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Early medieval settlement, iron smelting and crop processing at South Hook, Herbranston, Pembrokeshire, 2004–05

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Excavations carried out prior to the construction of a liquid natural gas storage installation at South Hook, Herbranston, Pembrokeshire, revealed an early medieval settlement with an associated iron smelting site and crop processing complex. There were no chronologically diagnostic artefacts from the site and therefore dating is entirely dependent on radiocarbon determinations. A life span of the late eighth century AD through to the middle of the twelfth century, with a ninth to eleventh century floruit, is indicated by the radiocarbon determinations. A least three timber domestic buildings, two with bow sides, and the fragmentary remains of several others were recorded. Two iron smelting slag-tapping furnaces lay within a timber workshop. Processing of iron smelted at a different location also took place on the site. This and evidence for refurbishing the furnaces on at least one occasion hints at a sustained and fairly sophisticated iron production operation. Drying of oats, barley and to a lesser extent wheat took place in four corn dryers. The dryers were also used for malting barley. A small assemblage of quernstones provided evidence for the on-site milling of grain. No culturally diagnostic artefacts were found and no parallels for the site have been identified. It is likely, however, that the settlement's technology and other traits reflect a shared western Britain and Irish Sea culture. An assemblage of flints mostly from residual contexts demonstrated a Mesolithic to Neolithic presence on the site. Later prehistoric use of the site was attested by fragments of an Early Bronze Age urn within a small pit and by two Bronze Age radiocarbon determinations.

INTRODUCTION

Between November 2004 and July 2005 Dyfed Archaeological Trust carried out an archaeological excavation on the site of the former Esso oil refinery, at South Hook, Herbranston, near Milford Haven in Pembrokeshire during construction of an Exxon Mobil liquid natural gas storage installation (Fig. 1). The archaeological work was commissioned by RPS Group Plc acting of behalf of Exxon Mobil South Hook Terminal Company Limited.

Esso was the first company to construct an oil refinery on the banks of the Milford Haven waterway, starting in 1957 (McKay 1993). It was decommissioned during the late 1980s and early 1990s. No archaeological investigations accompanied these construction or decommissioning episodes. Prior to the construction of the oil refinery the landscape was essentially agricultural, comprising large, regularly shaped fields divided between two large farms: South Hook and Gelliswick. It is not known when this landscape was established, but it is shown on late eighteenth-century estate maps (Murphy and Ludlow 2002). South Hook Fort, constructed between 1859 and 1865, is the only major landscape element to survive the construction of the refinery and the gas storage installation. The fort was abandoned by the

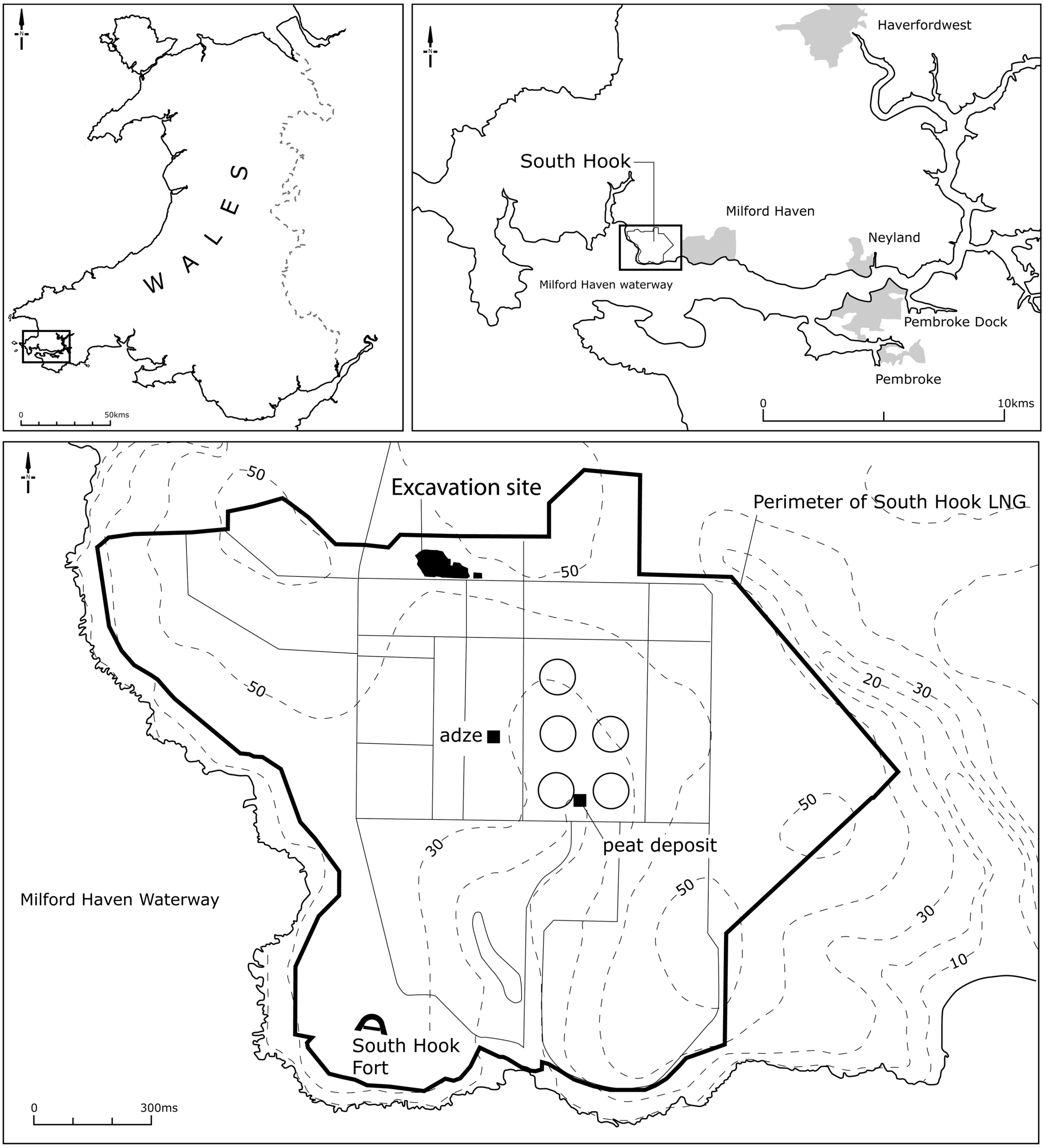

Fig. 1. Location map.

1930s, was briefly reused during the Second World War, and housed refinery equipment in the later twentieth century.

Apart from the nineteenth-century fort, almost all the land of the former refinery (measuring approximately 1.5km across) had experienced massive disturbance and consequently there was little potential for archaeological survival. However, towards the northern boundary of the refinery a relatively small area 130m by 70m had been left largely undisturbed by construction but was scheduled to be developed for the gas storage installation. It was in this area that the archaeological excavation took place. Prior to excavation it contained no known archaeological remains (Fig. 1).

The excavation site lies at approximately 50m above sea level on a gentle south-facing slope (centred on SM 8722 0675). Extensive views to the south-east, south and west across the Milford Haven waterway are obtained from the site, with the view to the south-west to the mouth of the waterway 6km away. A natural spring rises just to the west of the site.

Middle Devonian Old Red Sandstone comprises the site geology (Geological Survey of Great Britain 1978). This is folded and faulted (Allen *et al.* 1982; Williams *et al*. 1982) and presents a highly shattered and weathered surface containing pockets of stony silts and clays. Minor faults trend NNW/SSE and NNE/SSW across the region. During the excavation it was noted that the most shattered bedrock and pockets of silts and clays trend north-northwest/south-southeast, possibly following minor faults. It was within these softer pockets of material that most of the surviving archaeological features were discovered.

Seven 20m long and 2.75m wide evaluation trenches were excavated in late November and December 2004. A 30-ton, tracked, 360-degree machine with a 2.75m wide toothless bucket was used to remove topsoil from the trenches which were then hand-cleaned by a team of two archaeologists. This machine was used for all subsequent topsoil removal. Archaeological features were present in two trenches (Complexes 8 and 13)—the term 'complex' being used to describe a discrete area of excavated archaeological features. Three radiocarbon determinations (Beta-198850, 198851 and 222368) from features associated with these features were of early medieval to possibly medieval date. Given the paucity of early medieval evidence in west Wales an expansion of the trench around Complex 8 was carried out in late February 2005 to determine the extent and nature of the archaeology. This involved a small enlargement to the north taking in Complex 7 and subsequently with a larger extension to the west to include Complex 6. In May 2005 topsoil was stripped from the whole of the site to the west of Complex 9. Topsoil to the east of Complex 9 was removed in late June. Fieldwork was completed on the 1 July 2005. The whole of the area excavated and the fourteen complexes are shown on Figure 2, but the location of the evaluation trenches and sequence of trench excavation are not shown.

Topsoil was gradually removed in spits of less than 100mm to the top of the geological deposits. Where archaeological complexes were encountered the base of the topsoil was not machine excavated but reduced by hand to avoid damage to potentially sensitive archaeological deposits. In areas where the shattered bedrock provided poor definition and where no obvious archaeological features were observed the upper geological deposits were fractionally further machine reduced, but no significant archaeological features were detected in these instances.

Deposits were systematically sampled for palaeoenvironmental and metallurgical analysis. Early in the excavation it was recognised that iron-working had taken place on the site and therefore deposits were regularly checked with a magnet for hammerscale and other ferrous materials. The paucity of hammerscale and other evidence of smithing is therefore real and not the result of the sampling strategy.

Owing to the nature of the geology and the unusually dry weather during the Spring of 2005 identification of archaeological features was difficult and necessitated artificial dampening. Initially a small team of just three archaeologists was sufficient, but as the excavated area increased in size the team was gradually expanded to a maximum of 12, before being reduced in number towards the end of the excavation.

In addition to the excavation a peat deposit was recorded in the centre of the gas storage installation (SM 8754 0618). This had survived refinery construction as it lay in a base of a streambed (the former Little Hook Pill, 'pill' being a local name for a stream, often tidal). Palaeoenvironmental specialists from the University of Wales Lampeter took peat and wood samples from this deposit. A few flint flakes were

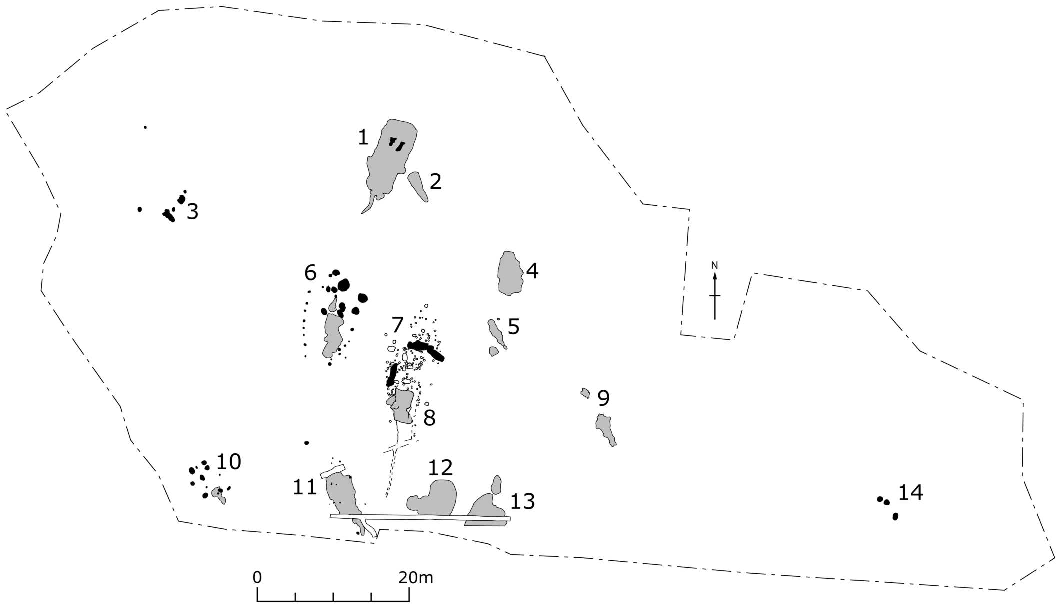

Fig. 2. Overall site plan showing the total area of the excavation and the location of Complexes 1–13.

recovered from the base of the peat and a late Bronze Age radiocarbon determination indicates the inception of peat formation. The results from this work have been reported separately (Bates *et al*. 2007), and are summarised below.

It is clear that several of the complexes—in particular 2, 4, 5 and 9—are arranged in a linear fashion, taking advantage of pockets of softer geological material (Fig. 2).

POLLEN ANALYSIS OF NEIGHBOURING PEAT DEPOSIT

Pollen analysis of the peat deposit at the centre of the gas storage installation was undertaken in anticipation that it would provide an environmental context for the results of the excavations (Bates *et al*. 2007). Although the lower part of the depositional sequence has be shown by radiocarbon dating to belong to the late Bronze Age, there is a *c*. 1500 year hiatus in the sequence probably from the late Iron Age to Romano-British period through to the fifteenth/sixteenth century AD, as three dates from upper part of the depositional sequence are post-medieval. Nevertheless, some useful data was obtained (Bates *et al.* 2007) which can be summarized as follows.

The lower levels of the sequence, interpreted as late Bronze Age, are dominated by *Alnus glutinosa* (alder), with significant amounts of *Corylus avellana* (hazel) and *Quercus* (oak), and a limited presence of other trees and shrubs. Open habitat taxa occur in relatively low frequencies. The pollen record points to a landscape of alder, oak and hazel wood and scrub with what may be a human presence and pastoral activity. Charcoal suggests that burning may have been used to clear woodland. Above this there are marked changes in the pollen record with a sharp decline in *Alnus* and a sharp increase in Poaceae (grass). There is a falling trend for *Quercus* and *Corylus*, rising curves for Lactuceae (dandelions) and *Plantago lanceolata* (ribwort plantain), and the appearance or expansion of a range of ruderal taxa. Many of these herbaceous taxa are associated with pastoral activity, but some are characteristic of bare ground and waste, reflecting arable practices. Following this initial phase of clearance there was a short episode of woodland and scrub recovery. *Alnus* values recover and Poacaeae, Lactuceae, *Plantago lanceolata* and *Pteridium* (bracken) decline. This phase of woodland expansion is dated by the radiocarbon determination of 1012–840 cal. BC. This woodland expansion was short-lived as afterwards *Alnus* begins a decline which ultimately sees it disappear from the record, as does *Corylus*. *Quercus* values rise following the onset of the *Alnus* decline, but they too then decline and eventually disappear. This decline in woody species is accompanied by a sharp rise in Poaceae pollen and ruderal taxa. There is also a rise in *Pteridium* spores reflecting the spread of bracken. This phase of extensive woodland clearance and the dominance of pastoral and arable farming is emphasised by the occurrence of cereal pollen. The record of this phase, which probably dates to the late Iron Age to Romano-British period, is abruptly terminated by disruption in the peat deposits.

PREHISTORIC ACTIVITY

Mesolithic and Neolithic lithics

Later Mesolithic and later Neolithic lithics were recovered from residual contexts scattered across the excavated area, such as the base of the topsoil, and Bronze Age and early medieval features which are reported on below. A Neolithic flint adzehead found some distance from the excavation is also reported upon below.

Bronze Age activity

Sherds representing *c.* 20% of an Early Bronze Age urn (Fig. 22) were recovered from pit 784 at the northern end of Complex 6 (Fig. 3) which seems to represent a hearth or furnace. This pit consisted of a bowl-shaped hollow, *c.* 0.6m diameter and 0.1m deep. A thin layer of soil, stone and charcoal (787) lined the bottom of the pit over which lay a layer of heat-reddened and burnt clay (783). This deposit had a smooth upper surface, resulting in a very distinct bowl shape. This was filled with patches of burnt clay, charcoal, heat-reddened soil and the shattered remains of the urn. A radiocarbon determination of 2200–1960 cal. BC (Beta-255069) was obtained from a barley grain from layer 787. Wheat grains as well as barley were also found in this pit, but there was a scarcity of weed contaminants. There is a possibility that the pit may contain residual material and be later in date (see the discussion of early medieval features in Complex 6 below). There is no evidence for a funerary context for the Bronze Age urn and if it and possibly other undated features in this complex are of prehistoric date the associated burnt grain with few contaminants may suggest a non-domestic context (see report on charred plant remains below).

Three shallow, subcircular pits (1520, 1523, 1526, detail not illustrated), in Complex 14 somewhat isolated from the rest of the site (Fig. 2), also seem likely to be of Bronze Age date. The pits were approximately 0.6–0.9m across and 0.20m deep. Pit 1526 may have been a natural hollow, perhaps a tree bole. Specks of charcoal and carbonised hazelnut shell were recovered from pit 1520 together with heat-affected stones, worked flints, a hammer stone (440) and a possible small cup-marked stone (441) (see report on worked stone below). A lower, charcoal-rich fill (1524) was present in pit 1523. A radiocarbon determination of 2010–1760 cal. BC (Beta-255072) was obtained from carbonised hazelnut from this fill. Analysis of charcoal showed that hazel and oak were the dominant species in pits 1520 and 1523, with some hawthorn in pit 1523.

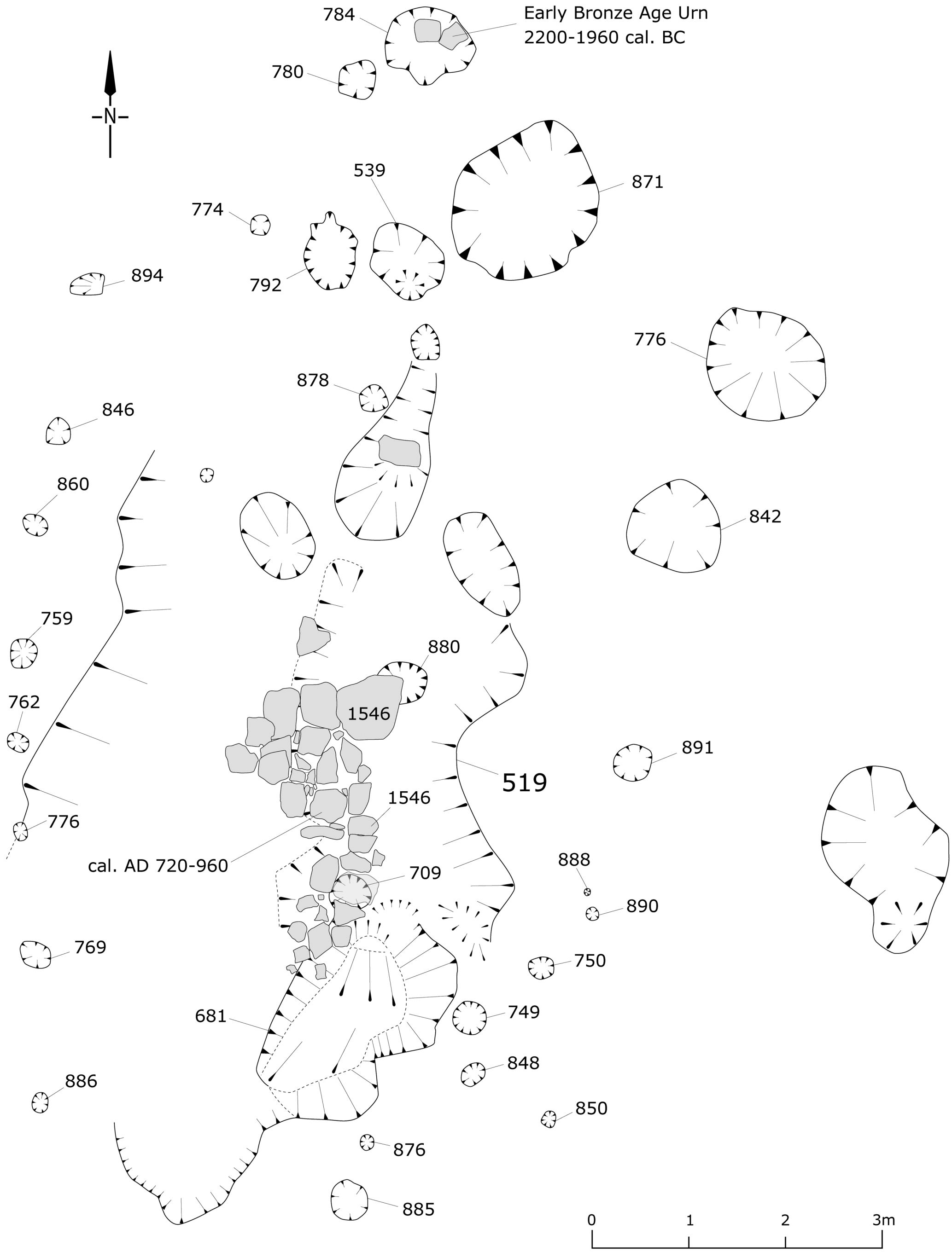

Fig. 3. Plan of Complex 6.

EARLY MEDIEVAL ACTIVITY

Complex 1

Complex 1 comprised a sharply defined, sub-rectangular hollow, *c.* 10m by 4m across, aligned NNE–SSW along its long axis, within which were the remains of two iron smelting furnaces (Figs 4 and 5). There were two distinct parts to the hollow, a northern part containing the furnaces measuring 7.5m × 4m and 0.3m deep and a southern part 4m × 3.5m and up to 1m deep, into which ran a narrow gully from the south. Pits, postholes and stakeholes were distributed across the whole of the bottom of the hollow. None of the features were visible until the accumulated silts within the hollow had been removed. The hollow and all associated features were cut into bedrock.

There was nothing to indicate that the accumulated layers of silt (1002, 1003, 1004, 1028, 1042 and 1054) within the hollow were anything other than natural deposition following its abandonment. A total of 22.7kg of iron slags and associated residues was recovered from these upper accumulated fills. Only the basal silt (1048), a thin silty-clay layer, may have been deposited following the excavation of the hollow and before construction of the furnaces, but this relationship was not certain. Pit 1039 (filled by 1043 containing 12.7kg of iron-working residues), 1m × 1.2m by 0.2m deep, cut through and destroyed part of furnace 1071, but apart from this there was no evidence to indicate that the hollow and features within it were not all broadly contemporaneous.

The two furnaces (1071, 1081) were similar in character, parallel, and approximately 1m apart; they seem to have been constructed as a pair (Fig. 6). Fills of the furnaces contained a total of 6.5kg of iron-working residues, mainly representing part of the iron slag produced during the last use of the furnaces, together with debris from their degradation. Few other contexts in Complex 1 contained iron-smelting residues, with these in total amounting to just 414g (21 pieces).

Furnace 1081 comprised a gully (1052) 1.5m long, 0.5m wide and 0.5m deep at its northern end where it was cut into the slope. Within the D-shaped pit at the northern end of the gully lay vertical blocks of stone associated with *in situ* slag. These blocks appear to be attempts to provide a firm blowing-wall for the furnace pit (Figs 6 and 7). Horizontal blocks, providing a firm floor, overlay slag flows and would therefore seem to represent refurbishment. Slag attached to the walls of the pit is suggestive of axial blowing from the north. No superstructure to the furnace survived, although two parallel lines of three stakeholes (1871, 1873, 1875 and 1877, 1879, 1881) to the north of the pit may have had a structural function, possibly mountings for bellows. It is not clear whether the vertical stones forming the straight blowing wall were original or whether they too were refurbishment. Slag deposit (1887) from the D-shaped pit contained flows fused to the underlying stone. In this instance the flows contained small tapped slag-like flows (6 pieces, 376g) and broad, flat-topped flows (5 pieces, 500g). One fragment of the flat-topped flow proved to be chemically related to tapped slag from pit 1039. Gorse or broom root wood from a thin layer of charcoal (1082) on the base of the gully (1052) produced a radiocarbon determination of cal. AD 770–1000 (Beta-222371). Layers (1037, 1053) of heat-affected clay, soil and charcoal overlay the charcoal (1082) and filled most of the gully, presumably representing accumulation following the last use of the furnace. Above them were similar layers overlying and spreading out beyond the extent of the gully (1028, 1042).

The gully (1079) of furnace 1071 was 2.0m long, 0.4m wide and 0.5m deep at its northern end where it was cut into the slope. Pit 1039 destroyed the central section of the gully. The fill (1038) of this pit contained charcoal, burnt clay and iron-working residues, as well as an upper quernstone (419). The 12.7kg of iron-working residues from pit 1039 appeared to be general waste and included smelting slags and smithing debris. The southern end of the gully was filled with a loose silty-clay with charcoal flecks (1078). The northern end of the gully widened into a heat-reddened, D-shaped pit, 0.55m across. This pit

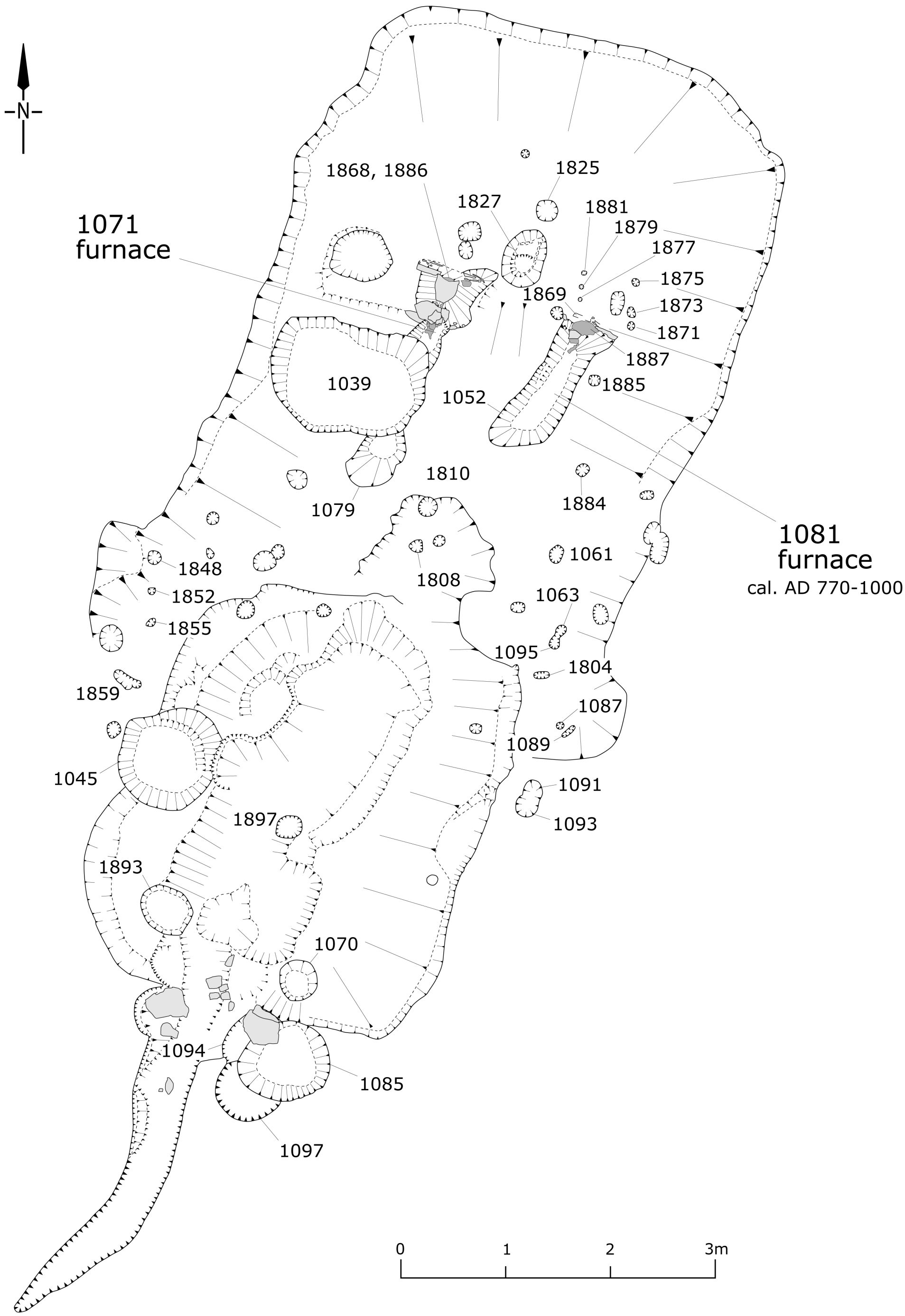

Fig. 4. Plan of Complex 1.

Fig. 5. General view of Complex 1 looking north. Scales 1m.

Fig. 6. View of furnaces 1071 and 1081 looking north. Scales 1m and 0.5m.

was similar in character to that of furnace 1081 in that it contained upright stones fused with slag (1868, 1886) on its northern side forming a blowing wall and horizontal stones overlying earlier slag flows. Again, slag attached to the pit wall suggests blowing from the north. A group of stones on the south side of the pit overlay a slag flow and probably represents a collapsed tapping arch. The *in situ* slag (1868, 1886) included a significant quantity (1.7kg, 91 pieces) of flowed slags in small horizontal flows and prills, as well as a smaller quantity (734g, 86 pieces) of highly fragmented vesicular slag. This is strongly suggestive of a 'within-furnace' assemblage; such assemblages may be raked out through the furnace arch and deposited in the tapping pit. A loose silty-clay (1830, 1853) with a distinct circular layer of charcoal (1067) 0.15m in diameter filled the upper levels of the pit above the stones and slag.

