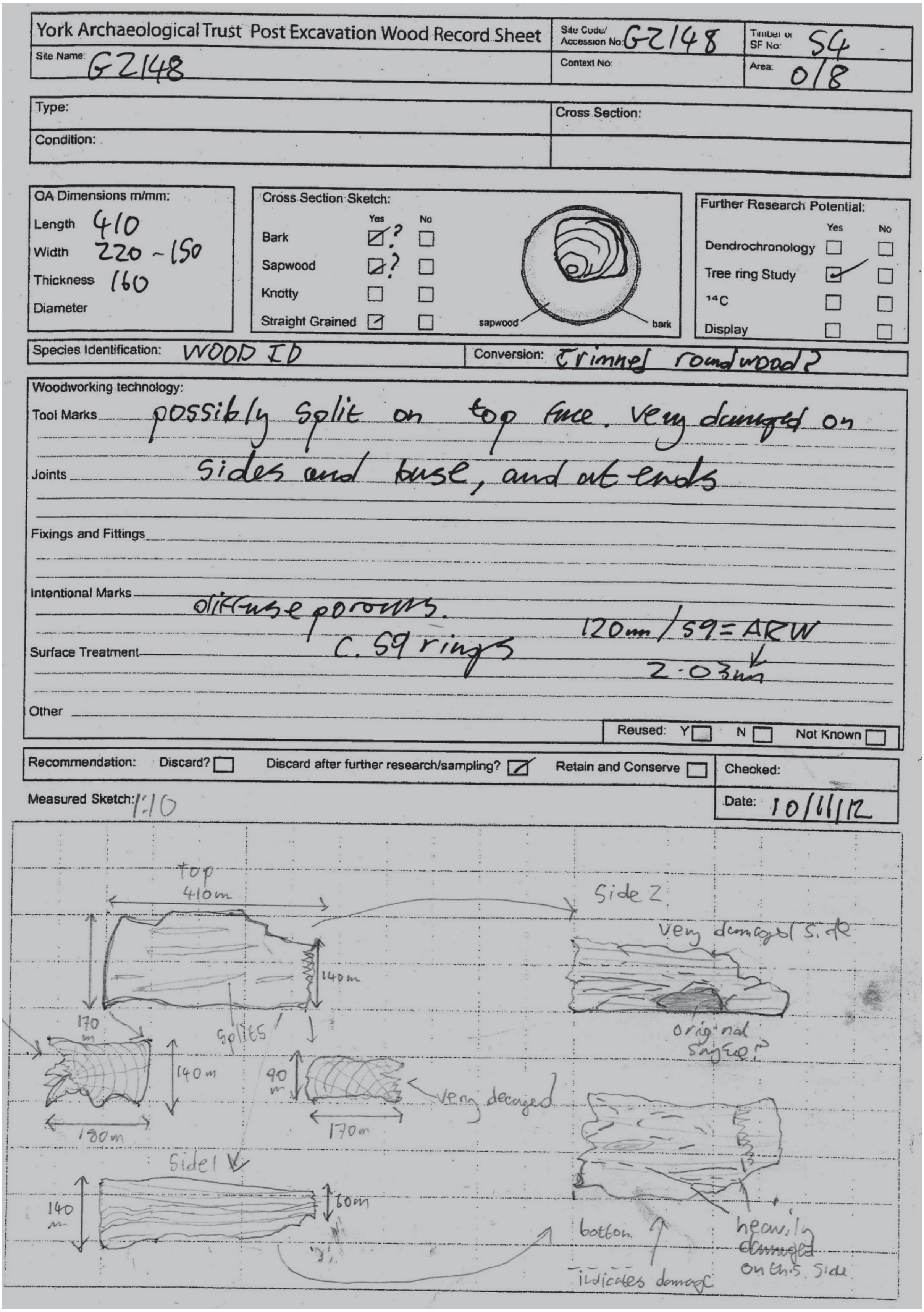
Plot: 0/8 Timber find spot

Grid: SH 39047 36352 Estimated period: Unknown

A light grey clay overlay a thick bed of peat, which was about 1.5m deep. Occasional pieces of wood were visible in the peat, mainly branches up to 0.65m in length and about 0.1m in diameter. A much larger piece of timber was found and recovered for study. This marsh lies at a height of about 5mOD in the valley of a small tributary to the Afon Erch. It is shown as marsh on the 1889 map although there had been considerable efforts by this time to drain it. Recorded during watching brief, timber sampled.

Wood record: Find number 54 as supplied is only some 410 mm in length and thus presumably represents only a sample of the large timber described above. Microscopic identification shows this is a piece of birch (*Betula pubescens*). The wood is badly decayed on one face resulting in an incomplete cross section of roundwood (Figures 12.4 and 12.5). There are no tool marks to suggest that this is a piece of converted wood, and it is more likely to have been part of natural woodland. The wood contains 59 growth rings and has an average ring width of 2.0mm.

Sketch drawings on the scanned wood sheet (Figure 12.1) are at 1:10 and each elevation/cross section is illustrated with a photograph.



York Archaeological Trust Post Excavation Wood Record Sheet

Site Code/ Accession No: GZ148

Timber or SF No: 54

Site Name: GZ148

Context No:

Area: 0/8

Type:

Cross Section:

Condition:

OA Dimensions m/mm:

Length 410

Width 220 - 150

Thickness 160

Diameter

Cross Section Sketch:

	Yes	No
Bark	☒ ?	☐
Sapwood	☒ ?	☐
Knotty	☐	☐
Straight Grained	☒	☐

sapwood

bark

Further Research Potential:

	Yes	No
Dendrochronology	☐	☐
Tree ring Study	☒	☐
^{14}C	☐	☐
Display	☐	☐

Species Identification: WOOD ID

Conversion: trimmed roundwood?

Woodworking technology:

Tool Marks possibly split on top face. very damaged on

Joints sides and base, and at ends

Fixings and Fittings

Intentional Marks

diffuse porous.

Surface Treatment C. 59 rings 120mm / 59 = ARW 2.03mm

Other

Reused: Y☐ N☐ Not Known ☐

Recommendation: Discard? ☐ Discard after further research/sampling? ☒ Retain and Conserve ☐

Checked:

Measured Sketch: 1:10

Date: 10/11/12

Figure 12.1 wood record sheet for sample 54

Figure 12.2 photograph of upper face of sample 54

Figure 12.3 photograph of degraded underside of sample 54

Figure 12.4 one end of sample 54

Figure 12.5 other end of sample 54

Plot: 6/29.4 Large burnt mound complex

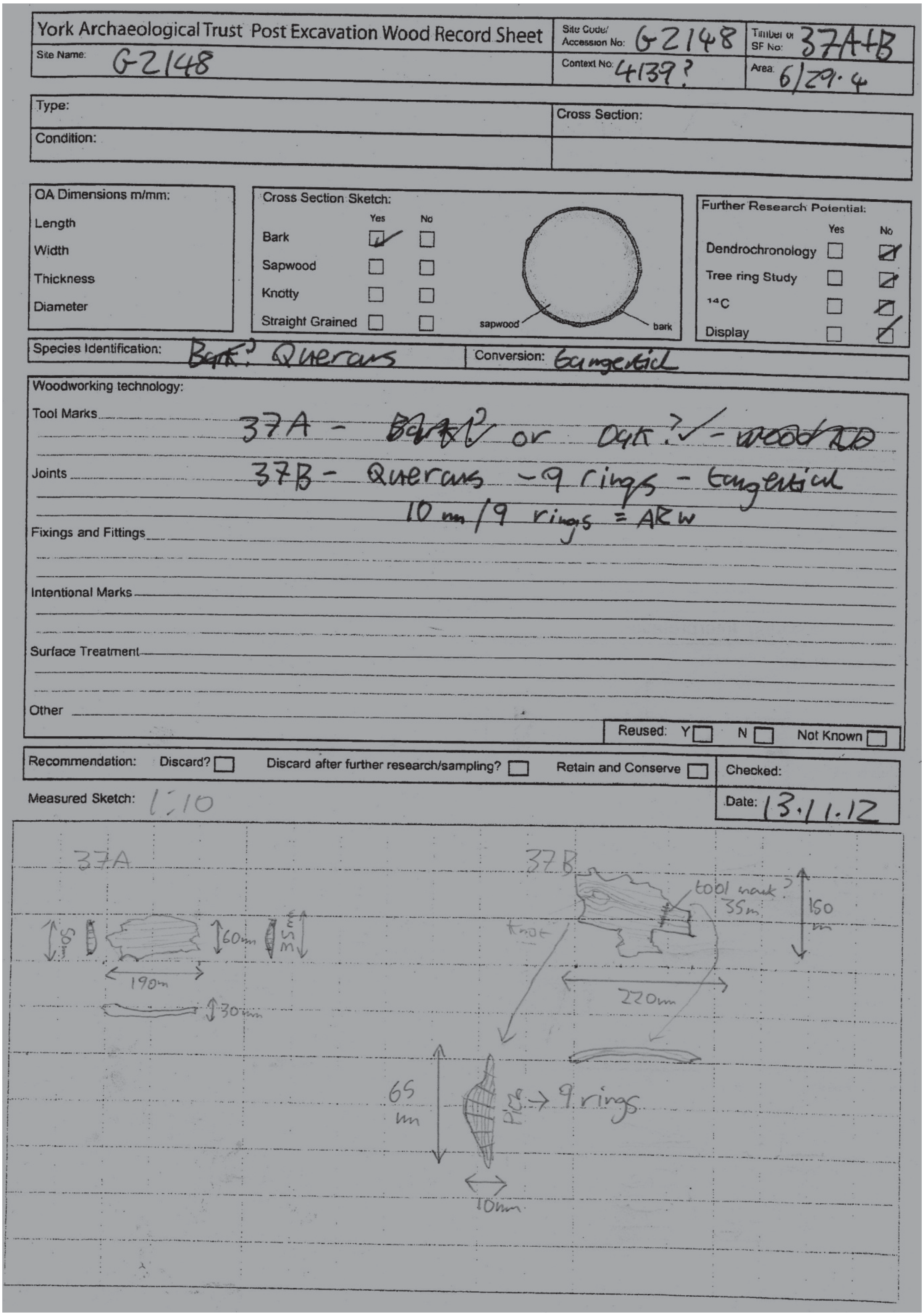
Grid SH 52254 39574   Estimated period: Bronze Age

Site includes a group of five small pits adjacent to an extensive spread from one or more burnt mounds. Excavation suggested one large truncated mound up to 25.0m in length, extending the 16m width of the working width. A 5m wide section of the burnt mound is preserved in situ under the running track. A complicated group of features was found under the burnt mound. There were 29 pits and troughs, a posthole and 5 gullies. Other hollows and linear features may have been natural features and some recent drains also cut the area. A layer, which may be a buried soil deposit, divided activity into two rough phases. The burnt mound was evaluated by hand-dug slots, then the burnt spread was removed by hand. Features were excavated and recorded, then the 'buried soil' layer was removed by machine and the remaining features on site

Wood record: A total of fifteen relatively small fragments of oak, most tangentially converted, were assessed. Unfortunately none retained sufficient rings to merit tree-ring dating. These may be woodworking waste or reflect fuel usage at the site. Ten pieces of wood have been recorded by tree record sheet, selective photography, and tree-ring analysis. Five other fragments (<2cm in size) were too small or decayed to be considered for more detailed recording.

Figure 12.6 table of 6 29.4 individual samples

Sample code	Origin of sample	Species	Cross-section	Dimensions (mm)	Total rings	Sapwood	ARW mm/year	Toolmarks/remarks
37A	6 29.4	*Quercus*	Tangential	190 x 60x30	19	-	0.52	-
37B	6 29.4	*Quercus*	Tangential	220 x 150x10	9	-	1.11	Possible –more likely compression. See Figure 11
56A	6 29.4	*Quercus*	Tangential	320 x 70x30	20	-	1.50	Very knotty- no toolmarks
56B	6 29.4	*Quercus*	Tangential	240x 90x10	17	-	1.17	Very knotty- no toolmarks
56C	6 29.4	*Quercus*	Tangential	280 x 60x20	8	-	2.5	Very knotty- no toolmarks
56D	6 29.4	*Quercus*	Tangential	250 x20x5	5	-	2.5	Very knotty- no toolmarks
56E	6 29.4	*Quercus*	Tangential	150 x10x5	3	-	1.66	Very knotty- no toolmarks
56F	6 29.4	*Quercus*	Tangential	140 x 45x20	3	-	2.22	Very knotty- no toolmarks
56G	6 29.4	*Quercus*	Tangential	190 x 17x17	7	-	2.42	Very knotty- no toolmarks
56H	6 29.4	*Quercus*	Tangential	200 x 20x15	7	-	**2.14**	Very knotty- no toolmarks



York Archaeological Trust Post Excavation Wood Record Sheet

Site Code/ Accession No: G2148

Timber or SF No: 37A+B

Site Name: G2148

Context No: 4139?

Area: 6/29.4

Type:

Cross Section:

Condition:

OA Dimensions m/mm:

Length

Width

Thickness

Diameter

Cross Section Sketch:

	Yes	No
Bark	✓	
Sapwood		
Knotty		
Straight Grained		

sapwood

bark

Further Research Potential:

	Yes	No
Dendrochronology		✓
Tree ring Study		✓
^{14}C		✓
Display		✓

Species Identification: ~~Bark~~? Quercus

Conversion: tangential

Woodworking technology:

Tool Marks 37A - ~~Bark~~? or Oak? ✓ - ~~wood ID~~

Joints 37B - Quercus - 9 rings - tangential

10 mm / 9 rings = ARW

Fixings and Fittings

Intentional Marks

Surface Treatment

Other

Reused: Y ☐ N ☐ Not Known ☐

Recommendation: Discard? ☐ Discard after further research/sampling? ☐ Retain and Conserve ☐

Checked:

Measured Sketch: 1:10

Date: 13.11.12

Figure 12.7 wood record sheet for samples 37 A and B

Figure 12.8 photograph of sample 37A

Figure 12.9 photograph of sample 37A

Figure 12.10 photograph of sample 37B

Figure 12.11 photograph of sample 37B

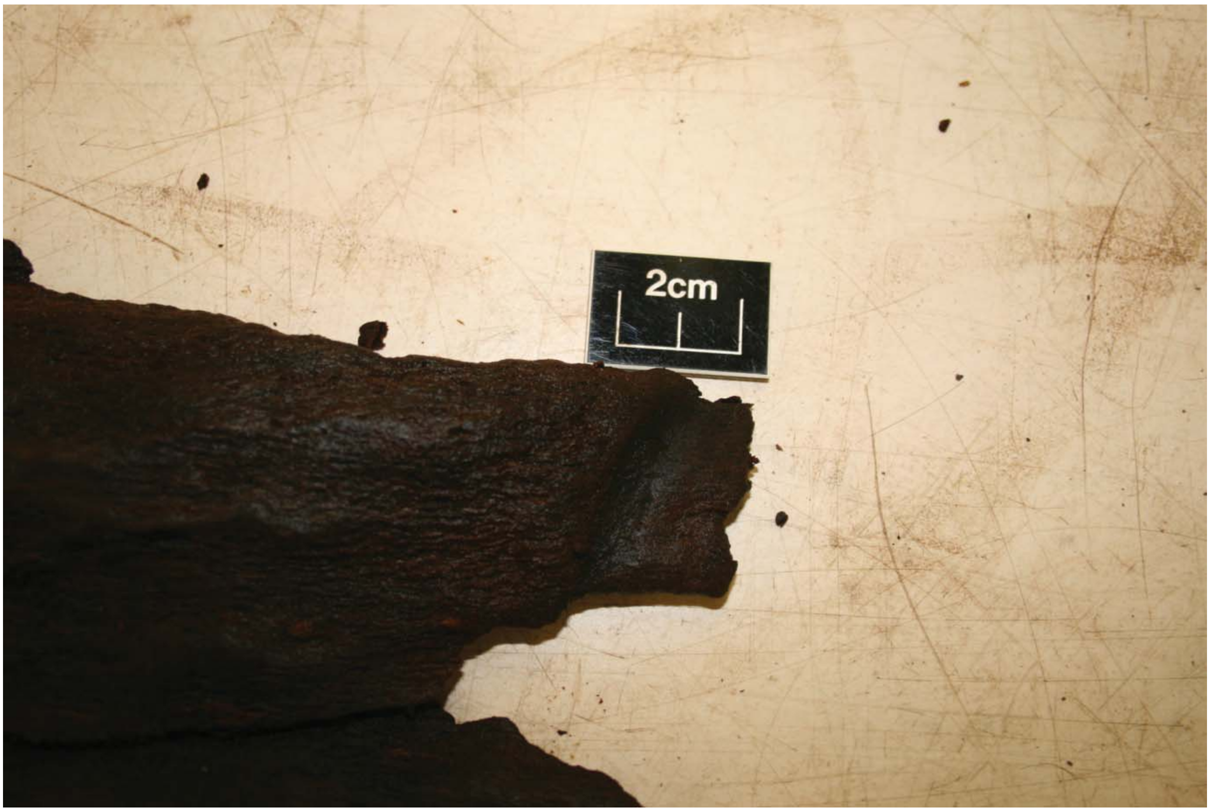
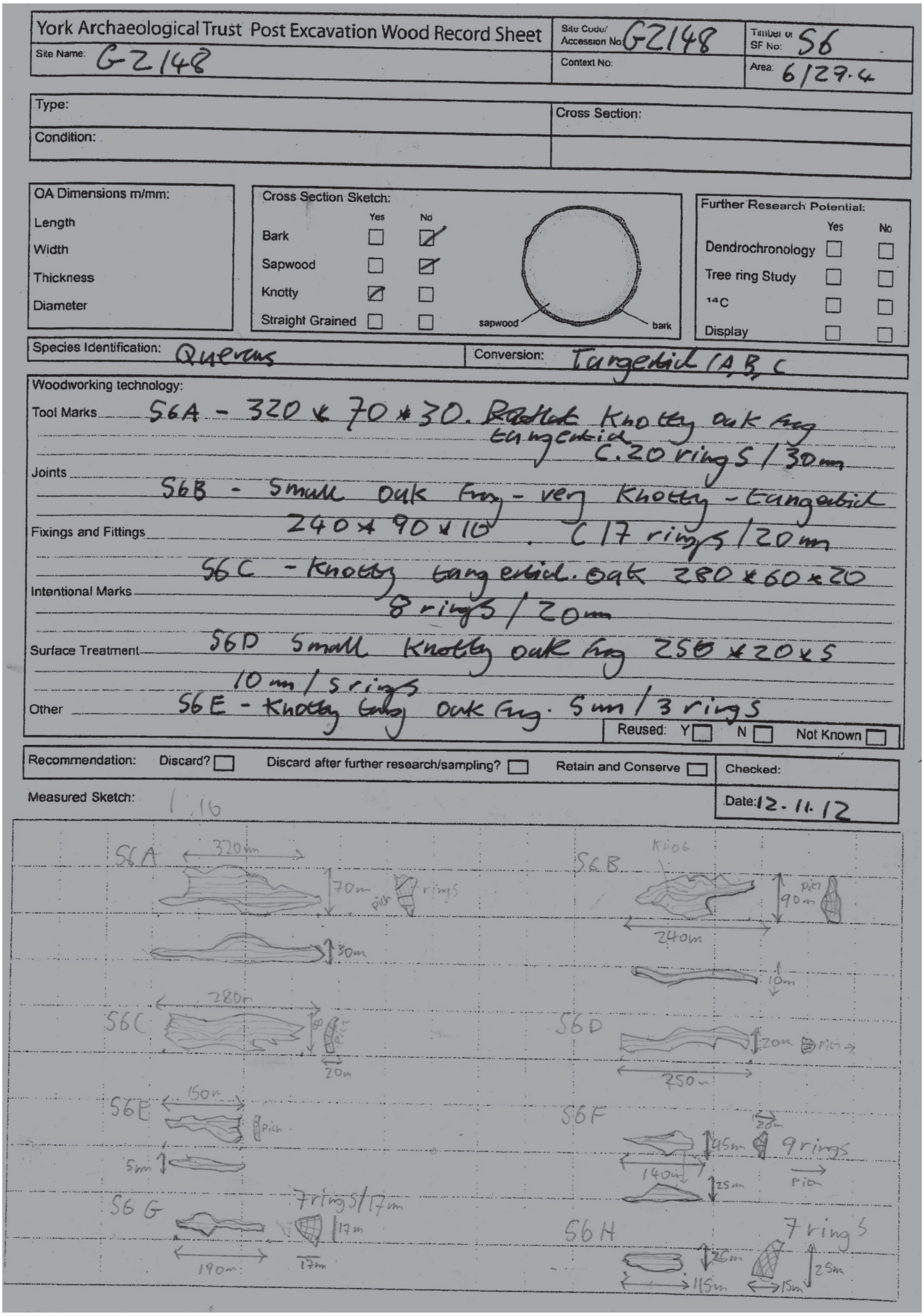


Figure 12.12 possible tool mark on sample 37B (35mm * 10mm as indicated on record sheet)



York Archaeological Trust Post Excavation Wood Record Sheet

Site Code/ Accession No: GZ148

Timber or SF No: 56

Site Name: GZ148

Context No:

Area: 6/27.4

Type:

Cross Section:

Condition:

OA Dimensions m/mm:
Length
Width
Thickness
Diameter

Cross Section Sketch:

	Yes	No
Bark	☐	☑
Sapwood	☐	☑
Knotty	☑	☐
Straight Grained	☐	☐

sapwood
bark

Further Research Potential:

	Yes	No
Dendrochronology	☐	☐
Tree ring Study	☐	☐
^{14}C	☐	☐
Display	☐	☐

Species Identification: Quercus

Conversion: Tangential / A, B, C

Woodworking technology:

Tool Marks: 56A – 320 x 70 x 30. ~~Radial~~ Knotty oak frag tangential C.20 rings / 30mm

Joints: 56B – Small oak frag – very knotty – tangential 240 x 90 x 10 C 17 rings / 20mm

Fixings and Fittings:

Intentional Marks: 56C – knotty tangential. oak 280 x 60 x 20 8 rings / 20mm

Surface Treatment: 56D Small knotty oak frag 250 x 20 x 5 10mm / 5 rings

Other: 56E – Knotty tang oak frag. 5mm / 3 rings

Reused: Y ☐ N ☐ Not Known ☐

Recommendation: Discard? ☐ Discard after further research/sampling? ☐ Retain and Conserve ☐

Checked:

Date: 12.11.12

Measured Sketch: 1:16

Figure 12.13 wood record sheet for samples 56 A to H

Figure 12.14 photograph of sample 56A

Figure 12.15 photograph of sample 56A

Figure 12.16 photograph of sample 56B

Figure 12.17 photograph of sample 56B

Figure 12.18 photograph of sample 56C

Figure 12.19 photograph of sample 56C

Figure 12.20 photograph of sample 56D

Figure 12.21 photograph of sample 56D

Figure 12.22 photograph of sample 56E

Figure 12.23 photograph of sample 56F

Figure 12.24 photograph of sample 56G

Figure 12.25 photograph of sample 56H

Figure 12.26 photograph of sample 56H

Conclusions

Unfortunately all the wood samples within this context have suffered from surface decay or damage, and in only one case (sample 37B) is there any sign of possible tool marks. The size and amount of the wood samples suggests a woodworking site of some description, though it is not possible to say the type of tool used. No pieces exhibited any charring, so that there is no evidence directly associating the wood with fuel usage. The absence of any other tree species may be indicative of the semi waterlogged nature of the site or periodic drying. *Quercus* would be more likely to survive such episodes of drying/partial waterlogging than other tree species.

Plot: 11/3 Timber find spot
Grid SH 61168 39172 Estimated period: Unknown
A layer of peat up to 2m thick was seen over much of plot 11/3. At a depth of about 1m within this peat was a rough layer where wood was more densely concentrated. Some of the fragments of wood appeared to be chopped or possibly sawn and some were radially split. Many of the pieces were fairly small but there was also the stump of a tree. The peat was found immediately below the ground surface in this area and the upper parts also contained wood, including remains of modern trees. This plot has been largely surrounded by houses since the 19th century, but has remained very wet through to the present day as it was covered by himalayan balsam and willows.

Wood record: Five individually numbered items or groups from this plot were listed in the documentation provided. One of these (find number 51), was not noted during the assessment. This group includes clearly worked items with evidence for removing side branches, conversion through splitting working of points, and in one instance (find number 52) both blind and through peg holes suggesting re-use. Of the 11 pieces examined, 10 have been recorded using a wood record sheet and selective photography. Eight exhibit tool mark evidence where additional recording has been undertaken, three were identified using microscopic wood identification, seven samples ring width characteristics have been noted, and two *Quercus* spp. samples with sufficient annual rings were subject to dendrochronological dating.

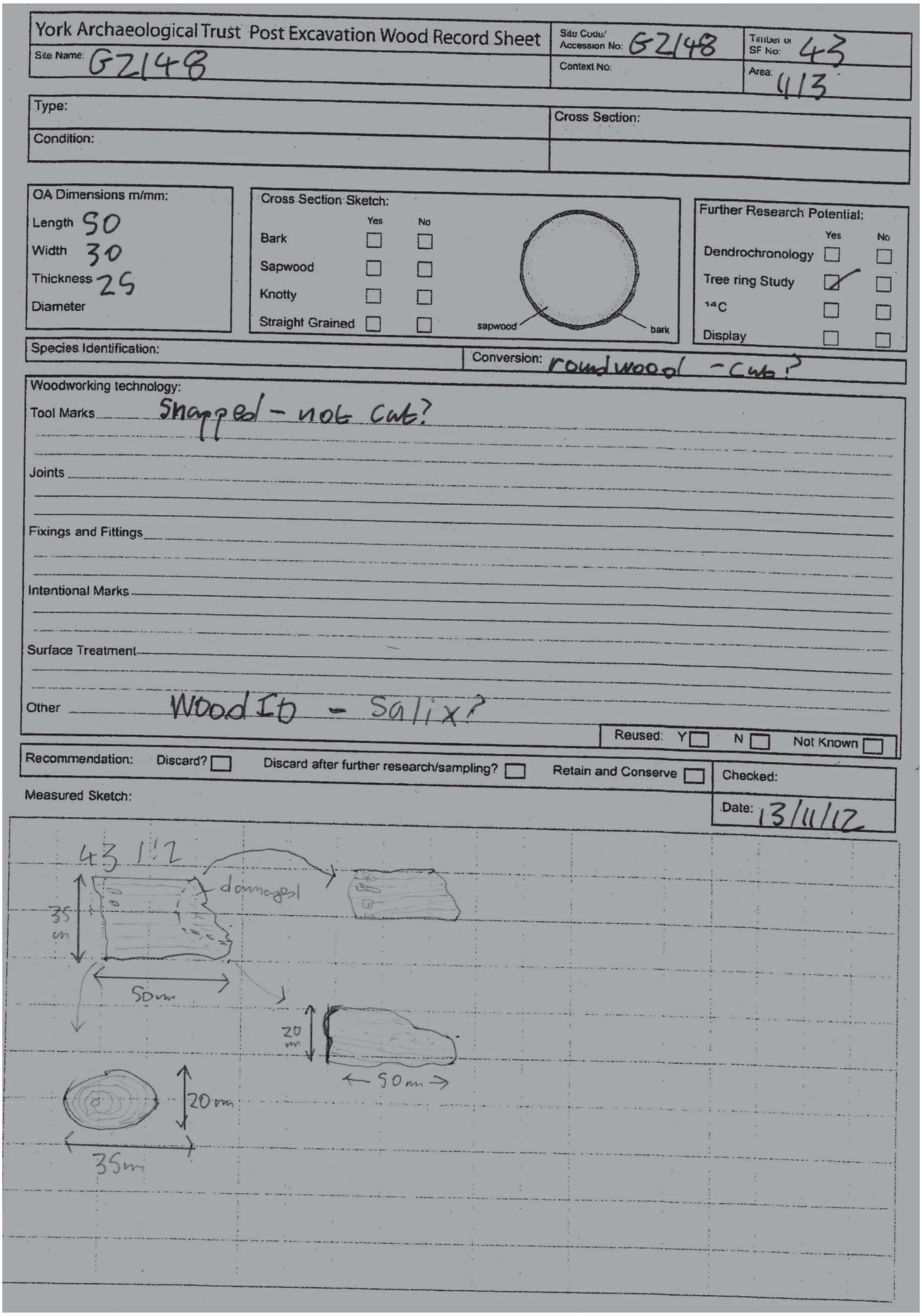
Unfortunately neither of the samples on which dendrochronology was undertaken (50 and 52 3 of 4) provided a date.

The saw marks present on one sample (52 4 of 4) in conjunction with the very good condition of some samples (52 4 of 4 and 53 1, 2 and 3 of 4) suggest that at least some of this material is of modern (ie 19^{th} or 20^{th} century) origin.

Figure.12. 27 Table of samples from area 11/3

Sample code	Origin of sample	Species	Cross-section	Dimensions (mm)	Total rings	Sapwood	ARW mm/year	Toolmarks/ comments
43	11/3	*Salix*	Roundwood	50 x 30x25	11	-	1.81	Bark edge present. Snapped ends-not cut
50	11/3	*Quercus*	Quartered	1040 x140x90	102	Heartwood/ sapwood boundary?	1.54	>10 rings to pith. Possible tool marks or compression (see figure 30) 25 and 30mm long. Dendro sample taken – does not date.
52 1 of 4	11/3	*Salix*	Tangential	325 x 70x70	7	-	5.71	No tool marks. Snapped at ends
52 2 of 4	11/3	*Salix*	Roundwood	300x 80x60	26	-	1.73	Possible tool or compression marks on all faces (see sketch and figures)

52 3 of 4	11/3	*Quercus*	Quartered	280 x 60x20	144	Heartwood/ sapwood boundary?	0.58	5-10 years to pith. Very slow grown- very narrow bands of rings. Possible tool marks (10mm and 60mm) on one face. Dendro sample – does not date
52 4 of 4	11/3	*Quercus*	Radial	250 x20x5	43	-	1.97	Sawn with peg hole. Re used?
53 1 of 4	11/3	*Quercus*	Radial	1100 x70x50	18	-	3.33	Sawn? Peg hole
53 2 of 4	11/3	*Salix*	Trimmed roundwood	1200x90x50	16	-	2.5	Cut marks, cut side branches
53 3 of 4	11/3	*Salix*	Trimmed roundwood	1040 x 80x60	27	-	1.85	Cut side branches
53 4 of 4	11/3	*Quercus*	Tangential	200 x 80x11	22	Heartwood/ sapwood boundary?	3.63	No tool marks



York Archaeological Trust Post Excavation Wood Record Sheet

Site Code/ Accession No: G2148

Timber or SF No: 43

Site Name: G2148

Context No:

Area: 413

Type:

Condition:

Cross Section:

OA Dimensions m/mm:

Length 50

Width 30

Thickness 25

Diameter

Cross Section Sketch:

	Yes	No
Bark	☐	☐
Sapwood	☐	☐
Knotty	☐	☐
Straight Grained	☐	☐

sapwood bark

Further Research Potential:

	Yes	No
Dendrochronology	☐	☐
Tree ring Study	☑	☐
^{14}C	☐	☐
Display	☐	☐

Species Identification:

Conversion: roundwood - cut?

Woodworking technology:

Tool Marks Snapped - not cut?

Joints

Fixings and Fittings

Intentional Marks

Surface Treatment

Other Wood ID - Salix?

Reused: Y ☐ N ☐ Not Known ☐

Recommendation: Discard? ☐ Discard after further research/sampling? ☐ Retain and Conserve ☐

Checked:

Date: 13/11/12

Measured Sketch:

Figure 12.28 wood record sheet for sample 43

Figure 12.29 photograph of sample 43

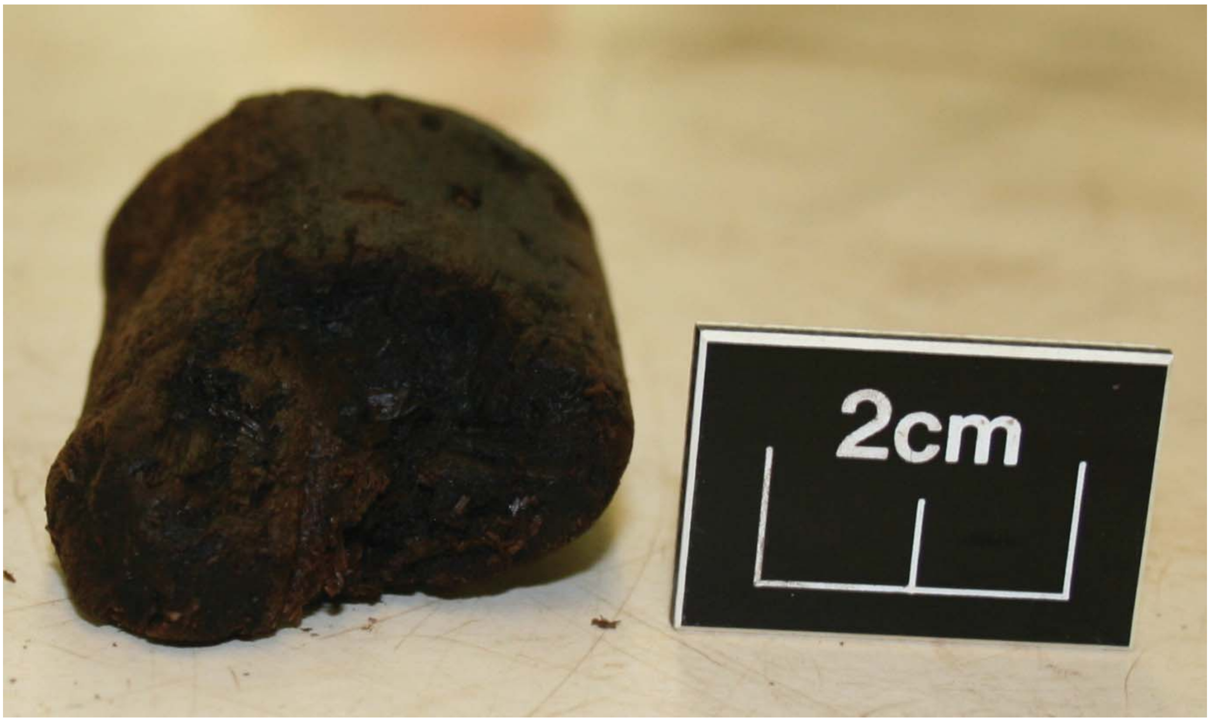


Figure 12.30 photograph of sample 43

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York Archaeological Trust Post Excavation Wood Record Sheet

Site Code/ Accession No: G-Z148
Timber or SF No: 050
Site Name: G-Z148
Context No:
Area: 11/3

Type:
Cross Section:
Condition:

OA Dimensions m/mm:
Length 1040 mm
Width 140 - 80 mm
Thickness 90 - 50 mm
Diameter

Cross Section Sketch:

	Yes	No
Bark	☐	☐
Sapwood	☐	☐
Knotty	☐	☐
Straight Grained	☑	☐

H/S?

sapwood
bark

Further Research Potential:

	Yes	No
Dendrochronology	☑	☐
Tree ring Study	☐	☐
^{14}C	☐	☐
Display	☐	☐

Species Identification: Quercus
Conversion: ¼ed Split

Woodworking technology:
Tool Marks possible axe marks? - see sketch
Joints
102 rings - does not date as yet.
Fixings and Fittings
Intentional Marks
Surface Treatment
Other

Reused: Y ☐ N ☐ Not Known ☐

Recommendation: Discard? ☐ Discard after further research/sampling? ☑ Retain and Conserve ☐
Checked:
Measured Sketch:
Date: 1.11.2012

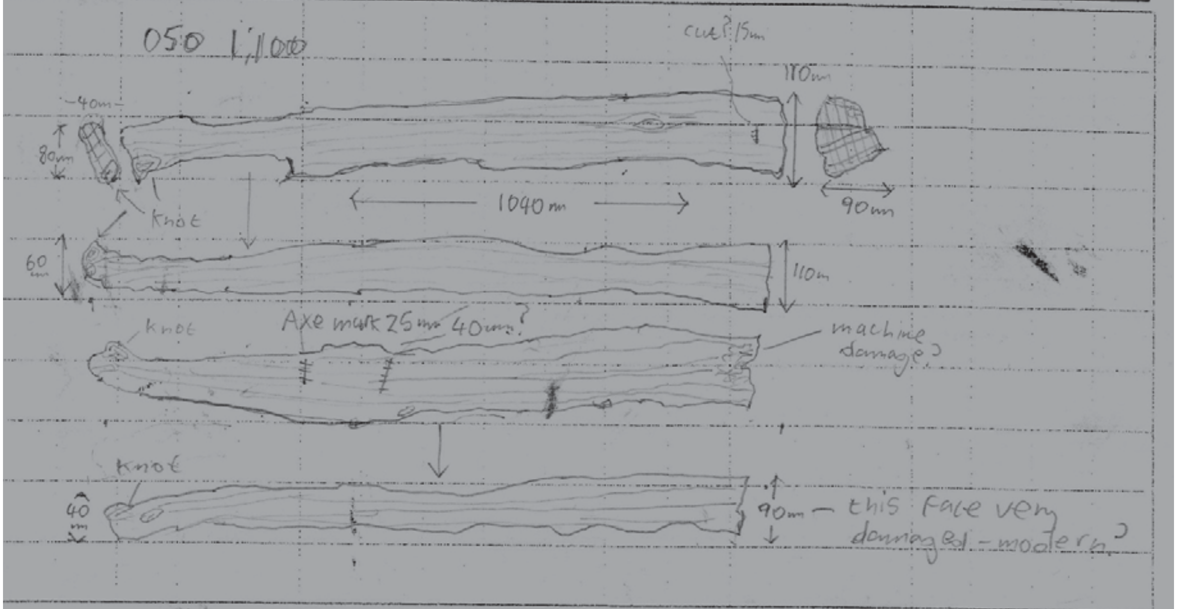

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Figure 12.31 wood record sheet for sample 50

Figure 12.32 photograph of sample 50

Figure 12.33 photograph of possible toolmarks on sample 50

Figure 12.34 photograph of sample 50

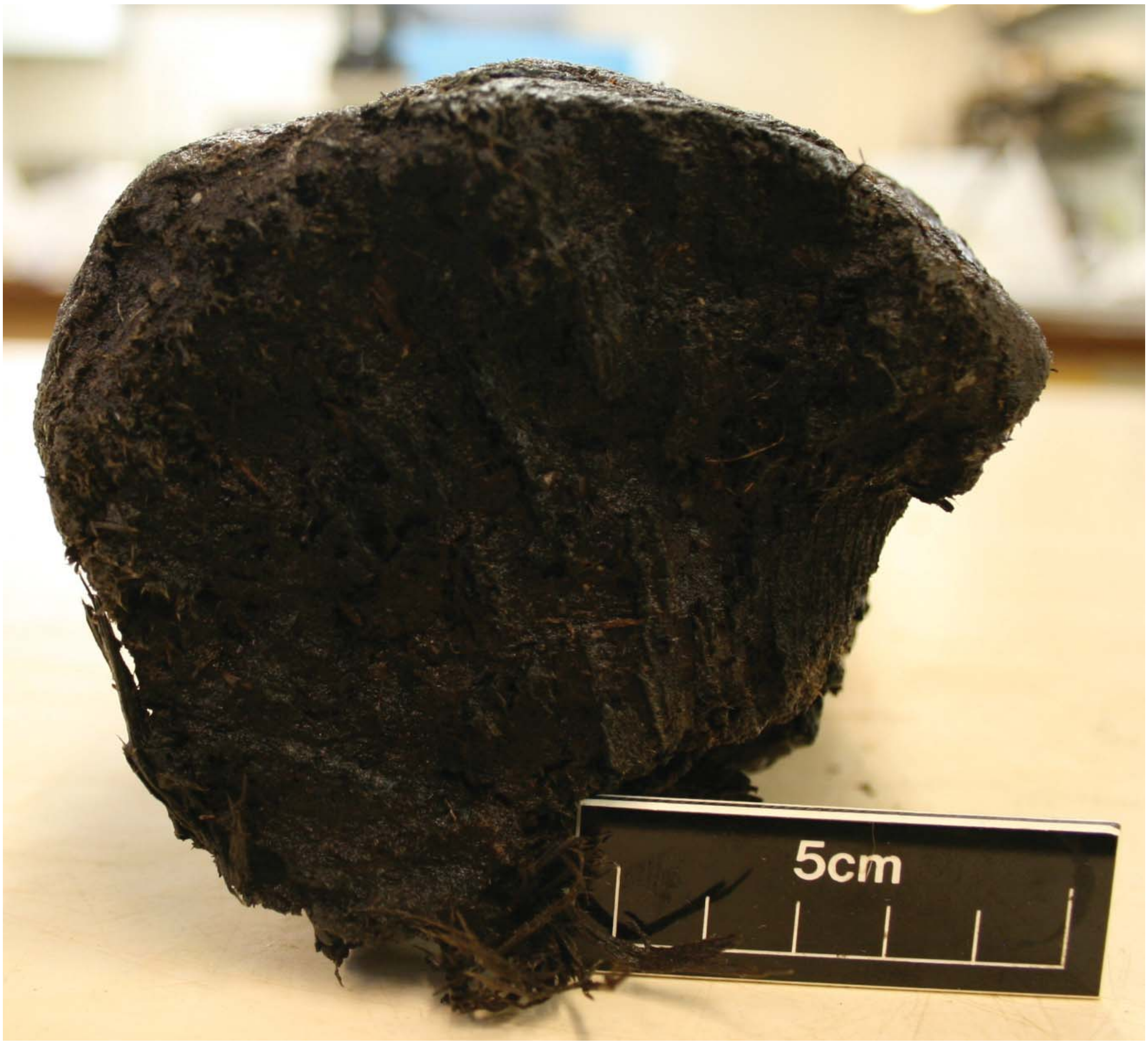
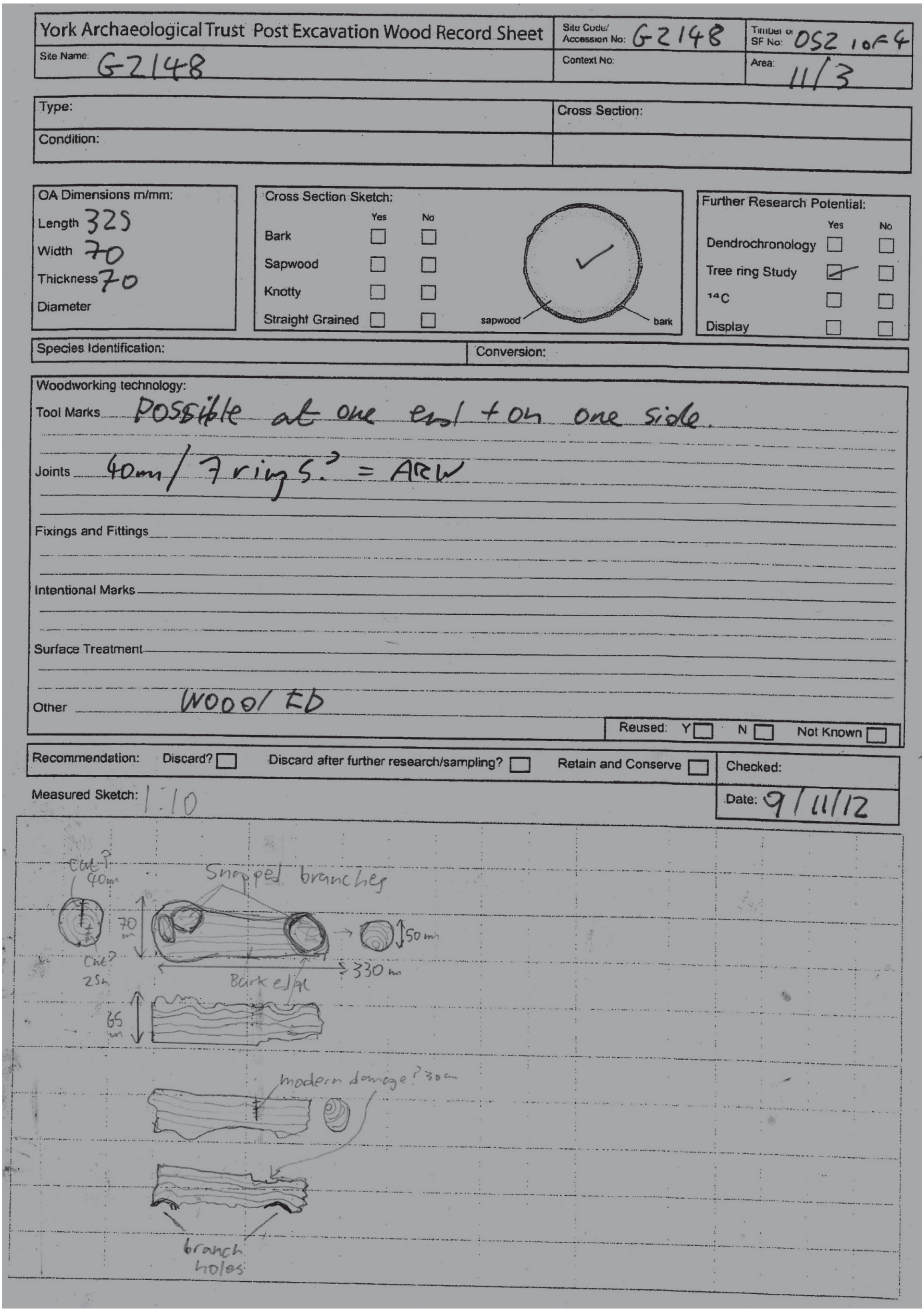


Figure 12.35 photograph of one end of sample 50



York Archaeological Trust Post Excavation Wood Record Sheet

Site Name: G2148	Site Code/ Accession No: G2148	Timber or SF No: 052 1 of 4	
	Context No:	Area: 11/3	

Type:

Condition:

Cross Section:

OA Dimensions m/mm:
Length 325
Width 70
Thickness 70
Diameter

Cross Section Sketch:

	Yes	No
Bark	☐	☐
Sapwood	☐	☐
Knotty	☐	☐
Straight Grained	☐	☐

sapwood
bark

Further Research Potential:

	Yes	No
Dendrochronology	☐	☐
Tree ring Study	☑	☐
^{14}C	☐	☐
Display	☐	☐

Species Identification:

Conversion:

Woodworking technology:

Tool Marks: Possible at one end + on one side.

Joints: 40mm / 7 rings? = ARW

Fixings and Fittings

Intentional Marks

Surface Treatment

Other: WOOD / ED

Reused: Y ☐ N ☐ Not Known ☐

Recommendation: Discard? ☐ Discard after further research/sampling? ☐ Retain and Conserve ☐

Checked:

Date: 9/11/12

Measured Sketch: 1:10

Figure 12.36 wood record sheet for sample 52 1 of 4

Figure 12.37 photograph of 52 1 of 4

Figure 12.38 photograph of 52 1 of 4

Figure 12.39 photograph of 52 1 of 4

York Archaeological Trust Post Excavation Wood Record Sheet

Site Name: G2148	Site Code/ Accession No: G2148	Timber or SF No: 52 2 of 4	
	Context No: -	Area: 11/3	

Type:

Cross Section:

Condition:

OA Dimensions m/mm:
Length 300
Width 85
Thickness 60
Diameter

Cross Section Sketch:

	Yes	No
Bark	☐	☐
Sapwood	☐	☐
Knotty	☐	☐
Straight Grained	☐	☐

sapwood ✓ bark

Further Research Potential:

	Yes	No
Dendrochronology	☐	☐
Tree ring Study	☑	☐
¹⁴C	☐	☐
Display	☐	☐

Species Identification:

Conversion:

Woodworking technology:

Tool Marks Unlikely - more likely snapped cut ends.
2 possible cut marks on one face

Joints Cut marks on other face?

Fixings and Fittings

c26 rings

Intentional Marks 45mm/26 = ARW = 1.73mm

Surface Treatment

Non oak roundwood with Bark edge

Other Wood ID

Reused: Y☐ N☐ Not Known☐

Recommendation: Discard? ☐ Discard after further research/sampling? ☐ Retain and Conserve ☐

Checked:

Date: 16/10/12

Measured Sketch:

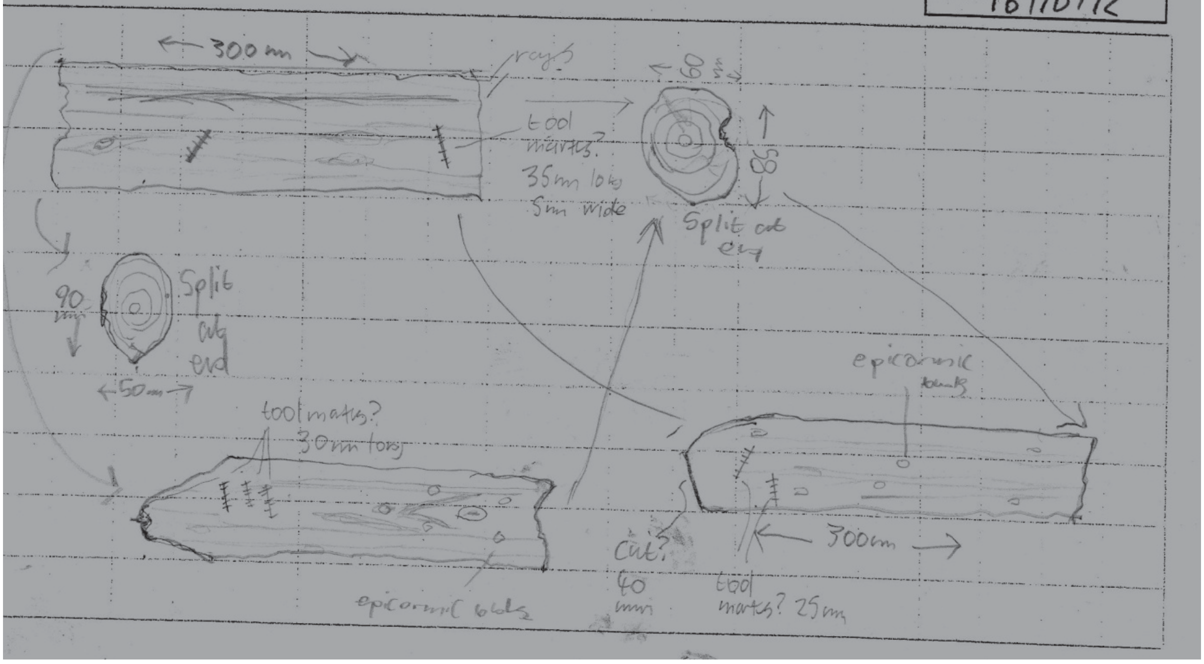


Figure 12.40 wood record sheet for sample 52 2 of 4

Figure 12.41 photograph of 52 2of4

Figure 12.42 photograph of 52 2of 4

Figure 12.43 photograph of 52 2of4

Figure 12.44 photograph of 52 2of 4

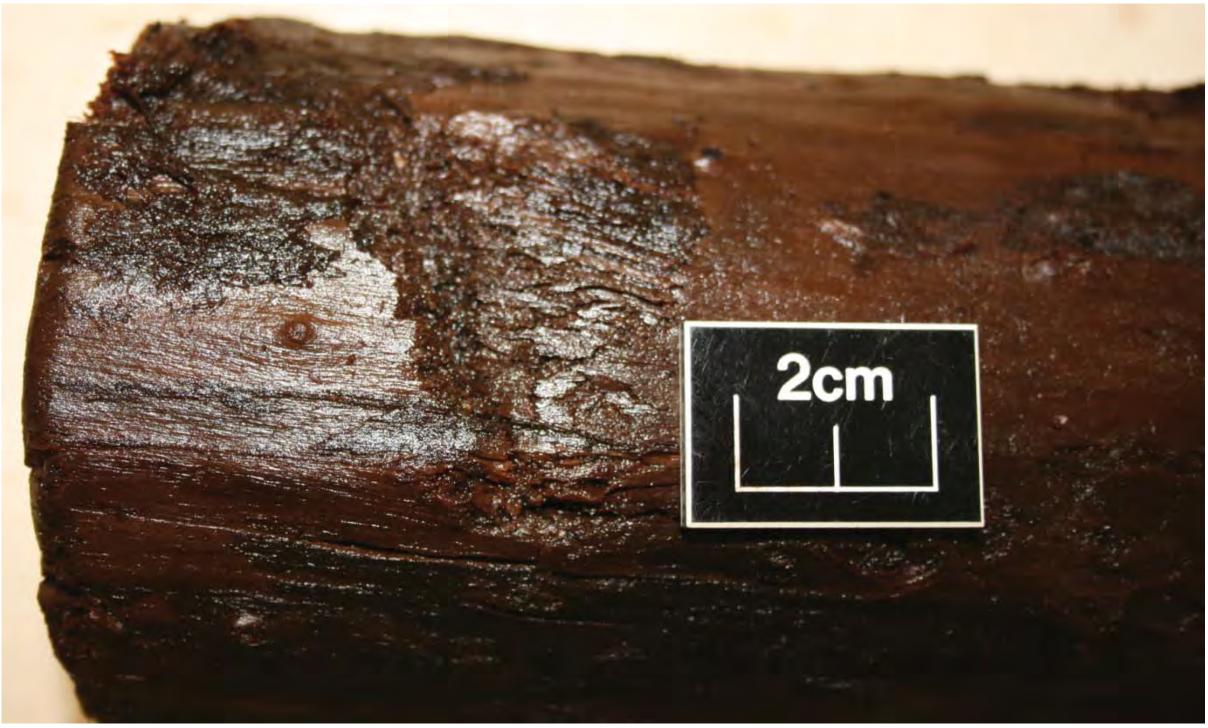


Figure 12.45 photograph of 52 2of 4

Figure 12.46 photograph of 52 2of 4

Figure 12.47 photograph of 52 2of4

York Archaeological Trust Post Excavation Wood Record Sheet	Site Code/ Accession No: GZ148	Timber or SF No: 52 3 of 4
Site Name: GZ148	Context No:	Area: 11/3

Type:	Cross Section:
Condition:	

OA Dimensions m/mm:
Length 820mm
Width
Thickness
Diameter

Cross Section Sketch:

	Yes	No
Bark	~~☒~~	☑
Sapwood	☑	☐
Knotty	☐	☐
Straight Grained	☑	☐

sapwood bark

Further Research Potential:

	Yes	No
Dendrochronology	☑	☐
Tree ring Study	☑	☐
¹⁴C	☐	☐
Display	☐	☐

Species Identification: Quercus | Conversion: 1/4 Split

Woodworking technology:
Tool Marks At both ends? + one face. H/S not bark
Joints
Fixings and Fittings
Intentional Marks
Surface Treatment
Other

Reused: Y ☐ N ☐ Not Known ☐

Recommendation: Discard? ☐ Discard after further research/sampling? ☐ Retain and Conserve ☐ | Checked:
Date: 10/10/12

Measured Sketch:

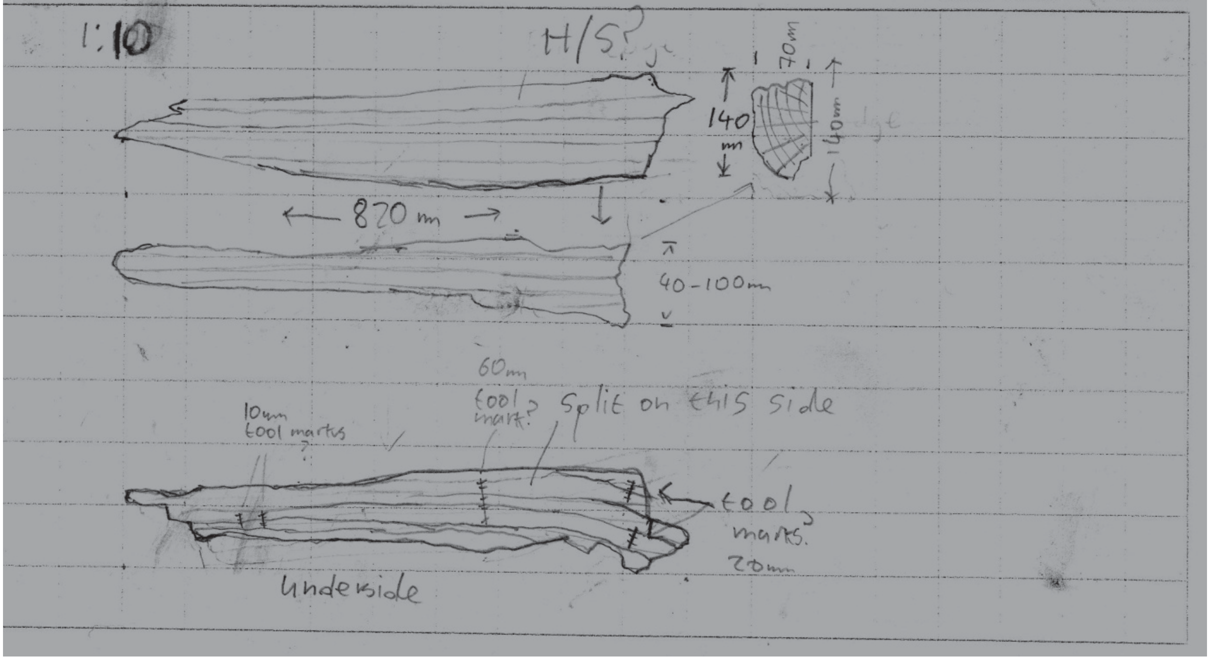


Figure 12.48 wood record sheet for sample 52 3 of 4

Figure 12.49 photograph of sample 52 3 of 4

Figure 12.50 photograph of sample 52 3 of 4

Figure 12.51 photograph of sample 52 3 of 4

Figure 12.52 photograph of possible tool marks on sample 52 3 of 4

York Archaeological Trust Post Excavation Wood Record Sheet	Site Code/ Accession No: G2148	Timber or SF No: 52 4 of 4
Site Name: G2148	Context No:	Area: 11/3

Type:	Cross Section:
Condition:	

OA Dimensions m/mm:
Length 920
Width 120-30
Thickness 70-20
Diameter

Cross Section Sketch:

	Yes	No
Bark	☐	☐
Sapwood	☐	☒
Knotty	☐	☐
Straight Grained	☒	☐

sapwood bark

Further Research Potential:

	Yes	No
Dendrochronology	☐ ?	☐
Tree ring Study	☒	☐
^{14}C	☐	☐
Display	☐	☐

Species Identification: Quercus
Conversion: radial - sawn?

