Archaeologia Cambrensis 159 (2010), 53–98

The excavation of a coastal promontory fort at Porth y Rhaw, Solva, Pembrokeshire, 1995–98

By Pete Crane and Kenneth Murphy[1]

with contributions by A. E. Caseldine and C. J. Griffiths,[2] C. S. Briggs,[3] N. Crummy,[4] A. David,[5] J. Henderson and Y. Sablerolles,[6] T. Young,[7] and P. Webster[8]

Porth y Rhaw is a massively defended multivallate coastal promontory fort, much reduced by cliff erosion, near Solva on the northern coast of St Brides Bay, Pembrokeshire, Wales. Part of the interior and a small section of inner bank were excavated, together with two trial trenches in the outer defences. These areas were considered to be the most vulnerable to further erosion. The partial remains of at least eight roundhouses were identified, some of which were rebuilt a number of times. Radiocarbon dating suggests an early phase of occupation in the Early to Middle Iron Age. Pottery from the later interior phases of occupation, including a large roundhouse with stone footings, indicates a later phase of activity from the first century AD to the fourth century AD. Evidence of both bronze and iron-working was found on the site.

INTRODUCTION

In 1993–94 the Dyfed Archaeological Trust undertook an assessment of all the coastal promontory forts of west Wales on behalf of Cadw (Crane 1994). The objective of this assessment was to identify the current land use of each site and to record exposed sections of archaeological importance. The project also highlighted that severe coastal erosion presented a major threat to a number of the forts. These sites are, by their nature, very exposed to the elements, and the larger and more complex defences tend to be sited on the more naturally defensive promontories, on high cliffs, which are more susceptible to being undermined by the sea.

The survey identified two sites of particular concern where excavation was recommended, at Porth y Rhaw on the north side of St Brides Bay (Fig. 1) and Great Castle Head on the Dale peninsula in south Pembrokeshire. The work at Great Castle Head took place in 1999 and focused on the massive defences, the results of which were published in *Archaeologia Cambrensis* 148. These appeared to have origins in the Early or Middle Iron Age (Crane 1999). However, no clear structures could be identified in the small area of the interior that was excavated. Possible medieval re-fortification of the site was suggested by finds of twelfth- and thirteenth-century date. (Crane 1999).

It was noted at Porth y Rhaw in 1994 that a considerable length of the surviving inner bank was critically close to the cliff edge, along with the exposed south-western end of the inner ditch. Furthermore, the western side of the eastern promontory in the fort's interior appeared to be fissuring parallel to the cliff edge and an imminent cliff fall in this area was considered probable. Excavations here were undertaken between 1995–98 and are the subject of this report. Initial evaluation work grant-aided by Cadw took place over four weeks in the summer of 1995 in extremely dry conditions, during which four trenches were excavated (Fig. 2, Trenches 1–4) to test the potential for any future work. Trenches 1 and Trench 4, the two areas considered to be most at risk, were subsequently enlarged during two short seasons in the summers of 1997 and 1998. The main research objectives were to provide

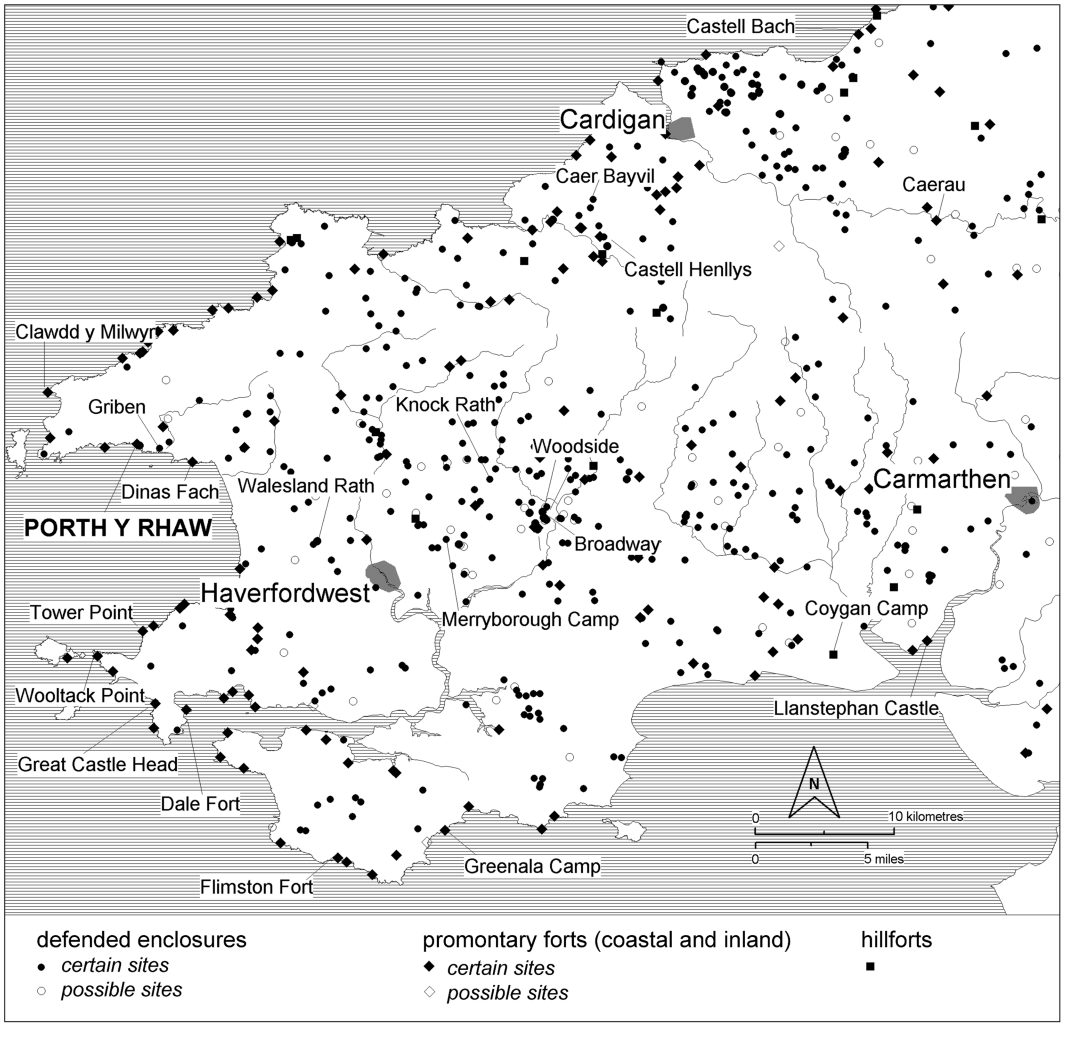

Fig. 1. Location map showing sites in south-west Wales mentioned in the text.

dating for the origin of the fort, the period of its occupation and the character of the defences and internal arrangements. Cadw again funded these excavations with some sponsorship in the final season from the Barclays County Focus Fund, arranged via the National Trust, who acquired ownership of the site in 1996.

All excavations took place with a small team of professional archaeologists from Dyfed Archaeological Trust assisted by a few students and volunteers. Initially, conditions in the 1997 season were mainly very dry and clear, causing problems with soil-colour differentiation. Heavy rain during the latter part of the season rendered the site unworkable. In 1998, conditions were more favourable, but rapid drying caused similar problems to those encountered the previous year. At the end of each excavation the trenches were backfilled and re-turfed. Both for safety reasons, and in order not to exacerbate erosion after reinstatement, no excavation took place closer than 1m to the edge of the cliff.

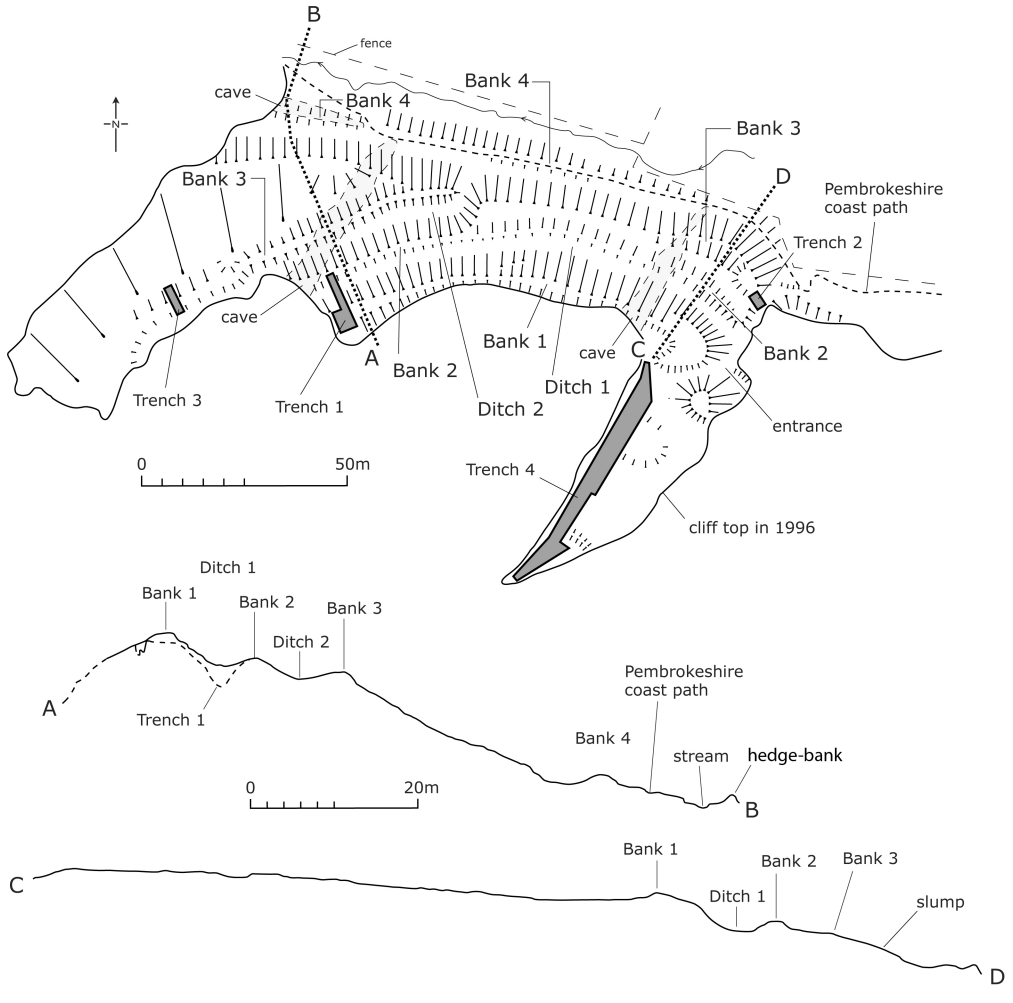

Fig. 2. Earthwork survey of Porth y Rhaw showing location of excavation trenches.

Although there are approximately 60 coastal promontory forts around the west coast of Wales, of which 52 are in Pembrokeshire, the only other major excavation undertaken in the last fifty years has been the work at Dale Fort in Pembrokeshire. This was started by W. F. Grimes in 1966 and continued until 1983. However, with the exception of the first interim report (Grimes 1966), the site remains unpublished. Limited area excavation took place at Tower Point, Pembrokeshire in 1970 (Wainwright 1971a), which recovered evidence for a roundhouse and recorded a section through the inner defence. Further work was subsequently undertaken at Dale in the late 1980s, concentrating on the defences and a separate small area within the enclosure (Benson and Williams 1987; Ramsey and Williams 1992). At the end of the nineteenth century the Revd Baring Gould (1899) investigated stone-built roundhouses within Clawdd y Milwyr fort on St David's Head, Pembrokeshire, although with the techniques available at the time he was not able to identify timber structures and other insubstantial remains. A small amount of work on comparable sites has been undertaken in South West England, notably that on the defences of

Embury Beacon, Devon (Jefferies 1974) and on a more limited scale in Cornwall (Peter Herring, pers. comm.; Herring 1994; Smith 1988). Within the context of this limited number of excavations on coastal promontory forts, the work at Porth y Rhaw, although restricted to a quarter of the present interior and three trenches investigating the defences, has made a significant contribution to our knowledge of this type of site.

Site topography

Porth y Rhaw lies on the coast (Fig. 1), 3.5 kilometres east of St David's in Pembrokeshire, 2 kilometres west of Solva and adjacent to the Pembrokeshire coast path (SM 786242). The remains of the fort (Figs 2–4) lie above the eastern side of the inlet of Porth y Rhaw, a rocky cove at the end of a steep-sided valley. The two promontories occupied by the fort are undoubtedly the eroded remains of a single much larger area projecting south-west into St Brides Bay. The promontories comprise vertical sandstone and mudstone cliffs 35m high, with strata, to a great extent, in near-vertical formation. There are two major sea caves below the fort (Fig. 2). The western one is at least 40m deep and the eastern more than 50m deep. A third, smaller cave is over 20m deep. The directions and edges of the caves, as indicated on the plan, are only approximate. The high ground of the promontories is somewhat separated from the flat hinterland by a minor valley, the stream in which issues from a spring opposite the fort's entrance.

The remains of the fort's multiple banks and ditches are still very impressive, especially as the inner defences are on much higher ground than the outer ones. The inner three banks (Banks 1–3) are closely spaced and curve around the hill-slope enclosing only the eastern promontory, while the outermost one (Bank 4) runs in a straight line close to the valley bottom (Figs 2 and 4) and encloses both promontories. In additional to the aerial photograph reproduced with this report, Toby Driver has

Fig. 3. View towards Porth y Rhaw from the west.

Fig. 4. Aerial photograph of Porth y Rhaw. *Photograph: Dyfed Archaeological Trust.*

published a near-vertical colour aerial photograph of the site taken in 1996 (Driver 2007, 107, fig. 161). Bank 1 and Ditch 1 present a very steep, continuous face, approximately 4m from the bank top to the ditch bottom. Bank 2 is less pronounced and not so steep-sided, rising about 1m above Ditch 1 and 2.5m above Ditch 2 (Fig. 2, Profile A–B). The central section of Bank 2 is very slight, appearing as little more than a counterscarp bank (Fig. 2, Profile C–D). Bank 3 rises 1–2m above Ditch 2 on the western side of the defences. However, near the mid point of the defences Ditch 2 turns abruptly to the north and passes through Bank 3. To the east of this point there is no surface evidence for Ditch 2, and there is no evidence for an external ditch to Bank 3. Bank 3 runs along the cliff edge of the western promontory, albeit in a much reduced form, and at its eastern end rises up to form a mound. Bank 4 decreases in size from over 2m in height at its west end and fading completely before it meets the cliff edge at the east side of the fort. This bank has been used as a later hedge-bank and the Pembrokeshire coast path runs along part of it. Hollows or scoops are visible on the slope between Banks 3 and 4, possibly created by slumping or by quarrying (these can be seen on Fig. 3).