Charcoal analysis from several contexts associated with the furnaces indicates that faggots or charcoal of gorse or broom were used as a fuel. A study of the plant macrofossils demonstrated the presence of grains of oats and barley in several contexts, with a little barley chaff and a few weed seeds, suggestive of the burning of domestic waste, but the use of the furnaces as corn dryers as well as for iron smelting cannot be ruled out.

A line of five, small and irregularly spaced postholes (1808, 1810, 1825, 1827, 1897) ran down the centre of the hollow. Their average size was 0.12m in diameter and 0.15m deep, with 1827 a little larger with dimensions of 0.5m × 0.3m, but of a similar depth to the others. A line of stakeholes and small postholes (1061, 1095, 1804, 1087, 1089, 1091, 1093, 1884, 1885) lay along the eastern side of the hollow, and a shorter alignment along the western side (1848, 1852, 1855, 1859). A pair of similar-sized postholes (1070, 1893), 0.25–0.30m diameter and 0.30m deep, lay at the southern end of the hollow, *c.* 0.80m apart. Other stakeholes and small postholes in the hollow formed no obvious pattern. Several

Fig. 7. Detailed view of furnace 1081 showing the blowing wall, slag flows above and below floor stone and stakeholes of a possible bellows' mountings. Scales 0.5m.

shallow pits (1045, 1085, 1094, 1097) in and around the hollow had no obvious function. A honestone (427) was found in posthole 1093.

The gully leading down into the hollow from the south and running between the pair of postholes (1070, 1893) was probably caused by erosion, rather than deliberately created. However, two terraces on the west side of the gully had been cut and had had flat stone slabs placed on them, seemingly functioning as steps.

Complex 1 is interpreted as representing the remains of an iron-smelting workshop that was possibly also used for corn drying that is dated by a single radiocarbon determination to the late eighth century AD to the end of the tenth century AD. The two furnaces were slag-tapping furnaces, of a slightly unusual form, with a straight blowing wall reinforced with vertical slabs of stone. Further stonework in furnace 1071 indicates the presence of a collapsed tapping arch. The bases of the furnaces were extended as a gully to the south as tapping pits. Both furnaces were blown axially from the uphill, northern side, contrasting to the more usual arrangement of blowing from a direction perpendicular to the tapping arch. Both furnaces had been refloored. They had been clearly built as a pair, and would have operated in tandem to ensure continuous production. The large amount of slag in the upper fills of the hollow was deposited after the furnaces had gone out of use and probably derived from eroding spoil heaps situated close by.

It is likely that a line of posts would have run down the centre of the hollow supporting a ridgepole. It is unclear whether this ridgepole was one element of a building, for which little other evidence survives, or whether moveable hurdles leant against it to provide shelter and shade. The case for a more substantial building is strengthened by the well-defined hollow, indicating a rounded-corner, rectangular structure 10m × 4m across, and by the presence of the pair of postholes forming what seems to be an entrance in the south end wall. Against the argument for a building are the two lines of small postholes or stakeholes within the hollow; these seem to represent light fences, something that would not have been required within a substantial building, but may have been necessary in a more makeshift structure as protection from the wind.

Complex 2

This complex lay immediately to the east of Complex 1 and consisted of a single elongated hollow (1006) approximately 2m long (NNW–SSE), up to 1m wide and a maximum of 0.13m deep (Fig. 2). It contained a homogenous silty-clay fill, within which was one piece (264g) of iron slag. It appeared to be aligned with Complexes 5 and 9 to the south-east. No function can be assigned to it.

Complex 3

Complex 3 comprised a small group of pits and postholes somewhat isolated to the west of the other complexes. An elongated oval pit (907) was the largest feature in the complex, measuring 1.7m × 0.7m across and 0.2m deep. Its fill mostly comprised a silty-clay and stones, which sealed a thin basal layer (909) of charcoal. This carbonised material consisted primarily of oat grains, one of which yielded a radiocarbon dated of cal. AD 980–1150 (Beta-255068). A small but deep posthole (916), 0.3m diameter, 0.6m deep, contained carbonised oat and barley grains, plus weed seeds. Other features in this complex consisted of two small postholes (992, 940) and two shallow pits (927, 935).

It is possible that pit 907 represents the base of an early medieval or medieval corn dryer, dating from the late tenth to the mid twelfth century AD, but given that there is no evidence for heating on the edges or base of the pit this interpretation is tentative.

Complex 4

This complex consisted of an amorphous, shallow hollow (1626), destroyed on its north-eastern and eastern sides by modern disturbance (1020), and containing a group of pits, postholes and stakeholes (Fig. 8). A significant quantity of iron slags (10.4kg), similar to that from the upper fills of Complex 1, was found in one of the upper fills (1037, 1083) of the hollow.

Below the upper fills (1037, 1083) of the hollow a layer of stone slabs and other stones (1601, 1602) were bedded on a thin silty-clay (1069) and formed a rough surface approximately 2.2m by 3.2m across. The thin silty-clay layer 1609 lay directly on the bedrock bottom of the hollow. A radiocarbon determination of cal. AD 900–1030 (Beta-255070) was obtained from a carbonised wheat grain from this layer. Barley and oat grains were also found in it, as well as two honestones (436, 438). Interspersed with the larger stones of the rough surface were patches of pebble metalling (1603); further patches of this metalling lay outside the hollow on bedrock to the north and west. An upper quernstone (430) had been incorporated into the rough stone surface and two honestones (424, 431) and a rubbing stone (437) were found in an upper fill (1083) of the hollow.

Cut into the bedrock at the base of the hollow were a group of similar sized postholes (1529, 1531, 1535, 1579, 1613,1615, 1619, 1625) on average 0.15m diameter and 0.20m deep, although 1613 was more substantial at 0.80m across and 0.35m deep. Postholes 1529, 1531 and 1613 had clear post-pipes. Feature 1543 was a shallow pit, 0.13m deep, with a small stakehole (1623) in one side. The postholes formed no obvious pattern.

This complex is early medieval in date, based on the limited artefactual evidence and a single radiocarbon date which indicates a date range of the tenth century AD through to the early eleventh

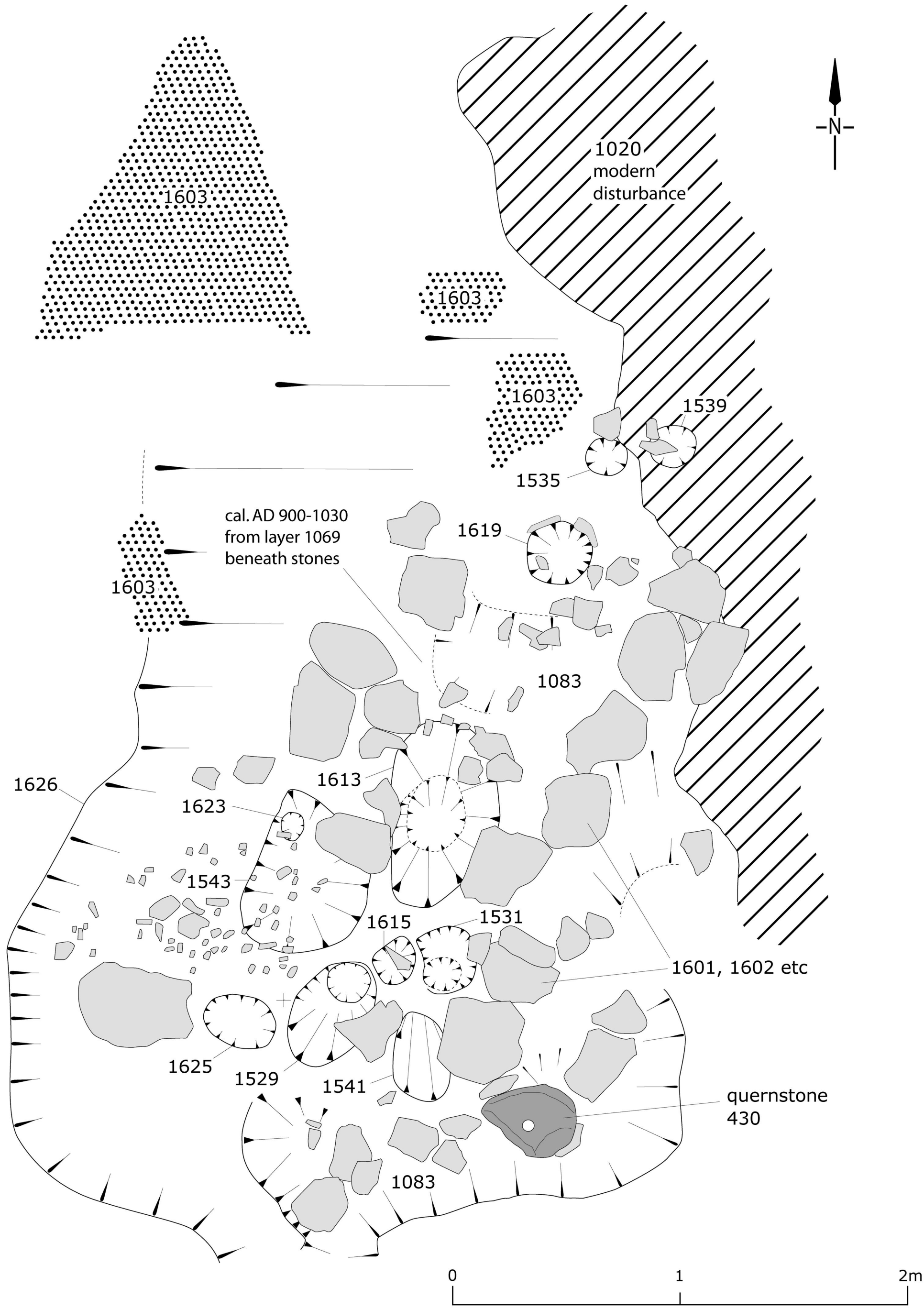

Fig. 8. Plan of Complex 4.

century. Little can be said about the group of postholes and other features within the hollow (1626), as they did not form part of an obvious structure, and formed no obvious relationship with the rough stone surface. There is no structural evidence to indicate that a building surrounded the stone surface, but the positioning of the stones in a rough rectangle suggests that it might have been part of a built structure. As noted above, it is unclear what role, if any, the group of postholes may have played in such a structure. The relatively large amount of iron slag in the upper fills of this complex was probably a result of the erosion of nearby spoil heaps formed from iron-smelting residues from the furnaces in Complex 1. There was no evidence for metalworking actually having taken place in this complex.

Complex 5

This complex was of a similar shape to Complex 2 lying to its north-west. It was also on the same NW/SE alignment as Complex 2 and Complex 9 (Fig. 2). Essentially it consisted of a shallow, elongated hollow (1016), 3.2m × 1m across and 0.1m deep (Fig. 9). The hollow was filled with a silty-clay with four, flat stone slabs (1606) lying on the bedrock at its northern end. Two small postholes (1018, 1604) had been cut into the base of the hollow, with a further one (1022) situated outside the hollow to the north. A small,

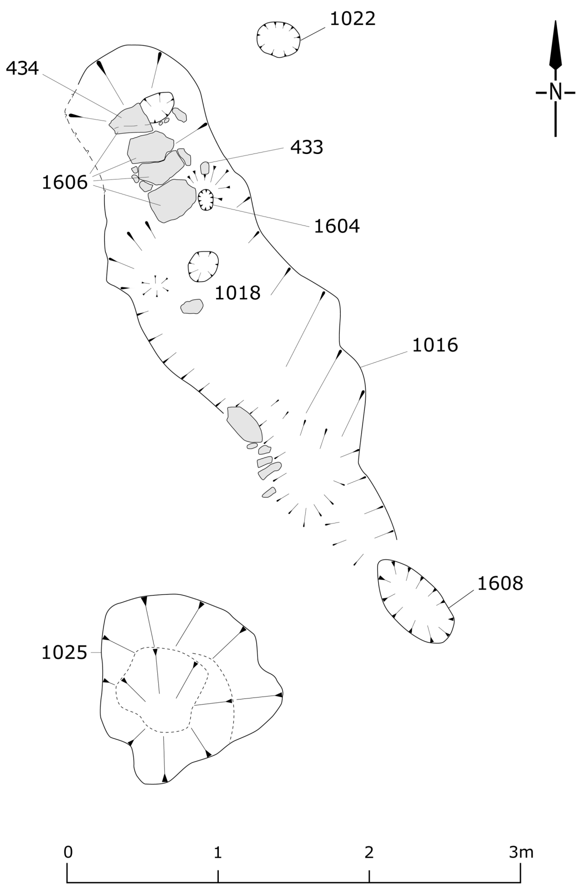

Fig. 9. Plan of Complex 5.

shallow (0.1m deep) pit (1608) lay at the southern end of the hollow, and a second larger pit (1025), 0.2m deep, lay immediately to the south-west. There was no dating evidence from any context or any evidence to indicate function.

Complex 6

In addition to the evidence for prehistoric activity described above, the main part of the complex comprised a shallow (0.2–0.3m deep) amorphous hollow (519) and associated postholes and pits. Removal of the upper fills (509, 517, 515, 518) of the hollow, which were silty-clays with charcoal fragments and two pieces of iron slag (324g), revealed a roughly L-shaped setting of large stone slabs (1546) located in the approximate centre of the hollow (Figs 3 and 10). The stones had been laid to form a flat surface *c.* 3m north–south with a maximum width 1.8m east–west. A charcoal rich and in places heat-reddened soil (543) filled the gaps between these stones, partly overlay them and spread *c.* 1m either side to the west and east. Charcoal from this layer returned a radiocarbon determination of cal. AD 720–960 (Beta-222369). Over the southern end of the stone slabs, a layer of burnt clay with charcoal (623) was sealed by layer 543 and overlay a charcoal-rich layer (624); the latter layer resting directly on the stones. Low concentrations of barley and oat grains were present in layer 623 and 624. Charcoal analysis of layer 543 and 624 showed that oak was the dominant species. The stone slabs sealed two postholes (709, 880) and a shallow pit (681), which were cut into bedrock, as were all other pits and postholes.

Three shallow pits (539, 792, 871), all less that 0.15m deep, lay to the north of the stone spread; the largest of these (871) contained fills (870, 872) of burnt clay, charcoal and heat-reddened soil, with a macrofossil assemblage including barley and oats. A shallow gully running north–south and lying to the south may be associated with pit 871. It was unclear during excavation whether this gully or other shallow depressions in and to the east of hollow 519 were shallow pits, slightly deeper areas of 519 or natural features. These features are not numbered on Figure 3. Patches of heat-reddening were evident on the sides and bottoms of some of these pits or depressions and across the bottom of the main hollow (519).

A series of evenly spaced (0.6–0.8m apart), similar-sized, small postholes (759, 762, 769, 774,776, 846, 860, 886, 894) with an average diameter of 0.15–0.20m and 0.12–0.15m deep formed a curving north–south line along the outer, western edge of the hollow. A less obvious line of postholes (749, 750, 848, 850, 876, 885, 888, 890, 891) of comparable size to the above lay to the south-east side of the hollow. Four postholes (709, 780, 878, 880)—slightly larger than those described above at c. 0.25m diameter and 0.20–0.25m deep—positioned between 2.3–3.0m apart, formed a rough line along the north–south axis of the hollow. Posthole 885 to the south may have been included in this line.

The features associated with Complex 6 are interpreted as representing a possible domestic building, likely to have been of more than one phase, and, on the basis of a single radiocarbon determination, dating from the early eighth century AD to the mid tenth century. A line of postholes (709, 780, 878, 880 and possibly 885) running north–south through the centre of the hollow could have supported a ridgepole, in a similar manner to that suggested for Complex 1, but this must have gone out of use prior to the construction of the stone surface. The line of postholes on the western side of the complex and those on the south-east side are firmer evidence for a structure, possibly a slightly bow-sided building *c.* 11m north–south and 6m east–west. It was not possible to determine whether the postulated central ridgepole and curving line of postholes were part of the same phase of structure, or whether one replaced the other. A layer of burnt clay and charcoal over the southern end of the stone surface appears to have been a hearth or furnace, as does pit 871 within or just outside this building. The small amount of plant remains associated with this complex was probably derived from these hearths or furnaces suggesting a domestic context. It is of interest to note that the possible Bronze Age hearth 784, noted above, is in a similar

Fig. 10. General view of Complex 6 looking south. Scales 1m.

position in relation to the building—3 to 4m axially to the north—as the hearths are to the possible early medieval buildings in Complexes 9 and 11. This may support the hypothesis already suggested that the urn and cereal grain from which the radiocarbon date was obtained were in a residual context and suggests that hearth 784 was contemporaneous with the domestic building in this complex.

Complex 7

Complexes 7 and 8 merged into each other making it impossible to allocate many of the small pits, postholes and stakeholes to an individual complex. However, the main elements of the complexes (four pits likely to have been corn dryers in the case of Complex 7, and a building surrounding a hollow in Complex 8) were sufficiently different to justify separate descriptions.

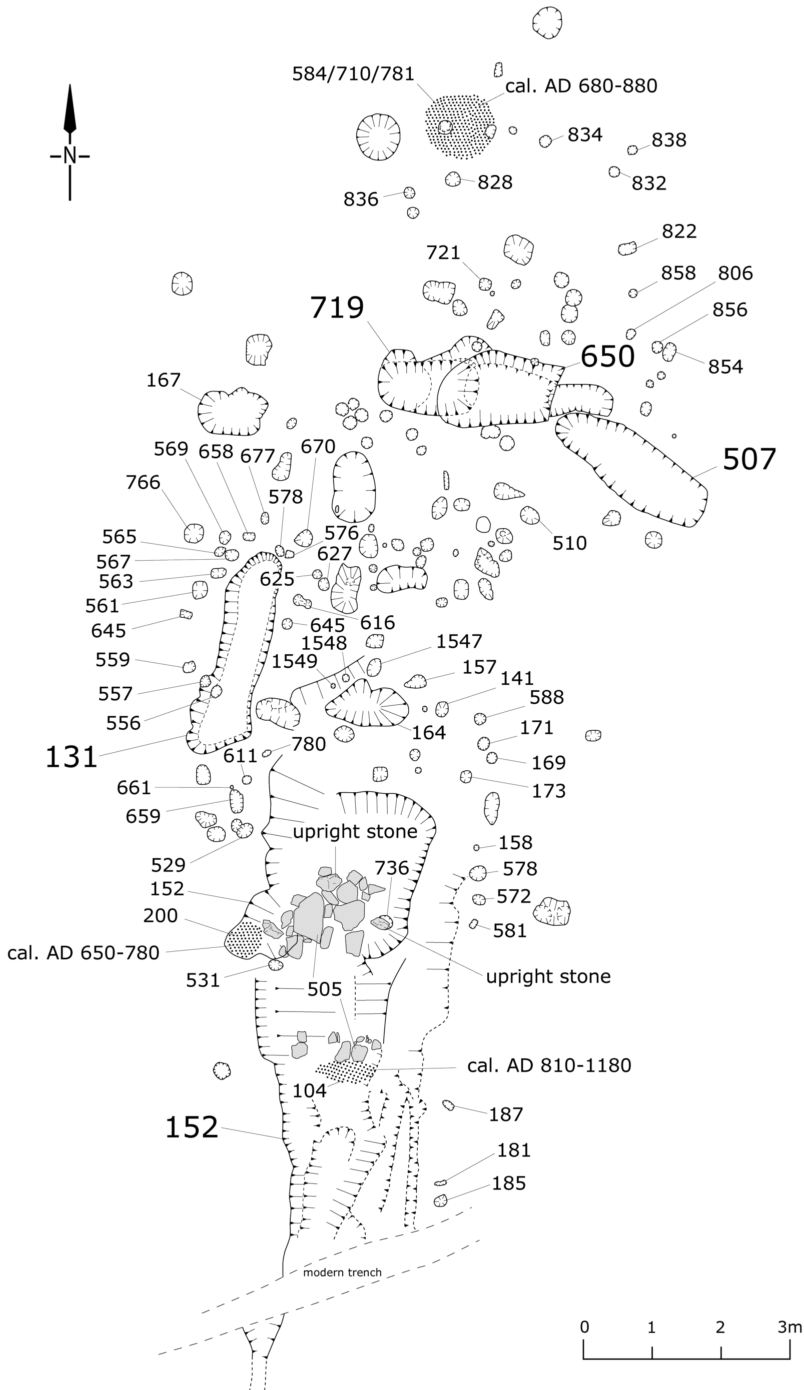

Fig. 11. Plan of Complexes 7 and 8.

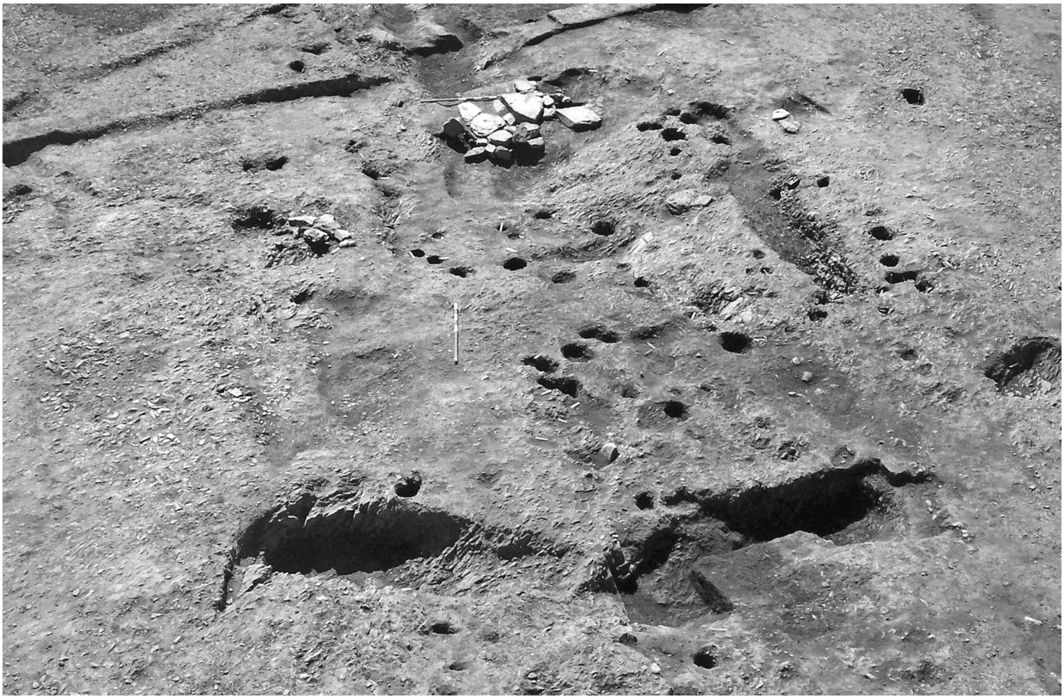

Fig. 12. General view of Complexes 7 and 8 looking south. Scales 1m.

The main elements of Complex 7 (Figs 11 and 12) were four elongated pits, (131, 507, 650, 719). Pit 131 was aligned north–south along its long axis and was a little separated from the other three pits, which were aligned roughly east–west. Pit 650 post-dated pit 719, and it is likely that pit 507 post-dated 650, but this relationship could not be confidently demonstrated. A quantity (1.1kg) of clinker-like slags was recovered from mostly the upper fills of these pits. Analysis has demonstrated that these are fuel-ash slags, and that they were derived from contaminants (a quartz-rich sand, probably a component of soil) brought in with the fuel, and were not a product of metallurgy.

Pit 131 was 3.2m long north–south, 0.7m wide and sloped down from the ground surface at its southern end to a maximum 0.45m deep at its northern end, where it was vertically-sided and flat-bottomed (Fig. 13). It was filled with layers of silty-soil, some of it heat-reddened, and contained flecks of charcoal and occasional charcoal-rich lenses. Analysis of a distinct but thin layer of charcoal (140) lying along the base of the pit showed that oats dominated the plant macrofossil assemblage. Some of the bedrock sides and base of the pit were heat-reddened. An arc of 19 small postholes (556, 557, 559, 561, 563, 565, 567, 569, 576, 578, 616, 625, 627, 645, 658, 670, 677, 766), average size 0.2–0.25m diameter and 0.15–0.2m deep, curved around the west side, north end and east side of pit 131. Postholes 556 and 557 were cut into the sides of the pit, but they were not detected until the removal of the entire pit fills. A group of postholes to the south may have been associated with Complex 8 rather than pit 131 and are therefore described later.

Pit 719 was vertically sided and flat-bottomed, 1.25m east–west, 0.75m north–south and 0.5 deep, although its eastern end had been nearly destroyed by the excavation of a later pit (650). A thin layer of charcoal (707) covered the bottom of the pit, above which was a stony silty-clay, probably deliberate

Fig. 13. Corn dryer 131 looking north during excavation, showing charcoal layer on bottom of pit. Scale 0.5m.

backfilling. Cereal grains in layer 707 were mostly oats with some barley. The pit was sealed by a silty-clay containing charcoal (637), analysis of which showed that the plant macrofossil record was dominated by barley.

The bottle-shaped pit (650) was filled by several layers, some comprising large amounts of carbonised material, representing gradual accumulation rather than deliberate backfilling. The main body of the pit was vertically-sided and flat-bottomed, 1.7m long east–west, 1m wide and 0.4m deep. The 'neck' at the east end was shallower (0.12m), narrower (0.4m) and 1m long. Analysis of a thin, charcoal-rich layer (642) lying on the bottom of the pit showed that oat was the main cereal present with some barley. Above 642 was a 0.1m thick layer of silty-clay then another thin charcoal deposit above which were more layers of silty-clay.

The long axis of pit 507 was aligned north-west to south-east. It was 2.5m long, 0.9m wide, with the bottom sloping down from the north-west to a maximum depth of 0.5m. The upper, 0.1m thick, fill of the pit sealed a thin charcoal-rich lens (198). This overlay a silty-clay and stones and included a lump of heavily heat-reddened clay mixed with charcoal (199), which may have been fired *in situ*. This layer sealed a 0.1m thick charcoal-rich deposit (508) resting on the base of the pit. Analysis of the charcoal-rich fills of pit 507 showed that lower fill 508 had a high percentage of oats compared with barley, but upper fill 198 was dominated by barley with few oat grains.

A small layer of burnt grain and charcoal (584,710,781) lying in a shallow hollow in the bedrock towards the northern edge of the complex comprised mainly barley grains with some oats, with oak the dominant woody species. A radiocarbon determination of cal. AD 680–880 (Beta-222370) was obtained from a barley grain from this layer. It sealed two small postholes.

Clusters of small postholes and shallow pits lay to the south and north of pits 507, 650, 719. Most of these formed no clear pattern, although a line of postholes (806, 822, 832, 838, 852, 854, 856, 858, 874) along the east side of the complex may have been part of a fence or wall. They formed a right-angle with a second, shorter posthole alignment (828, 836 834, 838). A honestone (413) was found in the fill (720) of posthole 721, to the north of pit 719. Other features are not described in detail apart from the following, which had charcoal-rich fills and were therefore examined for plant macrofossils. A quantity of charred barley was obtained from the fill (166) of shallow pit 167, and from a layer (510) filling a shallow hollow. An absence of cereal grains from the fill (755) of a small pit (756 not shown on plan) lying midway between Complexes 6 and 7 indicates that this feature is probably not associated with the corn dryers. A honestone (414) was found in the fill of this pit.

It likely that features 131, 507, 650 and 719 were early medieval corn dryers, dated from a single radiocarbon determination to the late seventh to late ninth century AD. The radiocarbon determination was obtained from a deposit likely to be of residues from cleaning out one of the dryers. The pits had broadly similar dimensions and were comparable in character. Barley and oats were being dried or otherwise processed. There was little to indicate how they would have functioned; the only evidence for a possible superstructure was the arc of postholes around the northern end of corn dryer 131. Posts in this arc may have supported a wattle and daub chimney over the dryer.

The presence of similar plant macrofossil assemblages in the surrounding deposits, small pits and postholes to those found in the dryers suggests that these features and the dryers were contemporaneous. Little else can be said about the pits and postholes except to comment that the two alignments of postholes to the north of corn dryers 507, 650, 719 may indicate fence lines or even two sides of a light, rectangular timber building.

Complex 8

Complex 8 comprised a roughly rectangular-shaped hollow (152) approximately 3m wide east–west and over 6m long north–south (Figs 11 and 12). Its exact length was difficult to ascertain as at its southern end it faded out rather than abruptly terminated. It achieved a maximum depth of 0.5m towards its northern end.

Intermixed silty-clays, some containing high percentages of charcoal, filled the upper part of hollow 152. Eight pieces of iron slag (121g) were found in these fills and three honestones (453, 454, 460) were found in two of these silty-clays (127 and 146). Removal of the upper fills revealed a group of stone slabs and more rounded stones (505) forming a rough surface. Two upright stones were incorporated into the surface, as well as a worked stone that may have formed part of an ard or plough (412). A smaller group of similar stones lay to the south of the main group. A layer of almost pure charcoal (200) lying to the west of the stone surface was dated to cal. AD 650–780 (Beta-198851), and a charcoal rich layer (104) partly overlying the south end of the stones returned at date of cal. AD 810–1180 (Beta-198850). Both these layers were excavated during the evaluation, and at this stage the carbonised wood samples used for radiocarbon determination were not identified. There was no evidence for heat reddening of the stones in the stone spread or on the sides and bottom of the hollow following the removal of the stones.