Woodworking technology:
Tool Marks: Saw marks on one face. Auger holes x2 50mm-20mm + 15mm
Joints: Insufficient rings for dendro
Fixings and Fittings: 85m/43 = ARW 1.97m
Intentional Marks
Surface Treatment
Other

Reused: Y ☐ ? N ☐ Not Known ☐

Recommendation: Discard? ☐ Discard after further research/sampling? ☐ Retain and Conserve ☐
Checked:
Date:

Measured Sketch:

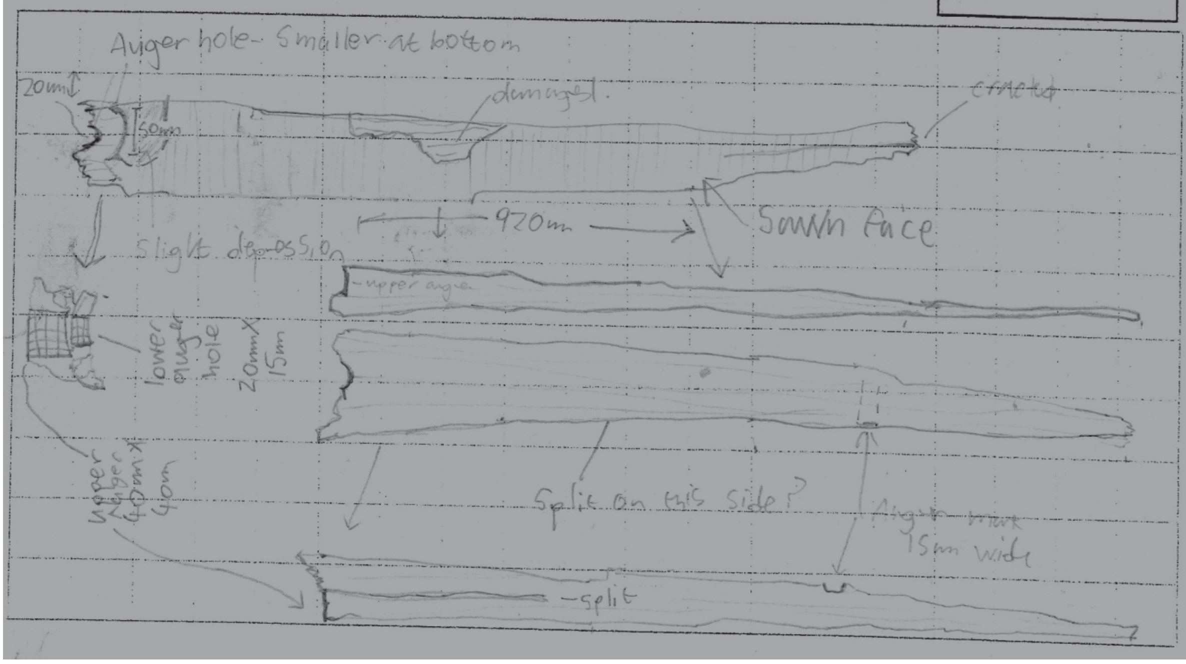


Figure 12.53 wood record sheet for sample 52 4 of 4


Figure 12.54 photograph of sample 52 4of 4


Figure 12.55 photograph of sample 52 4 of 4

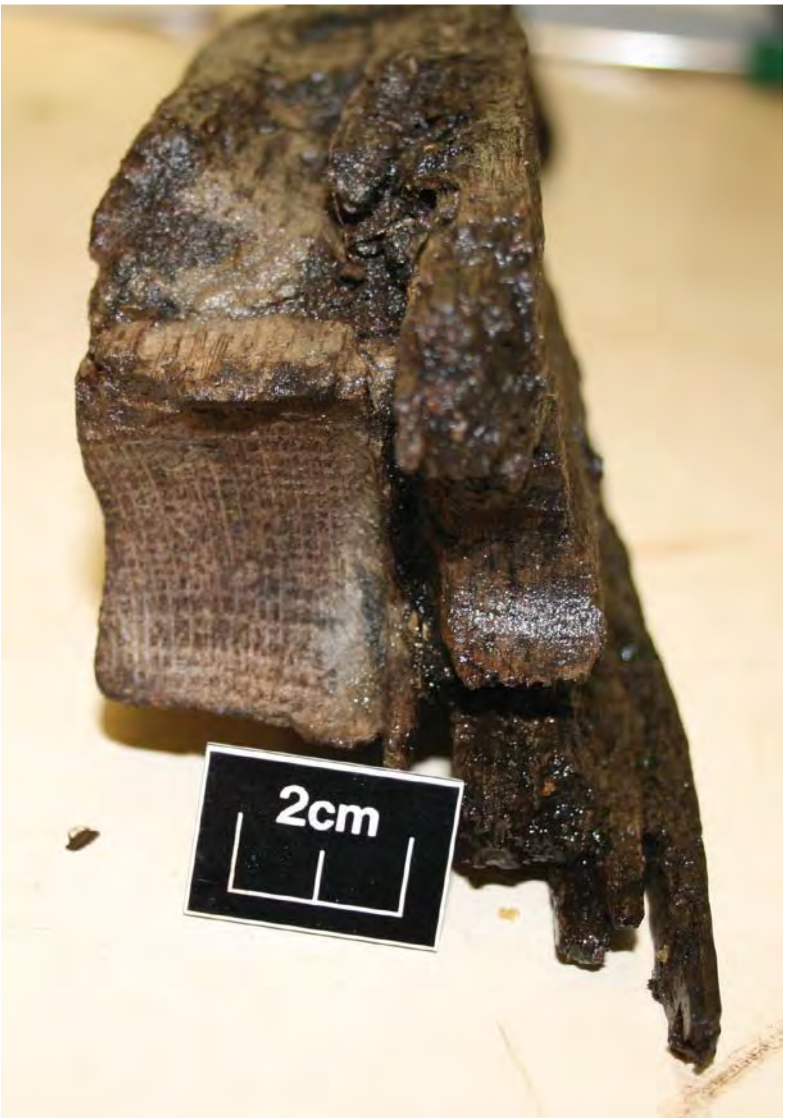


Figure 12.56 photograph of peg hole on sample 52 4 of 4

Figure 12.57 close up photograph of peg hole on underside of sample 52 4 of 4

Figure 12.58 photograph of peg hole impression on underside sample 52 4 of 4

Figure 12.59 photograph of vertical saw marks(left of scale) on upper face of sample 52 4 of 4

Figure 12.60 photograph of vertical saw marks on upper face of sample 52 4 of 4

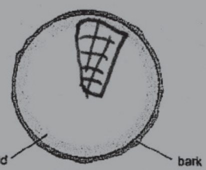
York Archaeological Trust Post Excavation Wood Record Sheet	Site Code/ Accession No: GZ148	Timber or SF No: 53 1 of 4
Site Name: GZ148	Context No:	Area: 11/3

Type:	Cross Section:
Condition:	

OA Dimensions m/mm:
Length ~~1140~~ 1100
Width 70-40
Thickness 50
Diameter

Cross Section Sketch:

	Yes	No
Bark	☐	☐
Sapwood	☐	☐
Knotty	☑	☐
Straight Grained	☐	☐



Further Research Potential:

	Yes	No
Dendrochronology	☐	☐
Tree ring Study	☑	☐
^{14}C	☐	☐
Display	☐	☐

Species Identification: Quercus | Conversion: ~~radial~~ sawn? – ¼ or -radial?

Woodworking technology:

Tool Marks: Auger hole. Saw marks?

Joints: 40mm wide then narrows with lip to 20mm – similar to

Fixings and Fittings

Intentional Marks: 60mm / 18 rings = ARW 3.33mm

Surface Treatment

Other

Reused: Y ☐ N ☐ Not Known ☐

Recommendation: Discard? ☐ Discard after further research/sampling? ☐ Retain and Conserve ☐ | Checked: | Date:

Measured Sketch: 1:10

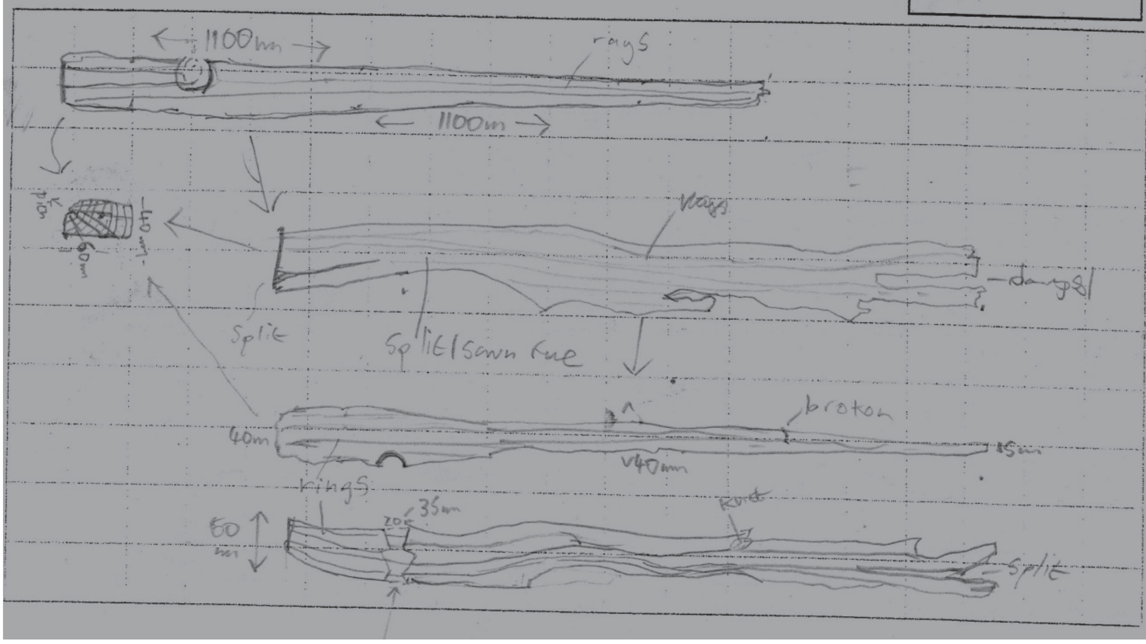


Figure 12.61 wood record sheet for sample 53 1 of 4

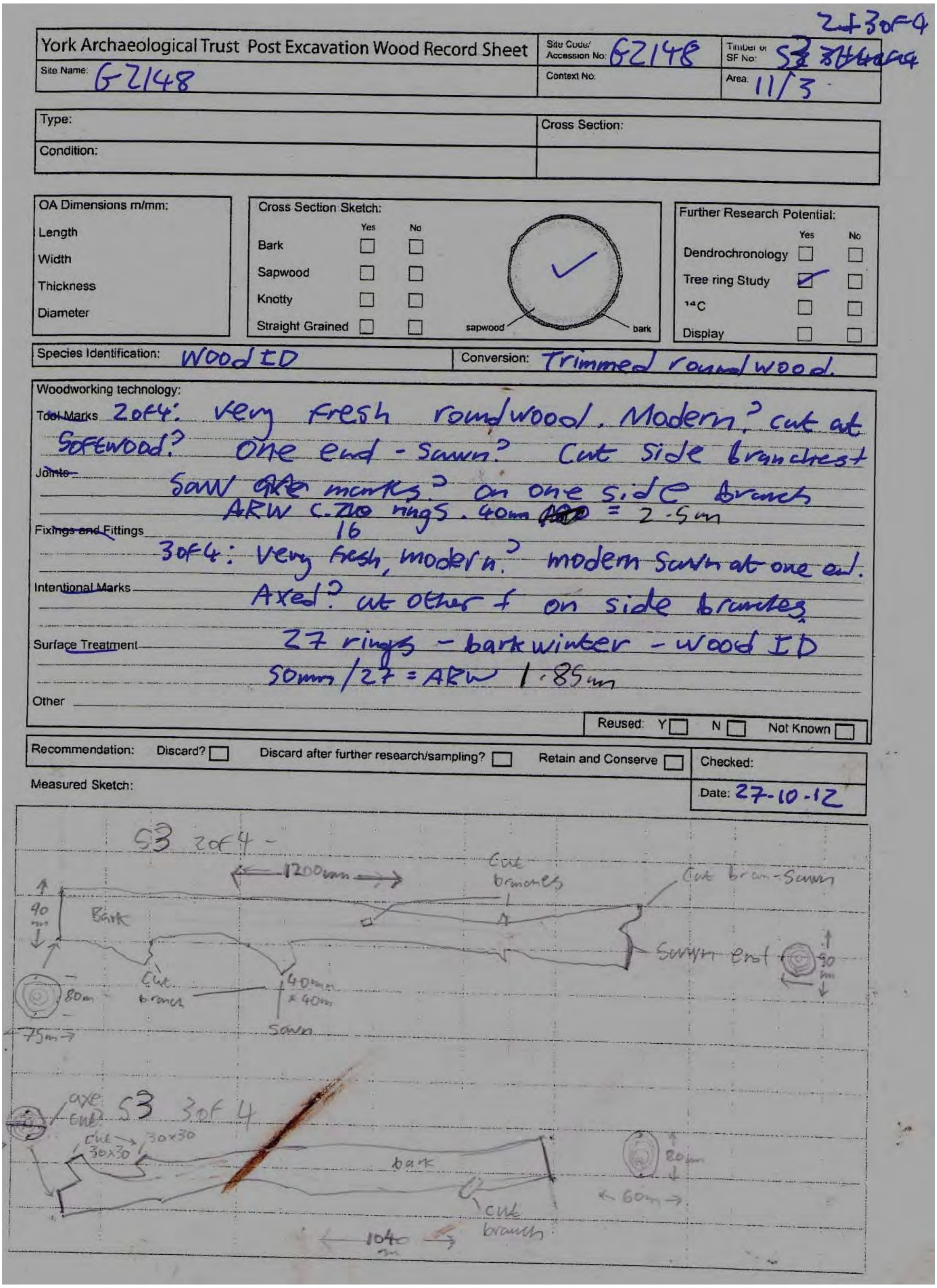

Figure 12.62 photograph of sample 53 1 of 4


Figure 12.63 photograph of sample 53 1 of 4


Figure 12.64 photograph of sample 53 1 of 4

Figure 12.65 photograph of end of sample 53 1 of 4

Figure 12.66 photograph of peg hole on sample 53 1 of 4



2+3 of 4

York Archaeological Trust Post Excavation Wood Record Sheet | Site Code/Accession No: G2148 | Timber or SF No: 53 ~~3/4~~

Site Name: G2148 | Context No: | Area: 11/3

Type: | Cross Section:

Condition:

OA Dimensions m/mm: Length, Width, Thickness, Diameter

Cross Section Sketch: Bark, Sapwood, Knotty, Straight Grained (Yes / No) — sapwood, bark

Further Research Potential: Dendrochronology, Tree ring Study (Yes ✓), 14C, Display (Yes / No)

Species Identification: Wood ID | Conversion: Trimmed roundwood.

Woodworking technology:

~~Tool~~ Marks 2of4: very fresh roundwood. Modern? cut at

Softwood? one end - sawn? Cut side branches+

~~Joints~~ saw ~~axe~~ marks? on one side branch

ARW c. ~~20~~ 16 rings. 40mm = 2.5mm

Fix~~ings and~~ Fittings

3of4: very fresh, modern? modern sawn at one end.

Intentional Marks Axed? at other + on side branches

Surface Treatment 27 rings - bark winter - wood ID

50mm/27 = ARW 1.85mm

Other

Reused: Y N Not Known

Recommendation: Discard? Discard after further research/sampling? Retain and Conserve | Checked:

Measured Sketch: | Date: 27-10-12

Figure 12.67 wood record sheet for samples 53 2 and 3 of 4

Figure 12.68 photograph of sample 53 2 of 4

Figure 12.69 photograph of worked side branch on sample 53 2 of 4

Figure 12.70 photograph of worked side branch on sample 53 2 of 4

Figure 12.71 photograph of cut side branch on sample 53 2 of 4

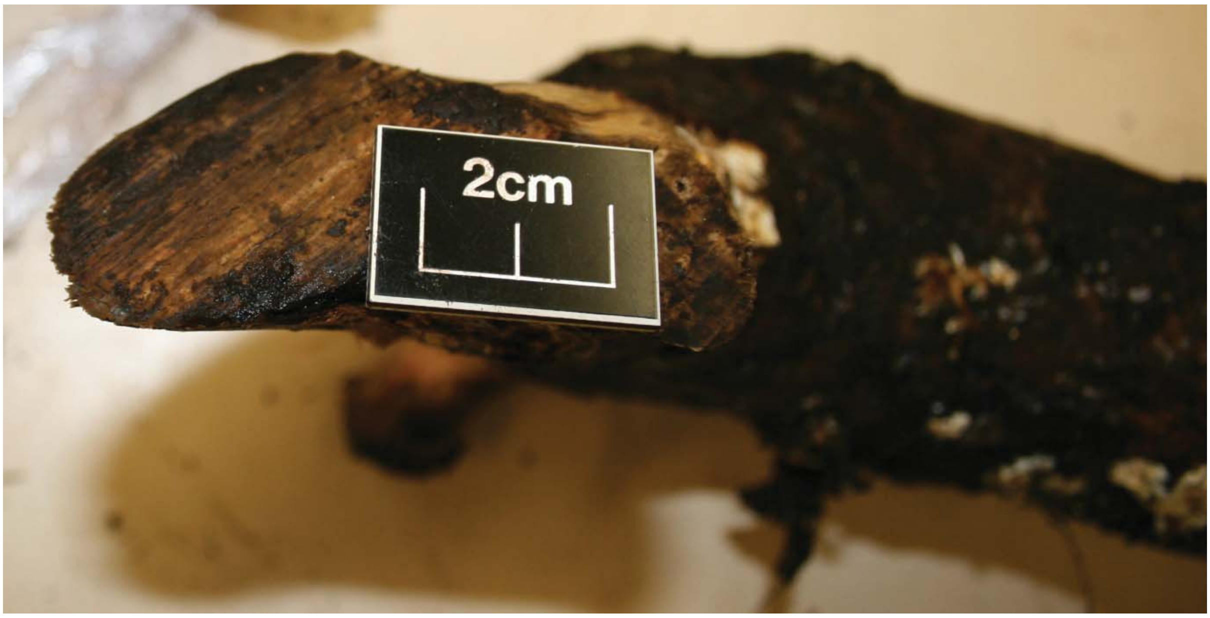


Figure 12.72 photograph of cut side branch on sample 53 2 of 4

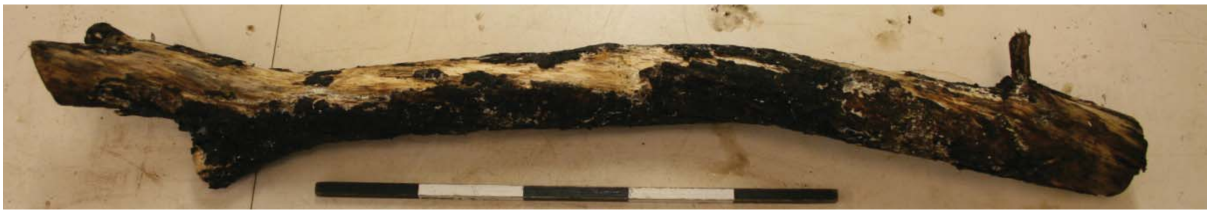


Figure 12.73 photograph of sample 53 3 of 4

Figure 12.74 photograph of cut side branch on sample 53 3 of 4

York Archaeological Trust Post Excavation Wood Record Sheet

Site Code/ Accession No:

Timber or SF No: 53 4 of 4

Site Name: GZ148

Context No:

Area: 11/3

Type:

Cross Section:

Condition: Good

OA Dimensions m/mm:

Length 200mm

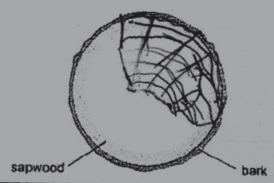
Width 110mm

Thickness 80mm

Diameter

Cross Section Sketch:

	Yes	No
Bark	☑	☐
Sapwood	☐	☐
Knotty	☑	☐
Straight Grained	☐	☐



Further Research Potential:

	Yes	No
Dendrochronology	☐	☐
Tree ring Study	☐	☐
^{14}C	☐	☐
Display	☐	☐

Species Identification: Quercus

Conversion:

Woodworking technology:

Tool Marks none visible

Joints Incomplete roundwood fragment, snapped

Fixings and Fittings at both ends - bark present - knotty.

Intentional Marks 22 annual rings.

80mm / 22 = ARW 3.63mm

Surface Treatment

Other

Reused: Y ☐ N ☐ Not Known ☐

Recommendation: Discard? ☐ Discard after further research/sampling? ☑ Retain and Conserve ☐

Checked:

Measured Sketch:

Date: 8/10/2012

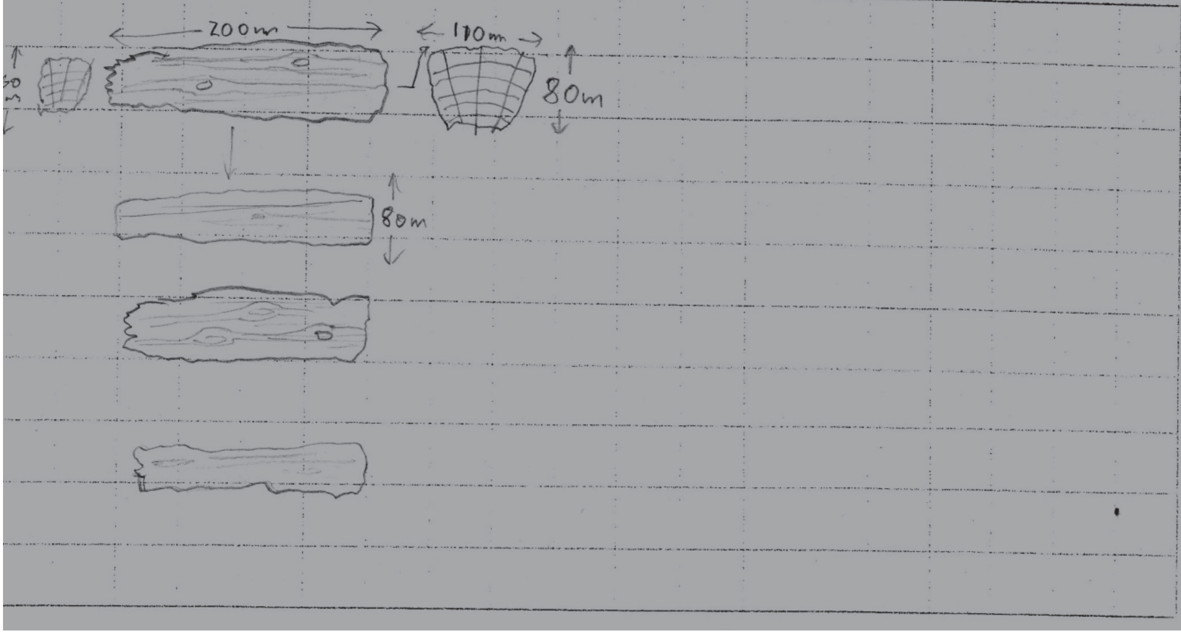


Figure 12.75 wood record sheet for sample 53 4 of 4

Additional notes plot 11/3

Dendrochronology of sample 50
This sample contained sufficient rings for dendrochronological analysis. Unfortunately the 102 ring sequence did not cross date with any reference chronologies. Several narrow bands of rings suggest this trees growth was controlled by microclimatic rather than regional climate factors.

Dendrochronology of sample 52 3 of 4
This sample contained sufficient rings for dendrochronology and two attempts were made to measure the rings. Several very narrow bands of rings proved problematic and the sample did not date against any reference chronologies. The slow growth rate and several very narrow bands of rings in sample 52 3 of 4 suggest that the timber may have been converted from the side branch of a tree and that the ring width pattern is the result of local microclimatic, rather than regional climate conditions.

Tool marks and working on Sample 52 4 of 4
What remains of this sample is a radial section of timber with saw marks on one face (Figures 32 and 33), and the remnants of two peg holes (Figures 27, 28, 29, 30 and 31). Its proportions are 920mm in length, from 120 narrowing to 30mm wide and from 20 to 70mm thick. It has been split down one side through one peg hole and at one end through the other peg hole, indicating dismantling and/or re use of the timber. The very good condition of the wood suggests it is of post medieval /modern date. Figure 12.31 shows the impression of a former peg hole on the underside of the sample (also see sketch), where the wood has been radially split apart along its length during dismantling. This peg hole is 15mm in diameter.

The incomplete peg hole at one end (Figures 27, 28, 29 and 30) is of two diameters (50mm on sawn upper face and 20mm on under side) and shows evidence of having been broken apart during dismantling/re use.

The distance between the two peg holes is 650mm.

Sample 53 1of 4
Saw marks are less evident on this sample than on 52 4 of 4, so the timber may have been converted by splitting. The wood condition is very good and appears almost fresh suggestive of a post medieval/modern date. The break on the side of the peg hole (Figures 35, 36, 37 and 39) suggests that the timber was originally larger and has been split apart during some sort of dismantling/re using process.

Sample 53 2of 4
This sample is a 1200mm long by 90mm wide branch, worked with four clearly cut side branches and one cut end. The marks on one side branch (Figures 42 and 43) are likely to be cut marks that have failed to cut through the branch. The wood appears almost fresh suggesting a post medieval or modern date.

Plot: 13/30 Timber find spot
Grid SH 65675 40350 Estimated period: Unknown
Two large timbers found in base of the trench at a depth of about 1.5m below the present surface. These were in a mid brownish grey silty sand of probable alluvial origin. Most of the layers above were alluvial silts and clays with a band of brown, organic material in places. This site is on the flood plain of the Afon Dwyryd about 190m west of the river. The river here is tidal and meanders across its flood plain, but has not changed its course since 1889, partly because there were already flood banks built along each side of the river at this date. Timber collected.

Wood record: These two large timbers were cut into two pieces during excavation with a saw to aid transport. One is quartered (find number 57) and was subjected to spot dating. The tree-ring sequence has however not cross-matched against existing dated British or Irish sequences. The second timber (find number 58) is an approximately quartered piece of knotty oak with possible tool mark survival and shows similarities to some of the timbers recovered from plot 14/7. Both timbers have been recorded on a wood record sheet, photographed, wood technology recorded and subject to further dendrochronological analysis.

Sample 57 1 of 2 has one cross cut worked end (Figure 12.80) though the decayed surface means no tool marks are visible.

Sample 58 1 of 2 has similarly been split and one end has been roughly cross cut to form a lipped end. Axe marks are visible at this end (Figures 88,89 and 90) with the cut being 90 mm in length and 35 mm deep. A visible axe mark is 25mm in length.

Both samples 57 and 58 may have formed horizontal elements to some sort of trackway structure.

Dendrochronological analysis
Both samples 57 and 58 contained sufficient rings for dendrochronological analysis. The ring width series from sample 57 contained 97 heartwood rings, and 58 contained 141 heartwood rings. The two timbers cross matched very highly with each other, with a *t* value of 12.6 suggestive of them having been converted from the same parent tree (English Heritage 1998). Unfortunately, neither sample, nor a 157 year mean created from both samples, dated when compared to British, Irish and European reference chronologies.

York Archaeological Trust Post Excavation Wood Record Sheet

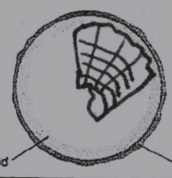
Site Name: G2148	Site Code/ Accession No: G2148	Timber or SF No: 057 1 of 2
	Context No:	Area: 13/30

Type:	Cross Section:
Condition:	

OA Dimensions m/mm:
- Length 1040
- Width 180
- Thickness 120
- Diameter

Cross Section Sketch:

	Yes	No
Bark	☐	☑
Sapwood	☐	☑
Knotty	☐	☑
Straight Grained	☑	☐



Further Research Potential:

	Yes	No
Dendrochronology	☑	☐
Tree ring Study	☐	☐
^{14}C	☐	☐
Display	☐	☐

Species Identification: Quercus

Conversion: ¼ed split?

Woodworking technology:

Tool Marks: heavily machine damaged. Possible tenon at one end - very damaged

Joints: dendro / matches SF058. t=12 - Same tree? - ~~to~~ does not date externally.

Fixings and Fittings

Intentional Marks

Surface Treatment

Other

Reused: Y ☐ N ☐ Not Known ☐

Recommendation: Discard? ☐ Discard after further research/sampling? ☐ Retain and Conserve ☐

Checked:

Measured Sketch: 1:10

Date: 5/11/2012

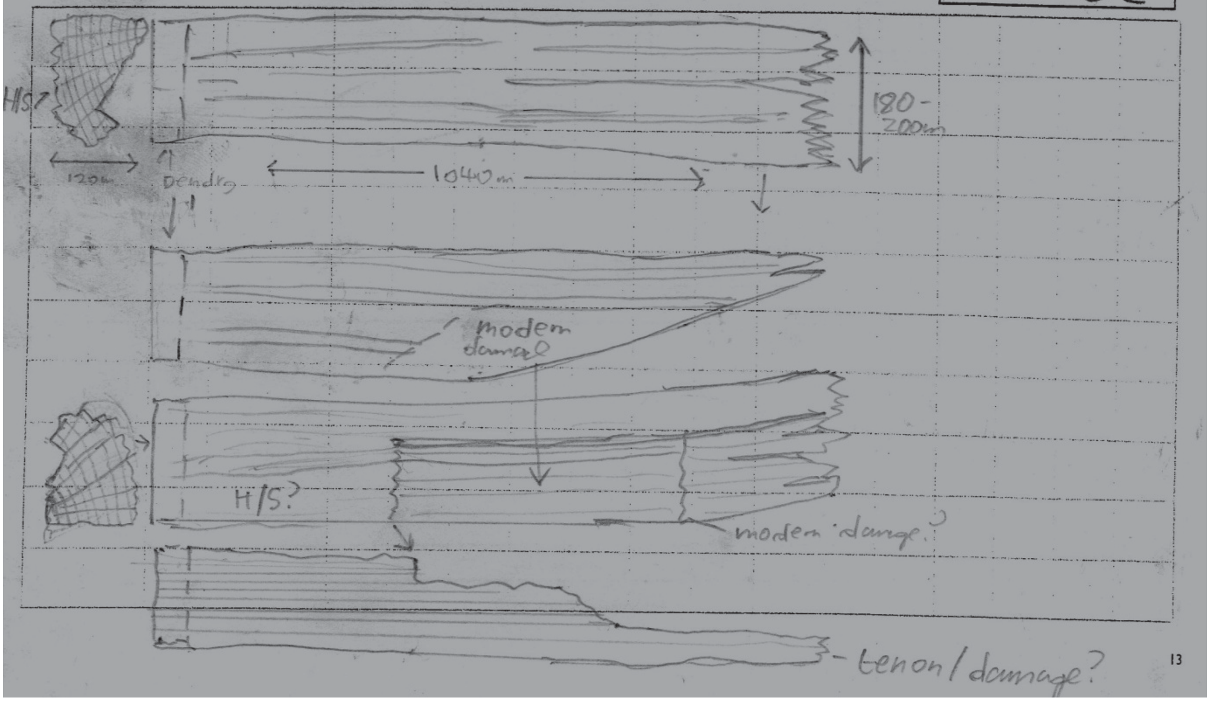


Figure 12.76 wood record sheet for sample 57 1 of 2

Figure 12.77 photo of sample 57 1 of 2

Figure 12.78 photo of sample 57 1 of 2

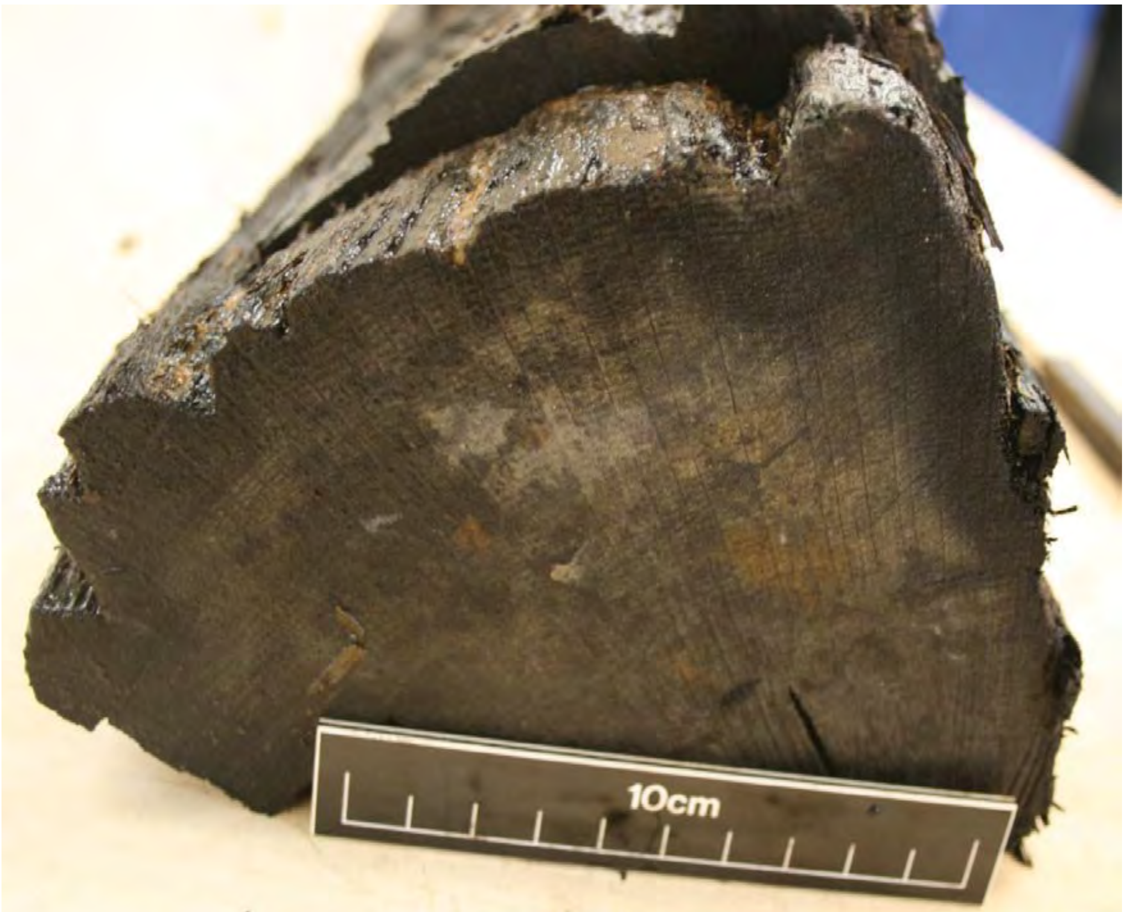


Figure 12.79 photo of 57 1 of 2 dendro sample cross section

Figure 12.80 photo of possible worked end of sample 57 1 of 2

York Archaeological Trust Post Excavation Wood Record Sheet

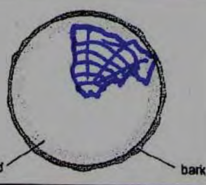
Site Name: G2148	Site Code/ Accession No: G2148	Timber or SF No: 057 2of2
	Context No:	Area: 13/30

Type:	Cross Section:
Condition:	

OA Dimensions m/mm:
Length 1070
Width 180
Thickness 120
Diameter

Cross Section Sketch:

	Yes	No
Bark	☐	☑
Sapwood	☐	☑ H/S?
Knotty	☐	☐
Straight Grained	☑	☐



Further Research Potential:

	Yes	No
Dendrochronology	☑	☐
Tree ring Study	☐	☐
^{14}C	☐	☐
Display	☐	☐

Species Identification: Quercus

Conversion: 1/4ed Split

Woodworking technology:

Tool Marks None evident. Very damaged surface.

Joints dendro from SF 057 matches SF 058 - same tree?

Fixings and Fittings

Intentional Marks

Surface Treatment

Other

Reused: Y ☐ N ☐ Not Known ☐

Recommendation: Discard? ☐ Discard after further research/sampling? ☐ Retain and Conserve ☐

Checked:

Date: 5/11/2012

Measured Sketch:

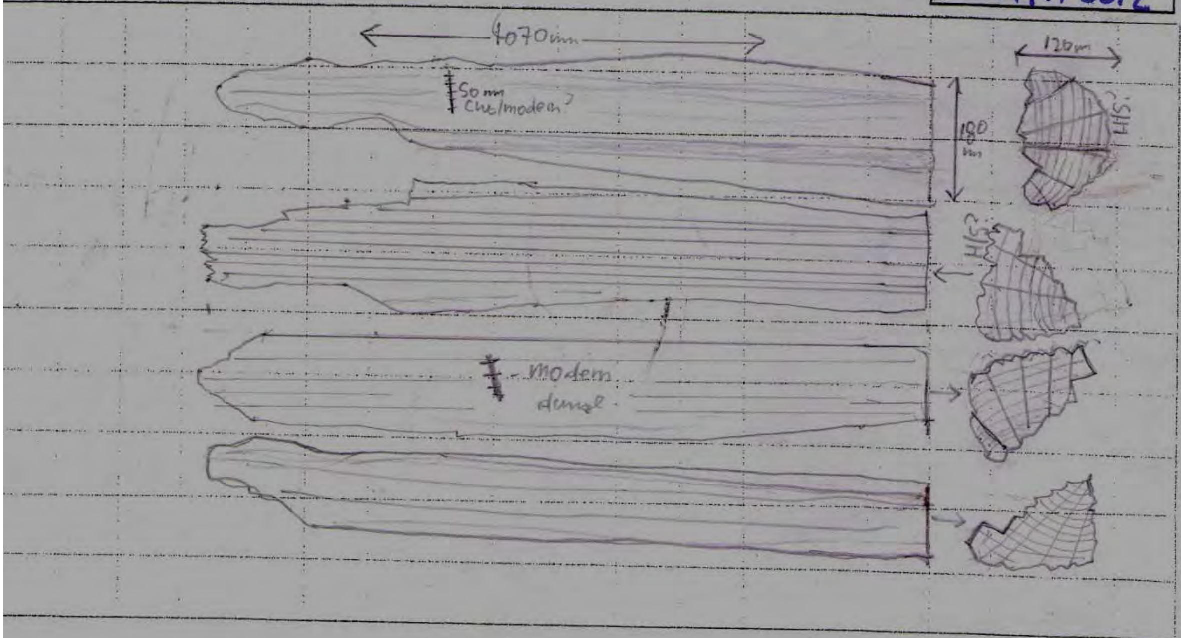


Figure 12.81 wood record sheet for sample 57 2 of 2

Figure 12.82 photograph of sample 57 1 and 2. Sample 2 is the left piece

Figure 12.83 photograph of sample 57 1 and 2. Sample 2 is the left piece

York Archaeological Trust Post Excavation Wood Record Sheet

Site Code/ Accession No: GZ148

Timber or SF No: 58 1 of 2

Site Name: GZ148

Context No:

Area: 13/30

Type:

Cross Section:

Condition:

OA Dimensions m/mm:

Length 1060 mm

Width 190 mm

Thickness 40-100 mm

Diameter

Cross Section Sketch:

	Yes	No
Bark	☐	☑
Sapwood	☐	☑
Knotty	☐	☐
Straight Grained	☑	☐

sapwood

bark

Further Research Potential:

	Yes	No
Dendrochronology	☑	☐
Tree ring Study	☐	☐
^{14}C	☐	☐
Display	☐	☐

Species Identification: Quercus

Conversion: radial split

Woodworking technology:

Tool Marks Axed at one end. Possible adze marks on one side

Joints Axed end may have been tenon Joint?

Fixings and Fittings Dendro Sample - 2 pieces. Bad Join - c.16

Intentional Marks rings on 2nd piece - not measured

Surface Treatment

Other

Reused: Y ☐ N ☐ Not Known ☐

Recommendation: Discard? ☐ Discard after further research/sampling? ☑ Retain and Conserve ☐

Checked:

Measured Sketch: 1:10

Date: 1.11.2012

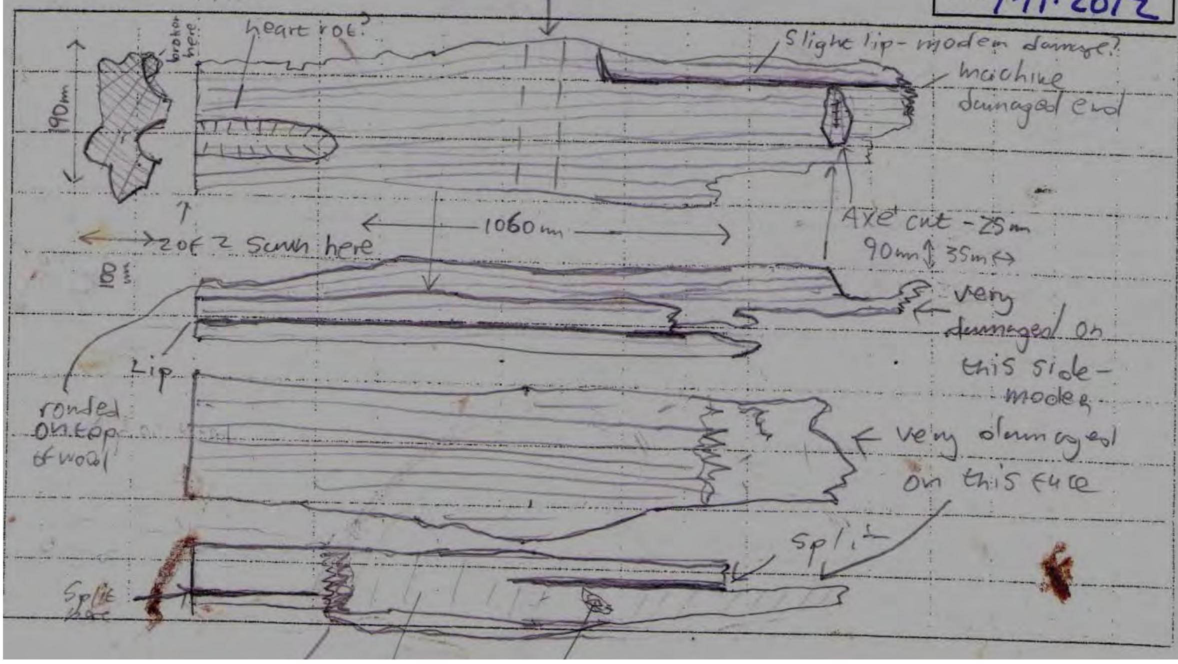


Figure 12.84 wood record sheet for sample 58 1 of 2

Figure 12.85 photograph of sample 58 1 of 2

Figure 12.86 photograph of sample 58 1 of 2

Figure 12.87 photograph of sample 58 1 of 2 showing cross section where sample joins 2 of 2

Figure 12.88 photograph of worked end joint on sample 58 1 of 2

Figure 12.89 photograph of worked end joint on sample 58 1 of 2

Figure 12.90 photograph of worked end joint on sample 58 1 of 2

Type: G2148

Cross Section: 058 2 of 2 13/30

Condition:

OA Dimensions m/mm:

Length 1260mm

Width 180mm

Thickness 110-40mm

Diameter

Cross Section Sketch:

	Yes	No
Bark	☐	☐
Sapwood	☐	☐ H/S
Knotty	☐	☐
Straight Grained	☐	☐

sapwood bark

Further Research Potential:

	Yes	No
Dendrochronology	☑	☐
Tree ring Study	☐	☐
^{14}C	☐	☐
Display	☐	☐

Species Identification:

Conversion:

Woodworking technology:

Tool Marks machine modern damaged.

Joints

Fixings and Fittings

Intentional Marks

Surface Treatment Very Compressed reed / Seam? on one Face

Other

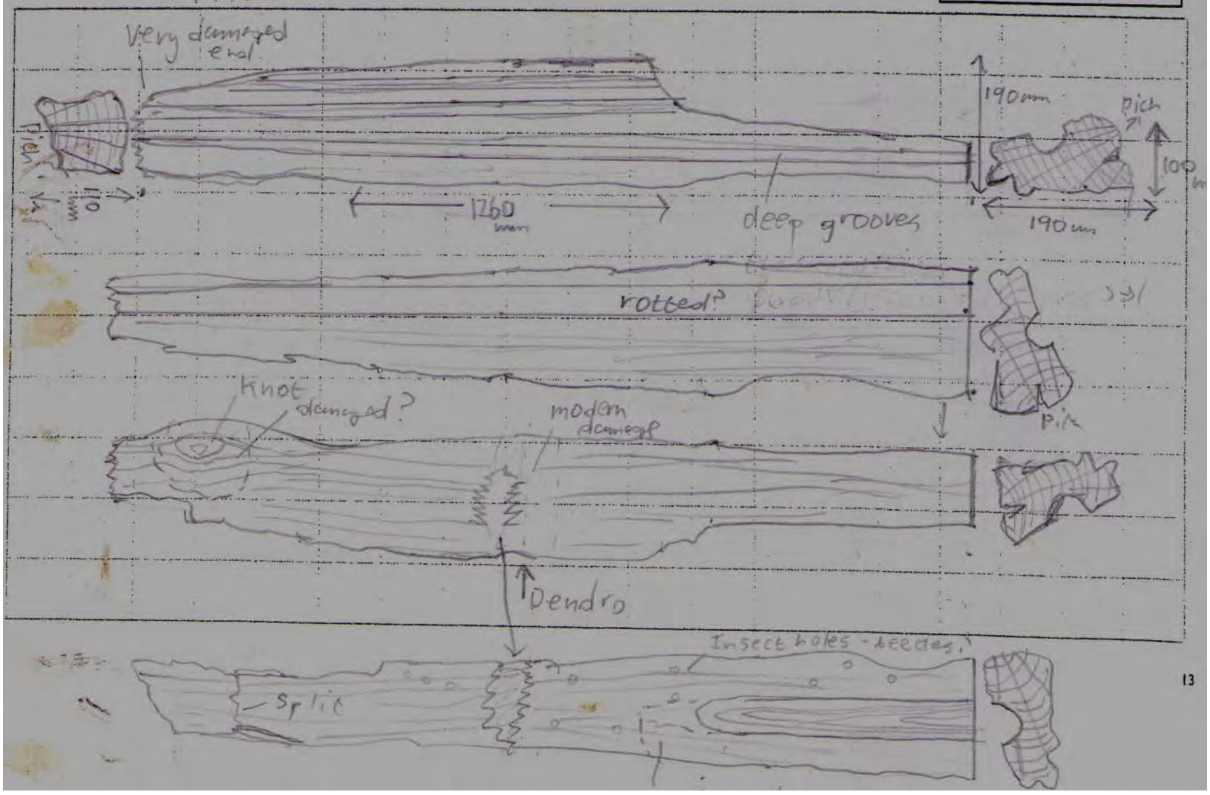
Reused: Y☐ N☐ Not Known ☐

Recommendation: Discard? ☐ Discard after further research/sampling? ☐ Retain and Conserve ☐

Checked:

Measured Sketch: 1:10

Date:



13

Figure 12.91 photograph of sample 58 2 of 2

Figure 12.92 photograph of sample 58 2 of 2


Figure 12.93 photograph of sample 58 2 of 2


Figure 12.94 photograph of sample 58 2 of 2

Figure 12.95 photograph of sample 58 2 of 2 showing eroded heartwood

Figure 12.96 photograph of sample 58 2 of 2


Figure 12.97 photograph of sample 58


Figure 12.98 photograph of sample 58


Figure 12.99 photograph of sample 58


Figure 12.100 photograph of sample 58

Plot: 14/1 Timber find spot
Grid SH 66445 40949 Estimated period: Unknown
A large squared timber was recovered from the mid grey silty clay in the base of the trench. This site is on the flood plain of the Afon Dwyryd about 180m north of the river. The river here is just at the tidal limit with the highest point of ordinary tides being under the bridge at Maentwrog. The river meanders across its flood plain, but has not changed its course since 1889, partly because there were already flood banks built along each side of the river at this. Recorded during watching brief, timber sampled.

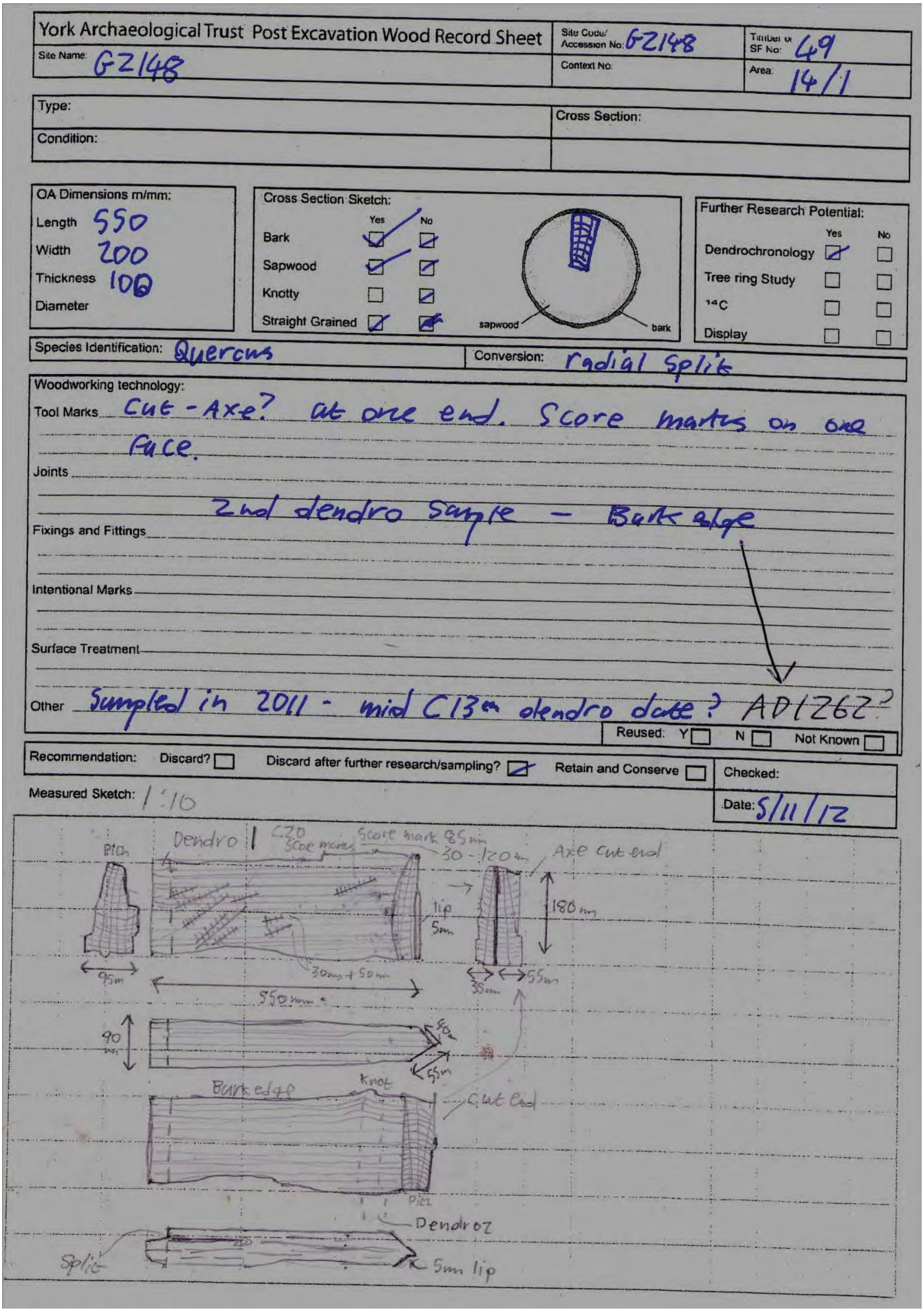
Wood record: This single large timber (find number 49) was cut at one end with a saw during excavation. It is a radially converted piece of slow-grown (c. 200 rings) oak with a wedge cut point at one end. As part of a selective spot-dating exercise, this timber with its large number of rings, was subjected to dendrochronological analysis. The sample proved difficult to measure with a number of bands of narrow, sometimes anomalous rings in the latter part of the tree-ring sequence. This sample yielded a suspected date in the mid 13th century.

The timber has been radially split from a large branch or trunk timber cross-cut from two directions to cut to length. Marks on one side suggest repeated use as a chopping block probably in cross-cutting other similar timbers to length

Dendrochronological dating of sample 49
An additional sample from this timber confirmed the suspected mid-13th century AD dating position obtained during assessment, with the innermost ring dating to AD1073 and the outermost surviving ring (heartwood/sapwood boundary) dating to AD 1262 (190 annual rings with an average ring width of .75mm). Using the estimate of sapwood rings for British trees of between 10 and 46 rings (English Heritage 1998), a felling date range of between AD1272 and AD1308 can be given for this timber. This second sample contained a phenomena known as included or 'double' sapwood (Govorčin and Sinković 2000) prior to the actual heartwood sapwood boundary (Figures 109 and 110), evidence of possible injury to the parent tree and possibly the reason for anomalous/narrow rings in the latter part of the sequence, and relatively low (though convincing) correlations with reference chronologies. A mean series, made using the ring width measurements from both dendrochronology samples shows good agreement with a range of reference ring width chronologies from Britain and Ireland (Figure 12.99). Unfortunately none of the samples from other contexts that were analysed cross dated with the sequence from this now dated sample.

Figure 12.101 table of t values between ring width series from G2148_49 dated AD1073-1262 and various reference chronologies

Chronology/Site	Age range	*t* value
Llynperis logboat (Nayling, 1999)	AD995-AD1186	6.59
St Audoen, Ireland (Baillie, 1977)	AD 865-AD1299	6.05
Falcon Pub (2), Chester (Leggett, 1989)	AD991-1234	5.23
Glasgow cathedral, Scotland (Baillie, 1977)	AD946 -1360	5.08
Caerlaverak Castle, Scotland (Baillie, 1977)	AD1020-AD1370	5.20
Shackerly, Salop, (Groves, 1994)	AD1008-AD1266	4.75



York Archaeological Trust Post Excavation Wood Record Sheet

Site Name: GZ148

Site Code/ Accession No: GZ148

Context No:

Timber or SF No: 49

Area: 14/1

Type:

Condition:

Cross Section:

OA Dimensions m/mm:
Length 550
Width 200
Thickness 100
Diameter

Cross Section Sketch:

	Yes	No
Bark	☑	☑
Sapwood	☑	☑
Knotty	☐	☑
Straight Grained	☑	☑

sapwood

bark

Further Research Potential:

	Yes	No
Dendrochronology	☑	☐
Tree ring Study	☐	☐
^{14}C	☐	☐
Display	☐	☐

Species Identification: Quercus

Conversion: radial split

Woodworking technology:

Tool Marks Cut - Axe? at one end. Score marks on one face.

Joints

2nd dendro sample – Bark edge

Fixings and Fittings

Intentional Marks

Surface Treatment

Other Sampled in 2011 - mid C13th dendro date? AD1262?

Reused: Y ☐ N ☐ Not Known ☐

Recommendation: Discard? ☐ Discard after further research/sampling? ☑ Retain and Conserve ☐

Checked:

Measured Sketch: 1:10

Date: 5/11/12

Figure 12.102 wood record sheet for sample 49

Figure 12.103 photograph of sample 49 upper face.

Figure 12.104 photograph of sample 49 side face

Figure 12.105 photograph of sample 49 lower face

Figure 12.106 photograph of worked end of lower face of sample 49

Figure 12.107 photograph of cut face on upper face ofsample 49

Figure 12.108 photograph showing worked end of sample 49

Figure 12.109 photograph showing cut marks on upper of 49

Figure 12.110 photograph of dendro sample 1 from sample 49

Figure 12.111 photograph of dendro sample 2 from sample 49, showing included sapwood on lower right of sample and heartwood/sapwood boundary

Figure 12.112 close up photograph of dendro sample 2. The paler area above the scale bar is included sapwood, with the actual heartwood/sapwood boundary at the outermost 2 rings of the sample

Plot: 14/4 Possibly worked wood

Grid SH 66605 41061 Estimated period: Unknown

A possibly cut branch and plank-shaped timber were found in alluvial clay. A large unworked branch was also found in this plot. The clay is described as firm dark grey silty clay, and it had alluvial gravels below it. This site is on the flood plain of the Afon Dwyryd about 180m north of the river. The river here is generally not tidal, but the highest point of ordinary tides is under the bridge at Maentwrog, so on some tides this section of river must still be tidal. The river meanders across its flood plain, but has not changed its course since 1889, partly because there were already flood banks built along each side of the river at this date. Recorded during watching brief, wood samples taken.

Wood record for sample 42

Microscopic analysis shows that this is a piece of *Salix spp*. Roundwood. Its dimensions are 100*35*25mm and there is a possible toolmark (15mm*15mm) on one side (Figures 2 and 3). It contains 11 annual rings and has an average ring width of 1.13mm.

York Archaeological Trust Post Excavation Wood Record Sheet	Site Code/ Accession No: G2148	Timber or SF No: 42
Site Name: G2148	Context No:	Area: 14/4

Type:	Cross Section:
Condition:	

OA Dimensions m/mm:
Length 100
Width 35
Thickness 25
Diameter

Cross Section Sketch:

	Yes	No
Bark	☐	☐
Sapwood	☐	☐
Knotty	☐	☐
Straight Grained	☐	☐

sapwood ✓ bark

Further Research Potential:

	Yes	No
Dendrochronology	☐	☐
Tree ring Study	☑	☐
^{14}C	☐	☐
Display	☐	☐

Species Identification: | Conversion:

Woodworking technology:

Tool Marks non oak roundwood
possible

Joints ARW 12.5m/11 rings =.113 m

Fixings and Fittings

Intentional Marks

Surface Treatment

Other WOOD/ID

Reused: Y☐ N☐ Not Known☐

Recommendation: Discard? ☐ Discard after further research/sampling? ☐ Retain and Conserve ☐ | Checked:

Measured Sketch: | Date: 13.11.12

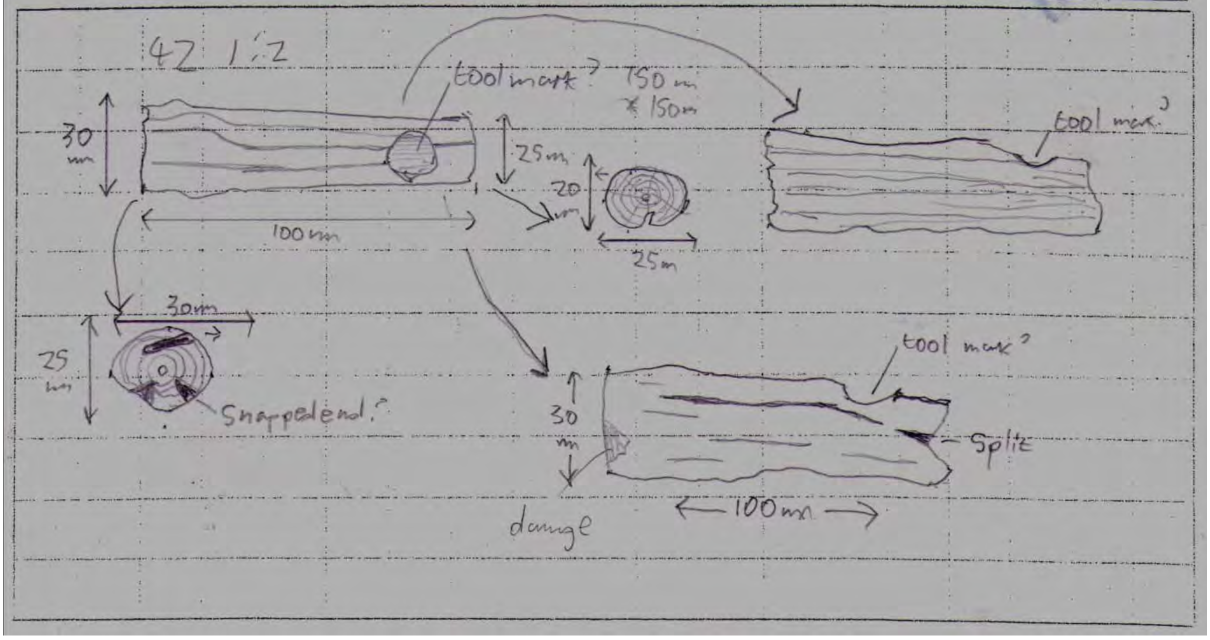


Figure 12.113 wood record sheet for sample 42

Figure 12.114 photograph of sample 42

Figure 12.115 photograph of sample 42

Figure 12.116 photograph of end of sample 42

Plot 14/7 Possible former riverbank with deposit of wood and branches
Grid SH 66907 41219	Estimated period: Unknown

Site description: Plot 14/7 lies within a bend of the Afon Dwyryd. The field is reclaimed land protected by a flood bank since at least the late 19th century. The 1841 tithe map for Maentwrog parish shows the same course of the river as in 1889. The bend in the river to the NE of plot 14/7 was straightened out in the 20th century and now exists as ox-bow lake type ponds. Under about 0.1m of topsoil (147001) was a layer of mid orange-brown silty clay (147002) 0.39m thick. This overlaid a mid grey-brown silty clay (147003), which in turn covered a light grey silty clay (147004/147006). All these deposits appeared to be alluvial silts. About 32m east of the current river bank a large piece of timber was recovered from the silts at a depth of 1.1m below the present surface from context 147006. In places beneath 147004 was a deposit composed largely of pieces of wood (147005). This deposit was between 0.9m and 1.1m below the present surface and composed of dark grey silt containing a dense concentration of pieces of wood, branches and hazelnuts. Many of the pieces were small but two large timbers were found, the largest was 0.75m in length. These pieces had some marks that might indicate working. Some of the smaller pieces also seemed to be cut or sawn and some pieces were radially split timber. There was a high concentration of hazelnuts but none of these seemed to be deliberately broken and they may indicate that many of the branches were deposited in the river in autumn with their nuts still attached. More probably nuts from riverside trees dropped into the water and were deposited in this location along with other debris. No artefacts, other than wood, were found in this area. Fourteen meters to the west of the wood deposit was a palaeochannel, c.5.8m wide and over 0.7m deep (it was not fully exposed in the trench). This channel was filled with layers of alluvial gravel and was cut through the grey alluvial silty clay. Towards the eastern end of plot 14/7 the top of a cattle skull with horns was found at a depth of 1.4m. This was found within what appeared to be a low mound of grey silty clay (147009). The grey clay was sealed by a mid orange-brown silt. Recorded during watching brief.