The fort entrance is located towards the eastern end of the surviving defences, where the valley is less deep and therefore where access onto the eastern promontory is fairly easy; this is also the naturally weakest defensible point. Bank 1 has an in-turn at the entrance. There is no such in-turn on the bank on the opposite side of the 8–10m wide entrance. Only a *c*. 8m length of this opposing bank now survives. The terminals of Banks 2 and 3 are now at the cliff edge indicating that most of this part of the entrance has been lost to the sea. Layers of pebbles and cobbles exposed in cliff exposures indicate the possible

course of a track running out to the north-east from the entrance. Undulations on the terminals of Banks 1 and 3 are possibly from old, unrecorded excavations.

The Ordnance Survey interpreted a circular earthwork in the interior of the fort *c.* 25m from the entrance as a house site in 1973[9] (see also Rees 1992, 72). The excavations confirmed this interpretation. Towards the southern end of the interior, at the highest point, there is a low bank. A geophysical survey of the eastern promontory undertaken in 2008 (Page *et al.* 2009, appendix 3) suggested the presence of much below ground archaeology other than that investigated during the 1995–98 excavations: a track seemed to curve around the south-east to the south of the fort's entrance, there was a four-post structure immediately behind the defensive bank to the south-east of the entrance, and several possible roundhouses lay along the east side of the promontory.

While the original interior area of the fort cannot be precisely estimated, the size enclosed was probably at least 4500m^2, allowing for a small sea inlet between the two surviving promontories. The surviving interior area is roughly 1000m^2. The main area of the excavation (Trench 4) covered 230m^2, representing about one quarter of the surviving interior. The rate and extent of erosion cannot be accurately calculated. However, based on an original internal area of 4500m^2, reduced to 1000m^2 over *c.* 2500 years, a loss of around 1 per cent every 30 years is indicated. Erosion along this coast tends to occur in sudden landslips and cliff collapses, rather than steady, gradual loss. A survey assessing the extent of erosion on several Pembrokeshire coastal promontory forts using remote sensing data demonstrated the practical difficulties in applying disparate types of information to quantify land lost to erosion (Page *et al*. 2009). LiDAR data, Ordnance Survey maps, mid-twentieth-century vertical aerial photographs and modern digital aerial photographs were all used. The main problem encountered was identifying the exact line of the cliff top on these data sources. Whilst it was not possible to plot detailed change, the study was able to demonstrate that there has not been dramatic loss at Porth y Rhaw since the publication of the Ordnance Survey 1:2500-scale map in 1889. Plotted against the modern survey undertaken during the excavation, the 1889 data seems to show some loss—particularly at promontory ends—but these differences may be due to different surveying techniques rather than actual loss. However, about three metres was lost from the tip of the eastern promontory between 1993 and 1998.

Earlier references to the site

The antiquary Richard Fenton, who visited the site in 1808–09, provides the first description of Porth y Rhaw. He recognised that much had already been eroded away (Fenton 1903, 76–7). Fenton carried out excavations within the ramparts on the summit of the cliffs and on an extensive grassy area by two large stones, and found charcoal, limpet shells and signs of fire. He also noted 'hut sites' between the ramparts although he may have been referring to the slumping or scoops, which can be seen on the north-western side of the promontory between Banks 3 and 4 (not shown on Fig. 2). These may well be house sites, but are more likely to be a result of natural slumping or quarrying, possibly associated with post-medieval activity in the valley where there was a mill that ceased working in about 1915 (Warburton 1944; Raggett 1990, 36–7).

A descriptive text and a somewhat inaccurate plan were published in the mid-nineteenth century (Jones and Freeman 1856). Although the drawing is distorted it shows two distinct promontories with much of Bank 1 lying directly above the cliff edge. In the early twentieth century a large worked stone was found in Ditch 3 (RCAHM 1925, 411, no. 1168). The present location of this object is unknown. In his *The History of Solva*, Warburton (1944, 10) refers to 'a shallow circular depression on the summit, 13 feet in diameter, and excavation showed that this was probably a cattle pond'. The highest part of the site is now towards the southern end of the eastern promontory. Warburton also states that about 1800, 'charcoal and limpet shells were found near the pond', almost certainly a reference to the investigations by Richard

Fenton (although there is no mention of a pond in Fenton's account). The excavation of the 'cattle pond' may have been undertaken by Warburton or by Felix Oswald, who assisted with the 1944 history. Oswald, known for his work on Samian pottery, had a holiday home in Solva, where he later retired. There are local oral accounts of Oswald having undertaken work on the site, and the possibility of him having pottery from the fort at his house in Solva, but none of his excavation records or finds from Porth y Rhaw have been found.

The Ordnance Survey archaeological record card of the site provides a brief description and a detailed plan, drawn in 1966, which shows Bank 3 turning south to the cliff edge at its western end. Local people remember someone digging holes in the fort in the 1970s. The old trenches visible on the terminals of Banks 1 and 3 may be remains of these diggings.

THE DEFENCES

The defences were investigated in three locations (Trenches 1, 2 and 3). Trench 1 was located *c.* 7m from surviving western end of Bank 1/Ditch 1. In 1995 this trench was 1.25 × 9m long, but was extended in 1997 by the addition of a 6 × 4m area to examine a hearth discovered on top of the bank. Trench 2, 4 × 2m, was positioned to establish whether the end of Bank 3 was the original terminal at the entrance. Trench 3, 6.5 × 1m, was excavated to determine whether Bank 3 continued along the western promontory.

Ditch 1 and Bank 1 (Trench 1)

The upper fills of Ditch 1 were examined in Trench 1, but the lower fills were not excavated. It was possible, however, to project a section of the ditch exposed in the cliff face *c*. 7m to the east onto the drawn excavated section to provide a full profile (Figs 5 and 6). The ditch was cut through bedrock and was *c*. 5m wide and 3.2m deep.

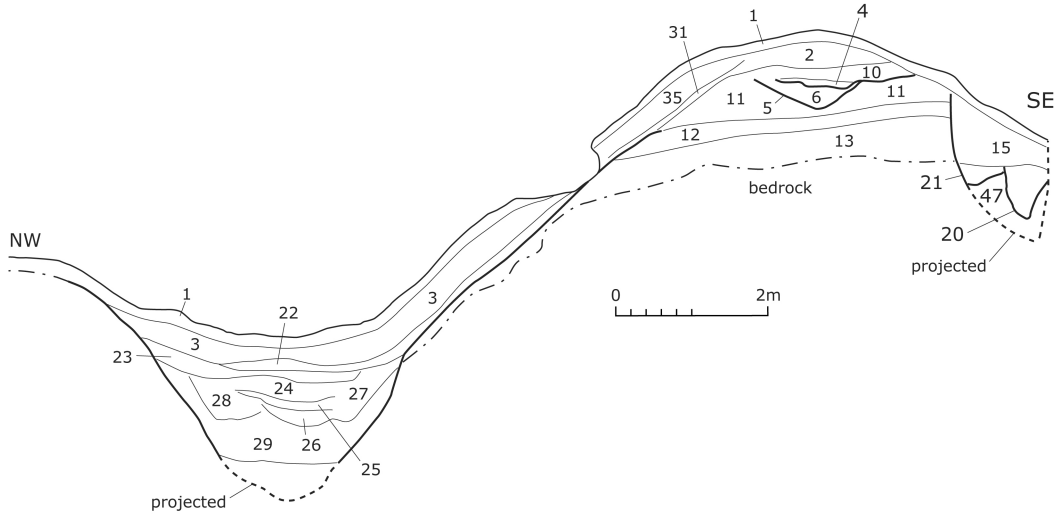

Fig. 5. Section of Trench 1.

Fig. 6. Section of Ditch 1 exposed in cliff-face immediately to the west of Trench 1.

The lowest fills were observed in the cliff exposure, but not examined in the excavation trench. The lowest excavated fill (29) comprised a clay loam with small, angular pieces of shale. Above this layers of large stones (27, 28) were intermixed with a fairly stone-free deposit (26). These fills appeared to be dipping eastwards along the axis of the ditch. The south-east side of layer 27 dipped steeply towards the centre of the ditch and may have rested against a recut of the ditch. Above these were three layers (23–25) of clay loam with varying amounts of angular stones, above which was a layer of shattered shale and gravel (22). This layer was probably the same as layer 31 in Bank 1, but no direct relationship could be established due to the presence of an eroding path. The upper ditch fill (3) immediately below topsoil (1) appeared to be composed of the same material (35) on the upper face of Bank 1. Burrowing animals had disturbed the upper layers of the slopes of the ditch and bank.

Bank 1 was constructed over a *c.* 0.18m-thick buried soil (12), which overlay *c.* 0.5m thick drift geological deposits of silty-clay (13), which in turn overlay bedrock. Pollen recovered from the buried soil indicates a predominantly grassland environment with some weeds and possible hazel woodland in the area.

Above these natural layers, the lowest bank deposit (11), as seen in the north-east facing section of the trench, was a fairly uniform silty-clay loam with random angular stones and cobbles, probably derived from the initial cutting of the ditch and/or rear revetment features. In the south-west-facing section, however, the stratification was more complex, with two or three separate layers forming the lower part of

the bank. These could have formed part of a primary bank, but it would have been very low, less than 0.5m high.

The lowest bank deposit (11) was cut by a posthole (5) containing substantial packing (6) and a post-pipe 0.1m in diameter and at least 0.58m deep. Both the upper part of the post-packing (6) and the upper surface of deposit 11 were heat-reddened by a hearth (4). Material from the hearth, including charcoal and a flint flake had fallen into the partly voided post-pipe, presumably as the timber post rotted. Part of a blue glass bead (431) and two globules of copper alloy were found in the charcoal rich deposit of the hearth (4), from which two radiocarbon determinations were obtained: 773–408 cal. BC (SWA-101) and 759–400 cal. BC (Beta-124342). By contrast, archaeomagnetic sampling of the hearth produced a date range of the second century BC to the first century AD (Tarling 1998a). A Roman or possibly late Iron Age date is suggested by analysis of the glass bead. The hearth was sealed by a layer (10) similar to that below it (11), above which was a stonier layer (2).

Two straight gullies (20, 21) ran along the inside edge of Bank 1. They appeared to take advantage of a natural fault filled with a clay deposit (47). There had been considerable mixing of the upper fills resulting in a homogeneous deposit (15), and the two separate gullies were only recognised once this had been removed. Both were *c.* 0.6m wide, with 21 surviving up to 0.25m deep and 20 up to 0.75m deep, but originally both would have been close to or over 1m deep. Gully 21 appeared to be the earlier, but this was not certain. A radiocarbon determination of 775–388 cal. BC (Beta-124341) was obtained from gully 21. Clay in the fill of gully 20 was possibly packing for timber uprights.

The deposit (29) that filled Ditch 1 to a depth of 1m was probably derived from gradual erosion of the bank and ditch sides, and pre-dates any major collapse of the bank. As noted above, the ditch may have been recut following the deposition of layer 29, evidenced by the angle of rest of rubble 27. It is likely that rubble (27, 28) came from collapsing bank material, possibly a stone revetment, although there is no surviving evidence for such a feature in the bank. A timber revetment to the outer face of the bank of widely spaced postholes could also have been missed in the narrow excavation trench.

While the nature of the outer face of the bank is uncertain, the substantial gullies along its inner face suggest that this side was revetted in timber. This revetting was probably partly supported by large packing stones, as 50m to the east of Trench 1, where the bank is right on the cliff edge, upright stones up to 1m high have been exposed.

The hearth (4) within the bank is considered to be a temporary feature, in use during the bank's construction, as is the posthole (5) beneath it. Both are considered to be broadly contemporaneous. Although their presence within the context may be coincidental, the two globules of copper alloy suggest the hearth may have been used for metal processing.

The disparity of the dates between radiocarbon and archaeomagnetic methods is problematic. The large amount of charcoal in the hearth is unlikely to be residual and the two radiocarbon samples gave similar results of 773–408 cal. BC (SWA-101) and 759–400 cal. BC (Beta-124342). The sample from the rear revetment of the bank, which could be expected to be of the same period, gave a similar date of 775–388 cal. BC (Beta-124344). The archaeomagnetic analysis, however, returned at date of the second century BC/first century AD. A more precise date could not be obtained due to the apparent settlement of the hearth after its use, causing anomalies in the samples (Tarling 1998a and b). Chemical analysis of the glass bead (Fig. 16, no. 1) strongly suggests a Roman date, although a late Iron Age date cannot not be ruled out. It is highly likely that the radiocarbon determinations provide an accurate date range for the construction of the bank, and that far more settling and slumping of the bank occurred than allowed for in the archaeomagnetic analysis, leading to an anomalous date. Given the animal disturbance in the upper part of this bank it is also possible that the bead is intrusive.

Bank 3 (Trenches 2 and 3)
Trench 2 was located at the eastern end of the surviving portion of Bank 3 in the area of the entrance. A voided, large-stone rubble layer was partly excavated, possibly indicating the upper layer of a deliberately backfilled ditch below the bank. A posthole lay in the terminal of the bank. However, the form of the bank layers appeared to indicate that the present shape of the bank end is due to erosion and that the entrance through the defences was originally located further to the east and has at least partly been lost over the cliff edge. The results from this trench suggest that the defences in the area of the entrance were remodelled, rather than unfinished.

Trench 3 was positioned to determine if Bank 3 continued along the surviving western promontory. Excavation revealed that the bank was possibly a counterscarp for a ditch now lost to the sea, rather than a continuation of the third bank proper. A buried soil was located beneath this bank.

THE INTERIOR

The excavations in the interior of the hillfort (Trench 4) lay along the western side of the eastern promontory. This promontory was fairly level, rising gently from north to south, and represents the only substantial surviving portion of the fort's interior. The western side was selected for excavation, as it seemed to be the most vulnerable area to erosion, leaving the central and eastern parts for possible future investigation (Fig. 7). The trench was over 61m long and varied in width from 3m at the northern end to over 5.5m towards its southern end. The partial remains of eight roundhouses (including a stone-built example, no VIII) were examined (Fig. 8). The remains of House III and those to the south were substantially excavated: those to the north of House III were sampled (Fig. 11).