Removing stones 505 revealed two postholes (531, 736) both 0.2m in diameter and 0.07m and 0.18m deep respectively. An arc of small postholes (141, 157, 158, 169, 171, 173, 529, 572, 578, 581, 588, 611, 659, 661,780, 1547–49), with an average size of 0.15–0.2m diameter and 0.12–0.18m, ran around the whole northern end of hollow 152, with a possible continuation down the south-east side (181, 185, 187). Other postholes and shallow pits (such as 164) possibly associated with this complex formed no obvious pattern and had no clear function, although a shallow, straight gully on the east side of the hollow may have been structural, perhaps supporting a light fence.

Complex 8 is interpreted as a building of early medieval to medieval date, not dissimilar to that in Complex 6 in that it was probably domestic and likely to have been of more than one phase. The two radiocarbon dates obtained from the building do not overlap when calibrated at two standard deviations. These dates were obtained from unidentified mixed charcoal, possibly containing old wood. They, therefore, could be earlier than would have been obtained from, for example, a single cereal grain. It is likely that the two postholes (531, 736) cut into the bottom of the hollow (152) served a structural function, perhaps supporting a light roof or shelter. The arc of postholes around the northern part of the hollow is, however, better evidence for a building. These postholes indicate a building with a curved northern end. The length of this building is unclear, but it was at least 3.6m north–south, and possibly much longer. It was not possible to ascertain whether the two postholes in the bottom of the hollow and those comprising the arc were contemporaneous, or represent two phases of activity.

It is likely given the proximity of the corn dryer (131) to the building delineated by the arc of postholes around the northern part of the hollow (152) that the two would not have coexisted. However, the three corn dryers several metres to the north and the building could have been contemporaneous.

Complex 9

The complex (Figs 14 and 15) consisted of two unrelated elements, a shallow, linear hollow (1512) containing a rough stone surface, and a hearth (1503). It seems likely that the upper levels of these two elements were lost prior to excavation and that they may have originally been connected. Patches of heat-reddened soil or bedrock with charcoal flecks were evident all around this complex. A shallow pit (1509) to the east may not have been associated with this complex.

The linear hollow (1512), aligned NNW–SSE along its long axis, was 4.5m long and up to 1.4m wide. It was filled with mostly flat stones (1504), although some rounded boulders were present, forming a rough surface. A quernstone (432) was incorporated into the surface. The stones were bedded onto a thin soil layer, from which charcoal, identified as alder or hazel, produced a radiocarbon date of 1380–1120 cal. BC (Beta-255067).

The hearth (1503) lay on the axis of the hollow, 3.5m to the north, and was set in an ill-defined shallow, bowl-shaped pit. It comprised several stone slabs, some set on edge, defining a roughly circular area *c.* 0.65m across, within which was a patch of heavily heat-reddened soil and charcoal (505). The stones were set in loose soil (1513), from which a barley grain was dated to cal. AD 890–1030 (Beta-255071). Oat as well as barley grains and weed seeds were present in deposits in the hearth.

The prehistoric radiocarbon date from beneath the stone spread in the hollow must be from residual charcoal, as although it is not possible to accurately date the quernstone, it is of an early medieval type, and therefore the hearth and the stone spread are likely to be broadly contemporaneous. Very few other interpretative comments can be offered except to note that the remains of this complex could be the last vestiges of a sunken floor building similar to that in Complex 11, albeit less well preserved. A contemporary relationship between the hearth (1503), which returned a late ninth to early eleventh century AD radiocarbon date and the possible building is of interest, as a similar relationship was recorded between the hearth or furnace and building in Complex 6 and between the hearth and possible building in Complex 11.

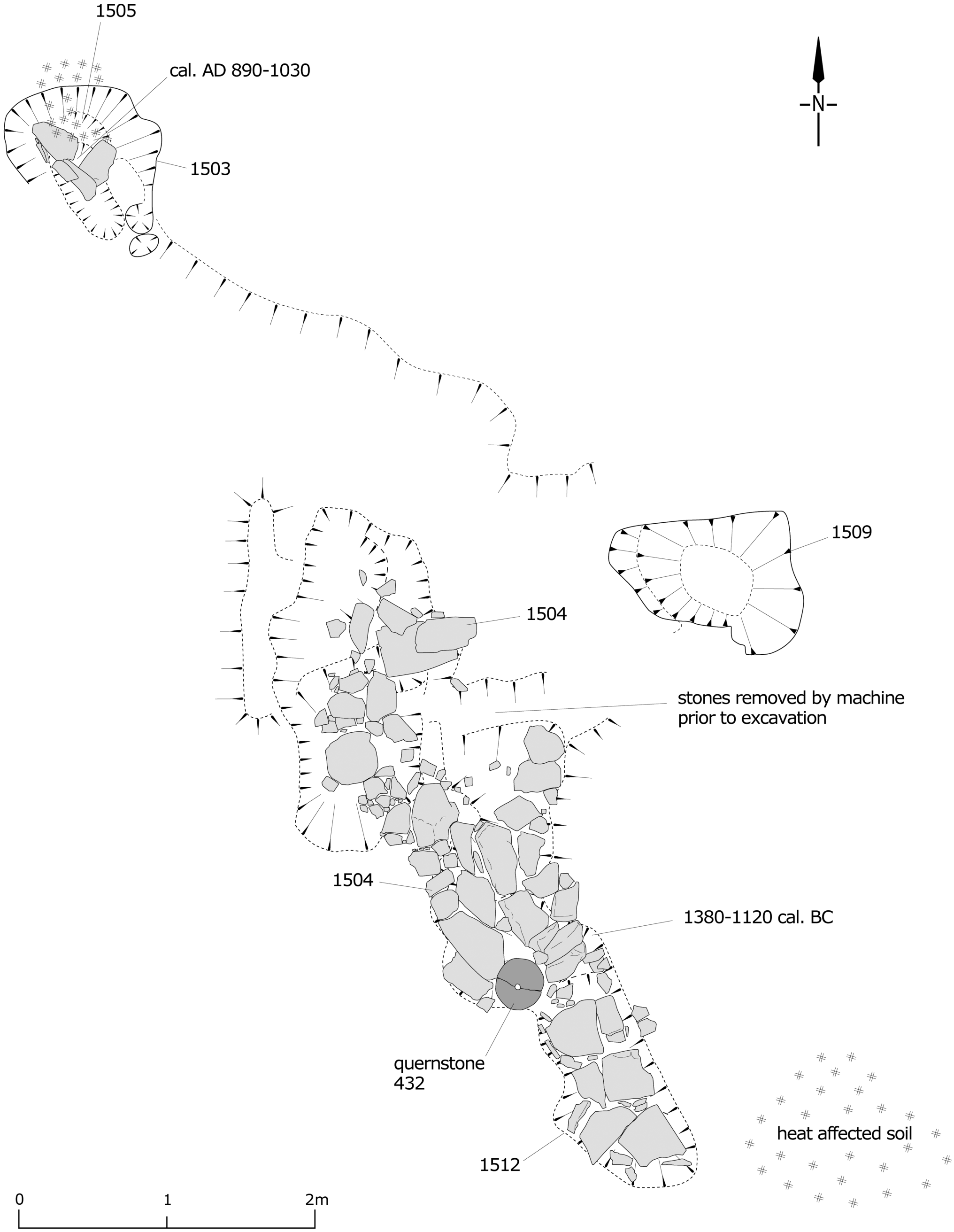

Fig. 14. Plan of Complex 9.

Fig. 15. General view of Complex 9 looking south. Scale 1.

Complex 10

This complex consisted of a small group of substantial postholes, some smaller postholes and a shallow hollow (Fig. 16). The larger postholes (903, 905, 914, 918, 925, 933, 937) were all of similar size, 0.8m diameter and 0.30m deep, and the smaller ones (912, 920, 939, 948, 923) averaged 0.2m diameter and 0.1–0.2m deep. The shallow (0.12 deep), amorphous hollow (931) contained a silty-clay fill with a little charcoal. These features form no obvious pattern. A radiocarbon determination of cal. AD 1010–1170 (Beta-255066) was obtained from a cereal grain from the fill of pit 905, and an identical date when calibrated of cal. AD 1010–1170 (Beta-255065) was obtained from a cereal grain from pit 937. A perforated shale object was found in pit 937. Analysis of the plant macrofossils from postholes 937 and 914 revealed low levels of domestic waste, including oats, barley and a grain of wheat.

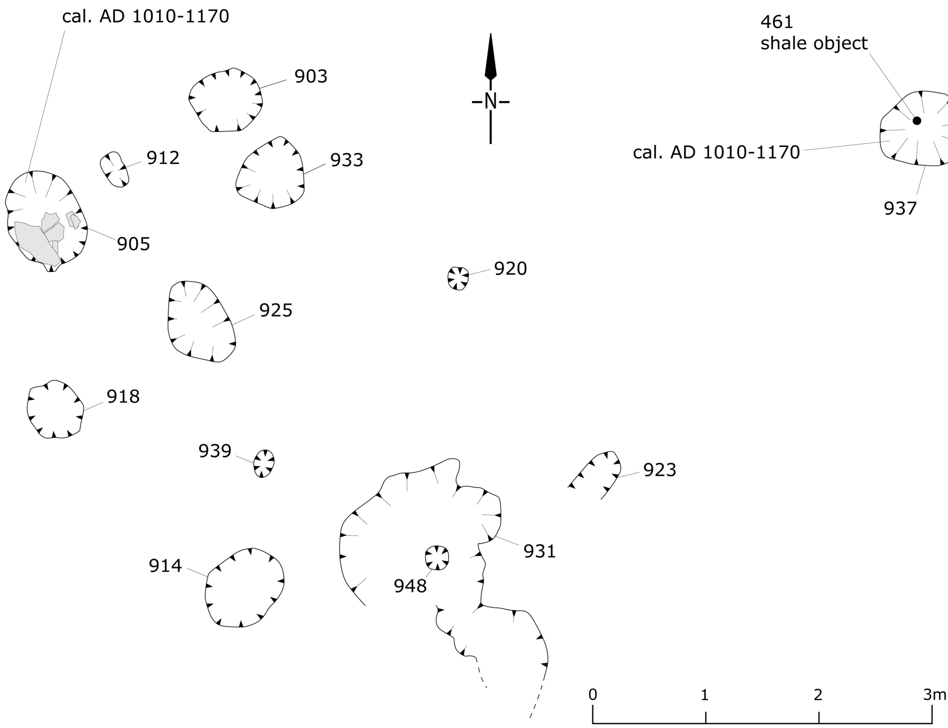

Fig. 16. Plan of Complex 10.

The two radiocarbon dates indicate that this complex is early medieval to medieval in date (early eleventh to late twelfth century AD). The more substantial postholes of this group would have held large timber posts, compatible with supporting a building. However, they formed no clear pattern and therefore without additional evidence the presence of a building cannot be confidently demonstrated.

Complex 11

This complex consisted of a rough stone surface (963) laid in a hollow excavated or worn (964) into soft bedrock, with associated pits, postholes and gullies (Figs 17 and 18). Several modern service trenches had destroyed parts of this complex. The stones (963), which lay beneath a thin layer of silty-clay (962, in which worked a stone (417) possibly from an ard or plough, was found), consisted mostly of very large slabs, up to 0.9m × 0.5m, laid to form a rough surface approximately 8.5m NNW–SSE and up to 1.6m east–west. A quernstone (418) had been reused in this surface. The stones towards the southern end of the surface were heavily heat-reddened. A thin layer of silty-clay soil lay beneath the stones. A slightly deeper area (1131) of the hollow, possibly a separate pit, contained a charcoal rich soil (1130, 1134), probably burnt domestic waste, from which an oat grain returned a radiocarbon determination of cal. AD 890–1030 (Beta-255064). A honestone (435) was found in fill 1130.

A pit (946) lay on the NNW–SSE axis of the stone surface, approximately 5m to the NNW. It had heavily heat-reddened sides, and contained heat-affected stone in its charcoal-rich fill (945). Analysis of the plant remains in the charcoal suggested burnt food waste. It is probable that this feature was the remains of a hearth.

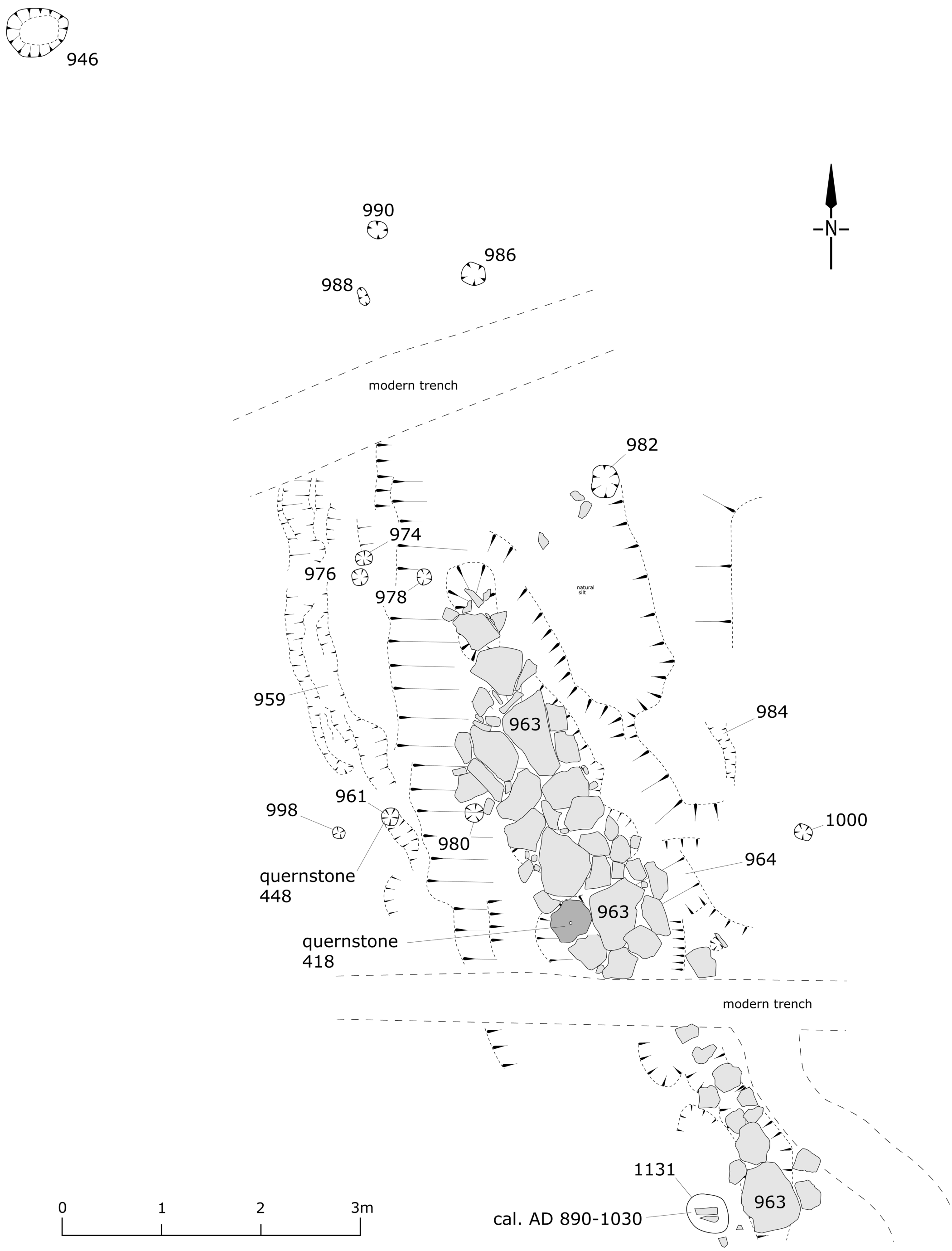

Fig. 17. Plan of Complex 11.

Fig. 18. General view of Complex 11 looking south.

A 4.5m long, shallow curving gully (959), along the west side of the hollow, contained a posthole (961), one of the packing stones of which was a reused quernstone (448). A very short section of a similar gully (984) lay on the eastern side of the hollow. Other shallow postholes (974, 976, 978, 980, 982, 988, 986, 990, 998, 1000) around the edges of the hollow formed no obvious pattern.

These remains are probably of a slightly bow-sided building, 3.5m east–west and at least 9m long, dating, on the basis of a single radiocarbon date, to the late ninth to early eleventh century AD, with the narrow gullies (959, 984) to the sides of the stone surface foundation trenches for timbers. The plant remains and quernstones are indicative of a domestic context. As with Complex 9, only the last vestiges of the building remain and it is unclear what relationship pit 946 had to the building.

Complex 12

This complex had been cut away on its south side by a roadside ditch and a service trench (Fig. 19). It consisted of a shallow (up to 0.2 deep) hollow (1108) containing several postholes. The postholes (1112, 1115, 1117, 1119, 1121, 1123, 1129) averaged between 0.2–0.3m diameter and 0.2–0.3m deep, although posthole 1119 was slightly larger. The fill (1120) of posthole 1121 contained a honestone (443). A group of flat stones (1109) lay towards the western side of the hollow. There were no charcoal deposits or slag associated with this complex, or evidence of heat reddening.

Very little can be said about this complex. There was no dating evidence and no indication of function. The postholes were large enough to support a structure, but they formed no clear pattern.

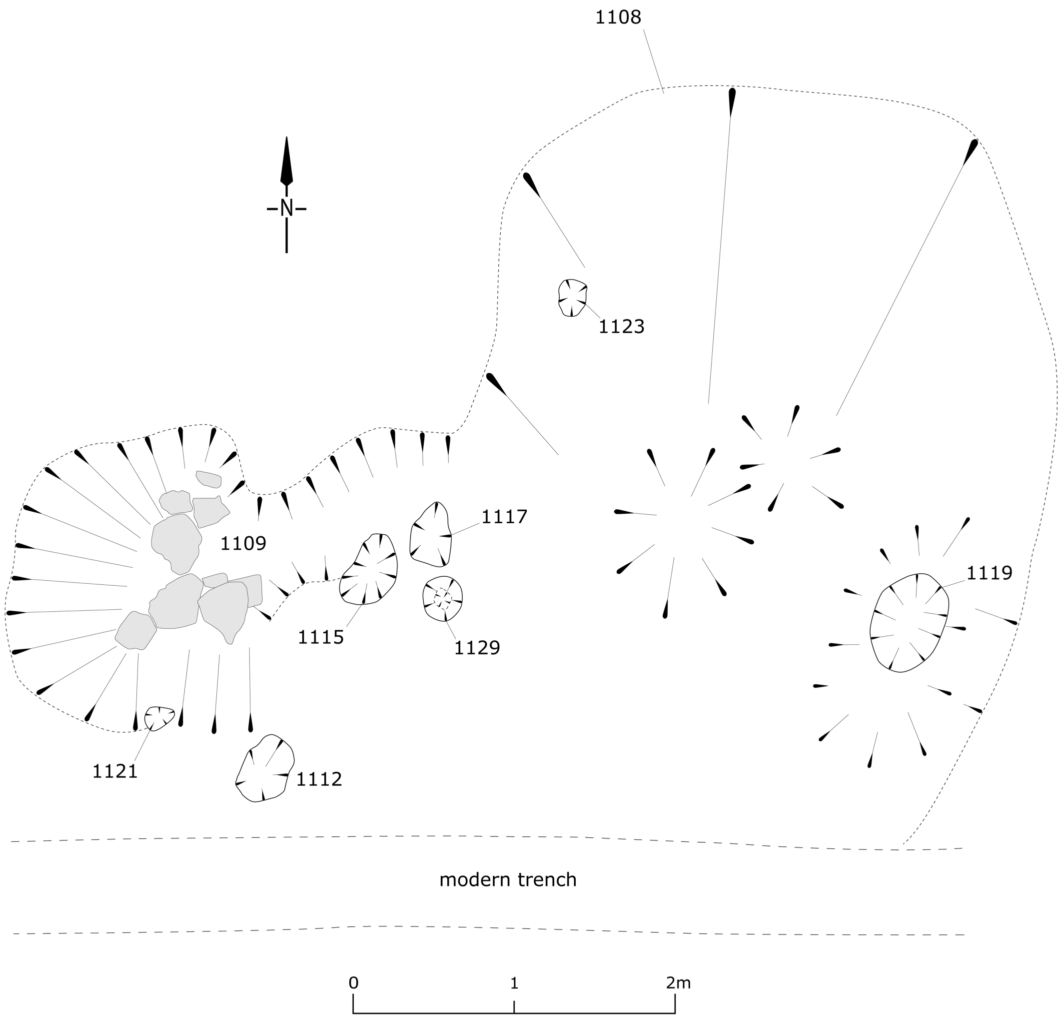

Fig. 19. Plan of Complex 12.

Complex 13

This was similar to Complex 12, in that it had been partly destroyed on its south side and consisted of a shallow hollow (1150) and associated postholes (Fig. 20). The hollow, which was up to 0.4m deep, was filled with a silty-loam (969, 1143, 1170) containing a little charcoal and slag, with a group of flat stones (1192) resting on the bottom of the hollow towards its northern end. Three honestones (444, 456, 458) were found in fill 969. Wood charcoal from the fill (1143) was dated to cal. AD 720–960 (Beta-222368). Charcoal used for dating was recovered during evaluation, and at this stage the wood species were not

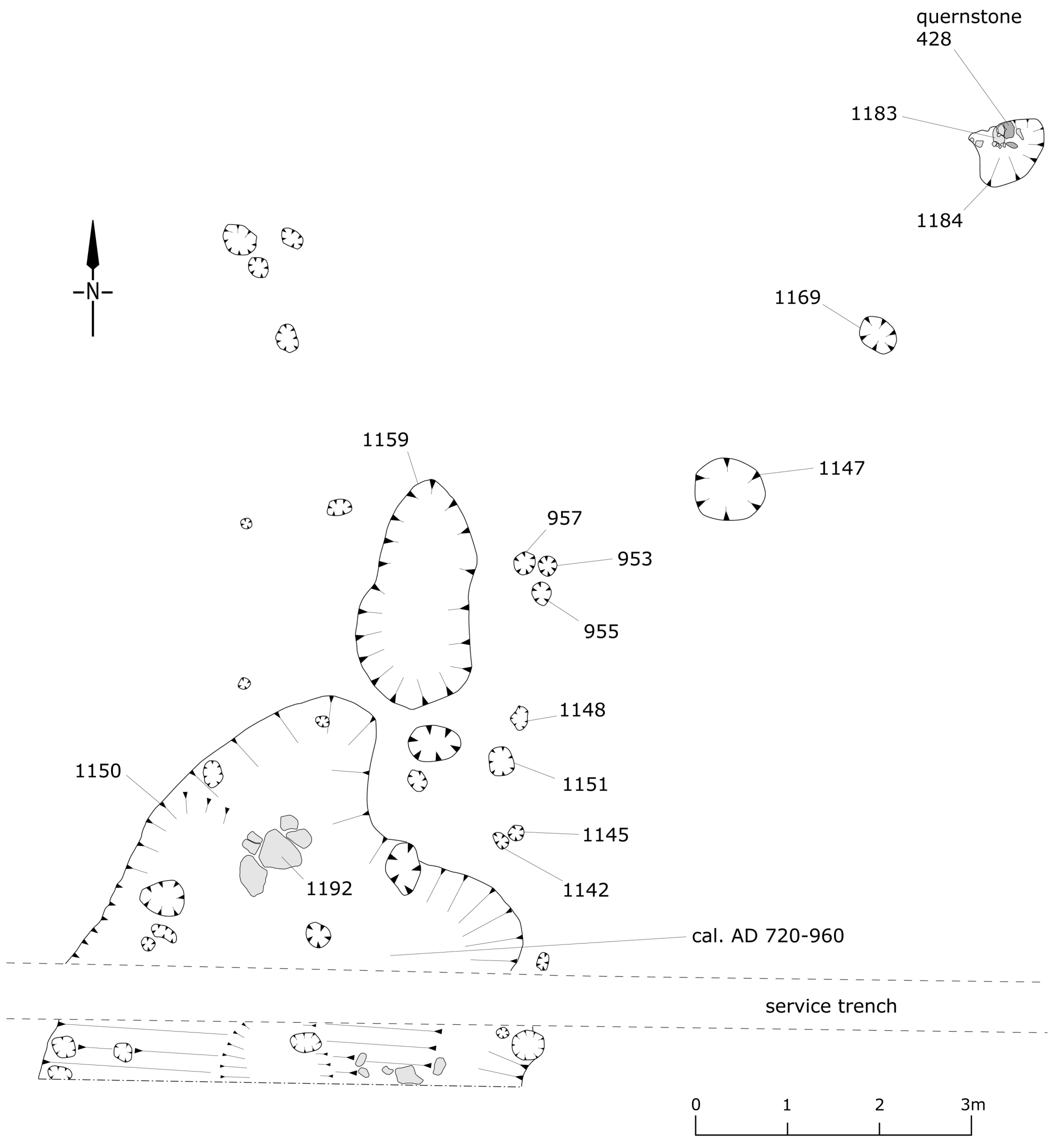

Fig. 20. Plan of Complex 13.

identified. Plant remains in fill 1170 included the only example from the site of large-seeded oats not to be accompanied by hulled barley.

A series of postholes averaging between 0.20–0.3m in diameter and 0.15–0.3m deep and a small number of stakeholes were cut into the bottom of the hollow and into surrounding bedrock. Most of these are not numbered on Figure 19. They formed no obvious pattern apart from an alignment (953, 955, 957, 1142, 1145, 1148, 1151) to the north-east of the hollow. An elongated shallow pit (1159) lay to the west of this alignment, and two further smaller, pits (1147, 1169) to the east. To the north-east of these pits, a posthole (1184) contained a reused quernstone (428) as part of its packing (1183). Wood charcoal was dominated by oak, but emmer and spelt grains were present, possibly derived from a prehistoric context.

As in the case of Complex 12, very little can be said about this complex. The radiocarbon date indicates an early eighth century to mid tenth century AD date for its use, although the possible presence of old wood in the sample could have resulted in an earlier date being obtained than if, for instance a cereal grain had been dated. The presence of a quernstone in a posthole to the north is compatible with this date, indicating that the emmer and spelt is probably not prehistoric. No function can be assigned to this complex, and no structures can be identified despite the large number of postholes.

RADIOCARBON DATES

All material used for dating was carbonised. Dates calibrated using the IntCal04 calibration curve (*Radiocarbon* 2004).

Beta-198850
Context: Complex 8. From layer (104) partly overlying stone spread (505) in hollow 152
Material: Wood charcoal
Result BP: 1040 ± 80 BP
Calibrated range at 2 sigma: cal. AD 810–840 and cal. AD 860–1180

Beta-198851
Context: Complex 8. From layer of charcoal (200) immediately west of stone spread (505) in hollow 152
Material: Wood charcoal
Result BP: 1320 ± 40 BP
Calibrated range at 2 sigma: cal. AD 650–780

Beta-222368
Context: Complex 13. Soil fill (1143) from hollow (1150)
Material: Wood charcoal
Result BP: 1190 ± 40 BP
Calibrated range at 2 sigma: cal. AD 720–740 and cal. AD 760–960

Beta-222369
Context: Complex 6. Charcoal-rich layer (543) over stone slabs (1546)
Material: Round-wood charcoal (min. 4 years old) of hazel
Result BP: 1190 ± 40 BP
Calibrated range at 2 sigma: cal. AD 720–740 and cal. AD 760–960

Beta-222370
Context: Complex 7. Layer of burnt grain (584) in hollow in bedrock
Material: Barley grain
Result BP: 1250 ± 40 BP
Calibrated range at 2 sigma: cal. AD 680–880

Beta-222371
Context: Complex 1. Charcoal deposit (1082) from bottom of gully of furnace 1052
Material: Root wood of gorse/broom (min. 8 years old)
Result BP: 1150 ± 50 BP
Calibrated range at 2 sigma: cal. AD 770–1000

Beta-255064
Context: Complex 11. From shallow pit 1131 beneath stone spread 963
Material: Oat grain
Result BP: 1060 ± 40 BP
Calibrated range at 2 sigma: cal. AD 890–1030

Beta-255065
Context: Complex 10. Fill (936) of pit/posthole 937
Material: Wheat grain
Result BP: 950 ± 40 BP
Calibrated range at 2 sigma: cal. AD 1010–1170

Beta-255066
Context: Complex 10. Fill (904) of posthole 905
Material: Cereal grain
Result BP: 960 ± 60 BP
Calibrated range at 2 sigma: cal. AD 1010–1170

Beta-255067
Context: Complex 9. From soil layer 1513 from beneath stone spread 1504
Material: Fragment of hazel/alder
Result BP: 2990 ± 40 BP
Calibrated range at 2 sigma: 1380–1330 cal. BC and 1330–1120 cal. BC

Beta-255068
Context: Complex 3. Basal fill (909) from pit 907 – possible corn dryer
Material: Cereal grain
Result BP: 1000 ± 40 BP
Calibrated range at 2 sigma: cal. AD 980–1060 and cal. AD 1080–1150

Beta-255069
Context: Complex 6. Layer 787 from possible hearth/furnace 784. The pit contained sherds of an Early Bronze Age urn
Material: Barley grain
Result BP: 3690 ± 40 BP
Calibrated range at 2 sigma: 2200–1960 cal. BC

Beta-255070
Context: Complex 4. From layer 1609 on base of hollow 1626 below rough stone surface (1601, 1602)
Material: Wheat grain
Result BP: 1050 ± 40 BP
Calibrated range at 2 sigma: cal. AD 900–1030

Beta-255071
Context: Complex 9. From soil (1513) beneath furnace/hearth 1503
Material: Barley grain
Result BP: 1060 ± 40 BP
Calibrated range at 2 sigma: cal. AD 890–1030

Beta-255072
Context: Complex 14. From charcoal-rich fill (1524) of shallow pit 1523
Material: Hazelnut shell
Result BP: 3550 ± 40 BP
Calibrated range at 2 sigma: 2010–2000 cal. BC and 1980–1760 cal. BC

PREHISTORIC LITHIC ARTEFACTS
By Elizabeth A. Walker

The excavations produced an assemblage of 336 knapped lithic artefacts. Of these all but six are flint; four chert and two stone. All four chert and one of the stone pieces are waste flakes, the other is a Neolithic stone adzehead reported on separately below. The assemblage is almost entirely residual and came from various contexts spread across the excavation. It shows characteristic tools and debitage that is mostly of later Mesolithic to later Neolithic date. The flint is predominately small pebble flint that would have been locally available on beaches, as indeed it is today. The pebbles tend to be small in size and, as is typical of Pembrokeshire assemblages, it contains a high proportion of knapping waste and failed cores (David 2007, 163).