Wood record: A total of eleven individually numbered items were examined from this plot, comprising a total of forty pieces of wood. The single piece from context 147006 (sample 59) was cut into two sections during excavation, and comprises a quartered piece of oak was possible axe marks on one end and one face (at least) with sufficient rings (approximately 70) and sapwood so was analysed for tree ring dating. The 37 pieces assigned to context 147005 include numerous quartered or radially split oak wood with tool marks. There are also smaller roundwood items with evidence of working such as the cutting of side branches. Contextual information provided does not suggest the presence of clear structure, however a number of the pieces exhibit clear woodworking from initial conversion through splitting followed by secondary hewing which implies that at least part of this assemblage represents worked and possibly finished timbers which may have been displaced, possibly during flood events, from its place of original use. Some of the smaller items may represent the debris from woodworking. This group of material cannot be explained as natural driftwood, or remnants of simple woodland clearance.

Forty of these pieces have been recorded using wood record sheets, selective photography, tree ring and wood technology analysis to provide a basic record. Thirteen of these pieces retain evidence of woodworking which has been recorded. The majority of this group is oak, but nine pieces are not and required microscopic wood identification. Rapid recording of tree ring information was undertaken for 19 pieces, and nine items retained sufficient rings to merit dendrochronological analysis.

Figure 12.117 Table of samples for area 14/7

Sample code	Origin of sample	Species	Cross-section/ conversion	Dimensions (mm)	Total rings	Sapwood	ARW mm/year	Toolmarks/ comments
36	14/7	*Quercus*	Roundwood	840x40x25	9	-	2.77	Cut end. Very knotty- c.16 side branches
38	14/7	*Betula*	Roundwood	110 x60x45	9	-	2.5	Cut side branch and snapped at one end
39	14/7	*Unidentified*	Radial?	50x20x2.5	1?	-	2?	No tool marks. Split?

40	14/7	*Quercus*	Radial - split	115x 50x10	30	-	1.66	Radial split with possible cut hole (figures 134,135)
41 A	14/7	*Corylus*	Radial	85x17	5	-	3.4	
41 B	14/7	*Corylus*	Roundwoo d	80x25	40+	-	.50	Very slow grown
41 C	14/7	*Corylus*	Roundwoo d	70x15	18	-	.66	Slow grown
44A	14/7	*Quercus*	Radial split	450x100x60	100	Heartwood/ sapwood boundary	.60	Very narrow bands of rings – unmeasurable.
44B	14/7	*Quercus*	Roundwoo d	190x50	c.5 0	Bark edge	.50	Cut or snapped at ends. Very slow grown. Insect galleries present
44C	14/7	*Quercus*	Roundwoo d	140x40	c.5 0	Bark edge	.50	Cut or snapped at ends. Very slow grown and knotty
44D	14/7	*Quercus*	Roundwoo d	100x25	17	Bark spring/sum mer	.70	Cut or snapped at ends
45	14/7	*Quercus*	Radial split	130x70x30	18	-	3.88	Possible tool mark
46	14/7	*Quercus*	Radial split	850x220x11 0	48	-	3.6	Axe cut at one end
47A	14/7	*Quercus*	Radial split	325x80x15	40	-	1.87	Axe cut at one end?
47B	14/7	*Quercus*	Radial split	420x40x20	c.7 8	-	.52	Unmeasurable
47C	14/7	*Quercus*	Radial split	420x60x30	c.8 0	-	.75	Unmeasurable
47D	14/7	*Quercus*	Radial split	860x90x40	c.1 16	-	.34	Unmeasurable
47E	14/7	*Quercus*	Radial split	860x90	c.1 20	-	.41	Very knotty. unmeasurable
47F	14/7	*Quercus*	Radial split	200x70x20	20	Sapwood on one edge	2.5	Axe cut at one end
47G	14/7	*Quercus*	Tangential split	300x55x10	16	-	.62	Possible tool marks or modern damage?
47H	14/7	*Quercus*	Radial split	200x55x20	7	-	2.85	Knotty. Axe mark?
47I	14/7	*Quercus*	Radial split	170x50x16	30	-	.53	Knotty. Very slow grown
47J	14/7	*Quercus*	Radial split	250x50x15	40	-	1.25	Knotty. Very slow grown
47K	14/7	*Quercus*	Tangential split	230x50x5	3	-	1.66	-
47L	14/7	*Quercus*	Radial	50x40x10	29	-	1.48	Cut at one end with 10mm and15mm tool marks

47M	14/7	*Quercus*	Roundwood	110x20x20	15	Bark winter	.67	
47N	14/7	*Quercus*	Roundwood	160x30x20	-	Bark edge	-	Impossible to discern rings – very slow grown. Cut at one end
47O	14/7	*Quercus*	Radial	30x20	10	-	.80	Cut at one end
47P	14/7	*Quercus*	Radial	30x20x8	11	-	.91	Cut at both ends
47Q	14/7	*Quercus*	Radial	40x40x12	7	-	.71	Cut at one end. Damaged at other
47R	14/7	*Quercus*	Radial	90x40x40	c.50	Bark	.50	Very slow grown
47Ri	14/7	*Quercus*	Radial	45x25x5	25	-	1	-
47S	14/7	*Unidentified*	Roundwood	100x20x15	5	-	1.5	-
47T	14/7	*Alnus*	Radial	80x30x12	7	-	1.42	Cut at one end?
47U	14/7	*Alnus*	Tangential	60x35x15	15	-	1	-
47V	14/7	*Quercus*	Radial split	400x35x10	-	-	-	Very slow grown-unmeasurable
47W	14/7	*Betula*	Halved roundwood	400x130x50	50+	-	1	Very slow grown.
48	14/7	*Quercus*	Radial split	355x80x25	c.99	-	.64	Slow grown-unmeasurable. Cut at one end
59 1 of 2	14/7	*Quercus*	Quartered split	990x130x90	182	-	.49	Some parts unmeasurable. Multiple measures of multiple samples do not date
59 2 of 2	14/7	*Quercus*	Quartered split	960x130x100	182	-	.49	Some parts unmeasurable. Multiple measures of multiple samples do not date

York Archaeological Trust Post Excavation Wood Record Sheet	Site Code/ Accession No: GZ148	Timber or SF No: 36
Site Name: GZ148	Context No:	Area: 14/7

Type:	Cross Section:
Condition:	

OA Dimensions m/mm:
Length 840
Width 45
Thickness 25
Diameter

Cross Section Sketch:

	Yes	No
Bark	☒	☐
Sapwood	☒	☐
Knotty	☒	☐
Straight Grained	☐	☐

sapwood bark

Further Research Potential:

	Yes	No
Dendrochronology	☐	☐
Tree ring Study	☐	☐
^{14}C	☐	☐
Display	☐	☐

Species Identification: Quercus
Conversion: roundwood

Woodworking technology:

Tool Marks: Oak? roundwood - cut at one end. Some patches of bark.

Joints: Cut end badly degraded.

Fixings and Fittings: Very knotty c/6 side branches

Intentional Marks: Wood ID

Surface Treatment: Ring count - 9 rings / 25 m/9 rings = ARW - 2.77 mm

Other

Reused: Y ☐ N ☐ Not Known ☐

Recommendation: Discard? ☐ Discard after further research/sampling? ☐ Retain and Conserve ☐

Checked:

Date: 1.10.12

Measured Sketch:

1:10

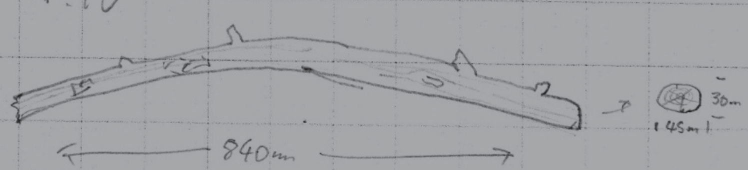


Figure 12.118 wood record sheet for sample 36

Figure 12.119 photograph of sample 36

Figure 12.120 photograph of sample 36

Figure 12.121 photograph of cut end of sample 36

Figure 12.122 photograph of cut end of sample 36

York Archaeological Trust Post Excavation Wood Record Sheet	Site Code/ Accession No: G2148	Timber or SF No: 38
Site Name: G2148	Context No:	Area: 14/7

Type:	Cross Section:
Condition:	

OA Dimensions m/mm:
Length 110
Width 60
Thickness 45
Diameter

Cross Section Sketch:

	Yes	No
Bark	☒	☐
Sapwood	☒	☐
Knotty	☒	☐
Straight Grained	☐	☐

sapwood — bark

Further Research Potential:

	Yes	No
Dendrochronology	☐	☐
Tree ring Study	☐	☐
^{14}C	☐	☐
Display	☐	☐

Species Identification: Betula — Conversion: roundwood

Woodworking technology:

Tool Marks: Cut at one end + on one side branch. Snapped at other end.

Joints: Radial Chains 2's - 3's
Diffuse Porous - transvese

Fixings and Fittings: Wood id: Biseriate rays - Tang
homogenous? - Tang

Intentional Marks: 22.5m / = 2.5m ARW
c.9 rings

Surface Treatment: Wood ID - Betula

Other: roundwood branch fragment

Reused: Y ☐ N ☐ Not Known ☒

Recommendation: Discard? ☐ Discard after further research/sampling? ☒ Retain and Conserve ☐

Checked:

Date: 7/9/2012

Measured Sketch:

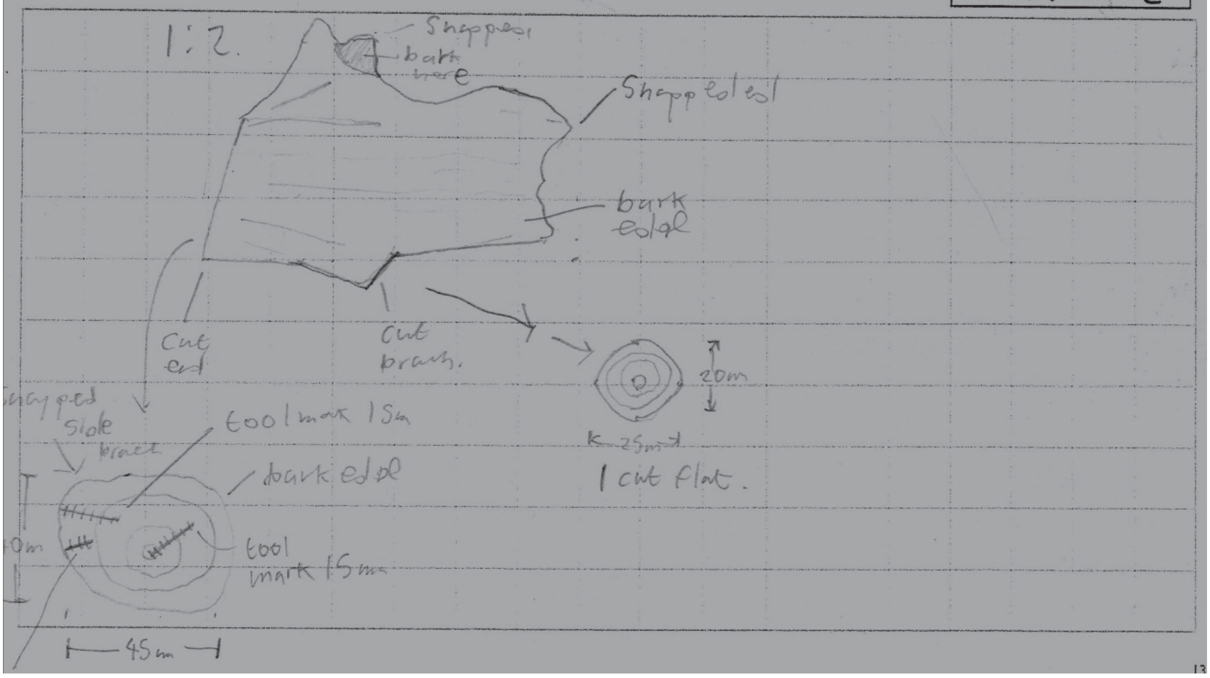


Figure 12.123 wood record sheet for sample 38

Figure 12.124 photograph of sample 38

Figure 12.125 photograph of sample 38

Figure 12.126 photograph of sample 38

Figure 12.127 photograph of sample 38

Figure 12.128 photograph of sample 38

Figure 12.129 photograph of sample 38

York Archaeological Trust Post Excavation Wood Record Sheet

Site Name: G2148	Site Code/ Accession No: G2148	Timber or SF No: 39
	Context No:	Area: 14/7

Type:	Cross Section:
Condition:	

OA Dimensions m/mm:
Length 50 mm
Width
Thickness 2.5 mm
Diameter

Cross Section Sketch:

	Yes	No
Bark	☐	☑
Sapwood	☐	☑
Knotty	☐	☑
Straight Grained	☑	☐

sapwood bark

Further Research Potential:

	Yes	No
Dendrochronology	☐	☑
Tree ring Study	☑	☐
^{14}C	☐	☑
Display	☐	☑

Species Identification:

Conversion: radial - split?

Woodworking technology:

Tool Marks /

wood id - needs ID. very difficult to get thin sections.

Joints /

Fixings and Fittings /

1 ring? - 20 mm

Intentional Marks /

Surface Treatment /

Other Small Fragment - non oak - no tool marks.

Reused: Y ☐ N ☐ Not Known ☐

Recommendation: Discard? ☐ Discard after further research/sampling? ☑ Retain and Conserve ☐

Checked:

Measured Sketch: 1:2

Date: 20/9/2012

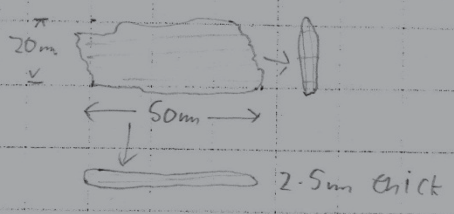


Figure 12.130 wood record sheet for sample 39

Figure 12.131 photograph of sample 39

Figure 12.132 photograph of sample 39

York Archaeological Trust Post Excavation Wood Record Sheet

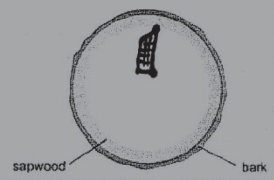
Site Name: GZ148	Site Code/ Accession No: GZ148	Timber or SF No: 40	
	Context No:	Area: 14/7	

Type:	Cross Section:
Condition:	

OA Dimensions m/mm:
Length ~~140~~ 115
Width 50
Thickness 10
Diameter

Cross Section Sketch:

	Yes	No
Bark	☐	☑
Sapwood	☐	☑
Knotty	☐	☐
Straight Grained	☑	☐



Further Research Potential:

	Yes	No
Dendrochronology	☐	☐
Tree ring Study	☑	☐
^{14}C	☐	☐
Display	☐	☐

Species Identification: Quercus
Conversion: radial split

Woodworking technology:
Tool Marks possible - see drawing + photos - prob. split marks
Joints ARW = 50mm / 30 rings = 1.66 mm
Fixings and Fittings
Intentional Marks
Surface Treatment
Other

Reused: Y ☐ N ☐ Not Known ☑

Recommendation: Discard? ☐ Discard after further research/sampling? ☑ Retain and Conserve ☐
Checked:
Measured Sketch: 1 : 2
Date: 7/9/12

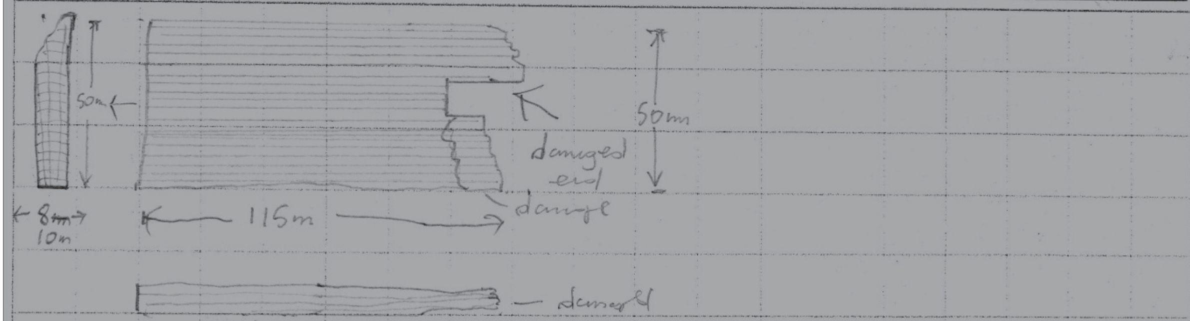


Figure 12.133 wood record sheet for sample 40

Figure 12.134 photograph of sample 40


Figure 12.135 photograph of sample 40

Figure 12.136 photograph of sample 40

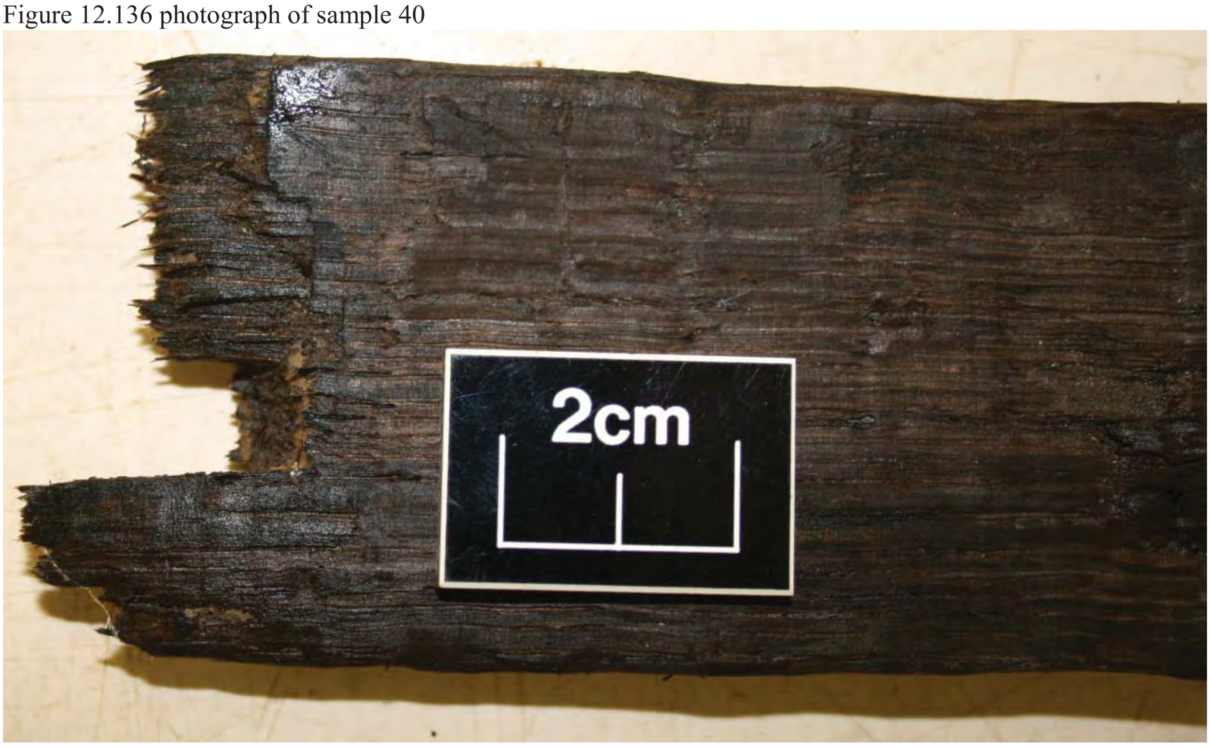


Figure 12.137 photograph of sample 40

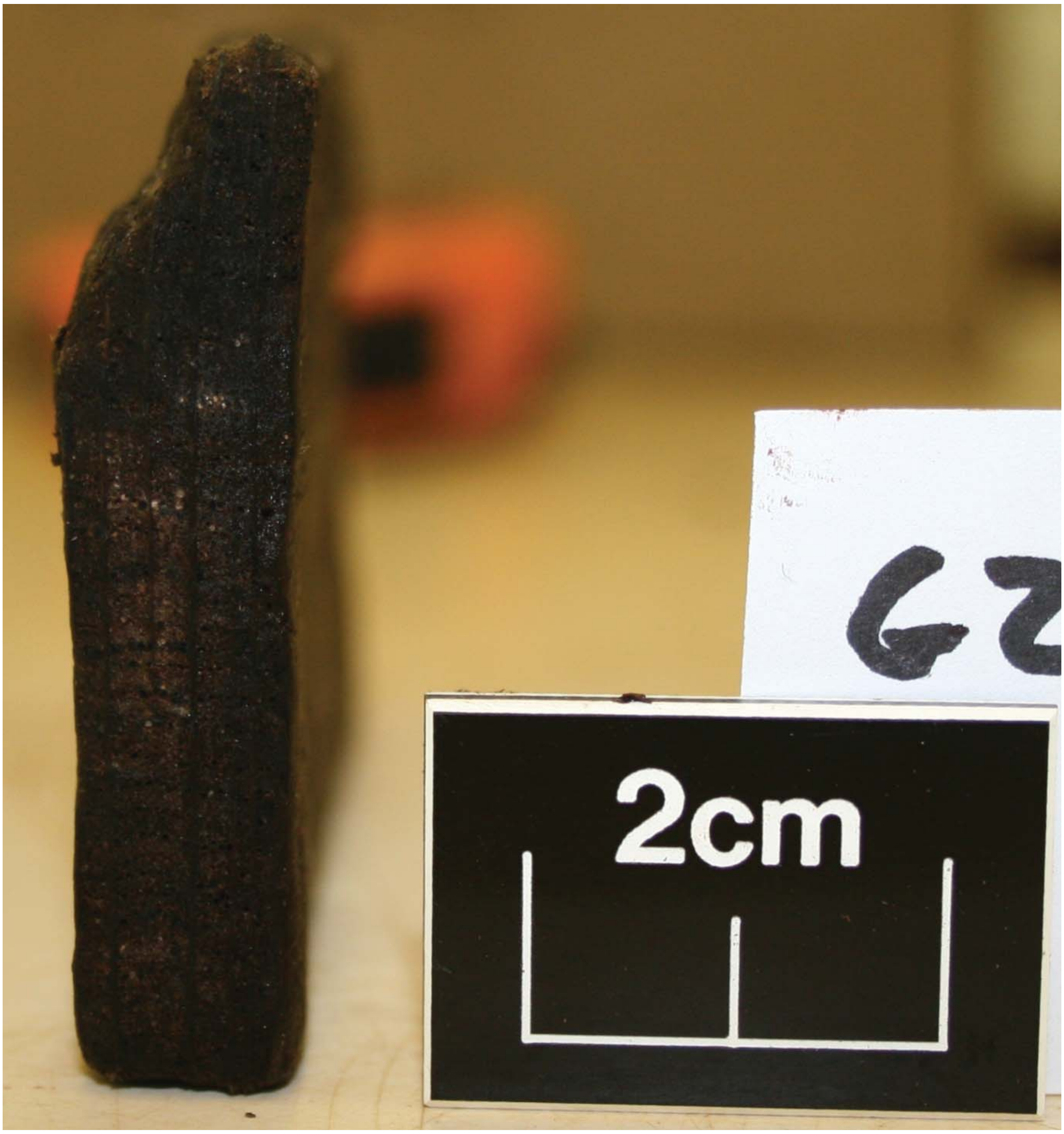
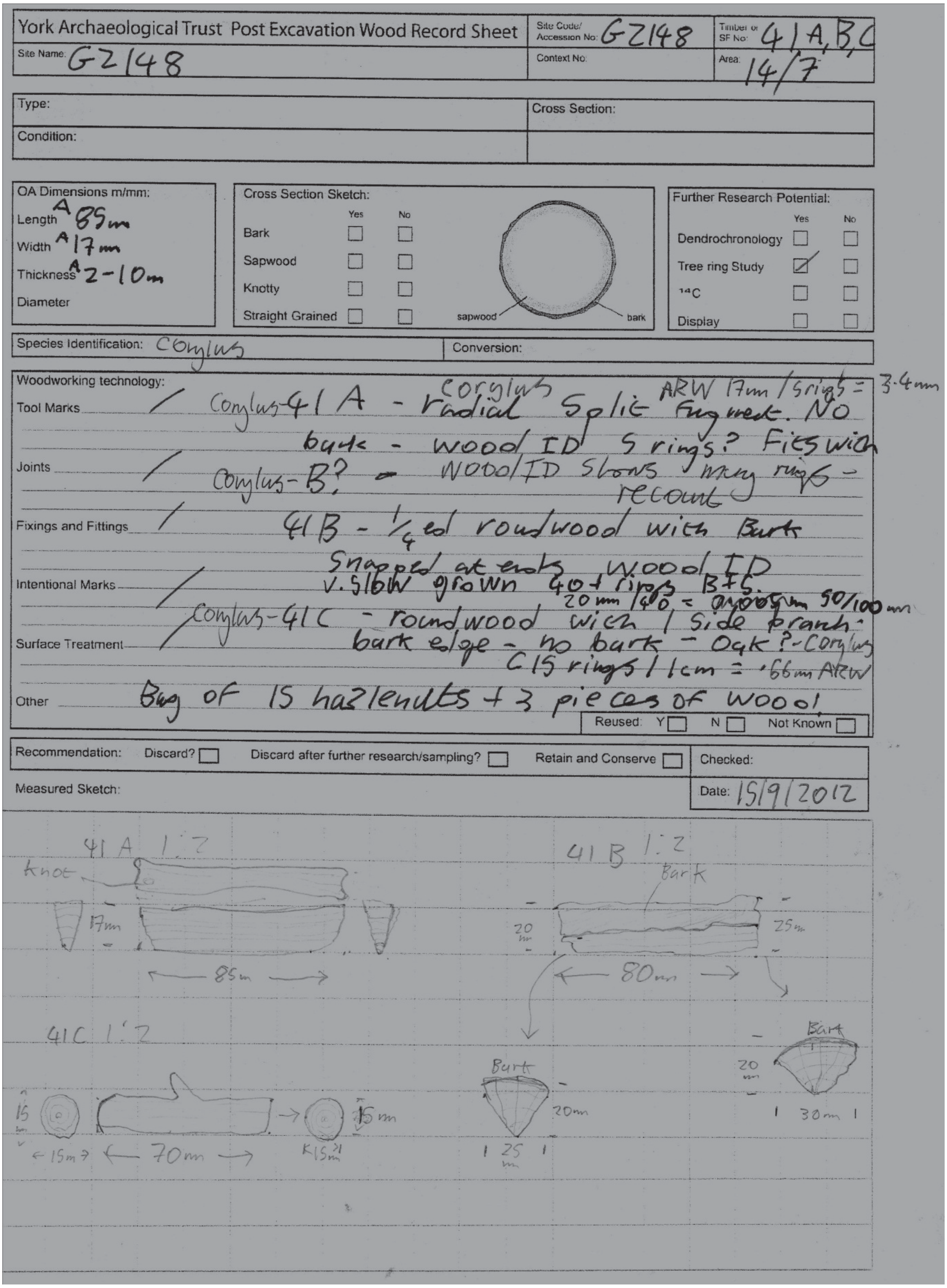


Figure 12.138 photograph of sample 40



York Archaeological Trust Post Excavation Wood Record Sheet

Site Code/ Accession No: GZ148

Timber or SF No: 41 A, B, C

Site Name: GZ148

Context No:

Area: 14/7

Type:

Cross Section:

Condition:

OA Dimensions m/mm:
Length A 85mm
Width A 17mm
Thickness A 2-10mm
Diameter

Cross Section Sketch:

	Yes	No
Bark	☐	☐
Sapwood	☐	☐
Knotty	☐	☐
Straight Grained	☐	☐

sapwood
bark

Further Research Potential:

	Yes	No
Dendrochronology	☐	☐
Tree ring Study	☑	☐
^{14}C	☐	☐
Display	☐	☐

Species Identification: Corylus

Conversion:

Woodworking technology:

Tool Marks / Corylus 41 A - ~~radial~~ Corylus Split fragment. NO ARW 17mm / 5 rings = 3.4mm

bark - wood ID 5 rings? Fits with

Joints / Corylus-B? - WOOD/ID shows many rings - recount

Fixings and Fittings / 41 B - 1/4 ed roundwood with Bark

Snapped at ends. Wood ID

Intentional Marks / v. slow grown 40+ rings BTS.

20mm / 40 = ~~[illegible]~~ 50/100mm

Corylus-41 C - roundwood with 1 side branch.

Surface Treatment / bark edge - no bark - Oak? - Corylus

C15 rings / 1cm = ·66mm ARW

Other Bag of 15 hazlenuts + 3 pieces of wood

Reused: Y ☐ N ☐ Not Known ☐

Recommendation: Discard? ☐ Discard after further research/sampling? ☐ Retain and Conserve ☐

Checked:

Measured Sketch:

Date: 15/9/2012

Figure 12.139 wood record sheet for sample 41 A, B and C

Figure 12.140 photograph of sample 41A

Figure 12.141 photograph of sample 41B

Figure 12.142 photograph of sample 41 B

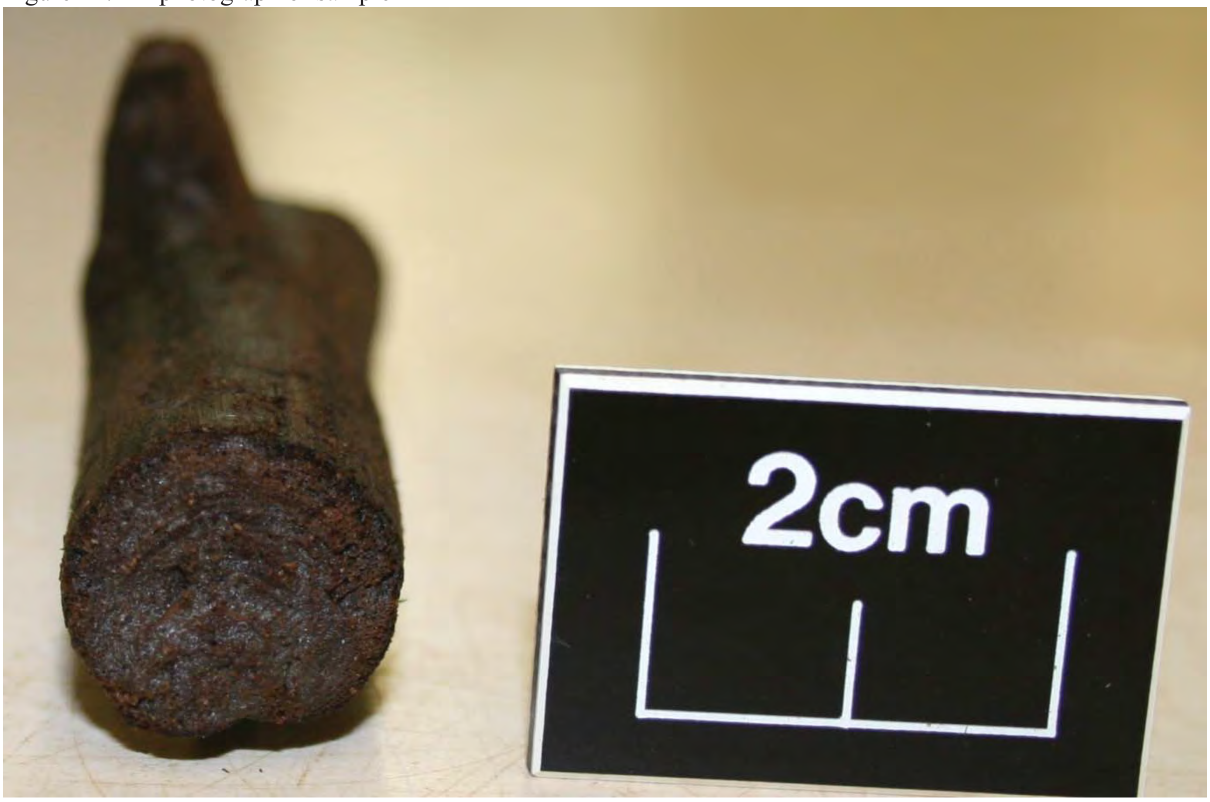
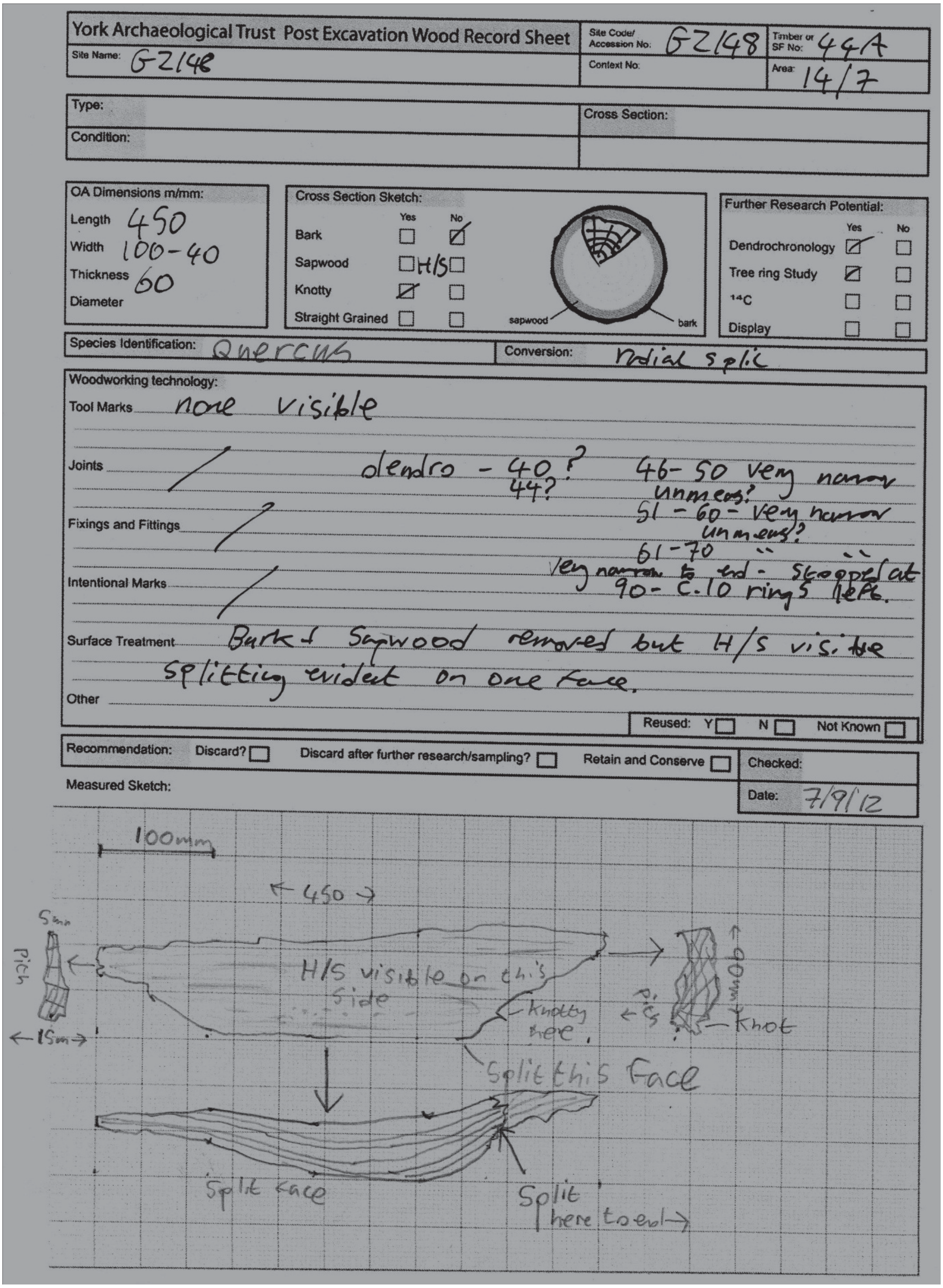


Figure 12.143 photograph of sample 41C

Figure 12.144 photograph of sample 41 C



York Archaeological Trust Post Excavation Wood Record Sheet

Site Code/ Accession No: GZ148
Timber or SF No: 44A
Site Name: GZ148
Context No:
Area: 14/7

Type:
Condition:
Cross Section:

OA Dimensions m/mm:
Length 450
Width 100-40
Thickness 60
Diameter

Cross Section Sketch:

	Yes	No
Bark	☐	☑
Sapwood	☐ H/S	☐
Knotty	☑	☐
Straight Grained	☐	☐

sapwood
bark

Further Research Potential:

	Yes	No
Dendrochronology	☑	☐
Tree ring Study	☑	☐
^{14}C	☐	☐
Display	☐	☐

Species Identification: Quercus
Conversion: radial split

Woodworking technology:
Tool Marks: none visible
Joints: / dendro - 40? 44? 46-50 very narrow unmeas? 51-60 - very narrow unmeas? 61-70 " " very narrow to end - stopped at 90 - c.10 rings left.
Fixings and Fittings: /
Intentional Marks: /
Surface Treatment: Bark & Sapwood removed but H/S visible splitting evident on one face.
Other

Reused: Y ☐ N ☐ Not Known ☐

Recommendation: Discard? ☐ Discard after further research/sampling? ☐ Retain and Conserve ☐
Checked:
Date: 7/9/12
Measured Sketch:

Figure 12.145 wood record sheet for sample 44A

Figure 12.146 photograph of sample 44A

Figure 12.147 photograph of sample 44A

Figure 12.148 photograph of sample 44A

York Archaeological Trust Post Excavation Wood Record Sheet

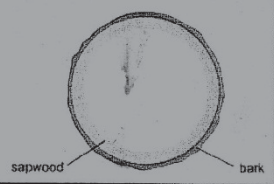
Site Code/ Accession No: G2148	Timber or SF No: 44 B,C,D
Site Name: G2148	Context No:
	Area: 14/2

Type:	Cross Section:
Condition:	

QA Dimensions m/mm:
Length
Width
Thickness
Diameter

Cross Section Sketch:

	Yes	No
Bark	☑	☐
Sapwood	☑	☐
Knotty	☐	☐
Straight Grained	☐	☐



Further Research Potential:

	Yes	No
Dendrochronology	☐	☐
Tree ring Study	☑	☐
^{14}C	☐	☐
Display	☐	☐

Species Identification: Quercus

Conversion: roundwood - worked - all

Woodworking technology:

Tool Marks: On ends of each piece - see photos + sketches

~~Joints~~ 44B: tool marks on ends? Bark + BE.
Insect galleries? c 50 rings / 25 mm
~~Fixings and~~ Fittings: very narrow - branch. ARW 005 mm - 50/100 mm
44C: tool marks at ends? Insect galleries
~~Intentional~~ Marks: ~~knotty~~. Bark edge ` or split off -
Snapped off? ARW ·005 mm 25/50 rings
~~Surface~~ Treatment: 44D - Smaller branch ~~[illegible]~~ Cut? Snapped'
~~Other~~: at ends. 17 rings - bark spring 12 mm / 17 = 0.70 mm

Reused: Y ☐ N ☐ Not Known ☑

Recommendation: Discard? ☐ Discard after further research/sampling? ☑ Retain and Conserve ☐

Checked:

Measured Sketch: 1:5

Date: 11/9/12

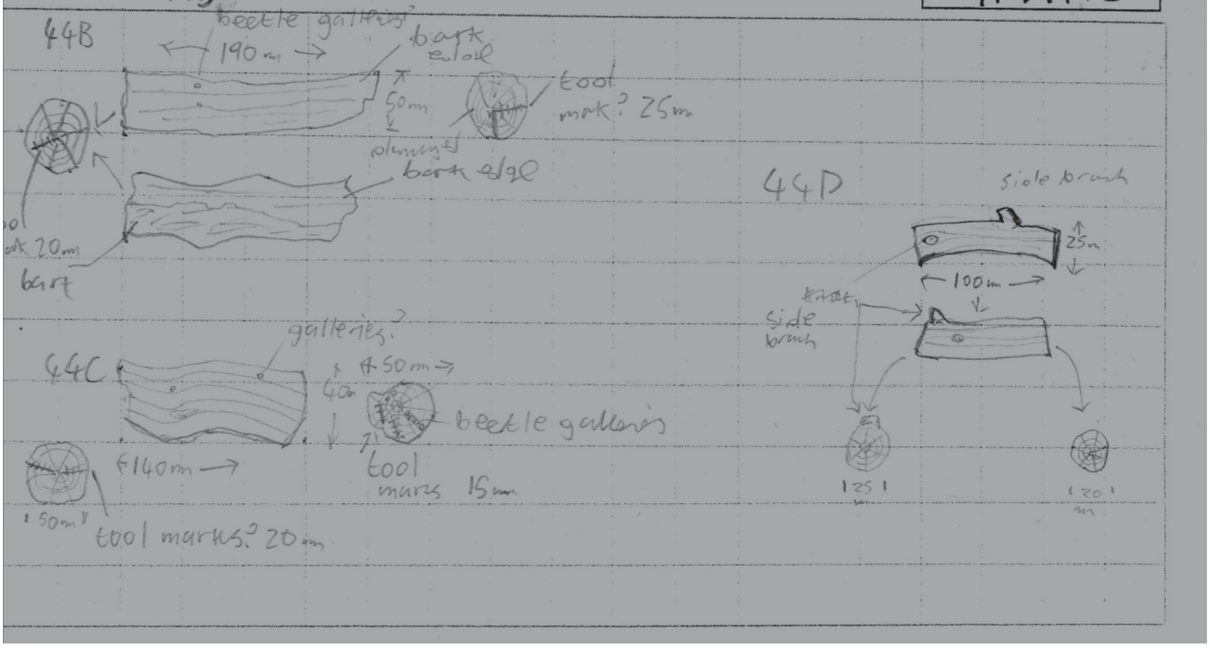


Figure 12.149 wood record sheet for samples 44 B, C and D

Figure 12.150 photograph of sample 44B

Figure 12.151 photograph of sample 44B

Figure 12.152 photograph of sample 44B

Figure 12.153 photograph of sample 44B

Figure 12.154 photograph of sample 44B

Figure 12.155 photograph of sample 44B

Figure 12.156 photograph of sample 44C

Figure 12.157 photograph of sample 44C

Figure 12.158 photograph of sample 44C

Figure 12.159 photograph of sample 44C

Figure 12.160 photograph of sample 44D


Figure 12.161 photograph of sample 44D

Figure 12.162 photograph of sample 44D

York Archaeological Trust Post Excavation Wood Record Sheet

Site Code/ Accession No: G2148	Timber or SF No: 44 BE	
Site Name: G2148	Context No:	Area: 14/7

Type:	Cross Section:
Condition:	

OA Dimensions m/mm:
Length 130
Width 70
Thickness ~~40~~ 30-35m
Diameter

Cross Section Sketch:

	Yes	No
Bark	☐	☑
Sapwood	☐	☑
Knotty	☐	☐
Straight Grained	☑	☐

sapwood
bark

Further Research Potential:

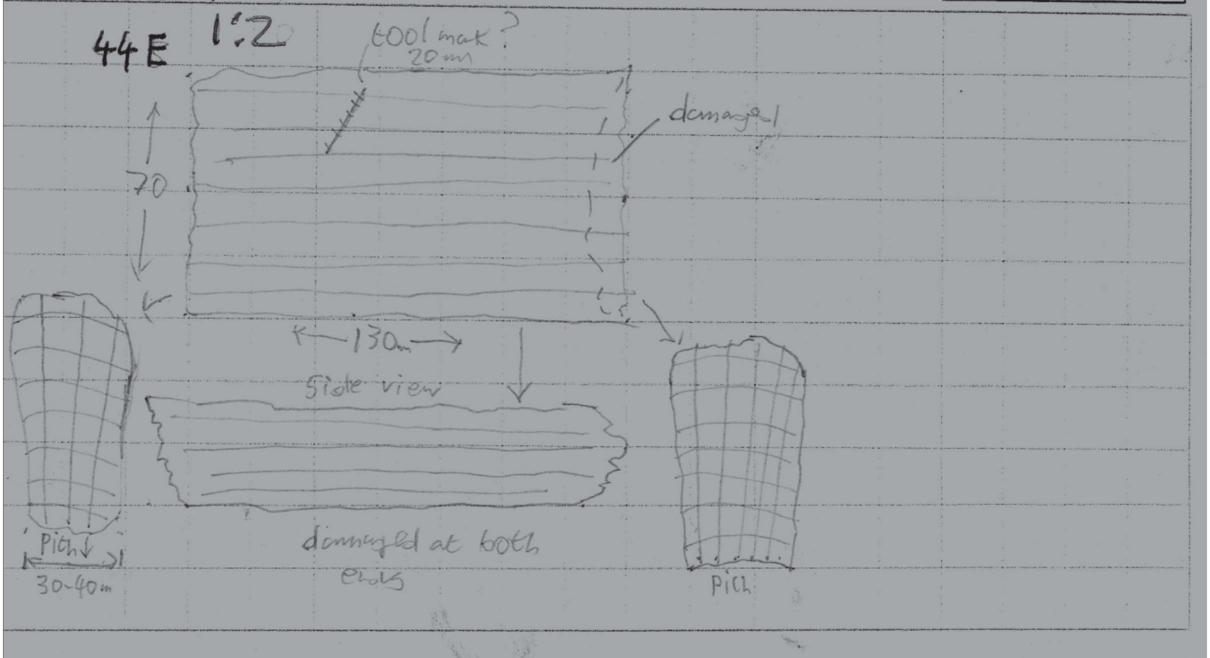
	Yes	No
Dendrochronology	☑	☐
Tree ring Study	☑	☐
^{14}C	☐	☐
Display	☐	☐

Species Identification: Quercus
Conversion: Radial Split

Woodworking technology:
Tool Marks Possibly - See drawing + Photos
Joints
Fixings and Fittings
Intentional Marks
Surface Treatment ARW = 70m / 18 = 3.88 mm
Other

Reused: Y ☐ N ☐ Not Known ☐

Recommendation: Discard? ☐ Discard after further research/sampling? ☑ Retain and Conserve ☐
Checked:
Measured Sketch: ~~44~~E 1:2
Date: 7.9.12



13

Figure 12.163 wood record sheet for sample 44E

Figure 12.164 photograph of sample 44E

Figure 12.165 photograph of sample 44E

York Archaeological Trust Post Excavation Wood Record Sheet

Site Name: G2148 14/7	Site Code/ Accession No:	Timber or SF No: 045	
	Context No:	Area: 14/7	

Type:	Cross Section:
Condition:	

OA Dimensions m/mm:

Length 410
Width 170
Thickness 50
Diameter

Cross Section Sketch:

	Yes	No
Bark	☐	☒
Sapwood	☐	☒
Knotty	☐	☐
Straight Grained	☒	☐

sapwood bark

Further Research Potential:

	Yes	No
Dendrochronology	☒	☐
Tree ring Study	☒	☐
^{14}C	☐	☐
Display	☐	☐

Species Identification: Quercus

Conversion: Radial Split

Woodworking technology:

Tool Marks None visible

Joints

Fixings and Fittings

Intentional Marks

Surface Treatment Possible Charring on one side - see photos

Other 37 rings ARW 377.84 (3.77mm)

Reused: Y ☐ N ☐ Not Known ☒

Recommendation: Discard? ☐ Discard after further research/sampling? ☒ Retain and Conserve ☐

Checked:

Measured Sketch: 1:50

Date: 7.9.12

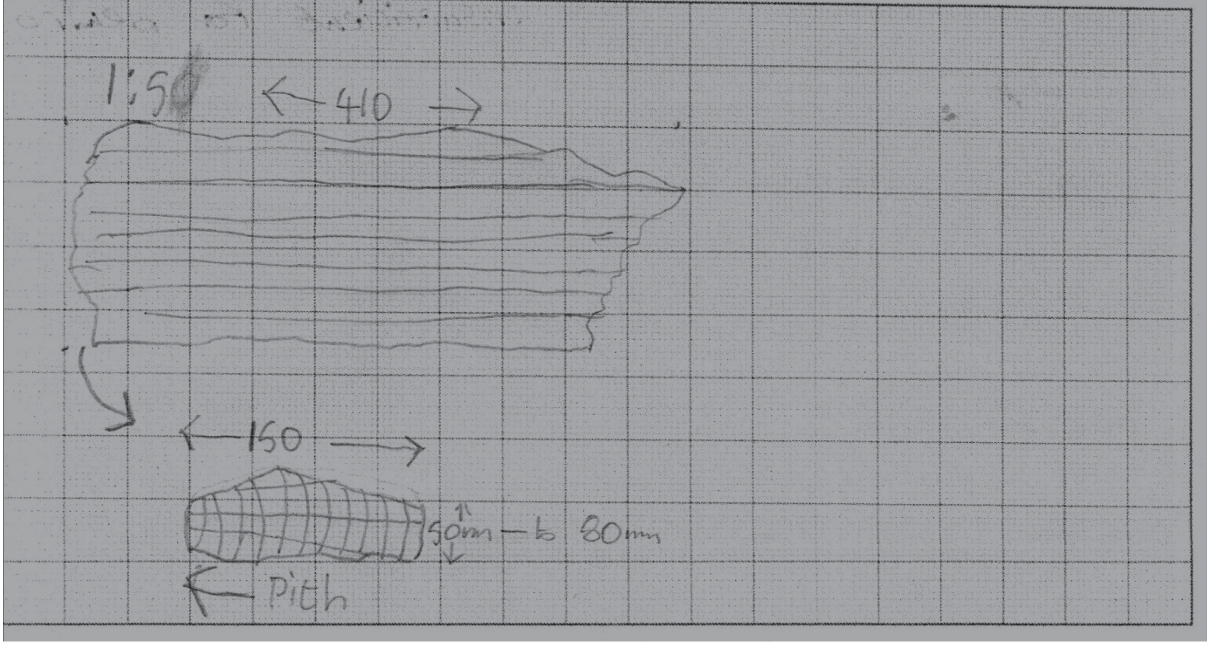
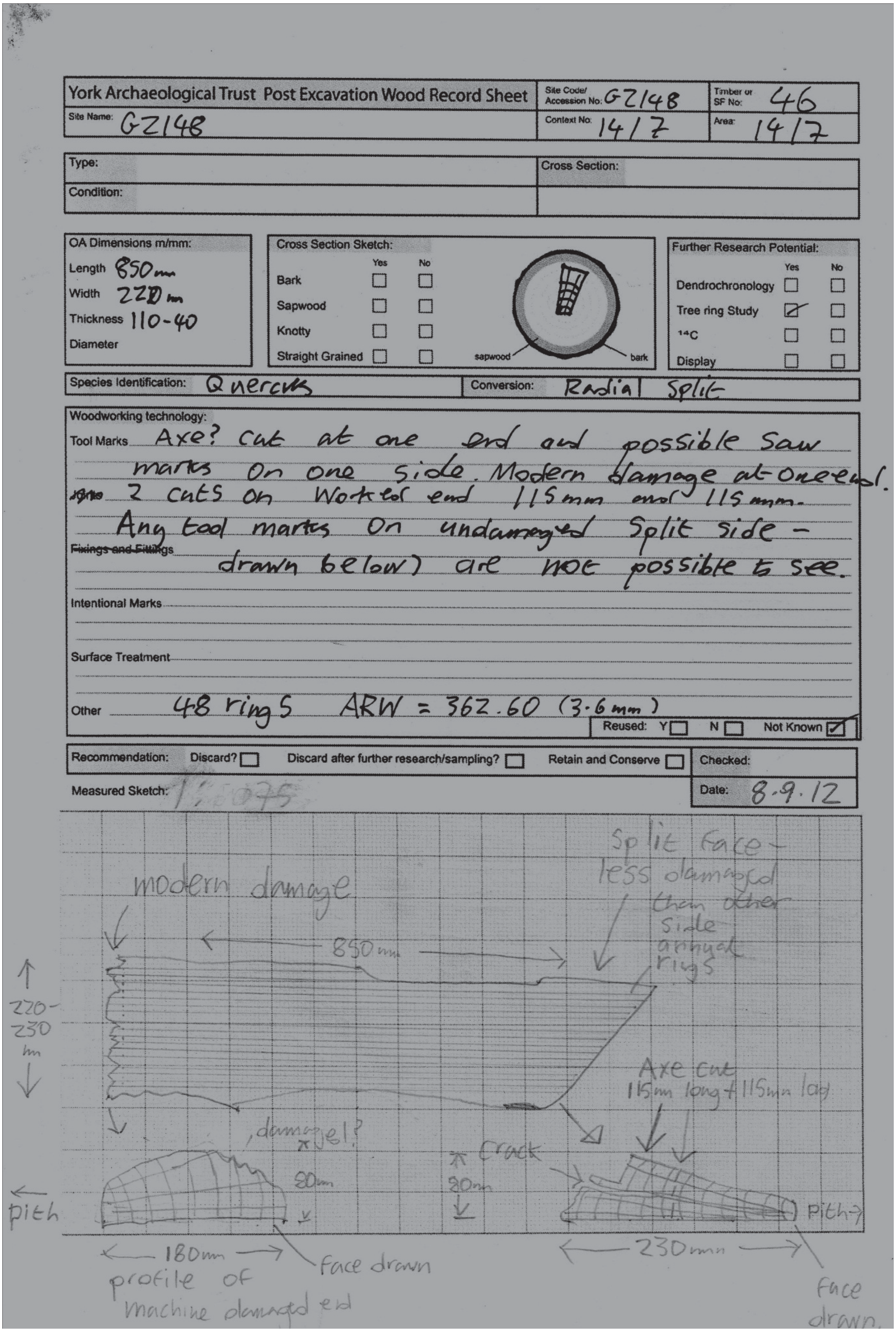


Figure 12.166 wood record sheet for sample 45

Figure 12.167 photograph of sample 45

Figure 12.168 photograph of sample 45

Figure 12.169 photograph of sample 45 end



York Archaeological Trust Post Excavation Wood Record Sheet	Site Code/ Accession No: GZ148	Timber or SF No: 46
Site Name: GZ148	Context No: 14/7	Area: 14/7

Type:	Cross Section:
Condition:	

OA Dimensions m/mm:
Length 850mm
Width 220mm
Thickness 110-40
Diameter

Cross Section Sketch:

	Yes	No
Bark	☐	☐
Sapwood	☐	☐
Knotty	☐	☐
Straight Grained	☐	☐

Further Research Potential:

	Yes	No
Dendrochronology	☐	☐
Tree ring Study	☑	☐
¹⁴C	☐	☐
Display	☐	☐

Species Identification: Quercus
Conversion: Radial Split

Woodworking technology:

Tool Marks Axe? cut at one end and possible saw marks on one side. Modern damage at one end. 2 cuts on worked end 115mm and 115mm. Any tool marks on undamaged split side - drawn below) are not possible to see.

~~Fixings and Fittings~~

Intentional Marks

Surface Treatment

Other 48 rings ARW = 362.60 (3.6mm)

Reused: Y ☐ N ☐ Not Known ☑

Recommendation: Discard? ☐ Discard after further research/sampling? ☐ Retain and Conserve ☐

Checked:

Date: 8.9.12

Measured Sketch: 1:5 0.75

Figure 12.170 wood record sheet for sample 46

Figure 12.171 photograph of sample 46

Figure 12.172 photograph of sample 46

Figure 12.173 photograph of sample 46

Figure 12.174 photograph of sample 46

Figure 12.175 photograph of sample 46

York Archaeological Trust Post Excavation Wood Record Sheet

Site Code/ Accession No: G2148

Timber or SF No: 047A

Site Name: G2148

Context No:

Area:

Type:

Condition:

Cross Section:

OA Dimensions m/mm:

Length 325

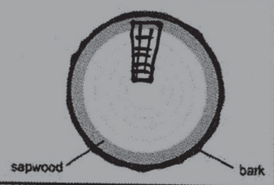
Width 80

Thickness 15

Diameter

Cross Section Sketch:

	Yes	No
Bark	☐	☑
Sapwood	☐	☑
Knotty	☐	☐
Straight Grained	☐	☑



Further Research Potential:

	Yes	No
Dendrochronology	☑	☐
Tree ring Study	☑	☐
^{14}C	☐	☐
Display	☐	☐

Species Identification: Quercus

Conversion: radial split

Woodworking technology:

Tool Marks: None visible - sides show piece is split

Joints: /

75mm / 40rings = ARW = 1.87mm

Fixings and Fittings: /

Intentional Marks: /

Surface Treatment: /

Other: Probably woodworking waste.