Fig. 7. View looking south along Trench 4 with the stonework of Roundhouse VIII in the foreground. west of Trench 1.

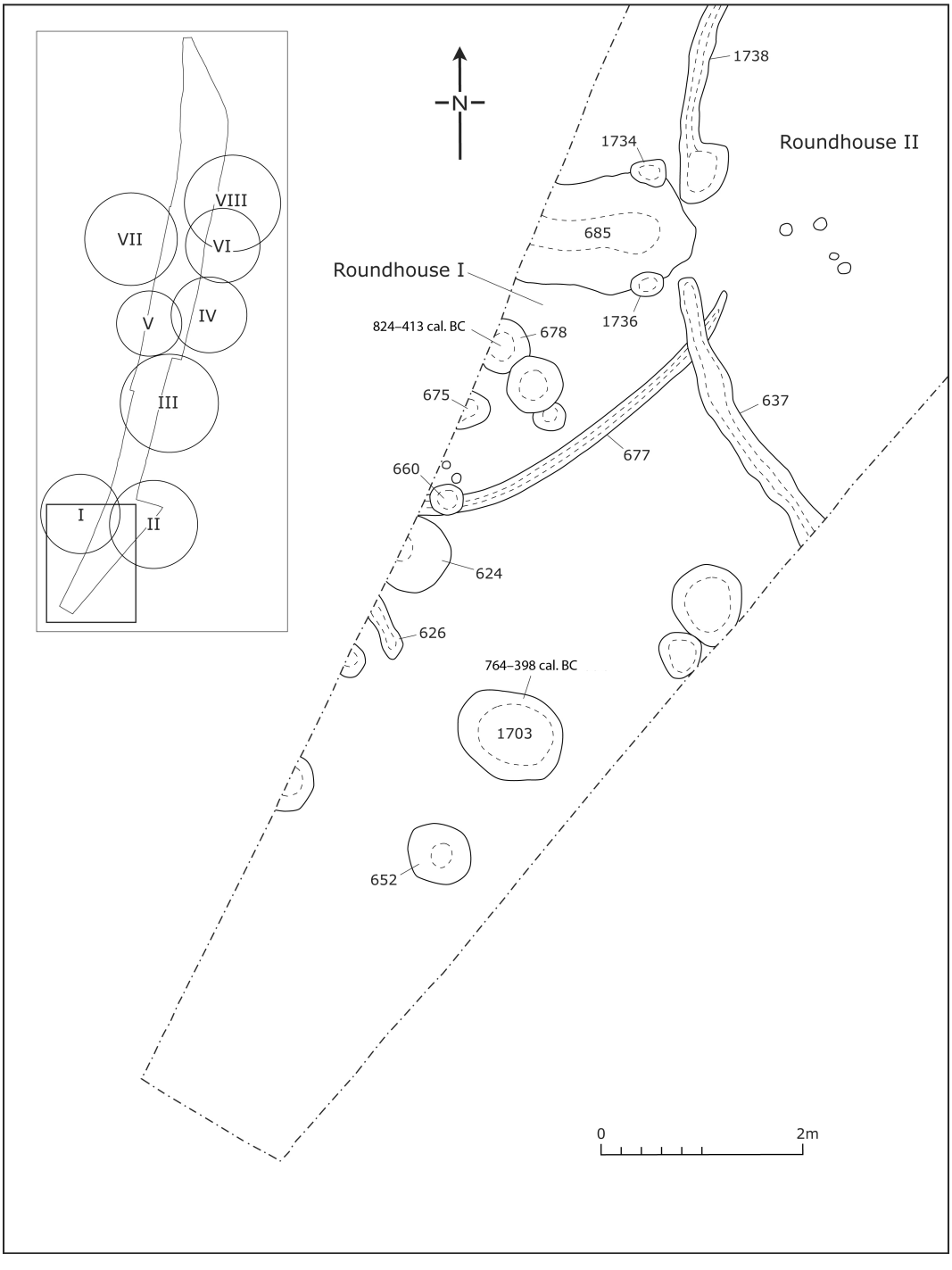

Fig. 8. Plan of the southern end of Trench 4 showing Roundhouse I and related features.

Apart from the extreme southern end of the trench where sea-spray had killed the vegetation, fescue grass forming a thick, springy turf up to 0.3m thick overlay an almost stone-free silty loam soil. Below this was a layer of shattered shale and soil (604), possibly derived from disturbed and spread occupation deposits. This layer was not present in the area of Roundhouse VIII, and stone foundations (607) close to Roundhouse II overlay it. Apart from these two exceptions, layer 604 sealed all archaeological deposits and features. Other than in association with Roundhouse VIII, very few stratified deposits survived. Most features were cut into drift geological deposits comprising silty clays with stones and pockets of clay, which overlay the solid geology. A scatter of flints of probably late Mesolithic date lay on the surface of the drift deposits.

Roundhouse I

A group of possibly unrelated features lay at the southern end of Trench 4 (Fig. 8). A shallow curving gully (677) 0.2m wide and 0.05–0.12m deep with a projected diameter of *c.* 8.5m represented the only remains of a probable roundhouse (Roundhouse I). There were no indications for post settings or stakeholes in this gully. It was cut by the gully of Roundhouse II (637) and by a small posthole (660). A similar, shorter length of gully (625) on the eastern edge of the excavation may be the remains of another roundhouse.

A group of postholes, stakeholes and two pits (624, 675) lay within and outside Roundhouse I. These pits and postholes were of varying size and did not form a recognisable building or structure, but this is not surprising given the relatively small area excavated. A radiocarbon date of 824–413 cal. BC (SWA-288) was obtained from posthole 678, and a date of 764–398 cal. BC (SWA-287) from the post-pipe of posthole 1703. A spindle whorl (Fig. 17, no. 16) came from posthole 652.

Roundhouse II

Roundhouse II (Figs 9 and 10) was represented by a two lengths of curving gully with a projected diameter of *c.* 9.2m and with a west-facing entrance. Both lengths of gully (637, 1738) varied from 0.17–0.3m in width, were 0.1m deep and contained groups of small packing stones, although it was not possible to distinguish individual post settings. The northern length terminated in a posthole (1743) at the entrance. Two postholes (1734, 1736) lay immediately outside this 0.8m wide entrance, presumably porch postholes, on the edge of a shallow hollow (685). Apart from a scattering of stakeholes and a burnt area (1740, possibly a hearth) on the edge of the excavation trench at the projected centre of the curving gullies, the roundhouse interior was blank.

Three shallow pits (662, 664, 666), all *c.* 0.18m deep, lay to the north of Roundhouse II on the highest point of the fort's interior. All contained heat-reddened stone and charcoal, with the pit sides of 644 heat-affected. Environmental analysis indicates marginally more burnt seeds from these pits than from other samples from the site. Charcoal from pit 666 returned a radiocarbon determination of 757–207 cal. BC (SWA-286). A group of stakeholes between 662 and 664 may be associated with the pits.

Foundations (607) of a *c*. 1.8m long section of curving stone wall overlay layer 604, making it stratigraphically later than other archaeological remains in this area. It was *c*. 0.8m wide and survived to one course. Low earthworks prior to excavation indicate that it may have formed a circular structure *c*. 4m diameter. A line of stones (606) to the south, also overlying 604, was probably associated with it.

Roundhouse III

A series of curving gullies and a cluster of internal postholes defined Roundhouse III (Fig. 11). Four phases of gully were excavated on the south side of the house and three on the north, but because of the

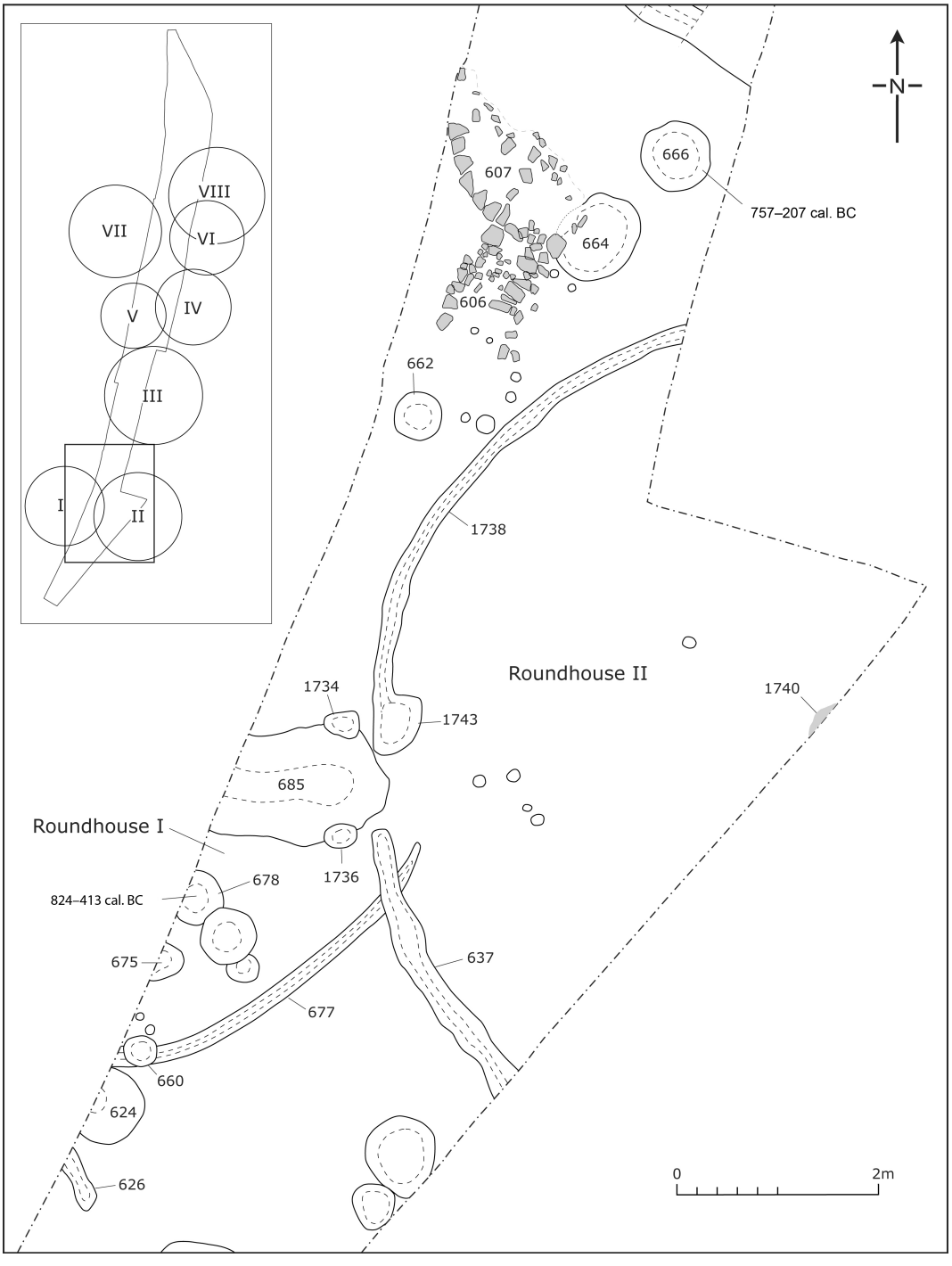

Fig. 9. Plan of the part of Trench 4 showing Roundhouse II.

Fig. 10. Trench 4 showing Roundhouse II, looking south.

location of Trench 4 it was not possible to connect the two sets of gully. However, relative stratigraphy and similar characteristics suggest that: south gully 1530 is the same as north gully 635 producing a roundhouse of *c.* 12m; south gully 1526 is the same as north gully 615 producing a roundhouse of *c.* 8m diameter; and south gully 1528 or 1535 is the same as north gully 1220 producing a roundhouse of either 9.5m or 10.3m diameter. Terminals to the northern gullies indicate that the house had a west-facing entrance.

On the south side of the house gully 1530 was the most substantial at *c.* 1m wide and 0.5m deep. It contained groups of packing stones, but the location of individual timbers could not be identified. Radiocarbon determination on charcoal from the fill of the gully returned at date of 755–177 cal. BC (Beta-124344). Gully 1530 cut gullies 1528 and 1535 which were of broadly similar dimensions, 0.2m deep and 0.35m wide). Gully 1528 contained packing stones for timbers, but no such stones were present in 1535. There was no relationship between gully 1526 and the other three gullies, but it was cut by a posthole (1503). It was 0.3m wide and 0.17m deep and contained packing stones for timbers.

On the north side of the house gully 635 was the largest at 0.85m wide and up to 0.3m deep and contained packing stones for timbers (see section on Fig. 12). It cut gully 1220 as well as gully 1757 of Roundhouse V to the north. Gully 1220 contained packing stones and measured 0.35m wide and 0.2m deep. Gully 615, at 0.18m wide and 0.08m deep, had no relationship with the other gullies, although it was cut by a posthole (643). It contained packing stones for timbers. Two spindle whorls (Fig. 17, nos 14, 17) were found in this gully

The internal postholes are of roughly equal dimensions, being 0.2–0.3m diameter and 0.15–0.25m deep, and probably represent more than one phase of internal post-ring. However, apart from possibly 655, 619, 647, 645, 608, 610 and 643 none lies on an obvious arc.