Composition of the assemblage

Cores

Beach pebble flint tends to be knapped from a single striking platform usually developed after the removal of one primary flake. The assemblage contains one failed core and a nodule with a single primary flake struck from it of this type. There are also fourteen worked single platform cores of this type; all predominantly cortical on one face, several of which are pyramidal in form. The average length of these is 31.6mm, which is within the usual range for later Mesolithic cores of this type. Just four fall beyond the usual 35mm definition for Mesolithic blade cores (David 2007, 164). There are also two cores of cylindrical form with platforms top and bottom and one where a flake removal has been used as the platform and the core turned 90° for further bladelets to be struck. These cores would be used to generate a series of small blades and flakes. The size ranges represented suggest that both the later Mesolithic and early Neolithic periods may be represented in this assemblage. There are four multi-platform cores amongst the assemblage. These have had flakes struck from different directions and are usually indicative of an early or middle Neolithic date (Edmonds 1995, 82). Also present are two bipolar cores made on pebbles; such a technology is sometimes also known as hammer and anvil or écaillée. These cores have been struck with a hard hammer whilst the pebble is located on another stone, or anvil. This leaves characteristic crushing at the platform and the opposing face. The flakes removed also often show the same features. There is just one écaillée flake amongst this assemblage. Bipolar cores are common, particularly in Scandinavian contexts, dating to the later Mesolithic and early Neolithic (Ballin 1999, 13). In Pembrokeshire, the study of surface assemblages has led David to suggest that, though on occasions they are linked to a Bronze Age date, they are more likely to be associated with a Neolithic date (David 2007, 129).

Knapping debitage

The debitage is predominantly comprised of blades and blade fragments. There are just 16 complete blades compared with 47 blade fragments. This proportion is not unsurprising given the dominance of blade cores in the assemblage. Flakes also make up a good proportion of the debitage and there is a quantity of chunks and other general knapping waste. Four chert flakes are present, although there are no tools or cores made of this material.

Microliths, microburins and truncated blades

There is one later Mesolithic microlith in the assemblage. It is a fragment of a narrowblade microlith missing both its base and its tip that cannot be attributed to one of the forms recognised by Jacobi due to the position of the breaks (Jacobi 1978). There is one microburin. This has a retouched notch on the ventral surface, but it is missing the usual ventral tranchet facet usually typical of such tools. The proximal, bulbar end is missing. The truncated blade has been trimmed with very marginal retouch at its proximal end. The retouch is through an older patina suggesting reuse of an older blade. All three tools can be attributed a later Mesolithic date.

Scrapers

This assemblage contains twelve scrapers. Of these four are made on split cortical pebbles with retouch through the cortex at one end making a very simple convex-ended scraper. Such forms are typically found in Mesolithic assemblages across south Wales and can be paralleled with examples from other Pembrokeshire sites such as The Nab Head site II (David 2007, 142). There are also four denticulated scrapers in the group. All these are made on split cortical pebbles, are D-shaped in cross-section and have two or three denticulations on them. One tool has been worked on an older patinated flake suggesting the reuse of a scarce raw material. These denticulated scrapers are commonly found in Pembrokeshire in later

Mesolithic contexts. Excavation assemblages, including those from The Nab Head Site II, have generated fifty such tools (David 2007, 140). Interestingly these are not generally found in later Mesolithic assemblages outside of Pembrokeshire and are apparently one tool that is distinctive to this region. There are four other scrapers in the assemblage. These are retouched in a convex manner around most of their edges and are of forms more likely to be of Neolithic or Early Bronze Age date.

Knives and utilised blades
There are four knives, of which two are probably Neolithic in date and the other two of either Neolithic or Bronze Age date. The Neolithic knives include a fragment with neat retouch running along one length of it. The other Neolithic knife has a series of denticulations running the length of the blade creating a cutting edge. The Neolithic or Bronze Age knives include one that has retouch along both lengths of the blade and is made on an older patinated flint blade. The retouch on this tool runs along both its long edges. The other tool attributed to this date has a natural cortex backing to it on one edge, with the other displaying moderately invasive retouch.

There are also seven complete blades, two fragmentary blades and two flakes with evidence for utilisation along one length. This is not retouch, in that it is a series of irregular small chips running the length of the blade that are very marginal to the tool. Of these, several have a natural cortex backing suggesting that they were used as simple cutting tools.

Awls and fabricators
There are two awls present, both probably of Neolithic date. One has retouch along two straight edges but has a broken tip. The other has retouch along one edge creating a point. One Neolithic fabricator tip is also present. This has been shaped along each length and has a very heavily worn tip to it, suggesting some considerable use. The tool itself is broken across its length, just leaving the tip surviving.

Arrowheads
There is just one arrowhead fragment present, a barb from a Late Neolithic oblique arrowhead. The tang is 25.9mm in length, so falls into the larger scale of such tools, which are rarely found in Wales (Green 1980). Only a handful of others of similar length have been found across south Wales, including a complete arrowhead from Lithalun Quarry, Vale of Glamorgan, which has also been attributed to the Late Neolithic on the basis of dated parallels elsewhere (Pearson and Walker 2002, 114).

Miscellaneous retouched pieces
There are five flakes, one flake fragment and two blade fragments all displaying evidence for small areas of deliberate retouch, but none of which can be allocated to a recognisable tool form.

Discussion of the lithic assemblage
The assemblage contains a range of tools that, where they can be attributed to a period, span a time-frame from the Later Mesolithic through to the Late Neolithic dating to between approximately 6000 cal. BC and 2200 cal. BC. The Mesolithic assemblage is predominantly made on beach pebble flint that would have been available locally. The scarcity of good quality raw material is, however, implied by the fact that several of the tools are made on older patinated flints that have been reworked later into tools. The Mesolithic artefacts form a typical Pembrokeshire assemblage, dominated by split cortical pebbles that have undergone simple modification into blade cores, simple scrapers and denticulated scrapers. The blades are generally narrow and the one microlith and microburin are also of later Mesolithic date. All these forms and the balance of tools mirror other later Mesolithic assemblages from Pembrokeshire.

The Neolithic group of tools includes awls, a fabricator, convex scrapers, bipolar cores, an écaillée flake and a single barb from an oblique arrowhead. The tools are typical of Pembrokeshire in that there are few finished tools of such date present. This feature of Neolithic assemblages from the county is highlighted in the Pembrokeshire section of a catalogue of the National Museum's collections (Burrow 2003). What is unusual about the assemblage is the presence of a long barbed arrowhead fragment. Presumably this was a tool brought into the area from elsewhere and was a casual loss.

Unfortunately, as is typical of so many lithic assemblages, a large proportion of this assemblage is not attributable with any certainty to a specific date. This is particularly a problem for so many assemblages where there is no other indication from their context, or stratigraphic position to assist in dating them. So many general prehistoric forms, especially retouched pieces, some scrapers and a lot of knapping debitage are difficult to date more precisely (Burrow 2003, 48).

NEOLITHIC STONE ADZEHEAD
By Steve Burrow

A Neolithic polished stone adzehead was discovered in spoil from a construction trench in October 2006 towards the centre of the gas storage installation (SM 87377 06299). An examination of the location showed the ground to be heavily disturbed and therefore the provenance of the adze is unknown.

The adze is 174mm long × 75mm at the widest point and 31mm at its thickest. Half of the blade has been removed by a recent flake and there is a further small fresh flake scar on one side. The overall shape of the object is however intact. It is finely ground and polished across the blade end, with polish extending towards the butt, removing the high points between flake scars. Some polish is present on the butt and sides. The piece is unusual because it possesses a very marked curvature down its length. This was exacerbated by an attempt to take a flake from the side—presumably to remove a high point—which has cut deep into the middle of the adze. Given the asymmetry of the piece it is surprising that worked continued after this mishap, but the sides were then flaked more to straighten them a little, with polishing following this. The resulting implement would have functioned well as an adze—to which end the curvature along the piece may have been advantageous—but could probably not have served as an axe.

A review of the Implement Petrology Group axe records failed to find close parallels for this piece, which was presumably the result of specific need, rather than an attempt to follow better known styles of axe morphology.

The source of the acid volcanic rock from which the adze has been made has not been established. The most immediate sources of such a lithology are the Roche and Benton Volcanic Formation, with outcrops approximately 5km north of Milford Haven, or exposures on Skomer Island, 17km to the west. In addition to these examples, rhyolitic lava and tuff occur within both the Precambrian rocks of the St David's area and Ordovician rock on the north Pembroke coast. Any attempt to obtain a provenance for this adzehead would require a thin section, and ideally geochemical analysis.

PERFORATED SHALE OBJECT
By Mary Davis

This perforated object measuring 31mm in diameter, surviving to a maximum thickness of 5.7mm and with a maximum perforation diameter of 3.2mm (Fig. 21) was found in posthole 937 of Complex 10 (Fig. 16). Cereal grain from the posthole was dated to cal. AD 1010–1170 (Beta-255065). The material from

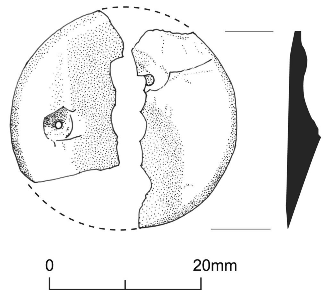

Fig. 21. Perforated shale object. Scale 1:1.

which it is made appears to be a cannel coal or shale: the surface is compact and polished in places, but many areas are delaminating badly. It is probable that this is a locally found lithic material.

The hole is towards one edge and drilled from one side only; it appears hand drilled using an awl and a twisting motion. This is a method of drilling similar to many jet and jet-like objects dating to the Early Bronze Age, but artefacts of this date are usually drilled from both sides. The perforation at the top is unusual; the wear facet faces downwards. The degree of wear implies considerable use in a consistent manner, possibly by a piece of string or twine. There is the start of a perforation on one of the larger fragments. This has no diagnostic characteristics, but could have contributed to the fracturing of the material. It is difficult to gauge the original thickness of the object, as none of the pieces are polished on both faces. However, one face appears to be an old fracture, in which case the object would have been fairly thin when buried.

EARLY BRONZE AGE URN

By Jody Deacon

Fragments of a single vessel (Fig. 22) were recovered from a pit (784) in Complex 6 (Fig. 6) and are associated with a radiocarbon date of 2200–1960 cal. BC (Beta-255069). These sherds represent approximately 20% of a large vase urn with a diameter of 250mm at the mouth. It is possible to reconstruct three quarters of the vessel profile from the surviving pieces. It has a rounded shoulder sloping gently to an upright neck decorated with two parallel horizontal raised cordons. The simple rounded rim is slightly everted. The entire surviving surface is decorated with bands of vertical or slightly oblique impressions, some probably made using the end of a small bone, others using a different tool to create lighter, more triangular impressions.

The urn is in poor condition, extremely soft and poorly fired. The clay matrix is slightly sandy with occasional iron oxide pellets and tempered with a moderate quantity of sub-angular grog 1–5mm across. The addition of grog to the clay is one of the most common characteristics of Early Bronze Age pottery. All surfaces are heavily burnt, ranging in colour from pink to buff to light grey. Differences in the level of abrasion are discernable between sherds suggesting exposure to a range of processes prior to final burial. The internal surfaces of those sherds nearest the rim are heavily abraded and the edges are rounded with varying levels of yellowish concretion. Other sherds have nearly unabraded internal surfaces. In general, decoration is visible across all external surfaces although is slightly more worn in some areas.

Exact parallels are hard to find, but one of the closet Welsh examples in terms of overall form is vessel B from Bedd Branwen on Anglesey. This has a similar upright neck with a raised cordon mid-way between

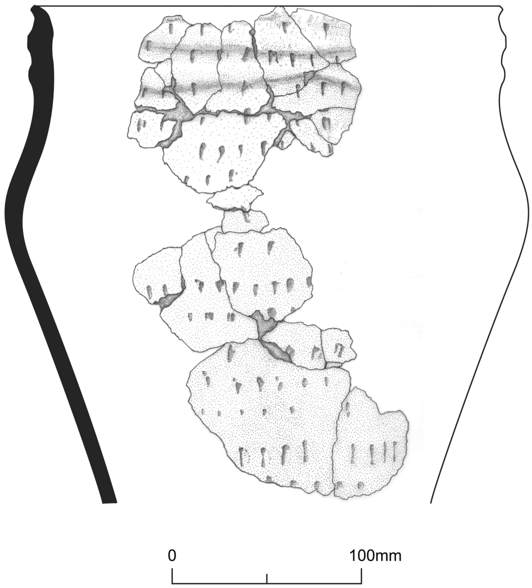

Fig. 22. Bronze Age urn. Scale 1:4.

the neck and the shoulder. Lynch noted the concentration of this usual form in Anglesey and north-west Wales and surmised that the form and decoration of these vessels were influenced by Irish traditions (Lynch 1971, 59). This may also be true of many of the food vessels found in south-west Wales. Ireland is also the best source of parallels for the form of this urn. Vessels with upright necks and rounded shoulders were found at Ballytresna, Co. Antrim and Kilclay, Co. Tyrone while those from Drumnakilly 10, Co. Tyrone and Coolhill, Co. Cork have similar cordoned necks (Brindley 2007, Appendix A, nos 3, 66, 65 and 17).

All over decoration is an unusual trait for a large urn from Wales—the majority have decoration restricted to only the neck, collar or sometimes shoulder of the vessel. Where all-over decoration does occur it tends to be a feature of the smaller bowl and vase types of food vessel rather than these larger urns (see Savory 1980, 204–207, figs 56–59). The decoration on the South Hook vase urn, while quite coarsely executed, is carefully ordered into horizontal bands, particularly around the shoulder and between the raised neck cordons. Simple decoration of this nature is less frequently observed on Irish and Scottish vase urns than Welsh examples. A vessel from Caltragh, Co. Galway is the most comparable example with slightly irregular bands of fingertip or tooled impressions between subtly raised cordons on the upper half of the vessel (Brindley 2007, Appendix A, no.46).

Raised or applied cordons are a common feature of vases, vase urns and collared urns across Britain and Ireland although the Welsh examples tend to concentrate in the north of the country. Of the southern examples, a pair of large, crudely made vase urns from a central cist beneath Simondston Cairn in the Vale of Glamorgan (Fox 1937, 130–141) have a very different overall shape but the presence of cordons in combination with horizontal bands of fingernail or stabbed impressions is comparable, as is the poor quality of the urns and the slightly irregular nature of the decoration. A recent radiocarbon date on cremated bone from this burial obtained by the National Museum of Wales yielded a comparable date of 2100–1900 cal. BC.

Amongst the Scottish examples, there are few with the distinctive upright neck but several with rounded shoulders and raised cordons including two with similarly early dates from Aberdour Road 4 and

Mains of Crawchie. These, and other, early dates clearly demonstrate that larger vase urns were in use by 2000 BC outside of Ireland (Sheridan 2003, 205, fig. 13.4).

Vase urns are nearly always found with cremation burials (Brindley 2007, 117), although it seems unlikely that a burial urn would be disturbed and destroyed in this manner so soon after interment and unlikely that all traces of a body, cist or burial mound would be obliterated. This, combined with the fragmented nature of the pot, its burnt surfaces and abraded condition might imply a more mundane origin for the South Hook urn. Food vessels from domestic contexts are uncommon but not unknown. The site of Killelan on Islay produced a range of fragmentary food vessels (including large vase urns) from a midden deposit dating between 2150–1750 BC. Amongst these were several large urns with upright necks, rounded shoulders and impressed decoration (Ritchie 2005, 61–65, fig. 65.36 and 46, fig. 66.46–7). Dalkey Island, Co. Dublin also provided vessels from a domestic context (Liversage 1968)

This unusual vessel, while fragmentary and not directly associated with burial, is of some importance, widening the distribution of these vessel types and strengthening the notion of an early domestic currency for this type of pottery in Wales. It therefore provides a slight, albeit significant, connection with lived everyday life during the Early Bronze Age rather than the death and burial with which we are so much more familiar.

PREHISTORIC AND EARLY MEDIEVAL WORKED STONE

By Mark Redknap and Jana Horák

A range of different functions can be identified within the items of worked or utilized stone found on the site. These include querns and hone sharpening stones, as well as stones utilized in other ways.

Raw materials

The site is located within the outcrop of the Devonian Old Red Sandstone sediments of the area. These comprise green, red and grey marls, sandstones and conglomerates. The majority of samples investigated, with the exception of pebbles of flint and a single sample of acid volcanic tuff, can be attributed to a source in the local area. The aforementioned pebbles are sourced from the local glacial drift, in which flints are widely recorded as are a variety of igneous rocks (Cantrill *et al*., 1916). Pebbles from the drift may show evidence of glacial striations.

Quernstones

All the quernstones are of the rotary type, and made of local Carboniferous or Old Red Sandstone. Modification of the non-grinding surfaces is minimal and none are perfectly circular, the natural form of the boulder influencing a variety of oval forms. One quern has a notch on its outer edge (no. 5), and one has a rynd slot (no. 2). It has not been possible to confirm that all querns had rynd slots, as most are incomplete (no. 1, which is fairly complete, did not have one). The central holes taper or have hour-glass profiles and their diameters vary in diameter from 12mm on the narrowest to 60mm on the widest (the size being influenced by the overall diameter of the stone). None have raised collars. Further comparative details are summarized in Table 1. All the querns were well used, having severely worn undersides, though one (no. 1) showed evidence of reconditioning, having random pecking to roughen the grinding surface. On reaching the end of their grinding lives, several querns (nos 1, 5) were reused as flagging. The calibrated radiocarbon date ranges from contexts 104, 200, 543, 584, 1082 and 1143 focus on the eighth to tenth century AD.

No saddle querns or rubbers have been identified within this component of the site assemblage, which consists solely of rotary querns. While rotary querns have a long pedigree of use in Wales from the late

Table 1. Frequency of quern sizes at South Hook and contemporary Welsh sites

Diameter (mm)	100–150	150–200	200–250	250–300	300–350	350–400	400–450	450–500	500–550	550–600	600–700	700–800	800+
South Hook	2	1	–	–	–	1	2	–	–	–	–	–	–
Brownslade Burrows	–	1	–	1	1	1	–	–	–	–	–	–	–
Llan-gors	–	–	–	–	–	–	–	–	1	–	–	–	–
Llanbedrgoch	–	–	1	–	1	11	10	4	5	3	–	–	2

Iron Age and Roman periods onwards, the South Hook querns appear to be broadly contemporary on morphological grounds with the early medieval radiocarbon dates that have been obtained from features such as the iron-smelting furnaces and corn dryers. Of course, many appear to be in secondary contexts, having been reused as packing or incorporated as flagging, features that provide *termini ante quos* for their use on site. Identification of examples that are chronologically fixed within the early medieval period has also been hampered by the paucity of excavated sites in Wales belonging to this period.

Some of the upper quernstones are oval rather than circular, and range in diameter from 415–450mm to 145mm. These are similar size ranges to querns from Loch Glashan (Clarke 2005, 95) and Dunadd in Argyll, where none at the latter site exceded 500mm in diameter (Clarke 2005, 100).

The quernstones belong to the regional sub-group recognised at Brownslade Burrows and Newton, Llandstadwell, Pembrokeshire (Redknap and Horák 2004, fig. 8), being rarely circular but retaining much of the original unmodified form of the boulder selected. The Newton quern was found in the top fill of a corn dryer, a layer at the base of which provided a radiocarbon date of cal. AD 720–960. The South Hook examples are similar in form to some of those excavated at the early medieval enclosed settlement at Llanbedrgoch on Anglesey, where they have occurred in eighth to tenth century AD contexts (Redknap 2000, fig. 115). The Llanbedrgoch quernstones also occur in a range of sizes, and are similarly characterized by a lack of radial grooves on their grinding faces. However, the Llanbedrgoch querns are notable for their larger size range (see Table 1). Similarly those found at the princely-fortified site of Dinas Powys, near Cardiff, and at the royal *llys* of Llan-gors crannog, near Brecon (one example made of local Old Red Sandstone) are larger in size. These have radial grooves typical of Roman quernstones, and are similarly distinguished from the Irish and Scottish series (Alcock 1963, 168, fig. 36 no. 1; Redknap and Lane 1999, 381). The millstone from Dinas Powys, for which a sub-Roman context has been invoked, has a diameter of about 700mm, comparable to those from Nendrum (Alcock 1963, 167). Recorded millstone diameters range from 550–1070mm (McErlean 2007, table 7.1). One upper rotary quern recovered during Leslie Alcock's excavations at Deganwy, and reused within the thirteenth-century walls, has a raised collar of early medieval form, and a diameter of 390mm (National Museum of Wales acc. no. 77.11H). Circular wear patterns similar to those on no. 1 also occur on rotary querns from Loch Glashan crannog (Clarke 2005, fig. 47).

The quantity of quernstones found is modest, but significant in the light of the discovery of four possible corn dryers. Like the honestones, they are derived from the everyday activities of the local population.

1. Upper quernstone made of very-fine grained quartoze sandstone, from a local source in Carboniferous (Fig. 23). The stone contains dark grains (?coal fragments). The unweathered colour was not well observed, but is thought to be cream; the surface has localized iron staining. This quern has an irregular

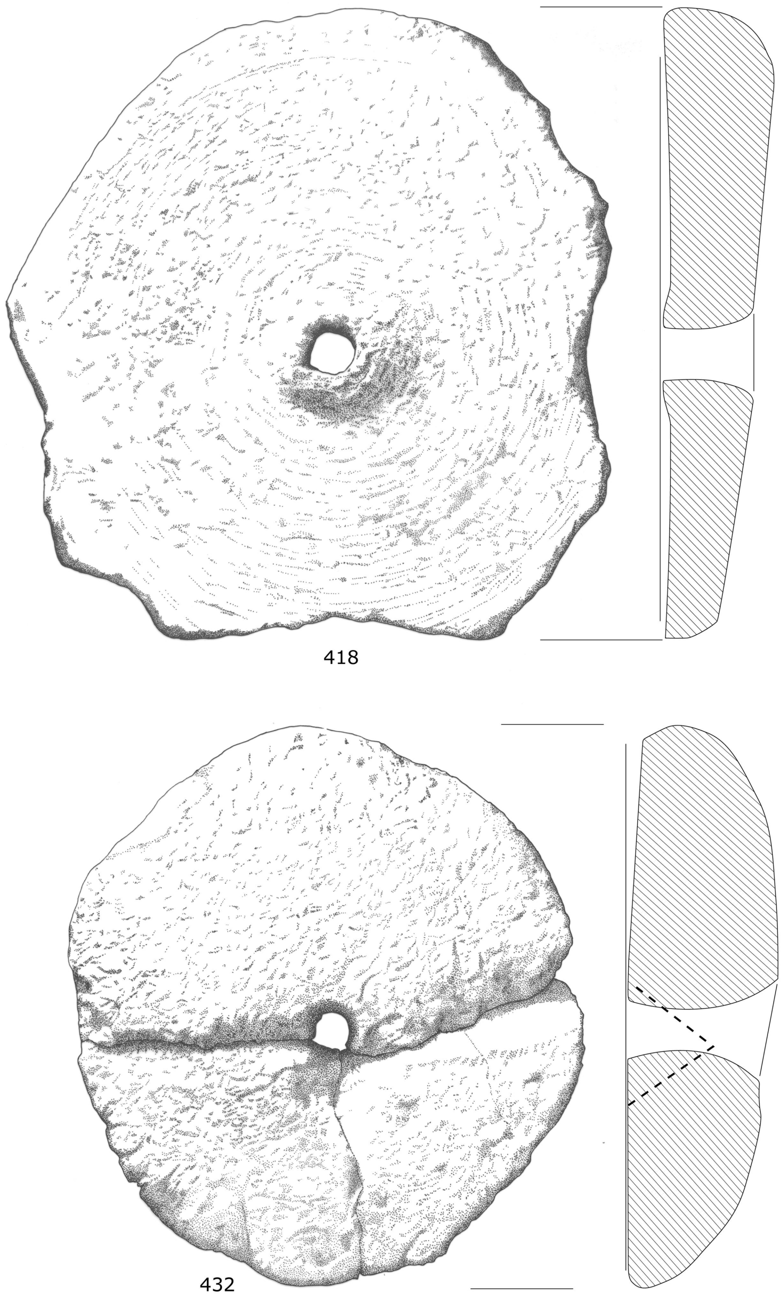

Fig. 23. Quernstones no. 1 (418) and no. 5 (432). Scale 1:5.

oval shape, with approximately 45% of the original circumference surviving (the rest having fractured away). The stone has been severely worn, with a strong circular wear pattern evident on the grinding surface. This has been reconditioned, having been random pecked in order to roughen the worn grinding surface. The central hole narrows from 55mm at the top to 35mm, is fairly cylindrical for most of the depth of the stone, narrowing to 30mm. Diameter 415 × 450mm; maximum thickness 75mm. Find SF 418, incorporated into stone surface (963) of Complex 11 (Fig. 17).

2. Upper quernstone made of grey-weathering, purple-red sandstone containing fibrous quartz veins, derived from the local Old Red Sandstone (Fig. 24). The stone is medium-grained but locally pebbly (pebbles to 7mm). Grain supported textures and quartz cement produced a durable stone. The quern was probably of oval form, with a small grinding surface. There is a slight recess on underside of hole, probably for a rynd. External diameter 145mm; 180mm based on perforation diameter; thickness 73mm. Find SF 419, from fill (1038) of pit 1039 in Complex 1 (Fig. 4).
3. Upper quernstone, in three fragments, made of a local medium- to coarse-grained, grey sandstone, superficially stained red by soil (Fig. 24). The grain support locally pebbly (pebbles up to 7mm); there are some dark fragments present (if coal, this could be derived form the local Carboniferous strata). The grinding surface is smooth, having smoother truncated quartz grains. Central hole is funnel shaped in profile, tapering from 52mm to 12mm. Diameter 180mm; thickness 85mm. Find SF 428, reused as post-packing (1183) in posthole 1184, Complex 13 (Fig. 20).
4. Upper quernstone with a smooth grinding face (no grooves), made of a locally derived conglomerate from Old Red Sandstone (Fig. 24). The matrix is poorly sorted, containing sub-angular to sub-rounded clasts (2–30mm in diameter: vein-quartz and larger angular pink ?porphyry or acid volcanic). Clasts are closely packed with a quartz cement. The hole has an hourglass profile, tapering from about 70mm to 20mm. Diameter 420mm. Find SF 430, from rough stone surface (1601–02) in hollow (1626) of Complex 4 (Fig. 8).
5. Oval upper quernstone with smooth under side, made of a locally derived conglomerate from Old Red Sandstone (Fig. 23). Poorly sorted, containing sub-angular to sub-rounded clasts 5–30mm in diameter, within in a red-brown, medium to coarse-grained matrix. The clasts are dominated by quartz (vein-quartz and darker quartz) and lithic fragments, some of which are volcanic in origin. There is a V-shaped recess at one point, possibly for a handle. The hole has an hourglass profile, tapering from 60 to 25mm. Diameter 370 × 335mm; thickness 92mm. Find SF 432, from rough stone surface (1504) of Complex 9 (Fig.14).
6. Upper quernstone made of medium-grained sandstone from local Old Red Sandstone (Fig. 24). The rock is white but has a superficial red staining and is composed of angular to sub-rounded grains of iron-stained quartz, vein-quartz and cleat quartz. A minor lithic and mica component is present, with smooth lower face. Diameter about 170mm; thickness 50mm. Find SF 448, from fill (960) of posthole 961 in Complex 11.

Honestones

The honestones from South Hook comprise eleven definite (Find nos 413, 427, 435, 438, 443, 444, 447, 454, 456, 458, 460) and six probable (414, 415, 421, 431, 436, 453) examples. Most are made from naturally shaped, elongated pebbles in a range of shapes and sizes from small, well-fashioned personal hones for keeping small blades keen to larger slip-stones and whetstones for sharpening iron-edged tools or weapons. The degrees of wear vary from dishing or waisting to slight polish, or grooves from the sharpening of points (e.g. 413). They have been assigned to geological groups on the basis of visual appearance, and most are made from locally derived fine-grained local red sandstone, good for the purpose as it contained hard angular material within a soft matrix.