Reused: Y ☐ N ☐ Not Known ☑

Recommendation: Discard? ☐ Discard after further research/sampling? ☑ Retain and Conserve ☐

Checked:

Date:

Measured Sketch: 1:5

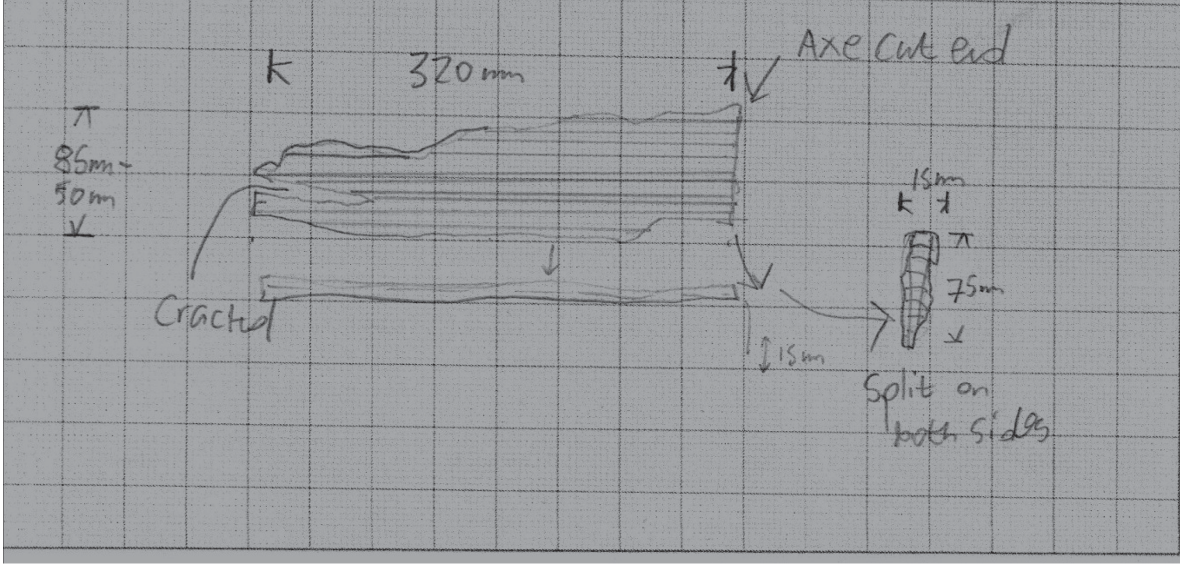
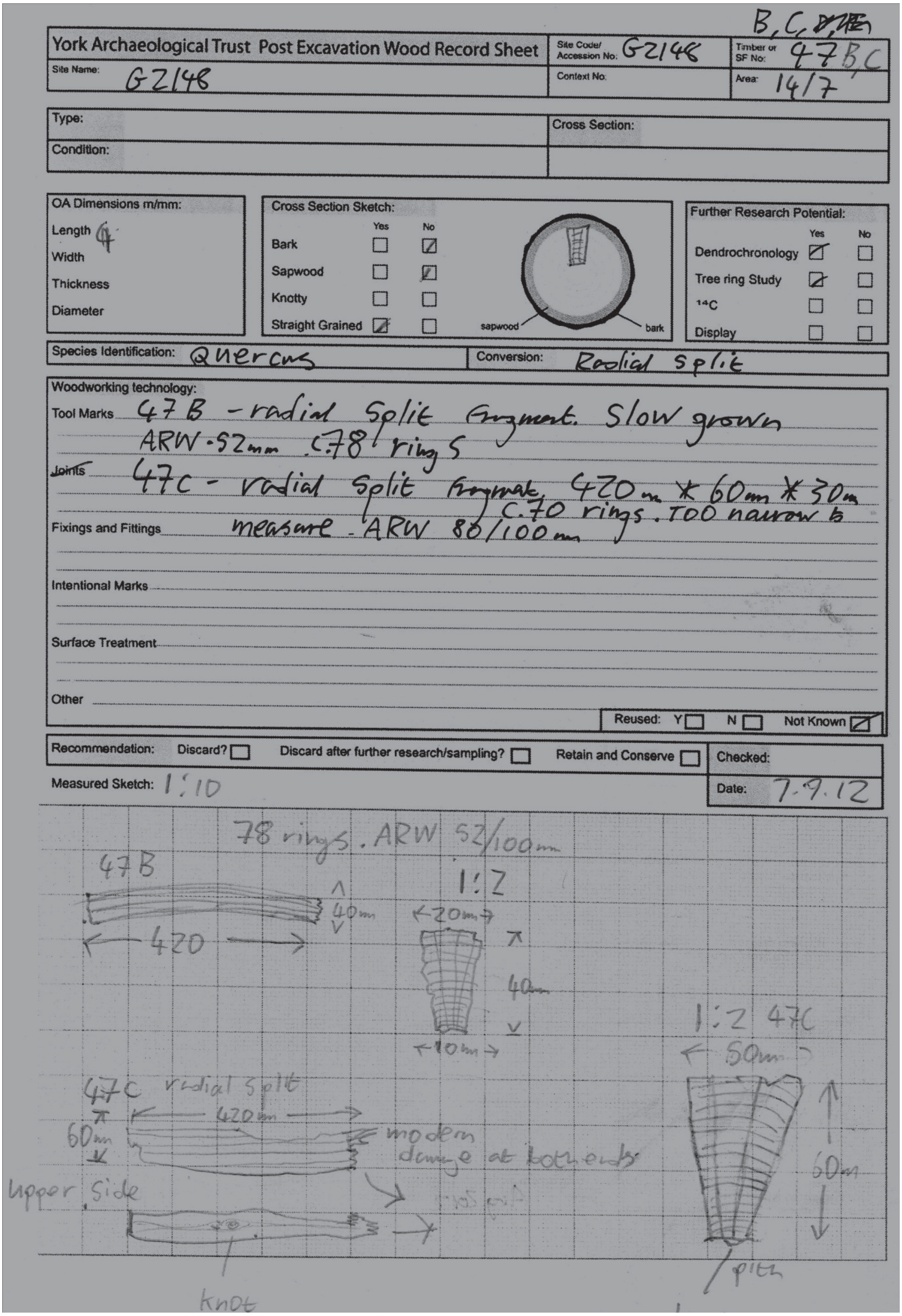


Figure 12.176 wood record sheet for sample 47A

Figure 12.177 photograph of sample 47A

Figure 12.178 photograph of sample 47A



B, C, ~~D, E~~

York Archaeological Trust Post Excavation Wood Record Sheet

Site Code/ Accession No: G2148

Timber or SF No: 47 B, C

Site Name: G2148

Context No:

Area: 14/7

Type:

Condition:

Cross Section:

OA Dimensions m/mm:

Length 4

Width

Thickness

Diameter

Cross Section Sketch:

	Yes	No
Bark	☐	☑
Sapwood	☐	☑
Knotty	☐	☐
Straight Grained	☑	☐

sapwood

bark

Further Research Potential:

	Yes	No
Dendrochronology	☑	☐
Tree ring Study	☑	☐
^{14}C	☐	☐
Display	☐	☐

Species Identification: Quercus

Conversion: Radial split

Woodworking technology:

Tool Marks 47B - radial split fragment. Slow grown ARW - 52mm c.78 rings

Joints 47C - radial split fragment. 420mm * 60mm * 30mm c.70 rings. Too narrow to measure. ARW 80/100mm

Fixings and Fittings

Intentional Marks

Surface Treatment

Other

Reused: Y ☐ N ☐ Not Known ☑

Recommendation: Discard? ☐ Discard after further research/sampling? ☐ Retain and Conserve ☐

Checked:

Measured Sketch: 1:10

Date: 7.9.12

78 rings. ARW 52/100mm

47B

1:2

40mm

420

20mm

40mm

10mm

1:2 47C

50mm

47C radial split

420mm

60mm

modern damage at both ends

upper side

60mm

knot

pith

Figure 12.179 wood records sheet for 47B and C


Figure 12.180 photograph of sample 47B

Figure 12.181 photograph of sample 47B


Figure 12.182 photograph of sample 47B


Figure 12.183 photograph of sample 47C

Figure 12.184 photograph of sample 47C

Figure 12.185 photograph of sample 47C

Figure 12.186 photograph of sample 47C

047D

York Archaeological Trust Post Excavation Wood Record Sheet	Site Code/ Accession No: G2148	Timber or SF No: 047D
Site Name: G2148	Context No:	Area: 14/7

Type:	Cross Section:
Condition:	

OA Dimensions m/mm:
Length 860
Width 90
Thickness 35-40
Diameter

Cross Section Sketch:

	Yes	No
Bark	☐	☑
Sapwood	☐	☑
Knotty	☑ E	☐ D
Straight Grained	☐	☑ D

sapwood bark

Further Research Potential:

	Yes	No
Dendrochronology	☑	☐
Tree ring Study	☑	☐
^{14}C	☐	☐
Display	☐	☐

Species Identification: Quercus
Conversion: Radial Split

Woodworking technology:
Tool Marks D=Not visible - modern damage at both ends
Split on one face - modern damage on
Joints other face. Split? on both sides or
Fixings and Fittings modern damage?
Intentional Marks
Surface Treatment ARW = 54/100 mm
Other c.116 rings. Unmeasurable sections very narrow
Reused: Y ☐ N ☐ Not Known ☑

Recommendation: Discard? ☐ Discard after further research/sampling? ☑ Retain and Conserve ☐
Checked:
Measured Sketch: 1:10
Date: 10.9.12

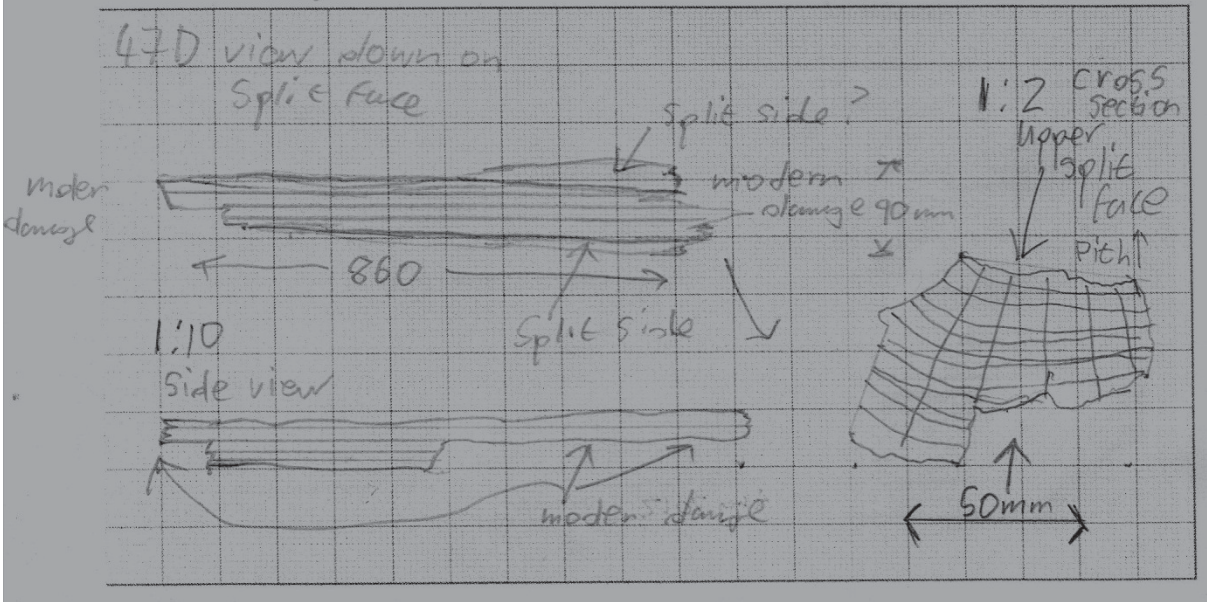


Figure 12.187 wood record sheet for sample 47D

Figure 12.188 photograph of sample 47D

Figure 12.189 photograph of sample 47D

Figure 12.190 photograph of sample 47D

Figure 12.191 photograph of sample 47D

Figure 12.192 photograph of cross section through 47D showing very narrow rings

York Archaeological Trust Post Excavation Wood Record Sheet

Site Name: GZ148	Site Code/ Accession No. GZ148	Timber or SF No: 47E
	Context No:	Area: 14/7

Type:	Cross Section:
Condition:	

OA Dimensions m/mm:
Length 860
Width 45–90
Thickness
Diameter

Cross Section Sketch:

	Yes	No
Bark	☐	☑
Sapwood	☐	☑
Knotty	☑	☐
Straight Grained	☐	☐

sapwood
bark

Further Research Potential:

	Yes	No
Dendrochronology	☐	☐
Tree ring Study	☑	☐
^{14}C	☐	☐
Display	☐	☐

Species Identification: Quercus
Conversion: Radial split?

Woodworking technology:
Tool Marks: None visible – much of the surface is damaged – modern? possible split faces
Joints
~~Fixings and Fittings~~ dendro – 11? 15? 18? 32? 38? 40? 41? 42? – 50 narrow 51? 64?
~~Intentional Marks~~ 68? 81–90 narrow, 104–6? 109?
~~Surface Treatment~~ 136 meas – not to 001 c last 10 rings unmeas?
Other: very slow grown
Reused: Y ☐ N ☐ Not Known ☑

Recommendation: Discard? ☐ Discard after further research/sampling? ☑ Retain and Conserve ☐
Checked:
Measured Sketch: 1:10
Date: 8.9.12

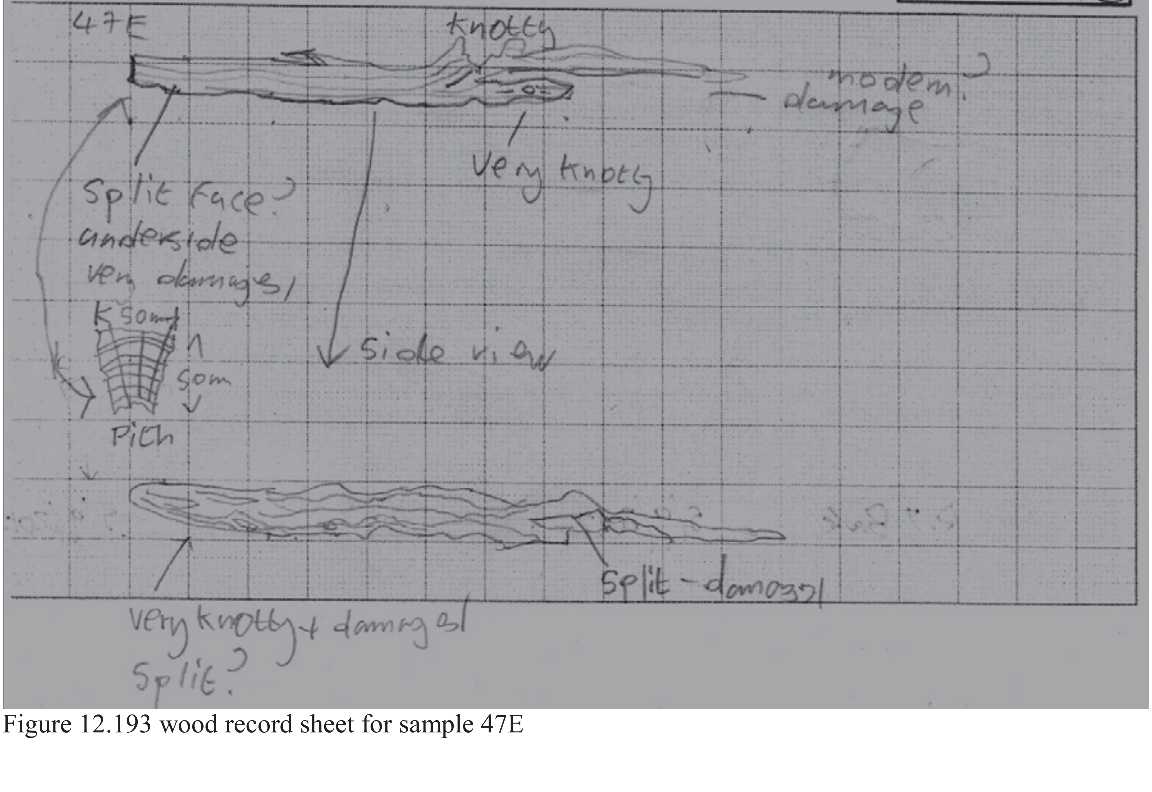


Figure 12.193 wood record sheet for sample 47E

Figure 12.194 photograph of sample 47E

Figure 12.195 photograph of sample 47E

Figure 12.196 photograph of sample 47E

Figure 12.197 photograph of sample 47E

York Archaeological Trust Post Excavation Wood Record Sheet

Site Name: G2148	Site Code/ Accession No:	Timber or SF No: 47 F
	Context No:	Area: 1417

Type:	Cross Section:
Condition:	

OA Dimensions m/mm:
Length 200
Width 70
Thickness 20
Diameter

Cross Section Sketch:

	Yes	No
Bark	☐	☐
Sapwood	☐	☐
Knotty	☐	☐
Straight Grained	☐	☐

sapwood bark

Further Research Potential:

	Yes	No
Dendrochronology	☐	☐
Tree ring Study	☑	☐
^{14}C	☐	☐
Display	☐	☐

Species Identification: Quercus
Conversion: radial split?

Woodworking technology:
Tool Marks Cut face at one end
Joints
Fixings and Fittings
Intentional Marks
Surface Treatment
Other C.20 rings/50mm = ARW ~2.5 mm

Reused: Y☐ N☐ Not Known☐

Recommendation: Discard?☐ Discard after further research/sampling?☐ Retain and Conserve☐
Checked:
Date: 20.10.12

Measured Sketch: 1:2

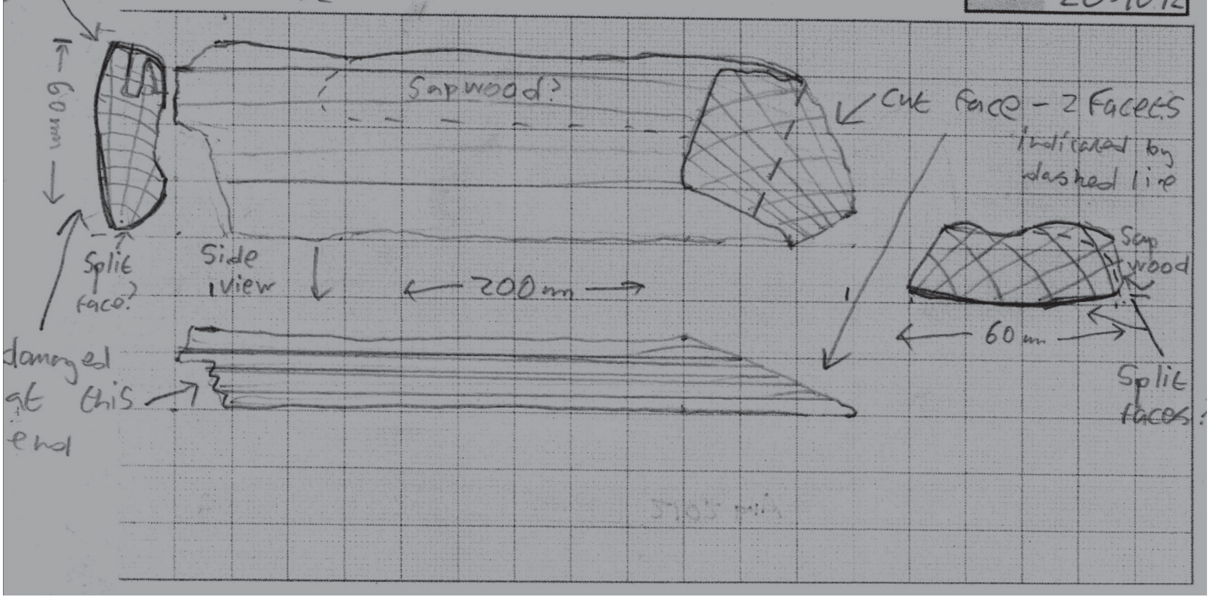


Figure 12.198 wood record sheet for sample 47F

Figure 12.199 photograph of sample 47F

Figure 12.200 photograph of sample 47F

Figure 12.201 photograph of sample 47F

Figure 12.202 photograph of sample 47F

York Archaeological Trust Post Excavation Wood Record Sheet	Site Code/ Accession No: G2148	Timber or SF No: 47G
Site Name: G2148	Context No:	Area: 14/7

Type:	Cross Section:
Condition:	

OA Dimensions m/mm:
Length 300 mm
Width 50 – 55 mm
Thickness ~~10~~ 5 – 10mm
Diameter

Cross Section Sketch:

	Yes	No
Bark	☐	☒
Sapwood	☐	☒
Knotty	☐	☐
Straight Grained	☒	☐

sapwood — bark

Further Research Potential:

	Yes	No
Dendrochronology	☐	☐
Tree ring Study	☒	☐
^{14}C	☐	☐
Display	☐	☐

Species Identification: Quercus | Conversion: tangential Split

Woodworking technology:
Tool Marks: Possible – but more likely modern surface damage
Joints
Fixings and Fittings
Intentional Marks
Surface Treatment: ARW 10mm/16 = 0.625mm
Other: ~~ARW = 10/16mm~~

Reused: Y ☐ N ☐ Not Known ☒

Recommendation: Discard? ☐ Discard after further research/sampling? ☒ Retain and Conserve ☐ | Checked:

Measured Sketch: 100mm 1:25 | Date: 22.10.12

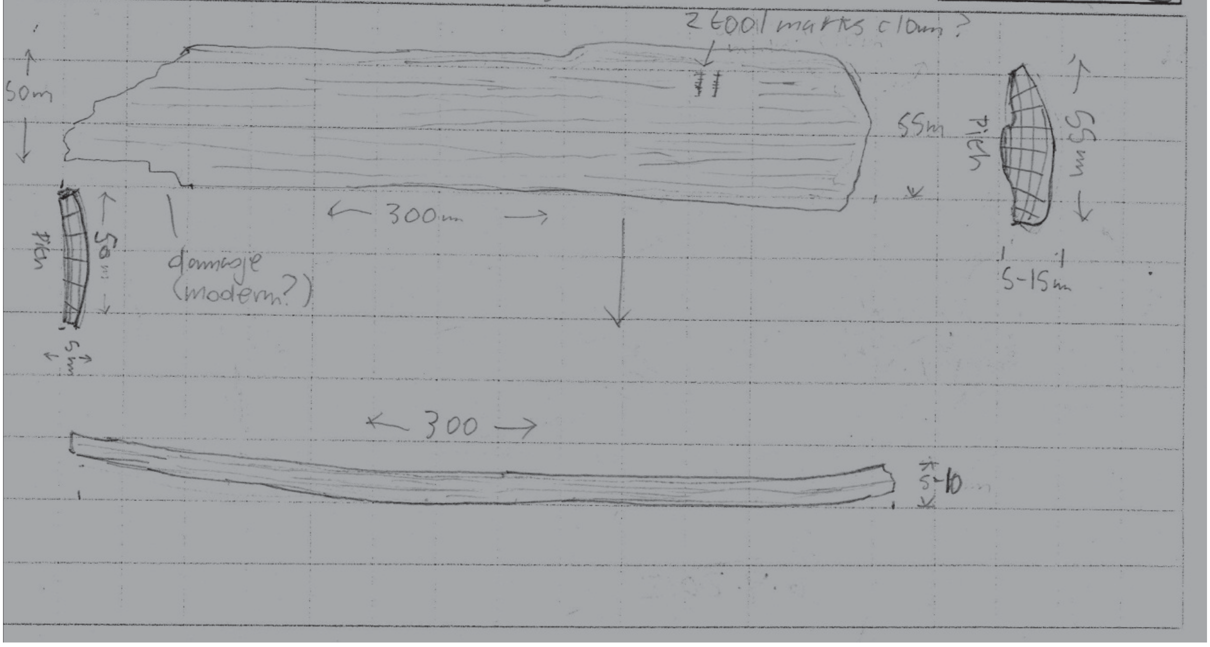


Figure 12.203 wood record sheet for sample 47G

Figure 12.204 photograph of sample 47G

Figure 12.205 photograph of sample 47G

Figure 12.206 photograph of sample 47G

York Archaeological Trust Post Excavation Wood Record Sheet

Site Name: G2148	Site Code/ Accession No: G214P	Timber or SF No: 47H, ~~I~~, J,
	Context No:	Area: 14/7

Type:

Condition:

Cross Section:

OA Dimensions m/mm: 47H

Length 200

Width 10–50

Thickness 20–5

Diameter

Cross Section Sketch:

	Yes	No
Bark	☐	☑
Sapwood	☐	☑
Knotty	☑	☐
Straight Grained	☐	☐

47H

sapwood

bark

Further Research Potential:

	Yes	No
Dendrochronology	☐	☐
Tree ring Study	☑	☐
¹⁴C	☐	☐
Display	☐	☐

Species Identification: Quercus

Conversion: radial Split

Woodworking technology:

Tool Marks 47H - At one end - See drawing + Photos knotty
axe mark c 20mm

~~Joints~~ 47I - knotty, slow grown Quercus Frag. nat. - radial split.

47J - Knotty - Quercus very Slow grown

~~Fixings and Fittings~~ 47K - bark ?

47H, ARW

~~Intentional Marks~~ Tree rings 20mm / 7 rings = 2.85mm

~~Surface Treatment~~ ARW ~~7 rings~~ ~~20mm~~ 47I - too narrow to measure or dist. rings 16mm / c.30? = ARW 0.53mm

ARW 47J 50mm / 40 = 1.25mm

Other

Reused: Y ☐ N ☐ Not Known ☑

Recommendation: Discard? ☐ Discard after further research/sampling? ☑ Retain and Conserve ☐

Checked:

Date: 6/9/12

Measured Sketch:

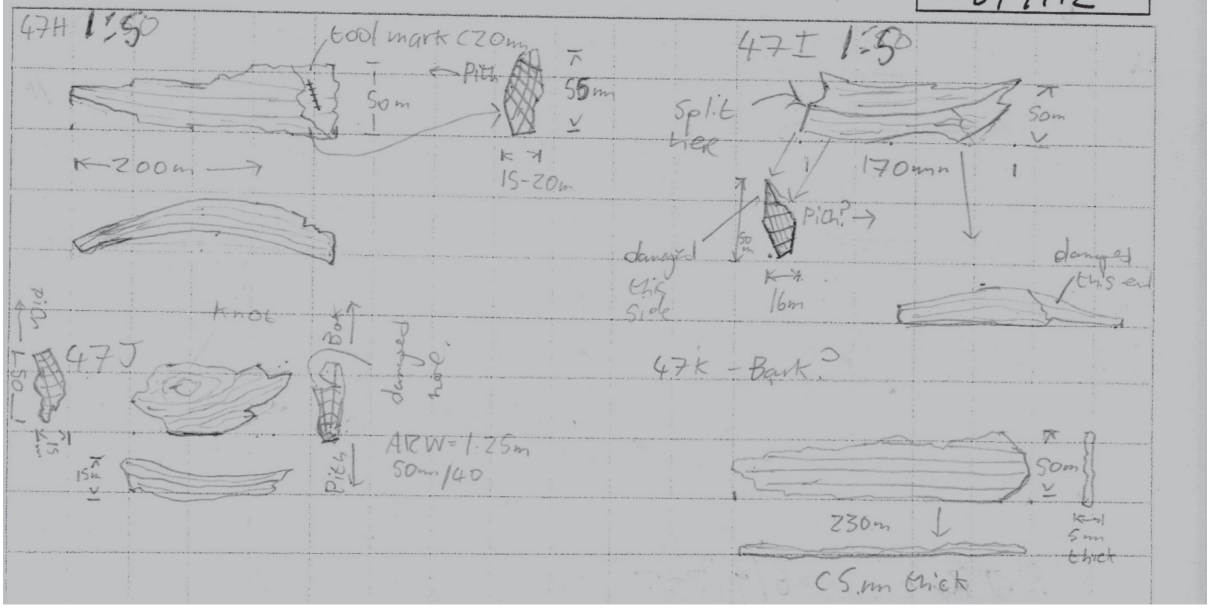


Figure 12.207 wood record sheet for samples 47H, I and J

Figure 12.208 photograph of sample 47H

Figure 12.209 photograph of sample 47H

Figure 12.210 photograph of sample 47H

Figure 12.211 photograph of sample 47H

Figure 12.212 photograph of sample 47I

Figure 12.213 photograph of sample 47I

Figure 12.214 photograph of sample 47I

Figure 12.215 photograph of sample 47J

Figure 12.216 photograph of sample 47J

Figure 12.217 photograph of sample 47J

Figure 12.218 photograph of sample 47K

Figure 12.219 photograph of sample 47K

York Archaeological Trust Post Excavation Wood Record Sheet

Site Name: G2148	Site Code/ Accession No: G2148	Timber or SF No: 47L,M,N,O	
	Context No:	Area: 1417	

Type:	Cross Section:
Condition:	

OA Dimensions m/mm:	
Length	
Width	
Thickness	
Diameter	

Cross Section Sketch:	Yes	No
Bark	☐	☑
Sapwood	☐	☑
Knotty	☐	☐
Straight Grained	☑	☐

sapwood bark

Further Research Potential:	Yes	No
Dendrochronology	☐	☐
Tree ring Study	☑	☐
^{14}C	☐	☐
Display	☐	☐

Species Identification: Quercus

Conversion:

Woodworking technology:

Tool Marks: 47k: Small radial chip - Cut at one end with tool marks? 29 rings. 40/29=1.48m - ARW

Joints: 47m: Oak roundwood fragments with bark edge. Snapped at each end? C.15 rings - Bark Winter? ARW = 0.67 mm

Fixings and Fittings

Intentional Marks: 47N: Oak roundwood with toolmarks? very slow grown. - Bark edge

Surface Treatment: ← Wood ID? 47O: Small oak? woodchip - Cut marks both ends. Radial

Other

Reused: Y ☐ N ☐ Not Known ☐

Recommendation: Discard? ☐ Discard after further research/sampling? ☐ Retain and Conserve ☐

Checked:

Measured Sketch:

Date: 9/9/12

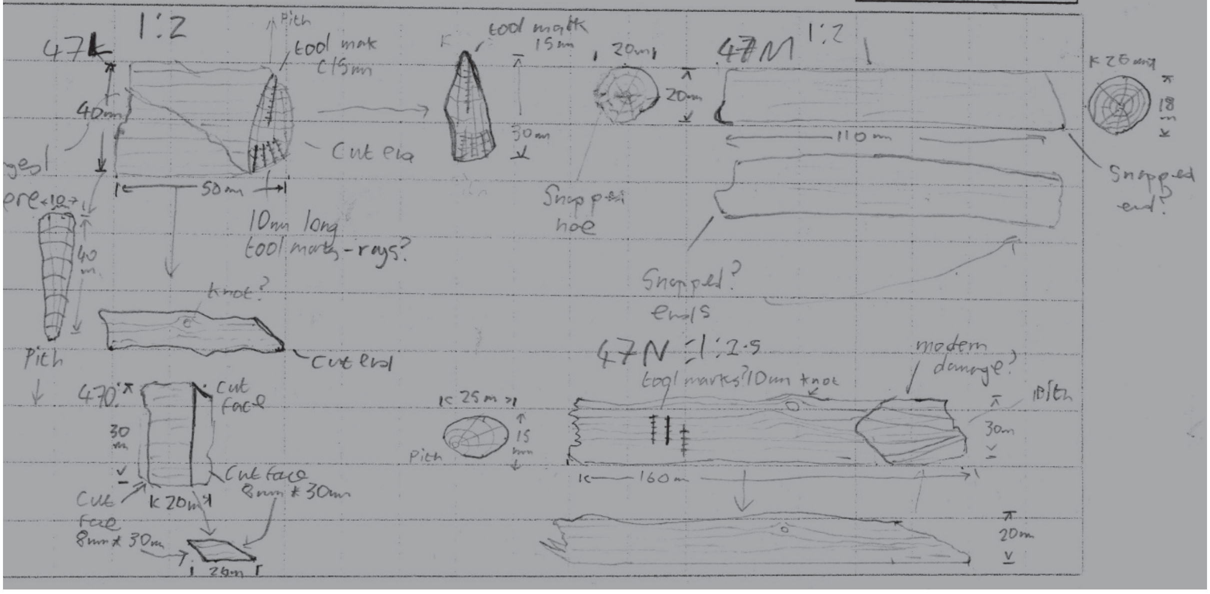


Figure 12.220 wood record sheet for samples 47 L, M, N and O

Figure 12.221 photograph of sample 47L

Figure 12.222 photograph of sample 47L

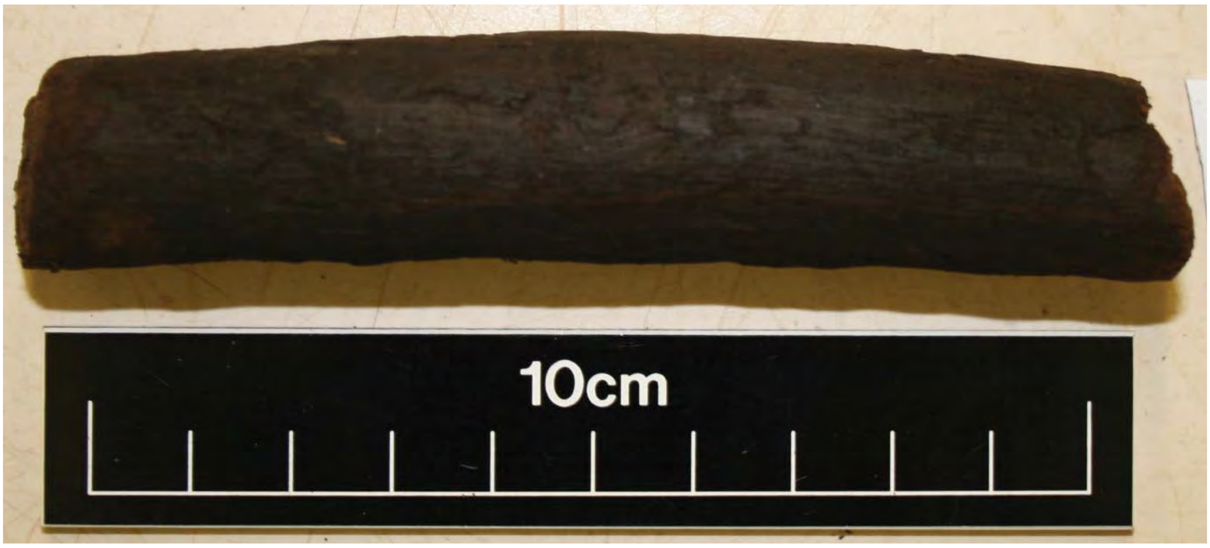


Figure 12.223 photograph of sample 47M

Figure 12.224 photograph of sample 47M

Figure 12.225 photograph of sample 47N

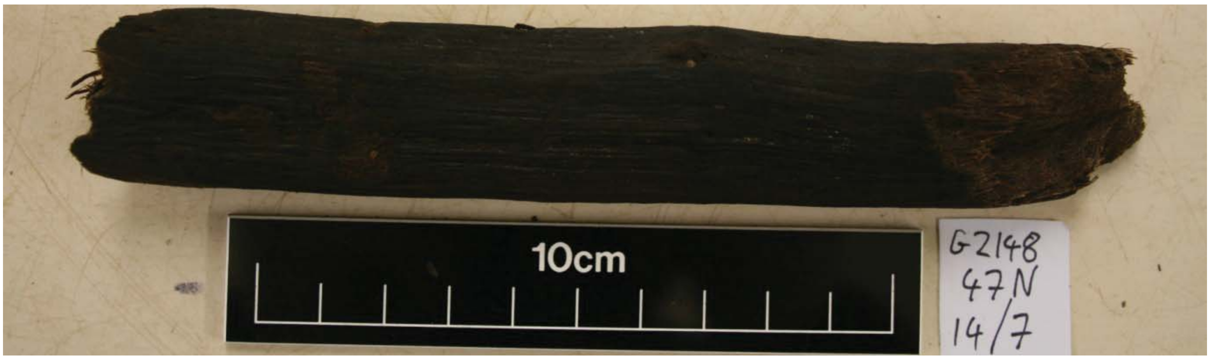


Figure 12.226 photograph of sample 47N

Figure 12.227 photograph of sample 47N

Figure 12.228 photograph of sample 47N

Figure 12.229 photograph of sample 47N

Figure 12.230 photograph of sample 47O

Figure 12.231 photograph of sample 47O

York Archaeological Trust Post Excavation Wood Record Sheet

Site Name: G2148	Site Code/ Accession No: G2148	Timber or SF No: 47 P, Q
	Context No:	Area: 14/7

Type:	Cross Section:
Condition:	

OA Dimensions m/mm:
Length
Width
Thickness
Diameter

Cross Section Sketch:

	Yes	No
Bark	☐	☑
Sapwood	☐	☑
Knotty	☐	☐
Straight Grained	☑	☐

sapwood bark

Further Research Potential:

	Yes	No
Dendrochronology	☐	☐
Tree ring Study	☑	☐
^{14}C	☐	☐
Display	☐	☐

Species Identification: Quercus

Conversion:

Woodworking technology:

Tool Marks: 47P: Small woodchip. ID? Cut at both ends. 11 rings/10 mm = 0.91 mm ARW

Joints: 47Q: Small woodchip. ID? - cut at 1 end - damaged at other. C.7 rings/5 mm = 0.71 mm ARW

Fixings and Fittings

Intentional Marks: 47R: Oak roundwood frag with B+BE. broke in 2, very slow grown. C50 rings. ARW 25/50 = C:005 mm

Surface Treatment

Other

Reused: Y ☐ N ☐ Not Known ☐

Recommendation: Discard? ☐ Discard after further research/sampling? ☐ Retain and Conserve ☐

Checked:

Measured Sketch:

Date: 12/9/2012

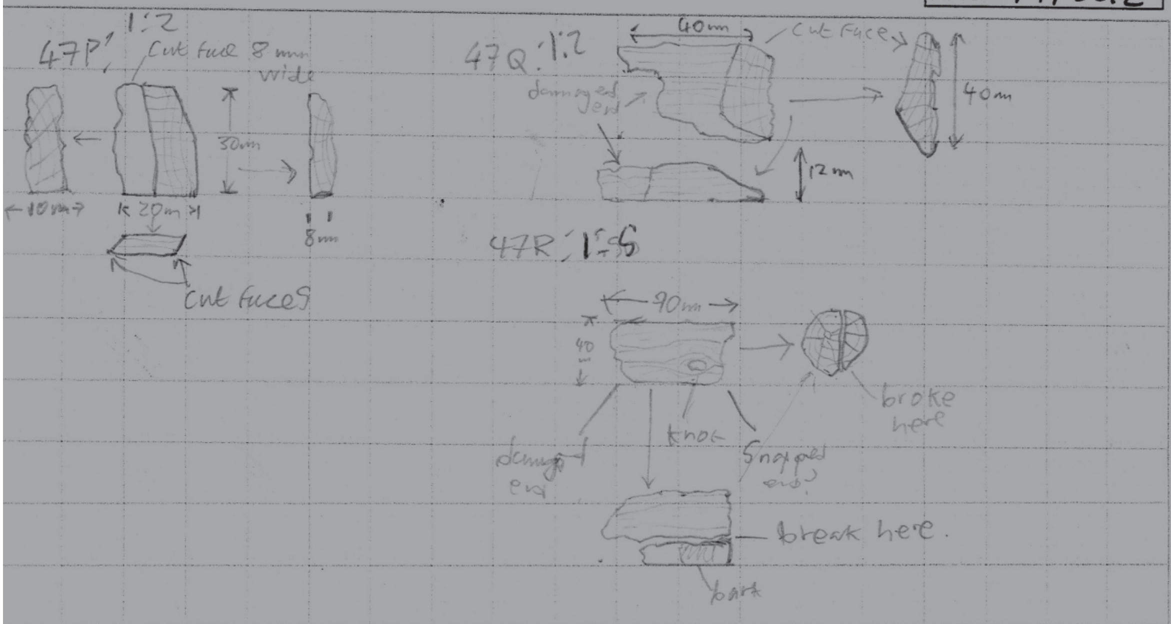


Figure 12.232 wood record sheet for sample 47P

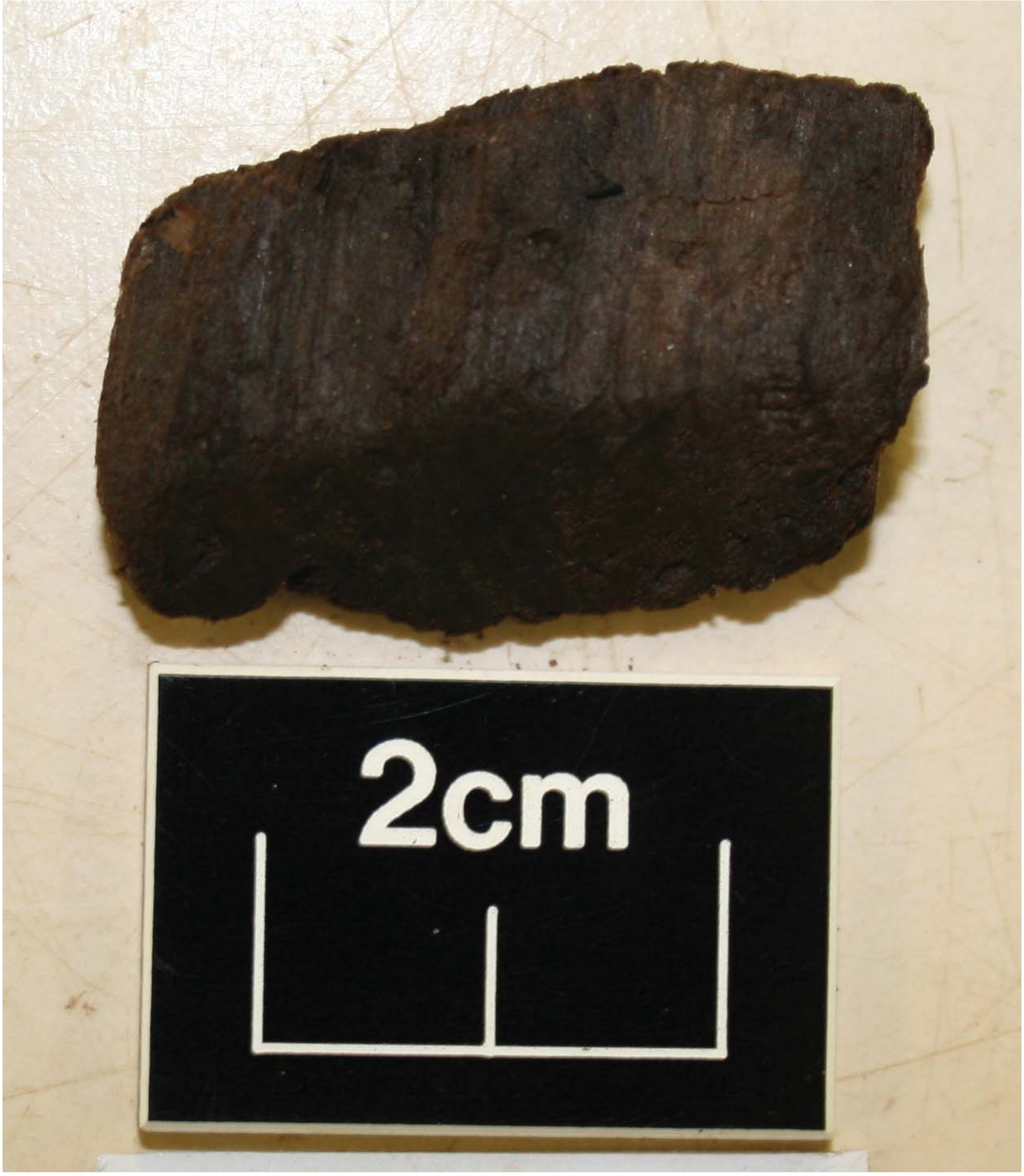


Figure 12.233 photograph of sample 47P

Figure 12.234 photograph of sample 47P

Figure 12.235 photograph of sample 47Q

Figure 12.236 photograph of sample 47Q

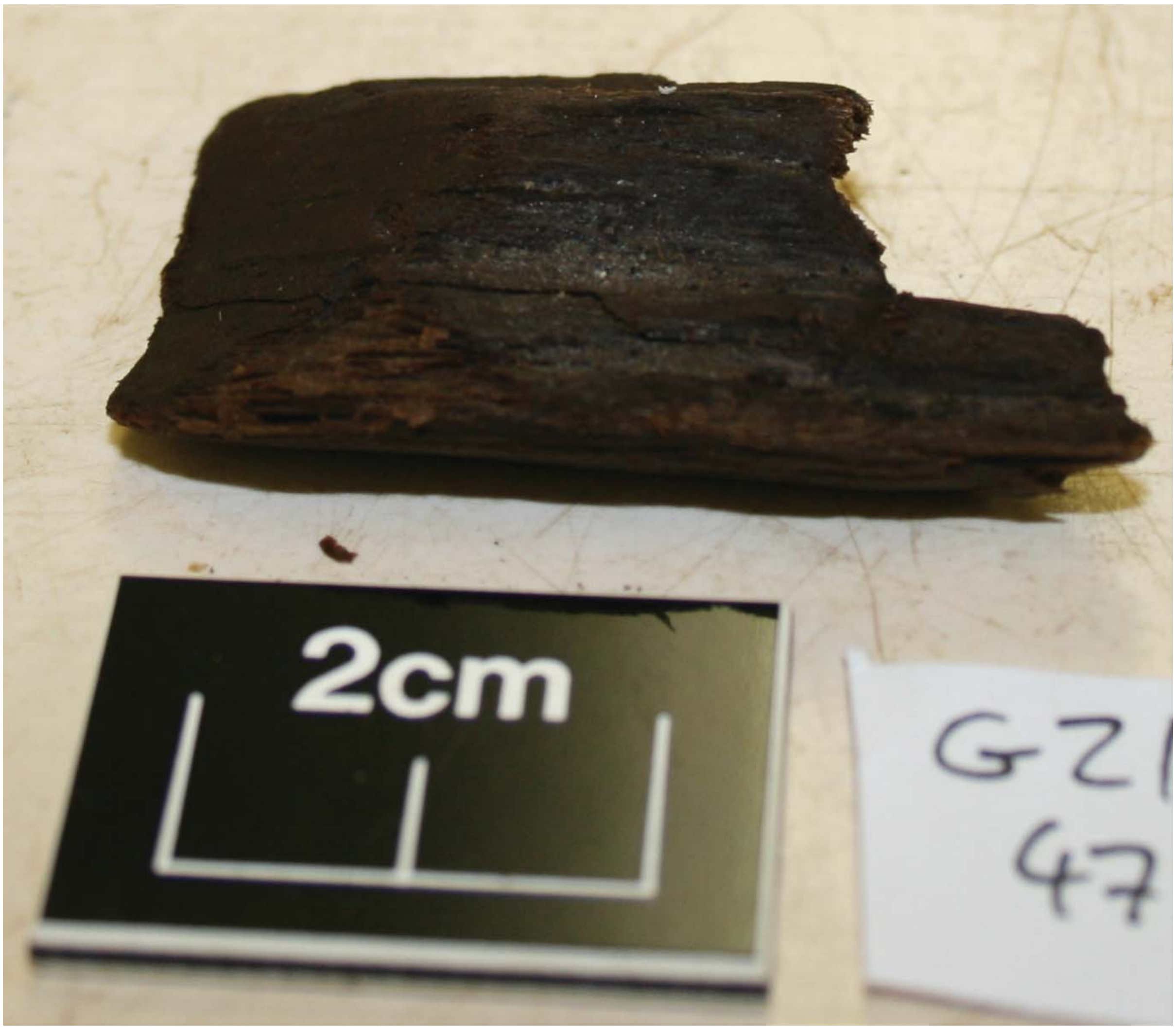
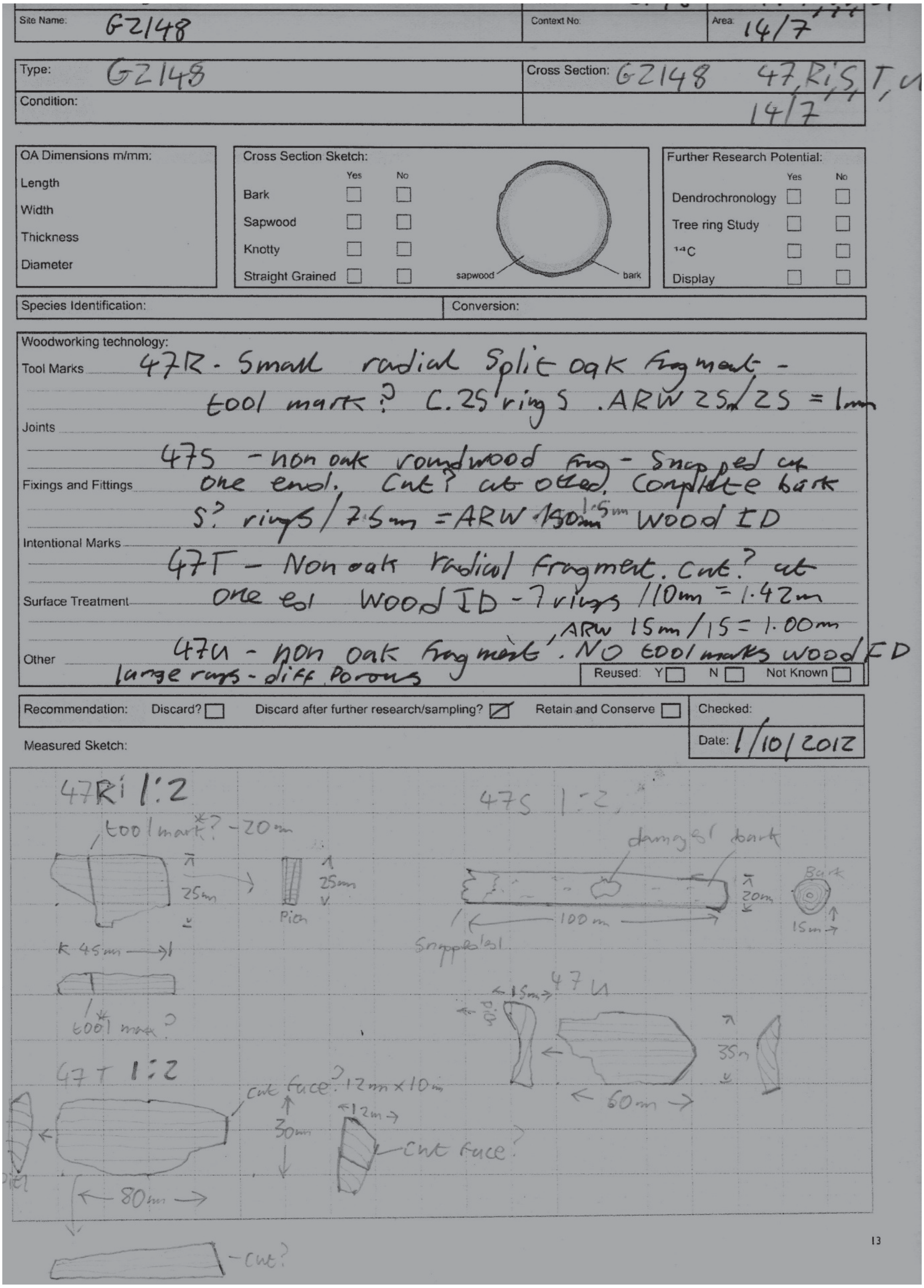


Figure 12.237 photograph of sample 47Q

Figure 12.238 photograph of sample 47R

Figure 12.239 photograph of sample 47R

Figure 12.240 photograph of sample 47R



Site Name: GZ148 | Context No: | Area: 14/7

Type: GZ148 | Cross Section: GZ148 47, Ri, S, T, U 14/7

Condition:

OA Dimensions m/mm: Length, Width, Thickness, Diameter

Cross Section Sketch: Yes / No — Bark, Sapwood, Knotty, Straight Grained (sapwood, bark)

Further Research Potential: Yes / No — Dendrochronology, Tree ring Study, ¹⁴C, Display

Species Identification: | Conversion:

Woodworking technology:

Tool Marks: 47R - Small radial split oak fragment - tool mark? C.25 rings .ARW 25m/25 = 1mm

Joints

Fixings and Fittings: 47S - non oak roundwood frag - snapped at one end. Cut? at other. Complete bark 5? rings / 7.5m = ARW 1.5mm wood ID

Intentional Marks: 47T - Non oak radial fragment. Cut? at one end wood ID - 7 rings / 10m = 1.42m

Surface Treatment: ARW 15m / 15 = 1.00m

Other: 47U - non oak fragment. NO tool marks wood ID large rays - diff porous

Reused: Y ☐ N ☐ Not Known ☐

Recommendation: Discard? ☐ Discard after further research/sampling? ☒ Retain and Conserve ☐ Checked:

Date: 1/10/2012

Measured Sketch:

Figure 12.241 wood record sheet for samples 47 ri,S, T and U

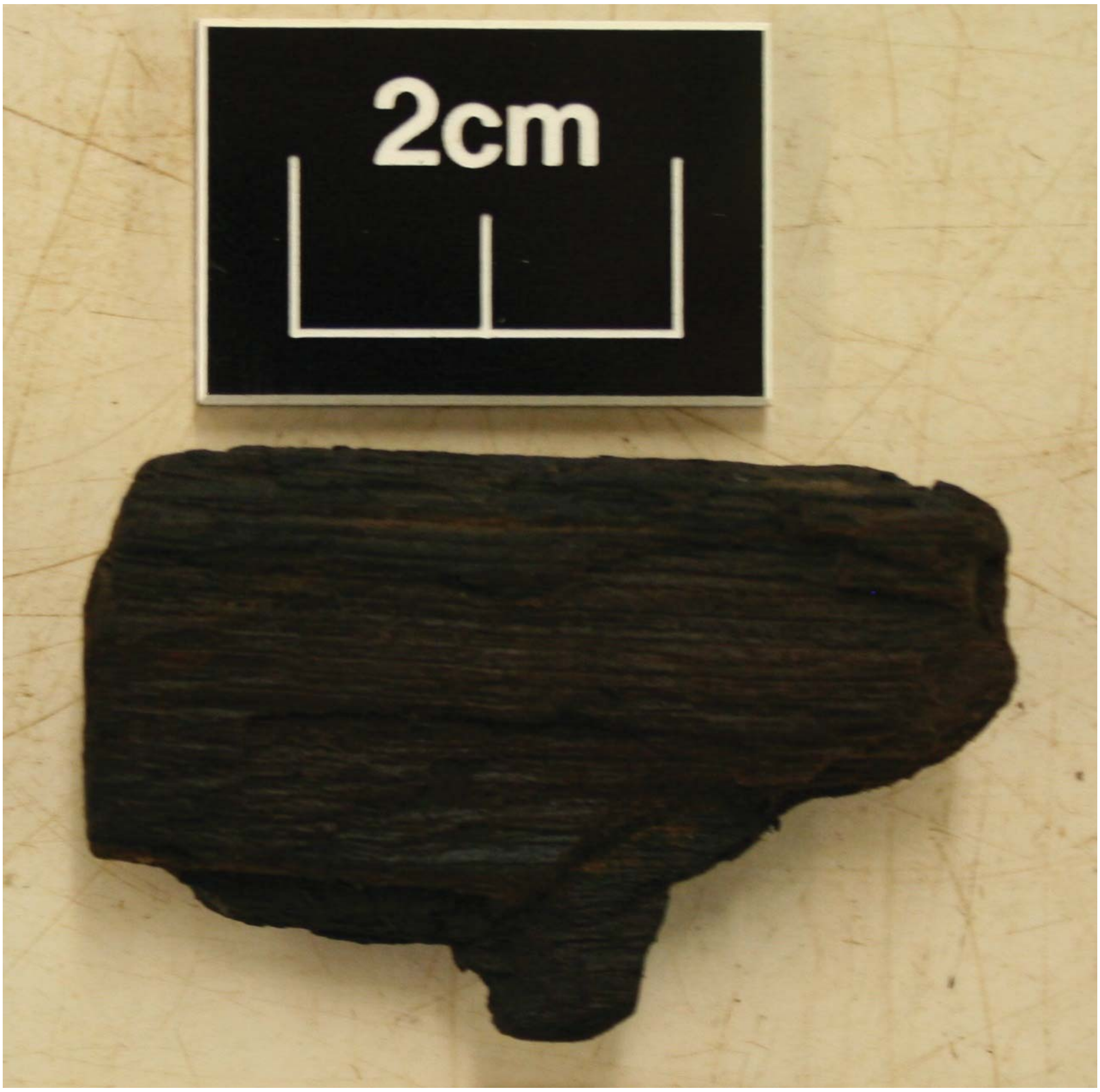


Figure 12.242 photograph of sample 47 ri

Figure 12.243 photograph of sample 47S

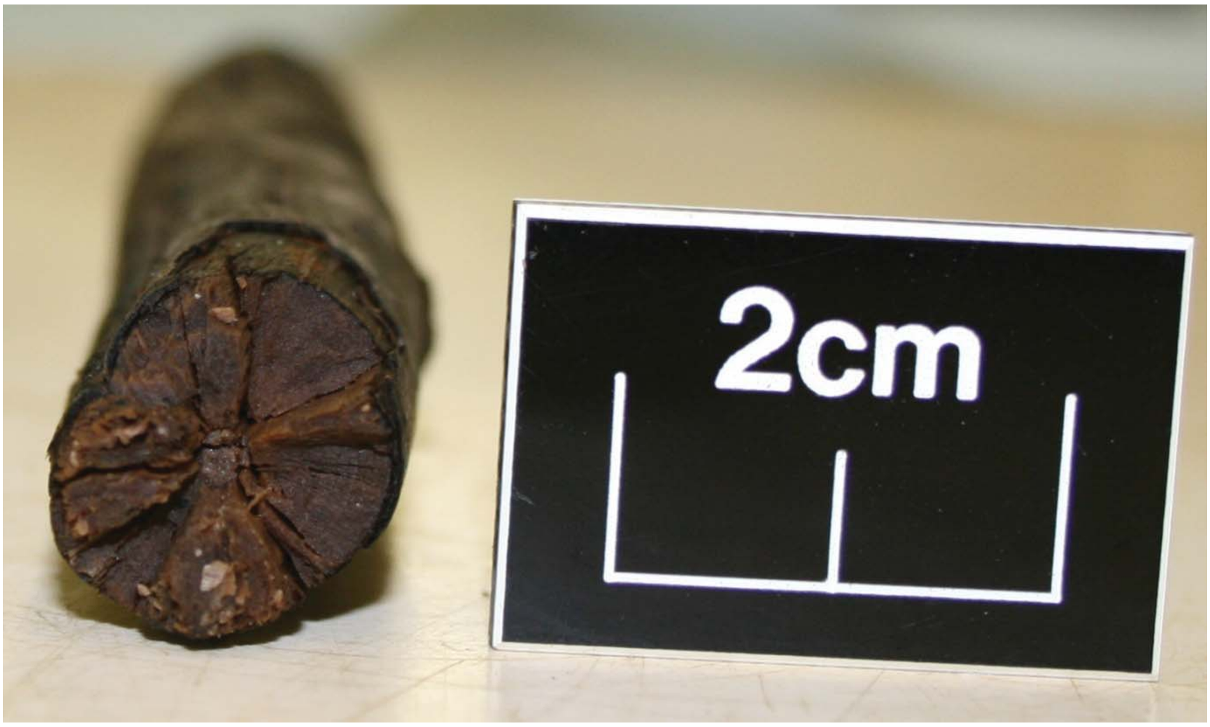


Figure 12.244 photograph of sample 47S

Figure 12.245 photograph of sample 47S

Figure 12.246 photograph of sample 47T

Figure 12.247 photograph of sample 47T

Figure 12.248 photograph of sample 47U

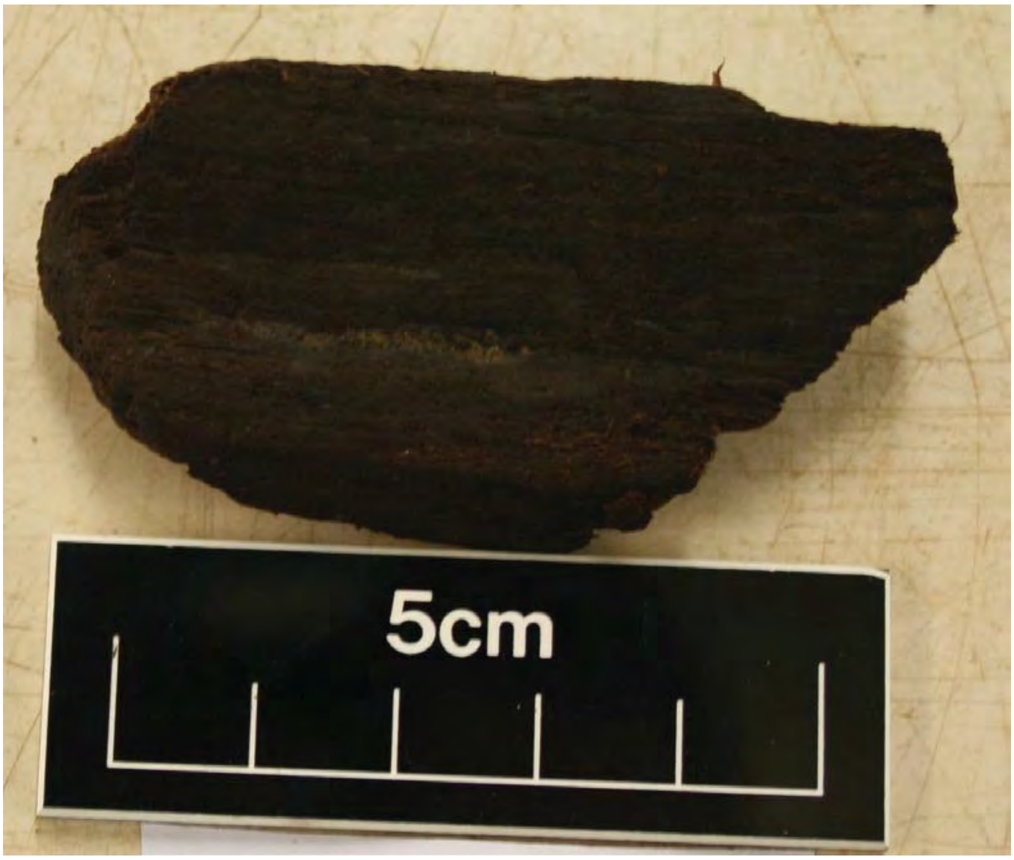


Figure 12.249 photograph of sample 47U

York Archaeological Trust Post Excavation Wood Record Sheet	Site Code/ Accession No: GZ148	Timber or SF No: 47V
Site Name: GZ148	Context No:	Area: 14/7

Type:	Cross Section:
Condition:	

OA Dimensions m/mm:
- Length 480
- Width 35
- Thickness 15-20
- Diameter

Cross Section Sketch:

	Yes	No
Bark	☐	☑
Sapwood	☐	☑
Knotty	☐	☐
Straight Grained	☑	☐

sapwood — bark

Further Research Potential:

	Yes	No
Dendrochronology	☐	☐
Tree ring Study	☑	☐
^{14}C	☐	☐
Display	☐	☐

Species Identification: Quercus | Conversion:

Woodworking technology:

Tool Marks radial split oak fragment - no signs of working or tool marks

Joints very slow grown - unmeas? - sample kept for dendro

Fixings and Fittings

Intentional Marks

Surface Treatment

Other

Reused: Y ☐ N ☐ Not Known ☐

Recommendation: Discard? ☐ Discard after further research/sampling? ☐ Retain and Conserve ☐ | Checked:

Measured Sketch: | Date: 2/10/12

47V 1:10

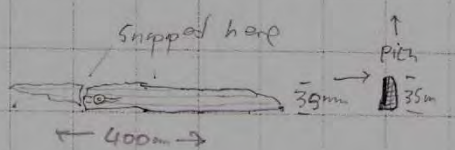


Figure 12.250 wood record sheet for sample 47V

Figure 12.251 photograph of sample 47V

Figure 12.252 photograph of sample 47V

York Archaeological Trust Post Excavation Wood Record Sheet	Site Code/ Accession No: G2148	Timber or SF No: 47W
Site Name: G2148	Context No:	Area: 14/7

Type:

Condition:

Cross Section:

OA Dimensions m/mm:

Length 400m

Width 130 - 110m

Thickness 50m - 60m

Diameter

Cross Section Sketch:

	Yes	No
Bark	☑	☐
Sapwood	☑	☐
Knotty	☐	☐
Straight Grained	☐	☑

sapwood bark

Further Research Potential:

	Yes	No
Dendrochronology	☐	☐
Tree ring Study	☑	☐
^{14}C	☐	☐
Display	☐	☐

Species Identification: Betula?