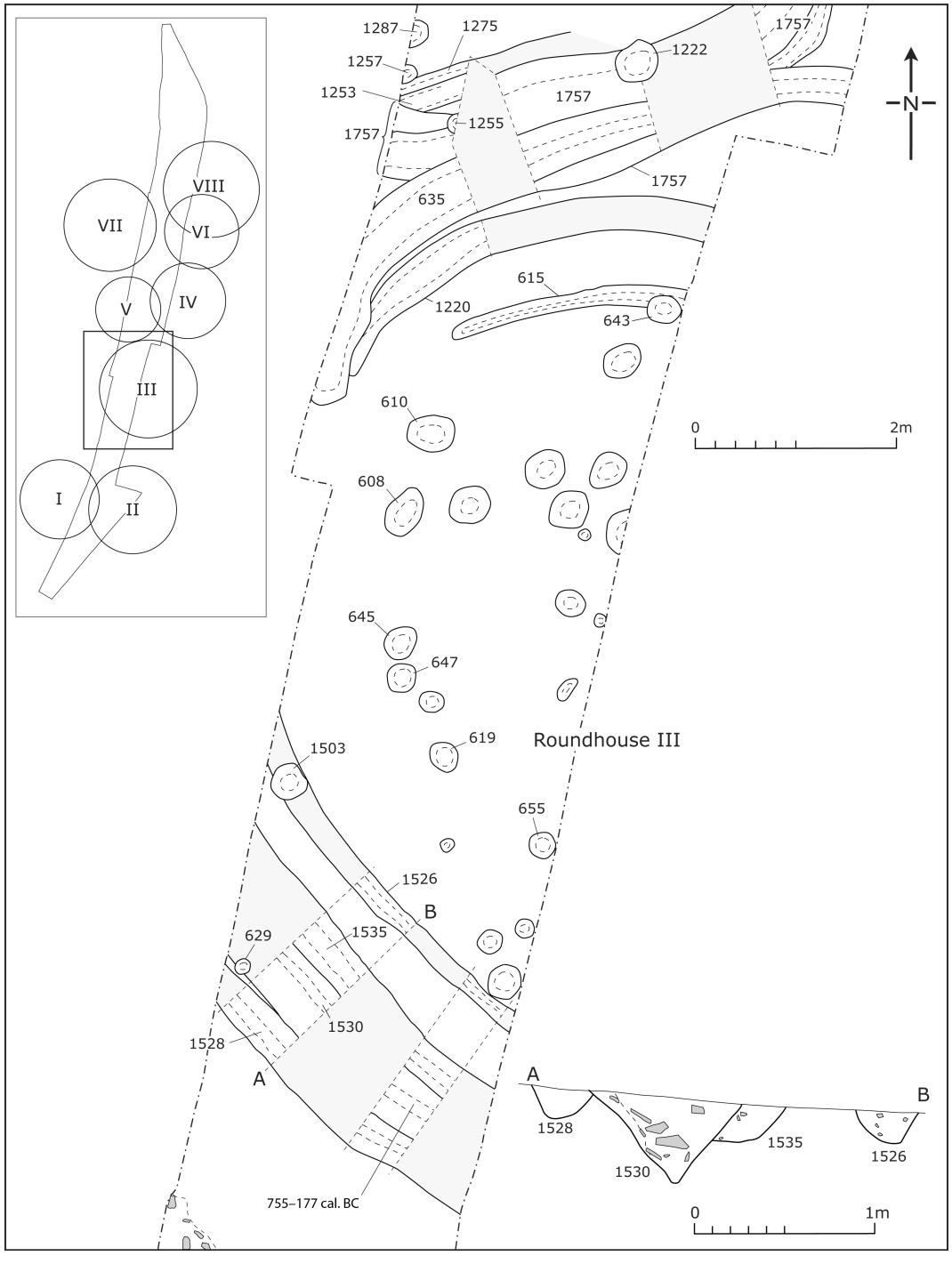

Fig. 11. Plan of part of Trench 4 showing Roundhouse III.

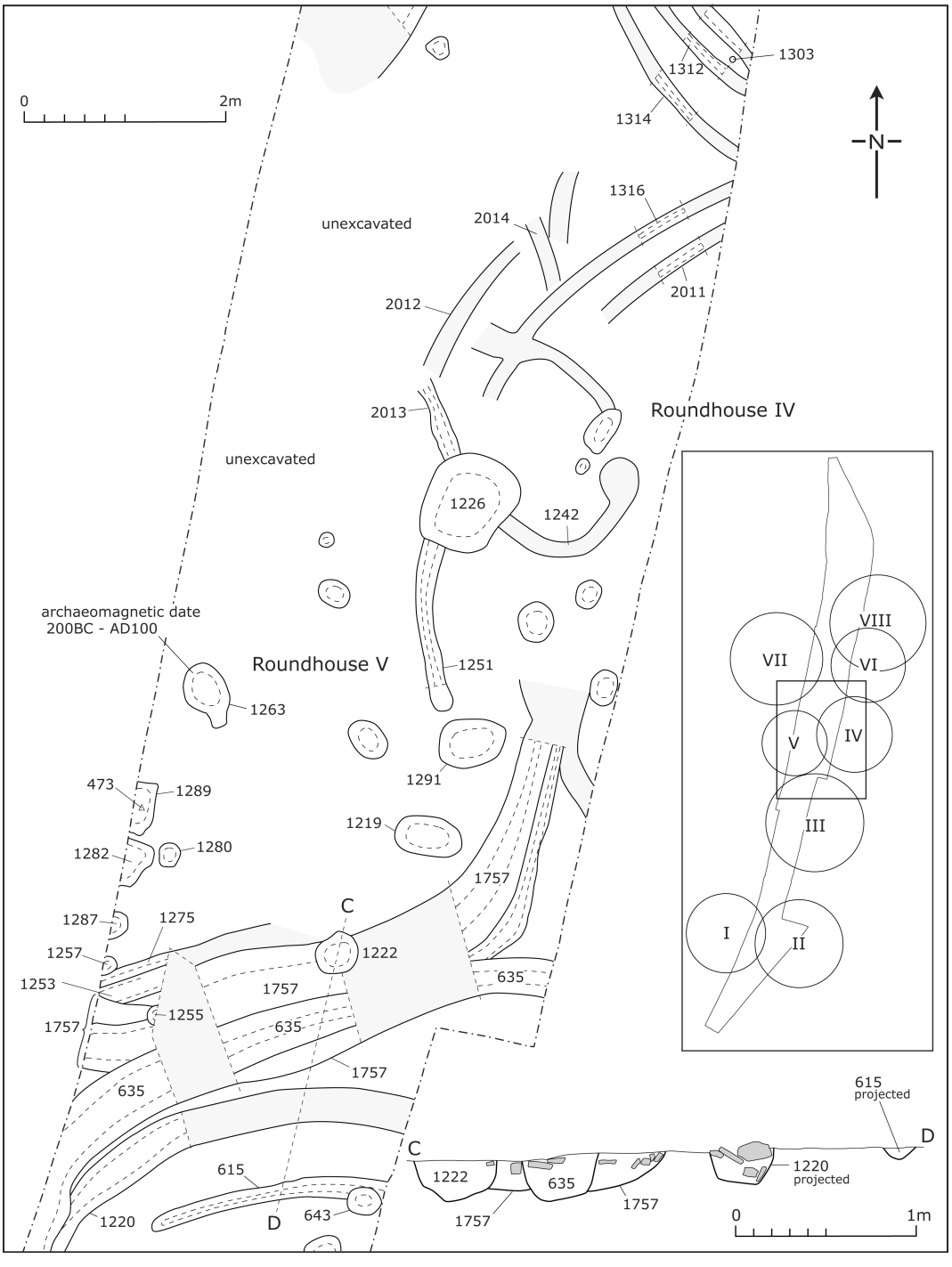

Fig. 12. Plan of part of Trench 4 showing Roundhouses IV and V.

Roundhouse IV

Roundhouse IV (Fig. 12) overlapped with Roundhouse V but their relative chronology was not investigated as both houses were only partially excavated. On its north-west/west side Roundhouse IV comprised three concentric gullies (1316/1251, 2011, 2012), giving overall diameters of 8.5–10.5m. Gullies 1316/1251 and 2011 were both 0.1m wide and 0.05m deep and contained packing stones and impressions of stakes or posts in their bases. Gully 2012 was not excavated. A substantial posthole (1226), 1m in diameter and 0.5m deep, cut gully 1251 and gullies 2013 and 1242. The function of a horseshoe-shaped gully (1242, unexcavated) is unknown, as is its connection, if any, with this roundhouse. It is unknown whether a small group of postholes inside and outside this roundhouse had any connection with it. Oval postholes 1219 and 1291, each *c*. 0.6m by 0.3m in plan and 0.3m deep, seemed to be a pair, but their locations indicates they were not door or porch posts of Roundhouse IV nor of Roundhouse V. A cluster of fused glass beads of Roman date was found in layer 604 overlying gully 2012 (Fig. 16, nos 3–8).

Roundhouse V

Only the southern part of this roundhouse was subjected to detailed investigation (Fig. 12), and its relationship with Roundhouse IV to the north-east was not established. Its north-east side was probably represented by two short, curving lengths of concentric gully (2013, 2014). Gully 2013 was shallow, 0.10m deep; gully 2014 was not excavated. On its south side the latest gully (635) of Roundhouse III cut the latest gully (1757) of this roundhouse. Unlike the gullies of other houses on the site, which approximate to a circle, those of Roundhouse V form a polygon *c.* 8–9m across.

Four phases of gully were investigated on the western edge of the trench. Less than a 0.8m length of the earliest two (1253, 1275) was excavated. These were shallow and narrow (*c*. 0.2m wide and less than 0.1m deep), with 1275 probably later than 1253, although this relationship could not be established with certainty. They were cut by the two larger, later gullies (both numbered 1757). The inner one of this pair seemed to cut the later one, but this was not firmly established. Both were *c.* 0.5m wide and 0.2m deep with indications of postholes/stakeholes along their bases.

The relationship between a small group of postholes (1257, 1287 and 1280) and other features on the western edge of the excavation trench with this roundhouse in uncertain, although posthole 1257 cut gully 1275. A thin deposit containing charcoal, iron-working slag (samples F and G) and fragments of crucibles (nos 1 and 3) filled shallow scoop (1289), which was probably used for melting bronze and likely to be of Roman date. A bowl-shaped depression (1263), 0.5m × 0.4m and 0.14m deep, with a ramp leading down into it on the south side had heat-reddened and hardened sides and base, and was probably a hearth or furnace. A heat-reddened patch lay immediately to its the east (not on plan). Archaeomagnetic dating from this patch and the probable hearth or furnace returned a date range of 200 BC to AD 100 at a 95% confidence limit. Glass beads (Fig. 16, no. 2 and unillustrated bead no. 9) of probable Iron Age date and an amber bead (Fig. 16, no. 9) were found in unstratified deposits over Roundhouse V.

Roundhouse VI

This roundhouse consisted of three arcs of very shallow, narrow gullies, probably all on the same centre, with projected diameters of 6–8m. Only a 0.5m length of each gully was excavated (Figs 12 and 13). The outer gully (1314) was 0.12m wide and 0.04m deep and contained packing stones. The middle (1312) and inner gullies were both 0.2m wide and 0.12m deep. All three had stakeholes in their bases. To the north it is likely that the gullies of this house ran beneath or had been removed by Roundhouse VIII.

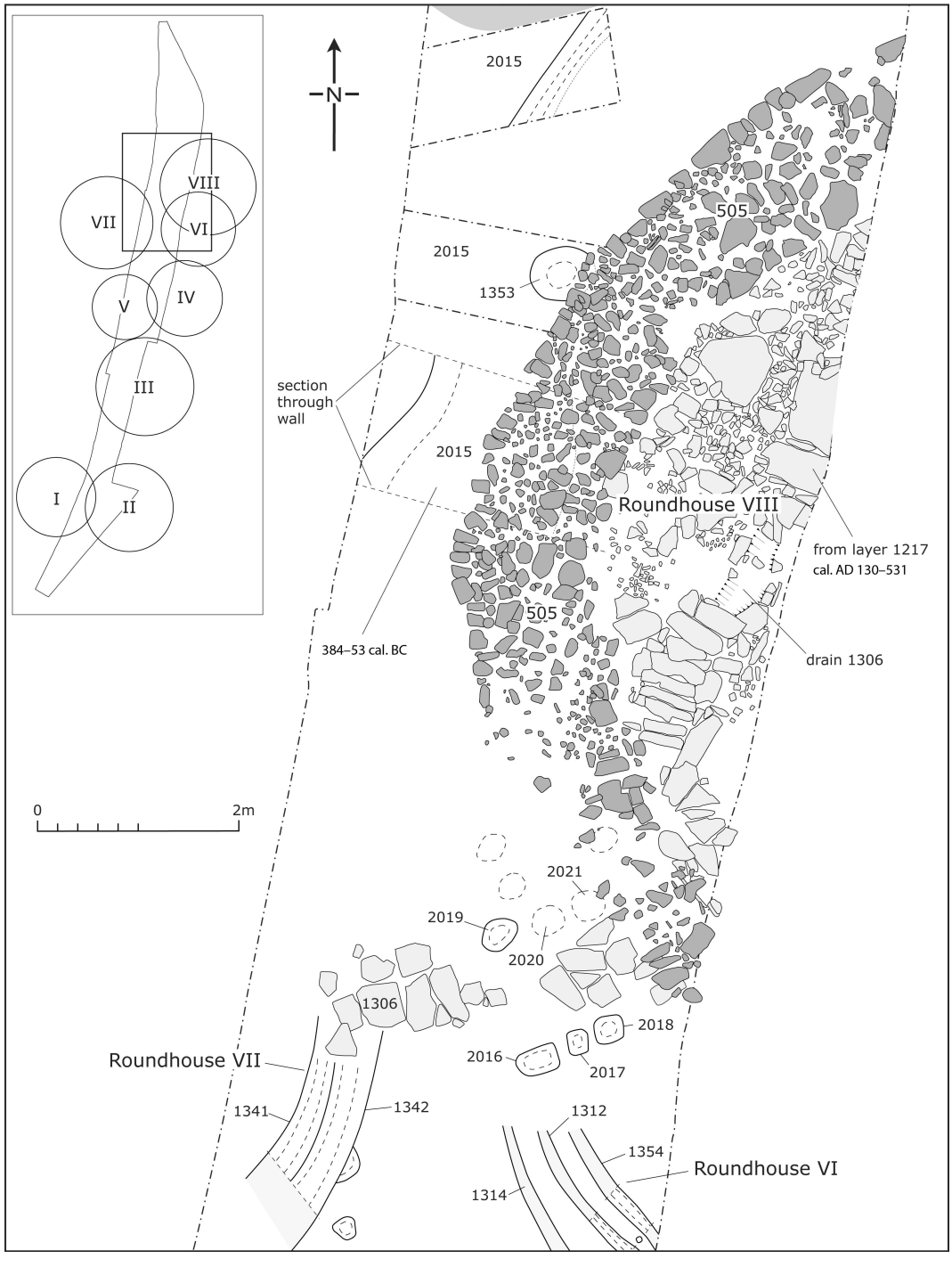

Fig. 13. Plan of part of Trench 4 showing Roundhouses VI, VII and VIII.

Roundhouse VII

Arcs of two gullies with estimated diameters of 9–10m underlay elements of Roundhouse VIII to the north. Both were *c.* 0.3m deep. The outer gully (1342) was up to 0.55m wide with a suggestion of a recut evident in its fill. The inner gully (1341) was 0.2m wide and seemed to cut the outer gully (1342). Its fill contained much fire-reddened stone.