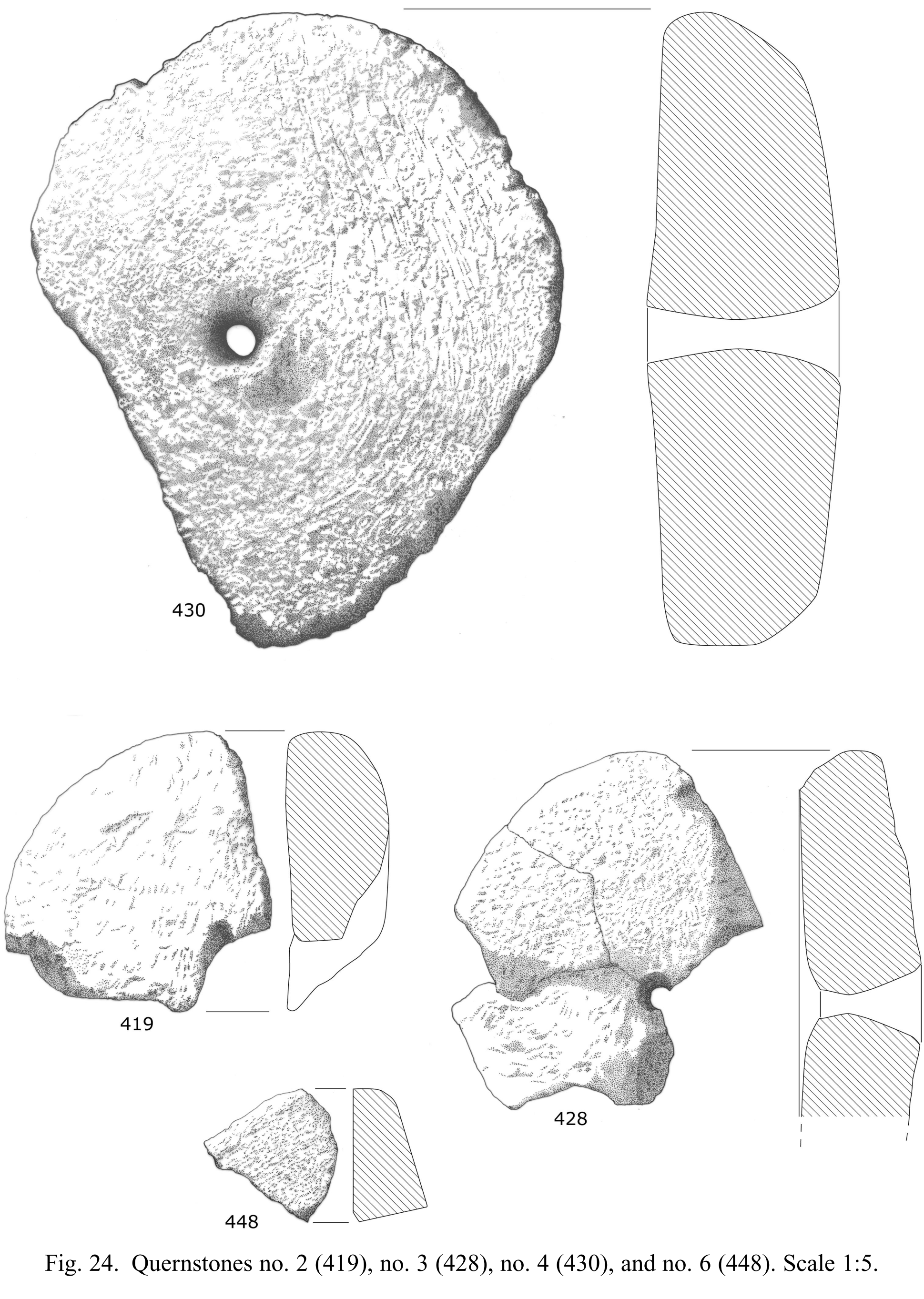

Fig. 24. Quernstones no. 2 (419), no. 3 (428), no. 4 (430), and no. 6 (448). Scale 1:5.

Hones of this simple form are used in medieval and earlier periods (for example, Old Red Sandstone hones from the Atlantic Trading Estate, Barry, found associated with Bronze Age potsherds; Redknap 1998, fig. 11.1, 4), and dating is reliant on context. Complex 1 produced one example (427); Complex 4 produced four examples (nos 424, 431, 436, 438); Complex 8 produced three examples (453, 454, 460), Complex 11 produced one example (435), Complex 12 produced one example (443) and Complex 13 produced three examples (444, 456, 458). All of these complexes, apart from 11, produced early medieval radiocarbon dates. The morphology of the honestones mirrors to some degree those from other early medieval sites such as Hen Gastell near Swansea (Redknap 1995b, figs 16–18) and Llan-gors crannog near Brecon (occupied between *c*. AD 889–93 and 916; Redknap and Lane, in prep.).

While they provide one indicator of human activity on the site, be it based in agriculture, crafts, industrial activity or daily life, the question of where their users lived remains unanswered.

The following catalogue give small find number, dimensions, stone type and provenance of the honestones from South Hook.

413 660mm long, 105mm wide, 45mm thick. Local Old Red Sandstone. Complex 7, Context 720.

414 Local Old Red Sandstone. Between Complexes 6 and 7, Context 755.

415 130mm long, 64mm wide, 30mm thick. Local fine-grained sandstone, possibly Silurian, unstratified.

421 280mm long, 140mm wide, 75mm thick. Local Old Red Sandstone. Between Complexes 12 and 13, pit 1165.

424 122mm long, 60mm wide, 24mm thick. Local Old Red Sandstone. Complex 4, Context 1083.

427 200mm long, 73mm wide, 115mm thick. Local Old Red Sandstone. Complex 1, Context 1093.

431 Local Old Red Sandstone. Complex 4, Context 1083.

435 46mm long, 15mm wide, 12mm thick. Local Old Red Sandstone. Complex 11, Context 1130.

436 70mm long, 62mm wide, 34mm thick. Local Old Red Sandstone. Complex 4, Context 1609.

438 140mm long, 57mm wide, 25mm thick. Possibly fine-grained granite derived from glacial drift. Complex 4, Context 1609.

443 78mm long, 32mm wide, 11mm thick. Grey sandstone; Old Red Sandstone. Complex 12, Context 1120.

444 110mm long, 44mm wide, 26mm thick. Grey sandstone; Old Red Sandstone. Complex 13, Context 969.

447 390mm long, 30mm wide, 120mm thick. Local Old Red Sandstone. Unstratified.

453 145mm long, 55mm wide, 36mm thick. Local fine-grained sandstone. Complex 8, Context 146.

454 122mm long, 86mm wide, 31mm thick. Fine-grained well-sorted sandstone, Complex 8, Context 146.

456 240mm long, 145mm wide, 6mm thick. Fine-grained red-brown sandstone, Complex 13, Context 969.

458 92mm long, 23mm wide, 20mm thick. Fine-grained sandstone, Lower Palaeozoic, Complex 13, Context 969.

460 107mm long, 28mm wide, 22mm thick. Fine-grained local red sandstone, Complex 8, Context 127.

Other utilized stone

One piece of red micaceous sandstone of local origin (Find number 441) bears a pecked, cup-like depression on one face measuring 75mm in diameter and 23mm deep. It was found in the fill of pit 1520, Complex 14. Hazelnut shell from the fill of an adjacent pit was radiocarbon dated to 2010–1760 cal. BC (Beta-255072). The dating of cup-marked stones remains controversial, some favouring a late Neolithic to Early Bronze Age date, others believing that they had a longer currency. One cup-marked stone found built into a cist within the Bronze Age Simondston cairn, Coity Higher Parish, Bridgend, bears five cup-marks that range in diameter from 55mm to 10mm and in depth from 12mm to 30mm (Fox 1937). The Simondston stone may have been taken out of circulation for use in the grave structure. Another small stone bearing two cup-marks has been published from Dan-y-garn, Mynachlog-Ddu, Pembrokeshire (Darvill and Wainwright 2003, 253–64). The stone measures 250 × 180 × 90mm, and is similar in size to no. 441 (240 × 175 × 80mm). Its cup-marks have diameters of 44m and 54mm and depths 9mm and 18mm and are slightly smaller than the cup-mark on the South Hook specimen (75 × 23mm). Unlike the Dan-y-garn stone, there are no traces of pecking on the South Hook stone to prepare surfaces prior to the cup being made and the profile of the cup is more conical than spherical.

One stone made of a micaceous, reddish-brown Old Red Sandstone (glacial?) boulder of local origin (no. 425, unstratified, 290 × 230 × 120mm) bears a cluster of fifteen man-made grooves with a depth of 3–4mm in a regular pattern, either the result of repeated wear, or the intentional creation of a design in the manner of a trial piece. The pattern is reminiscent of that on the Middle Neolithic macehead from Maesmor, Denbighshire (Burrow 2003, fig. 50, 6).

One honestone (427, Complex 1, context 1092) appears to have been used at some point as an anvil. Another rubbing stone made from a natural cobble bears a concave wear depression on one side (437, Complex 4, context 1083). Two stones (412, Complex 8, context 505; 417, Complex 11, context 962) may have formed part of an ard, plough, or similar implement, while one rounded pebble made of local dark grey coarse-grained sandstone appears to have percussion marks (433, Complex 9, context 1605). One oval pebble has two percussion marks (440, Complex 14, pit 1520). Some utilised stone may be contemporary with earlier activity, such as that associated with the Bronze Age pit (Complex 6).

ARCHAEOMETALLURGICAL RESIDUES[6]

By Tim Young

The site yielded approximately 53kg of iron slag. Metallurgical activities on the site included both iron smelting and smithing of the raw blooms. Smelting was undertaken in a pair of furnaces in Complex 1. There is no evidence from the residues for metallurgical activities in any of the other complexes. The following is a summary taken from the technical report lodged with the site archive (Young 2010c), which includes SEM images, geochemical plots and other illustrations, and should be referred to by those wanting more information on the archaeolmetallurgical residues.

A description of the slag-tapping furnaces is incorporated into the excavation section of this report. The evidence for refurbishment and the construction of a pair of furnaces indicates that this was a sustained attempt to make iron on a significant scale. The amount of slag and other waste from the iron-making operation is, however, rather small. The area around the furnaces in Complex 1 appears to have been rather clean, with most of the recovered slag probably representing material reworked into the hollow after abandonment, presumably from waste dumps in areas outside the hollows containing the preserved archaeology.

It is suggested that two distinct sources of iron ore were employed, but it is possible that only one of these was actually smelted at South Hook. Tapped smelting slags were produced by the smelting of a manganese-rich ore, possibly a bog iron ore or Carboniferous claystone ironstone. A second suite of materials, represented by bloomsmithing slags and possibly furnace slags from several contexts, also shows strong manganese enrichment, but also markedly elevated zirconium contents. The source of this second group was probably a bog ore deposit, possibly in a location influenced by a zircon-rich rhyolitic unit within the Skomer Volcanic Group that crops out from the St Ishmaels area (three kilometres west of South Hook) westwards to Skomer. This suggests that the South Hook site may have been involved with the refining of blooms produced elsewhere, in addition to its own smelting operation. Centralised smithing of blooms smelted close to ore sources or to charcoal-producing woodlands is a common feature in early iron production.

Distribution of slags and residues

The iron slags and associated residues were concentrated in Complex 1. The upper fills (1002, 1003, 1004, 1028, 1042,1054) over the structures of this complex yielded 22.7kg of residues, and pit 1039 produced 12.7kg. Fills of the furnaces themselves contained 6.5kg of residues. This was mainly slag produced during the last use of the furnaces and some slag from the last use before refurbishment, together with debris from degradation of the shafts. Only a few contexts elsewhere in the complex yielded any residues, with the total from those contexts being only 414g (21 pieces).

Outside of Complex 1, only Complex 4 produced any significant quantity of metallurgical residue, with 10.4kg from upper fill 1037. This material was of similar make-up to the residues from Complex 1 and it is suggested that both groups of material derive from directly or indirectly from the waste produced by the operations in Complex 1. Complex 2 yielded just one piece of slag (264g), Complex 6 two pieces (324g) and Complex 8 four pieces (121g). These quantities are too insignificant to provide support for proposals of metalworking activity having been undertaken in any of these other areas.

Tapped smelting slags

The tapped slags were from the two furnaces of Complex 1 and accumulated in thin flows (usually <40mm), at least some of which were moderately wide (<0.2m) and on the evidence of the flows left *in situ* in the furnaces, many were moderately long (<0.60m?).

Three samples provide evidence for the nature of the tapping channel. One has a strongly hooked shape to the flows in profile, showing that the flows had dropped sharply over a fall in the floor. Such a drop is provided by the distal ends of the stone slabs placed onto the floors of both furnaces during their refurbishment. A similar flow morphology is shown in the section of Ramsbury Furnace 4 (Haslam 1980), where slag flows that were not fully cleared from the furnace produced similar rises in furnace floor level and falls over their distal (fractured?) ends.

A second sample shows a narrow ‘runner’, with the flow constricted into a channel only 50mm wide. This flow solidified in the channel, with its proximal end grading inwards into the charcoal-rich furnace fill. A third sample is from an early, flat-topped flow well within the furnace base itself.

The samples show some variety in composition, but in general are characterised by primary wustite dendrites, which are extensive and delicate in the tapped slags, but stockier in the less quenched materials. The wustite shows some Al substitution and often quite high levels of Mn substitution. The wustite is followed by elongate olivine, typically with high levels of manganese substitution. Interstitial areas of typical textures are mainly glassy.

In contrast, the samples which solidified inside the furnace show extensive development of a leucite-wustite cotectic, particularly around vesicle margins, in association with an olivine which bears small quantities of calcium. Such areas have coarse-grained olivine and are typically poor in primary wustite.

Furnace and smithing slags

This section deals with material identified as being smithing hearth cakes (SHCs) as well as with material identified as being furnace slags (i.e. slags which solidified within the smelting furnaces). Both classes of material include much slag that is very rich in charcoal inclusions, and their certain differentiation in hand specimen is not always possible.

The SHCs are all large, with seven possible cakes identified (two definite), of which five are probably complete and weigh over 700g. The specimens did not, in general, have a classic SHC morphology; only one sample was of a typical compact form with a dense lower crust. Most of the other specimens contained a high proportion of charcoal-rich slag. One was a very wide cake, with a dense upper layer and low density charcoal-rich material below.

In both Britain (Crew, 1996) and Ireland (Young, forthcoming) SHCs from blacksmithing (the use of iron in making or repairing artefacts) mainly seem to weigh in the range of 100–600g, although heavier cakes may appear in the later medieval period. SHCs heavier than 600g are mainly associated with the smithing of blooms down to usable iron. In Britain, SHCs from early medieval bloomsmithing (a general term for the refining of blooms from the raw state down to usable iron) range up to about 2kg (Crew 1996), but in Ireland SHCs can be much larger, as much as 11kg on some sites (Young forthcoming). That all five possible complete SHCs from this site weigh over 700g is strongly suggestive that they are from bloom refining rather than artefact manufacture. It also, despite the rather small assemblage, suggests that the bloomsmithing was not being undertaken within an Irish tradition.

For the two specimens which were firmly identifiable as being SHCs the key microstructural features are an extremely heterogeneous primary wustite distribution, ranging from zones of densely-packed blebs (suggestive of an original hammerscale or iron particle) through to well marked zones (early vesicles?) with no primary wustite. In one sample the primary wustite overgrew pieces (now highly altered) of metallic iron and small enclaves may represent similar altered iron in other samples. In some of the specimens the olivine, which follows the wustite, is relatively magnesian, with values as low as Fa83 being recorded in one sample. Levels of Mn substitution were relatively low (up to a maximum of 9%, but typically much less) in agreement with the modest bulk Mn content of these samples.

One sample shows a different microstructure from the other members of this group. The primary wustite is rather sparse and forms well developed, but fine dendrites. The rather coarse elongate olivine is cotectic with hercynite and the material shows an interstitial leucite-wustite cotectic, which locally approaches 50%. This difference may support an interpretation of this piece as a furnace slag.

Iron ore

A single small (2g) sample of bog iron ore was examined. This small piece was selected because it derived from the same context within Complex 1 as much of the slag examined and therefore there was a reasonable possibility of a genetic link between them.

The specimen is very porous and shows well marked zones of varying density. In some areas there was a marked contrast between dense areas, often with a botryoidal texture and less dense, more porous areas, also having a lower electron density. The dense areas are composed of a manganese mineral; probably cryptomelane and the porous areas are dominantly iron oxides (probably hydrated iron oxides). One area showed several moderately large (250–300µm) euhedral potassium feldspar crystals.

Chemical composition of the residues

The bulk analyses of the slags fall into two distinct groups.

Group 1 tapped smelting slags

These samples show an Upper Crust-normalised (Taylor and McLennan 1981) rare earth elements (REE) profile inclined with progressive light rare earth element (LREE) depletion with respect to Upper Crust, with superimposed elevated MREE and a negative cerium anomaly. The degree of elevation of the middle rare earth elements (MREE) results in quite a wide dispersion of data-points when Gd_N/Lu_N is plotted against Gd_N/La_N, allowing discrimination of many of the local ores (Young 2000a; Young and Thomas 1998; 1999).

The group is also characterised by high U/Th ratios, moderately low concentrations of U and Th, together with high manganese contents (giving a high MnO:U ratio), and a low Nb:TiO_2 ratio.

Group 2 furnace and smithing slags

This group includes samples with a more gently inclined Upper Crust-normalised REE profile with progressive depletion of the LREE (with a variable negative cerium anomaly), but with a virtually horizontal profile for the heavy rare earth elements (HREE). The profiles are very similar in shape, leading to tight clustering on the Gd_N/Lu_N against Gd_N/La_N.

Other properties of this group include high U, Th, and Zr contents, a lower MnO:U ratio than for Group1 and a higher Nb/TiO_2 ratio.

The Group 2 residues can be further differentiated into those samples with elevated levels of the siderophile elements cobalt, molybdenum and nickel (Group 2a) and those samples with low levels of these elements (Group 2b). The presence of these elements in elevated quantities is strongly correlated with the presence of altered fragments of iron in the slag.

Group 2a samples show an elevated Zr:Al_2O_3 ratio of up to 73×10^{-5}, reflecting a Zr content for these samples of 126–152 ppm, equivalent to 646–945 ppm recalculated on an iron-free basis.

Group 2b samples show higher values of U and Zr than the Group 1 smelting slags, but with a similar U:Zr ratio. They have similar levels of the siderophile elements to the Group 1 slags. They show a significantly different Nb/TiO_2 ratio to the Group 1 slags, but which is similar to local ore samples and moderately close to that of the furnace lining samples.

Analysis suggests the Group 2a samples are the result of mixing of a slag phase (of composition close to that of the Group 2b samples) with an iron-dominated component with extremely elevated levels of Co, Mo and Ni, but with a lower P_2O_5 content than the slag and little or no Mn. Detailed calculations of the mixing are hindered by the alteration of the iron and hence potential mobility (and non-conservation) of the elements contained within the iron. It seems reasonable to suggest, however, that the iron had very highly elevated levels of Co, Mo and Ni and that the iron pieces were mixed with a slag of a composition close to that of Group 2b. If such high levels of these elements are characteristic of the finished iron, it would be an unusual signature for the metal produced here.

Iron ore

The small piece of manganese-rich bog ore did not prove to be a good match for either suite of slags. Despite its overall lack of chemical similarity to the slags, the presence of large potassium feldspar crystals may provide a link to acidic igneous rocks and thus perhaps to a similar source area to the zirconium-enhanced Group 2. Its rare earth element profile was fairly similar to unprovenanced manganese ores (wad) probably recovered during excavation of the Palaeolithic burial at Paviland Cave, Gower (Young 2000a), despite having a cerium anomaly of opposite sense.

Interpretation

The chemical analyses of slags show a marked differentiation into two groups. The analyses which were taken from samples identifiable morphologically as tapped bloomery slags show REE profiles in Group 1 (profile inclined with progressive LREE depletion with respect to Upper Crust, with superimposed elevated MREE and a negative cerium anomaly). Manganese contents are typically very high.

Those samples morphologically identifiable as SHCs and other hearth or furnace slags show a more gently inclined profile with depletion of the LREE (with a variable negative cerium anomaly), but with a virtually horizontal profile for the HREE (Group 2).

A direct trace element similarity between the two groups of residues would have been expected, but there is little sign, particularly in the evidence from the REE, of material identifiable as being smelting slag being carried forward into the smithing stage. On the other hand, the smithing slags show an unusual chemical composition with exceptionally high uranium content, high manganese content and with Upper Crust-normalised REE profiles largely well above parity.

The interpretation of the chemical composition of the residues therefore has to address the problem of the smithing slags having a chemical signature quite distinct from that of the smelting slags. Such a situation might arise if:

1. The source of the iron ore was different: i.e. the smithing slags were produced during the working of iron from a different source than that being smelted.
2. The smithing process entailed the chemical signature of the ore being diluted by another input, such as the lining of the smithing hearth or a smithing flux.
3. The smithing residues are not from bloomsmithing, but from the smithing of finished iron, they therefore inherited no significant silicate component from the workpiece and the chemical signature is that of the smithing hearth.
4. The smithing slags are misidentified and are actually smelting slags, working a different ore from the tapped slags.

Option 4 is unlikely, given the clear morphological evidence for at least some of these samples being from smithing in conjunction with their chemical homogeneity as a group. One member of Group 2 shows significantly different microstructures from the rest of the group and may be a smelting slag. Options 2 and 3 are equally unlikely given that zirconium and manganese are not likely to be dominant elements in any potential smithing flux or smithing hearth ceramic. This leaves the most likely interpretation of Option 1: the smithing residues were the result of the working of iron produced from a different ore source from that employed in the smelting operation in Complex 1.

The origin of the smithing residues is also problematic because very little smithing debris was recognised, there was no structural evidence for a smithing hearth and, although there was no concerted programme of sampling for hammerscale (although deposits were regularly checked with a magnet for ferrous material), none was recognised in the field nor was any found attached to the submitted specimens, This may suggest that the smithing undertaken on the site was separate from the smelting in Complex 1 and the small amount of material recovered and analysed from Complex 1 may not have been representative of the smithing undertaken on the site as a whole.

Both the slags with Group 1 and those with Group 2 REE patterns are typically manganese-rich, with elevated levels of uranium. However, they are distinguished by their U and Zr contents together with their Nb/TiO_2 and U/Th ratios as well as by their REE profiles. The evidence from the smithing slags is also that the iron being worked was particularly rich in Co, Mo and Ni. These factors all suggest that the two iron sources were chemically quite distinct: Group 1 (REE profile with MREE enrichment; high U:Th ratio; low $Nb:TiO_2$ ratio; low U, Th, Zr contents; high Mn content), Group 2 (gently inclined REE profile; lower U:Th ratio; higher $Nb:TiO_2$ ratio; high U, Th, Zr contents; lower Mn content).

Group 1, shows some chemical similarities with a block of ore from Brownslade on the south Pembrokeshire Coast (Young 2010a). The origin of that block is uncertain. It is not something that would have occurred naturally on the Brownslade site, it has a geochemical composition quite close to some bog iron ores, but has a texture suggestive of that of the Carboniferous claystone ironstones. If it is a Carboniferous ore then it may have been moved to Brownslade by human agency, but such nodules also occur in the Quaternary drift deposits, derived by glacial and fluvio-glacial activity from the Carboniferous outcrops to the north and north-west of South Hook.

The high Zr content of the Group 2 materials requires further investigation. The extreme values shown in the 'iron-free' calculations are only a real measure of Zr in the silicate fraction if the Zr does not actually occur in the iron to any great extent (which would be the normal expectation). Analyses of the iron-bearing SHCs (Group 2a) do not appear, however, to show a marked dilution of the Zr content. The high Zr content may suggest a relationship with the high-Zr rhyolitic rocks within the Skomer Volcanic Group (Thorpe *et al*. 1989) which outcrop to the west of South Hook—either because the iron ore was sourced in this area, or because the iron was smelted in furnaces formed of Zr-rich materials. In either case it suggests that the South Hook site was smithing blooms produced west of Sandy Haven Pill, immediately to the west of the site, as well as smelting ores from another, perhaps more local, source.

FUEL ASH SLAGS

By Tim Young

The interpretation of clinker-like fuel ash slag (FAS) within archaeological sites has long been problematic as they are frequently misidentified as the product of metallurgy. This summary discussion, taken from technical report in the site archive (Young 2010b), of the South Hook slags has the intention of firmly establishing processes such as corn drying as a likely origin of such material.

Fuel ash slags were recovered from several contexts within the site, but particularly from within Complex 7, where they were recovered in significant quantities (1.1kg) in association with corn dryers, and are therefore interpreted as being of non-metallurgical origin.

Current interest in the slagging and fouling produced by biomass biofuels has led in recent years to an enhanced framework within which the archaeological material can be viewed. Chemical analysis of two samples of typical agglomerated FAS suggest that the siliceous input to these slags was probably in the form of quartz-rich sand, which is likely to have been a contaminant in the fuel. These examples lie at the siliceous end of the compositional range of modern wood biomass fuel ash slags. This presumably reflects the (usually) 'cleaner' fuels employed in modern burners and also the possibility for incorporation of siliceous material from the kiln sides and floor in the ancient examples. The high-melting point siliceous material was fluxed by the high calcium, magnesium and potassium fuel ash. Modelling of the ash composition produces an estimated composition compatible with studies on wood ashes. Partial melting of the silicate occurred with the formation of immiscible liquids in at least some areas of the slag, particularly where is a high proportion of unmelted quartz. One of these liquids is a relatively low Ca, low Mg, low P melt but with high Si, K and Al. The second, forming rounded blebs within the first, has high Ca, high Mg, high P with lower Si and very low Al. In pockets with larger melt volumes, the melt shows crystallization with generation of a calcium magnesium phosphate and of a pyroxene of a mainly endiopside composition.

CHARRED PLANT REMAINS

By Wendy Carruthers

Introduction

Soil samples were taken during the excavations for the recovery of environmental remains (see the bottom of Table 2 for sample volumes). A 250 micron and 1mm mesh were used to recover the flots, and the residues were sieved through a 1mm mesh.

Out of 103 samples that were assessed, 41 samples and two hand-picked hazelnut shell samples were selected for full analysis. This report discusses the results of the analysis of charred plant macrofossils, i.e. primarily fruits and seeds, with a few other identifiable items such as chaff fragments.

Some of the samples produced abundant charred cereal grains, and these were subsampled for quantification purposes, as noted at the bottom of Table 2. The remaining unquantified fractions of the flots were scanned for weeds and chaff fragments. The entries in Table 5 show the counts of grain in the subsample (marked in square brackets in the table) but the total counts of weed seeds and chaff fragments in the flot (no brackets). 'Charred fragments per litre' figures (given at the bottom of the table) have been calculated taking these factors into account.

The results of the analysis are presented in Table 2. Nomenclature follows Stace (1997), and most of the habitat details are taken from this volume. However, information concerning plant ecology is derived from a range of sources including Ellenburg (1988), Hill *et al.* (1999), and the author's own field experience.

Preservation and identification

The Old Red Sandstone soils in the Milford Haven area are acidic and are better suited to dairying than arable cultivation. On acid soils, movement of minerals and clay particles down the soil profile can cause charred material to become silt and mineral impregnated. This causes two problems—failure to float during sample processing, and difficulties in identification, because important characters are often obscured by silt. The sandy soils can also cause abrasion to seed surfaces, which makes remains difficult to identify and increases fragmentation. Many of the assemblages from this site were affected by these problems, resulting in high numbers of unidentified cereal grains in the species table. Where fragmentation was a major problem, grain numbers were estimated by counting embryo ends and almost complete grains only. As a check on recovery, a number of residues were scanned to ensure that whole categories of remains (e.g. chaff fragments) were not being missed. Although a few poorly preserved cereal grains were found in the residues, the processing was considered efficient enough not to have produced biased results.

Sprouting and insect damage

In several samples, holes and depressions in the dorsal sides of barley grains were observed, suggesting that insect pests may have damaged the crops. In most cases the damage consisted of small holes in the dorsal surfaces, which opened up to larger holes internally. This type of damage is typical of grain weevils. Small amounts of sprouting were observed in both barley and oats, but usually the embryos had only sprouted a short distance along the length of the grain. It is likely that in most cases, sprouting had occurred accidentally, due to inadequate drying of the grain, and damp storage conditions.

In the case of the large hulled barley deposit in Complex 7, however, the majority of grain had either sprouted or been 'damaged'. A particular type of damage had occurred prior to charring; the embryo end had been completely lost, as if the grain had been sliced at a slanted angle just above the embryo. Because this damaged end does not appear to have been hollowed out by insect gnawing, and because the deposit was associated with corn dryers, malting is the preferred explanation given (see 'Complex 7' section below). Experiments carried out by the author showed that mobilisation of starches in the grain early in sprouting caused the embryo ends to soften. Charring at this early stage may result in this 'halfing' effect. Further experimental work attempting to reproduce this effect is currently under way. Even though the sprouts that were seen were only around half the length of the grain, this would have been sufficient to convert the starches into malt sugars (Merryn Dineley, pers. comm.). This deposit, therefore, is considered to represent malted barley that had become burnt during the 'stopping' of germination.

Barley

Where the state of preservation was good, hulled barley was identified. A few possible naked grains were seen, but these were likely to have been sporadic mutations within a hulled barley crop. Both straight and twisted grains were observed, indicating that hulled six-row barley (*Hordeum vulgare*) was the main barley crop grown. It is possible that some two-row barley was present, but this could not be confirmed due to the lack of well-preserved chaff fragments. Two-row barley has only straight grains, but because the ratios of straight to twisted grains are affected by crop processing, and because the grains were often too poor to be sure whether they were twisted or not, it would have been misleading to use grain ratios to try to detect two-row barley. Where well-preserved rachis fragments were present, long internode measurements (generally around 3mm) suggested that a lax-eared variety of hulled six-row barley was being grown. Of course, this does not rule out the growing of dense-eared barley in addition, or genetically diverse crops containing both forms.