Conversion: Halved roundwood

Woodworking technology:

Tool Marks – Possible on side.

Joints

very slow grown

Fixings and Fittings

50+ rings

Intentional Marks

50m / 50+ rings

Surface Treatment

Other ~~oa~~ Halved non oak roundwood with Bark on one side Wood ID

Reused: Y ☐ N ☐ Not Known ☐

Recommendation: Discard? ☐ Discard after further research/sampling? ☐ Retain and Conserve ☐

Checked:

Measured Sketch: 1 : 5

Date: 3/10/12

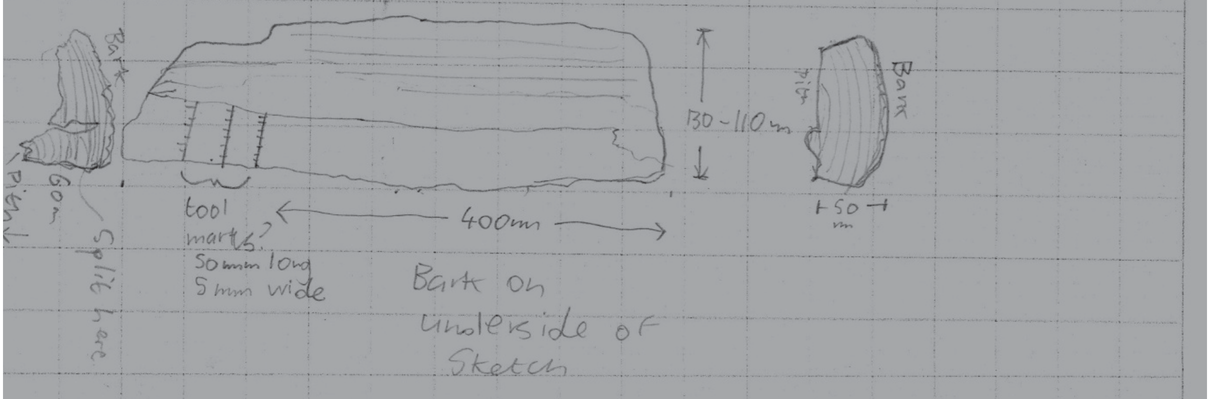


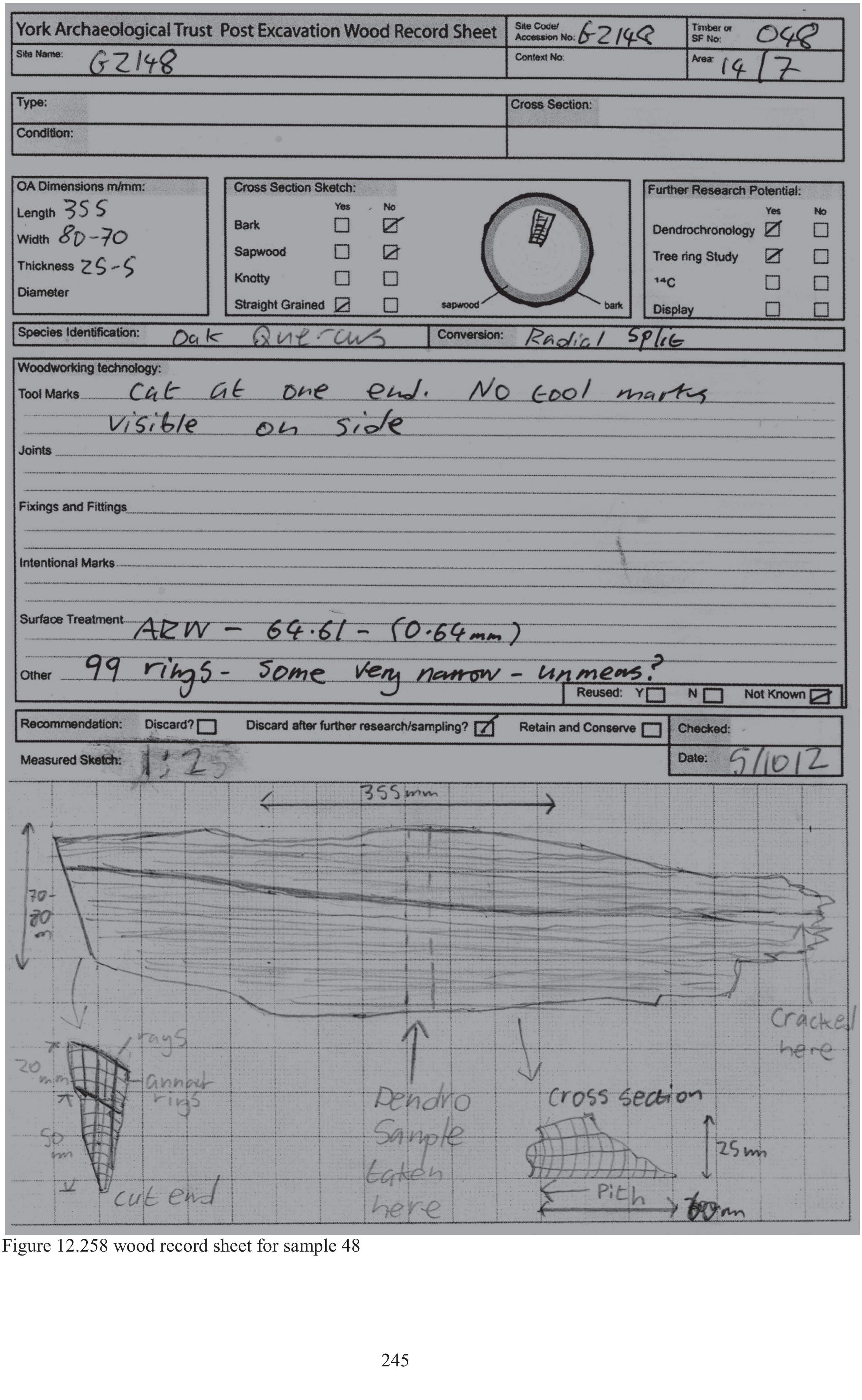
Figure 12.253 wood record sheet for sample 47W

Figure 12.254 photograph of sample 47W

Figure 12.255 photograph of sample 47W

Figure 12.256 photograph of sample 47W

Figure 12.257 photograph of sample 47W



York Archaeological Trust Post Excavation Wood Record Sheet

Site Name: GZ148	Site Code/ Accession No: GZ148	Timber or SF No: 048
	Context No:	Area: 14/7

Type:	Cross Section:
Condition:	

OA Dimensions m/mm:
Length 355
Width 80-70
Thickness 25-5
Diameter

Cross Section Sketch:

	Yes	No
Bark	☐	☒
Sapwood	☐	☒
Knotty	☐	☐
Straight Grained	☒	☐

sapwood
bark

Further Research Potential:

	Yes	No
Dendrochronology	☒	☐
Tree ring Study	☒	☐
^{14}C	☐	☐
Display	☐	☐

Species Identification: Oak Quercus
Conversion: Radial Split

Woodworking technology:
Tool Marks: Cut at one end. No tool marks visible on side
Joints
Fixings and Fittings
Intentional Marks
Surface Treatment: ARW – 64.61 – (0.64mm)
Other: 99 rings – some very narrow – unmeas?
Reused: Y ☐ N ☐ Not Known ☒

Recommendation: Discard? ☐ Discard after further research/sampling? ☒ Retain and Conserve ☐
Checked:
Measured Sketch: 1:25
Date: 5/10/12

Figure 12.258 wood record sheet for sample 48

Figure 12.259 photograph of sample 48

York Archaeological Trust Post Excavation Wood Record Sheet	Site Code/ Accession No: G2148	Timber or SF No: 059 1of2
Site Name: G2148	Context No:	Area: 14/7

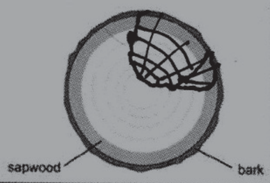
Type:	Cross Section:
Condition:	

OA Dimensions m/mm:

Length 990mm
Width 130mm
Thickness 90-30m
Diameter

Cross Section Sketch:

	Yes	No
Bark	☑ ?	☐
Sapwood	☑	☐
Knotty	☐	☐
Straight Grained	☐	☐



Further Research Potential:

	Yes	No
Dendrochronology	☑	☐
Tree ring Study	☐	☐
^{14}C	☐	☐
Display	☐	☐

Species Identification: Quercus | Conversion: 1/4 ed split

Woodworking technology:

Tool Marks Possible between piece 1+2 (see photos)

Joints dendro - does not date

Fixings and Fittings

Intentional Marks

Surface Treatment

Other

Reused: Y ☐ N ☐ Not Known ☑

Recommendation: Discard? ☐ Discard after further research/sampling? ☑ Retain and Conserve ☐

Checked:

Measured Sketch: 1:10

Date: 20.10.12

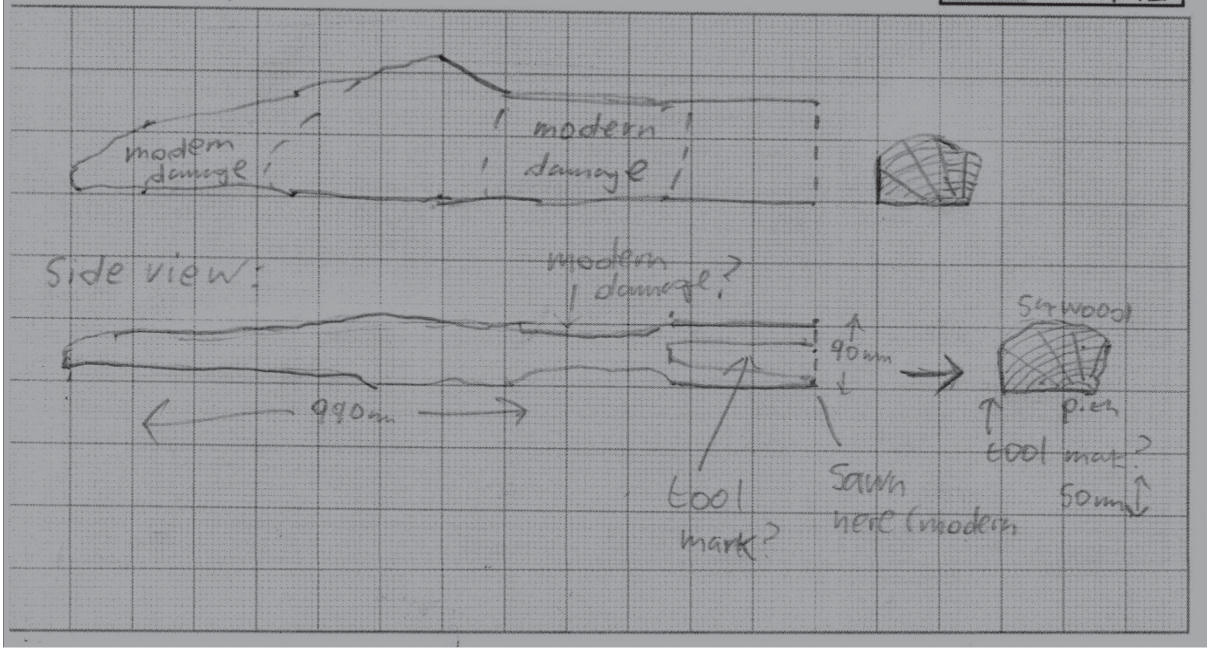
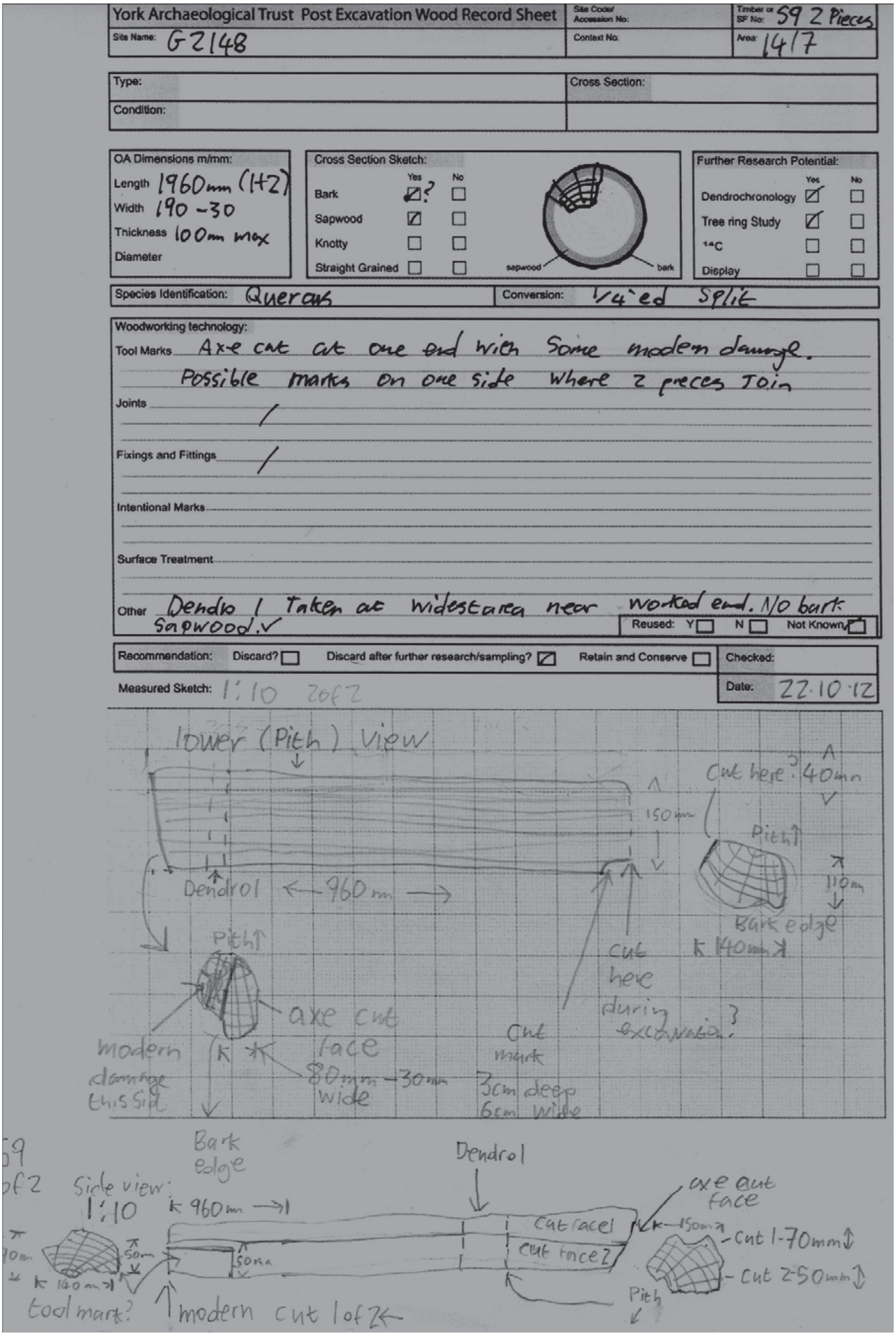


Figure 12.260 wood record sheet for sample 59 1 of 2

Figure 12.261 photograph of sample 59 1 of 2

Figure 12.262 photograph of sample 59 1 of 2

Figure 12.263 photograph of cross section through sample 59 1 of 2



York Archaeological Trust Post Excavation Wood Record Sheet

Site Name: G2148	Site Code/ Accession No:	Timber or SF No: 59 2 Pieces	
	Context No:	Area: 14/7	

Type:	Cross Section:
Condition:	

OA Dimensions m/mm:
Length 1960mm (1+2)
Width 190 - 30
Thickness 100mm max
Diameter

Cross Section Sketch:

	Yes	No
Bark	☑?	☐
Sapwood	☑	☐
Knotty	☐	☐
Straight Grained	☐	☐

sapwood
bark

Further Research Potential:

	Yes	No
Dendrochronology	☑	☐
Tree ring Study	☑	☐
^{14}C	☐	☐
Display	☐	☐

Species Identification: Quercus
Conversion: 1/4'ed Split

Woodworking technology:
Tool Marks: Axe cut at one end with some modern damage. Possible marks on one side where 2 pieces join
Joints /
Fixings and Fittings /
Intentional Marks
Surface Treatment
Other: Dendro 1 Taken at widest area near worked end. No bark sapwood.✓
Reused: Y ☐ N ☐ Not Known ☑

Recommendation: Discard? ☐ Discard after further research/sampling? ☑ Retain and Conserve ☐
Checked:
Measured Sketch: 1:10 2of2
Date: 22.10.12

Figure 12.264 wood record sheet for sample 59 2 of 2

Figure 12.265 photograph of sample 59 2 of 2

Figure 12.266 photograph of sample 59 2 of 2

Figure 12.267 photograph of sample 59 2 of 2

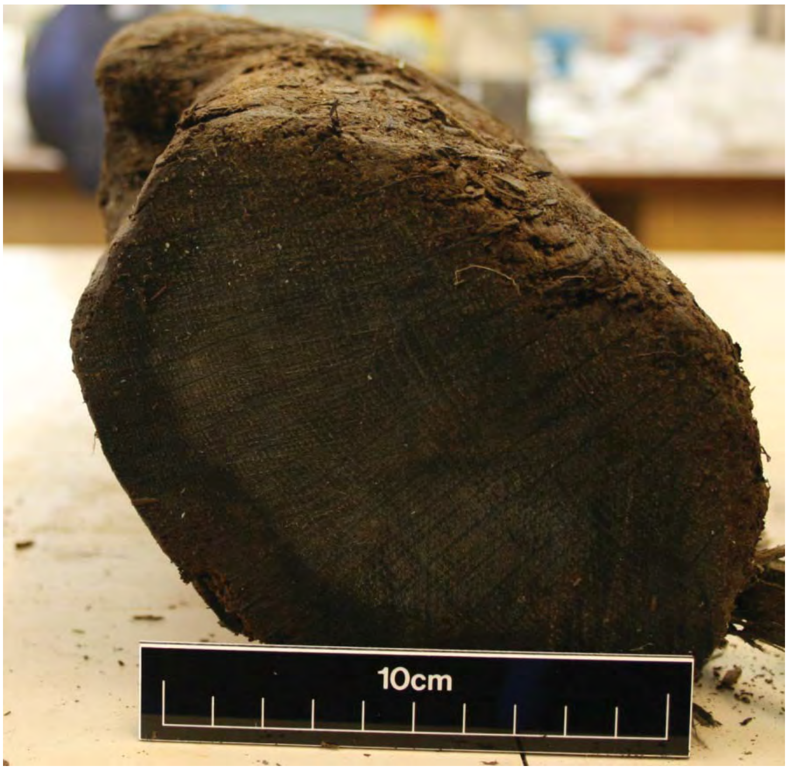


Figure 12.268 photograph of cross section through sample 59 2 of 2

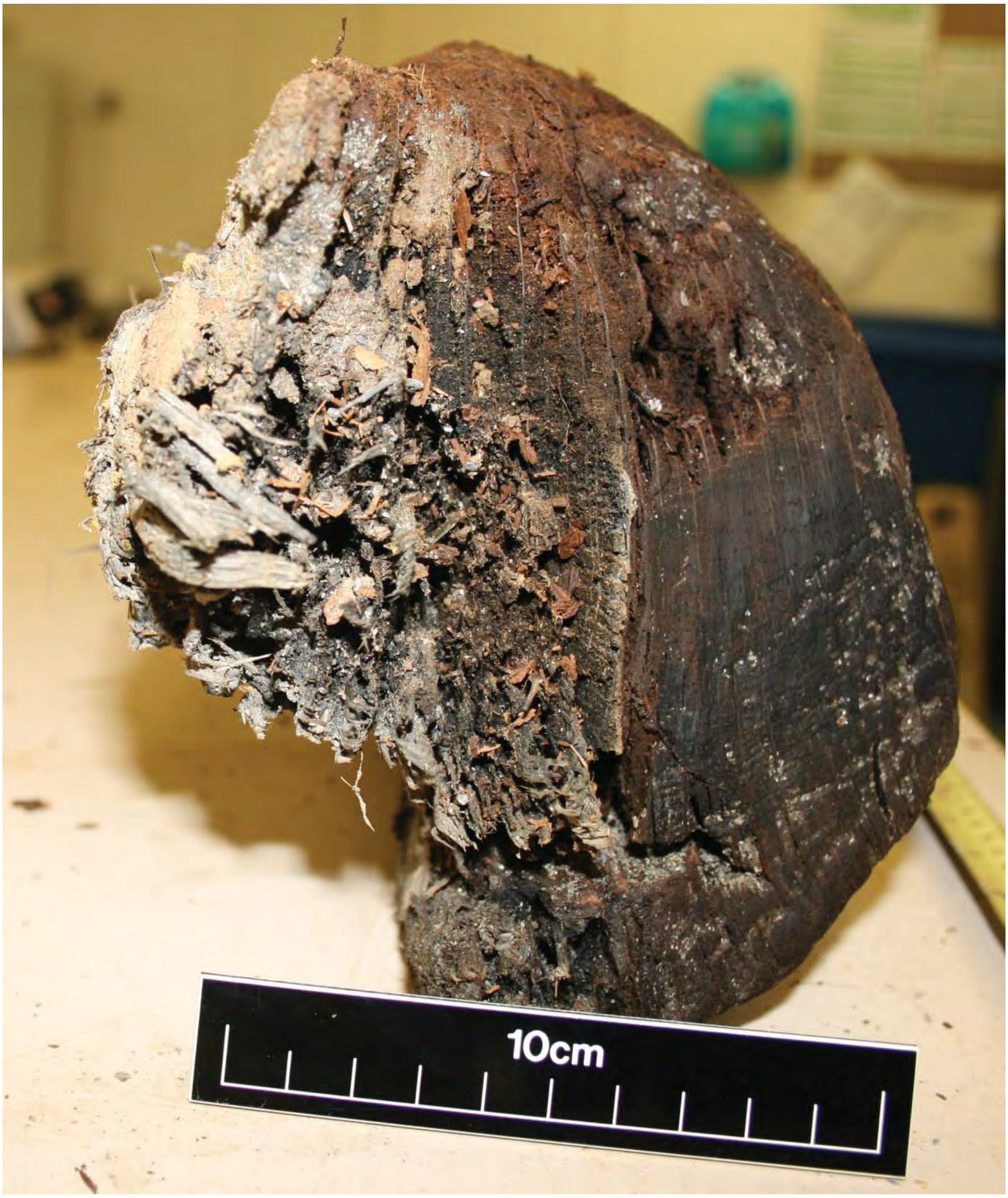


Figure 12.269 photograph of end of sample 59 2 of 2

Figure 12.270 photograph of sample 59 2 of 2


Figure 12.271 photograph of sample 59 (both pieces)


Figure 12.272 photograph of sample 59 (both pieces)

Additional notes for area 14/7
Wood identification

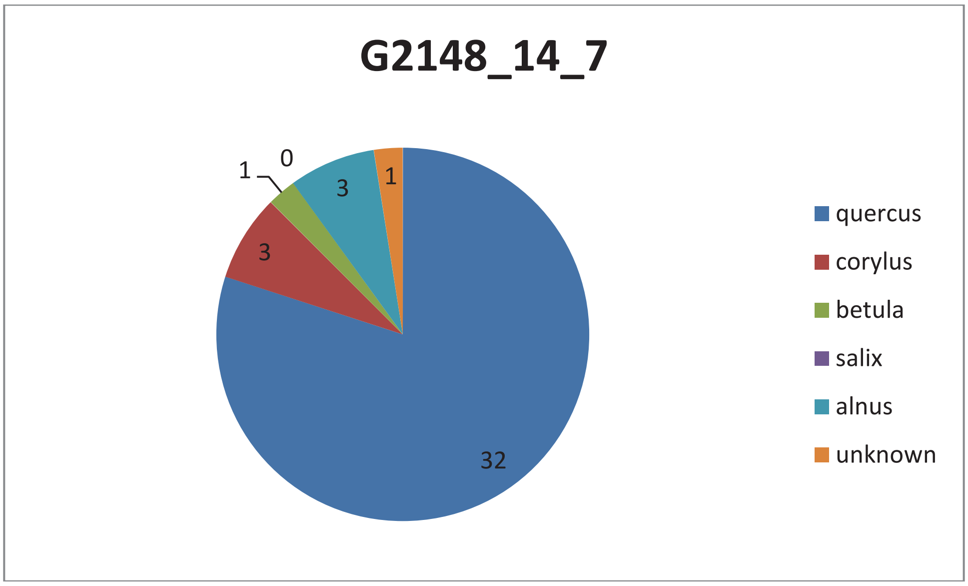


Figure 12.273 pie chart showing tree species within area 14/7

The distribution of species is dominated by *Quercus* with the other species present typical of mixed deciduous wet woodland. The dominance of *Quercus* may be either a reflection of the semi waterlogged nature of the site and, and preferential preservation of *Quercus* over other species although the presence of many clearly worked timbers (19 of 28 samples exhibit signs of working) suggest the area is one where woodworking was concentrated with *Quercus* being the preferred species.

All of the tree species identified are common in Wales and have the following ecological preferences.

Alnus glutinosa (L.) Gaertner (black alder)
Common in marshy places and by streams but also occurs in well drained woods (Hyde and Harrison 1977). May be coppiced.

Betula spp. (birch)
Both *B. pendula* Roth. (silver birch) and *B. pubescens* Ehrh. (downy birch) are native and the wood of the two species cannot be separated. Both are small trees which occur in woods on all types of soil.

Corylus avellana L. (hazel)
A shrub or small tree, which is often an important part of the understorey of oakwoods. May be coppiced.

Salix spp. (willow)
The wood of *Salix* species cannot be differentiated on anatomical characteristics. Goat willow (*Salix caprea* L. occurs as a small tree throughout Wales. Bay willow (*Salix pentandra* L.) occurs as a small tree or shrub, particularly on streamsides in North Wales. White willow (*Salix alba* L.) occurs as a tree up to 90ft tall in damp places, and is often planted by streams and pollarded. Crack willow (*Salix fragilis* L.) is common besides streams in Wales and is usually planted and pollarded Hyde and Harrison 1977). Hybridisation between willow species readily occurs.

Dendrochronology
Although nine timbers from this plot contained sufficient rings to warrant dendrochronological investigation, none of the samples measured provided a date. Some samples (e.g 47B, 47C) that contained sufficient rings were unmeasurable due to very slow growth and therefore narrow rings. In other instances (e.g sample 59 and 47 D) parts of the sequence was measurable but contained bands of narrow rings that were not. In the case of sample 59 multiple dendro samples were taken and multiple measurements taken from before and after any unmeasurable sections. Unfortunately it was not possible to cross date any of the timbers with each other or with any external reference chronologies. The very narrow growth rates observed in some of the material suggests the parent material may have been branchwood and that the very narrow rings are the result of microclimatic rather than regional climate effects.

12.5. References

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Schweingruber, F H. 1982 Microscopic wood anatomy – structural variability of stems and twigs in recent and subfossil woods from Central Europe. 2nd edition. Zurcher [for] Eidgenossische Anstalt fur das forstliche Versuchswesen

Tyers, I. 2004 Dendro for Windows programme guide, 3rd edn

12.6. Appendix: Table Summarising results of Wood Assessment

Find Number	Assessment Description	Context Number	Plot	Period	No of items	Site Description	Ring Estimate	Pith	Sap-wood	Bark Edge	Dendro Required	Treerings Required	Wood ID Required	Wood technology required	Wood Record sheet and photography required	Length	Width	Thick
36	Oak branch with chisel cut at one end	147005	14_7	Unknown	1	Medium sized piece of cut wood		Y	Y	Y	0	1	0	1	1	880	50	50
37	2 pieces of bark	6294139	6/29.4	Bronze Age?	2	2 fairly small split pieces		N	N	Y	0	0	0	0	1	240	100	5
38	Roundwood fragment with cut side-branch	147005	14_7	Unknown	1	Small cut branch		Y	Y	Y	0	1	1	1	1	95	60	35
39	Non-oak small wood fragment	147005	14_7	Unknown	1	small piece of wood		N	N	N	0	0	1	0	0	52	20	5
40	Radial oak fragment with toolmarks	147005	14_7	Unknown	1	Small plank		N	N	N	0	1	0	1	1	110	50	10
41	Three wood fragments (2 radials and one roundwood). One radial piece has possible toolmarks. 7 hazelnuts	147005	14_7	Unknown	3	Small branches and hazelnuts		N	N	N	0	3	3	1	4			
42	Oak roundwood fragment labelled 'cut wood from bottom of trench'		14_4	Unknown	1	Small, possibly cut branch		Y	Y	Y	0	1	0	1	1	105	30	25
43	Roundwood fragment		11_3	Unknown	1	Small cut branch		Y	Y	Y	0	1	1	1	1	50	30	25
44	Roundwood and split fragments	147005	14_7	Unknown	8	Cut branch, squared wood and other more natural pieces (7 small, 1 medium)		N	N	N	2	7	3	1	8			
45	Radial oak fragment with possible charring on one face	147005	14_7	Unknown	1	Medium sized possible split timber		N	N	N	1	0	0		1	410	170	50
46	Radial oak timber with possible toolmarks on one face and end. Other end damaged	147005	14_7	Unknown	1	Large timber with (saw) cut end		N	N	N	0	1	0	1	1	850	220	110
47	Multiple oak fragments (20+)	147005	14_7	Unknown	11	Small flat, possibly		N	N	N	4	5	1	5	10			

Find Number	Assessment Description	Context Number	Plot	Period	No of items	Site Description	Ring Estimate	Pith	Sap-wood	Bark Edge	Dendro Required	Treerings Required	Wood ID Required	Wood technology required	Wood Record sheet and photography required	Length	Width	Thick
	with numerous cut marks. Four pieces roundwood					split timbers												
48	Oak radial split with cut marks on one face and end. Good dendro potential	147005	14_7	Unknown	1	Medium sized possibly split timber		N	N	N	1	0	0	1	1	360	90	20
49	Radial oak timber with wedge cut end (modern saw cut at other?)	0	14_1	Unknown	1	Large squared timber	200	N	N	N	1	0	0	1	1	630	190	90
50	Radial slow grown oak. Modern saw cut at one end	0	11_3	Unknown	1	Large branch, probably not worked		N	N	N	1	0	0	0	1	1070	130	100
51	Not found	0	11_3	Unknown	2	Large pieces of wood, possibly worked		N	N	N								
52	Two worked non-oak roundwood pieces. Two radial oak pieces worked to points, one with through and blind auger holes	0	11_3	Unknown	4	2 large pieces of wood, possibly worked, 2 medium sized pieces		N	N	N	2	2	2	4	4			
53	Three lengths of oak? Including radial split and two roundwood latter with cut sidebranches. All approx 1100mm long and cut with modern saw at both ends? One smaller branch fragment	0	11_3	Unknown	3	Large pieces of wood, possibly worked		Y	Y	Y		4	0	3	4			
54	Non oak roundwood	0	0/8	Unknown	1	Large piece of timber		Y	N	Y	0	1	1	0	1	410	220	160
56	13 oak fragments. No toolmarks evident	6294046	6/29.4	Bronze Age?	5	Medium sized flat pieces of wood,		N	N	N	0	13	0	0	13	280	70	

Find Number	Assessment Description	Context Number	Plot	Period	No of items	Site Description	Ring Estimate	Pith	Sap-wood	Bark Edge	Dendro Required	Treerings Required	Wood ID Required	Wood technology required	Wood Record sheet and photography required	Length	Width	Thick
						possible split timber												
57	Quartered oak with dried out surface. No toolmarks evident but needs final cleaning. Cut onto two pieces with saw during excavation	0	13/30	Unknown	1	Very large timber, worked?	100	N	N	N	1	0	0	1	1	1130	210	130
58	Approximately quartered knotty oak. Possible toolmarks survival under adhering sediment (not cleaned off during assessment). Possible rebate. Cut into two pieces during excavation with saw.	0	13/30	Unknown	1	Very Large timber, worked?	90	N	N	N	1	0	0	1	1	2185	210	110
59	Quartered oak with axe? Cuts at one end and one face (at least). Cut into 2 pieces during excavation with saw?	147006	14_7	Unknown	1	Very large timber, worked?	70	N	Y	N	1	0	0	1	1	1990	200	120
											15	41	13	25	58			

13. POLLEN ANALYSIS OF MONOLITHS IN PLOT 6/29.4

Fiona Grant

13.1. Introduction

In October 2012 the author was commissioned to carry out pollen analysis on thirty sub-samples from two profiles (M2 and M3) collected from the vicinity of the burnt mound in plot 6/29.4. Profile M2 was taken from a natural hollow just south of the mound, whilst M3 originated from an area of peat adjacent to a small stream at the foot of a slope *c.*50m from the burnt mound (figure 13.5). Initial assessment of eight samples (three from M2 and five from M3) had shown excellent pollen preservation, and further work was recommended (Jones 2012). This further work hoped to more fully describe vegetation and landscape development in the area, identify any human activity, and assist in identifying any key horizons for radiocarbon dating. In total, including previously assessed samples, profile M2 comprised ten sub-samples from 5cm to 31cm. Profile M3 comprised in total twenty sub-samples from 3cm to 67cm.

Laboratory Treatment

The pollen samples were prepared using standard techniques (Moore *et al.,* 1991), as detailed in the assessment report. Counting and identification was carried out using an Zeiss Axiolab at x400 magnification, and with the aid of a reference collection of type slides, online pollen image databases, and the pollen and spore key in Moore *et al.* (1991).

A minimum total pollen sum of 400 pollen grains (excluding aquatics) plus spores was attained from each sample. The results of the assessment phase counts (100 grains) were added to those additional counts carried out as part of the full analysis. The pollen diagrams are presented both including and excluding *Alnus* from the pollen sum. This is to allow the recognition of more subtle changes which may otherwise be disguised by the swamping effect of *Alnus.* For ease of description the pollen diagrams were divided into a series of local pollen assemblage zones or LPAZs. It should be stressed that the zones do not represent any specific archaeological time periods, and are applied purely in order to aid description of any changes in the pollen data. Values (including spores and charcoal) are expressed in terms of percentages of total land pollen (TLP) unless otherwise specified.

Microscopic charcoal

Microscopic charcoal particles were counted as they were encountered during the general pollen count.

Radiocarbon Dating

Based upon the pollen evidence samples from both cores were submitted for AMS radiocarbon dating. A single sample was submitted from M2 from 18-20cm, and three dates acquired from M3, from 28-30cm, 50-52cm and 65-67cm. The latter produced a date completely out of sequence and is not discussed below. The dates were obtained by accelerator mass spectrometry of organic sediments by BetaAnalytic Laboratories. Full details of the dates are presented in the table below.

Table 13.1. Radiocarbon dates from pollen monoliths M2 and M3

Lab number	Monolith	Depth of sample	Measured age	Conventional age	Calibrated age (2 sigma)
Beta-348671	M2	18-20cm	3570 ±30 BP	3490 ±30 BP	1890-1740 cal BC
Beta-348672	M3	28-30cm	2220 ±30 BP	2140 ±30 BP	350-60 cal BC
Beta-348673	M3	50-52cm	3080 ±30 BP	3020 ±30 BP	1380-1130 cal BC
Beta-348674	M3	65-67cm	1820 ±30 BP	1720 ±30 BP	Cal AD 240-400

13.2. Results

The Pollen Record

Pollen preservation was generally excellent in all of the samples analysed in the second stage of the project, and full counts were achieved. See figures 13.1-4.

M2

Four local pollen assemblage zones (LPAZ), M2i-iv, were recognised within the diagram.

M2i

Arboreal pollen dominates this zone, forming between 70-80% TLP (total land pollen). Much of this is accounted for by high *Alnus* values of around 50%. However, *Quercus* also forms an important component of the arboreal spectra with up 24% TLP, whilst *Betula* is less significant at less than 10%, and other more light-demanding species such as *Ulmus* (elm), *Ilex* and *Hedera* (ivy) form only a very low presence. Arboreal pollen in general initially increases slightly before declining at the end of the zone. This decline is owing to reductions in *Quercus* and *Betula,* although *Alnus* continues expanding. *Corylus* and *Salix* increase, accompanied by a slight increase in herbs such as Poaceae, *Rumex* (docks and sorrels), *Plantago* (plantain), and Ranunculus (buttercups).

Despite this slight increase in herbs, values for species indicative of open areas such as Poaceae and Cyperaceae (sedges) are generally low, each forming less than 5% of the pollen spectra. Heaths are represented by single grains only. Large grass or cereal-type grains however, demonstrate a low peak in the basal sample (albeit only three grains). This peak is accompanied by moderately increased levels of microscopic charcoal deposition, and the presence of herbs such as Lactuceae (e.g. dandelion) which flourish under disturbed conditions. The spores of Pteropsida (monolete) (ferns) and *Polypodium* (polypody fern) also demonstrate a peak in the basal sample. Other herbs present in this zone are *Rumex Plantago,* Ranunculaceae, *Filipendula ulmaris* (meadowsweet), *Silene dioica* (red campion), *Digitalis* (foxglove) and *Hypericum elodes*-type (marsh St. John's wort).

M2ii

Some expansion of dryland woodland is suggested here as *Alnus* experiences a slight decline as *Betula* initially increases, followed by *Quercus,* which peaks at almost 30% TLP. *Ulmus* and *Ilex* also increase in this zone, whilst *Corylus* declines to *c.*10%. Species indicative of open areas are once again low, although values for Poaceae begin to rise at the close of the zone, heralding the onset of an almost continuous rise thereafter. A sample from 18-20cm, encompassing this change, was radiocarbon dated to 3490+/-30BP. Cereal-type grains are recorded as single grains only, but are accompanied by ruderal herbs such as *Plantago,* Lactuceae, and *Achillea*-type. Microscopic charcoal deposition is low.

M2iii

Alnus peaks at the start of this zone, corresponding with declining levels of *Betula, Quercus* and *Ulmus*. *Corylus* too has recovered. Pinaceae appears, albeit at very low levels, accompanied by a short-lived peak in heaths to almost 1%. Cyperaceae continues to fluctuate at low levels, whilst Poaceae continues its rise, reaching almost 8% at the end of the zone. Accordingly floristic diversity begins to increase as well. *Urtica* (nettle) appears, with Ranunculaceae, *Filipendula*, Apiaceae and *Plantago.* The increase in *Plantago* towards the close of the zone corresponds with a dramatic increase in microscopic charcoal deposition, a peak in *Ilex* at *c.*3% TLP, and the identification of a cereal-type grain.

M2iv

This zone overall appears to represent the final decline of arboreal and shrub species, as herbaceous species increase. All tree and shrub species are ultimately affected, although *Alnus* shows a short-lived increase mid-zone at the expense of *Betula,* Poaceae and Cyperaceae. *Ilex* also increases slightly at this point. This mid-zone is a period of low microscopic charcoal deposition, with an absence of cereal-type pollen and heaths.

Quercus demonstrates a steady decline throughout the zone, from *c.*11% to *c.*4%. A similar pattern is shown by *Corylus. Lonicera* (honeysuckle) appears in this zone, whilst *Hedera,* although present at the start, ultimately disappears. *Ulmus* presents an intermittent, low presence throughout, whilst Pinaceae and *Salix* are absent.

Both Poaceae and Cyperaceae peak at the close of the zone, (top of the profile). Poaceae attains almost 17% TLP, whilst Cyperaceae peaks at *c.* 11%. The range of herbaceous species has similarly increased, with *Hypericum perforatum* (St. John's wort), and *H.elodes* (marsh St. John's wort), and *Stachys sylvatica* (hedge woundwort) joining those previously described. *Plantago*, Ranunculaceae and Lactuceae peak at the top of the profile, accompanied by high values for microscopic charcoal deposition. Although at low levels mid-zone, values for microscopic charcoal deposition peak generally in this zone. Spores of *Pteridium aquilinum* (bracken) appear, showing a steady rise throughout. A similar pattern is displayed by Pteropsida monolete spores, whilst those of *Polypodium* decline. Values for aquatic species peak in this zone.

M3

Six local pollen assemblage zones (LPAZ), M3i-vi, were recognised within the diagram.

M3i

Arboreal pollen dominates this zone at between 50-60% TLP, suggesting a predominantly wooded landscape. Much of this, however, is accounted for by high deposition of *Alnus* pollen which comprises *c*.45%. *Betula* and *Quercus* are also present at around 5% each, with lower levels of Pinaceae and *Ulmus*. *Lonicera* and *Hedera* are also recorded. *Corylus*-type pollen forms *c*.20% TLP, although this falls slightly towards the end of the zone, as *Salix* increases slightly. Heaths are represented by single grains only.

Herbaceous species increase from *c*.20% TLP at the base of the profile to almost 30% by the close of the zone. Poaceae increases from *c*.5% TLP at the start to almost 10% mid-zone, before declining again at the close. This decline is in the face of rising Cyperaceae values, which form 20% TLP at the close of the zone. This increase in Cyperaceae is accompanied by increases in tall herbs, particularly those of damp, wetland areas such as *Filpendula, Symphytum* (comfrey), *Scutellaria* (e.g. *S. galericulata)* (marsh skullcap), and *Typha latifolia* (bulrush). Other herbs present throughout the zone include *Rumex* (docks and sorrels), *Plantago,* Lactuceae, *Solidago-vigaurea*-type (e.g. daisy), Achillea-type (yarrow), *Urtica,* Apiaceae sp. (parsley family) and *Stachys sylvatica.* Spores of *Polypodium* and Pteropsida (monolete) decline, whilst those for *Sphagnum* (bog moss) increase at the end of the zone, as do values for aquatic species. Microscopic charcoal deposition declines from a moderate peak at the onset of the zone.

M3ii

Values for arboreal pollen increase in this zone to over 70% TLP. Increases in *Alnus* are shown, but *Quercus* also increases to form over 8% at the close, and *Carpinus* occurs in trace amounts. *Corylus* also shows an increase from the previous zone. *Betula* and Pinaceae decline, and *Ulmus* forms only a very low and intermittent presence. Open area species are reduced, with Poaceae and Cyperaceae each forming less that 5% TLP, and a correspondingly low value for other herbaceous types. Microscopic charcoal deposition is low, and there is a decline in all spores and aquatic species.

M3iii

Arboreal pollen increases from a low of *c*.50% TLP at the start of the zone, to just over 70% by the close. Although *Alnus* increases initially, it then declines in the face of rising values for *Betula,* which reach almost 20% TLP at the end of the zone. This corresponds with a peak in microscopic charcoal deposition and herbs. *Quercus* fluctuates at relatively low levels of less than 10%. *Ilex* appears, and from here remains present throughout much of the remainder of the profile. From a low at the start of the zone, *Corylus* peaks at just under 25% TLP, before declining slightly again. The peak in microscopic charcoal deposition at the beginning of the zone corresponds to a peak in Poaceae and Cyperaceae, and herbs such as *Rumex, Filipendula, Artemisia*-type (mugworts), *Achillea, Cirsium*-type (thistles) and Rubiaceae (bedstraws). A sample from 50-52cm, encompassing this peak, was radiocarbon dated to 3020+/-30BP. Pteropsida (monolete) declines overall from a peak at the start of the zone, whilst *Polypodium* fluctuates throughout. Cereal-type grains, some attributable to *Avena-Triticum* type (oat-wheat) were recorded.

M3iv

Arboreal pollen remains high in this zone, as *Quercus* peaks at almost 20% TLP, with continuing high values for *Alnus*. This increase is also accompanied by a peak in *Ilex.* Conversely *Betula* and *Corylus* have declined somewhat. Other tree and shrub species such as *Ulmus, Salix* and Pinaceae are absent, as are heaths.

Values for Cyperaceae remain low, whilst Poaceae initially exhibits a moderate increase to almost 5%, before declining slightly again. Despite these low values a range of herbaceous plants are recorded, including *Plantago, Potentilla*-type (tormentil)*, Solidago vigaurea*-type, Lactuceae, Rubiaceae, Apicaceae, Caryophyllaceae including *Stellaria holostea* (greater stitchwort)*, Filipendula, Symphytum,* and Ranunculaceae. Microscopic charcoal deposition is low, as are values for spores, although *Pteridium aquilinum* appears for the first time at the end of the zone. A sample from 28-30cm, marking the transition from LPAZ M3iv to M3v, was radiocarbon dated to 2140+/-30BP.

M3v

Although values for *Alnus* remain constant and high in this zone, if it is removed from the sum, arboreal pollen generally sees an overall reduction, albeit forming a fluctuating curve. This fall is predominantly owing to a decline in *Quercus,* but *Ilex* also decreases slightly. *Betula* fluctuates, but appears to display a converse pattern to *Quercus,* rising as *Quercus* declines and vice versa. *Betula* then peaks at the close of the zone. *Sorbus* (probably rowan) appears for the first time, albeit as a trace. *Corylus* recovers from its previous low, climbing steadily throughout the zone.

Values for herbs increase very slightly on the previous zone, but they remain relatively low at just over 10% TLP. Poaceae however, begins a fluctuating but general increase in this zone. This increase continues to the top of the profile. Heaths and *Pteridium* likewise display the onset of a similarly increasing, albeit more intermittent, pattern overall. A slight increase at the start of the zone for Cyperaceae is followed by decline. Chenopodiaceae (goosefoots) appear to join the herbaceous flora. *Polypodium* and Pteropsida (monolete) peak mid-zone. Values for microscopic charcoal deposition, although low overall, exhibit a very slight increase at this point.

M3vi
Generally this zone sees the ultimate decline of arboreal and shrub species, as open area flora such as Poaceae, Cyperaceae and heaths increase, accompanied by increases in herbs indicative of human activity, grazing and cultivation. Microscopic charcoal deposition also increases generally in this zone, and aquatic species, including *Sparganium* (bur-reed) are recorded throughout. There are, however, more complex variations within this general theme.

The zone opens with arboreal pollen values reduced slightly from the previous zone to *c.*60% TLP, but increasing generally. *Alnus* and *Betula* demonstrate this increase, whilst *Quercus* declines somewhat. *Ilex* increases initially, but then remains static. Values for shrubs also increase initially, led by increases in *Corylus,* as *Salix* contracts. Accordingly open area species are declining. Poaceae reduces from 9% TLP at the start of the zone to 5%, and Cyperaceae and heaths are likewise declining. Herbs indicative of grazing such as *Plantago, Potentilla* and Lactuceae are initially present at the start of the zone, but these too reduce. Likewise species favouring disturbed or cultivated ground, including *Urtica, Sinapsis* (mustards), and *Calystegia* (bindweed) are recorded at the start of the zone, but then disappear.

Mid-zone at 9-10cm, a distinct event is seen in the pollen spectrum. Arboreal species decline dramatically. This decline is displayed by *Alnus, Quercus, Ilex* and *Ulmus. Corylus* also falls to below 15%. *Betula* however, appears unaffected at this point and continues to increase, and *Salix* actually peaks. Pinaceae reappears, and heaths also show a slight increase at this point. Herbaceous species peak at *c.*34% TLP at 9-10cm. This peak is led by the peak in Poaceae to almost 20%, although Cyperaceae also increases. *Plantago* increases, accompanied by other herbs such as Lactuceae, *Achillea*, *Cirsium* and *Potentilla.* Microscopic charcoal deposition increases, as do the values for *Pteridium* spores.

A brief recovery in values for *Quercus, Ilex, Corylus* and *Alnus* follows, as *Betula* also continues to increase. *Salix* declines, accompanied by declines in heaths and a contraction of open grassland species. Microscopic charcoal deposition also declines.

The recovery in arboreal species is however short-lived and all tree and shrub species aside from Pinaceae and *Salix*, ultimately decline. Poaceae, Cyperaceae, cereal-type grains and heaths increase, accompanied by higher levels of herbs such as *Plantago,* Lactuceae, Rubiaceae and *Solidago-vigaurea. Pteridium aquilinum* peaks at the close of the zone, when high levels of microscopic charcoal deposition are also recorded.

13.3. Discussion

Burnt Mounds
Burnt mounds are a common site type of Ireland and many parts of Britain, and generally date to the Bronze Age, although slightly earlier and later examples are known. They generally consist of a mound of burned stones surrounding a wooden trough or pit. They are thought to have been created from the use of hot stone technology to heat water for a variety of purposes, including cooking, bathing, laundering or industrial use. Several palaeoenvironmental analyses have studied the associated environmental changes with their period of use, and attempted to identify specifics of vegetational exploitation.

A prevalence of *Alnus* pollen is unsurprisingly common in such studies, and reflects the location of burnt mounds close to streams or other water courses, or generally marshy ground. Wood was used to construct the trough, for charcoal to heat the stones, and for ancillary structures such as stake walls as windbreaks or shelters. Exploitation of a range of tree species has been recorded, but by far the most common is that of *Quercus* and *Corylus.*

At Parc Bryn Cegin, Llandegai near Bangor in North Wales, charcoal from several burnt mounds identified hazel as the prime fuel wood used in the mounds, along with some oak (Flook and Kenney 2008, 51-67). A similar picture was recorded at the burnt mounds at Beechwood Farm in Inverness (Cressey and Strachan 2003). Here the wood used to construct the trough was identified as oak, whilst hazel was a prime fuel wood.

The majority of the charcoal associated with a burnt mound at Bryn Cefni, Llangefni, Anglesey was likewise identified as hazel, although ash and holly were also recorded (Smith and Kenney 2002).

At Troedrhiwgwinau Farm, near Aberystwyth an increase in the diversity of the pollen taxa coincided with the appearance of mound material in the stratigraphy. The pollen evidence implied that whilst the immediate area of the mound probably remained under wet woodland, cultivation and pastoralism both increased. The clearance indicators in the pollen record also suggest that there had been some deforestation and agricultural activity prior to the construction of the mound (Caseldine and Murphy 1989). Although of low sampling resolution, pollen samples from close to a presumed Bronze Age burnt mound at Clogwynygarreg, Drws y Coed, Snowdonia evidenced increases in clearance and human activity generally relating to this period, with particular increases in microscopic charcoal deposition, (Grant 2012a). This is consistent with the general picture of the Bronze Age landscape presented by other pollen sites in the region.

The Palaeoenvironmental Evidence

The dating evidence suggests that the core from M3 may depict vegetation change within the local area from the earlier Bronze Age *c.*3700BP (extrapolated from two dates only). The central date from M2 likewise depicts a Bronze Age date of 3490+/-30BP.

The earliest pollen evidence for the area suggests a largely wooded landscape. The local environment is dominated by the presence of alder carr woodland, probably along the margins of the water-course and any pools of open water. *Betula* and *Salix* would also form part of this woodland, although *Betula,* along with *Corylus,* may have also been growing as scrub woodland on drier areas, slopes and so on. A mixed deciduous woodland existed within the wider landscape, consisting of *Quercus* and *Ulmus,* with a *Corylus* understorey. That this woodland was more open in places is suggested by the presence of light-demanding taxa such as *Lonicera.* Pinaceae pollen can travel great distances, and probably reflects a more regional presence, mainly in the uplands.

The pollen evidence from the lowest levels of M2 suggests relatively little in the way of open habitat taxa, although some low-level disturbance, possibly related to grazing is indicated by the presence of *Plantago* and Lactuceae.

Episodes of disturbance are then reflected in both diagrams by marked declines in arboreal and shrub species, and an increase in open area taxa, often accompanied by increases in microscopic charcoal deposition. Short-lived recoveries of tree and shrub species generally follow. It is suggested that these episodes of disturbance may directly relate to the use of the burnt mound. Studies elsewhere imply that burnt mounds often had similar relatively short-lived phases of use and reuse (Kenney 2008).

Such a disturbance is depicted at 24-25cm in M2, when *Quercus* in particular declines in the face of increasing levels of Poaceae and Cyperaceae, and the appearance of *Rumex* and *Plantago.* A small peak in microscopic charcoal deposition is also evidenced here. Such changes may relate to the earliest use of the burnt mound. Evidence of increasing disturbance is also suggested at 61-62cm in M3i. Extrapolation of the radiocarbon dates suggests that this may correlate to the changes noted in M2 at the transition from LPAZ M2ii to M2iii. *Corylus* scrub declines in both diagrams, with a particular expansion in Cyperaceae noted in M3. From the base of M3, an increase in Poaceae and Cyperaceae suggests some overall expansion in open areas within the local area, with a corresponding decline in *Corylus* scrub. An increase in Cyperaceae, *Salix* and damp-loving herbs suggests increasing areas of damp sedge-rich grassland. Relatively high levels of charcoal may indicate deliberate burning of the vegetation for clearance or to increase areas for grazing. The increase in Cyperaceae may be partly attributable to this. Sedges such as *Eriophorum vaginatum* (cotton grass) can be particularly encouraged by frequent burning. However, some of the charcoal detected may also be related to the use of the burnt mound, or as a result of domestic fires, rather than the burning of the vegetation. (Ryan and Blackford 2010, 11).

The ensuing recovery of tree and shrub species, and associated contraction of open areas, is clearly depicted in M3ii. The *Alnus* carr appears to have expanded, and on drier areas *Quercus* and *Corylus* have colonised formerly open areas. *Corylus* and *Betula* are opportunistic species which will rapidly colonise and expand over any recently cleared open ground, (Bell and Walker 2005; Mighall and Chambers 1995, 313; Walker *et al.* 2006). Low charcoal deposition levels suggest reduced human activity in the area, and accordingly there are few herbs indicative of disturbance.

A further distinct episode of disturbance is recorded in M3iii, dated to 3020+/-30BP. A charcoal peak at the start of the zone suggests an increase in burning activity in the local area. The distinct associated reductions in

Quercus and *Corylus* in particular suggest that either these areas were deliberately being burned for clearance, or that they were being exploited as a fuel source. Certainly an expansion in open areas is indicated by the increase in Poaceae and Cyperaceae pollen, and those herbs which are favoured by mildly disturbed soil conditions such as *Achillea* and *Artemisia.* It is possible that this episode relates to changes noted in M2 at 10-11cm, but further dating would be necessary to confirm this.

Once again, a recovery of tree and shrub species follows. *Corylus* quickly recovers, whilst other tree species expand more slowly. Regrowth after burning could rejuvenate *Corylus* shrubs and encourage increased flowering and thus pollen production. Alternatively coppicing of *Corylus* stands may also produce an increase in flowering and thus pollen production, although this is not certain and is thought to vary from individual tree depending on age of the tree, the coppice interval and the surrounding vegetation (Out 2009, 314). Despite this apparent expansion of *Corylus*, and the subsequent contraction of open areas, the identification of cereal-type pollen attributable to *Avena-Triticum* type, in association with herbs indicative of disturbance such as *Plantago* strongly suggests cultivation was taking place in close proximity to the sampling site, or possibly that cereals were being brought into the area for processing or other purposes. In addition, the increases in *Ilex* in both profiles suggest possible increases in soil disturbance and erosion. *Ilex* pollen is generally rare in peat deposits because of poor dispersal characteristics (it is insect-pollinated), but more common where increased soil erosion from clearance has resulted in increased mineragenic inputs to the peat (Moore *et al.* 1986). *Ilex* is also rather light-demanding, and its occurrence here further reflects the presence of more open areas.

However, dramatic impacts on the vegetation now appear to cease for some time, suggesting an ending of the episodic activity associated with the burnt mound. In M3iv a reduction in activity is implied, allowing *Quercus* and *Ilex* to expand over areas of former hazel scrub and open ground. Open areas generally remain somewhat limited. There does however appear to be a continuation of low-level, probably predominantly grazing activity.

This activity appears to increase once again during the Iron Age, as depicted in M3v, from *c.*2140+/-30BP onwards. Cereal-type pollen grains in association with Chenopodiaceae and other ruderals strongly suggest cereal cultivation taking place close to the sampling site. Grassland indicators also increase. Cultivation and grazing activity appear to be impacting particularly on the *Quercus* woodland, which begins its final decline in this zone. *Betula,* Cyperaceae and ericaceous species both increase, suggesting an increase in more acidic grassland and heath in the area. *Betula* and *Calluna/Erica* sp. could also colonise drier areas of the wetland. The causal factors for the acidification are complex and relate to soil and climatic change, as well as land-use practices including grazing regimes and burning. However, the increases in *Calluna* and other ericaceous species are not as notable as in upland sequences from the area, suggesting the soils in the area remained generally more fertile and less vulnerable to acidification. At Llyn Morwynion, northeast of Ffestiniog, a marked expansion of *Calluna* was recorded dating to 2930+/-70 yr BP and linked to an expansion in peat development as a result of anthropogenic activity or climatic deterioration (Caseldine, Smith and Griffiths 2001, 29). Similar expansions in heathland communities are noted at Ffridd y Bwlch, Blaenau Ffestiniog *c.*2650BP (Grant 2012b), and at Bryn Y Castell *c.*2700 yr BP (Mighall and Chambers 1995).

Pteridium is a strong competitor on open, deeper, drier soils and can spread rapidly. It is encouraged by burning, an increase in which is demonstrated by the increasing rates of microscopic charcoal deposition. Grazing, especially by sheep, can also encourage its spread as it is unimpeded by their light trampling. An increasingly open landscape is suggested, with areas of pasture, meadow, and cultivation, probably on the lower-lying more fertile soils. A mosaic of scrub woodland, bracken and heath would exist on slopes and higher ground. The *Alnus* carr continues to fringe the water course or pool.

An expansion of *Corylus* and *Betula* towards the close of this zone, whilst *Quercus,* Poaceae and Cyperaceae decline, suggests a period of possible abandonment or at least a reduction in activity.

The final zone, M3vi depicts the intensification of clearance and human activity in the area which culminates in the landscape as seen today. Overall there is ultimately a reduction in all tree and shrub species, and open areas of heath and grassland expand. Levels of microscopic charcoal deposition indicate increased burning activity, and indicators of cultivation increase. The changes however, are not linear, and variations in the pollen record suggest episodes of increased activity, as well as changes in the nature of that activity itself.