Roundhouse VIII

A ditch (2015) pre-dating Roundhouse VIII was investigated in three sections (Fig. 13). The wall footings (505) of Roundhouse VIII were removed in the southern section revealing this ditch to be up to 2m wide and 0.75m deep. Its lower fill (1225) was similar to the superficial geological deposits through which it had been cut, but contained a little iron-working slag (deposits H and I). Above this was a charcoal-rich fill (1209) containing two sherds of Roman pottery (catalogue nos 8–9) and a possible Bronze Age axe (Fig. 16, no. 13). A radiocarbon determination from this layer returned at date of 384–53 cal. BC (Beta-124345). The central section of this ditch was not excavated, but it was cut by a clay-filled pit (1353) which pre-dated the wall footings (505) of Roundhouse VIII. Only the western side of this ditch was excavated in the northern section.

Fig. 14. Roundhouse VIII looking north, partially excavated.

The western side of Roundhouse VIII lay within the excavation trench (Figs 13 and 14); the outline of the rest could be traced as a slight earthwork to the east. Its internal diameter was *c*. 9.2m and the maximum width of its wall (505), on its northern side, was 1.4m. The house was constructed on a platform created by cutting into the slightly higher ground to the south and depositing the excavated material to the north. Where excavated, the northern section of the house wall (505), built over the redeposited material, was more substantial than the southern section. The wall was constructed of stone bonded with soil, and, where large facing stones had been used, survived to one course up to 0.4m high. Smaller stones had been used in one section, and here the wall stood to four courses. Some of the internal facing stones were heat reddened. Wall 505 was not removed apart from the short length required to investigate the south section of ditch 2015.

A small amount of rubble (not shown on Fig. 13) lay outside (650) and inside (653) the roundhouse, indicating, perhaps, that the wall was never much higher than what was excavated. Several sherds of Roman pottery (catalogue nos 3, 7, 8, 11, 12) were found in these layers. The interior rubble (653) overlay a thin, patchy, charcoal rich soil (1217). This layer overlay a floor of roughly laid, slabby stones incorporating the capping stones of a drain (1306), and also filled the drain where the capping stones were absent. A sherd of Roman pottery (catalogue no. 8) and a small amount of iron slag associated with low temperature smithing came from this layer. A radiocarbon determination of cal. AD 130–531 (Beta 124343) was obtained from charcoal from layer 1217. The largest capping stone had a hole 8mm by 50mm cut through it; this did not appear to lead into the drain and so the stone is likely to have been reused. The drain turned sharply to the west after passing through the entrance of the house. Both its inlet and outlet lay outside the excavation. Apart from in a small section, the floor and the drain were not excavated. The drain in the excavated section was very shallow, only 0.08m deep. The bottom was not lined but the sides were constructed from small stones.

A *c.* 1.2m wide entrance lay on the south-west side of the roundhouse. The wall (505) continued across the entrance with its inner face lined with thin upright stones producing a small step down into the interior. Three pairs of postholes (2016–2021, two postholes on the northern side unexcavated), each sub-rectangular 0.2–0.4m across and 0.15m deep, defined a porch. It was unclear whether these represented a single structure or successive replacements of a two-post porch. Similar sized, unexcavated postholes to the north may have been a different phase of a porch. The capping of the drain (1306) and other flat stones formed a path inside and outside the porch. These flat stones seem to have been laid in a worn hollow.

Entrance tracks

To the north of Roundhouse VIII a track (620) comprising a 4.2m wide band of loose pebbles and cobbles was aligned on the fort's entrance to the north-east (Fig. 15). It was cut by posthole 1762. The northern edge of this track overlay an earlier track (1333) containing a greater proportion of cobbles, again aligned on the fort's entrance. A layer of pebbles and cobbles exposed by cliff erosion to the north-east suggests that these tracks ran through the fort's entrance. Removal of small sections of the tracks revealed two gullies and a group of postholes. These features formed no obvious pattern, although one of the gullies (1311) was parallel to the northern edge of track 620 and the southern edge of track 1333. Iron-working slag (sample E) was found in one of the postholes of the group.

Interpretation of the features identified in the interior

The partial remains of at least eight roundhouses were excavated. At the southern end of the trench surviving archaeology was relatively simple with little intercutting of features, indicating a less intensively used part of the interior than that examined in the northern section of the trench where a stone-built roundhouse (VIII) overlay several phases of timber-built roundhouses. Although Roundhouses I and

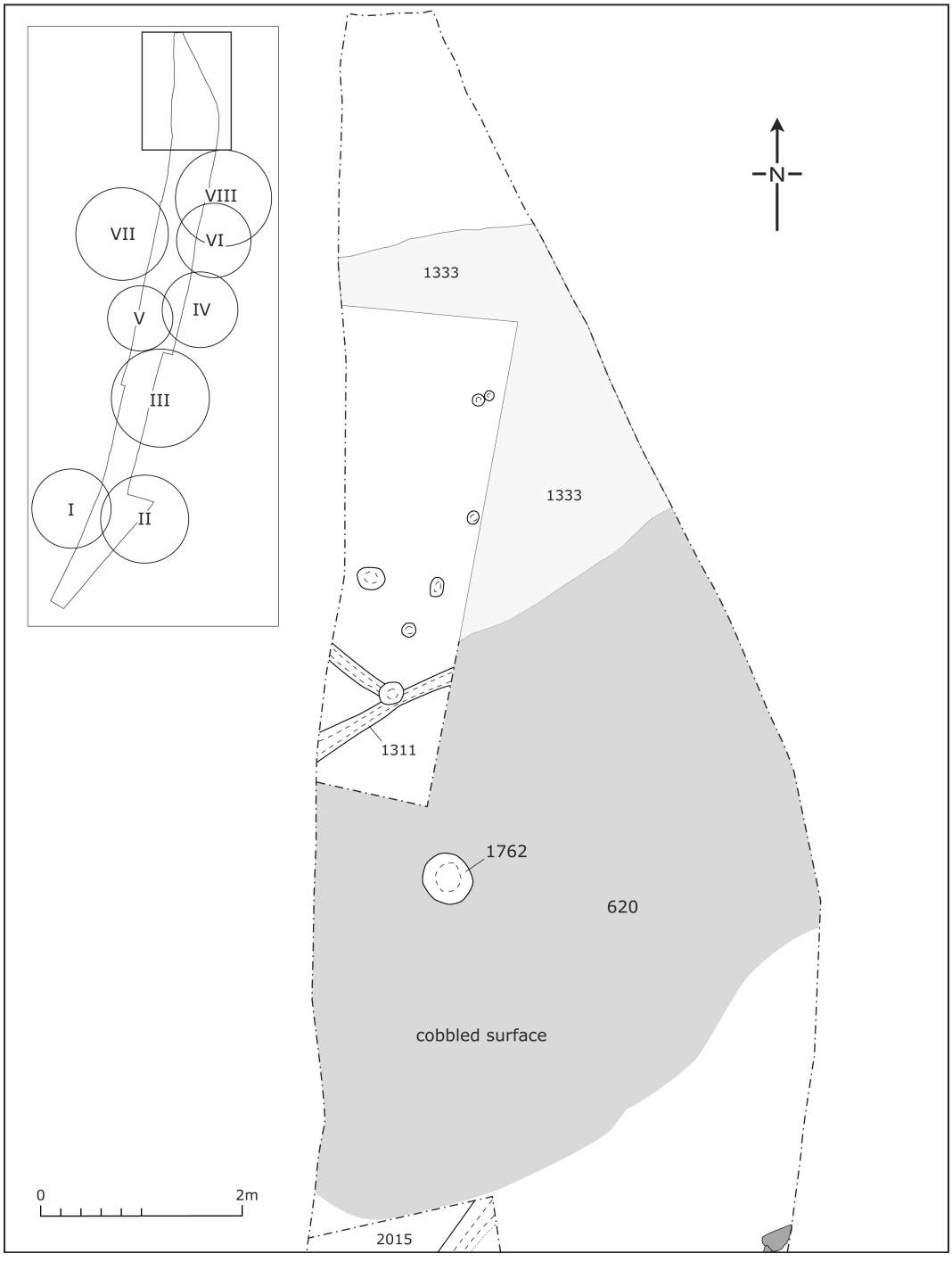

Fig. 15. Northern end of Trench 4, showing entrance tracks.

II could not have co-existed, nor could Roundhouses VI and V, it is possible that at least one of the phases of Roundhouses III, VI and VII together with I or II and a phase of IV or V could have stood at the same time. Most of the gullies of most of Roundhouses I–VII contained evidence that they were foundation trenches for timber walls, rather than for drainage.

Apart from the stone-built roundhouse (VIII), which is clearly Roman in date, dating of the roundhouses and other features is problematic, with great reliance on radiocarbon determinations derived from mixed charcoal, all of which may be in residual contexts. The radiocarbon dates, however, indicate an eighth to second century BC use for the timber roundhouses and associated features, with a mid point of the sixth to fifth centuries. It is tempting to postulate a second century BC/first century AD break in occupation between the timber roundhouses and the construction of the Roman stone-built house, but evidence, both scientific and artefactual, is not sufficiently precise to support this.

At the southern end of the trench the earliest recognisable structure was Roundhouse I was followed by Roundhouse II. They were broadly of similar size. There was no evidence for contemporary internal structures within either of these roundhouses. Both had single gullies and they appeared to be very similar in construction to the more lightly built roundhouses further to the north, which also had narrow, shallow gullies and some evidence of post-packing. Whilst there was a number of individual postholes in the vicinity of Roundhouses I and II, it is not possible to group these into structures such as four-posters or for roundhouses for which no other evidence survives, as has been suggested occurs elsewhere (Williams 1945, 226). Charcoal from postholes close to Roundhouse I returned radiocarbon determinations of 824–413 cal. BC (SWA-288) and 764–398 cal. BC (SWA-287). These postholes, however, may not have any relationship with the roundhouse.

Three shallow pits and an adjacent group of stakeholes, possibly a small structure, appeared to respect the perimeters of both Roundhouses I and II and the larger Roundhouse III. The pits, cut into clay, all held water, and could have been used for cooking. There was a little evidence of fire reddening within one of them, but all contained a large amount of burnt material. The environmental analyses suggest that burnt seeds may be due to waste material being used as a fuel. Charcoal from one of these pits gave a radiocarbon date covering a very large calibrated range 757–207 cal. BC (SWA-286).

Roundhouse III was very different in form from those to the south, having larger wall gullies with less steep sides and evidence of at least four rebuilds. The much smaller and shallower inner gully may represent an internal wall, possibly to provide insulation of the kind suggested by Cunliffe (1983, 98). However, given the very shallow nature of the gullies of Roundhouses I–II and IV–VI, it may simply be a smaller, different phase of roundhouse on the same centre as the others. There appeared to be several phases of internal post-ring, although it was not possible to associate these with any particular phase of the gullies. Some of the postholes probably represent repairs to an ageing roof (P. Bennett, pers. comm.).

No relationship could be demonstrated between the group of postholes and other features and Roundhouse V, other than they lay within the circumference of the house. The presence of a hearth or furnace, a crucible possibly for bronze melting and iron-working slag indicates at least some of these features had an industrial use. As the crucible is most likely to be of Roman date, and a archaeomagnetic date of 200 BC to AD 100 was obtained from the furnace it is probable that this industrial use post-dates Roundhouse V and the other timber roundhouses, and may be contemporaneous with stone-built Roundhouse VIII).

Ditch 2015 pre-dating Roundhouse VIII was too large to be a roundhouse construction gully, and was more probably a drainage feature. However, only a short segment was excavated and it was not necessarily a linear feature. Its lower fill appeared to be re-deposited natural, but contained occasional slag fragments, possibly being deliberately backfilled not long after excavation. Analysis of the slag indicated smithing activity, and was also suggestive of higher temperature processes such as welding. The

pottery sherds recovered from the upper fill of the ditch date to the first to the fourth centuries AD. Charcoal providing a radiocarbon determination of 384–53 cal. BC (Beta-124345) and a possible Bronze Age axe may therefore be residual.

Only a small sector (approximately 25% of the wall and 15% of the interior) of Roundhouse VIII was investigated, and consequently few overall conclusions can be made. However, a considerable amount of effort appears to have gone into its construction, a platform having been created on the slope before building the walls with good stone faces and rubble core. The porch on the south-west side appears to be an original feature, although the flagstone path porch appears to have been laid after the development of a worn hollow. No evidence was found for the relative date of the drain inside Roundhouse VIII, it may have been much later than house construction. There were indications of much burning within the roundhouse and fire-reddening of the inner wall face, suggesting a possible conflagration.

The wheel-thrown sherds from Ditch 2015 indicate that this roundhouse could not have been constructed until the Roman period. All other pottery from the site was, with one exception, from within, or adjacent to, Roundhouse VIII and was deposited after its construction. The pottery ranged in date from the first to the fourth centuries AD, and this date range is supported by the radiocarbon determination, taken from a very large fragment of charcoal that is unlikely to have been redeposited.

The postholes and gullies, located on the west side at the north end of the trench, were probably part of a number of larger, complex features that may well have extended under the unexcavated part of the pebble/cobble surfaces. Little more can be said about them.

Foundation of a wall (607) close to Roundhouse II would appear to have been too small to be a typical Iron Age/Romano-British roundhouse. Stratigraphically this feature must be later than most of the occupation on the site, as it lay above the shaly/shattered stone and soil (604). Whilst this structure could have been very small roundhouse of cell-like proportions contemporaneous with the stone-footed Roundhouse VIII, it is more likely to belong to a period after the abandonment of the fort, possibly even being as late as post-medieval in date. It was located on the highest present-day point of the fort's interior and could perhaps have been an observation tower, or it may also be the feature reported by Warburton (1944), which he described as the remains of a 13-foot cattle pond 'on the summit'.

RADIOCARBON DATING

The following radiocarbon dates have been calibrated using the radiocarbon calibration program Calib. Rev. 5.0.2. (Stuiver and Reimer1993).