Oats

Samples rich in small oat grains and awn fragments could be thought to contain cereal processing waste (i.e. tail grain and chaff), but in this case distinct differences could be seen between the large and small oats. In addition, other categories of processing waste such as weed seeds and chaff fragments were not more abundant in the assemblages containing small oats than in those containing large oats. The presence of identifiable chaff fragments confirmed that two species of oats were being cultivated at South Hook.

The three main oat species that are found in the British Isles comprise wild oats (*Avena fatua*), a common weed of arable crops; common oats (*A. sativa*), which is the widely cultivated hexaploid species still grown today and bristle or sand oats (*A. strigosa*), a small-grained, hardy, diploid species. Descriptions are given of the two latter species below. It should be noted that grain morphology is notoriously difficult to use for identification purposes, because it can be affected by factors such as soil quality, cultivation methods, processing methods and distortion during charring. Therefore in the species table (Table 2) the different grain shapes have all been recorded under 'oats' (*Avena* sp.), although a superscript S (for small, *c*. 4–5mm) or L (for large, *c*. 5–6mm) has been added to indicate the main size category present. Since many eroded and poorly preserved grains were present in these samples it was thought to be misleading (and very time consuming) to provide actual counts of large and small grains. Grain sizes also vary at different points in the ear, so an overlap in the ranges exists. The presence of both common oat (*A. sativa*) and bristle oat (*A. strigosa*) was confirmed by the recovery of a few reasonably well-preserved floret bases (see Renfrew 1973 for identification criteria).

Avena sativa L., common oat; a hexaploid, widely cultivated species. The grains are large (*c*. 5–6mm charred), plump and wider towards the embryo-end, and often show slight notching at the opposite end. Large hairs are often visible on the grains. The lowest floret may be awned but the upper florets are not. A single, wider-scarred floret base (i.e. wider than *A. strigosa* but narrow compared to *A. fatua*) was recovered from South Hook to confirm that common oat was being cultivated. Oats of all species are useful crops on poor, acidic soils and in wet climates. They are harvested prior to ripening to reduce grain loss due to ears shattering. For this reason they may need to be dried in an oven prior to storage to reduce spoilage through sprouting and fungal attack. Being hulled grains, drying also helps to remove the chaff. If grain is to be used for sprouting or as seed corn, however, the husk is important in protecting the embryo from damage.

Table 2a. Charred plant remains (Complexes 1, 3–4, 6)

Complex Context/sample no. Feature type /sample size in litres	1 1028/362 L/4	1 1037/385 L/5	1 1078/389 F1070/5	1 1054/390 L/7.5	1 1813/391 L/5	1 1826/393/ Ph1827/5	1 1069/396 Ph1070/5	3 915/339 Ph916/10	3 909/398 C906/6	4 16091904 L/7.5	6 623/319 L/7.5	6 624/324 L/10	6 870/334 P871/10	6 872/375 P871/1	6 783/337 P784/?	6 787/1901 P784/5	Habitat preference
GRAIN and CHAFF																	
Triticum aestivum-type (bread-type wheat grain)	–	–	–	–	–	–	–	–	–	1*	–	–	–	–	–	–	
T. aestivum ssp. *compactum*-type (club-type Wheat grain)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	cf. 13	
Triticum sp. (indeterminate wheat grain)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	
Triticum dicoccum/spelta (emmer/spelt grain)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	
T. dicoccum/spelta (emmer/spelt glume base)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	
Secale cereale L. (rye grain)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	
Hordeum vulgare (hulled barley grain)	29	10	25	30	5	201	–	–	–	2*	1	2	6	14	–	15*	
Hordeum sp. (barley grain)	–	4	–	–	–	–	2	5	6	1	–	–	6	1	3	–	
Hordeum sp. (sprouted barley grain)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	
Hordeum sp. (embryo end damaged or lost prior to charring)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	
Hordeum sp. (barley rachis frag.)	–	–	–	–	1	11	–	–	–	1	–	–	–	–	–	1	
Avena sativa L. (common oat floret base)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	
Avena strigosa Schreb. (bristle oat floret base)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	
Avena strigosa-type (bristle oat-type rachilla)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	
Avena sp. (wild/cultivated oat grain)	10^{L}	3S	32^{LS}	5	2	32^{L}	197^{SL}	8^{L}	59S*	1	–	3	4^{L}	2	–	–	
Avena sp. (sprouted oat grain)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	
Avena sp. (indeterminate oat rachilla)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	
Avena sp. (oat rachis node)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	
Avena sp. (oat awn frags)	–	–	–	–	–	+	+	++	–	–	–	+	–	–	–	–	
Avena/Poaceae (small oat/grass)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	
indeterminate cereal grains	10	–	33	10	6	139	187	19	44	4	4	9	8	19	2	87	
cereal-sized culm node or base	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	
detached grain sprouts	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	
WEEDS etc.																	
Ranunculus acris/bulbosus/repens (buttercup achene)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	DG
R. flammula L. (lesser spearwort achene)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	MP
R. subg. *Batrachium* (crowfoot achenes)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	BP
Ranunculus sp. (buttercup embryo)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	DG
Urtica dioica L. (stinging nettle achene)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	CDn
Alnus glutinosa L. (alder seed)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	WSF
Alnus glutinosa L. (alder catkin)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	WSF
Corylus avellana L. (hazelnut shell frag.)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	HSW
Chenopodium album L. (fat-hen seed)	–	–	1	–	2	1	5	2	6	–	1	–	–	1	–	–	CDn
C. rubrum L. (red goosefoot seed)	–	–	–	–	–	–	6		2	–	–	–	–	–	–	–	CDn
Chenopodiaceae embryo	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	
Atriplex patula/prostrata (orache seed)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	CDn
Stellaria media (L.) Vill. (common chickweed seed)	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	Cno
S. graminea L. (lesser stitchwort seed)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	GDn
Spergula arvensis L. (corn spurrey seed)	1	–	–	–	–	1	–		–				2	–	–		
Persicaria maculosa (redshank achene)	–	1	–	1	–	–	–	6	–	1	2	1	2	–	–	1	Cdo
Persicaria lapathifolia (L.) Gray (pale persicaria achene)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	CDw
Persicaria hydropiper (L.) Spach (water-pepper achene)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	Pwh

Polygonum aviculare (L.) Spach (knotgrass achene)	–	–	–	–	–	–	1	–	–	–	1	1	–	–	–	–	CD
Fallopia convolvulus (L.) A. Love (black bindweed achene)	–	–	–	–	–	1	–	–	–	–	1	–	–	–	–	–	CD
Rumex acetosella L. (sheep's sorrel achene)	–	–	–	–	–	–	1	–	–	–		–	–	–	–	–	EoGCas
Rumex sp. (dock achene)	–	–	–	1	–	–	–	–	–	–	1	–	–	–	–	–	CDG
Hypericum sp. (St John's wort seed)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G
Viola sp. (violet seed)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	GEWSH
Raphanus raphanistrum ssp. *raphanistrum* (wild radish mericarp)	–	–	1	–	–	–	1	2	1	–	–	–	–	–	–	–	CD
Raphanus raphanistrum ssp. *raphanistrum* (wild radish seed)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	CD
Potentilla sp. (cinquefoil achene)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	DGMY
Rubus sect. *Glandulosus* (bramble seed)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	DHSW
Crataegus monogyna Jacq. (hawthorn fruit stone)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	HSW
rose/blackberry-type thorn	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	
Vicia/*Lathyrus* sp. (c. 2–3mm small vetch seed)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	
Medicago/*Trifolium*/*Lotus* sp. (medick/clover/trefoil seed)	–	–	–	–	6	–	–	–	–	–	–	–	–	–	–	–	GD
Ulex sp. (gorse seed)	–	cf.1	–	–	cf.1	–	–	–	–	–	–	–	–	–	–	–	GE
cf. *Ulex* sp. (cf. gorse leaf spine)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	GE
Linum usitatissimum L. (cultivated flax seed)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	
Apium nodoflorum (L.) Lag. (fool's watercress mericarp)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	MPw
Solanum nigrum L. (black nightshade seed)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	CD
Galeopsis tetrahit L. (common hemp-nettle nutlet)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	ADWod
Ajuga reptans L. (bugle nutlet)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	WGw
Prunella vulgaris L. (selfheal nutlet)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	GDWo
Mentha sp. (mint nutlet)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	GwBM
Lycopus europaeus L. (gypsywort nutlet)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	FGwP
Plantago major L. (greater plantain seed)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	Cgo
Plantago lanceolata L. (ribwort plantain seed)	–	1	–	–	2	–	1	–	–	–	–	–	–	–	–	–	Go
Sherardia arvensis L. (field madder nutlet)	–	–	–	–		–	–	–	–	–	–	–	–	–	–	–	AD
Galium aparine L. (cleavers nutlet)	–	–	–	–	1	–	–	–	–	–	1	–	–	–	–	–	CDSH
Sambucus nigra L. (elder seed)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	DHSW
Carduus/*Cirsium* sp. (thistle achene)	–	cf. 1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	GDY
Crepis sp. (hawl's-beard achene)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	GD
Anthemis cotula L. (stinking chamomile achene)	–	–	2	–	–	–	37	6	9	3	1	1	1	–	–	–	Adhw
Tripleurospermum inodorum (L.) Sch. Bip. (scentless mayweed achene)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	AD
Juncus sp. (rush seed)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	MPd
Eleocharis subg. *Palustres* (spike-rush nutlet)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	MPw
Isolepis setacea (L.) R. Br (bristle club-rush nut)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	PFME
Carex sp. (trigonous sedge nutlet)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	MPw
Carex sp. (lenticular sedge nutlet)	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	MPw
Danthonia decumbens (L.) DC (heath-grass caryopsis)	–	–	–	–	–	–	–	2	–	–	–	–	–	–	–	–	EGa
Glyceria sp. (sweet-grass caryopsis)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	P
Poaceae (small seeded grass caryopsis)	–	–	–	–	–	1	–	–	3	–	1	–	–	–	–	–	CDG
Pteridium aquilinum (L.) Kühn (bracken pinnule frag.)	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	EGa

Key: * = radiocarbon dated; [ ] = no. in subsample; + = occasional; ++ = several; +++ = frequent; ++++ = abundant; Oat superscript L = mainly large-type; superscript S = mainly small-type
Feature type: C = corn dryer; H = hearth; L = layer; Ph = posthole
Habitat preference: A = arable; C = cultivated; D = disturbed; E = hearth; G = grassland; H = hedgerow; M = marsh; P = pond, river, etc; S = scrub; W = woodland; Y = wayside. **Soils**: a = acidic; 0 = open; n = nutrient rich; w = wet

Table 2b. Charred plant remains (Complex 7)

Complex Context/sample no. Feature type/sample size in litres	7 140/305 C131/?	7 508/308 C507/7.5	7 198/386 C507/5	7 198/1925 C507/1.6	7 584/317 L/9	7 584/318 L/3	7 637/320 L/5	7 642/321 C650/5	7 710/325 L/3	7 707/326 C718/5	7 781/332 L/15	7 166/333 P167/15	7 510/1924 L/?	7? 636/369 Ph604/1	7? 684/379 P685/7.5	Habitat preference
GRAIN and CHAFF																
Triticum aestivum-type (bread-type wheat grain)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	
T. aestivum ssp. *compactum*-type																
(club-type wheat grain)	–	–	–	–	–	3	5	–	3	–	–	–	–	–	8	
Triticum sp. (indeterminate wheat grain)	–	–	–	–	–		1	–		–	–	–	–	–	–	
Triticum dicoccum/spelta (emmer/spelt grain)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	
T. dicoccum/spelta (emmer/spelt glume base)	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	
Secale cereale L. (rye grain)	–	cf. 1	–	–	–	–	–	–	–	–	–	–	–	–	–	
Hordeum vulgare (hulled barley grain)	–	20	301	[858]	[228]	[101]	28	[102]	[320]	1	2	232	382	21	20	
Hordeum sp. (barley grain)	–	128	–	–	–	[1706]	62	[58]		32	–	–	–	–	–	
Hordeum sp. (sprouted barley grain)	–	–	–	–	[126]	[260]	14	–	[82]	–	–	–	–	–	–	
Hordeum sp.																
(embryo end damaged or lost prior to charring)	–	–	–	–	[495]	[822]	74	–	[517]	–	–	–	–	20	10	
Hordeum sp. (barley rachis frag.)	–	1	–	–	–	1	–	3	–	1	2	1	1	–	–	
Avena sativa L. (common oat floret base)	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	
Avena strigosa Schreb. (bristle oat floret base)	–	1	–	–	–	–	–	6	–	–	–	–	–	–	–	
Avena strigosa-type (bristle oat-type rachilla)	–	–	–	–	–	–	–	5	–	–	–	–	–	–	–	
Avena sp. (wild/cultivated oat grain)	1 cf. 6	466^{SL}	7^{L}	[16^{L}]	[6^{L}]	131	7^{L}	[681^{SL}]	[6^{L}]	107^{S}	3	6^{L}	12^{L}	–	5	
Avena sp. (sprouted oat grain)	–	–	–	–	–	–	4	–	–	–	–	–	–	–	–	
Avena sp. (indeterminate oat rachilla)	–	–	–	–	–	–	–	2	–	–	–	–	–	–	–	
Avena sp. (oat rachis node)	–	–	–	–	–	–	–	33	–	–	–	–	–	–	–	
Avena sp. (oat awn frags)	+++	++++	++	–	+	–	–	+++	–	+++	–	–	–	–	–	
Avena/Poaceae (small oat/grass)		13		[2]	–	–	–	[15]	–	27	–	–	–	–	–	
indeterminate cereal grains	17	544	12	[5]	[8]	–	23	[519]	[25]	102	4	6	14	20	24	
cereal-sized culm node or base	–	–	–	–	–	–	–	3	–	–	–	–	–	–	–	
detached grain sprouts	–	–	–	–	–	+++	–	–	–	–	–	–	–	–	–	
WEEDS etc.																
Ranunculus acris/bulbosus/repens (buttercup achene)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	DG
R. flammula L. (lesser spearwort achene)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	MP
R. subg. *Batrachium* (crowfoot achenes)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	BP
Ranunculus sp. (buttercup embryo)	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	DG
Urtica dioica L. (stinging nettle achene)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	CDn
Alnus glutinosa L. (alder seed)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	WSF
Alnus glutinosa L. (alder catkin)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	WSF
Corylus avellana L. (hazelnut shell frag.)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	HSW
Chenopodium album L. (fat-hen seed)	–	–	–	3	14	43	4	4	3	–	–	3	–	–	10	CDn
C. rubrum L. (red goosefoot seed)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	CDn
Chenopodiaceae embryo	–	–	–	6	9	3	1	1	–	–	–	1	–	–	4	
Atriplex patula/prostrata (orache seed)	–	–	–	2	1	–	–	–	–	–	–	–	1	–	–	CDn
Stellaria media (L.) Vill. (common chickweed seed)	–	–	–	2	1	1	1	5	–	–	–	–	–	–	–	Cno
S. graminea L. (lesser stitchwort seed)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	GDn
Spergula arvensis L. (corn spurrey seed)	–	–	–	–	–	–	–	1	–	–	1	–	2	–	–	
Persicaria maculosa (redshank achene)	–	–	–	5	–	10	–	1	2	–	1	1	–	1	–	Cdo
Persicaria lapathifolia (L.) Gray																
(pale persicaria achene)	–	–	–	–	–	8	–	–	–	–	–	–	–	–	–	CDw
Persicaria hydropiper (L.) Spach																
(water-pepper achene)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	Pwh
Polygonum aviculare (L.) Spach (knotgrass achene)	–	1	–	–	–	–	–	3	–	–	1	–	–	–	–	CD

Fallopia convolvulus (L.) A. Love (black bindweed achene)	1	–	–	–	–	4	–	–	–	–	–	–	–	–	–	CD
Rumex acetosella L. (sheep's sorrel achene)	–	1	–	1	1	–	–	–	–	–	–	–	–	–	–	EoGCas
Rumex sp. (dock achene)	–	–	–	–	–	1	–	8	1	–	–	–	–	–	5	CDG
Hypericum sp. (St John's wort seed)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	G
Viola sp. (violet seed)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	GEWSH
Raphanus raphanistrum ssp. *raphanistrum* (wild radish mericarp)	–	3	–	–	1	1	–	2	–	12	–	–	2	–	–	CD
Raphanus raphanistrum ssp. *raphanistrum* (wild radish seed)	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	CD
Potentilla sp. (cinquefoil achene)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	DGMY
Rubus sect. *Glandulosus* (bramble seed)	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	DHSW
Crataegus monogyna Jacq. (hawthorn fruit stone)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	HSW
rose/blackberry-type thorn	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	
Vicia/*Lathyrus* sp. (c. 2–3mm small vetch seed)	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	
Medicago/*Trifolium*/*Lotus* sp. (medick/clover/trefoil seed)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	GD
Ulex sp. (gorse seed)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	GE
cf. *Ulex* sp. (cf. gorse leaf spine)	–	–	–	–	–	–	–	–	–	–	1	1	–	–	–	GE
Linum usitatissimum L. (cultivated flax seed)	–	–	–	–	–	–	–	–	–	–	–	–	117	–	–	
Apium nodoflorum (L.) Lag. (fool's watercress mericarp)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	MPw
Solanum nigrum L. (black nightshade seed)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	CD
Galeopsis tetrahit L. (common hemp-nettle nutlet)	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	ADWod
Ajuga reptans L. (bugle nutlet)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	WGw
Prunella vulgaris L. (selfheal nutlet)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	GDWo
Mentha sp. (mint nutlet)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	GwBM
Lycopus europaeus L. (gypsywort nutlet)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	FGwP
Plantago major L. (greater plantain seed)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	Cgo
Plantago lanceolata L. (ribwort plantain seed)	–	1	–	–	–	–	–	–	–	–	1	–	–	–	–	Go
Sherardia arvensis L. (field madder nutlet)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	AD
Galium aparine L. (cleavers nutlet)	–	–	–	–	–	1	1	–	–	–	–	–	–	–	–	CDSH
Sambucus nigra L. (elder seed)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	DHSW
Carduus/*Cirsium* sp. (thistle achene)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	GDY
Crepis sp. (hawl's-beard achene)	–	–	–	–	–	–	–	cf. 1	–	–	–	–	–	–	–	GD
Anthemis cotula L. (stinking chamomile achene)	2	32	–	2	–	–	1	65	–	70	3	2	–	–	5	Adhw
Tripleurospermum inodorum (L.) Sch. Bip. (scentless mayweed achene)	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	AD
Juncus sp. (rush seed)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	MPd
Eleocharis subg. *Palustres* (spike-rush nutlet)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	MPw
Isolepis setacea (L.) R. Br (bristle club-rush nut)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	PFME
Carex sp. (trigonous sedge nutlet)	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	MPw
Carex sp. (lenticular sedge nutlet)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	MPw
Danthonia decumbens (L.) DC (heath-grass caryopsis)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	EGa
Glyceria sp. (sweet-grass caryopsis)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	P
Poaceae (small seeded grass caryopsis)	1	–	–	–	–	–	–	1	–	–	–	1	–	–	–	CDG
Pteridium aquilinum (L.) Kühn (bracken pinnule frag.)	3	–	–	–	–	–	–	–	–	48	–	–	–	–	–	EGa

Key: * = radiocarbon dated; [ ] = no. in subsample; + = occasional; ++ = several; +++ = frequent; ++++ = abundant; Oat superscript L = mainly large-type; superscript S = mainly small-type
Feature type: C = corn dryer; H = hearth; L = layer; Ph = posthole
Habitat preference: A = arable; C = cultivated; D = disturbed; E = heath; G = grassland; H = hedgerow; M = marsh; P = pond, river, etc; S = scrub; W = woodland; Y = wayside. **Soils**: a = acidic; o = open; n = nutrient rich; w = wet

Table 2c. Charred plant remains (Complexes 9–10, 11, 13–14)

Complex	9	10	10	11	11	11	13	N of 13	14	Habitat
Context/sample no.	1503/1907	913/350	936/351	1134/346	1130/387	945/368	1170/360	1183/392	1524/1916	preference
Feature type/sample size in litres	H?/5	PH914/7.5	PH937/4	P1131/6	P1131/15	P946/7.5	L/7.5	P1184/7.5	P1523/15	
GRAIN and CHAFF										
Triticum aestivum-type (bread-type wheat grain)	–	–	–	–	–	–	–	–	–	
T. aestivum ssp. *compactum*-type club-type wheat grain)	–	–	1	–	–	–	–	–	–	
Triticum sp. (indeterminate wheat grain)	–	1	–	–	–	3	–	1	–	
Triticum dicoccum/spelta (emmer/spelt grain)	cf. 1	–	–	–	–	3	1	1	–	
T. dicoccum/spelta (emmer/spelt glume base)	–	–	–	–	–	–	–	–	1	
Secale cereale L. (rye grain)	–	–	–	–	–	–	–	–	–	
Hordeum vulgare (hulled barley grain)	–	–	–	–	–	–	–	–	–	
Hordeum sp. (barley grain)	4	4	–	–	2	1	–	–	–	
Hordeum sp. (sprouted barley grain)	6	–	1	–	1	–	–	3	–	
Hordeum sp. (embryo end damaged or lost prior to charring)	–	–	–	–	–	–	–	–	–	
Hordeum sp. (barley rachis frag.)	–	–	–	–	–	–	–	–	–	
Avena sativa L. (common oat floret base)	–	–	–	–	–	1	–	–	–	
Avena strigosa Schreb. (bristle oat floret base)	–	–	–	–	–	–	–	–	–	
Avena strigosa-type (bristle oat-type rachilla)	–	–	–	–	–	–	–	–	–	
Avena sp. (wild/cultivated oat grain)	–	–	–	–	–	–	–	–	–	
Avena sp. (sprouted oat grain)	19^{S}	2	3*	22^{SL}*	2	3	38^{L}	–	–	
Avena sp. (indeterminate oat rachilla)	–	–	–	–	–	–	–	–	–	
Avena sp. (oat rachis node)	–	–	–	–	–	–	–	–	–	
Avena sp. (oat awn frags)	–	–	–	–	–	–	–	–	–	
Avena/Poaceae (small oat/grass)	–	–	–	–	–	–	–	–	–	
Indeterminte cereal grains	–	–	–	–	–	–	–	4	–	
cereal-sized culm node or base	14	–	1	8	3	18	26	4	3	
detached grain sprouts	1	–	–	–	–	–	–	–	–	
WEEDS etc.										
Ranunculus acris/bulbosus/repens (buttercup achene)	–	–	–	–	–	–	–	–	–	DG
R. flammula L. (lesser spearwort achene)	–	–	–	–	–	–	–	–	–	MP
R. subg. *Batrachium* (crowfoot achenes)	–	–	–	–	–	–	–	–	–	BP
Ranunculus sp. (buttercup embryo)	–	–	–	–	–	–	–	–	–	DG
Urtica dioica L. (stinging nettle achene)	–	–	–	–	–	–	–	–	–	CDn
Alnus glutinosa L. (alder seed)	–	–	–	–	–	–	–	–	–	WSF
Alnus glutinosa L. (alder catkin)	–	–	–	–	–	–	–	–	–	WSF
Corylus avellana L. (hazelnut shell frag.)	–	–	–	–	–	–	–	–	–	HSW
Chenopodium album L. (fat-hen seed)	–	–	–	–	–	1	–	–	117	CDn
C. rubrum L. (red goosefoot seed)	–	–	–	–	–	–	5	1	–	CDn
Chenopodiaceae embryo	–	–	–	–	–	–	–	–	–	
Atriplex patula/prostrata (orache seed)	1	–	–	–	–	4	–	–	–	CDn
Stellaria media (L.) Vill. (common chickweed seed)	–	–	–	–	–	–	–	–	–	Cno
S. graminea L. (lesser stitchwort seed)	–	–	–	–	–	–	–	–	–	GDn
Spergula arvensis L. (corn spurrey seed)	–	–	–	–	–	–	1	–	–	
Persicaria maculosa (redshank achene)	–	–	–	1	–	1	–	–	–	Cdo
Persicaria lapathifolia (L.) Gray (pale persicaria achene)	2	1	–	–	–	–	–	–	–	CDw
Persicaria hydropiper (L.) Spach (water-pepper achene)	–	–	–	–	–	–	–	–	–	Pwh

Polygonum aviculare (L.) Spach (knotgrass achene)	–	–	–	–	–	–	–	–	–	CD
Fallopia convolvulus (L.) A. Love (black bindweed achene)	1	1	–	–	–	1	–	–	–	CD
Rumex acetosella L. (sheep's sorrel achene)	–	–	–	–	–	–	–	–	–	EoGCas
Rumex sp. (dock achene)	–	–	–	–	1	–	–	–	–	CDG
Hypericum sp. (St John's wort seed)	–	–	–	–	–	–	–	–	–	G
Viola sp. (violet seed)	–	–	–	–	–	–	–	–	–	GEWSH
Raphanus raphanistrum ssp. *raphanistrum* (wild radish mericarp)	–	–	–	–	–	–	–	–	–	CD
Raphanus raphanistrum ssp. *raphanistrum* (wild radish seed)	–	–	1	–	–	–	–	–	–	CD
Potentilla sp. (cinquefoil achene)	–	–	–	–	–	–	–	–	–	DGMY
Rubus sect. *Glandulosus* (bramble seed)	–	–	–	–	–	–	–	–	–	DHSW
Crataegus monogyna Jacq. (hawthorn fruit stone)	–	–	–	–	–	–	–	–	–	HSW
rose/blackberry-type thorn	–	–	–	–	–	–	–	–	–	
Vicia/Lathyrus sp. (c. 2–3mm small vetch seed)	–	–	–	–	–	–	–	–	–	
Medicago/Trifolium/Lotus sp. (medick/clover/trefoil seed)	–	–	–	–	–	–	–	–	–	GD
Ulex sp. (gorse seed)	–	–	–	–	–	–	–	–	–	GE
cf. *Ulex* sp. (cf. gorse leaf spine)	–	–	–	–	–	–	–	–	–	GE
Linum usitatissimum L. (cultivated flax seed)	–	–	–	–	–	–	–	–	–	
Apium nodoflorum (L.) Lag. (fool's watercress mericarp)	–	–	–	–	–	–	–	–	–	MPw
Solanum nigrum L. (black nightshade seed)	–	–	–	–	–	–	–	–	–	CD
Galeopsis tetrahit L. (common hemp-nettle nutlet)	–	1	–	–	–	–	–	–	–	ADWod
Ajuga reptans L. (bugle nutlet)	–	–	–	–	–	–	–	–	–	WGw
Prunella vulgaris L. (selfheal nutlet)	–	–	–	–	–	–	–	–	–	GDWo
Mentha sp. (mint nutlet)	–	–	–	–	–	–	–	–	–	GwBM
Lycopus europaeus L. (gypsywort nutlet)	–	–	–	–	–	–	–	–	–	FGwP
Plantago major L. (greater plantain seed)	–	–	–	–	–	–	–	–	–	Cgo
Plantago lanceolata L. (ribwort plantain seed)	–	1	–	–	–	–	–	–	–	Go
Sherardia arvensis L. (field madder nutlet)	–	–	–	–	–	–	–	–	–	AD
Galium aparine L. (cleavers nutlet)	–	–	–	–	–	–	–	–	–	CDSH
Sambucus nigra L. (elder seed)	–	–	–	–	–	–	–	–	–	DHSW
Carduus/Cirsium sp. (thistle achene)	–	–	–	–	–	–	–	–	–	GDY
Crepis sp. (hawl's-beard achene)	–	–	–	–	–	–	–	–	–	GD
Anthemis cotula L. (stinking chamomile achene)	–	–	–	–	–	–	–	–	–	Adhw
Tripleurospermum inodorum (L.) Sch. Bip. (scentless mayweed achene)	1	–	–	–	1	–	1	–	–	AD
Juncus sp. (rush seed)	–	–	–	–	–	–	–	–	–	MPd
Eleocharis subg. *Palustres* (spike-rush nutlet)	–	cf. 3	–	–	–	–	–	–	–	MPw
Isolepis setacea (L.) R. Br (bristle club-rush nut)	–	–	–	–	–	–	–	–	–	PFME
Carex sp. (trigonous sedge nutlet)	–	–	–	–	–	–	–	–	–	MPw
Carex sp. (lenticular sedge nutlet)	–	–	–	–	–	–	–	1	–	MPw
Danthonia decumbens (L.) DC (heath-grass caryopsis)	–	–	–	–	–	–	–	–	–	EGa
Glyceria sp. (sweet-grass caryopsis)	–	–	–	1	–	–	–	–	–	P
Poaceae (small seeded grass caryopsis)	–	–	–	–	–	–	–	–	–	CDG
Pteridium aquilinum (L.) Kühn (bracken pinnule frag.)	2	–	–	–	–	–	–	1	–	EGa

Key: * = radiocarbon dated; [ ] = no. in subsample; + = occasional; ++ = several; +++ = frequent; ++++ = abundant; Oat superscript L = mainly large-type; superscript S = mainly small-type
Feature type: C = corn dryer; H = hearth; L = layer; Ph = posthole
Habitat preference: A = arable; C = cultivated; D = disturbed; E = hearth; G = grassland; H = hedgerow; M = marsh; P = pond, river, etc; S = scrub; W = woodland; Y = wayside. **Soils**: a = acidic; 0 = open; n = nutrient rich; w = wet

Avena strigosa Schreb, bristle or sand oat. This diploid cultivated species has a smaller (*c.* 4–5mm charred), more slender grain that is characteristically slightly wider (and sometimes flattened) towards the apex of the grain (i.e. opposite end to the embryo). Hairs were less obvious than those on *A. sativa* on the South Hook examples. The ears of bristle oat are heavily awned. At South Hook the samples producing abundant awn fragments in the fine flots were always the ones with frequent small-grained oats, lending more support to the argument that two different species were present, rather than poorly grown, smaller versions of the same species (or 'tail' grains, i.e. slim, poorly formed grains that pass through the sieve with the weeds). Bristle oats prefer heavier soils, and they can cope with nutrient-poor clays and acidic soils. They appear to have mainly been grown during the medieval period in Scotland and Wales in the United Kingdom, and occasionally back into the Iron Age in parts of northern Europe (Helmut Kroll's database; http://www.archaeobotany.de). A few bristle-oat floret bases and rachilla were identified in the large assemblage from corn dryer 650, confirming the presence of this species. The very narrow floret bases of bristle-oat can be differentiated from the narrow bases of the upper florets of common oat where awns are observed (Jacomet 2006). No wild oat remains were identified from any of the samples, but as only a few fragments of chaff were identifiable to species level this may be due to chance.