A particular increase in activity is suggested at 9-10cm as a major expansion in grassland and open areas is evidenced. All tree and shrub species, aside from *Betula,* demonstrate a reduction. This implies that as well as deliberate clearance of hitherto wooded areas, grazing had increased to a level which inhibited regeneration, and was acting as an active clearance mechanism in itself. Even the *Alnus* carr appears affected. *Alnus* may have been inhibited by trampling by increased levels of stock, especially cattle. In addition somewhat drier conditions may be allowing colonisation of the *Alnus* carr by *Betula.* Increasing levels of *Rumex, Plantago,* Lactuceae and Ranunculus demonstrate the development of the grasslands. An increase in *Potentilla* may further imply increased grazing pressure, as it has been suggested that grazing may be beneficial to the flowering of *Potentilla erecta* (tormentil), (Moore *et al.* 1986).

Damp conditions persist though. Active bog growth is demonstrated by the presence of *Sphagnum* sp. and the continued presence of marsh or open water is confirmed further by the presence of aquatic species such as *Sparganium*, and those herbs favoured by damp, meadow habitats, such as *Filipendula* and Apiaceae.

The final, uppermost sample from M3 demonstrates a period of major expansion of grassland and heath communities, illustrating the landscape common to the area today. All woodland and shrub species have contracted, leaving only isolated stands, hedgerows and areas of wet woodland fringing the watercourse. High levels of microscopic charcoal deposition probably relate to the practice of burning of heather to increase palatability for stock, especially sheep. The increase in Pinaceae pollen seen in the upper part of M3 is common on pollen diagrams from the region, and probably indicates reafforestation in the post-medieval period.

13.4. Conclusions

The earliest evidence from these cores, suggests that wet woodland dominated by *Alnus* formed an important component of the local environment, and persisted throughout the pollen records. Within the wider environment, a dryland woodland of *Quercus*, *Corylus*, *Betula*, and later *Ilex,* remained important until the latest phases, with sporadic occurrences of *Pinus, Ulmus, Carpinus* and *Sorbus.*

However those species indicative of disturbance and open areas are also recorded throughout. The degree of disturbance varies through time, and suggests patterns of changing grazing practice, and episodes of progressive clearance. The presence of cereal-type grains in association with well-attested anthropogenic disturbance indicators, suggests cereal cultivation was carried out close to the sampling points from early in the period of sediment accumulation.

Human activity increases closer to the present day, resulting ultimately in a relatively open landscape with fewer areas of woodland, restricted to hedgerows, isolated stands and areas of wet woodland.

Of particular interest in relation to the burnt mound are the episodic disturbances noted in both profiles, being particularly clear in the lower phases of M3. The reductions in *Corylus* and *Quercus* pollen, associated with increased levels of ruderals and microscopic charcoal deposition, strongly suggest periods of activity related to the use of the burnt mound. The radiocarbon dates confirm that these episodes fall within the Bronze Age, acknowledged as the predominant period of use of these features.

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13.6. Figures

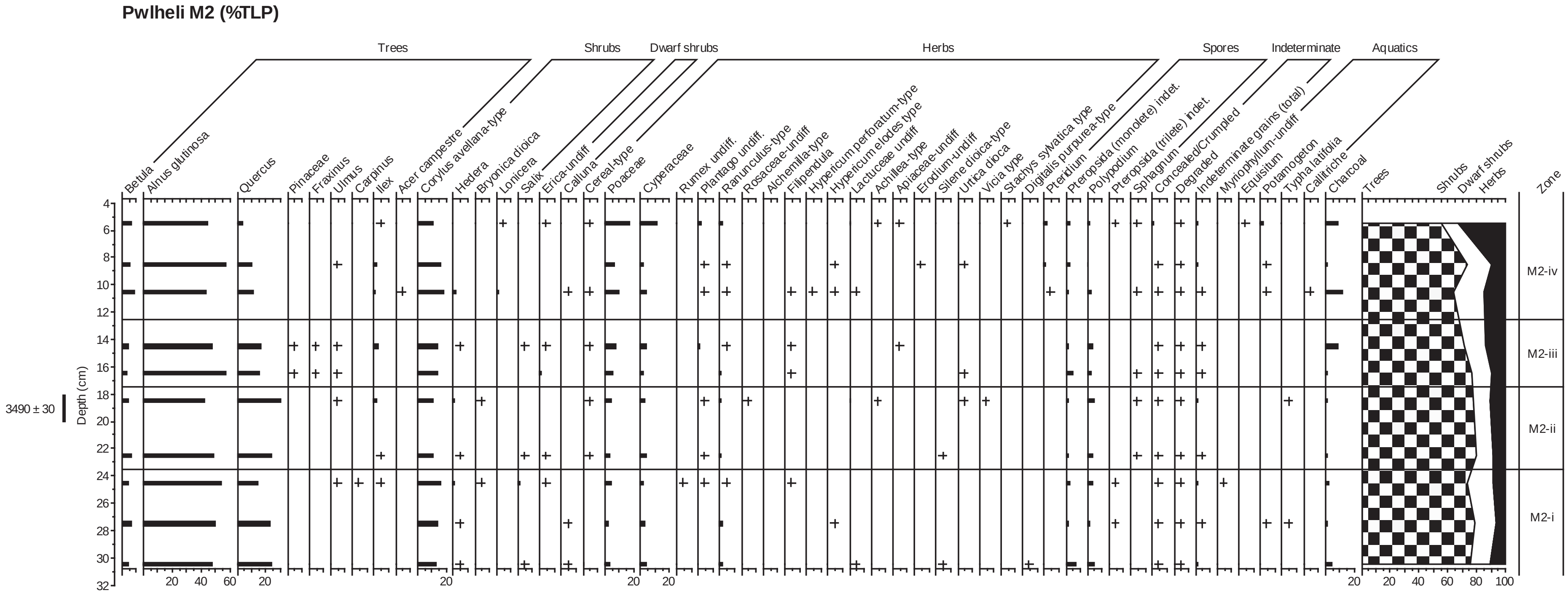

Figure 13.1. *M2, Pollen and Charcoal Diagram (%TLP)*

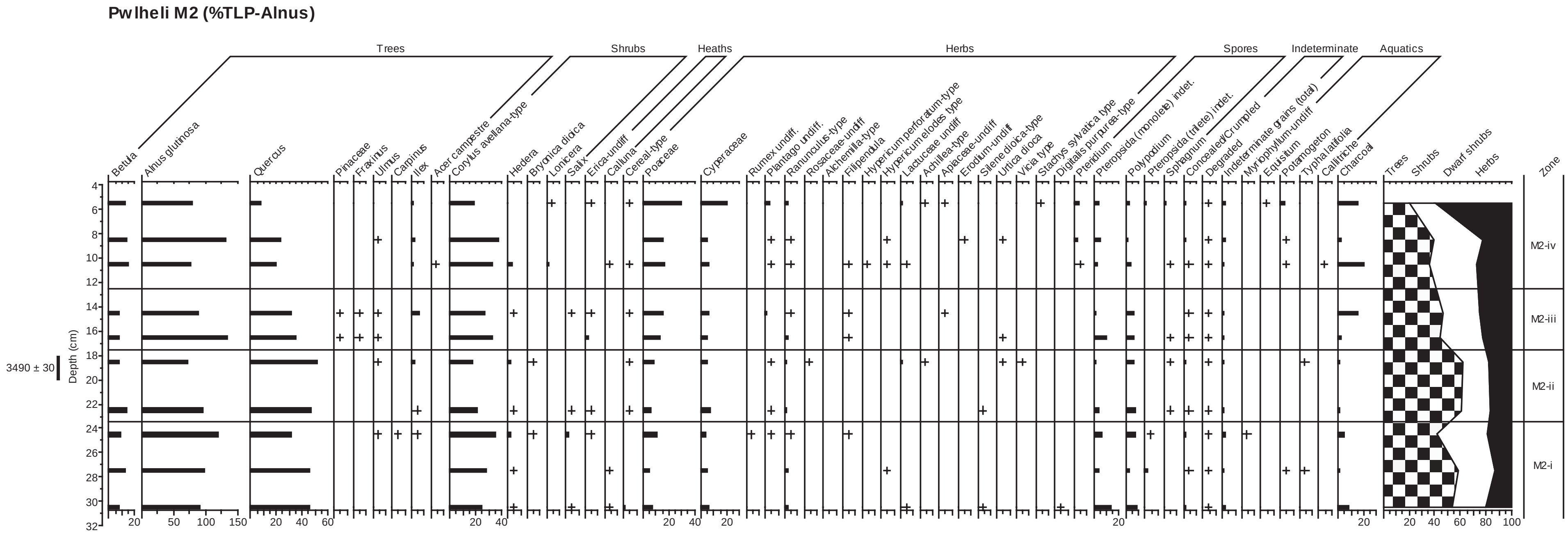

Figure 13.2. *M2, Pollen and Charcoal Diagram (%TLP-Alnus)*

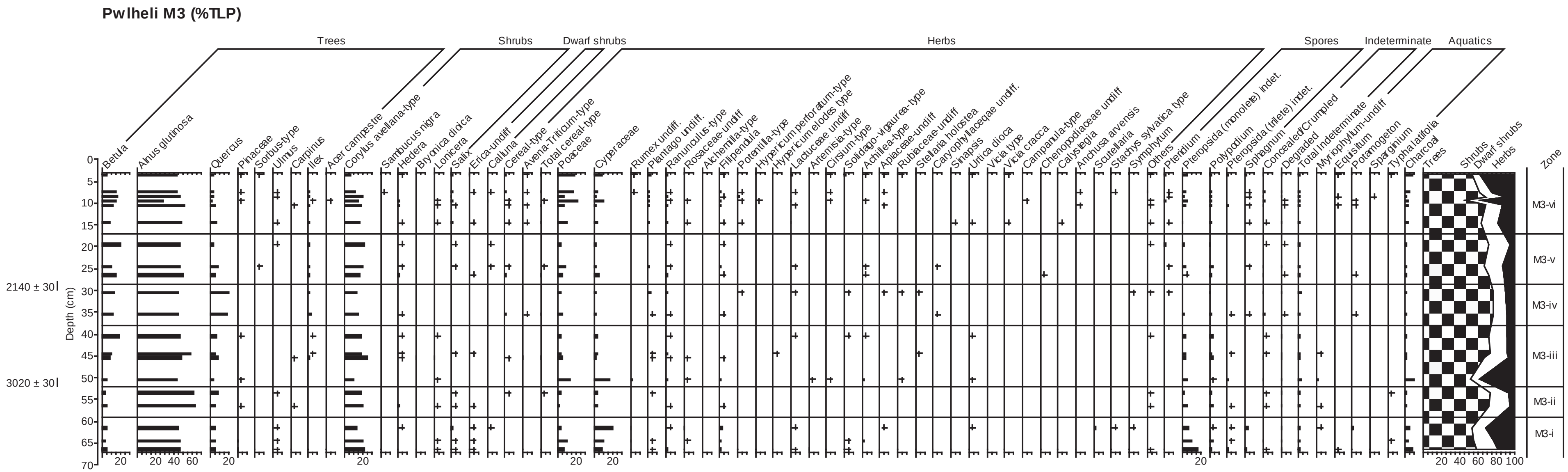

Figure 13.3. *M3, Pollen and Charcoal Diagram (%TLP)*

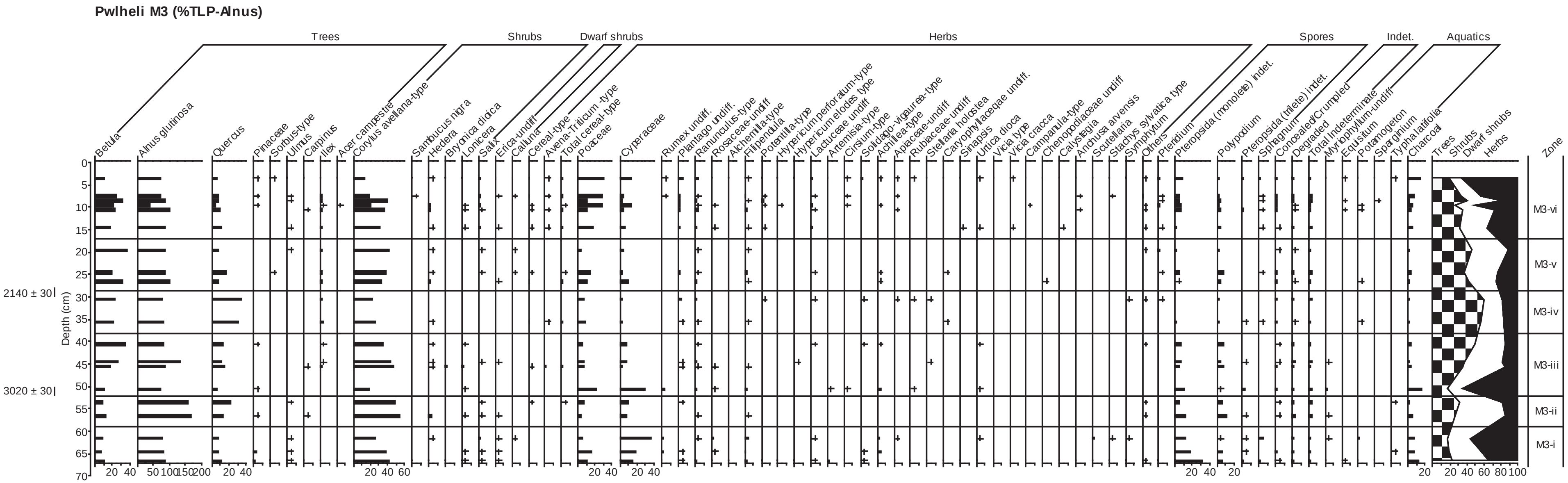

Figure 13.4. *M3, Pollen and Charcoal Diagram (%TLP-Alnus)*

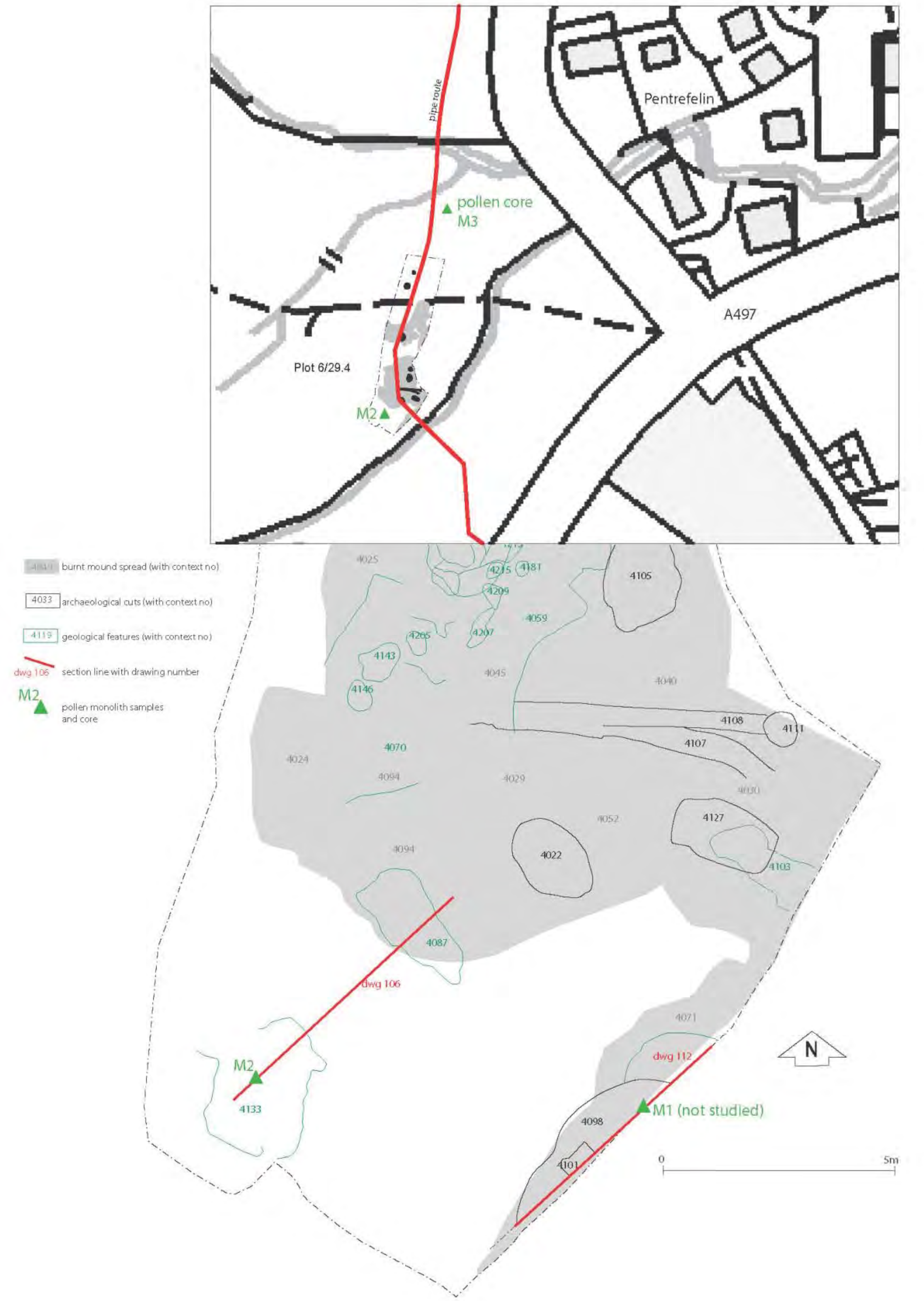

Figure 13.5. Location of pollen monoliths and pollen core in plot 6/29.4

14. SOIL MICROMORPHOLOGY

Dr Richard I Macphail

14.1. Summary

Five thin sections from three soil monolith samples were analysed employing soil micromorphology. The three samples come from the burnt mound in plot 6/29.4, and occur on stagnogleyic soils. Samples 1 and 3 apparently found constructed mounds. Resulting enhanced nutrient levels at all three sites lead to anomalously high levels of biological activity. Post-depositional re-establishment of typical wet and acid conditions led to some burned rocks developing bleached rims. Overall, burned rocks and charcoal (including probable broadleaved wood, conifer wood and monocotyledonous material) occur, while the presence of char also indicates possible cooking. These are all consistent with use of burnt mounds.

14.2. Introduction

Three soil monoliths from a burnt mound in North Wales (Blaenau Pipeline Project) were received from Martin Bates (University of Wales, Trinity Saint David, Lampeter), in order to study their microstratigraphy (soil micromorphology).

14.3. Methods

The undisturbed monolith subsamples (Tables 14.1 and 14.2; Figs 14.1 and 14.2) were impregnated with a clear polyester resin-acetone mixture; samples were then topped up with resin, ahead of curing and slabbing for 75x50 mm-size thin section manufacture by Spectrum Petrographics, Vancouver, Washington, USA (Goldberg and Macphail, 2006; Murphy, 1986). Resin impregnated samples were sliced, and in order to study the soils properly, these were sub- sampled: M1A (0-75mm) and M1B (75-150 mm); M2 (0-75 mm); M3A (0-75mm) and M3B (75-150 mm) (e.g., Figs 14.1-3 and 14.6). Thin sections were further polished with 1,000 grit papers and analysed using a petrological microscope under plane polarised light (PPL), crossed polarised light (XPL), oblique incident light (OIL) and using fluorescent microscopy (blue light – BL), at magnifications ranging from x1 to x200/400. Thin sections were described, ascribed soil microfabric types (MFTs) and microfacies types (MFTs)(see Tables 14.2-3), and counted according to established methods (Bullock et al., 1985; Courty, 2001; Courty et al., 1989; Macphail and Cruise, 2001; Stoops, 2003; Stoops et al., 2010).

14.4. Results

The locations of the monolith samples are shown on figure 20.

BP M1B: This lower sample is a fissured massive very humic soil, with channel and chamber voids, and a fine pellety microstructure (Figs 14.1 and 14.3-4). One very broad burrow introduces minerogenic silty clay soil. There are common small and medium stones (max 16mm). Also present are occasional fine charcoal (max 3mm), very abundant amorphous organic matter, humified organs and tissues – some of possible woody origin – occasional root traces, many pollen and spores including polypodium (Fig 16.14.5), and rare fungal sclerotia; there is also a trace of yellowish organs. This soil layer is characterised by a trace of ferruginised organic matter, an example of 8mm wide insect burrow section, with compacted margins, and abundant very broad (max 10mm) and very abundant thin burrows , alongside very abundant very thin and thin, with many broad organo-mineral excrements.

This appears to be a burnt mound-buried very humic silty soil worked by small acidophyle mesofauna. It is a Mor humus/Ah or peaty horizon (Oh), which includes both fungal and pollen/spore material. Small amounts of charcoal record an anthropogenic background environment. It is also possible that the thin section is sampling a large piece of humic soil dumped to create the burnt mound.

BP M1A: This upper sample records a heterogeneous massive iron depleted minerogenic and mixed humic soil layer, with prismatic, chamber and pellety microstructure (Figs 14.1 and 14.6-8). Overall there are dominant amounts of small and medium stones (max 30mm). Also present are very abundant examples of burned rocks (max 30mm; metamorphic and iron cemented fine sandstone), occasional fine charcoal (max 1.5mm), and occasional yellowish organs (plant material). Upwards there are diminishing amounts upwards of humifying rare woody root fragments, organic tissue, amorphous organic matter and fungal sclerotia. An example of a sand size peat fragment was also noted. Burned rocks can show a 2mm wide iron- depletion rim, and very abundant very thin, thin and broad burrows and very abundant very thin, thin and broad organo-excrements, were recorded.

This is a burnt mound constructed from dumped silty clay gley soil (see M2 E or G horizon), alongside humic soil, peat etc which became mixed. Anomalous high levels of bioworking are probably due to added nutrients present in the burnt mound – from past weathered ash etc.

BP M2 lower: This layer is composed of massive minerogenic iron-depleted soil, with small amounts of burrow-mixed humic soil, especially along horizon boundary with the overlying humic soil (Figs 14.2, 14.9-10). This minerogenic silty clay soil is almost stone free, with only very few small stones (max 4mm, shale?). This material also includes rare fine root traces (max 0.5mm), fine charcoal and trace of amorphous organic matter fragments. The fine fabric includes occasional very fine charcoal and amorphous organic matter. There are abundant matrix intercalations (root disturbance?), abundant thin diffuse burrows; abundant broad burrows and the mixed boundary includes rare very thin and broad organo-mineral excrements.

This is an E or G horizon of a gley soil; it was probably originally vegetated with wetland grasses. It is a water saturated horizon, with relict remains of occupation in the form of sparse fine charcoal.

[This sample inadvertently included the fill of a gully [6294107], so this lower horizon is part of the fill of this gully (6294109). (JK)]

BP M2 upper: The upper part of the sample is a fissured massive humic soil, with fine subangular blocky and crumb structures (Fig 16.2). It has dominant small and medium angular and sub-angular and sub-rounded stones (max 25mm). There are very abundant burned rock fragments – some with bleached rims (metamorphosed siltstones, shale – max 25mm), and showing rubefication. There is also abundant fine charcoal (max 1.75mm), with examples of iron-stained charred wood and charred monocotyledonous material(?), occasional peat fragments (some also iron-stained) and rare root traces (Figs 14.11-12). There is rare ferrihydrite(?) infilling voids and staining charcoal and peaty materials, and very abundant broad and very broad burrows, and very abundant broad organo-mineral excrements, were recorded.

The uppermost horizon is a rather anomalous strongly bioworked peaty topsoil which includes very fine and fine charcoal and burned rocks of burnt mound origin. Soil nutrients had probably been supplied by ash breakdown after burning.

BP M3B: This lowermost sample found a heterogeneous humic soil, with massive, fissured and poorly formed subangular blocky and fine prismatic structures. There are very dominant small and medium stones, which become common upwards (shale; max 27mm; some tabular rock clasts are horizontally oriented; stones are not obviously burned). The soils include rare fine charcoal (max 0.5mm) which increases to occasional upwards, with likely monocotyledonous material being present. There is also a trace of roots (and rare ferruginised remains), many tissue fragments, rare fungal fragments including sclerotia in the base and an example birefringent (aged?) arbuscular mychorrizae. The soil is characterised by a trace of ferryhidrite becoming rare upwards, as well as ferruginised roots. Rare iron impregnation increase to many upwards, especially affecting the less humic soil encountered upwards (orange under OIL – lepidocrocite – FeO(OH))(Bullock et al., 1985) 127. There are, in addition, abundant broad and very broad burrows in the upper part of this subsample and occasional thin burrows at the base. Also at the bottom of the thin section, abundant extremely thin and very thin excrements occur, while a partial total excremental fabric is recorded in the upper part of the slide.

This thin section found anomalous, diffusely layered(?) Mor humus material which is finely biologically homogenised with silty soil (see M2B – subsoil E or G horizon). There has been inputs of small amounts of charcoal, and some evidence of fungal activity – the birefringent arbuscular mychorrizae – could imply a >800 year age ((Romans and Robertson, 1983)Romans and Robertson, 1983). Secondary iron staining resulted from fluctuating water tables, and the possible lepidocrocite is typical of iron staining of gley soils (Bullock et al., 1985, 127).

BP M3A: The upper part of sample 3 is moderately heterogeneous, with very dominant humic and few minerogenic soil materials. Common fine and medium stone-size tabular and other shale rocks, occur, some apparently horizontally oriented and some with bleached rims. Also present are many fine charcoal, including wood charcoal (max 4mm), likely monocotyledonous charcoal (max 2mm), a possible conifer charcoal fragment (max 4mm), and a 3mm-size char fragment (possible finer fragments are probably present) (Figs 14.16-19). There are many weakly burned/rubefied shale, with one rubefied weathered micaceous quartzite gravel clast, and likely rare calcined rocks also occur. A trace amount of roots and fungal material, including sclerotia, were observed. Pedofeatures are similar to those below, but with abundant impregnative iron and void hypocoatings of iron (lepidocrocite?).

This burnt mound was also affected by probable secondary lepidocrocite iron staining, due to water table fluctuations (typical gley iron mineral; Bullock et al., 1985, 127). The burnt mound records the burning of probable broad-leaved trees, monocotyledonous plants and conifer wood; the presence of one piece of char (and likely finer fragments) is evidence of possible cooking (cf (Goldberg et al., 2009)). Bone would not likely have survived the leaching conditions, which also had the effect of bleaching stone rims.

14.5. Discussion and conclusions

The soil micromorphological analysis of five thin sections from the three monolith samples suggest that the local soils are Orthic stagno-humic gley soils (Cambic stagnohumic gley soil; FAO: Humic Gleysol) formed on a fine textured (silty clay) very poorly draining substrate such as till ((Avery, 1990), 354-358). These soils are essentially formed of a humic or very humic topsoil (Ah/Oh) over an iron depleted Eg (or G) horizon, that is permanently water saturated. At sample 2, the burnt mound and associated charcoal-rich humic soil, which also includes fragments of peat (Oh), rests directly on the minerogenic Eg horizon. Nutrients, such as potassium (K) released from weathered ashes led to heightened and anomalous biological working (cf (Babel, 1975), sometimes burrowing into the underlying gleyed substrate. Bioworking of burnt mounds is common (Goldberg and Byrd, Fall 1999; Goldberg and Guy, 1996). Samples 1 and 3 also indicate construction of the burnt mound by dumping of both topsoil and subsoil materials, along with rocks. Subsequent bioworking mixed both unburned and burned rocks. Ensuing gley conditions sometimes led to the bleaching of burned rock rims; such bleaching of rocks because of stagnogleyic and other acid soils conditions in general (~pH 5; Avery, 1990, 356) has been reported elsewhere (Scord of Brouster, Shetland; and below Dark Age dykes in upland Powys (Macphail, 2006; Whittle et al., 1986). The latter also included examples of birefringent ('aged') arbuscular mychorrizae. As acidity is so high at this pipeline site, no bone or burned bone was identified unlike in some burnt mounds (Bell et al., 1996; Stafford et al., 2012). On the other hand, burned rocks and charcoal (including broadleaved wood, conifer wood and monocotyledonous material) occur, while the presence of char indicates possible cooking (Goldberg et al., 2009), all consistent with use of the burnt mound. Their assumed proximity to poorly drained areas/wetland can be typical (cf burnt mounds along the River Eden, north-west of Carlisle) (Macphail and Crowther, 2012).

Five thin sections from three soil monolith samples were analysed employing soil micromorphology. The three samples come from a burnt mound, and occur on stagnogleyic soils. Samples 1 and 3 apparently found constructed mounds. Resulting enhanced nutrient levels at all three sites lead to anomalously high levels of biological activity. Post-depositional re-establishment of typical wet and acid conditions led to some burned rocks developing bleached rims. Overall, burned rocks and charcoal (including probable broadleaved wood, conifer wood and monocotyledonous material) occur, while the presence of char also indicates possible cooking. These are all consistent with use of burnt mounds.

14.6. References

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Table 14.1: Blaenau Pipeline Project: Soil Micromorphology Samples and Counts

Thin section	Rel. depth	MFT	SMT	Voids	Gravel	Root traces	Charcoal	Char	Fungal sclerotia	Amorph OM	Pollen/ spores	Burned rock	2ndary Fe
BP1A	0-75 mm	B1	2a/1a(1b)	50%	ffff	a*	aa		0/a*	aa/aaaaa	a/aaa	aaaaa	
BP1B	75-150 mm	A1	1a, 1b(2a)	45%	fff	aa	aa		a	aaaaa	aaa		a*
BP2	0-45 mm	D1	3a(2b)	40%	ffff	a	aaaa			aaaaa		aaaaa	a
BP2	45-75 mm	C1	2b(3a)	20%	*	a	a			(aaa)			
BP3A	0-75 mm	E2	1c(2a)	35-40%	fff	a	aaa	a-1	a*	aaa	a*	a (aaa)	a*
BP3B	75-150 mm	E1/A2	1c/1a(1b)	35%	fff/ffff	a*(a)	aa/a		0/a*	aaa/aaaaa	a*/a	(aa)	a/a*

Table 1, cont.

Thin section	Rel. depth	2ndary Fe (Lep.)	Thin Burrows	Broad burrows	V Broad burrows	V thin Excr	Thin Excr.	Broad excr.
BP1A	0-75 mm		aaaaa	aaaaa	aaaaa	aaaaa	aaaaa	aaaaa
BP1B	75-150 mm		aaaaa		aaaaa	aaaaa	aaaaa	aaa
BP2	0-45 mm			aaaaa	aaaaa			aaaaa
BP2	45-75 mm		aaaa	aaaa			(a)	(a)
BP3A	0-75 mm	aaaa	aaa	aaa	aaa		(total)	(total)
BP3B	75-150 mm	aaa/a	aa	aaaa	aaaa	/aaaa	(total)	(total)

* - very few 0-5%, f - few 5-15%, ff - frequent 15-30%, fff - common 30-50%, ffff - dominant 50-70%, fffff - very dominant >70%

a - rare <2% (a*1%; a-1, single occurrence), aa - occasional 2-5%, aaa - many 5-10%, aaaa - abundant 10-20%, aaaaa - very abundant >20%

Table 14.2: Blaenau Pipeline Project: Soil Micromorphology Descriptions and Preliminary Interpretations

Microfacies type (MFT)/Soil microfabric type (SMT)	Sample No.	Depth (relative depth) Soil Micromorphology (SM)	Preliminary Interpretation and Comments
MFT B1/SMT 2a/1a (1b)	BP1A	0-75 mm SM: heterogeneous with common SMT 1a and very few 1b at the base of the thin section, becoming very dominant SMT 2a upwards; *Microstructure*: massive, prismatic, with chamber and pellety, 50% voids, chambers, channels, poorly accommodated planar voids, simple and complex packing voids; *Coarse Mineral*: C:F, SMT 2a, C:F=85:15, with overall dominant small and medium stones (max 30mm); *Coarse Organic and Anthropogenic*: very abundant examples of burned rocks (max 30mm; metamorphic and iron cemented fine sandstone), occasional fine charcoal (max 1.5mm); occasional yellowish organs, with diminishing upwards humifying rare woody root fragments, as below, but diminished amounts of tissue, amorphous organic matter and fungal sclerotia; eg of sand size peat fragment; *Fine Fabric*: SMT 2a: cloudy and dusty pale brownish grey (PPL), very low interference colours (close porphyric, stipple speckled b-fabric, XPL), very pale yellowish grey (OIL), weakly humic stained, with occasional very fine amorphous organic matter; *Pedofeatures*: *Depletion*: eg of 2mm wide surface depletion on one burned rock fragment; *Fabric*: very abundant very thin, thin and broad burrows; *Excrements*: very abundant very	Heterogeneous massive minerogenic and mixed humic soil layer, with prismatic, chamber and pellet microstructure. Overall there are dominant amounts of small and medium stones (max 30mm). Also present are very abundant examples of burned rocks (max 30mm; metamorphic and iron cemented fine sandstone), occasional fine charcoal (max 1.5mm), and occasional yellowish organs. Upwards there are diminishing amounts upwards of humifying rare woody root fragments, organic tissue, amorphous organic matter and fungal sclerotia. An example of sand size peat fragment was also noted. Burned rocks can show a 2mm wide iron- depletion rim, and very abundant very thin, thin and broad burrows and very abundant very thin, thin and broad organo-excrements, were recorded. *Burned rock midden constructed from dumped silty clay gley soil (see M2 E or G horizon), alongside humic soil, peat etc which became mixed. Anomalous bioworking due to added nutrients present*

		thin, thin and broad organo-excrements.	*in the midden – ash etc.*
MFT A1/SMT 1a, 1b(2a)	BP1B	75-150 mm SM: heterogeneous with very dominant SMT 1a, and the additional presence of frequent SMT 1b upwards, where it is finely mixed-in (very broad burrow fill of SMT 2a); *Microstructure*: fissured massive, with channel and chamber, with fine pellety, 45% voids, poorly accommodated planar voids, chambers and simple and complex packing voids; *Coarse Mineral*: C:F (Coarse:Fine limit at 10 µm), C:F=60:40, very poorly sorted with silt and coarse silt (quartz, feldspar, mica) and fine to very coarse sand size subangular and angular rock fragments (shales and metamorphic phylite rocks, with fine sandstone) – common small and medium stones (max 16mm); *Coarse Organic and Anthropogenic*: occasional fine charcoal (max 3mm), very abundant amorphous OM, humified organs and tissues – some of possible woody origin, occasional root traces, many pollen and spores including polypodium, and rare fungal sclerotia; trace of yellowish organs; *Fine Fabric*: SMT 1a: speckled brown to reddish brown (PPL), isotropic matrix and silt with low interference colours (close porphyric, undifferentiated and stipple speckled b- fabric, XPL), orange brown to reddish brown (OIL), very humic with very abundant tissues and amorphous organic matter, pollen and spores; SMT 1b: speckled and dotted reddish brown (PPL), as SMT 1a under XPL, reddish and blackish (OIL), humic with very abundant very fine charcoal; *Pedofeatures*: *Amorphous*: trace of ferruginised	Fissured massive very humic soil, with channel and chamber voids, and a fine pellet microstructure. One very broad burrow introduces minerogenic silty clay soil. There are common small and medium stones (max 16mm). Also present are occasional fine charcoal (max 3mm), very abundant amorphous organic matter, humified organs and tissues – some of possible woody origin – occasional root traces, many pollen and spores including polypodium, and rare fungal sclerotia; there is also a trace of yellowish organs. This soil layer is characterised by a trace of ferruginised organic matter, an example of 8mm wide insect burrow section, with compacted margins, and abundant very broad (max 10mm) and very abundant thin burrows , alongside very abundant very thin and thin, with many broad organo-mineral excrements. *Midden-buried very humic silty soil worked by small acidophyle mesofauna. It is a Mor humus or peaty horizon, which includes both fungal and pollen/spore material. Small amounts of charcoal record an anthropogenic background environment.*

		organic matter; *Fabric*: example of 8mm wide insect burrow section, with compacted margins, with abundant very broad (max 10mm), very abundant thin burrows (very broad burrow fill of SMT 2a); *Excrements*: very abundant very thin and thin, with many broad organo-mineral excrements.	
MFT D1/SMT 3a (2b)	BP2	0-75 mm 0-45 mm SM: heterogeneous with coarsely mixed very dominant SMT 3a and few SMT 2b; *Microstructure*: fissured massive with fine subangular blocky and crumb, 40% voids, mainly poorly accommodated planar voids, simple packing voids; *Coarse Mineral*: C:F, SMT 3a, C:F=50:50, dominant small and medium angular and sub- angular and sub-rounded stones (max 25mm); *Coarse Organic and Anthropogenic*: very abundant burned rock fragments – some with bleached rims – metamorphosed siltstones, shale – max 25mm, showing rubefication, with abundant fine charcoal (max 1.75mm), with eg of iron-stained charred and charred monocotyledonous material(?), occasional peat fragments (some also iron-stained) and rare root traces; *Fine Fabric*: SMT 3a: very dark brown, blackish (PPL), isotropic (open porphyric, undifferentiated b-fabric, XPL), very dark brown with black inclusions (OIL), humic with abundant very fine charcoal and amorphous organic matter – some rubefied; *Pedofeatures*: *Depletion*: occasional rocks with bleached rims; *Amorphous*: rare ferrihydrite(?) infilling voids and staining charcoal and peaty materials; *Fabric*: very abundant broad	Fissured massive humic soil, with fine subangular blocky and crumb structures. It has dominant small and medium angular and sub-angular and sub-rounded stones (max 25mm). There are very abundant burned rock fragments – some with bleached rims – metamorphosed siltstones, shale – max 25mm, showing rubefication, with abundant fine charcoal (max 1.75mm), with also examples of of iron-stained charred wood and charred monocotyledonous material(?), occasional peat fragments (some also iron-stained) and rare root traces. There are rare ferrihydrite(?) infilling voids and staining charcoal and peaty materials, very abundant broad and very broad burrows, and very abundant broad organo-mineral excrements. *Rather anomalous strongly bioworked peaty topsoil composed including very fine and fine charcoal and burned rocks of burned rock midden origin. Nutrients had probably been supplied by ash from burning.*

		and very broad burrows; *Excrements*: very abundant broad organo-mineral excrements. Sharply contrasting boundary with broad burrow mixing downwards.	
MFT C1/SMT 2b (3a)		45-75 mm SM: heterogeneous with dominant SMT 2b and frequent SMT 3a; *Microstructure*: massive, 20% voids, fine root channels, broad burrows (infilled with SMT 3a); *Coarse Mineral*: C:F, as SMT 2a, very few small stones (max 4mm, shale?); *Coarse Organic and Anthropogenic*: rare fine root traces (max 0.5mm), fine charcoal and trace of amorphous organic matter fragments; *Fine Fabric*: SMT 2b: as SMT 2a, with occasional very fine charcoal and amorphous OM; *Pedofeatures*: *Textural*: abundant matrix intercalations (root disturbance?); *Depletion*: iron depleted; *Fabric*: abundant thin diffuse burrows within SMT 2b, and abundant broad burrows (SMT 3a fills); *Excrements*: mixed boundary includes rare very thin and broad organo- mineral excrements.	Massive minerogenic iron-depleted soil, with small amounts of burrow-mixed humic soil, especially along horizon boundary. The minerogenic silty clay soil is almost stone free, with only very few small stones (max 4mm, shale?). This material also includes rare fine root traces (max 0.5mm), fine charcoal and trace of amorphous organic matter fragments. The fine fabric includes occasional very fine charcoal and amorphous organic matter. There are abundant matrix intercalations (root disturbance?), abundant thin diffuse burrows; abundant broad burrows and the mixed boundary includes rare very thin and broad organo-mineral excrements. *E or G horizon of gley soil; probably originally vegetated with wetland grasses. Water saturated horizon, with relict remains of occupation in the form of sparse fine charcoal.*
MFT E2/SMT 1c (2a)	BP3A	0-75 mm SM: heterogeneous with very dominant variants of SMT 1c and very few 2a; *Microstructure*: massive, fissured with poorly formed subangular blocky and fine prisms, 35-40% voids, fissures and poorly accommodated planar voids; *Coarse Mineral*: C:F, as SMT 1a, with common fine and medium stone-	Moderately heterogeneous, with very dominant humic and few minerogenic soil materials. Common fine and medium stone-size tabular and other shale rocks, occur, some apparently horizontally oriented and some with bleached rims. Also present are many fine charcoal,

		size tabular and other shale, some apparently horizontally oriented, some with bleached rims; *Coarse Organic and Anthropogenic*: many fine charcoal, including wood charcoal (max 4mm), likely monocotyledonous charcoal (max 2mm), a possible conifer charcoal fragment (max 4mm), and a 3mm-size char fragment; many weakly burned/rubefied shale, with one rubefied weathered micaceous quartzite; likely rare calcined rocks occur; trace of roots; trace of fungal material, sclerotia; *Fine Fabric*: as SMT 1c and 2a; *Pedofeatures*: *Amorphous*: rare ferrihydrite root traces and relict materials, with abundant impregnative and void hypocoatings of iron (lepidocrocite?); *Fabric*: many thin, broad and very broad burrows; *Excrements*: partial total excremental fabric.	including wood charcoal (max 4mm), likely monocotyledonous charcoal (max 2mm), a possible conifer charcoal fragment (max 4mm), and a 3mm-size char fragment. There are many weakly burned/rubefied shale, with one rubefied weathered micaceous quartzite gravel clast, and likely rare calcined rocks occur. A trace amount of roots materialfungal material, including sclerotia, were observed. Pedofeatures are similar to those below, but with abundant impregnative and void hypocoatings of iron (lepidocrocite?). *Burned rock midden also affected by probable secondary lepidocrocite iron staining, due to water table fluctuations. The midden records the burning of probable broad-leaved trees, monocotyledonous plants and conifer wood; the presence of one piece of char (and likely finer fragments) is evidence of possible cooking (cf Goldberg et al., 2009); bone would not likely have survived the leaching conditions which bleached stone rims.*
MFT E1/SMT 1c over MFT A2/SMT 1a (1b)	BP3B	75-150 mm SM: heterogeneous with dominant SMT 1a (and very few 1b) at the base, becoming mixed with frequent SMT 1c and very few SMT 2a, upwards; *Microstructure*: massive, fissured with poorly formed subangular blocky and fine prisms, 35%	Heterogeneous humic soil, with massive, fissured and poorly formed subangular blocky and fine prismatic structures. There are very dominant small and medium stones, which become common upwards (shale; max 27mm; some tabular

		voids, fissures and poorly accommodated planar voids; *Coarse Mineral*: C:F, as SMT 1a, with very dominant small and medium stones becoming common upwards (shale; max 27mm; some tabular rock clasts are horizontally oriented); *Coarse Organic and Anthropogenic*: rare fine charcoal (max 0.5mm) becomes occasional upwards, with likely monocotyledonous material being present; trace of roots (and rare ferruginised remains); many tissue fragments, rare fungal fragments including sclerotia in the base and birefringent arbuscular mychorrizae (aged?); *Fine Fabric*: SMT 1c: darkish speckled and dotted brown (PPL), XPL as SMT 1a, yellowish brown (OIL), weakly humic stained with many very fine charcoal and oxidised OM; *Pedofeatures*: *Amorphous*: trace of ferryhidrite becoming rare upwards, as well as ferruginising roots; rare iron impregnation becoming many upwards, especially affecting SMT 1c (orange under OIL – lepidocrocite – FeO(OH)); *Fabric*: abundant broad and very broad burrows in upper part; occasional thin burrows in base of thin section; *Excrements*: at the base, abundant extremely thin and very thin excrements, partial total excremental fabric upwards.	rock clasts are horizontally oriented; not obviously burned). The soils include rare fine charcoal (max 0.5mm) which increases to occasional upwards, with likely monocotyledonous material being present. There are also a trace of roots (and rare ferruginised remains), many tissue fragments, rare fungal fragments including sclerotia in the base and an example birefringent (aged?) arbuscular mychorrizae. The soil is characterised by trace of ferryhidrite becoming rare upwards, as well as ferruginised roots, and rare iron impregnation increase to many upwards, especially affecting the less humic soil encountered upwards (orange under OIL – lepidocrocite – FeO(OH)). There are, in addition, abundant broad and very broad burrows in upper part; occasional thin burrows in base of thin section, and at the base of the thin section, abundant extremely thin and very thin excrements, while a partial total excremental fabric is recorded in the upper part of the slide. *Anomalous, diffusely layered(?) Mor humus material which is finely biologically homogenised with silty soil (see M2B – subsoil E or G horizon). There has been inputs of small amounts of charcoal, and some evidence of fungal activity – the birefringent arbuscular*

			mychorrizae – could imply a >800 year age (Romans and Robertson, 1983). Secondary iron staining resulted from fluctuating water tables, and possible lepidocrocite is typical of iron staining of gley soils (Bullock et al., 1985).

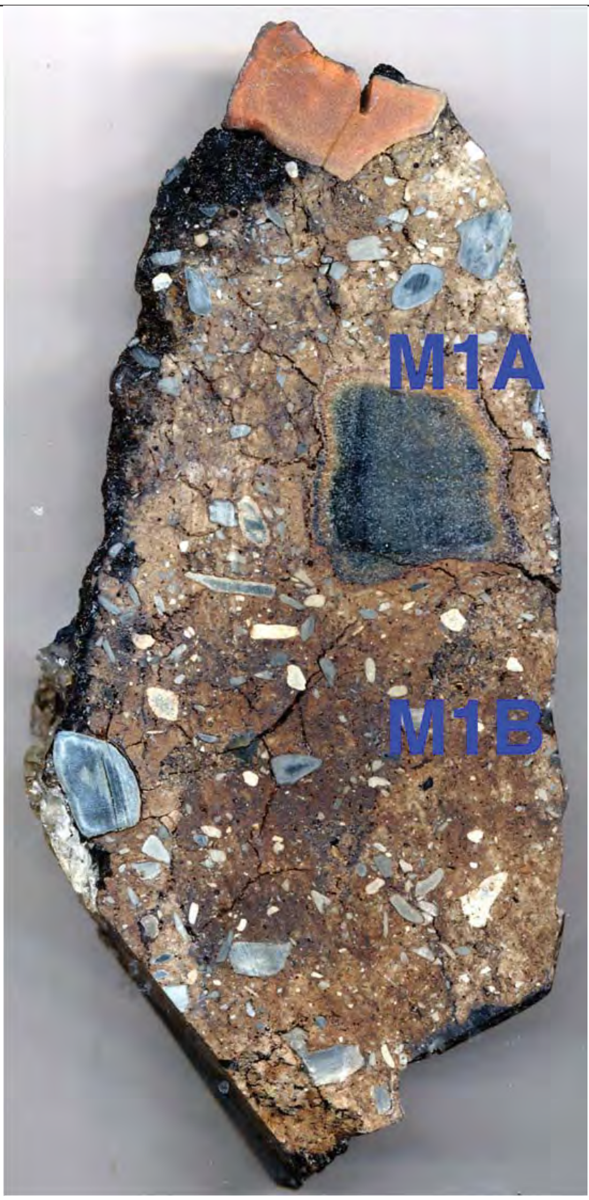

Fig. 14.1: Scan of Sample 1, showing stony soil and midden with rubefied rock inclusions. Thin sections M1A and M1B are located; M1B samples the humic buried soil, or humic soil inclusion. Length of sample=~17cm.

Fig. 14.2: Scan of Sample 2, showing location of thin section M2 across the boundary between the gleyed E or G subsoil, and overlying burned rock midden and humic soil. Length of sample is ~13cm.

Fig. 14.3: Scan of M1A, illustrating mixed humic soil and stones, some showing bleached rims due to iron leaching. Note numerous very broad burrows. Frame width is ~50mm.

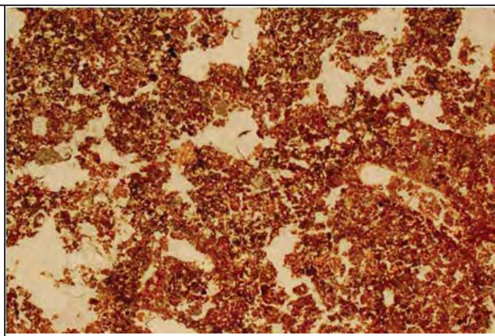

Fig. 14.4: Photomicrograph of M1A; pellety humic soil – Oh/Ah horizon. Plane polarised light (PPL), frame width is ~4.62mm.

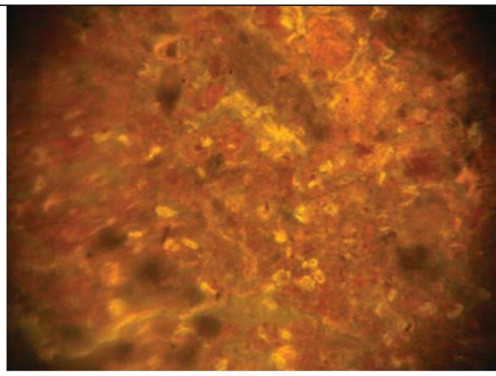

Fig. 14.5: Detail of Fig 4, under blue light (BL); note large amount of autofluorescing fresh plant remains, pollen and spores. Frame width is ~0.80mm.

Fig. 14.6: Scan of M1A; midden is composed of mainly minerogenic silty clay (see Figs 7-8) and included rubefied rock fragments; note bleached stone rim due to wet acid conditions. Frame width is ~50mm.

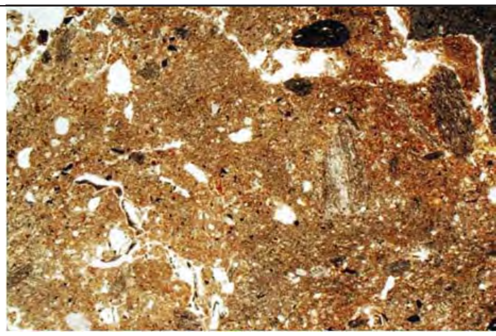

Fig. 14.7: Photomicrograph of M1A; massive silty clay with relict root channels – dumped midden/burned rock mound constructional material. PPL, frame width is ~4.62mm.

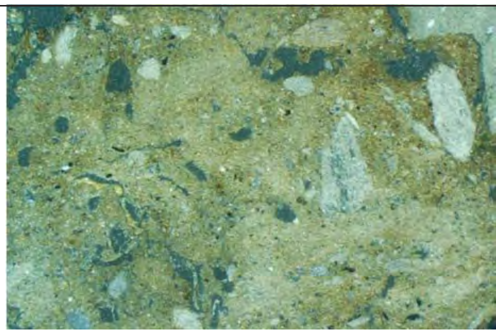

Fig. 14.8: As Fig 7, under oblique incident light (OIL). Note generally iron depleted character of dumped gleysoil material. (See Figs 9-10)

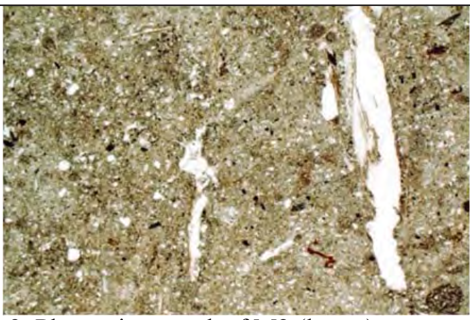

Fig. 14.9: Photomicrograph of M2 (lower); root traces in massive iron-depleted silty clay in subsoil E or G horizon. PPL, frame width is ~4.62mm.

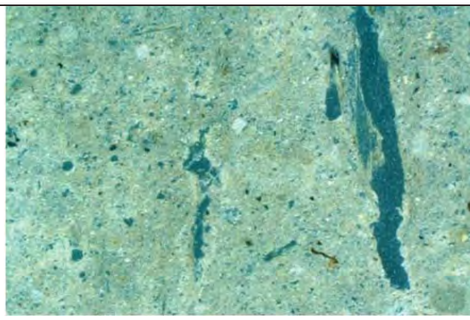

Fig. 14.10: As Fig 9, under OIL; iron depleted character of gleyed horizon is clear (cf Figs 7-8).

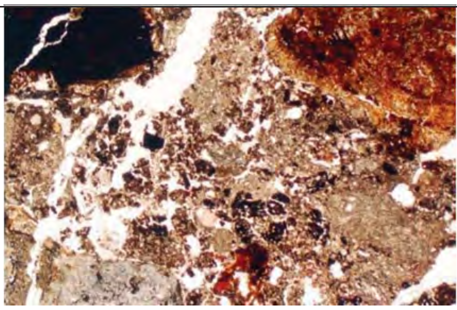

Fig. 14.11: Photomicrograph of M2 (upper), burrowed humic and minerogenic soil with mixed-in burned rock fragments and iron-stained charcoal. Secondary iron (ferrihydrite is also present) as coatings. PPL, frame width is ~4.62mm.

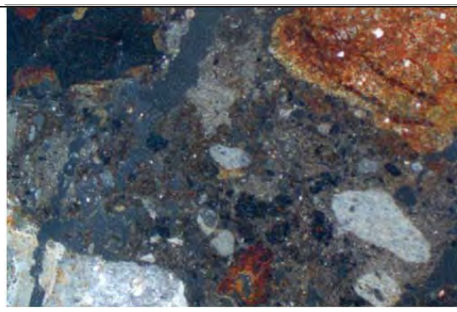

Fig. 14.12: As Fig 11, under OIL, showing rubefied and calcined burned rocks, as well as fine charcoal and iron staining.

Fig. 14.13: Scan of M3B, showing diffuse layering of humic and stony soil, with tabular shale with sub-horizontal orientation. Frame width is ~50mm.

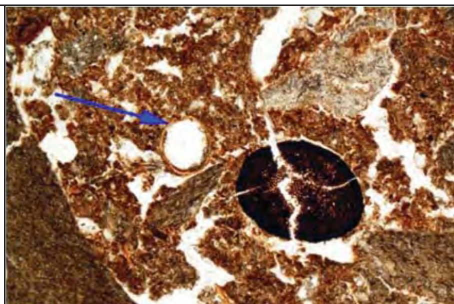

Fig. 14.14: Photomicrograph of M3B; pellety humic soil and stones, with fungal sclerotium and probably associated arbuscular mychorrizae body (arrow). Frame width is ~2.38mm.

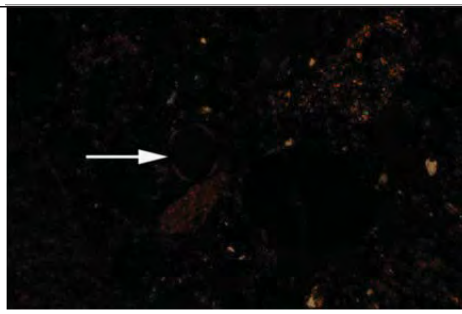

Fig. 14.15: As Fig 14, under XPL; birefringent nature of arbuscular mychorrizae body (arrow) could imply ageing.

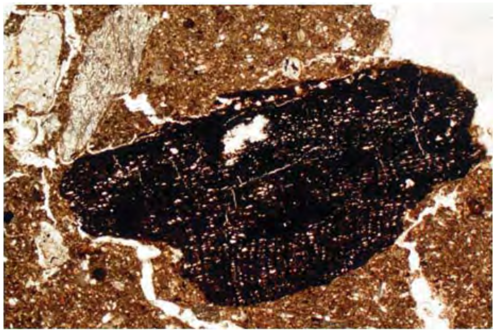	
Fig. 14.16: Photomicrograph of M3A; charred conifer wood? PPL, frame width is ~4.62mm.	Fig. 14.17: As Fig 16, under OIL; note ochreous orange iron (lepidocrocite – FeO(OH) ?) staining of fine soil.
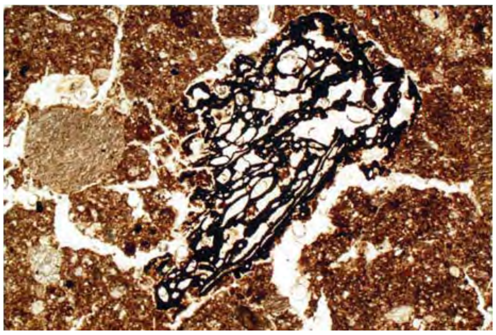	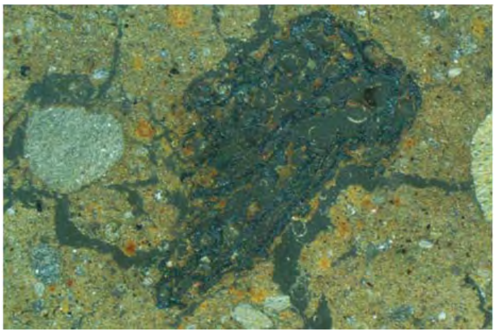
Fig. 14.18: Photomicrograph of M3A; semi- vesicular char – a form of charcoal slag – possibly from cooking. PPL, frame width is ~4.62mm.	Fig. 14.19: As Fig 18, under OIL; again note ochreous orange iron (lepidocrocite?) impregation, typical of gley soils.

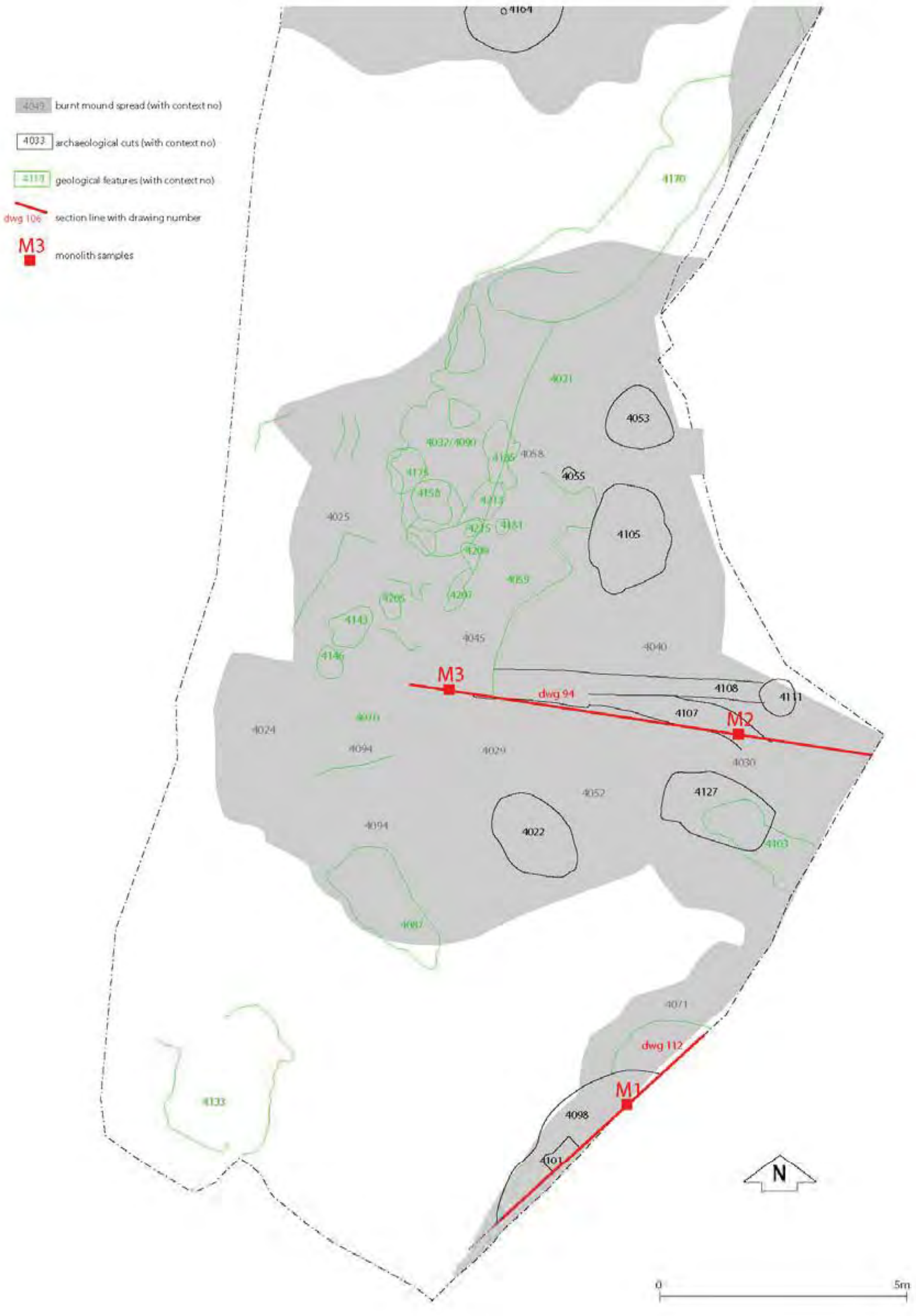

Figure 14.20. Outline plan of plot 6/29.4 showing location of monolith samples

15. INVESTIGATION OF BURNT STONE

Martin R Bates

15.1. Introduction

This investigation of samples recovered from a number of different plots that were excavated was undertaken in order to shed light on the nature and taphonomic history of the burnt mound material recovered during the excavations. At the outset it was assumed that the structure and integrity of the episodes of burning are likely to have had a significant impact on the residual material from the activity at the site and these were categorised into the following areas for the investigation:

Size distribution of burnt mound material between the different samples, and where appropriate different parts of the site(s)

Angularity of burnt mound material

Degree of burning exhibited by material recovered

Composition of burnt mound material

Specifically these four areas for investigation were targeted because it was considered that the size distribution of material might be indicative of taphonomic processes at work both during site formation and immediately following site formation. By contrast the angularity of the clastic material might be informative with regards source area of clastic material used and ultimately discarded at the site. The degree of burning of material would be indicative of use and taphonomic process at the site while the composition of the material may be indicative of source area for clastic material used at the site.