SWA-101
Sample and context: mixed charcoal from hearth 4 within defensive bank, Trench 1.
Result BP: 2470 ± 70 BP
Calibrated range at 2 sigma: 773–408 cal. BC

SWA-286
Sample and context: mixed charcoal from fill of shallow pit 666, Trench 4.
Result BP: 2350 ± 80 BP
Calibrated range at 2 sigma: 757–207 cal. BC

SWA-287
Sample and context: Mixed charcoal from post pipe of posthole 1703, Trench 4.
Result BP: 2430 ± 70 BP
Calibrated range at 2 sigma: 764–398 cal. BC

SWA-288
Sample and context: mixed charcoal from fill of posthole 678, Trench 4.
Result BP: 2550 ± 80 BP
Calibrated range at 2 sigma: 824–413 cal. BC

Beta-124341
Sample and context: mixed charcoal from fill gully 21 on inner edge of Bank 1, Trench 1.
Result BP: 2420 ± 80 BP
Calibrated range at 2 sigma: 775–388 cal. BC

Beta-124342
Sample and context: mixed charcoal from hearth 4 within defensive bank, Trench 1.
Result BP: 2430 ± 60 BP
Calibrated range at 2 sigma: 759–400 cal. BC

Beta-124343
Sample and context: mixed charcoal from layer 1217 in and around stone-capped drain 1306 within Roundhouse VIII, Trench 1.
Result BP: 1720 ± 70 BP
Calibrated range at 2 sigma: cal. AD 130–531

Beta-124344
Sample and context: mixed charcoal from fill of latest gully 1247 of Roundhouse III, Trench 4.
Result BP: 2320 ± 90 BP
Calibrated range at 2 sigma: 755–177 cal. BC

Beta-124345
Sample and context: mixed charcoal from layer 1209 in ditch 2015 pre-dating Roundhouse VIII, Trench 4.
Result BP: 2170 ± 70 BP
Calibrated range at 2 sigma: 384–53 cal. BC

FLINT
By Andrew David

There were 202 flint items. Of these at least 16 were unmodified and 24 were smaller than 10mm; these are not included in the following commentary. Most flint was residual except for a possible concentration of objects towards the south end of Trench 4. Most worked flint was undiagnostic flakes or fragments of flakes. In addition there were three blades, a bladelet fragment, two bladed cores, eight core fragments, three flaked lumps, and one miscellaneous fragment. Two pieces had coarse retouching. There were six tools. Four of these were ‘denticulates’, one ‘end-tool’ and two microlith fragments. All these fall within the suite of tool types familiar from surface lithic scatters along the western coast of Wales, and in the Solva area in particular. By analogy with material from other sites—and especially with the collection from the Nab Head Site II (David 1990)—these are likely to be late Mesolithic and residual on the promontory fort. There are no items of distinctively earlier or later appearance. One non-flint lithic from layer 604, although unworked, could be a fragment from a ‘bevelled pebble’, another common tool in late Mesolithic coastal assemblages. Previous finds from near the Porth y Rhaw fort include part of a tranchet axe (Grimes 1951, 14).

ROMAN POTTERY
By Peter Webster

A total of 88 sherds of Roman pottery was recovered, the majority of which was Black Burnished Ware. Apart from one sherd, all were associated with the stone-built Roundhouse VIII. The date range of the pottery is from first/fourth centuries AD

With such a small collection and with such a limited stratigraphic distribution, the pottery can do little more than provide a general idea of the dating of Roman occupation on the site. In the catalogue below the more diagnostic pieces have been selected.

Chronologically, the material appears to be spread across the Roman period. However, Black Burnished Ware, the predominant fabric, is most popular in Wales in the second to fourth centuries and

there is only one sherd (no. 6) likely to be first-century in date. A closer look at the more diagnostic pieces catalogued suggests, moreover, that the *floruit* of the site may be narrower than this. With the exception of no. 6, all sherds could have been deposited between the late second and the early fourth century and this is suggested as the main period of Roman activity.

Fabric sources are remarkably varied for such a small collection. Samian ware is present, although in the small quantities typical of many rural sites. Oxfordshire is represented by a single mortarium. Other fabrics are represented only by kitchen-ware, with the possible exception of the Severn Valley tankard. The site is clearly not a high status establishment. However, the range of wares present that have been imported into the region does suggest a successful, presumably agricultural, operation.

Black Burnished Ware

Black Burnished Ware may be expected in south Wales from the conquest period onwards, although most will be Trajanic or later. Here most of the sherds recovered were too small to allow meaningful dating beyond this extremely broad range. However, a few pieces are more diagnostic:

1. The decoration is similar to that on Gillam 1976, no. 5 (late second-century) and a similar date for this piece may be expected. Above wall (505) of Roundhouse VIII.
2. Fragment from a bowl with looped decoration suggesting a mid/late second-century date. Above wall (505) of Roundhouse VIII.
3. Shoulder fragment from a jar. The angle of the wall and rim suggests a third- or early fourth-century date. Rubble (650) outside Roundhouse VIII.
4. Wall fragment from a jar with decoration of obtuse angle lattice below double horizontal line, similar to Gillam 1976, nos 12–14. Fourth-century. Above porch floor of Roundhouse VIII.
5. Fragment from a jar with decoration of obtuse angle lattice suggesting a late third- or fourth-century date. Drain (1306) in Roundhouse VIII.

Other wares

6. Fragment of calcite gritted fabric. Calcite usually appears as a pottery filler in the late Iron Age and immediately post-conquest period and at the very end of the Roman period. The former seems more probable in this case. Layer 604 close to Roundhouse VIII.
7. Two fragments of Central Gaulish samian ware. Both sherds are from bowls of Form 31 but are probably not from the same vessel. Second half of the second century. Rubble (650) outside Roundhouse VIII.
8. Three sherds of oxidised ware. Upper fill (1209) of ditch 2015 below Roundhouse VIII, layer 1217 over floor of Roundhouse VIII, and from rubble (653) within Roundhouse VIII.
9. Romano-British jar sherd in a grey fabric containing large quantities of mica. Upper fill (1209) of ditch 2015 below Roundhouse VIII.
10. Fragment of Oxford red colour coated mortarium. The fabric was in production from the mid third until the late fourth century. Layer 604 close to Roundhouse VIII.
11. Severn Valley Ware jar fragment. The fabric was in production throughout the Roman period. However, it is most common in west Wales in the third and fourth centuries. Rubble (650) outside Roundhouse VIII.
12. Tankard rim in an orange buff fabric with a thin grey core. The fabric is probably Severn Valley Ware; cf. Webster 1976, no 44 (fourth-century). Rubble (650) outside Roundhouse VIII.

GLASS BEADS (Fig. 16, nos 1–3)

By Yvette Sablerolles and Julian Henderson

The remains of three individual beads and a cluster of at least six beads were recovered from the site. A detailed chemical analysis of the beads has been carried out, the results of which are contained in the site archive.

Small, flattened, globular beads of translucent blue glass (nos 1–4, 7) are very common in the Roman period and can still be found in fifth- to sixth-century AD necklaces. They are also known from a few native sites of earlier Iron Age date, as for example at Meare Lake Village, Somerset (Gray 1966). They fall into Guido's (1978) Group 7 (iv). Chemical analyses support a Roman date for the beads, although an Iron Age date is possible for no. 2 and cannot be entirely excluded for no. 1.

Beads of translucent turquoise glass, on the other hand, are not very common during the Roman period. They are more frequently, although not commonly, found in late Bronze Age and Iron Age contexts, e.g. annular beads from Rathgall, Co. Wicklow (Ireland) of a late Bronze Age date (Raftery and Henderson 1988) and an annular bead from Meare Lake Village of an early Iron Age date (Gray 1966). Chemical analyses indicates that bead no. 9 is of a typical Iron Age composition, rather than the very different late Bronze Age composition of the Rathgall beads.

The beads in the clusters (nos 3–8) are certainly Roman in date, something that is also supported by the chemical analyses of the beads. The technique of colouring a bead by introducing coloured streaks in a translucent matrix (no. 5) is not a common Roman technique, however, and has not been found in Iron Age glass. It has been observed in three large globular beads (with matrix of colourless/pale blue

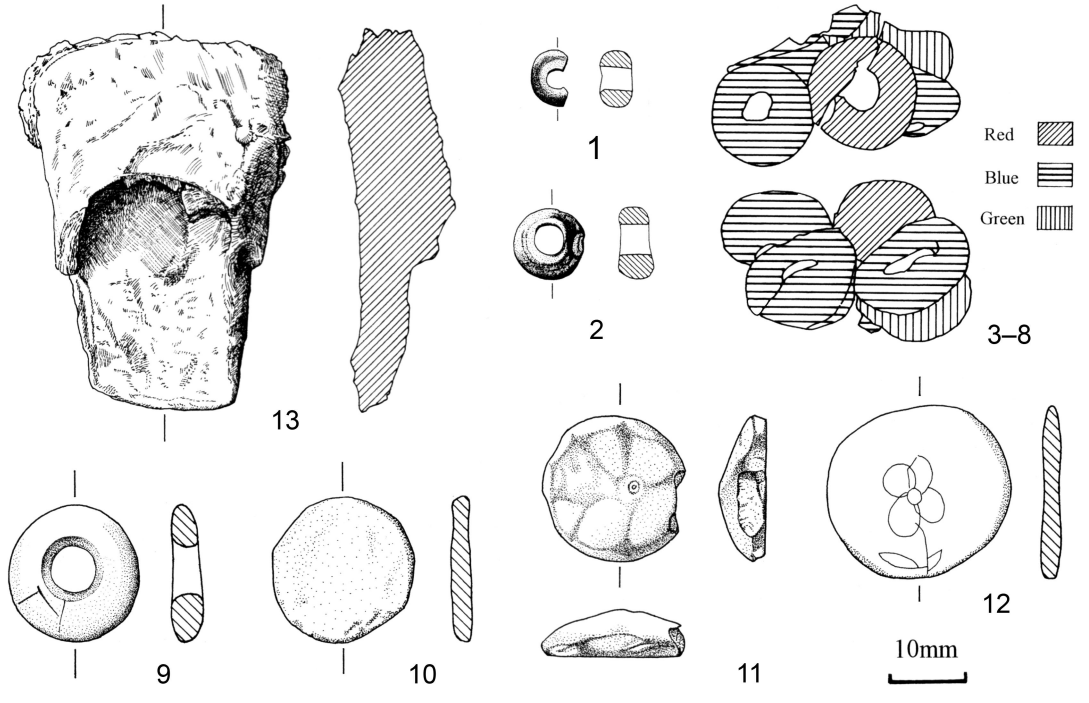

Fig. 16. Beads (nos 2–8), amber bead (no. 9), counters (nos 10–12), copper alloy (no. 13).

glass coloured by streaks of white, green, grey-blue and purple/reddish glass) from the early Roman harbour-fort at Velsen I in the Netherlands, dated between *c.* AD 15–30/39 (unpublished data; information from YS).

1. Approximately half of a small, irregular, flattened globular bead of faintly translucent dark/sky blue glass; metal contains many small bubbles, causing some small holes visible on the surface of the bead and on the fractures. Height 4.3mm, diameter 7.4mm, perforation 1 2.8mm, perforation 2: 3.0mm. Find no. 431, from hearth (4) in Bank 1, Trench 1.
2. Complete, flattened globular bead of faintly translucent ultramarine blue glass. The bead is irregularly wound, causing a difference in height; the surface of the bead shows two small indentations which are probably flaws in the production of the bead. Height 4.8–5.5, diameter 9.5mm, perforation 3.8–3.9mm. Find no. 432, unstratified, above Roundhouse V.

3–8. Fused cluster of 6 beads, find nos 452 and 453, found in layer 604 immediately above gully 2012 of Roundhouse IV. The following beads are identifiable in the cluster:

No. 3. Complete, flattened globular bead of faintly translucent dark/sky blue glass similar to 431; irregularly wound causing a difference in height; slightly heat-affected and fused to no. 4. Height *c*. 3–3.7mm, diameter 7.1mm, perforation 2.9mm. Find no. 452A.

No. 4. Probably complete, partially molten and deformed globular bead, or possibly two beads, of faintly translucent dark/sky blue glass; fused to 452A. Diameter reconstructed *c.* 7–8mm. Find no. 452B.

No. 5. Approximately two halves of a flattened globular bead of apparent translucent reddish glass which, looking at the fractures, is actually made of a translucent pale blue matrix coloured red by bright opaque reddish streaks. Height 3.9mm, diameter 7.2mm, perforation 2.8mm. Find no. 452C/453B.

No. 6. Small part of a probably flattened globular, bead of faintly translucent brownish green glass; fused with small part of no. 8. This small fragment of bead appears to be black but is in fact a deep translucent brownish-green colour. Like the other beads it is of a SLS basic composition. Find no. 452D.

No. 7. Complete, flattened globular bead of faintly translucent sky/dark blue glass; slightly heat-affected and deformed. Height *c*. 4mm, diameter reconstructed *c*. 7mm. Find no. 453A.

No. 8. Almost complete, flattened globular bead of faintly translucent brownish green glass; small part missing (see no. 6), light iridescence on fracture, slightly heat-affected. Height 3.5mm (min.), diameter 6.9mm, perforation 2.5mm. Find no. 453C.

9. A small part of a globular bead of faintly translucent, turquoise glass with some small bubbles (appearing as bright spots in the matrix/on the fractures). Height 5mm (min.), diameter reconstructed *c.* 7mm, perforation reconstructed *c*. 3.5mm. Find no. 483, from layer 604 over Roundhouse V. Not illustrated.

AMBER BEAD (Fig. 16, no. 9)
By Nina Crummy

An annular amber bead, find no. 435, from layer 604 to the north of Roundhouse VIII. It was found complete, but now cannot be fully reconstructed from the fragments into which it shattered immediately after excavation. External diameter 19mm, by 4mm thick.