Wheat

The very small, rounded size and shape of most of wheat grains recovered from the features suggested that a compact form of wheat, club wheat, was being cultivated (*Triticum aestivum* subsp. *compactum*) from the eighth/ninth century AD, with more typical large, square bread-type wheat occurring in the later periods (tenth/twelfth century AD). Wheat grain identification is problematic, since sizes and shapes are very variable and the ranges overlap (Jacomet 2006). Since no free-threshing wheat chaff fragments were recovered to confirm the species identifications, the wheat grains are listed as 'types', as recommended by Jacomet (ibid.).

Club wheat is thought to have been the earliest wheat grown in some areas of Europe during the Neolithic period, perhaps because it is generally hardy and can be grown on poor soils. It can also be left in the field for some time after ripening (Percival 1921), unlike bread-type wheat, which often sprouts in the ear or is shed. This can be an advantage if workforces are small or harvesting weather is unpredictable. However, it is a low-yield wheat and it is best suited to spring sowing. Club wheat appears to have become replaced by bread-type wheat by the later prehistoric period, although a number of Iron Age, Roman, early medieval and later medieval sites have produced compact-type grains, so perhaps it is able to re-surface amongst genetically diverse crops from time to time. It may also have been grown in addition to bread wheat in marginal areas, perhaps as a maslin to safeguard against crop failure in the same way that dredge was widely grown.

Charred plant macrofossil assemblages

Complex 1

This complex represents an iron-smelting workshop with two furnaces. Carbonised gorse/broom root-wood from the base of one of the furnaces returned a radiocarbon date of cal. AD 770–1000.

Charcoal analysis (see report on wood charcoal below) revealed that gorse or broom had been used as fuel for the iron-smelting furnaces. Seven samples from layers, postholes and a furnace fill from this complex were examined for plant macrofossils. Two of the samples produced possible gorse seed fragments (*Ulex* sp.) and several small fragments of bracken frond (*Pteridium aquilinum*), providing more evidence of the type of vegetation that was being used for fuel or kindling. In addition, gorse or broom were the dominant charcoal types in the furnaces. Gorse, broom and bracken commonly come to dominate open habitats on poor acidic, sandy soils, particularly where land has been grazed and then abandoned.

Oats and barley were the only cereals recovered from these samples. Hulled six-row barley (*Hordeum vulgare*) was frequent, as were large-grained oats that were probably common oats (*Avena sativa*). The species of oat could not be confirmed as no chaff was present, and some small grained oats were recovered suggesting that bristle oat (*A. strigosa*) was also present. However, oat awn fragments were not frequent (see notes on identification above). Oats and barley appear to have been widely consumed in south Wales during this period (Caseldine 1990), as bread wheat (the preferred grain for human consumption in England) would not have grown well on the nutrient-poor, acidic soils.

Some of the samples (e.g. the furnace fill, context 1078) produced similar proportions of oats and barley, suggesting that a mixed crop or 'dredge' could have been present. Others were dominated either by oats (e.g. posthole 1070) or barley (posthole 1827). Although a few barley chaff fragments (rachis segments) were present in the latter feature fill, chaff and weed seeds were generally rare, suggesting that burnt domestic waste was the probable origin of the remains rather than concentrated cereal processing waste. It is possible that the grain had been used as fodder for draught animals that were being used to bring raw materials to the site and transport the finished product to market. Alternatively, the furnaces could have had multiple functions, being used as grain dryers from time to time. Grain drying would have required much lower temperatures than iron-working, so a different fuel may have been used. Oak, alder or hazel, cherry-type and Maloideae (apple, hawthorn etc.) charcoal fragments were present in small quantities in the Complex 1 samples (see report on wood charcoal below), and these are slower burning fuels. Comparisons of the furnaces in Complex 1 with the corn dryers in Complex 7 (see report on wood charcoal below) showed that oak dominated the corn dryers, and this would have produced a slower-burning, more controllable heat. The furnaces, on the other hand, were dominated by gorse or broom charcoal.

An arable weed characteristic of heavy, damp, clay soils stinking chamomile (*Anthemis cotula*) was particularly frequent in the sample from posthole 1070, a sample that produced frequent oat grains. The association of oats with this weed is discussed further below. In general, the range of crops and weed seeds was very similar to assemblages from most of the other complexes examined for this report, in particular Complex 7.

Complex 3

This small complex to the west of Complex 1 contained a possible truncated corn dryer or hearth and a few postholes. Two samples were examined in detail; one from possible corn dryer 907, and one from posthole 916. The corn dryer sample produced primarily small oat grains (probably bristle oats but identifiable only as *Avena* sp.) with a little barley. An oat grain was dated from this feature to cal. AD 980–1150. The posthole produced a small number of oat and barley grains with quite a few weed seeds (mainly chickweed (*Stellaria media*) and stinking chamomile (*Anthemis cotula*)). Perhaps a little crop processing waste was present, or the post and local weedy vegetation had been burnt *in situ*. Preservation was very poor in both samples, with surface erosion and mud encrustation making identification difficult. Oak was the dominant charcoal type on this site, rather than gorse or broom, perhaps reflecting the different type of heat that was required for grain drying, in comparison with the iron smelting (see report on wood charcoal below).

Complex 4

A sample was examined from the fill of a hollow that may have been roofed. Low concentrations of hulled barley and oat grains, with a few weed seeds and a barley rachis (chaff) fragment suggest that small amounts of domestic waste were being burnt. A single bread-type wheat grain (*Triticum aestivum*-type) from layer 1609 was radiocarbon dated to cal. AD 900–1030. This cereal may have been much more important than the charred record suggests. Free-threshing wheat is less likely to become charred by accident during processing, as heat is not required to separate the grain from the chaff. Being a highly valued food for human consumption, it is also less likely to have been wasted and spread around the site. The same types of weed seeds were present (in small quantities) as in the previous complexes.

Complex 6

This complex comprised a timber building surrounding a central floor hollow. Pits and postholes were present. Charcoal from the hollow gave a date of cal. AD 720–960. However, a pit in the northern edge of the complex (pit 784) contained part of an Early Bronze Age urn, and a hulled barley grain from fill 787 associated with it produced a date of 2200–1960 cal. BC. Therefore, two different phases of occupation separated by possibly as much as three thousand years were represented in this area.

Six samples were examined, including two from layers within the hollow, two from pit 871 and two from the shallow prehistoric pit 784. Low concentrations of grain (hulled barley and oats) and a range of weed seeds similar to those in other early medieval complex samples were present in the layers and in pit 871. As with the other less-productive samples, background levels of burnt domestic waste were probably the source of these charred remains.

The prehistoric pit samples were a little different in that weed seeds were very scarce (one redshank (*Persicaria maculosa*) seed). Equal quantities of hulled barley and free-threshing wheat grains were identified from among the very poorly preserved, silt encrusted and eroded grains recovered from the sample. As with most of the wheat from this site, the grains were small, plump and rounded. They appear to be a compact form such as club wheat (*Triticum aestivum* ssp. *compactum*). However, chaff fragments were not recovered to confirm this identification. The scarcity of contaminants (weed seeds and chaff fragments) and frequency of free-threshing wheat suggests that this could have been a deliberately burnt, 'ritual' deposit of grain, since large numbers of free-threshing wheat grains rarely become accidentally burnt in the prehistoric period.

Complex 7

Four elongated features, identified as probable corn dryers, were excavated. Fifteen samples were analysed for plant macrofossils in detail, including samples from the corn dryers, two pits, a posthole and five samples from burnt spreads.

Charred barley from a spread of grain that may represent cleaning out prior to the final stage of use of a corn dryer was dated to cal. AD 680–880. This extensive deposit (includes contexts 584, 637 and 710) was found to consist of sprouted barley (12%) and barley grains with damaged embryo-ends (57%; see notes on preservation and identification above). The glassy appearance of the damaged surfaces of the grains confirmed that the damage had definitely occurred prior to charring. Initially, it was uncertain whether this deposit represented deliberate sprouting for malt, or damage by crop pests such as grain weevils, since both have a similar effect on the appearance of the grain. Two of the common signs of malted grain, detached sprouts and grains with caved in sides, were not frequent. Pest damage tends to be centred on the highly nutritious embryo, and in some cases holes on the dorsal sides of the grains were observed. No charred beetles were found. Perhaps the crop was burnt in order to destroy an infestation? However, an infested crop is much more likely to have been burnt in a bonfire, well away from an area being used for processing crops. The association of this deposit with corn dryers provided strong support for the suggestion of malted grain. If the crop was charred at an early stage in the malting process (suggested by the short length of the coleoptiles, <1/2 length of grain) the majority of delicate sprouts may have been burnt away and the grain would not yet be at the 'collapsing' stage (when reserves in the seed have been used up by the germinating embryo). Besides which, the highest yield of malt is obtained if sprouting is stopped before this point, i.e. before the sprout or 'acrospire' has used up the valuable malt sugars (Merryn Dineley, pers. comm.). Therefore, malting is the preferred interpretation in this case. Unfortunately, members of the Malting Association of Great Britain who kindly agreed to examine a sample of 'damaged' barley were unable to confirm this suggestion.[7]

The sample from layer 510 also produced frequent hulled barley grains with a few long-grained oats, but the barley showed only slight signs of insect damage, in addition to longitudinal grain splitting and oozing (an indication that the grain was not fully ripe or had a relatively high moisture content). The notable factor concerning this sample was that 117 poorly preserved cultivated flax seeds (*Linum usitatissimum*) were also present. Flax seeds produce a useful oil, linseed, which can be extracted by cold pressing. Heat can be used to improve extraction, and the oil can be boiled to make it thicker. This was the only sample from the site to produce flax seeds. Flax was a common crop in the early medieval period across the British Isles but it does not preserve well by charring due to the high oil content (*c*. 40% of the seed weight). These charred remains probably represent waste from an oven being used to improve oil extraction. Of course, flax was also an important fibre crop, and the seeds have medicinal and nutritional value. Although fibre was probably also extracted from plants grown at this site, the presence of charred seeds in the sample suggests that, in this instance, oil extraction was taking place. Work on the Devon Pipeline (Carruthers, Cotswold Archaeology Assessment Report) revealed frequent whole charred flax capsules containing seeds from Roman deposits, suggesting that oil extraction was being carried out with the use of heat. Flax retting waste (fibre extraction waste) is much more likely to become preserved by waterlogging.

The four corn dryers produced abundant evidence for the types of crops being dried. Oats dominated four of the six samples, and two were dominated by barley, as shown in Table 3.

Discounting corn dryer 131 because such a small number of grains were recovered, the remaining three structures produced mixed assemblages from their bases at a ratio of 1:3 or 1:2 barley to oat grains. This could represent a build up of material from the processing of both barley and oat crops, or it could at least partly result from drying dredge (a mixed crop of oats and barley). The upper layer of corn dryer 507 produced a fairly clean crop of barley, with the few large oats probably representing the remains of a previous crop grown on the same land.

Table 3. Cereal grains and other plant macrofossils from the corn dryers

	Corn dryer 131	Corn dryer 507			Corn dryer 650	Corn dryer 719
Context	140	508	198	198	642	707
Barley	0%	24%	98%	98%	32%	24%
Oats (grain size Small or Long)	indeterminate	76% S	2% L	2% L	68% S(L)	76% S
Stinking chamomile (*Anthemis cotula*) seeds	2	32	0	2	65	70
Total identifiable grains	7	614	308	4370	1001	140

Although most of the oats could not be identified to species level, it was clear from the presence of a few identifiable floret bases, from the abundance of oat awn fragments and from the small size of most of the oat grains that bristle oat (*Avena strigosa*) was the main oat species present in the lower levels of the corn dryers. Long, plump oats characteristic of common oat (*A. sativa*), were almost exclusively found in the barley-dominated samples. Although this could indicate a change in the crops being dried through time, the occurrence of the weed stinking chamomile (*Anthemis cotula*) suggested an alternative explanation relating to crop husbandry. Stinking chamomile is a weed of heavy, damp clay soils, i.e. the type of soil that oats can tolerate but on which barley would not thrive. It appears, then, that the tough but small-seeded bristle oats were being grown on the poorer, heavier soils, whilst the barley, and probably more highly valued large-seeded common oats, were being grown on the better drained, lighter soils. Barley and common oats may have been grown in rotation, or as dredge.

The low numbers of other weed seeds (for example fat hen (*Chenopodium album*), wild radish (*Raphanus raphanistrum*)) provided a little information about crop husbandry, suggesting that manuring was probably occurring. These types of weeds were fairly evenly distributed across oat-dominant and barley-dominant crops, and most of the weeds species found occurred throughout the early medieval samples. The assemblages from the corn dryers contained relatively few chaff fragments or weed seeds, so they probably comprised processed crops that were being dried prior to storage or grinding. Both oats and barley require drying before they are fit for consumption; oats need to be dried because they are harvested in a semi-ripe state, and both cereals require heat to remove the husks prior to consumption. Barley and oat husks are unlikely to be preserved in any great quantity, as they are thin and papery and would burn away in the flames. However, grain may have become charred if it accidentally fell into the flames, or if the oven accidentally overheated. Waste material lying in and around the ovens may also have been swept up and burnt as fuel.

It appears, then, that a range of crops were being dried in the ovens at different times (hulled barley, common oats, bristle oats, and perhaps dredge), and at times the ovens may have been used to produced malt and to extract oil from flax seed. The barley would have been sprouted for a short time to convert stored starches to sugars, then the grain was heated so that germination stopped and the malt could be extracted. Charring probably occurred when the sprouted grain became over-heated.

Most of the samples from the pits and postholes produced small quantities of poorly preserved barley and large oat grains. Since these soil samples were often small in volume, the concentration of charred fragments per litre (fpl) was surprisingly high, suggesting that burnt material had spilt into the features from deposits such as the burnt barley spread. Barley was always dominant, and most of the identifiable oats were large-grained (cf. common oat), much like the assemblages in layers 584, 637 and 710. Virtually no chaff and very few weed seeds were present, confirming that the burnt waste had originated as processed grain. One feature, pit 167, produced a high concentration of this type of barley-rich burnt waste (16.9 fpl).

A handpicked sample from pit 756 consisted of a few large fragments of hazelnut shell (*Corylus avellana*). It is uncertain whether this was contemporary with the grain-rich samples, as little hazelnut shell was recovered from the early medieval samples. Two pits in Complex 14, however, produced hazelnut shell, and one of the abundant fragments from pit 1523 was dated to the Bronze Age (2010–1760 cal. BC).

Complex 9

A sample from a possible hearth or furnace (context 1503) produced a small assemblage containing more bristle-type oats than barley grains, with a few typical weed seeds such as redshank (*Persicaria maculosa*). A hulled barley grain was accelerator dated to AD 890–1030. If the feature was a domestic hearth, this could indicate that bristle oats had been consumed from time to time, rather than only being used for fodder. However, the material could also represent animal waste (dried dung or bedding) being used for fuel and tinder.

Complex 10

The arrangement of postholes in this area suggested that a structure may have been present. Radiocarbon dates have shown that the possible structure dates to the early medieval period (bread-type bread wheat grain from posthole 937 dated to cal. AD 1010–1170; cereal grain from posthole 905 dated also to cal. AD 1010–1170). The sample from pit 937 (which produced a shale object) and one from posthole 914 produced low concentrations of domestic waste containing a few grains of oats and barley. It was notable that, although charred remains were scarce, a well-preserved grain of free-threshing wheat was recovered from each sample (one bread-type and one club-type grain).

Complex 11

This complex consisted of a slightly bow-sided building around a central hollow. Samples from two pits were examined, and these produced predominantly small and large oat grains, with some club-type wheat grains in pit 946 and small amounts of barley in both pits. A chaff fragment (barley rachis segment) and several weed seeds were recovered. These remains appear to represent low concentrations of burnt domestic waste. An oat grain from pit 1131 was radiocarbon dated to cal. AD 890–1030.

Complex 13

A paved hollow with postholes provided a charcoal date of cal. AD 780–890. A sample from layer 1170 provided the only assemblage of large-seeded oat grains not to be accompanied by hulled barley. A single free-threshing wheat grain was present. Weed seeds were scarce but did include one new taxon, lesser stitchwort (*Stellaria gramineae*), a common weed of grassy and disturbed places. Perhaps the burnt material in this complex had a slightly different origin to the samples from other complexes in the trench. Pit 1184 located to the north of Complex 13 produced a few cereal grains and weed seeds including a possible club-type wheat grain, an indeterminate wheat grain and a few barley grains. Unfortunately the state of preservation of the cereal grains was poor.

Complex 14

One sample and a couple of handpicked fragments of hazelnut shell were examined from two pits that were thought to be prehistoric. A radiocarbon date on some hazelnut shell produced a date of 2010–1760 cal. BC, confirming a Bronze Age date. The charred plant assemblage from sample 1916 (pit 1523) was typical of the period, containing frequent hazelnut shell fragments (117 fragments) but scarce evidence of arable activity. The only identifiable grain from the complex was a well-preserved emmer or spelt wheat (*Triticum dicoccum* or *spelta*) grain. No chaff or weed seeds were recovered.

General discussion of the charred plant remains

Prehistoric period

Bronze Age accelerator dates were recovered from three archaeobotanical remains, including charcoal, hazelnut shell and a hulled barley grain. The barley grain came from the possible ritual deposit of processed free-threshing club-type wheat (*Triticum aestivum* ssp. *compactum*) and hulled barley (*Hordeum* sp.) in pit 784, Complex 6 (2200–1960 cal. BC). Because free-threshing wheat would have been a high status crop at this time, and because it does not need to come into contact with fire during processing, the charring of a relatively large number of grains (13 grains) suggests some sort of deliberate burning event. In comparison, a Bronze Age charred assemblage that was more obviously ritual in nature was the large deposit of Celtic beans at the spectacular site cliff-top site of Le Pinacle, Jersey (Carruthers 2001). This deposit also contained a few compact-type free-threshing wheat grains.

The second sample that provided evidence of prehistoric activity was the large number (117 fragments) of hazelnut shell fragments in pit 1523 in Complex 14 (2010–1760 cal. BC). In addition to the hazelnut shells, a few poorly preserved cereal grains were recovered, including one grain of emmer or spelt wheat (*Triticum dicoccum* or *spelta*). This demonstrates that cereals and wild food resources were both being exploited during this period, although it is uncertain whether the grain had been grown locally or brought to the site, since no chaff or weed seeds were recovered. The third dated sample, charcoal from a Middle Bronze Age feature in Complex 9, is discussed in the charcoal report (see report below).

These scant remains demonstrate that a variety of cereals were being consumed during the Bronze Age, including emmer or spelt wheat (most likely emmer), a small-grained free-threshing wheat (possibly club wheat) and hulled barley. However, native foods gathered from hedgerows, scrub and woodland margins were still important. Because so few weed seeds (one redshank seed) and chaff fragments (one barley rachis fragment) were recovered, it is not possible to say anything more about crop processing or crop husbandry. It is likely that at least some of these burnt food remains were associated with ritual activity on the site.

The early to later medieval periods (late eighth century to middle twelfth century AD)

During this period two kinds of oats and hulled barley constituted the main cereals recovered as charred plant remains, with either oats or barley being found in 92% of the samples. Both oats and barley were present in 83% of the 36 early and later medieval samples, so it is likely that oats and barley had frequently been grown as a mixed crop called 'dredge'. Free-threshing wheat (club-type wheat and bread-type wheat) was identified in small quantities in 30% of the samples. This could be a gross under-representation, because free-threshing cereals are less likely to become charred than hulled cereals such as oats and barley. However, the poor soils in the area would not have suited a demanding crop like bread wheat, so it is possible that the amount of land sown with wheat was limited, enabling valuable stocks of manure to be concentrated in a small area. Club wheat, however, is said to be less demanding and more resilient than bread wheat, which may be why it was grown in preference to bread wheat, even though it produced lower yields. Only a single possible rye grain was recovered, so this crop does not appear to have been grown at South Hook. This is surprising, as it is a useful crop on poor, acid soils. Perhaps the cultivation of bristle oat (in addition to common oat) took the place of rye in the economy, being used primarily for fodder and grown on the poorest soils.

The following observations were made about the assemblages. Only the larger assemblages (> 100 identifiable cereal grains) were used for these purposes:

- where oats were dominant, they were always primarily bristle-type oats (5 incidences), rather than large-grained common oats.
- wherever the arable weed stinking chamomile was abundant in the sample (>30 seeds), bristle-type oat was always the dominant crop (4 incidences), rather than barley or common oats.
- wherever barley was dominant in the assemblage (7 incidences), the type of oat present was always large-seeded cf. common oat (never bristle oat). Oat awn fragments were never abundant in these samples. No specific weed taxa were associated with these samples.

These observations have lead to the following interpretations. Bristle oats were being grown as a separate crop from common oats, and on different types of soils. Heavier, clay soils were being used for this relatively low-status crop, which has a much smaller grain size than common oat. In some areas bristle oats are considered to be a weed and in others they are used as a fodder crop. The latter may have been the case at South Hook, although in poor years bristle oats may have been a useful fallback crop to save the occupants from starvation.

Bristle oats are a useful, hardy crop in cold, wet climates on poor, acidic soils. In the past they have been grown on loams and clays in Scotland and Wales, as they have a high water requirement (Rougemont 1989). They can cope with nutrient-poor acidic soils, and can be spring or autumn sown. Their abundant awns can be beneficial where birds are a problem, but the grains are much smaller than common oats, so the yield is lower.

Hulled barley was probably being grown on the lighter, better drained soils, to which it is better suited. It is likely that common oats were mainly being grown with the barley as 'dredge', since no large assemblages containing only common oats were recovered (only 38 grains of large-seeded oats in layer 1170, Complex 13). Dredge was a common crop in the medieval period, perhaps because it could be used for a variety of purposes (bread-making, malting, fodder). It is also a valuable failsafe crop for marginal land in areas with an unreliable climate, because if the growing season is too wet for the barley, oats can compensate to some extent, and vice versa. Growing mixed crops can also help mitigate against problems such as lodging (important in a coastal location), predation by birds, and attacks by pests and diseases that are specific to one or other of the crops.

The few early medieval free-threshing wheat grains recovered from the samples were all found in the central and southern complexes (4, 6, 7, 9, 10, 11, 13). The medieval wheat grains were a little more varied in size and shape than the Bronze Age grains, suggesting more genetic diversity within the crops, although small, rounded grains were still predominant. Using the radiocarbon dates in each complex as guidance, the following general trends can be seen (Table 4).

Allowing for the differences in sample numbers, and for the small numbers of grains under discussion, trends can cautiously be suggested. It appears that most of the club-type wheat was found in eighth/ninth-century AD features, although the fact that these included the corn dryers could explain this observation. No wheat was found in ninth/tenth-century AD metalworking area, Complex 1, which may also be a reflection on the type of activity taking place. Human food waste is less likely to be burnt in an industrial situation than around settlement features, although waste fodder and animal bedding may be close at hand if draught animals were stabled nearby. There appears to be a small change from club-type wheat to increased bread-type wheat use from the tenth century, although clearly more data is needed to confirm this tentative suggestion, and other factors such as differences in feature types could be responsible. This apparent change to a higher yielding but less robust type of wheat may have been made possible with improvements in crop husbandry, although no obvious changes in weed taxa were observed to support this suggestion. Nor was there evidence for the cultivation of pulses in crop rotation systems, or for a

Table 4. Trends over time of early medieval wheat types

	Complex	Club-type wheat grains	Bread-type wheat grains	No. of samples
7–9th cent. AD	6, 7, 13	34	0	18
9–10th cent. AD	1	0	0	7
10–11th cent. AD	4, 9, 11	3	1	5
11–12th cent. AD	3, 10	1	1	4

change from spring to autumn sowing, though preservation by charring has many limitations when trying to uncover the wider picture.

Club wheat does not appear to have been widely grown in the British Isles, although unless chaff is recovered identification is not easy to confirm. Being a fairly low growing, robust plant that can tolerate nutrient-poor soils it may have been better suited to coastal areas of south-west Wales than bread wheat. It would also have coped better with the wet climate of south-west Wales, since, in the author's experience of growing free-threshing wheat in south Wales, the 'loose' chaff of bread wheat can let in enough rain to make sprouting in the ear a major problem. Percival (1921) notes that club wheat can be left to stand in the field longer than bread wheat, because of its tighter-fitting glumes. A longer harvest period would have been a distinct advantage where the weather was very unpredictable, and where the labour force was small. Tighter-fitting glumes would also help to prevent sprouting in the ear.

The only other crop plant recovered from this site was cultivated flax (*Linum usitatissimum*). The association of a large number of seeds with the corn dryers in Complex 7 suggests that the crop was being grown for oil that could be extracted from its seeds. Of course, it may also have been grown as a fibre crop, and seeds may have been consumed for medicinal purposes or as a food, but waterlogged and mineralised samples would have been more likely to provide evidence for these other types of uses.

There was little evidence for the cultivation of pulses such as peas and beans, even though pulses are commonly recovered (albeit in small numbers) from early medieval sites in England. There was also only a little evidence for the use of native hedgerow fruits and nuts in the early medieval period, such as hazelnut shell and blackberries. Some rural sites of this date produce much larger quantities of hazelnut shell. However, the use of negative evidence is not a reliable method of assessing the importance of this type of food, because non-cereal foods must either be thrown into domestic fires as waste, or become burnt by accident, in order to become preserved by charring. Therefore, differences in behaviour between sites can have large affects on the archaeobotanical assemblages.

Comparisons with other sites

Barley, oats or dredge was recovered from a shell midden close to Brownslade Barrow (Carruthers, forthcoming). Although this material has not yet been dated, an early medieval date was obtained from cremated human bone recovered from the barrow area (cal. AD 450–960).

Dark Age deposits at Capel Maelog, Powys (Caseldine 1990), produced primarily oats and barley. A slightly later (cal. AD 980–1160) sample from a hearth at Maenclochog, *c*. 20 miles north-east of South Hook, produced a sample that contained primarily oats and rye, with a few bread-type wheat grains and only a single grain of barley. Because only a single sample was available, it is difficult to know whether these results were typical of the area and period or not (Carruthers, forthcoming).

A large sample of oats from a twelfth/thirteenth-century AD burnt layer at Loughor Castle, West Glamorgan, produced evidence for the use of both bristle oats and common oats (Carruthers 1994). The range of accompanying weed seeds was very similar to South Hook, except that corn marigold (*Chrysanthemum segetum*) was by far the most frequent species, and stinking chamomile was scarce. The oats at Loughor, therefore, appear to have been grown on lighter, sandy soils, rather than heavy clay.

Twelfth/thirteenth-century samples from settlement features at Talgarth, Breconshire (Carruthers and Hunter 1998), were also dominated by oats, but bread-type wheat was fairly frequent. Although a little rye was present, only a trace of barley was identified. A similar range of weeds of acid soils was found (e.g. corn spurrey, wild radish). However, at this site leguminous crops were being grown to help increase soils fertility, including cultivated vetch and Celtic beans.

Differences between sites like Talgarth and South Hook are probably not only due to advances such as crop rotation in later medieval periods, but may also mark the difference between larger settlements and rural sites. Barley may have been primarily used for animal fodder, so it would be less likely to have become incorporated into waste being burnt on a more urban site. In addition, the drying of crops like oats and barley soon after harvest, prior to storage or transportation to market, is more likely to occur close to the point of production, i.e. in a rural location. Accidental charring is much more likely to occur where large quantities of grain were being processed, particularly where corn dryers were located. This accounts for the high concentration of charred plant remains at this site (overall average = 187 fragments per litre). Whether the dominance of oats and barley reflects what the local workers were consuming or not is a more difficult question to answer, because different types of waste may not have an equal chance of becoming preserved by charring. However, because a reasonable number of samples were examined from this site, and because similar results are being obtained from the Milford Haven gas pipeline, the scarcity of free-threshing wheat in these rural locations is probably genuine. This contrasts with rural medieval sites on better soils in southern England, which tend to produce much more mixed assemblages (e.g. Eckweek, Avon, Carruthers, 1995) with frequent bread-type wheat.