Specifically this investigation aimed to adopt a geoarchaeological approach to the investigation of the burnt mound material. The focus of the study aimed to examine the full set of samples taken (Table 15.1) but with particular focus on the nature of the material collected from plot 6/29.4 (Figure 15.1).

Burnt mounds

Burnt mounds are well known in the archaeological literature since at least the mid 19th century (Graves, 1854; Buckley, 1990) and they have been found from Kent (Parfitt, 2006) to the north of Scotland (Hedges, 1975). Typically they consist of a low mound that is horseshoe shaped and made of shattered and broken stone mixed with wash and charcoal. The centre of the horseshoe is usually associated with the trough. Archaeological investigation typically focuses on the nature of the trough and sometimes with the micromorphology of the surfaces associated with the feature (e.g. see Ellis in Suddaby, 2009) or the structure of the mound itself (Goldberg and Byrd, Fall 1999; Goldberg and Guy, 1996) with the aim to interpret the function of the site. However, as noted by Suddaby (p15, 2009) the uncertainty of their function 'stems from the unrewarding nature of burnt mounds in terms of artefacts and as a contribution to our understanding of past processes'. This may in part be a function of the limiting nature of the available information on such sites because typically published reports on the burnt material offer only vague comments on the nature of the burnt mound material itself and even where information is forthcoming on the material itself (e.g. Heawood and Huckerby, 2002; Chapple, 2007) detail is often absent.

15.2. Methodology

Samples were recovered during excavation and subsequently weighed and washed through a 7mm and 1mm sieve stack. Residues were dried then weighed and <1mm, 1-7mm and >7mm factions calculated and tabulated. A list of all samples investigated are presented in Table 15.1 and results presented in Table 15.2.

Samples were subsequently examined for degree of burning and burnt and non-burnt parts of the samples recorded. Samples were also examined for lithological composition of the contained material and non-local rocks identified where possible. Direct sourcing of non-local rocks has not been possible however where appropriate comments are made regarding their significance. Samples were also examined for degree of roundness/angularity (classified as either angular or subrounded) and the nature of edge damage on margins of clasts.

Notes on selected samples are presented in Appendix 15.1.

15.3. Results

A total of 46 samples were examined (Tables 15.1 and 15.2) from six different site plots. Plots are listed below and some of the main sample locations are shown in Figure 1 from the main study area plot 6/29.4:

Plot 3/2. A feature interpreted as a corn drier and two pits lying in close proximity and initially assumed to be contemporary, and tentatively assigned to the medieval period. Five samples were examined.
Plot 3/10. This site comprised two burnt mound troughs. Three samples were examined.
Plot 6/6. A burnt mound of probable Bronze Age date. Two samples were examined.
Plot 6/21. This site is a burnt mound spread and an oval pit of probable Bronze Age date. Three samples were examined.
Plot 6.29. A large Bronze Age burnt mound complex with pits, other features and natural hollows. Twenty four samples were examined.
Plot 6/33. Two burnt mounds of probable Bronze Age date and a pit. Nine samples were examined.

The samples varied in size from less than 10kg to greater than 47kg (Figure 15.2) and care needs to be taken in comparing the results from different sized samples in order to avoid biasing results. The plots showing total unsieved sample weight against total material above 7mm (Figure 15.3) indicate that a broad correlation exists between sample size and quantity of material above 7mm while as a percentage a similar trend can be seen (Figure 4) albeit less clearly.

Size distribution of burnt mound material across the plots
The distribution of clasts size across the plots can be seen in the full data set exhibited in Figure 15.5 and by plots in Figure 15.6. Variation in percentage of largest clasts can be seen to fluctuate between less than 5% to nearly 70% and no discernable trends can be seen. However, where greater numbers of samples are available from plot 6/29 and where the results from selected samples are plotted from south to north across the site (Figures 15.7 and 15.8) a pattern can be discerned that shows (crudely) higher percentages of >7mm clasts at either end of the site with lower, and more variable, percentages of the coarsest clasts in the middle parts of the site (with the exception of sample 68). Selected plotting of results by feature (Figure 15.9) also indicates differences with feature 4105 displaying very marked contrast in terms of the percentages of the coarsest fractions to those of 4087 for example. Figure 10 indicates that there are changes in the distribution of clast sizes across a transect in the southern part of the site where a strong contrast between the size distributions in the natural features with those in the archaeological features can be noted (see Figure 15.1 for ascription of natural and anthropogenic features).

Angularity of burnt mound material across the plots
The shape of the burnt mound material is remarkably consistent across much of the site in is typically in the angular to very angular category (Figures 15.11-14) with some degradation of the edges of the clasts in places. Appendix 1 summarises selected samples and highlights those that have predominantly angular fragments (i.e assumed to have been heavily burnt) from those with high numbers of subrounded clasts (i.e. with little evidence of burning) and those with mixed populations. The distribution of these angular samples is widespread across nearly all of plot 6/29 with the exception of two samples from the southern part of 6/29 associated with feature 4098/4101 (54/55) and two samples from features 4087 and 4133 (75/77). These samples contain subrounded clasts (Figures 15.15-16) with few or no angular fragments of rock. Elsewhere samples with mixed populations of angular and subrounded fragments occur (e.g. samples 58/61/70/79/82/84/85/102).

In addition to the angularity of the material a careful search was made of the samples to ascertain whether any other features could be seen on the clasts. Thus although many clasts had an angular appearance in many cases some surfaces exhibited subrounded appearances (Figures 15.17 and 15.18) that suggest the rounded or sub-rounded surfaces are present prior to the imposition of an angular outline to the clasts. Furthermore many of the clasts that exhibit a degree of rolling and edge abrasion.

Degree of burning exhibited by material recovered from the plots

The percentage of burnt stone material is shown by total (Figure 19) and for clasts >7mm (Figure 15.20). Clear evidence of burning (in terms of surface alteration of clasts) is low for all size grades with the exception of a few samples (e.g. samples 15-17) although when plotted for only the coarsest fragments the percentage does appear increased across a number of samples.

Data by transect from north to south (Figure 15.21) appears to indicate higher percentages of burnt stone in the central part of the site while across the southern part of the site the pattern is not as clear.

However caution should be taken in interpreting this data as surface alteration of clasts does not always take place. For example burning experiments conducted as part of our investigation indicates that shattering and alteration of clasts is not only dependant on time in fire (Figure 15.23) but also probably on raw material type, condition etc. Consequently it is possible that far higher numbers of clasts are burnt except the evidence in terms of surface modification of clasts is not apparent.

Composition of burnt mound material recovered from the plots

The main material present in the clastic samples at the site is fine grained sedimentary rocks (shales, fine sandstones and grits). Occasional quartz clasts are also present in the samples (Figure 15.16) as are non-local sandstones (Figure 15.16). A considerable number of samples also contained microgabbro in a heavily weathered state and other probable igneous rocks (Figure 15.24). Also present in some instances were clasts of fine grained sediment that were relatively soft and unconsolidated. These are likely to be fragments of superficial sediments such as till (deposited by the Devensian ice) or alluvium from the floodplain of rivers/estuaries.

15.4. Discussion

The results of the investigation have provided a number of patterns that can be discerned in the data. Although no significant patterns are clearly observable in the full data set consideration of the results from plot 6/29 indicate the following:

There is a clear distinction between patterning of material across the site. The central part of the site associated with features 4053 (sample 58), 4105 (samples 57, 68, 82), 4111 (sample 61) and 4022 (sample 58) exhibits typically lower percentages of large clasts (Figure 15.25) despite sample sizes remaining large. These samples are also associated with higher incidences of observable burning on the >7mm size fraction (Figure 15.26). This could be a result of moving coarser debris laterally to the northern and southern parts of the site through a deliberate policy of 'waste management' or through wash and movement down slope (at least to the north) of elements of the debris.

There is a clear distinction in terms of distribution of clast sizes between those parts of the site (plot 6/29) in which deposits associated with anthropogenic features exhibit coarser grain distributions than those associated with natural features (Figure 15.10). This pattern (seen most clearly on the southern part of the site) is probably due to taphonomic features resulting from wash across the surface of the burnt mound debris redistributing finer grained materials laterally across the site.

Unburnt samples appear to be present along the southern margin of the site associated with 4098 as well as parts of the western area of the site suggesting perhaps spatial differences in material storage/discard across the site.

The surface texture and shape of most of the sample material is indicative of shattering following heating however remnant features (rounding/edge damage) in most samples suggests a source for most of the material within river worn gravels probably local to the site. This is substantiated by the well rounded appearance of the samples 54/55 (Figures 15.15 and 15.16) which appears to be a natural fluvial gravel.

The presence of clasts of till or alluvium in elements of the debris from the site suggest that such material is either being introduced from an excavated source of raw material or perhaps grubbed up with burnt stone from the hearth/fire pit and redistributed during the discard process.

All identified rock types present in the samples are of local derivation. The bedrock at the site is the Ffestiniog Flags Formations (Figure 15.27) and the majority of clasts examined in the samples appear to be mud, silt and sandstone typical of that formation. Elsewhere in the vicinity Ordovician microgabbros do occur that provide a source for the igneous rocks noted. Till outcrops extensively across the Ffestiniog Flags Formation and is another source for stone.

The evidence obtained from the investigation suggests that the primary material incorporated into the mound is sourced locally from adjacent stream channels and none of the non-siltstone/sandstone material is exotic to the immediate vicinity of the site. The presence of collections of minimally altered fluvial gravel in parts of the site suggests important and stock piling of material prior to its requirement and it is possible that parts of the site began life as stockpiles for future use. These stockpiles have subsequently been incorporated into the mound through mound growth through time (Figure 28). Development of the mound and internal segregation of materials may have occurred through a series of processes outlined in Figure 28. The distribution of larger clasts away from the site centre suggest the possibility of either direct removal of larger clastic material from the central area to the periphery or the movement through overland flow and gravity of larger fragments to the margins of the mound. Subsequently further wash of material may have occurred leading to the distribution of finer grained material at the margins of the mound either during use or following abandonment of the site.

15.5. Bibliography

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15.6. Appendix 15.1. Notes on samples examined from plot 6/29.4.

Sample No	Context number	Feature cut number and type	Comments
45	6294006	[6294002], pit	Angular clasts with many flattened fragments of stone. Occasional very large fragments of angular stone (>30cm). Lumps of burnt and unburnt till or alluvium. Microgabbros as well as quartz present.
46	6294010	[6294003], pit	Angular very heavily burnt sample with lumps of till or alluvium but with some unburnt material as well. Fragments of fluvial gravel noted.
47	6294011	[6294003], pit	Mostly angular fragments but with occasional clasts exhibiting subrounded surfaces indicative of rolled clast from fluvial context. Occasional fragments of Quartz as well as ubiquitous local greywacke. Low numbers of microgabbros noted. Occasional very heavily burnt materials.
53	6294071	Burnt mound	Nearly all angular fragments but with occasional subrounded clasts. Quartz present.
54	6294100	[6294098], natural hollow	This consists of totally unburnt material with many subrounded clasts. Great variety of sizes and most clasts rolled. Occasional quartz clasts
55	6924102	[6294101], natural hollow	This consists of totally unburnt material with many subrounded clasts. Great variety of sizes and most clasts rolled. Occasional quartz clasts
56	6294054	[6294053], pit	Mostly angular fragments but with occasional clasts exhibiting subrounded surfaces indicative of rolled clast from fluvial context. Numerous small subrounded clasts (unbroken, <3cm). Occasional fragments of Quartz as well as ubiquitous local silt/sandstone. Low numbers of igneous material.
57	6294106	[6294105], pit	Small residue, clasts typically less than 5cm. Mostly angular clasts. No Quartz. No small subrounded fluvial pebbles.
58	6294023	[6294022], pit	Mixture of angular broken clasts and smaller subrounded clasts. Quartz and other materials such as microgabbro plus possible other igneous material.
60	6294115	[6294111], pit	Predominantly angular gravel clasts.
61	6294116	[6294111], pit	Mix of angular and subrounded clasts. Some unusual clasts including. Very common small subrounded clasts present as well.
66	6294049	Burnt mound	Mostly angular fragments but with rare clasts exhibiting subrounded surfaces indicative of rolled clast from fluvial context. Some very large fragments of stone >15cm. Occasional fragments of Quartz as well as ubiquitous local greywacke. Low numbers of microgabbro and igneous rocks.
68	6294106	[6294105], pit	Predominantly angular gravel clasts.
70	6294126	[6294127], trough	Very large clasts (>15cm) with many fragments of rolled and subrounded clasts. Occasional small (<3cm) subrounded clasts. Quartz and igneous material.
72	6294088	[6294087], natural hollow	Predominantly angular gravel clasts.
75	6294134	[6294087], natural hollow	Very little residue. Clasts present contain a high proportion of subrounded clasts that are unbroken.
77	6294140	[6294133], natural hollow	Unburnt material made of fluvial gravel. Quartz common.
79	6294091	Buried soil	Mix of burnt and unburnt material present
82	6294106	[6294105], pit	Mix of burnt and unburnt material. Common quartz clasts, common clasts of till/alluvium.
84	6294145	[6294143], natural hollow	Mix of burnt and unburnt material with subrounded and angular clasts. Occasional quartz fragments.
85	6294144	[6294143],	Mix of unburnt subrounded to angular fragments. Quartz, microgabbro

		natural hollow	and till fragments common. Occasional other igneous material.
87	6294152	[6294033], pit	Angular clasts. No Quartz
88	6294153	[6294033], pit	Predominantly unburnt subrounded material
91	6294156	[6294033], pit	Occasional very large angular clasts.
102	6294151	Burnt mound	Mix of burnt and unburnt material. Microgabbro and other igneous material present.
106	6294192	Burnt mound	Angular fragments with till and quartz material

Grey shading – burnt samples
No shading – mixed samples
Blue shading – unburnt samples

15.7. Appendix 15.2. Tables and figures.

List of Tables

List of Figures

Tables

Table 1. Samples processed for investigation.

Site	Sample	Context	Sample wt
Plot 3/2	4	32016	14
Plot 3/2	5	32012	12
Plot 3/2	6	32013	11
Plot 3/2	7	32019	16.25
Plot 3/2	11	32021	9.75
Plot 3/10	15	310010	7
Plot 3/10	16	310003	13
Plot 3/10	17	310004	9
Plot 6/6	19	66004	12
Plot 6/6	20	66010	14
Plot 6/33	37	633004	17
Plot 6/33	38	633005	15.75
Plot 6/33	41	633024	13
Plot 6/33	42	633024	18.5
Plot 6/33	43	633010	22.25
Plot 6/29.4	45	6294006	8.5
Plot 6/29.4	47	6294011	8.25
Plot 6/33	48	633029	8.75
Plot 6/33	49	633021	17
Plot 6/33	50	633019	13
Plot 6/33	51	633035	32.25
Plot 6/29.4	53	4071	36
Plot 6/29.4	55	4102	40
Plot 6/29.4	56	4054	27.5
Plot 6/29.4	57	4106	8
Plot 6/29.4	58	4023	16
Plot 6/29.4	59	4112	8
Plot 6/29.4	61	4116	14.75
Plot 6/21	62	621003	7.74
Plot 6/21	63	621004	12.5
Plot 6/21	64	621007	9.5
Plot 6/29.4	66	4049	30
Plot 6/29.4	67	4117	21.5
Plot 6/29.4	68	4106	13
Plot 6/29.4	69	4104	9
Plot 6/29.4	70	4129	16
Plot 6/29.4	72	4088	8.75
Plot 6/29.4	74	4088	8
Plot 6/29.4	75	4134	7
Plot 6/29.4	76	4134	7
Plot 6/29.4	77	4140	14
Plot 6/29.4	82	4106	19
Plot 6/29.4	83	4070	13

Plot 6/29.4	45*	6294006	42
Plot 6/29.4	46*	6294010	36
Plot 6/29.4	47*	6294011	47.75

Table 2. Data collected from processed samples.

Site	Sample	Context	Cut No.	Feature type	Sample wt	<1 mm	>1 mm	>7 mm	1-7mm	Burnt wt	% <1mm	%1-7mm	%>7 mm	% burnt total	% burnt >7 mm
Plot 3/2	4	32016	32003	Pit	14	10.193	3.807	3.807	0	0.341	72.807	0	27.193	2.436	8.957
Plot 3/2	5	32012	32003	Pit	12	8.73	3.27	1.166	2.104	0.584	72.75	17.533	9.717	4.867	50.086
Plot 3/2	6	32013	32014	Pit	11	6.889	4.111	0.564	3.547	0.033	62.627	32.245	5.127	0.3	5.851
Plot 3/2	7	32019	32014	Pit	16.25	9.663	6.587	0.659	5.928	0.209	59.465	36.48	4.055	1.286	31.715
Plot 3/2	11	32021	32014	Pit	9.75	6.867	2.883	0.547	2.336	0.259	70.431	23.959	5.610	2.656	47.349
Plot 3/10	15	310010	310007	Pit/trough	7	4.302	2.698	1.853	0.845	1.461	61.457143	12.071	26.471	20.871	78.845
Plot 3/10	16	310003	310001	Pit/trough	13	3.881	9.119	8.43	0.689	7.049	29.854	5.3	64.846	54.223	83.618
Plot 3/10	17	310004	310001	Pit/trough	9	4.266	4.734	3.556	1.178	2.398	47.4	13.089	39.511	26.644	67.435
Plot 6/6	19	66004		Burnt mound	12	11.501	0.499	0.23	0.269	0	95.842	2.242	1.917	0	0
Plot 6/6	20	66010	66011	Pit/trough	14	11.288	2.712	1.865	0.847	0	80.629	6.05	13.321	0	0
Plot 6/33	37	633004		Burnt mound	17	4.885	12.115	11.425	0.69	0	28.735	4.059	67.206	0	0
Plot 6/33	38	633005		Burnt mound	15.75	5.222	10.528	9.704	0.824	0.011	33.156	5.232	61.613	0.070	0.113
Plot 6/33	41	633024		Burnt mound	13	4.97	8.03	7.197	0.833	0.917	38.231	6.408	55.362	7.054	12.741
Plot 6/33	42	633024		Burnt mound	18.5	7.115	11.385	10.53	0.855	0.661	38.459	4.622	56.919	3.573	6.277
Plot 6/33	43	633011	633010	pit	22.25	5.75	16.5	15.2	1.3	0	25.843	5.843	68.315	0	0
Plot 6/29.4	45	6294006	6294002	pit	8.5	4.208	4.292	3.522	0.77	0.018	49.506	9.059	41.435	0.212	0.511

Site	Sample	Context	Cut No.	Feature type	Sample wt	<1 mm	>1 mm	>7 mm	1-7mm	Burnt wt	% <1mm	%1-7mm	%>7 mm	% burnt total	% burnt >7 mm
Plot 6/29.4	45*	6294006	6294002	pit	42	24.652	17.348	10.599	6.749	1.13	58.695	16.069	25.236	2.690	10.661
Plot 6/29.4	46*	6294006	6294002	pit	36	13.059	22.941	20.715	2.226	0.695	36.275	6.183	57.542	1.931	3.355
Plot 6/29.4	47*	6294011	6294003	pit	47.75	16.241	31.509	29.003	2.506	0.888	34.013	5.2482	60.739	1.860	3.062
Plot 6/29.4	47	6294011	6294003	pit	8.25	3.567	4.683	4.041	0.642	0.089	43.236	7.782	48.982	1.079	2.202
Plot 6/33	48	633029	633028	pit	8.75	7.268	1.482	0.5	0.982	0.202	83.063	11.223	5.714	2.309	40.4
Plot 6/33	49	633021		Burnt mound	17	10.411	6.589	1.78	4.809	1.554	61.241	28.288	10.471	9.141	87.303
Plot 6/33	50	633019	633032	pit	13	8.684	4.316	3.19	1.126	0.195	66.8	8.661	24.538	1.5	6.113
Plot 6/33	51	633035	633034	pit	32.25	12.019	20.231	17.38	2.851	2.753	37.268	8.840	53.891	8.536	15.840
Plot 6/29.4	53	4071		Burnt mound	36	15.91	20.09	17.599	2.491	0	44.194	6.9194	48.886	0	0
Plot 6/29.4	55	4102	6294101	Natural	40	11.5	28.5	20.257	8.243	0	28.75	20.608	50.642	0	0
Plot 6/29.4	56	4054	6294053	pit	27.5	19.422	8.078	4.583	3.495	0.074	70.625	12.709	16.665	0.270	1.615
Plot 6/29.4	57	4106	6294105	pit	8	6.007	1.993	1.305	0.688	0.019	75.087	8.6	16.312	0.2375	1.456
Plot 6/29.4	58	4023	6294022	pit	16	11.059	4.941	2.217	2.724	0.177	69.119	17.025	13.856	1.106	7.984
Plot 6/29.4	59	4112	6294111	pit	8	2.966	5.034	4.792	0.242	0.226	37.075	3.025	59.9	2.825	4.716
Plot 6/2	61	4116	6294111	pit	14.75	7.89	6.86	4.68	2.18	0.487	53.492	14.780	31.729	3.302	10.406

Site	Sample	Context	Cut No.	Feature type	Sample wt	<1 mm	>1 mm	>7 mm	1-7mm	Burnt wt	% <1mm	%1-7mm	%>7 mm	% burnt total	% burnt >7 mm
9.4															
Plot 6/21	62	621003		Burnt mound	7.74	5.5	2.24	0.966	1.274	0	71.059	16.460	12.480	0	0
Plot 6/21	63	621004		Burnt mound	12.5	8.792	3.708	1.909	1.799	0	70.336	14.392	15.272	0	0
Plot 6/21	64	621007		Burnt mound	9.5	4.85	4.65	4.026	0.624	1.247	51.053	6.568	42.379	13.126	30.974
Plot 6/29.4	66	4049		Burnt mound	30	11.668	18.332	15.004	3.328	0.111	38.893	11.093	50.013	0.37	0.740
Plot 6/29.4	67	4117	6294118	Natural	21.5	12.441	9.059	6.247	2.812	0.062	57.865	13.079	29.056	0.288	0.992
Plot 6/29.4	68	4106	6294105	pit	13	4.02	8.98	8.024	0.956	0.368	30.923	7.354	61.723	2.831	4.586
Plot 6/29.4	69	4104	6294103	Natural	9	6.675	2.325	1.892	0.433	0	74.167	4.811	21.022	0	0
Plot 6/29.4	70	4129	6294127	Pit/trough	16	6.5	9.5	9.067	0.433	0.033	40.625	2.706	56.669	0.206	0.364
Plot 6/29.4	72	4088	6294087	Natural	8.75	8.461	0.289	0.081	0.208	0.006	96.697	2.377	0.926	0.069	7.407
Plot 6/29.4	74	4088	6294087	Natural	8	7.84	0.16	0.036	0.124	0.003	98	1.55	0.45	0.038	8.333
Plot 6/29.4	75	4134	6294087	Natural	7	6.519	0.481	0.163	0.318	0.029	93.129	4.543	2.329	0.414	17.791
Plot 6/29.4	76	4134	6294087	Natural	7	6.962	0.038	0.003	0.035	0	99.457	0.5	0.043	0	0
Plot 6/29.4	77	4140	6294133	Natural	14	12.082	1.918	0.769	1.149	0	86.3	8.207	5.493	0	0
Plot 6/29.4	82	4106	6294105	pit	19	10.25	8.75	5.663	3.087	0.348	53.947	16.247	29.805	1.832	6.145
Plot	83	4070		Buried	13	11.9	1.05	0.39	0.6	0	91.892	5.05	3.054	0	0

Site	Sample	Context	Cut No.	Feature type	Sample wt	<1 mm	>1 mm	>7 mm	1-7mm	Burnt wt	% <1mm	%1-7mm	%>7 mm	% burnt total	% burnt >7 mm
6/29.4				soil		46	4	7	57			4			

Figures

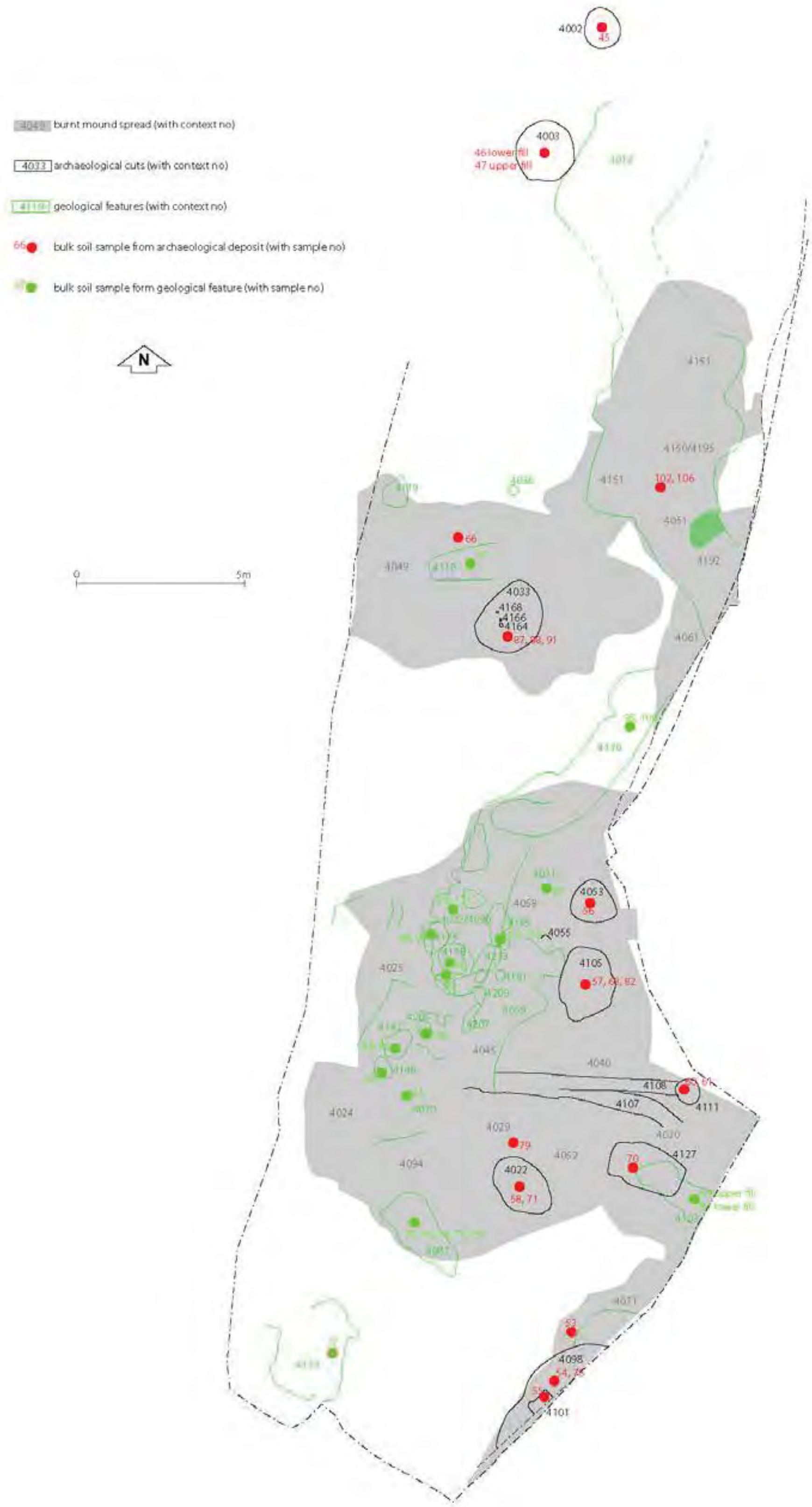

Figure 15.1. Plan of plot 6/29.4 showing location of bulk soil samples

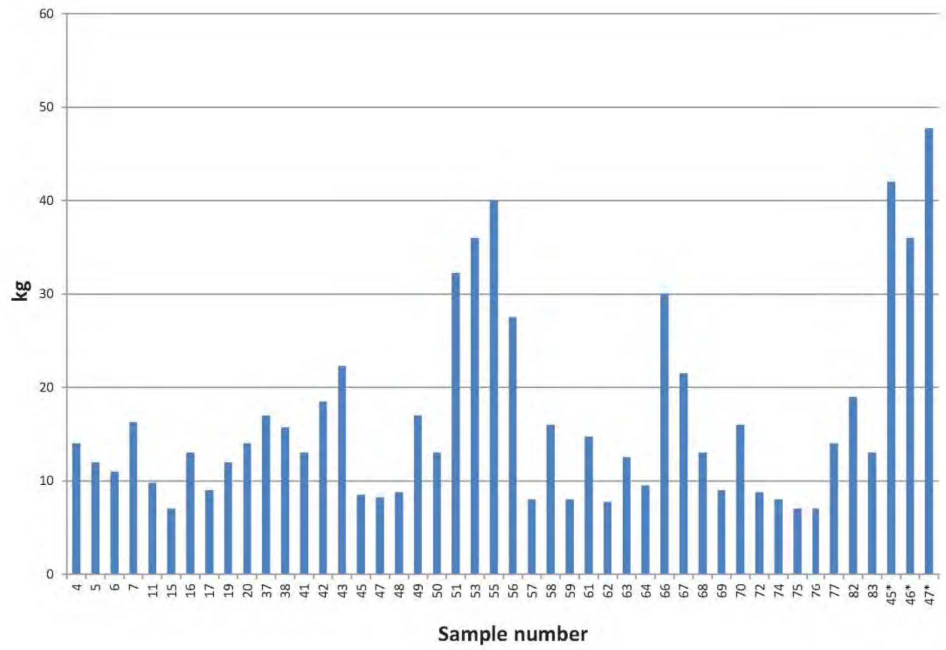

Figure 15.2. Weight of all samples investigated.

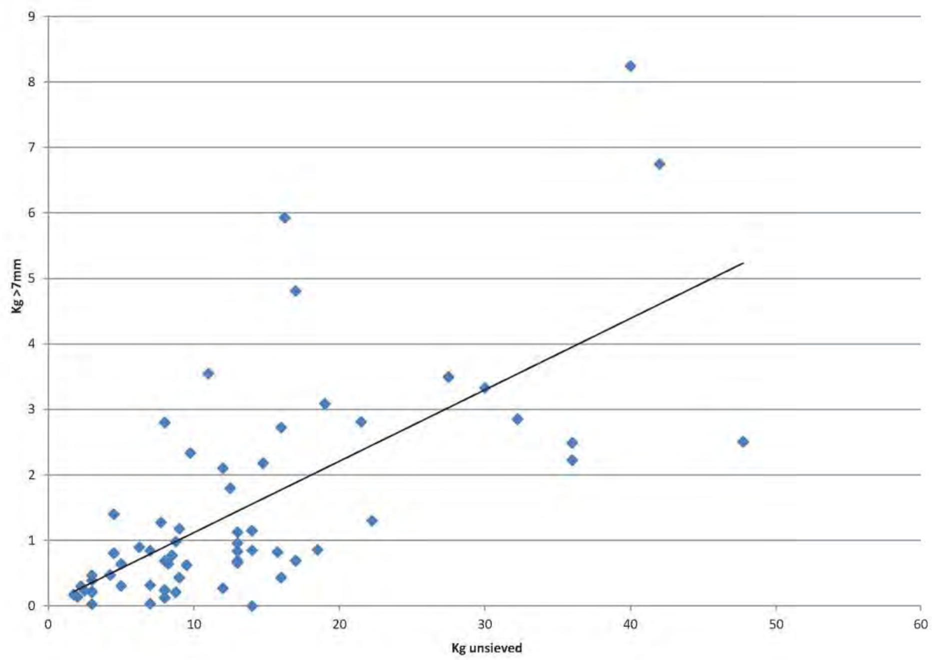

Figure 15.3. Unsieved sample weight plotted against weight of sample >7mm.

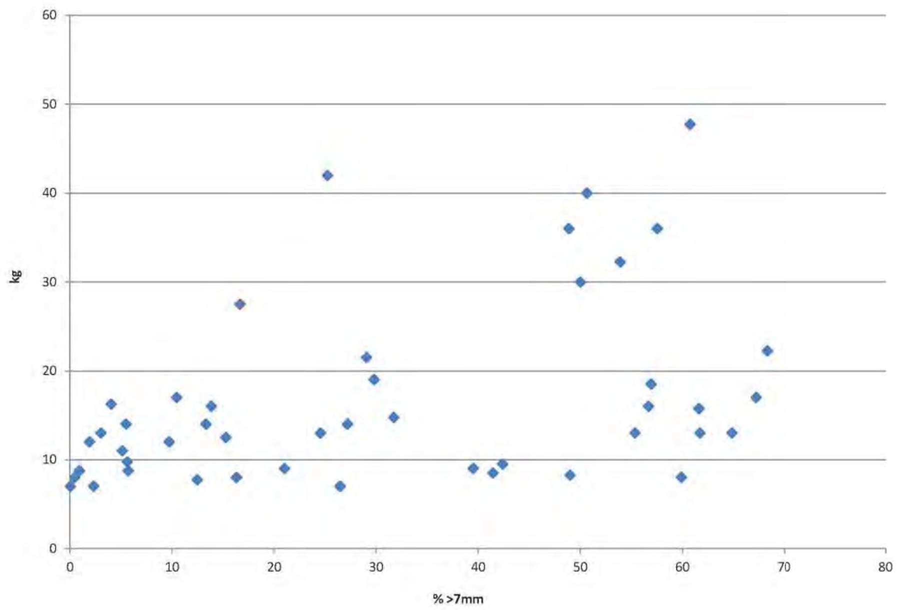

Figure 15.4. Unsieved sample weight plotted against % sample >7mm

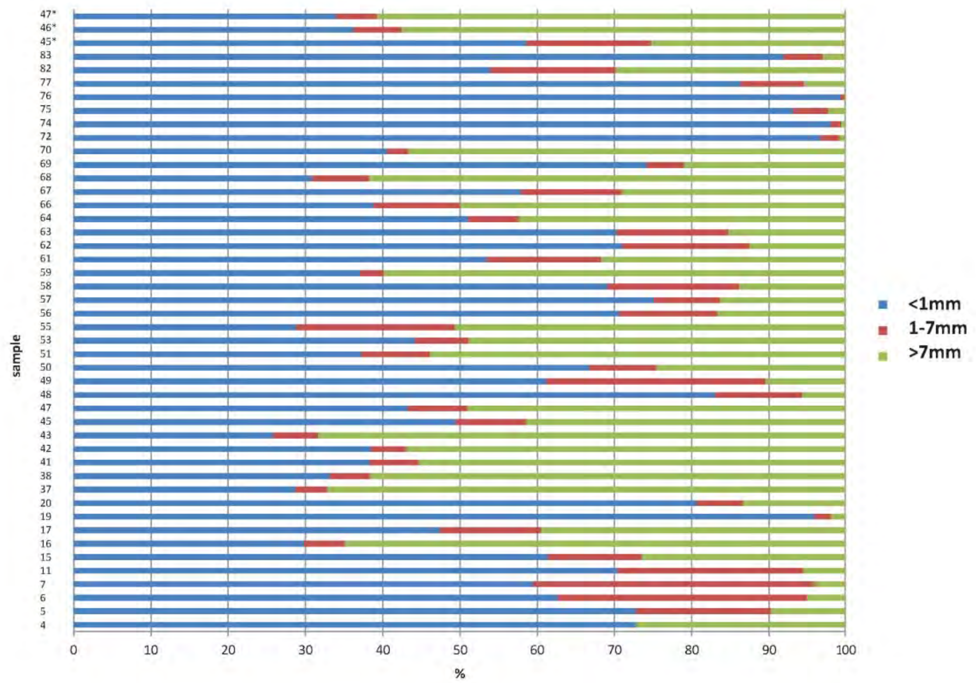

Figure 15.5. Percentage of clasts by sample.

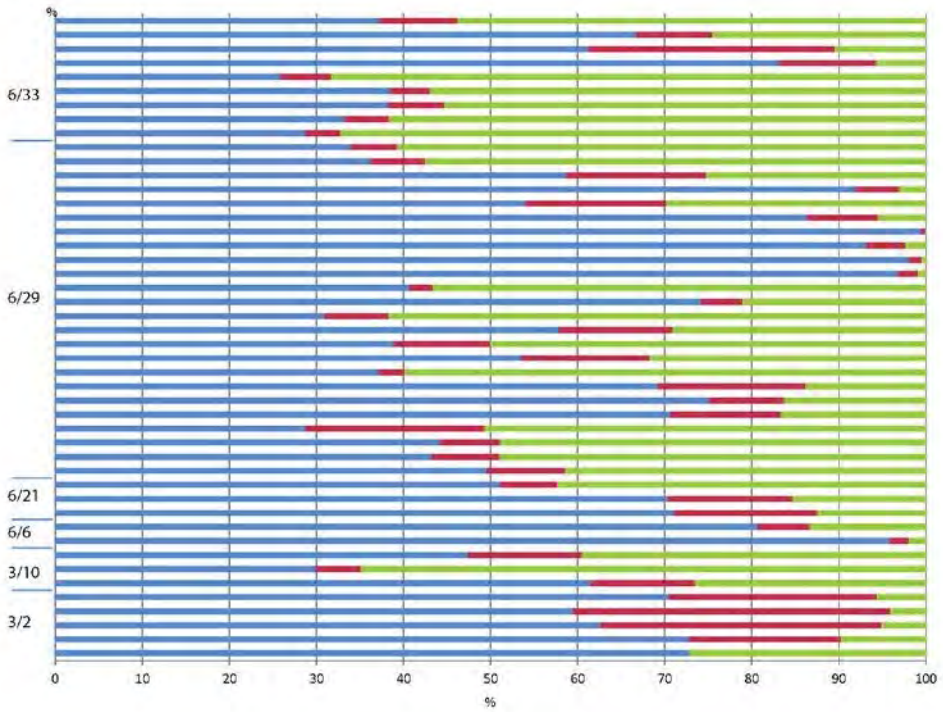

Figure 15. 6. Percentage of clasts by sample and plots

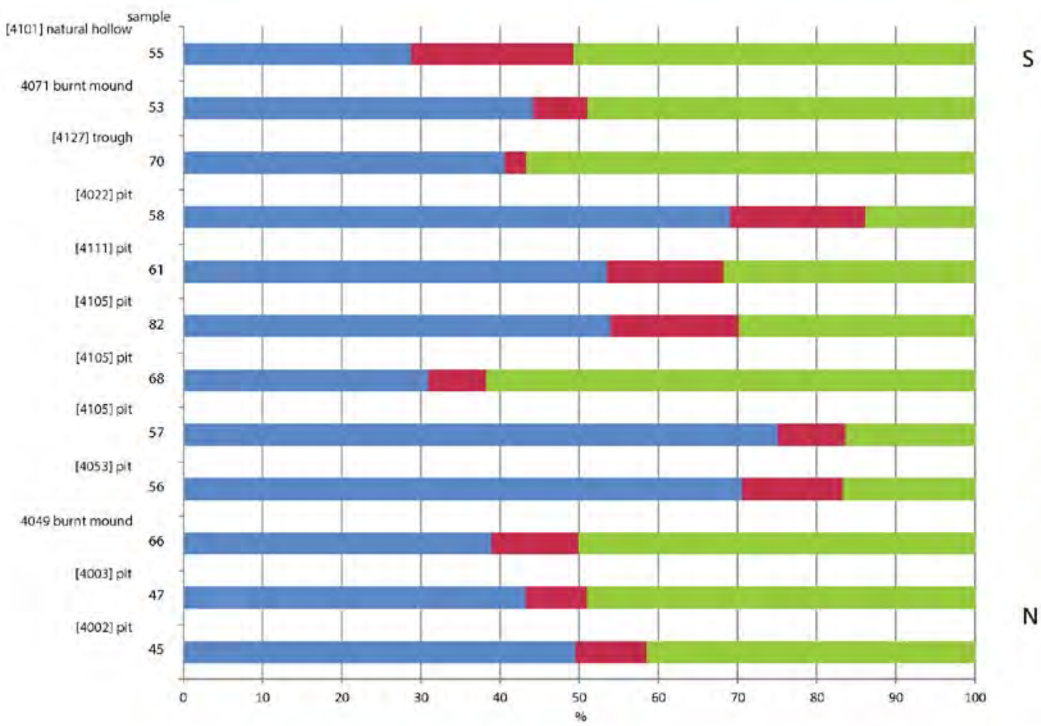

Figure 15.7. Percentage of clast sizes by archaeological feature from south to north (plot 6/29.4)

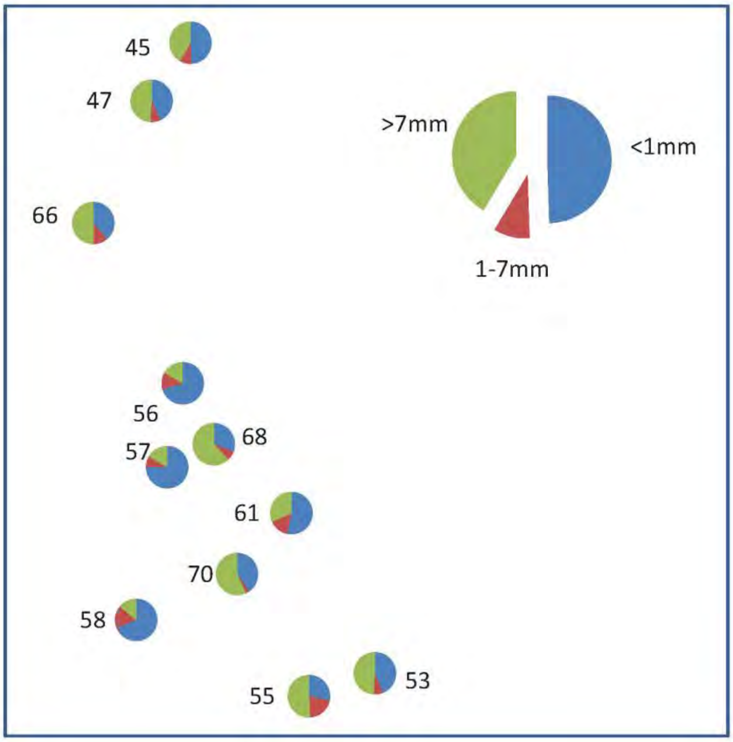

Figure 15.8. Percentage of clast sizes by archaeological feature from south to north (plot 6/29.4)

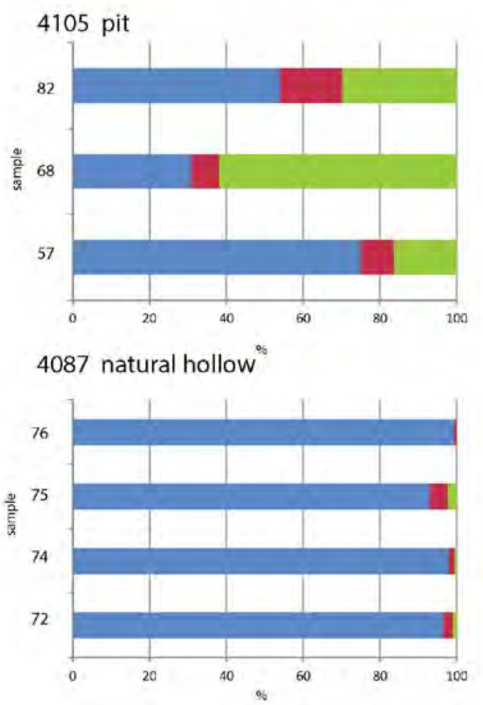

Figure 15.9. Percentage of clasts by sample number for different features in plot 6/29.4

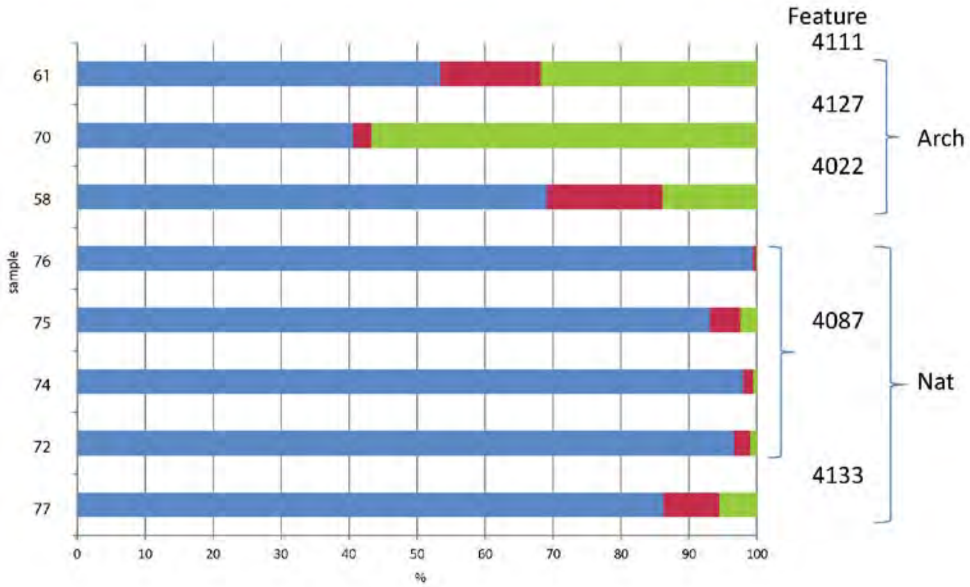

Figure 15.10. Percentage of clasts by transect across southern part of site (plot 6/29.4). (Arch – in archaeological feature. Nat – in natural feature)

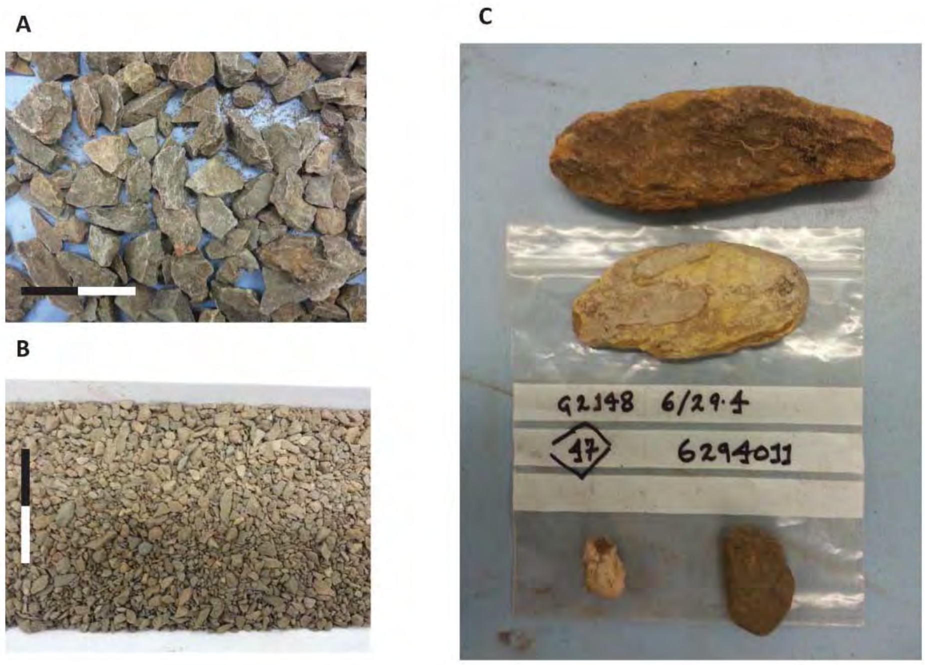

Figure 15.11. Sample 47. A: >7mm fraction. B: <1mm fraction. C: selected material

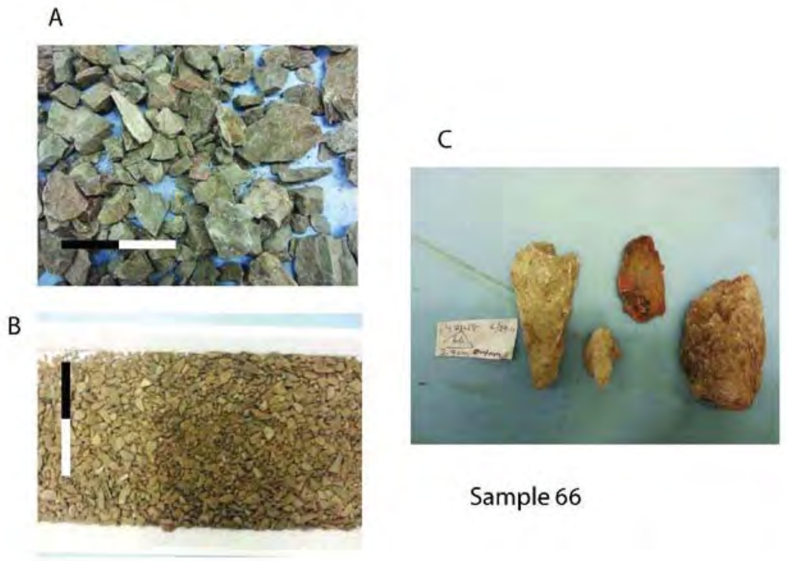

Figure 15.12. Sample 66. A: >7mm fraction. B: <1mm fraction. C: selected material

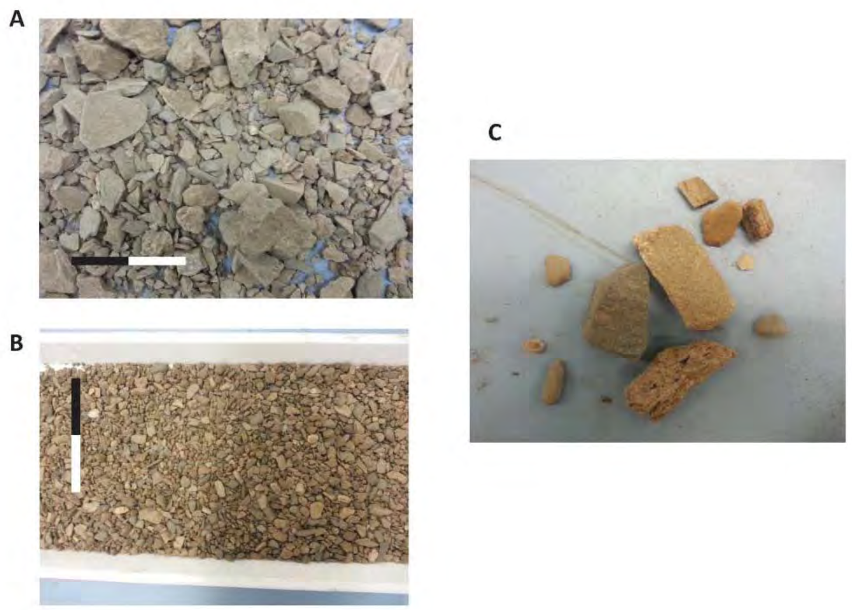

Figure 15.13. Sample 56. A: >7mm fraction. B: <1mm fraction. C: selected material

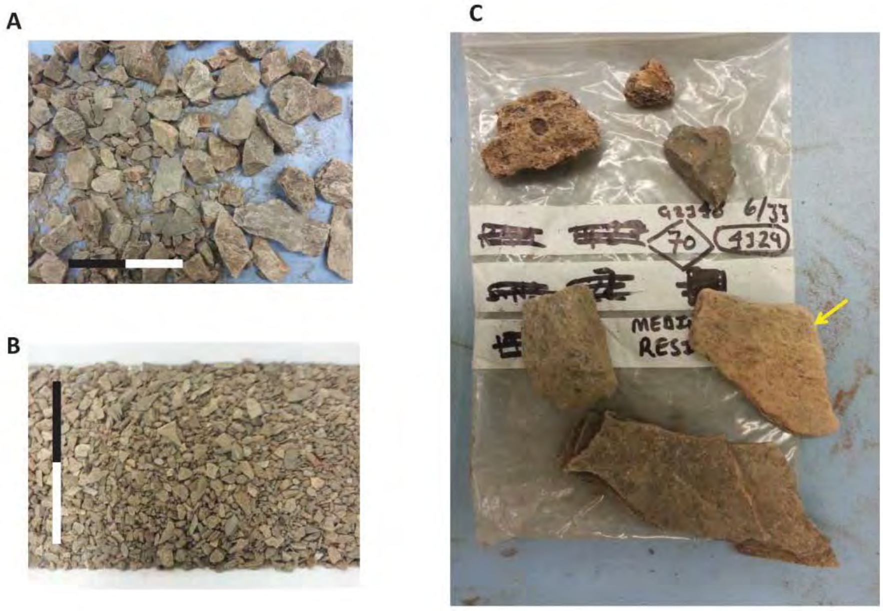

Figure 15.14. Sample 70. A: >7mm fraction. B: <1mm fraction. C: selected material. Yellow arrow indicates edge rounding on an angular fragment

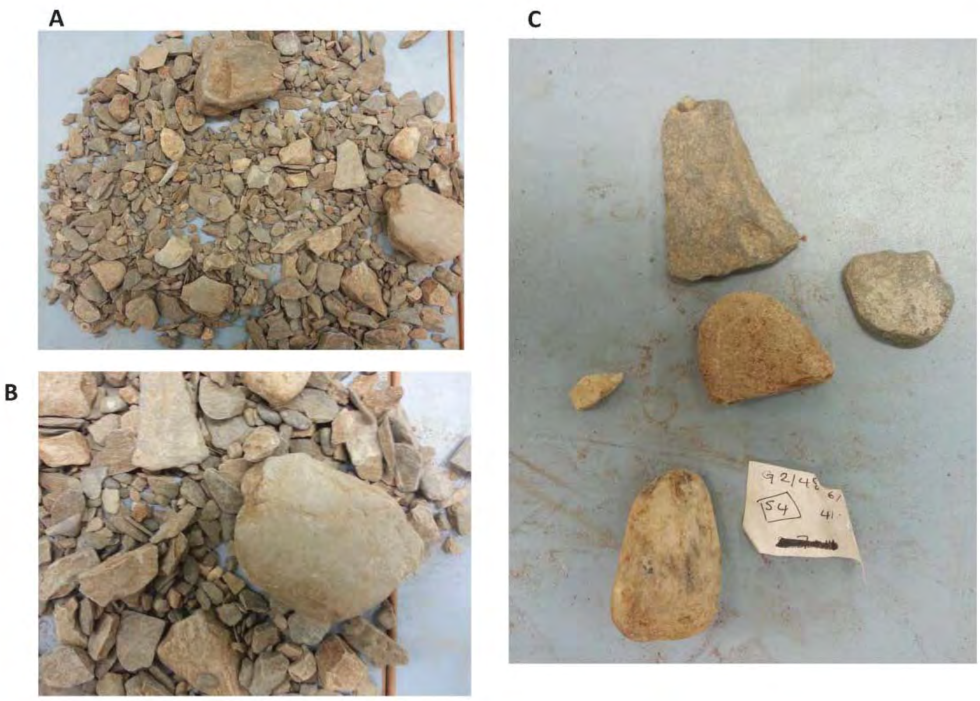

Figure 15.15. Sample 54. A: >7mm fraction. B: <1mm fraction. C: selected material

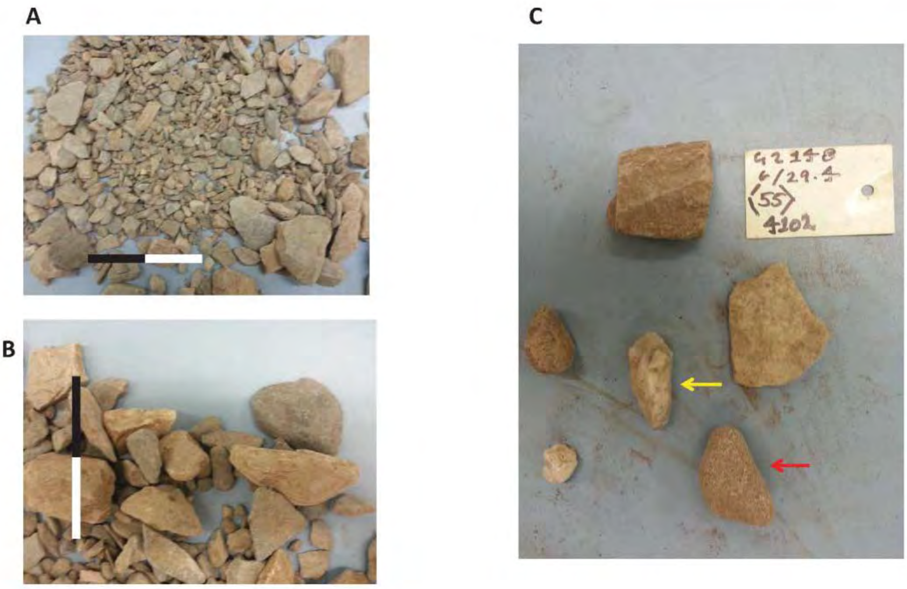

Figure 15.16. Sample 55. A: >7mm fraction. B: <1mm fraction. C: selected material. Quartz indicated yellow arrow, red sandstone indicated red arrow

Figure 15.17. Sample 70, subrounded clasts.