Amber, a fossil resin, is primarily sourced from submarine deposits around the coast of the Baltic. It was prized in antiquity not only for its appearance but also for its electrostatic qualities, which must have appeared magical. It was traded extensively in Europe from the Bronze Age (Cunliffe 1994, 327, 350, 440), but may not only have reached Britain by overseas trade, for occasionally raw lumps of amber can be washed up on the East Anglian coast (Shepherd 1985, 204). By the second century BC the trade in amber on mainland Europe was at least partially under Roman control, passing from the north through Hungary and the colony of Aquileia to the Mediterranean (Cunliffe 1997, 220). Annular amber beads make only a sporadic appearance in Iron Age Britain, but whether this paucity was a direct result of the highly organised trade with the Mediterranean countries is uncertain. Three were found at Danebury, one in the grave of a female (Cunliffe 1984, 396–7); and one in the grave of a young female with a new-born child at Kirkburn, East Yorkshire (Stead 1991, 93). Stead suggests that the recovery of single beads in graves may indicate that they were used as ear-pendants. It may equally reflect great value. Amber is rare in Wales, with only three other Iron Age pieces being recorded: Woodside in Pembrokeshire, Caerau, Henllan in Ceredigion (David 1998, 95) and Castell Henllys, Pembrokeshire (unpublished information), all in west Wales

STONE COUNTERS (Fig. 16, nos 10–12)
By Nina Crummy

Two of the three counters (nos 10, 12) are of local shale and simple design. The naïve flower pattern incised on no. 12 cannot be matched to Celtic designs (Kilbride-Jones 1980, 39–67) or to the repertoire of, for example, Roman wall painters (Davey and Ling 1982, 44) and mosaicists (Rainey 1973, 171–91). It may be modern. The third counter, no. 11, is a more or less conical piece of jet, not dissimilar in shape and size to the shale and jet buttons of the Bronze Age (Shepherd 1985, 208–9). Its identification as a counter is not certain. It bears a lathe-centre mark near the apex. Jet, like amber, has been a prized material since prehistoric times. In Britain the main source is Whitby on the north Yorkshire coast, which is also a known source of amber. Other dark fine-grained materials with a close resemblance to jet were also exploited in antiquity, notably Kimmeridge shale, lignite and cannel coal, but all were suited to being worked on a pole-lathe. Analysis, undertaken by Phil Parkes of Cardiff University, revealed the distinct phases on the scanning electron microscope image that are characteristic of cannel coal (Davies 1993). This would suggest that the object is manufactured from a cannel coal rather than jet. A frequent process employed in the manufacture of jet and shale jewellery was to use the lathe to cut out first an armlet, and then make spindle whorls or beads from the waste inner disc removed during the operation. The lathe-centre mark on the Porth y Rhaw piece suggests that it, too, originated in this way, while the facets on both edge and upper surface indicate that it was finished with hand-tools.

10. Disc-shaped counter. Well worn disc-shaped counter of brownish shale, slightly chipped at one point on the edge. Diameter 19.5mm, thickness 3mm. The very flat surfaces indicate that this is a deliberately-made counter, not the opportunistic use of a natural shape, and the flat edge shows that it was brought to its circular form by the abrasion of a roughly-shaped original, a process paralleled by the production of counters from recycled pot sherds, broken tiles, and stone veneer (Crummy 1983, 93–4). Find no. 433, from layer 604 over Roundhouse II.
11. Conical counter. Highly polished jet, with part of the edge broken off. Convex to conical in section, with a flat base and bevelled edge, diameter 19.5mm, height 6mm. Just to one side of the apex of the upper surface is a small flat patch that lacks the polish of the rest of the surface. Cut

into this patch is the characteristic ring and dot of a spur centre from a pole lathe. The edge is faceted, and the upper surface is also very slightly faceted, though the high polish obscures the facets. Find no. 442, unstratified.

12. Disc-shaped counter. Well worn disc-shaped counter made from the local dark grey shale. Diameter 25mm, maximum thickness 3.5mm. The shape appears to be produced entirely naturally, the edge being either gently tapered or smoothly rounded. Any adaptation of the form would have resulted in a flat edge, as seen on no. 10 above. Part of one face has flaked off, almost certainly the result of natural erosion before the piece was used as a counter, and still shows as a dark un-abraded streak across the face. This same face bears an incised flower, faint, but neatly executed. Find no. 445, unstratified, above Roundhouse II.

SPINDLE WHORLS (Fig. 17, nos 14–17)
By Nina Crummy

14. Probably made from local stone. Diameter 25mm; thickness 4mm. The upper surface is smooth, either trimmed or polished; the underside is rough and uneven, suggesting that the disc has broken laterally and is incomplete. The upper edges were rounded and the sides of the perforation slope inwards from 7mm to 4mm. The dimensions of this object, even at the probable original thickness, indicate that it must have been used for the production of very fine thread. Find no. 438, from gully 615 of Roundhouse III.
15. Slate. Irregular in shape, with one roughly curved side, two tapering straight sides and one smaller uneven side. Diameter 45–50mm; thickness 3mm. Perforation semi-oval, 6–10mm across, with smooth, curved upper and lower edges, indicating that this hole was probably drilled, rather than punched. On one face there were slight traces of three to five radial lines, possibly intentional. Find no. 441, from layer 604.
16. Fine-grained buff stone, slightly reddened, probably by fire. Diameter 43mm; thickness 15mm. Perforation 6–7mm in diameter, slightly inclined and off centre. The outer edges are rounded and the object appears to be well made. There was one chip out of the outer part of one face. Find no. 444, from posthole 652, south end of Trench 4.
17. Local mudstone, irregular in shape, upper edges curved. Diameter *c.* 50mm, thickness 7mm. Perforation from 3–8mm on surface and bored from both sides. Find no. 462, from gully 615 of Roundhouse III.

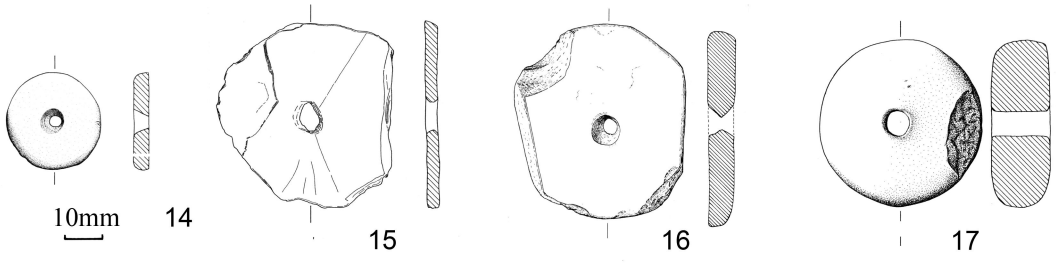

Fig. 17. Stone spindle whorls.

COPPER ALLOY
By C. Stephen Briggs

Wedge-shaped object (Fig. 16, no. 13)
A copper alloy wedge-shaped object measuring 50mm long by 37mm max. width and weighing *c.* 30g. It was originally about 10mm in section, but the thickness is now increased by some 3–4mm due to heavy corrosion incrustation. Indeed, virtually the entire object is covered in a heavy oxidation product, leaving little of the original surface visible, and making it difficult to conjecture its precise shape. A notable feature of this corrosion deposit is a significant iron content, presumably the result of panning through impeded drainage in the surrounding soil. Find no. 464, from the upper fill (1209) of ditch 2015 below Roundhouse VIII, a context that contained Roman pottery and yielded a radiocarbon date of 384–53 cal. BC (Beta-124345).

The artefact's poor condition makes firm typological identification difficult, though its form most closely resembles that of a Late Bronze Age socketted axe. It most closely resembles the type of small bag-shaped axes (Evans 1897, 139, fig. 170), some of which characterise Late Bronze Age hoards (Eogan 1983), some British (Coombs 1975) and some Breton forms (Briard 1965). Metallographic analysis (Northover 1980) might assist better understanding of this problem, though, so far, such analyses have been unable to take into account ore types, casting methods or the potential effects of cold-working some of the metals (Briggs and Williams 1995).

It is generally believed that Late Bronze Age implements were abandoned *c*. 750–500 BC, so did not survive in use as late as this one. Unfortunately, little is understood of the tool-types that actually replaced the Late Bronze Age repertory.

If this is part of a bag-shaped axe, its occurrence in such a late context might be explained variously: as a genuine Bronze Age loss; alternatively the artefact may have been handed down and used beyond its generally accepted lifespan; or we may be dealing with the survival of an Iron Age artefact of a type which is currently difficult to parallel.

METALLURGICAL RESIDUES
By Tim Young

Metallurgical residues were recovered from nineteen contexts that divided into five groups. One group included layer 604 and unstratified material. The other four represented discrete stratified settings: (1) Iron Age features, (2) contexts associated with a furnace or hearth, (3) a posthole near the fort's entrance, and (4) deposits of Roman date mainly associated with Roundhouse VIII. These four settings yielded correspondingly discrete assemblages of metallurgical residues. The Iron Age deposits yielded three fragments of a dense grey slag derived from a smithing hearth cake. The hearth-associated features contained three sherds of a metallurgical crucible (a single sherd was also present in layer 604) and one of a possible cupel, together with some small fragments of smithing slags. The posthole contained a considerable quantity of smithing slag cake fragments, together with material from the hearth wall. The deposits associated with the roundhouse contained fragments of vitrified clay, probably from the wall of a metallurgical hearth.

Crucibles
The incomplete examples makes comparison of this material with published examples difficult. There are three possible interpretations for the thickened region of crucible no. 1. Firstly it is possible that this not

a deliberate feature, and that the crucible is essentially of a sub-angular form. Although some early crucibles are highly irregular in shape, e.g. some of the Glastonbury examples (Bulleid and Gray 1911), the degree of regularity of the remainder of this specimen makes this unlikely. Secondly the crucible could be of a pinched form (cf. Tylecote 1986, form D1), but one might have expected to be able to see an out-turn of the external surface approaching the 'handle region', but this is not present. The third, and most likely, interpretation is that the thickened region represents the thickened elongated corner of a D-shaped crucible (Tylecote 1986, form A3).

The earlier Iron Age (fifth to fourth centuries BC) seems to be typified, at least in western Britain, by cup-shaped crucibles (Old Oswestry, Llwyn Bryn-Dinas, The Berth, Danebury); the later Iron Age (second to first century BC) by triangular forms (Glastonbury, Gussage, Collfryn, Castell Henllys). D-shaped crucibles are of a shape intermediate between these triangular forms and the circular crucibles common on Roman sites. Tylecote (1986) illustrated the form of these D-shaped crucibles with an example from Sutton Walls (Herefordshire), probably dating to the first century AD (Kenyon 1953). The Sutton Walls example has walls that diverge evenly upwards, giving an open shape, markedly different to the slightly inverted rim form of this specimen. A very similar wall profile to the Porth y Rhaw specimen is seen in an example from Exeter, also of first-century AD date, described as being sub-angular (Fox 1952). Neither the Exeter nor the Sutton Walls examples shows the marked thickening of the Porth y Rhaw specimen, but the Sutton Walls specimen does show some slight thickening. Thus, although the material is incomplete, and is without exact parallel, it appears to fit best with sub-angular to D-shaped crucibles representing the evolution of the triangular crucible during the Roman period.

The crucible contained traces of a tin oxide-rich material, both internally as a slagged residue and as tiny blebs up to 50μm across on the external vitrified surfaces of the crucible. The precise mineralogical phase was not identified, but the material was not tin ore (cassiterite), and was probably a hydrated oxide of tin. The persistent, if low, quantities of copper present in the altered patches and in the slag strongly suggest that the tin-rich patches are the result of the decomposition of tin bronze, with subsequent dissolution of the copper-bearing weathering products. An extreme example of this process was quoted by Tylecote (1986). The highly altered composition of these residues means that it is not possible to use the absence of arsenic, zinc and lead as a provenance indicator. There is no evidence that the crucible was used for making bronze, rather than for re-melting.

Crucible no. 3 is also problematic, for it is only represented by a small, almost planar sherd. The low degree of convexity and the dark colour of the glaze suggest, however, that this sherd is from a cupel. Cupellation in a ceramic cupel may be employed for separating a noble metal (usually silver) from a small quantity of material in which the noble metal is mixed with base metals. This may be done for the purpose of assaying a silver-bearing material, but within the context of small-scale metalworking, such as that likely here, the technique may be used during the recycling of materials for new use (including the extraction of silver from debased coinage). Cupellation entails heating the metal to be separated with an excess of lead. This may done in a bone-ash cupel or, more commonly in early contexts and on a small scale, in a ceramic cupel (an open, dish-shaped, vessel). The lead is oxidised by heating from above and reacts with silica in the cupel to form a slag, which in turn takes up most of the base metals, leaving the silver as a small metallic bead in the centre of the cupel. Cupels are not particularly common finds on Roman sites, but small scale cupellation was recently observed at Dymock (Young and Kearns 2010), where it was interpreted that the recycling of small quantities of silver may have accompanied the manufacture of silvered brooches.

1. Three conjoining fragments of a crucible (Fig. 18), find no. 473, from fill of a shallow scoop (1289) to the south-west of the small hearth in Roundhouse V. The base of the crucible is missing,

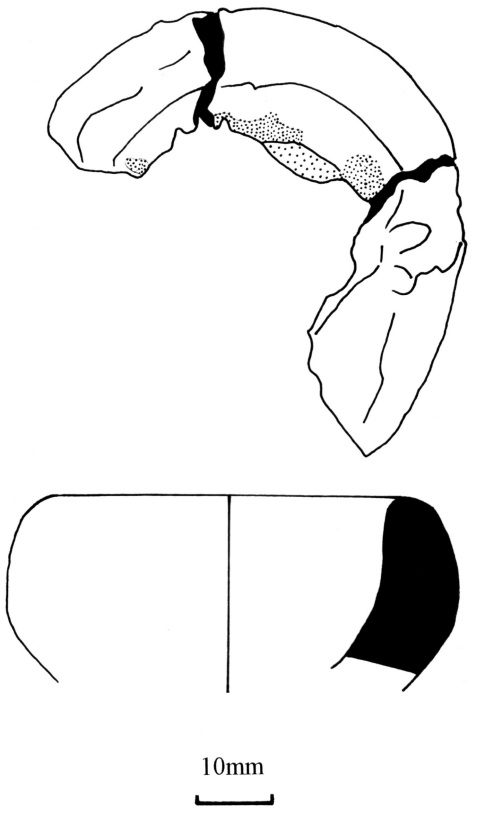

Fig. 18. Crucible no. 1.

as is around 40% of its wall. The crucible is rounded, but with slightly tighter curvature at two points giving a slightly sub-angular outline. The wall has a rounded rim, dropping vertically internally, but swelling slightly externally; to give the widest point approximately 13mm below the rim. The surviving piece has one of the slightly angular regions at one end, the other angular region centrally and a substantially thickened area at the opposing end. The unfortunate position of the breakage through this thickened area makes its interpretation difficult. The thickening involves the wall increasing from its typical 10mm thickness, to around 15mm at a point 7mm below the rim. The internal margin of the thickened area is damaged, but appears steep, and continues the curve of the internal face of the wall from the adjacent area of normal wall. The internal well of the crucible is therefore sub-circular, with a diameter of approximately 38mm, a maximum preserved depth of 20mm, and an estimated original depth of approximately 29mm, giving a volume of approximately 26cm^3. The crucible has a grey fabric bearing quartz grains of up to 4mm. The surface of the crucible is vitrified to approximately 10m below the rim on the side away from the thickening, but extending to at least 20mm below the rim in the thickened area. The inner face is also well vitrified to at least 10mm below the rim, but below that is generally covered with a skim of slag, which thickens to 2mm in a few places. The external vitrification is dominantly black in colour, change to a reddish tinge over the top of the rim and on to the internal face. The area in which the wall starts to thicken is marked by a partly annealed fracture running

over the rim. Two further fractures cut the thickened area. A region 16mm wide by 13mm high spanning this second crack forms a flat surface, with a less highly reflective vitrified surface. It is possible that this may represent a mark formed by contact with tongs. The analytical data is included in the site archive.