Perhaps one of the most important factors when choosing which crop to grow is the available soil type and climatic factors such as rainfall and average temperature. The Early to Middle Saxon settlement at West Heslerton, Yorkshire, produced a mixed barley, bread wheat, oats and rye assemblage with barley being by far the dominant crop preserved (Carruthers, forthcoming). Since West Heslerton is located in the Yorkshire Wolds, barley would have grown well on the dry, chalky soils. No doubt the poor, acid soils and high rainfall of south Wales were highly significant factors when choosing cereal crops to grow at South Hook.

WOOD CHARCOAL

By Dana Challinor

The well-preserved charcoal from the excavations at South Hook offered the rare opportunity to examine the fuel used in an early medieval iron-smelting furnace. An assessment of the charcoal had shown that a limited range of taxa were utilised for fuel, so the analysis aimed to confirm the assessment results and examine the maturity of the wood. For comparison, samples were also chosen from the early medieval corn dryers, although these were less rich in material. Two prehistoric pits were also examined.

Given the apparent dominance of a few species in the samples, the following sampling procedure was adopted. Twenty fragments were selected from two sieve sizes (4mm and 2mm), and examined by fracturing and sorting into groups based on the anatomical features observed in transverse section at ×7 to ×45 magnification. The maturity of the wood was noted where possible and age and diameter details were recorded for a selection of small whole stems. Representative fragments from each group were then selected for further examination in longitudinal sections using a Meiji incident-light microscope at up to ×400 magnification. Identifications were made with reference to Schweingruber (1990), Hather (2000) and modern reference material. A total of 16 samples were analysed. The intention was to reflect the range of species represented, so non-oak fragments were deliberately selected and an estimate of the relative abundance of each taxon within the whole sample was made. Nomenclature and classification follow Stace (1997).

Results

The full results of the analysis are recorded in the archive, and Tables 5 and 6 present the data using a representational key that incorporates both the assessment and full identifications. The charcoal was generally very well preserved and it was possible to obtain many identifications to genus or species level.

Where the identification is uncertain (with *Cytisus*, *Ulex* or Maloideae), this is because the anatomical structure of these species is rarely distinguishable. The *Prunus* could only be confirmed as *P. spinosa* in one sample, because the diagnostic characteristics were not clear, and it is possible that *P. avium* is present in other samples. Eight taxa were confirmed, all of which are consistent with native specimens; *Quercus* sp. (oak), *Corylus avellana* (hazel), *Prunus spinosa* (blackthorn), Maloideae (hawthorn, apple, pear, service etc.), *Cytisus* or *Ulex* (broom or gorse), *Hedera helix* (ivy), *Fraxinus excelsior* (ash) and *Sambucus nigra* (elder).

Many of the samples contained small diameter stems, of which a small selection was examined. The iron-smelting Complex 1 produced several samples with *Cytisus* or *Ulex* (broom or gorse), *Corylus avellana* (hazel) and *Quercus* (oak) stems, some with bark (as did Complex 6). The range of diameters was relatively small, with most falling between 7 and 12mm, and aged between 6 and 13 years. Some oak stems in context 543 were older, 16–18 years, but there were also 7 year-old oak stems in this sample. Charred material may be up to 40% narrower than the diameter of living stems (Gale and Cutler 2000), but the data suggests that small branches were used. Even though the majority of the charcoals were fragmented, it was apparent that a high percentage came from small roundwood. Few mature oak fragments were noted in the samples, but context 584 (related to the corn dryer in Complex 7) contained oak heartwood, including fragments of larger roundwood which had laid down tyloses.

Discussion of the wood charcoal

Bronze Age

Pit 1523 was securely dated by radiocarbon to the early Bronze Age (2010–1760 cal. BC), and pit 1520 is likely to be of similar date. Both pits produced assemblages with limited species diversity (Table 5): context 1522 was dominated by hazel, with a little oak; context 1524 was slightly more mixed, though hazel formed a significant component. Since there was a fair amount of hazel nutshell in pit 1523 (see report on charred plant remains above) it seems likely that there was a connection between food gathering and wood collection. Clearly the Bronze Age dataset has its limitations, but the availability of hazel-oak woodland is reflected in the pollen record (Bates *et al.* 2007) and these taxa were commonly used for domestic fuel purposes in this period.

Early medieval

In contrast to the Bronze Age samples, the early medieval charcoals exhibit greater taxonomic diversity, but this may be a reflection of the greater number of samples. In fact, most of the assemblages were dominated by a single taxon, with small quantities of other species. Notably, there is a significant difference in the dominance of broom or gorse in the metalworking furnaces of Complex 1, whilst oak

Table 5. Results of the charcoal analysis from the Bronze Age pits

Feature type	Pit 1520	Pit 1523
Context number	1522	1524
Sample number	1915	1916
Quercus sp. (oak)	xh	xrh
Corylus avellana L. (hazel)	Xr	xr
Maloideae (hawthorn type)	–	xr

X = dominant; x = present; r = roundwood; h = heartwood

Table 6. Results of the charcoal analysis from early medieval contexts

Complex number	1	6	7	9	11	13								
Feature type	Layer						Pit 1039		Furnace 1071					
Complex	1	1	1	1	1	1	6	6	7	7	9	9	11	13
Feature type	L	L	P1039	F1071	F1071	F1071	L	L	L	L	P871	H	P946	P1184
Context no.	1028	1042	1043	1067	1853	1830	543	624	584	781	870	1503	945	1144
Sample no.	362	388	361	1906	1908	1905	312	324	317	332	334	1907	368	358
Quercus sp. (oak)	xr	xh	–	–	–	–	Xr	Xr	Xrh	Xr	xrs	Xrs	–	Xhs
Corylus avellana L. (hazel)	–	–	xr	–	–	xr	xr	xr	x	x	–	x	xr	–
Prunus spinosa L. (blackthorn)	–	–	–	–	–	–	–	–	–	–	–	–	xr	–
Prunus sp. (cherry type)	–	–	–	xr	x	–	–	–	–	x	–	–	Xr	–
Maloideae (hawthorn type)	–	–	x	–	x	–	–	–	–	–	xr	–	–	–
Cytisus/Ulex (broom/gorse)	Xr	Xr	Xr	Xr	Xr	Xr	–	–	–	x	Xr	–	–	–
Hedera helix L. (ivy)	–	–	xr	–	–	–	–	–	–	–	–	–	–	–
Fraxinus excelsior L. (ash)	–	–	–	–	–	–	–	–	–	–	–	x	–	–
Sambucus nigra L. (elder)	–	–	–	x	–	–	–	–	–	–	–	–	–	–

L = layer; P = pit; F = furnace; H = hearth
X = dominant; x = present; r = roundwood; h = heartwood; s=sapwood

generally dominates the assemblages associated with the corn dryers in Complex 7 (Table 6). The type of fire required for cooking or grain drying would be less intense, and potentially slower than that for smelting, which may explain the variation in fuel wood selection.

Until the eighteenth century when the use of coke became common, charcoal was the fuel generally used for iron smelting (Goffer 2007, 174); firstly because it provides a high heat and, secondly because it produces less smoke than wood fuel. Archaeological fuel residues associated with iron-working tend to be dominated by oak, which makes a good charcoal fuel (Edlin 1949) or, less commonly, mixed assemblages, including gorse or broom as a component (e.g. Cowgill 2004). An extensive bibliographic trawl and discussions with other specialists have not revealed any other examples of gorse or broom being utilised as the main fuelwood for iron working. Traditionally, gorse or broom wood was used extensively as fuel in areas like the south-west of England (Grigson 1987, 126) where it is found in archaeological deposits from the prehistoric period onwards (e.g. Challinor 2009). The taxa are also recorded where there was pressure on woodland resources (Murphy 2001, 21), but this does not appear to be the case at South Hook, since woodland trees such as oak and hazel were utilised in the early medieval corn dryers. Gorse wood burns with a fast, intense heat that produces little ash (Gale and Cutler 2000, 260) and was traditionally cut on a three-year cycle. There are no clear patterns of management in the South Hook evidence, since the gorse or broom stems were of varying age and probably came from gathered faggots. Gorse is a common component of the coastal heath lands of Pembrokeshire, which would have provided ample fuel, and possible gorse seeds were recovered from several of the samples (see report on charred plant remains above).

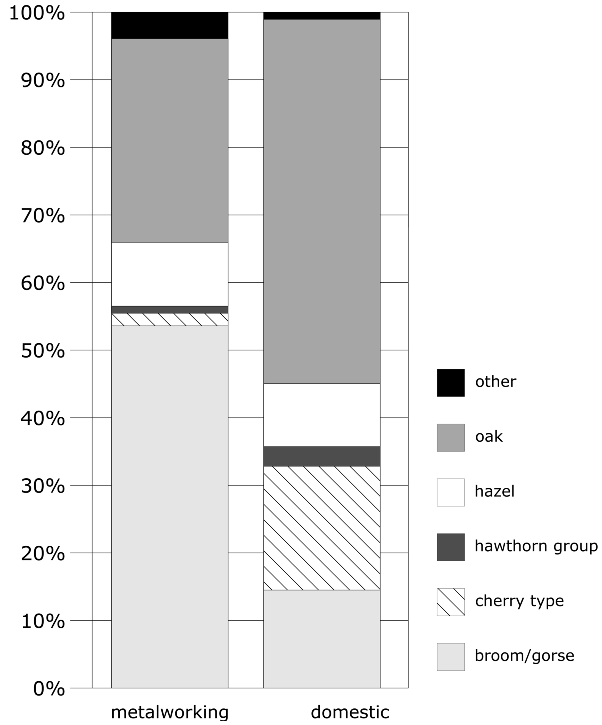

Fig. 25. Percentage of charcoal taxa for early medieval iron-smelting and domestic features.

The charcoal evidence from South Hook suggests that faggots or charcoal of gorse or broom, with lesser use of other species such as oak, hazel and cherry type, fuelled the early medieval iron-smelting furnaces. This would appear to be a highly unusual choice for the primary fuel and the efficacy of gorse for iron smelting is uncertain. Two possible explanations are suggested:

- The assemblages of charcoal do not accurately reflect the primary fuel in the furnaces. The quantities and extent of the taxon in the deposits associated with iron-working, rather suggest that the main fuel wood is represented. However, the presence of charred grain in some of these deposits (Carruthers, this volume) might indicate that the taphonomy is not so straightforward and that the deposits are more mixed.
- Pressure on woodland resources due to clearances and increase in heathland. It is likely that the environment around South Hook was relatively open by the early medieval period, but the use of woodland trees such as oak and hazel for corn drying points to a deliberate selection of fuel wood.

In conclusion, the use of gorse/broom in iron smelting is atypcial, although the rarity of metalworking features in early medieval Wales means that there are no comparable publications. The assemblages from South Hook are not consistent with metalworking sites in southern England where oak charcoal was commonly utilised.

DISCUSSION

By K. Murphy, P. Crane and T. Young

Demonstrable prehistoric activity on the site is limited to a lithic assemblage almost entirely from residual contexts, part of a Bronze Age urn and three Bronze Age radiocarbon dates. Few conclusions can be drawn from this data given the paucity of contextual information. For instance, the urn may have been placed in the ground with a ritual food deposit, but this is far from certain, and it could be that both the urn and the food deposit were in a residual context. The data does, however, indicate a long period of prehistoric activity in and around the site. In relation to this it is worth noting that evidence of Bronze Age and later occupation has been found at other development sites around Milford Haven in recent years (Crane 2004; Barber and Pannett 2006).

Establishing a site chronology for the early medieval and medieval elements of the site is entirely dependent on radiocarbon dates as artefacts are few and those present are not chronologically diagnostic. Twelve radiocarbon samples returned early medieval or medieval dates (Fig. 26). Of these, one (cal. AD 650–780; Beta-198851) may be from old wood and, therefore, be earlier than most of the other dates obtained from young wood or single cereal grains. A second sample (cal. AD 810–1180; Beta-198850) from mixed, possibly old wood returned a date with a wide standard deviation. Allowing for these potentially anomalous dates, the site seems to have been in use from the late eighth century AD through to the middle of the twelfth century, with a ninth/eleventh century *floruit*. The radiocarbon dates also suggest that the furnaces of Complex 1 and the corn dryers of Complex 7 had already gone out of use when other areas of the site were occupied. The plant macrofossil record also hints at a long sequence of occupation, with evidence of the differing mixtures of grain used across the centuries; this, however, could just reflect different process taking place across the site and not be chronologically significant. It would, therefore, be unwise to press for too long a sequence based entirely on radiocarbon dates as it could be argued that if the data were calibrated to three standard deviations then a shorter period of activity centred on the mid-tenth century is feasible.

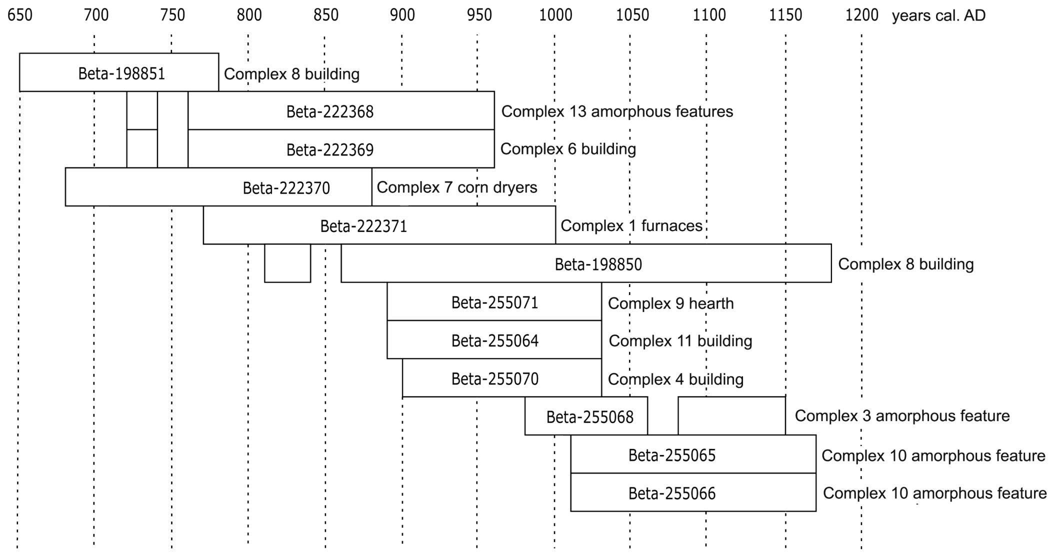

Fig. 26. Bar chart showing the early medieval/medieval radiocarbon determinations.

In any discussion on the remains at South Hook consideration must be given to the fact that an unknown, but probably considerable, amount of archaeology has been lost and that, apart from some deeper pits and postholes, only features within or on the periphery of excavated or worn hollows have survived. Those parts of the site assigned to the early medieval or medieval period are the remains of a small nucleated settlement with industrial elements, namely iron smelting and corn drying. Iron smelting clearly was the principal activity taking place within a building situated in Complex 1. Other buildings appear to have a domestic function, based on the absence of industrial activity but the presence of artefacts one would expect in a domestic context, such as rotary querns and honestones, and evidence of cultivation and the processing of cereals. Complexes 6, 8 and 11 produced very good evidence for broadly similar buildings. The buildings were centred on central hollows that had rough stone floors and all had evidence of at least two phases of use. The building in Complex 6 measured *c.* 6m wide and 11m long and had slightly bowed sides formed by driving individual timber stakes into the ground. Posts could have supported a ridgepole, but it was not possible to demonstrate if these would have provided extra support to the bow-sided walls, or were of a different phase of building. Entrance location is unknown. The original floor of the building seems to have been the base of the hollow, but a rough stone floor replaced this, perhaps when the building was remodelled. There was no evidence for raised benching around this central hollow, as there was in the late ninth/tenth-century AD Building 1 at Llanbedrgoch on Anglesey (Redknap 2000, 76–7). A smaller but similar bow-sided building was present in Complex 11; although here the slight timber walls were placed in a shallow trench rather than driven into the ground. An arc of postholes in Complex 8 indicates a curved end to a 3.6m-wide building. Its length is unknown. As with the building in Complex 6, postholes could have supported a ridgepole, but it was not possible to demonstrate whether these were contemporaneous with the curved end wall or from an earlier or later phase of the building. The entrance to the building was probably at the southern end. It is likely that the remains in Complex 5 and 9 also represent buildings similar to those described above. Postholes in Complexes 4 and 10 probably represent buildings, but these cannot be characterised. There is a paucity of evidence for early medieval settlement in Wales, and particular for that of the eighth to eleventh century AD and running on into middle of the twelfth century

AD (Edwards and Lane 1988). It is not surprising, therefore, that there are no known parallels for the settlement morphology nor for the type of buildings at South Hook.

Corn dryers, comparable to those from South Hook, have been, in recent years, recognised at several sites in Wales, most notably at Newton (Crane 2004) 7km to the east of South Hook and in a similar location, on the north side of the Milford Haven waterway. A single radiocarbon date of cal. AD 720–960 from these two corn dryers indicates a similar period of use to the South Hook examples. They were also remarkably similar in character, and analysis has showed that oat and barley were the dominant cereals being processed but that wheat was present in greater quantities than found at South Hook. At Sarn-y-bryn-caled near Welshpool, Powys, nine ovens or hearths dating to the mid fifth-century AD were interpreted as corn dryers. They were similar to those at South Hook, although somewhat shallower (Blockley and Taverner 2002, 46–57). Other examples of a similar date, such as those at Killederdadrum, County Tipperary Ireland, constructed in *c.* AD 1000 (Manning 1984, 242) and Graeanog, Gwynedd dating to the ninth/twelfth century AD (Fasham *et al*. 1998, 132–135) are more substantial with stone-lined flues and bowls.

Often, the only surviving evidence for a corn dryer is an elongated pit, as at South Hook. These would have had a stokehole at one end and a drying chamber at the other. Kelly (1997, 241) has suggested that grain would have been placed on wicker trays in the drying chamber, and that grain falling through these trays would account for the charred grain found in the pits, as at South Hook and elsewhere. Owing to the paucity of evidence the nature of the above ground superstructure is unclear, but it was probably quite simple and in a form that could have been easily rebuilt following accidental conflagrations. Corn dryers were (and still are) essential in the wet, western parts of Britain for drying or even ripening grain prior to threshing and storage. Grain could also be hardened prior to milling, a process that can considerably speed up grinding (Monk 1983, 217). Quernstones from South Hook testify to the fact that milling took place on site. Analysis of carbonised grain from the site demonstrates that the dryers were also used for malting barley, probably in preparation for making beer. All this evidence strongly supports a mainly domestic context for the South Hook site.

The evidence of iron smelting at South Hook is of enormous significance for there are very few other such sites known from the early medieval period in Britain and no confirmed examples from south-west Wales, although there are three other recently investigated sites which may include some evidence of smelting during the early medieval period. Excavations at Brownslade (8km south of South Hook) have produced mostly unstratified slag (Young 2006, 2010b) from an early medieval cemetery site with both tapslag and possible flow slag (from a non-tapping furnace). Current work at Robeston Wathen (22km east-northeast of South Hook) has also revealed traces of bloomery iron-making with tapped slags but there is currently no date for this smelting (Young 2010d). On the outskirts of Cardiff a substantial iron production site at Rhiwbina (Young 2000b) is again of uncertain age and characterised by tapped slags. It lies adjacent to the Twmpath motte and arguably close to a location of 'Cincenn's kiln' in one of the Llandaff charters (Evan 1893, 258 and 382). There is thus circumstantial evidence hinting that the site might be of earlier medieval age.

Early medieval iron-smelting sites in the broader area of south-west Britain are known at Ramsbury, Wiltshire (eighth century; Haslam 1980), Burlescombe, Devon (eighth/tenth century; Reed *et al*. 2006), Clearwell Quarry, Gloucestershire (seventh-ninth century: Pine e*t al*. 2010), Carhampton, Somerset and probably at Cheddar (late tenth-eleventh century; Rahtz 1979, xv and 411). Slightly further east are Gillingham (Heaton 1992) and Worgret (Hinton 1992) in Dorset.

In contrast, many iron-smelting sites of the early medieval period are now being recognised in Ireland (e.g. Young 2003a, b, 2005a, b) but these differ in technology from South Hook, being non slag-tapping slagpit furnaces.

Of the British examples, it appears from published evidence that the earlier furnaces at Ramsbury, together with those at Burlescombe, Clearwell and Carhampton, were non slag-tapping furnaces too, although the precise morphology of these furnaces remains rather controversial. All these examples probably date to before the late ninth century. The later furnace at Ramsbury, Furnace 4, appears, however, to have been a fully slag-tapping furnace, but unfortunately the slag assemblages were not fully published.

The two furnaces at South Hook are rather poorly preserved, but do allow comparison with the published examples. The closest comparison is with Furnace 4 at Ramsbury. Although this superficially appears very different to the South Hook examples, particularly in the evidence for its massively relined, inverted 'bell-shaped' superstructure, there is a similarity at a lower level. Furnace 4 shows a relatively straight rear wall, with large slag accumulations at its foot, although the excavator preferred to envisage blowing from the other three sides. Slag accumulations on the floor of Furnace 4 had not always been cleared after smelting; instead the furnace had been raised to accommodate the raised floor. The tapping pit for Furnace 4 is deepest immediately outside the tap arch and shallower at its distal end. Finally, the markedly sloping sides of the pit below the furnace give the structure a transversely elongated plan. A largely unmodelled aspect of Ramsbury Furnace 4 is the lateral splaying of the lining from about 0.4m above the base of the cut. This implies that the initial structure of the furnace cannot have supported a shaft, although later phases of the furnace became more constricted and tubular. The earlier non slag-tapping furnaces at Ramsbury are remarkable for the inclusion within their structure of large diameter bowl-like cuts that were relatively shallow in depth, producing large low-density 'furnace bottoms' which were oriented transversely in the furnaces. The non slag-tapping furnaces at Burlescombe were much deeper and produced much more vertically aligned 'furnace bottoms'. The Clearwell furnaces were different from both of the extremes and their slagpits were formed by very small pits. There was clearly enormous variation in the British non-slag tapping furnaces.

The use of these two quite distinct furnace styles in the eighth/ninth century AD remains a subject requiring further study. Slag-tapping furnaces may be derived from Roman period techniques (either by survival or reintroduction), whereas the non slag-tapping furnaces reflect a tradition widespread in pre-Roman Europe, which may have survived in southern Britain (an Iron Age example from south-west England was described by Young 2008a), or been reintroduced from either the east (northern Europe) or west (Ireland).

Understanding of the situation in Ireland in the eighth century/tenth century AD is made problematic by a lack of well-preserved early medieval furnaces. Iron making was being undertaken on a large scale at this period, but much of the evidence is derived from settlement sites with bloom-smithing, but little primary smelting. The Iron Age tradition still current in the first half of the first millennium AD seems to be for small non slag-tapping furnaces (with cut diameters of <0.5m). These Iron Age type furnaces employed a careful pit packing of large split wood (as also seen for instance at Burlescombe) and probably had a low shaft or bottle-shaped superstructure. They show a great deal of variation in detail, including some examples with a furnace arch (for clearing the furnace rather than tapping) (e.g. Derrinsallagh 4, Young 2008e).

By the ninth/tenth century AD a few examples with slightly larger pit diameter are known. Arched furnaces are rare (but see the two examples below) but for the following centuries several sites are providing evidence that furnaces with an arch (although probably not for the purpose of tapping) were being built on the ground surface, with adjacent pits used to receive the furnace rakings (e.g. Ballynamorohan, Young 2009b; Derrinsallagh 1, Young 2008b). The pits employed in conjunction with the non slag-tapping furnaces are either rather shallow pits, often irregular in form and adjacent to the arch or are more substantial pits separated from the furnace structure. Despite this diversity of furnace design, the style of construction at South Hook with the furnace superstructure built at one end of a trench—seen in Britain in many Roman examples, Ramsbury Furnace 4 and many later medieval examples—is currently unknown in Ireland.

Although the majority of Irish smelting sites were clearly not tapping the slag, there are two early medieval examples with possible evidence for slag-tapping. The first of these is Woodstown, Co. Waterford (Young 2009a), where a small furnace was constructed in the butt-end of an enclosure ditch. This furnace is poorly understood because of its closure, or possible conversion into a hearth, by having a packing of large stones rammed into the truncated basal section of its shaft. These stones sealed a dense accumulation of lobed slags, which appear to have flowed from the furnace base on one side, suggesting the former presence of a tapping arch. Identical slag textures, probably tap slags were recovered from a later excavation in a different area of the same site, suggesting that this furnace may not have been an isolated example. The date of this furnace is likely to be late ninth century AD.

A second early medieval site with evidence for slag-tapping is at Knockbrack, Co. Kerry. This site had two furnace pits, each 0.36m in diameter, providing radiocarbon dates from oak of cal. AD 110–380 and cal. AD 260–450, but with a date from hazel of cal. AD 570–670 (Hull and Taylor 2006). These furnaces appear to have been carefully constructed with a clay lining added to the excavated pits and with a large stone acting as the floor. They were interpreted as slag-tapping furnaces by the excavators, and must at very least have employed a furnace arch for the clearance of hot waste and possibly the bloom. The pairing of furnaces is an apparently common feature in the first half of the first millennium AD (e.g. Clonrud 4, Derryvorrigan 1, Derrinsallagh 4; Young 2008b, c, d), although paired furnaces may possibly be confused in some instances with a furnace plus external working hollow. The Knockbrack site is significant, therefore, on several grounds: it has a similar overall plan to Complex 1, with paired furnaces about 1m apart facing into a working area, it may, unusually for early medieval Ireland, have undertaken slag-tapping and, like Complex 1 it seems, again rather unusually, to have used flat stones to provide a firm floor for the furnace.

The surprising discovery that the smithing slags from Complex 1 had a different chemical signature to the smelting slags suggests that South Hook may have been a focal point for iron-making in the area. Smelting may, therefore, have been undertaken not only at South Hook itself but possibly at outlying locations closer to the sources of ore or fuel. The analysis of material from South Hook indicates that it was possibly a result of the smithing of blooms produced to the west of Sandy Haven Pill (on the evidence of their high zirconium contents) that lies immediately to the west of the site. The source of the ores has not been located, but they are likely to have been bog ores, probably from mires developed at the heads of the many small arms of the Milford Haven waterway or from peat accumulated in small valleys such as that sampled for palaeoenvironmental analysis at the South Hook site.

Identifying cultural influences and affinities with the South Hook site is problematic owing to the absence of diagnostic artefacts. This is in contrast to the one of the few comparable sites in Wales, Llanbedrgoch on Angelsey, where several seasons of excavation in the 1990s have more than doubled the number of Viking-age artefacts from Wales, placing the settlement in the Hiberno-Norse world of the Irish Sea (Redknap 1994, 1995a, 1996, 1997, 2000). At Llanbedrgoch a seventh-century AD agricultural community consisting of roundhouses and rectangular halls developed into a tenth century AD fortified settlement. At least three buildings of this later phase were rectangular of sill beam construction. Building 1 had sunken floor with central hearth surrounded by raised benching and an entrance in an end wall. It was similar in size to the South Hook Complex 1 building. Benching has been considered a trait of Scandinavian buildings. However, as Redknap (2000, 79) points out with the lack on information on Welsh buildings of this period it is unknown whether the Llanbedrgoch structures represent a local tradition or a local adaptation of a different culture. A similar argument applies to the bow-sided buildings at South Hook. Comparative sites in the style of iron smelting to South Hook can best be paralleled in south-west Ireland (Knockbrack) and to a lesser extent at the Viking site of Woodstown. However, the structure of the furnaces themselves can probably be paralleled best in the later phase at Ramsbury. Thus the similarities are to be found in sites which are respectively Irish, Viking and Saxon; a situation which probably reflects the lack of present understanding of early medieval iron-making rather than real cultural influences.

Historical sources and place-names attest a Scandinavian presence in south-west Wales. The first recorded Viking raid on Wales was in 852, and in 878 a Viking force overwintered in Dyfed (Redknap 2000, 29–30). Charles (1992, xxxvi) suggests that the twenty-three Vikings ships involved in the raid were accommodated in the Milford Haven waterway. On this evidence it is tempting to take a romantic view and interpret the South Hook site wholly as the result of Viking influence, perhaps even an habitual overwintering location that developed into a permanent settlement—a plausible interpretation given the radiocarbon dates. It is, however, more likely that the settlement was in existence in the late eighth century AD prior to Viking incursions in south-west Wales and that occupation carried on throughout the period of Viking raids and settlement, absorbing technology and traits from other Irish Sea cultures.

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NOTES

1. Dyfed Archaeological Trust, The Shire Hall, Carmarthen Street, Llandeilo, Carmarthenshire SA19 6AF.
2. National Museum Wales, Cathays Park, Cardiff CF10 3NP.
3. Sawmills House, Castellau, Llantrisant, Mid Glamorgan CF72 8LQ.
4. Lavender Cottage, Little Lane, Aynho, Nr Banbury, OXON OX17 3BJ.
5. GeoArch, Unit 6, Western Industrial Estate, Caerphilly, CF83 1BQ.
6. A detailed report on the archaeometallurgical residues is lodged with the archive (Young 2010c).
7. I am very grateful to Bill Handley and Peter Hanson of the Home Grown Cereals Authority for showing a sample of ‘damaged’ barley to members of the Malting Association of Great Britain. I would also like to thank Merryn Dineley for sharing her extensive knowledge about malting with me and for answering my questions about grain sprouting.

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