Figure 15.18. Sample 61. A: >7mm angular clasts. B: selected subrounded clasts. Fine sandstone (indicated yellow arrow)

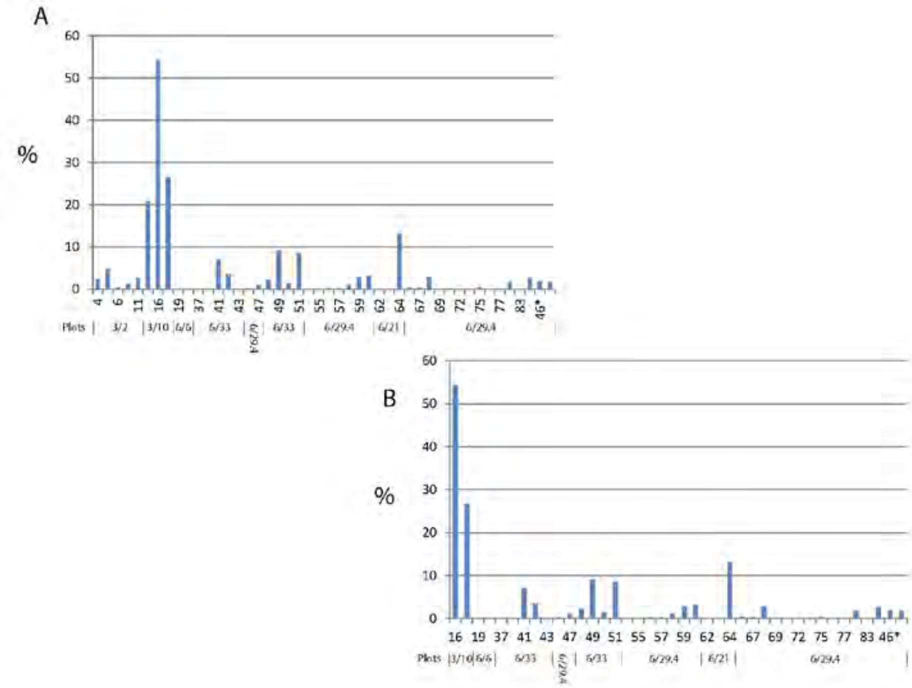

Figure 15.19. A: Percentage of burnt clasts (total) for all period. B: Percentage of burnt clasts (total) for only burnt mounds

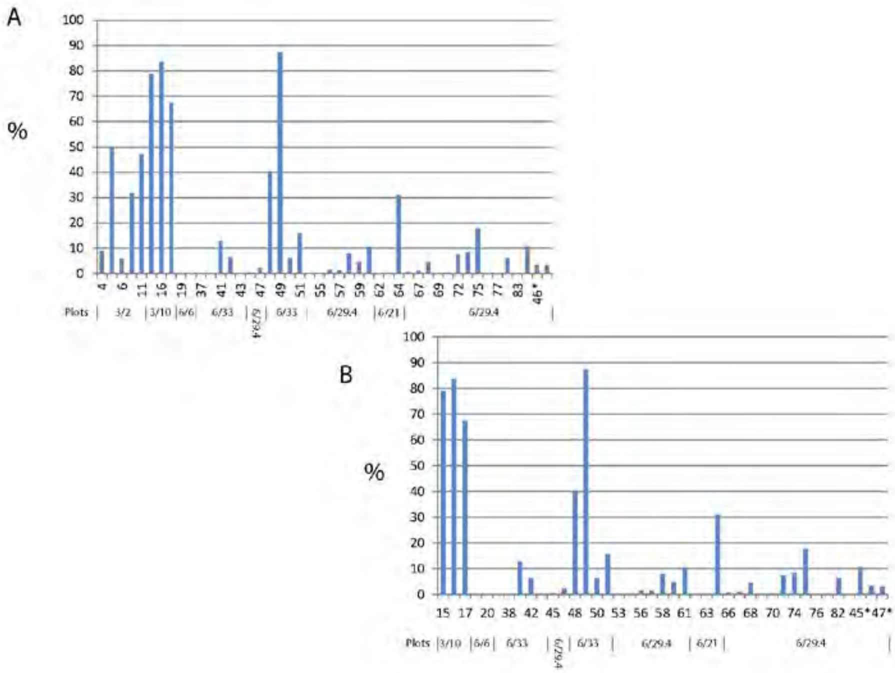

Figure 15.20. A: Percentage of burnt clasts of >7mm for all period. B: Percentage of burnt clasts of >7mm for only Bronze Age

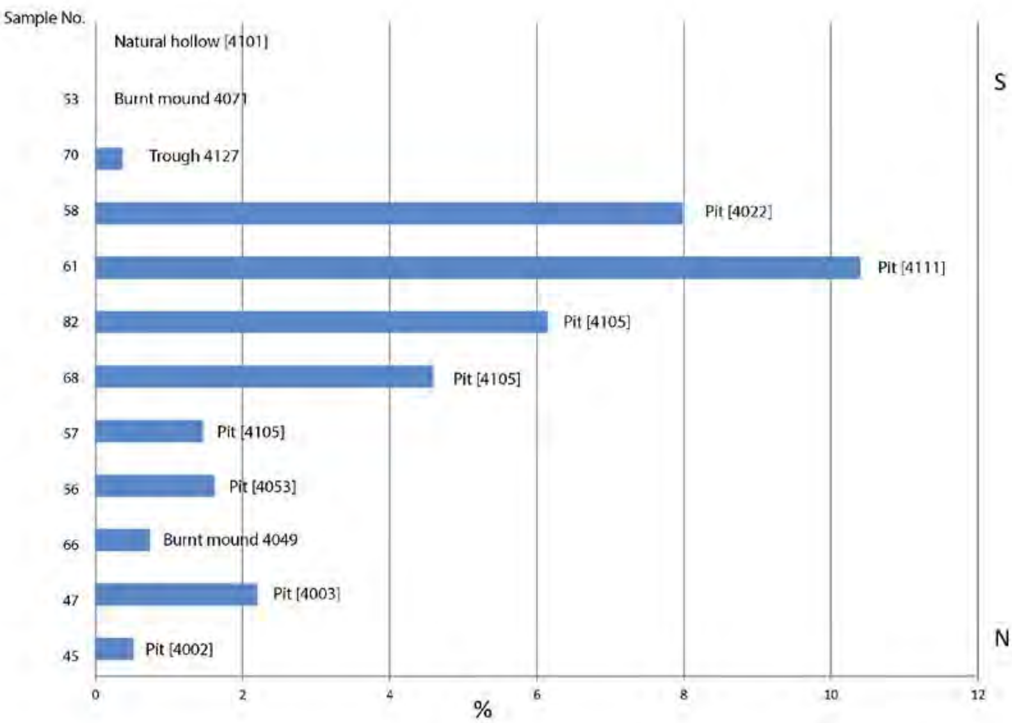

Figure 15.21. Percentage of burnt stone >7mm by archaeological feature from south to north (plot 6/29.4)

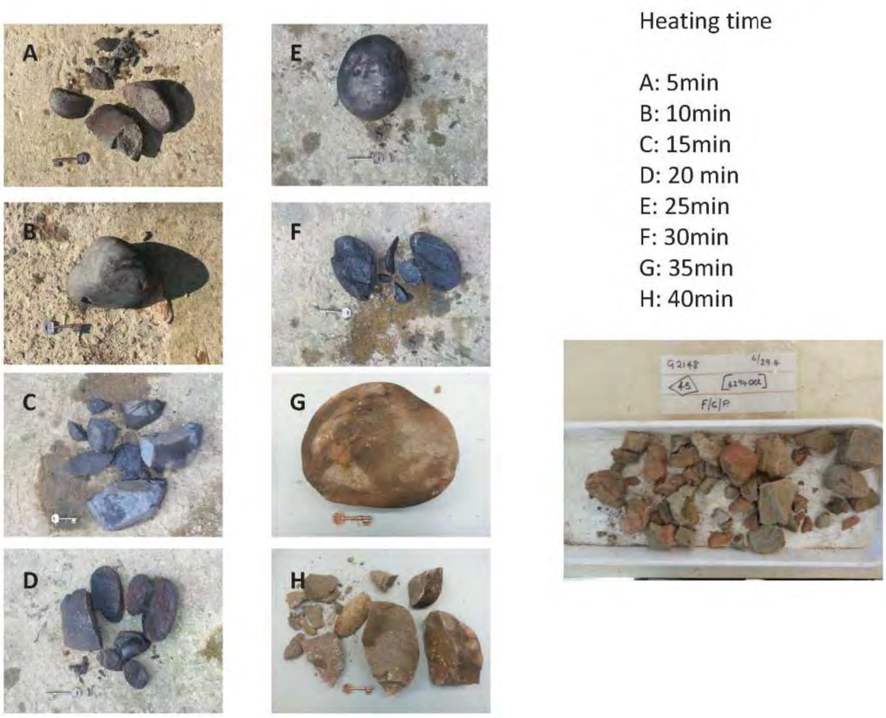

Figure 15.22. Burning experimental data (A-H) and selected sample from 6/29 (Sample 45) showing heavily burnt stone

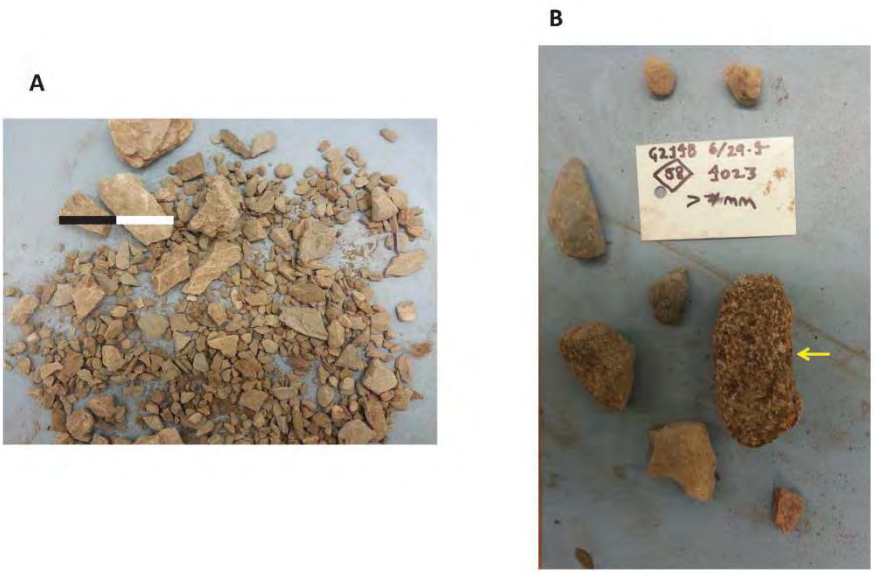

Figure 15.23. Sample 58 . A: >7mm fraction. B: selected material including metamorphic rock types (indicated yellow arrow).

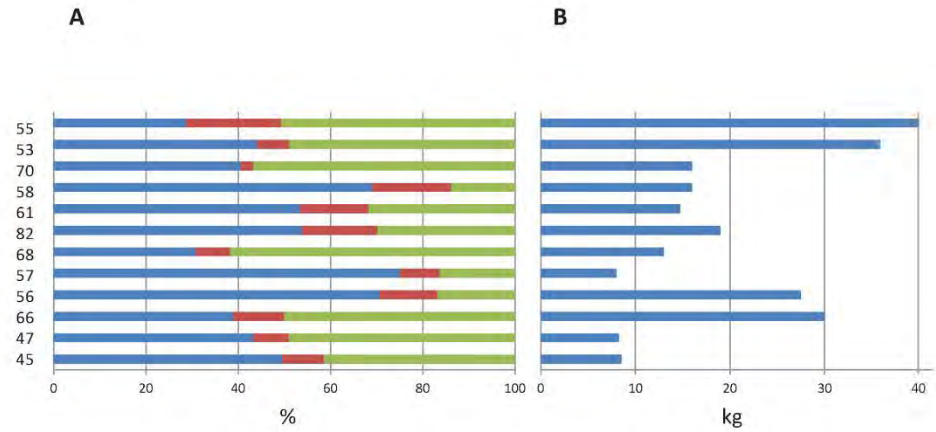

Figure 15.24. Comparision of percentage of clast size (A) and original sample size (B) for north south transect in plot 6/29.4

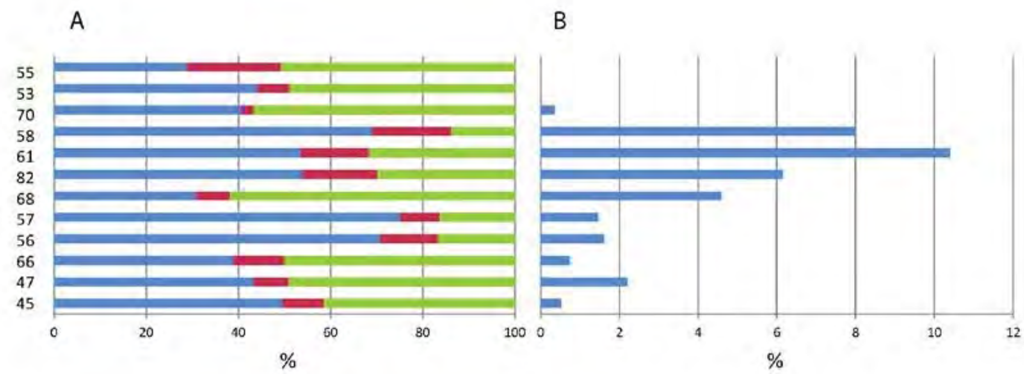

Figure 15.25. Comparision of percentage of clast size (A) and percentage burnt (>7mm) (B) for north south transect in plot 6/29.4

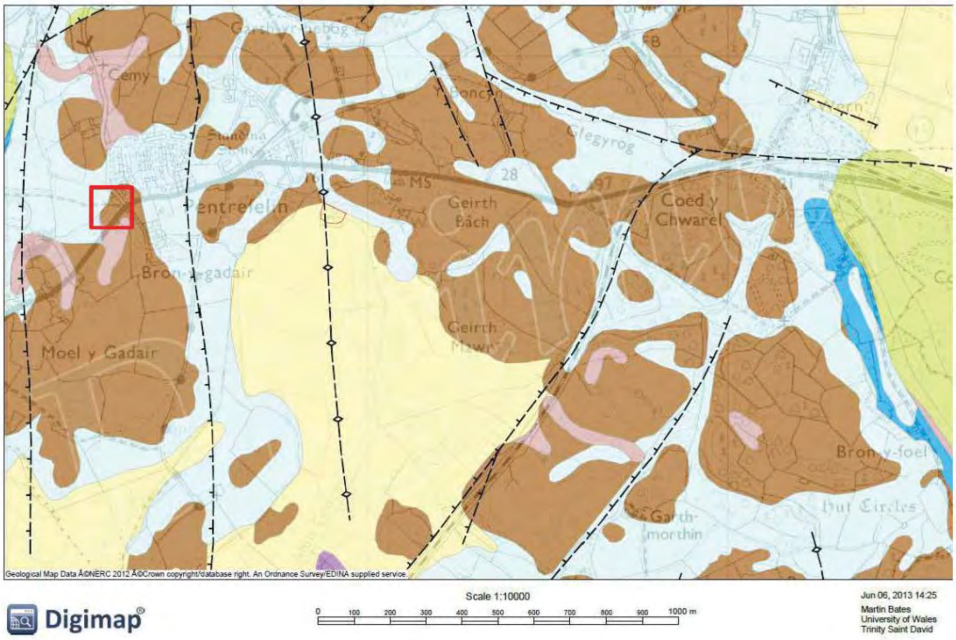

Figure 15.26. Site location showing local bedrock (brown = Ffestiniog Flats Formation, strong purple = microgabbro) and superficial deposits (pale blue = till, yellow = alluvium, pale purple = head)

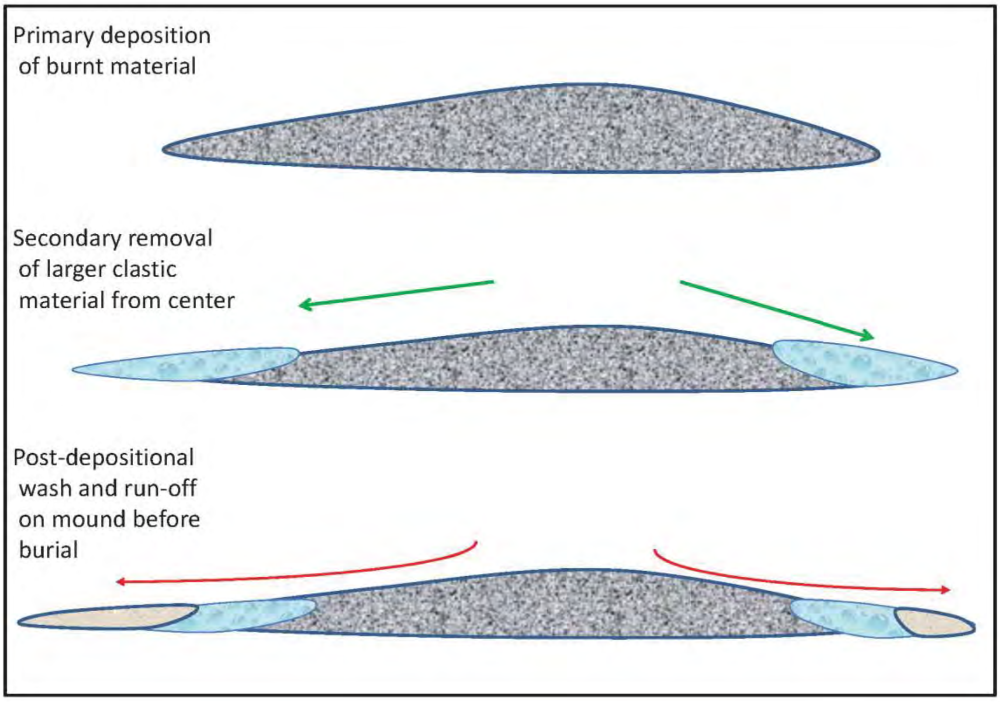

Figure 15.27. Simplified model for mound development

16. RADIOCARBON DATING AND BAYESIAN MODELLING

Derek Hamilton (SUERC)

16.1. Methodology

A total of 43 radiocarbon dates are available from features excavated along the path of the Pwllheli to Blaenau Ffestiniog replacement pipeline corridor. All the samples were submitted to the Scottish Universities Environmental Research Centre (SUERC) in East Kilbride for radiocarbon dating by accelerator mass spectrometry (AMS). The samples were all single entities of short-life material (Ashmore 1999), and included charcoal, preserved plant macrofossil remains, cremated human bone and a marine shell. All the non-bone and shell samples were pretreated following the protocols of Stenhouse and Baxter (1983). The cremated bone was pretreated following Lanting et al. (2001), and the shell following a modified version of Heier-Nielsen et al. (1995). The pretreated material was then combusted to CO_2 (Vandeputte 1996), which was cryogenically purified and converted to graphite using the method of Slota et al. (1987). The graphite was then pressed into aluminium target holders for subsequent AMS analysis (Xu et al. 2004; Naysmith et al. 2010). The SUERC laboratory maintains rigorous internal quality assurance procedures, and participation in international inter-comparisons (Scott 2003) indicate no laboratory offsets; thus validating the measurement precision quoted for the radiocarbon ages.

The radiocarbon results are given in Table 16.1. These are conventional radiocarbon ages (Stuiver and Polach 1977), quoted according to the international standard set at the Trondheim Convention (Stuiver and Kra 1986). The results have been calibrated using OxCal v4.2 (Bronk Ramsey 1995; 1998; 2001; 2009). The terrestrial plant and human bone results were calibrated using the internationally agreed terrestrial curve of Reimer et al. (2009) (IntCal09), while the internationally agreed marine curve (Reimer et al. 2009) (Marine09) was used for the shell sample with a ΔR of -52 ±43 years that was derived using the 10 measurements in the ^{14}Chrono marine reservoir database closest to Pwllheli (http://calib.qub.ac.uk/marine). The date ranges in Table 16.1 have been calculated using the maximum intercept method (Stuiver and Reimer 1986), and quoted in the form recommended by Mook (1986) with the endpoints rounded outward to 10 years for errors of 25 or more years, and rounded to five years for errors less than 25 years. The probability distributions seen in Figures 16.1–8 were obtained by the probability method (Stuiver and Reimer 1993).

A Bayesian approach has been adopted for the interpretation of the chronology of some of the burnt mound features from the project (Buck et al. 1996). Although the simple calibrated dates are accurate estimates of the dates of the samples, this is usually not what archaeologists really wish to know. It is the dates of the archaeological events represented by those samples, which are of interest. In the case of the burnt mounds, it is the overall chronology of the use of these features in this area – when did it begin; when did it end; and for how long did it take place – that is under consideration, not necessarily the dates of any individual samples. The dates of this activity can be estimated not only using the absolute dating information from the radiocarbon measurements on the samples, but also by using the stratigraphic relationships between samples.

Fortunately, methodology is now available which allows the combination of these different types of information explicitly, to produce realistic estimates of the dates of archaeological interest. It should be emphasised that the *posterior density estimates* produced by this modelling are not absolute. They are interpretative *estimates*, which can and will change as further data become available and as other researchers choose to model the existing data from different perspectives.

The technique used is a form of Markov Chain Monte Carlo sampling, and has been applied using the program OxCal v4.2. Details of the algorithms employed by this program are available from the on-line manual or in Bronk Ramsey (1995; 1998; 2001; 2009). The algorithm used in the model described below can be derived directly from the model structure shown in Figures 16.1–8.

16.2. The samples and models

3/2: Pits and corn drier

There are two results from each of two pits excavated in area 3/2, and three results from the cord drier. The two measurements (SUERC-44176 and -46825) on single grains of wheat and barley from the fill (32016) of pit [32003] that contained heat-cracked quern stones are statistically consistent (T'=0.6; ν=1; T'(5%)=3.8) and could be the same actual age. There are another two results (SUERC-46253 and -46254) on single fragments of alder/hazel and hazel charcoal from fills (32019 and 32021) of pit [32014]. Given fill (32021) is the stone lining of the pit, SUERC-46254 is considered here to have no direct stratigraphic relationship with SUERC-46253. The two measurements are statistically consistent (T'=0.1; v=1; T'(5%)=3.8) and could be the same actual age. The four results have put in a chronological model that simply uses the prior information that they come from two stratigraphically unrelated features that would appear, archaeologically, to be from the same period of activity on the site. The dates have good individual agreements with the model assumptions. The model estimates that the activity at 3/2 associated with these two pits began in *460–365 cal BC* (*95% probability*; Fig 16.1; *start: Pits 3/2*), and probably in *410–380 cal BC* (*68% probability*). The activity lasted for *1–165 years* (*95% probability*; Fig 16.9; *span: Pits 3/2*), but probably for *1–40 years* (*68% probability*). The activity ended in *400–230 cal BC* (*95% probability*; Fig 16.1; *end: Pits 3/2*), and probably in *390–355 cal BC* (*68% probability*).

There are three results (SUERC-44174/5 and -44177) on single grains of oat and wheat from fill (32002) of the corn drier [32009] in area 3/2. The three measurements are statistically consistent (T'=2.3; v=2; T'(5%)=6.0) and could be the same actual age. The best estimate for the date of this deposit is *cal AD 1175–1260* (*95% probability*; Fig 16.1; *Last Corn drier 3/2*), and probably *cal AD 1185–1255* (*68% probability*).

3/10: Two burnt mound troughs
There are two results from each of the burnt mound troughs excavated in area 3/10. There are two results (SUERC-46257 and -46258) on single fragments of alder and hazel charcoal from the fill (310004) of burnt mound trough [310001]. The two measurements are statistically consistent (T'=1.2; v=1; T'(5%)=3.8) and could be the same actual age. There are another two results (SUERC-46255 and -46256) on single fragments of alder charcoal from the fill (310010) of burnt mound trough [310007]. The two measurements are statistically consistent (T'=0.5; v=1; T'(5%)=3.8) and could be the same actual age. The four results have put in a chronological model that simply uses the prior information that they come from two stratigraphically unrelated features that would appear, archaeologically, to be from the same period of activity on the site. The dates have good individual agreements with the model assumptions. The model estimates that the activity at 3/10 associated with these two burnt mound troughs began in *1715–1520 cal BC* (*95% probability*; Fig 16.4; *start: Burnt mound troughs 3/10*), and probably in *1635–1550 cal BC* (*68% probability*). The activity lasted for *1–275 years* (*95% probability*; Fig 16.9; *span: Burnt mound troughs 3/10*), and probably for *1–100 years* (*68% probability*). The activity ended in *1610–1410 cal BC* (*95% probability*; Fig 16.4; *end: Burnt mound troughs 3/10*), and probably in *1585–1490 cal BC* (*68% probability*).

All four results from these two burnt mounds are statistically consistent (T'=1.8; v=3; T'(5%)=7.8), indicating that they could be the same actual age. It is also indicative of dates that are spread over a shorter, rather than longer, period of time.

3/14: Smithing pit
There are two results (SUERC-44178 and -46460) on a charred cereal grain and a fragment of alder charcoal, respectively, from the fill (314005) of smithing site [314002]. The two measurements are statistically consistent (T'=0.6; v=1; T'(5%)=3.8) and could be the same actual age. The best estimate for the date of this deposit is *cal AD 1060–1255* (*95% probability*; Fig 16.2; *Last Smithing pit 3/14*), and probably *cal AD 1160–1215* (*68% probability*).

3/27: Cremation burial
There are three results (SUERC-44825–7) on cremated bone from two pits. There is no replication of skeletal elements between the two deposits and the interpretation is that one pit represents the burial [327001], with the other forming a 'formal' pyre deposit that contained some of the cremated bone [327002]. The three measurements are statistically consistent (T'=0.8; v=2; T'(5%)=6.0) and could be the same actual age. While this does not prove that the two deposits are of the same individual, it does not invalidate the archaeological interpretation. If the two deposits are contemporary, the best estimate for the date of this activity is *1540–1420 cal BC 95% probability*; Fig 16.3; *Last cremation 3/27*), and probably *1515–1445 cal BC* (*68% probability*).

6/6: Burnt mound
There are two results (SUERC-46826 and -46838) on two fragments of hazel charcoal from the fill (66010) of a burnt mound trough [66011]. The two measurements are not statistically consistent (T'=22.4; v=1; T'(5%)=3.8), suggesting the material is of mixed ages. The best estimate for the date of this deposit is *2560–2305 cal BC* (*95% probability*; Fig 16.4; *Last Burnt mound 6/6*), and probably *2480–2345 cal BC* (*68% probability*).

6/21: Burnt mound

There are two results (SUERC-46839 and -46843) on two fragments of hazel charcoal from the fill (621009) of a burnt mound trough [621008]. The two measurements are not statistically consistent (T'=26.8; v=1; T'(5%)=3.8), suggesting the material is of mixed ages. The best estimate for the date of this deposit is *2575–2460 cal BC* (*95% probability*; Fig 16.4; *Last Burnt mound 6/21*), and probably *2565–2470 cal BC* (*68% probability*).

6/29: Large burnt mound complex

The large burnt mound complex in plot 6/29 is by far the most well dated area of these excavations. A total of 13 radiocarbon results are available from seven individual contexts. There is one result (SUERC-46268) on a fragment of willow/poplar charcoal in the fill (6294054) of burnt mound pit [6294053]. Two results (SUERC-46269 and -46462) on single fragments of alder and willow/poplar charcoal from fill (6294112) of burnt mound pit [6294111] are not statistically consistent (T'=9.7; v=1; T'(5%)=3.8), and indicate a deposit likely composed of mixed-age material. The two results (SUERC-46836/7) on hazel and cherry charcoal recovered in fill (6294151) of burnt mound channel [6294150] are not statistically consistent (T'=25.5; v=1; T'(5%)=3.8), and indicate that this deposit likely contains material of mixed ages. The two results (SUERC-46829 and -46833) on single fragments of alder and hazel charcoal recovered from fill (6294106) of burnt mound pit [6294105] are not statistically consistent (T'=7.2; v=1; T'(5%)=3.8), and indicate that this deposit likely contains material of mixed ages. The two results (SUERC-46835 and -46844) on a charred hazel nut shell and fragment of hazel charcoal recovered in fill (6294156) of burnt mound pit [6294033] are not statistically consistent (T'=10.4; v=1; T'(5%)=3.8), and indicate that this deposit likely contains material of mixed ages. The are another two results (SUERC-46263/4) on single fragments of alder and hazel charcoal recovered from fill (6294010) of burnt mound pit [6294003] that are statistically consistent (T'=0.3; v=1; T'(5%)=3.8), and could be the same actual age. Finally, the two results (SUERC-46463 and -46834) on alder and birch charcoal recovered in fill (6294126) of burnt mound trough [6294127] are not statistically consistent (T'=10.1; v=1; T'(5%)=3.8), and indicate that this deposit likely contains material of mixed ages. Furthermore, these two measurements are significantly later than the other dates from the burnt mound complex and have been excluded from all further modelling of this area. The later date (SUERC-46463) provides the best estimate for the date of this particular feature (980–810 cal BC).

The low level of statistical consistency between pairs of short-life samples from the same secure contexts suggests that there was a high degree of reworking of these contexts in antiquity. As a result, the 11 results have put in a chronological model that simply uses the prior information that they come from stratigraphically unrelated features that would appear, archaeologically, to be from the same period of activity on the site. The dates have good individual agreements with the model assumptions. The model estimates that the activity associated with the main use of the burnt mound complex in plot 6/29 began in *2840–2500 cal BC* (*95% probability*; Fig 16.4; *start: Burnt mound 6/29*), and probably in *2715–2510 cal BC* (*68% probability*). The activity lasted for *405–975 years* (*95% probability*; Fig 16.9; *span: Burnt mound 6/29*), and probably for *525–790 years* (*68% probability*). The activity ended in *2125–1790 cal BC* (*95% probability*; Fig 16.4; *end: Burnt mound 6/29*), and probably in *2105–1895 cal BC* (*68% probability*). The large span for the use of the area may be the result of punctuated, rather than continuous, use over a protracted period of time that was not readily identifiable within the archaeology.

6/33: Two burnt mounds with isolated pit

In area 6/33 there are three features that were dated from two separate burnt mound deposits and an isolated pit. From each feature there are two radiocarbon results. There are two results (SUERC-46267 and -46461) on single fragments of alder charcoal from layer (633019) under burnt mound (633012) in this area, and thought to be directly related to the use of the mound. The two measurements are statistically consistent (T'=2.5; v=1; T'(5%)=3.8) and could be the same actual age. There are another two results (SUERC-46827 and -46828) on single fragments of ash and hazel charcoal, respectively, from fill (633011) of pit [633010]. The two measurements are statistically consistent (T'=0.0; v=1; T'(5%)=3.8) and could be the same actual age. Furthermore, the measurements from burnt mound (633012) and pit [63310] are not statistically consistent, suggesting that the use of these two features is separated in time by some period. There are a final two results (SUERC-46265 and -46266) on single fragments of hazel and alder charcoal, respectively, from fill (633029) of burnt mound trough [633028], associated with the second burnt mound (633015). The two measurements are statistically consistent (T'=0.5; v=1; T'(5%)=3.8) and could be the same actual age, placing increased reliability in the interpretation of this feature as a medieval burnt mound.

The fill of pit [633010] is thought to represent a single event, and so the two radiocarbon dates from the pit have been combined using the Bayesian Combine (A_{comb}=111.0%; n=2; A_n=50.0%) function in OxCal to provide the best estimate for the date of this event: *2470–2305 cal BC* (*95% probability*; Fig 16.4; *Combine 633010*).

The Last function in OxCal was used to provide the best estimate for the date of the deposits associated with the two burnt mounds. The ground surface deposit has been used to date burnt mound (633012) to *2875–2625 cal BC* (*95% probability*; Fig 16.4; *Last Ground surface 6/33*), and probably in *2800–2670 cal BC* (*68% probability*). The best estimate for the date of the burnt mound trough deposit associated with mound (633015) is *cal AD 600–665* (*95% probability*; Fig 16.4; *Last Burnt mound trough 6/33*), and probably in *cal AD 620–655* (*68% probability*).

7/1: Small shell midden
There are two results (SUERC-46259 and -46845) on a fragment of hazel charcoal and a cockle shell from a layer in a small shell midden (71002). Since the two samples have different carbon reservoirs, terrestrial and marine, they cannot be directly compared in the same way as the other pairs of samples using a simple χ^2 test on the uncalibrated measurements. It is possible to use the Combine function within OxCal, which allows for the two measurements to be calibrated using their appropriate calibration curve, and then compared statistically. The Combine has good agreement (A_{comb}=122.6%; n=2; A_n=50.0%), and the associated T-value indicates statistical consistency between the two dates (T'=0.1; v=1; T'(5%)=3.8). The best estimate for the date of this deposit is *590–335 cal BC* (*95% probability*; Fig 16.5; *Last Midden 7/1*), and probably *500–385 cal BC* (*68% probability*).

14/7: Deposit of wood branches
There are two results (SUERC-46248/9) on oak bark from timbers in a dense wood layer that formed part of a possible structure (147005). The two measurements are statistically consistent (T'=0.4; v=1; T'(5%)=3.8) and could be the same actual age. The best estimate for the date of this deposit is *cal AD 1290–1400* (*95% probability*; Fig 16.6; *Last Wood deposit 14/7*), and probably *cal AD 1350–1395* (*68% probability*).

16.3. Discussion

Discussion of modelled results
While the uniform distribution prior produces robust models, when there are only a few radiocarbon measurements the models can be less precise then we might hope. This is the result of having an inadequate number of measurements to fully account for the statistical spread on the radiocarbon measurements (Steier and Rom 2000), which can be further exacerbated by the location of the measurements in relation to the wiggles of the calibration curve. When this is the case, there is usually a pronounced tail on the modelled probability distributions for the start and end dates of dated activity, causing the 95% probability ranges to be rather wide and the probability that the real start or end date is any individual year is very low. In these situations the 68% probability range is often more informative for the interpretation as the probabilities for each individual year are generally much higher.

The results in their regional context
A number of results are available on material from cremations and burnt mounds that have been excavated in the past by GAT in the vicinity of the Pwllheli to Blaenau Ffestiniog Gas Pipeline Replacement project. These are briefly presented here (Table 16.2), along with the results from this analysis. All of the measurements were made at Beta Analytic, using conventional radiometric techniques, on bulk identified charcoal samples. Only one of the seven results discussed here (Beta-204433) did not come from a sample mainly or wholly consisting of oak charcoal. These results must all be interpreted with caution and treated as *termini post quo* dates for their features, since oak is a long-lived species and the results could suffer from an 'old wood' effect, rendering the ages older than the context being dated.

Cremation Burials
The radiocarbon results from cremation burials at Afon Wen (Beta-210124) and Blaen y Cae (Beta-186976–8) are shown in Figure 16.7 in relation to the best estimated date for the cremation in Plot 3/27 (Last cremation 3/27) from the Pwllheli to Blaenau project. The cremation in 3/27 was more similar in character to those excavated from Blaen y Cae than it was to Afon Wen in that there were unurned cremations and pits with pyre material. However, at Blaen y Cae there are more cremations and some have urns. At Afon Wen, there were two cremation urns inside a circular ditched enclosure.

The modelled result from Pwllheli to Blaenau is substantially later than the results from the other two sites. There would need to be an old wood offset of 200–300 years before the other cremations might be considered potentially contemporary. Furthermore, the offset between Pit 10 at Blaen y Cae and Pwllheli to Blaenau Plot 3/27 is approximately 500 years. It would seem likely that the cremation at Pwllheli is the latest in the group.

Burnt Mounds
There are three radiocarbon measurements from a burnt mound (Bryn Bachau) and burnt mound-like site (Glanllynnau) near the Pwllheli to Blaenau project. The result from Glanllynnau (Beta-204433) is on a bulk sample of hazel charcoal from a lower pit fill and is likely to provide a secure date for the feature, however, both results from Bryn Bachau are on bulk hazel and oak and provide a *tpq* for the burnt spread and primary fill of pit 402 at that site. These measurements are presented in Figure 8 along with the modelled results for the Bronze Age burnt mounds from the Pwllheli to Blaenau project.

The results from Bryn Bachau, while *tpq*s, fit well within the general burnt mound activity spread across much of the 3rd millennium cal BC. The result from Glanllynnau is substantially later, falling in the final centuries of the 2nd millennium cal BC, after the mid-2nd millennium activity dated in the burnt mound troughs in Plot 3/10 from Pwllheli.

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Xu, S, Anderson, R, Bryant, C, Cook, GT, Dougans, A, Freeman, S, Naysmith, P, Schnabel, C and Scott, EM 2004 Capabilities of the new SUERC 5MV AMS facility for ^{14}C dating, *Radiocarbon*, 46(1), 59–64

16.5. Figures

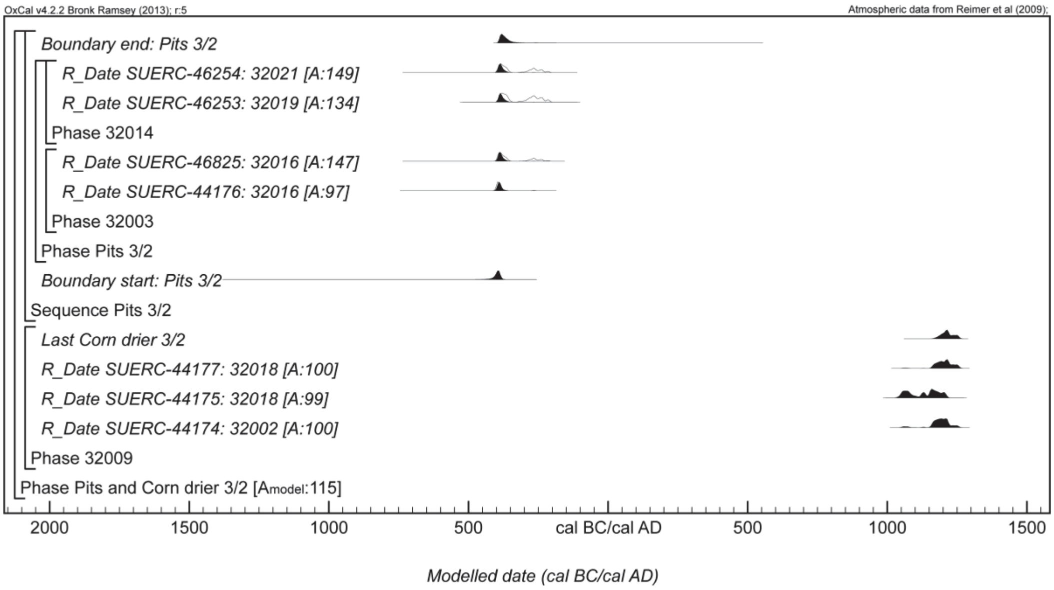

Figure 16.1: Chronological model for Plot 3/2. Each distribution represents the relative probability that an event occurred at some particular time. For each of the radiocarbon measurements two distributions have been plotted, one in outline, which is the result of simple radiocarbon calibration, and a solid one, which is based on the chronological model use. The other distributions correspond to aspects if the model. For example, '*start: Pits 3/2*' is the estimated date that the dated activity associated with the pits took place, based on the radiocarbon dating results. The large square 'brackets' along with the OxCal keywords define the overall model exactly

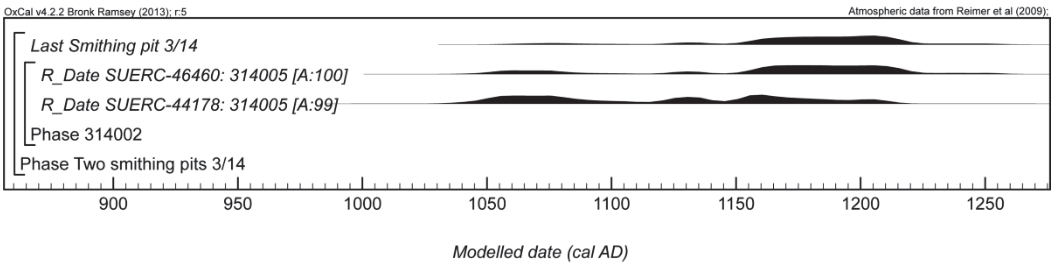

Figure 16.2: Chronological model for the Smithing pit in Plot 3/14. The format of the model is as described in Figure 16.1

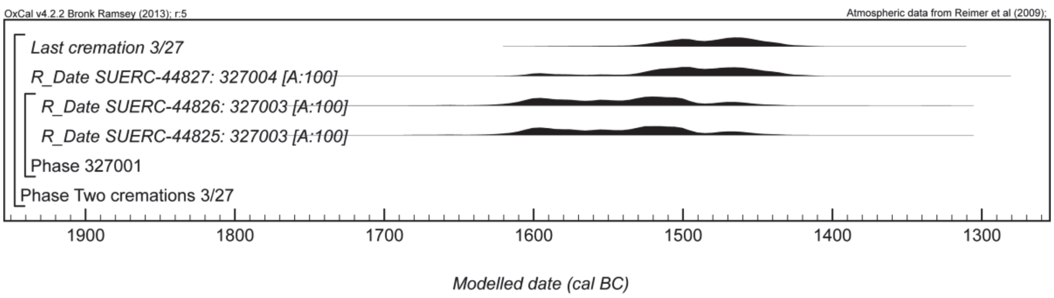

Figure 16.3: Chronological model for the cremation in Plot 3/27. The format of the model is as described in Figure 16.1

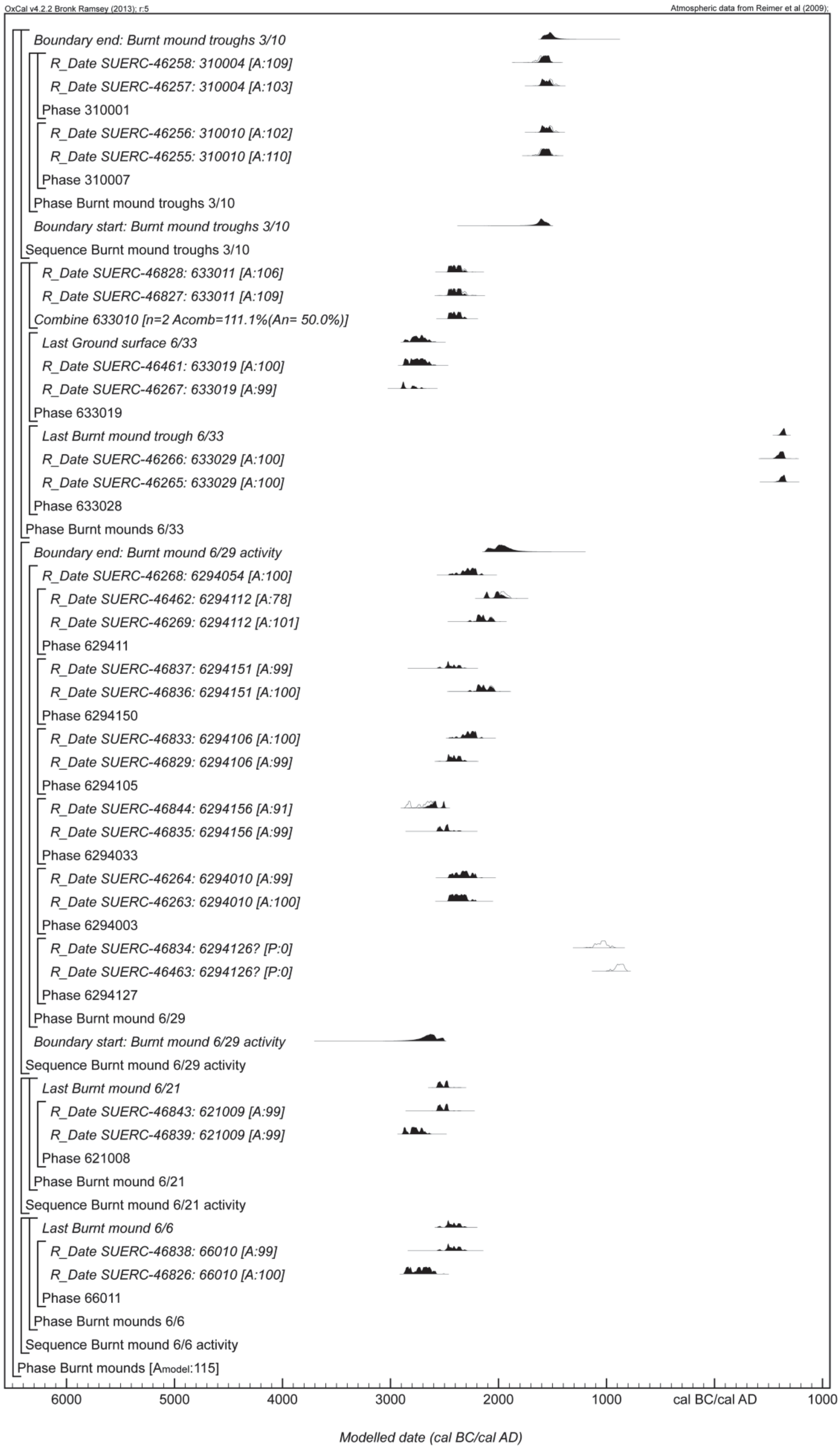

Figure 16.4: Chronological model for the burnt mounds and burnt mound-like deposits from the Pwllheli to Blaenau project. The format of the model is as described in Figure 16.1

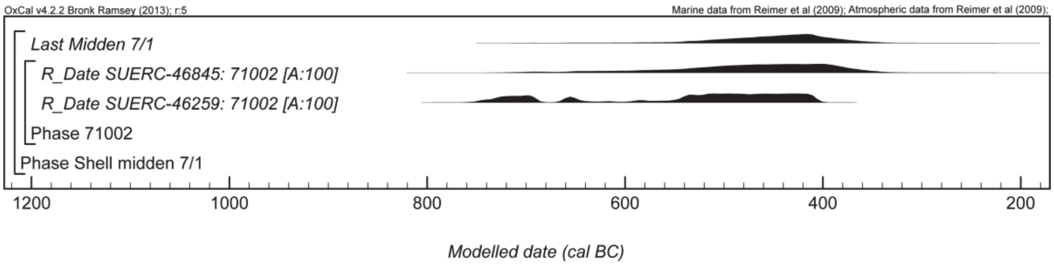

Figure 16.5: Chronological model for the shell midden in Plot 7/1. The format of the model is as described in Figure 16.1

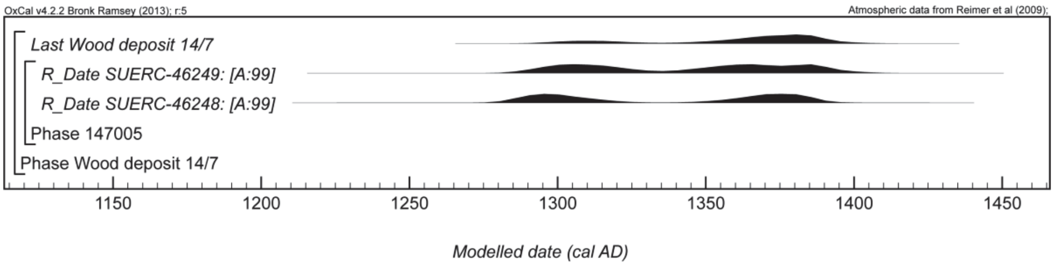

Figure 16.6: Chronological model for the wood deposit in Plot 14/7. The format of the model is as described in Figure 16.1

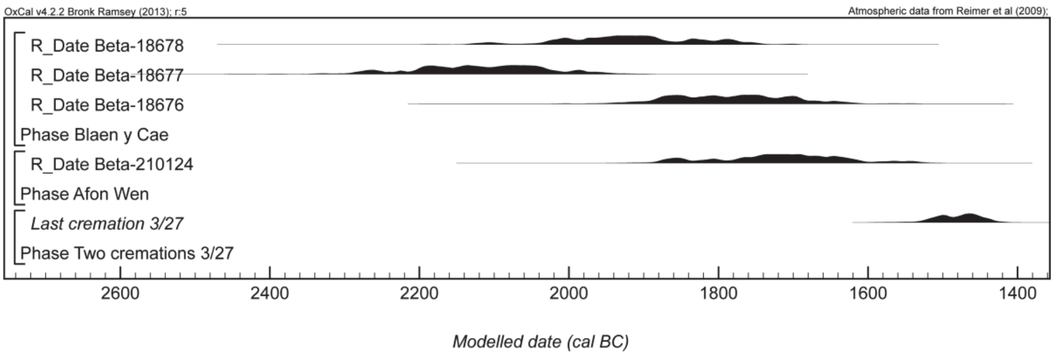

Figure 16.7: Dates from dated cremation deposits in the vicinity of the Pwllheli to Blaenau project

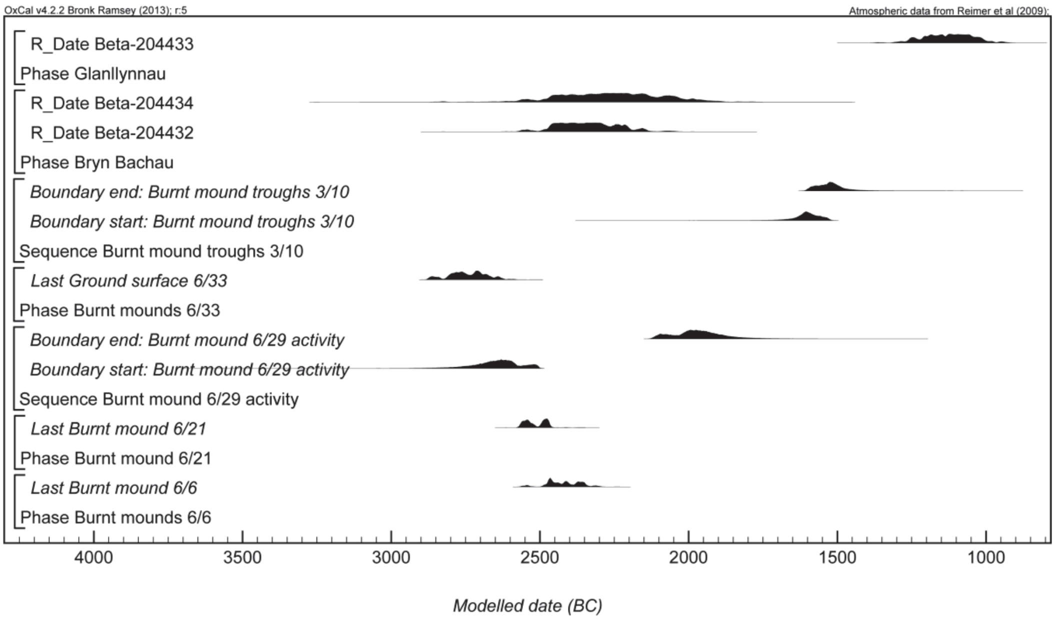

Figure 16.8: Dates from dated burnt mound deposits in the vicinity of the Pwllheli to Blaenau project

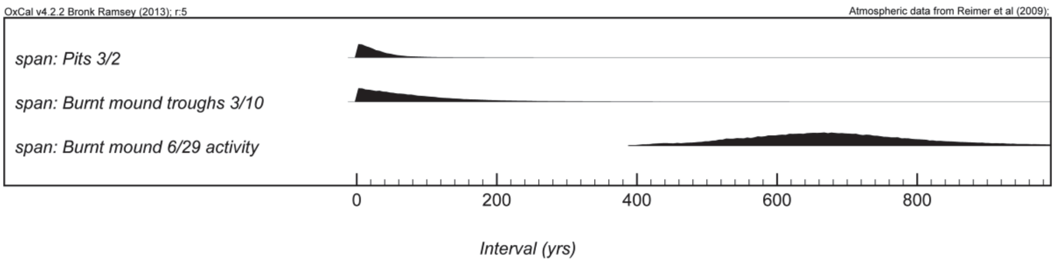

Figure 16.9: Spans of activity in areas that have been formally modelled in this report: Pits 3/2, Burnt mound troughs 3/10, and Burnt mound 6/29. The models for these spans are given, in full, in Figures 16.1 and 4

16.6. Tables

Table 16.1. Radiocarbon dates from the Pwllheli to Blaenau Ffestiniog Pipeline Replacement Project

Lab ID	Sample ID	Context number	Context description	Material	$\delta^{13}C$ (‰)	Radiocarbon age (BP)	Calibrated date (95% confidence)
SUERC-44174	G2148.02	32002	fill of corn drier [32009]	charred grain: *Avena* sp.	-24.5	851 ±25	cal AD 1150–1260
SUERC-44175	G2148.03	32018	fill of corn drier [32009]	charred grain: *Triticum* spp.	-23.7	891 ±26	cal AD 1040–1220
SUERC-44176	G2148.04	32016	fill of pit with grinding stones [32003]	charred grain: *Triticum* spp.	-22.8	2319 ±26	410–370 cal BC
SUERC-44177	G2148.08	32018	fill of corn drier [32009]	charred grain: *Avena* sp.	-24.4	839 ±25	cal AD 1150–1260
SUERC-44178	G2148.10	314005	fill of smithing site [314002]	charred grain: *Avena/Poaceae* sp.	-26.3	897 ±25	cal AD 1030–1220
SUERC-44825	G2148.13.01	327003	fill of pit [327001]	cremated human bone	-21.5	3262 ±35	1630–1440 cal BC
SUERC-44826	G2148.13.02	327003	fill of pit [327001]	cremated human bone	-25.5	3263 ±35	1630–1440 cal BC
SUERC-44827	G2148.14.01	327004	fill of pit [327002]	cremated human bone	-26.2	3225 ±35	1610–1420 cal BC
SUERC-46248	G2148.14-7.47R		dense wood layer, possible structure (147005)	bark: *Quercus* sp.	-28.9	656 ±27	cal AD 1280–1400
SUERC-46249	G2148.14-7.44B		dense wood layer, possible structure (147005)	bark: *Quercus* sp.	-26.8	631 ±30	cal AD 1280–1410
SUERC-46253	G2148.07.02	32019	lower fill of pit [32014]	charcoal: *Alnus/Corylus* sp., roundwood	-27.0	2269 ±30	400–210 cal BC
SUERC-46254	G2148.11.02	32021	stone lining of pit [32014]	charcoal: *Corylus avellana*, roundwood	-25.7	2282 ±30	400–230 cal BC
SUERC-46255	G2148.15.01	310010	fill of burnt mound trough [310007]	charcoal: *Alnus glutinosa*	-25.5	3296 ±30	1670–1500 cal BC
SUERC-46256	G2148.15.02	310010	fill of burnt mound trough [310007]	charcoal: *Alnus glutinosa*	-26.5	3266 ±28	1620–1450 cal BC
SUERC-46257	G2148.17.01	310004	fill of burnt mound trough [310001]	charcoal: *Alnus glutinosa*	-26.9	3265 ±30	1620–1450 cal BC
SUERC-46258	G2148.17.02	310004	fill of burnt mound trough [310001]	charcoal: *Corylus avellana*	-27.0	3310 ±28	1690–1510 cal BC

Lab ID	**Sample ID**	**Context number**	**Context description**	**Material**	**δ^{13}C (‰)**	**Radiocarbon age (BP)**	**Calibrated date (95% confidence)**
SUERC-46259	G2148.44.01	71002	shell midden	charcoal: *Corylus avellana*	-26.7	2428 ±30	750–400 cal BC
SUERC-46263	G2148.46.01	6294010	fill of burnt mound pit [6294003]	charcoal: *Alnus glutinosa*	-24.6	3877 ±28	2470–2210 cal BC
SUERC-46264	G2148.46.02	6294010	fill of burnt mound pit [6294003]	charcoal: *Corylus avellana*	-25.9	3853 ±30	2470–2200 cal BC
SUERC-46265	G2148.48.01	633029	fill of burnt mound trough [633028]	charcoal: *Corylus avellana*	-28.1	1414 ±30	cal AD 590–670
SUERC-46266	G2148.48.02	633029	fill of burnt mound trough [633028]	charcoal: *Alnus glutinosa*	-29.4	1444 ±30	cal AD 560–660
SUERC-46267	G2148.50.02	633019	charcoal layer sealed under burnt mound	charcoal: *Alnus glutinosa*	-23.0	4224 ±27	2900–2700 cal BC
SUERC-46268	G2148.56.01	6294054	fill of burnt mound pit [6294053]	charcoal: *Salix/Populus* sp.	-26.0	3828 ±30	2460–2150 cal BC
SUERC-46269	G2148.59.01	6294112	fill of burnt mound pit [6294111]	charcoal: *Alnus glutinosa*	-26.6	3740 ±27	2280–2030 cal BC
SUERC-46460	G2148.10.02	314005	fill of smithing site [314002]	charcoal: *Alnus glutinosa*	-27.1	868 ±30	cal AD 1040–1230
SUERC-46461	G2148.50.01	633019	charcoal layer sealed under burnt mound	charcoal: *Alnus glutinosa*	-30.1	4159 ±31	2890–2620 cal BC
SUERC-46462	G2148.59.02	6294112	fill of burnt mound pit [6294111]	charcoal: *Salix/Populus* sp.	-27.1	3612 ±31	2120–1880 cal BC
SUERC-46463	G2148.70.01	6294126	fill of burnt mound trough [6294127]	charcoal: *Alnus glutinosa*	-27.1	2739 ±31	980–810 cal BC
SUERC-46825	G2148.04.02	32016	fill of pit [32003] with heat-cracked quern stones	charred grain: *Hordeum* sp.	-23.9	2290 ±29	410–230 cal BC
SUERC-46826	G2148.20.1	66010	fill of burnt mound trough [66011]	charcoal: *Corylus avellana*	-26.5	4127 ±29	2880–2570 cal BC
SUERC-46827	G2148.43.1	633011	fill of burnt mound pit [633010]	charcoal: *Fraxinus excelsior*	-24.3	3901 ±29	2480–2290 cal BC
SUERC-46828	G2148.43.2	633011	fill of burnt mound pit [633010]	charcoal: *Corylus avellana*	-25.0	3903 ±25	2480–2290 cal BC
SUERC-46829	G2148.57.1	6294106	fill of burnt mound pit [6294105]	charcoal: *Alnus glutinosa*	-26.2	3920 ±24	2480–2300 cal BC
SUERC-	G2148.57.2	6294106	fill of burnt mound pit [6294105]	charcoal: *Corylus avellana*	-26.1	3827 ±25	2410–2150 cal BC

Lab ID	Sample ID	Context number	Context description	Material	$\delta^{13}C$ (‰)	Radiocarbon age (BP)	Calibrated date (95% confidence)
46833							
SUERC-46834	G2148.70.2	6294126	fill of burnt mound trough [6294127]	charcoal: *Betula* sp.	-26.0	2868 ±26	1130–930 cal BC
SUERC-46835	G2148.91.1	6294156	fill of burnt mound pit [6294033]	charred hazel nutshell	-25.5	3966 ±29	2570–2450 cal BC
SUERC-46836	G2148.102.1	6294151	burnt mound material in channel [6294150]	charcoal: *Corylus avellana*	-25.5	3734 ±30	2280–2030 cal BC
SUERC-46837	G2148.102.2	6294151	burnt mound material in channel [6294150]	charcoal: *Prunus* sp.	-25.2	3938 ±27	2550–2340 cal BC
SUERC-46838	G2148.28	66010	fill of burnt mound pit [66011]	charcoal: *Corylus avellana*	-25.6	3933 ±29	2550–2340 cal BC
SUERC-46839	G2148.65.1	621009	fill of burnt mound trough [621008]	charcoal: *Corylus avellana*	-25.0	4183 ±29	2890–2640 cal BC
SUERC-46843	G2148.65.2	621009	fill of burnt mound trough [621008]	charcoal: *Corylus avellana*	-25.3	3978 ±27	2580–2460 cal BC
SUERC-46844	G2148.91.2	6294156	fill of burnt mound pit [6294033]	charcoal: *Corylus avellana*	-27.4	4098 ±29	2870–2500 cal BC
SUERC-46845	G2148.44.2	71002	shell midden	marine shell: *Cardium edule* (cockle)	1.3	2652 ±29	660–340 cal BC

Table 16.2. Radiocarbon dates from nearby and/or similar discussed in this report

Lab ID	**Context number**	**Context description**	**Material**	**$\delta^{13}C$ (‰)**	**Radiocarbon age (BP)**	**Calibrated date (95% confidence)**
A497 Road Improvement Project (GAT project G1692) (Berks *et al* 2007)						
Afon Wen Early Bronze Age Funerary Site (PRN 19659)						
Beta-210124	9961	lower fill of pit with cremation urn SF4	charcoal: oak (radiometric)	-	3410 ±60	1890–1530 cal BC
Bryn Bachau Burnt Mound with Pits (PRN 31151)						
Beta-204432	275	burnt spread	charcoal: hazel and oak (radiometric)	-	3870 ±70	2570–2130 cal BC
Beta-204434	400	primary fill of pit 402	charcoal: hazel and oak (radiometric)	-	3810 ±120	2580–1920 cal BC
Glannynnau pit containing Burnt Mound-like material (PRN 35032)						
Beta-204433	343	lower pit fill	charcoal: hazel (radiometric)	-	2920 ±50	1300–940 cal BC
Cremation Cemetery at Blaen y Cae, Bryncir (GAT project G1653) (Smith 2004)						
Beta-186976	fill of pit 2	charcoal-filled pit with no cremated bone	charcoal: mixed species, mainly oak (radiometric)	-	3460 ±60	1940–1620 cal BC
Beta-186977	fill of pit 10	charcoal-filled pit with no cremated bone	charcoal: mixed species, mainly oak (radiometric)	-	3720 ±60	2300–1940 cal BC
Beta-186978	fill of pit 6	pit containing urn and a small amount of cremated bone	charcoal: mixed species, mainly oak (radiometric)	-	3570 ±60	2130–1740 cal BC

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