2. Crucible fragment recovered from layer 604 over Roundhouse V close to nos 1 and 3, and is similar to no. 1. The rim bends markedly along the 15mm length of the piece, suggesting that the fragment comes from one of the sub-angular bends described above. The inner face appears not to be vitrified, but is covered at least in part by a skim of slag. The external vitrification is red for 5mm below the rim and black for at least 15mm below this.
3. Crucible/cupel fragment recovered from the same area as no. 1, from scoop 1289 in Roundhouse V. It was a small fragment of similar fabric to the crucible fragments described above, but considerably thinner. The piece has one slightly concave, but almost planar face, showing black vitrification, which turns red near the margin and along the edge of one of the fractured margins. The other face curves around to the margin of the fragment, which is 3mm thick at 3mm from the margin and 5mm at 15mm from the margin. This more strongly curved face appears to be less vitrified. The original margin of the fragment is irregularly curved, with a radius of curvature somewhat larger than that of most of the lip of the crucible 1 described above. The almost planar nature of this piece and the dark colour of the glassy slag on the slightly concave face suggest that it may be a fragment of a ceramic cupel.

Iron-working slags

The iron-working slags are typical of the varied slags produced during blacksmithing. They vary in chemical and mineralogical composition, possibly reflecting a spectrum of activity from high to low temperature processes. The total weight of iron-working slags recovered is very small and it is therefore difficult to judge the significance of this activity for the site.

The iron-working slags are all rather fragmentary, so little interpretation can be made of their overall morphology, or the original slag cake size. They are all of moderate density and the specimens were all consistent with identification as smithing hearth cake fragments from blacksmithing. Four specimens from three contexts were examined by electron optical techniques (together with an additional four small specimens from two contexts which were problematic in hand specimen, but which proved to be various natural iron-rich rocks, and which are not described further). A single sample was given a full chemical analysis. Detailed results are included in the site archive.

The material studied was typical of early smithing residues. The analytical work undertaken confirmed this interpretation and revealed no evidence that any of these slags was associated with non-ferrous metalworking. The sample size was very small, but the studied slags were extremely varied, suggesting a range of iron-working tasks was being carried out on site. None of the iron slags is likely to have been associated with smelting, and none of the smithing slags need be associated with bloomsmithing. One sample did not contain significant hammerscale, but is more likely to be associated with welding, than with any stage of the primary production process.

Microstructure

Sample E (upper fill of posthole in the area of the northern trackway adjacent to the entrance). This sample is of a fayalite-wustite dominated slag. Wustite dendrites of up to 500µm occur distributed throughout, but are particularly spatially associated with the abundant, and often large, fragments of hammerscale. The hammerscale is up to 2mm in width and 200µm thickness. The matrix to the dendrites is formed of densely packed laths (500µm × 20µm) of fayalite (generally with a small amount of Ca

substitution). This slag is noticeably richer in fayalite than those from contexts 1225 and 1251. The wustite is locally altered to and/or overgrown by magnetite.

Sample F (occupation deposit near hearth in Roundhouse V). This low density material proved to be mainly a partially melted fragment of sedimentary rock (probably once an inclusion in a hearth wall). At one end the rock is in contact with a fayalite-wustite slag, similar to that of sample G, but bearing small grains of hercynite (reflecting increased alumimium supply from the melting rock fragment).

Sample G (occupation deposit near hearth in Roundhouse V). This slag is dominated by wustite. It contains abundant hammerscale. Details of the silicate mineralogy are frequently obscured by weathering, but subordinate fayalite is present. Irregular regions may contain grains with a leucite-wustite eutectic. This sample is much poorer in silicate minerals than those above. The decreased significance of the silicate component, plus the abundance of hammerscale, may suggest that this sample was produced during relatively low temperature blacksmithing.

Sample H (gully XI below Roundhouse VIII). This material was grey in colour and rather uniform in hand specimen. The slag was heterogeneous on a fine scale. It was characterised by the co-occurrence of coarse granular wustite and magnetite. These granular crystals were up to 150μm in diameter. Wustite crystals were rounded, and bore rounded cavities; the magnetite grains were angular and bore planar crevices. Some grains contained both minerals, and there was some indication that alteration and/or superposition of these two phases occurred in both directions. Finer wustite dendrites also occurred. Fayalite occurred as large laths, possibly up to 1mm in length in some areas, but in others fayalite was seen mainly in tiny late-stage dendrites in the glassy matrix. Leucite (commonly as a leucite-fayalite? eutectic) and hercynite occur sporadically, particularly near the vesicles. The texture of this slag is suggestive of its generation in a higher temperature process (e.g. welding) than that producing the slags of samples E, F and G.

Chemistry

Sample I (gully XI below Roundhouse VIII). The composition is entirely consistent with these slags being iron-working slags. The low take-up of elements present in the fuel is typical of the dense smithing slag cakes on other sites, in which the composition is determined by partial melting of the hearth wall, and the reaction of that melt with iron and iron oxides from the workpiece.

ENVIRONMENTAL EVIDENCE

By Astrid E. Caseldine and Catherine J. Griffiths

Very little is known about the environment and agricultural economy during the Iron Age and Romano-British period in this part of west Wales (see Caseldine 1990). Samples were therefore taken both for pollen analysis and the identification of charred plant remains to provide information about the landscape and agricultural activity at this time.

Pollen evidence

Two pollen columns and three spot samples have been examined for pollen. One pollen column was from the buried soil (12) beneath the inner bank (Trench 1) and the other was from Gully XI underlying Roundhouse VIII (Trench 4). The three spot samples were from the capped drain fill of Roundhouse VIII, the later gully fill from Roundhouse III, and layer 604 from Roundhouse II. Detailed results of the analysis are not presented here; they are included in the site archive.

Interpretation of pollen from soil samples must be treated with a degree of caution because of taphonomic problems, including the movement of pollen down the profile and differential preservation.

However, certain observations can be made from the pollen evidence. The analysis indicates a largely open environment but some differences are evident.

The record from the pollen column from the base of the defensive bank and the buried soil (10) is dominated by herbaceous pollen, notably *Plantago* spp., Lactuceae and Poaceae, suggesting a predominantly grassland environment with weeds such as plantains and dandelion type. Arboreal pollen is sparse apart from *Corylus avellana* type, which suggests some hazel woodland in the area. A decline in *Corylus* towards the top of the buried soil suggests some clearance in the area around the time the fort was constructed. A decline in *Polypodium* and increase in *Pteridium* may also be associated with clearance of woodland and invasion by bracken. Although values are low, a slight decline in *Alnus* occurs earlier in the record and may suggest some clearance of alder carr, perhaps growing close to the stream in the valley to the north-west of the site. An increase in *Calluna* pollen indicates some acidification of the soil and the establishment of heathland vegetation communities in the area, which could be related to agricultural activity. *Calluna* values are marginally lower in the upper levels of the buried soil whilst herbaceous pollen is more frequent, perhaps reflecting activity at the site as heather is susceptible to trampling. Similarly, a reduction in *Pteridium* may represent clearance of bracken locally. Cereal type pollen is also recorded from the top of the soil but weeds associated with cultivation are scarce, suggesting that any cultivation was taking place away from the immediate environs of the fort. The presence of Chenopodiaceae pollen in the profile could reflect either cultivation, disturbed ground, or salt-marsh environments. The coastal environment is also reflected by the occurrence of *Armeria* and *Plantago maritima*. An increase in *Corylus* and *Polypodium* in the upper levels, which were from the bank, mirrors the record from lower down the profile, suggesting upcast from the ditch. Pollen concentration values are highest around the buried soil/bank boundary.

All the samples from within the fort indicate a largely open environment and have lower arboreal pollen values than from the soil under the bank, which may reflect their location and their slightly later date. The assemblage from Gully XI outside Roundhouse VIII is dominated by Lactuceae pollen which has particularly high values in the levels from the 'redeposited natural' of the lower fill, suggesting there may be some differential pollen preservation. Although *Quercus* and *Corylus avellana* type values are slightly higher in the basal level and then decline it is difficult to be certain whether these changes represent contemporary small scale clearance of oak and hazel woodland in the area because of the nature of the lower fill. Small amounts of *Alnus* occur throughout the diagram and suggest carr woodland in the area. A return to slightly higher *Corylus* values in the lower levels of the upper gully fill might either reflect older pollen washed in with the sediment, some minor regeneration of hazel scrubland, or possibly pollen from hazel wood brought onto site. *Calluna* pollen is poorly represented which may reflect the different environmental conditions and different pollen source areas within the fort compared with the buried soil beneath the bank. This is further demonstrated by a greater incidence of Cerealia type pollen in the upper sediments of the gully. This probably reflects cereal brought onto the site rather than local cultivation, although this may have occurred on the area of flat ground behind the fort. However, high Poaceae, *Plantago* and Lactuceae values again suggest a predominantly grassland environment.

The pollen spectrum from the sample from the later gully fill from Roundhouse III is similar to that from Gully XI, including the presence of Cerealia type pollen. The pollen from the layer from Roundhouse II is also similar, apart from the absence of Cerealia type. In contrast, the pollen sample from the capped drain from Roundhouse VIII contains large amounts of Lactuceae pollen, possibly reflecting the context and less favourable conditions for preservation.

The nearest pollen evidence from other sites in west Wales covering this period is from buried soils from enclosures at Merryborough Camp (Webley 1964) and Knock Rath (Bartley and Webley 1965) and the promontory fort at Great Castle Head, Dale (Caseldine 1999). The information at the former two sites

is very limited, although from the presence of cereal pollens at Merryborough it is suggested there was some arable farming prior to the construction of the bank and at Knock Rath a large increase in *Plantago* pollen on the old ground surface is interpreted as indicative of grazing. At Merryborough a large part of the pollen is said to be oak but the date of this is unclear. The pollen record from beneath the bank at Great Castle Head is very similar to that at Porth y Rhaw, indicating a predominantly open grassland environment but with evidence for some arable activity in the area.

A pollen sequence from the raised bog at Esgyrn Bottom (Slater and Seymour 1977), near Fishguard, is undated, making direct comparison difficult, although changes in the pollen zone attributed to this period are interpreted as woodland clearance and grazing. Later changes, interpreted as evidence of arable farming, are assigned to the Norman period. A more recent pollen diagram from Esgyrn Bottom (Fyfe 2007) is dated but the latest date obtained dates the elm decline and is early Neolithic. Later changes are undated but a decline in woodland and a slight increase in grasses and herbs in the upper levels may reflect Iron Age activity, although these events coud be earlier and the Iron Age and later periods missing from the diagram. In contrast, the pollen record from Whitland Roman road (Caseldine *et al*. forthcoming) is dated and suggests increased clearance during the Iron Age and a largely pastoral economy, although occasional grains of cereal type pollen are recorded indicating some cultivation. Further east, the pollen record (Walker 1985) from the enclosure at Penycoed also suggests a mainly pastoral landscape with only limited cereal cultivation. Woodland is scarce but, as at Porth y Rhaw, alder and hazel are most strongly represented. In the diagram from Llanllwch (Thomas 1965) a sharp decline in Coryloid frequencies is interpreted as being associated with Roman activity and a Celtic monastic community at Carmarthen, but the diagram is inadequately dated.

Charred plant remains

Charred plant remains were recovered in order to obtain information about crop husbandry practices in the area and crop processing activity at the site. Samples were taken from a range of contexts including a burnt layer above a hearth, possible cooking pits, an occupation layer, a layer above a floor, and capped and uncapped drain fills. Detailed results of the analysis are included in the site archive.

Charred plant remains are sparse but provide some information about crop husbandry during the Iron Age and Romano-British period. One sample, from above the floor of Roundhouse VIII, failed to produce any remains. Wheat (*Triticum*) is the most frequent cereal recorded from the site and glume bases indicate the presence of both emmer (*T. dicoccum*) and spelt wheat (*T. spelta*), although a number of glume bases could only be assigned to an emmer/spelt category. Spelt dominates and it is possible that emmer was present only as a contaminant. Hulled barley (*Hordeum sativum*) is also present and may be under-represented as it is more likely to be destroyed than the glume wheats when exposed to heating. Weed seeds are scarce but include *Persicaria* spp. (knotweeds), Chenopodiaceae (goosefoots) and Poaceae (grasses). Other remains include stems of *Calluna vulgaris* (heather), *Pteridium aquilinum* (bracken) leaf fragments and a fruit-stone of *Prunus spinosa* (blackthorn).

The assemblages largely represent waste from crop processing, mainly glumes bases as a by-product of sieving. Charred cereal remains from the pits 662, 664, 666, are marginally more frequent than in the other samples, probably reflecting the use of waste as fuel although the few cereal grains could represent accidental charring during cooking activity. However, generally, none of the samples yielded large quantities of material, the amounts present probably representing charred material that was blown about or trampled in, suggesting waste material was being deposited outside the immediate environs of the fort.

Although chaff might have been deliberately burnt it might also have been used as animal fodder at the site. Similarly, charred bracken fragments could represent animal bedding as well as fuel and charred heather could derive from flooring material or fuel. The few weed seeds provide only limited ecological

information. Poaceae indicate grassland, *Persicaria* spp., *Polygonum aviculare*, Chenopodiaceae could reflect cultivation or waste ground. The presence of *Calluna* remains indicates heath communities and the thorns and fruit-stone of *Prunus spinosa* suggest scrubland.

There is no evidence for a change in the crops being grown between the Iron Age and Romano-British period with spelt dominating throughout, but the total assemblage is small. There is also insufficient evidence to assess the status of the site from the plant macrofossil remains. The glume wheats, emmer and spelt, are frequently stored and traded in spikelet form, particularly in areas with wet climates, so that in an area like west Wales the presence of glume bases may or may not indicate local production. The extent to which crops were being grown in the immediate area, ie the area of flat land behind the fort, is therefore unclear, if probable.

The results are similar to those from Great Castle Head, Dale (Caseldine 1999) and Llawhaden (Caseldine and Holden 1998) where wheat, largely spelt, predominated, but barley was also present. In addition, oat (*Avena* sp.) was recorded at both these sites, but it was uncertain whether it was wild or cultivated, and there was some evidence for bread/club wheat (*T. aestivum*). The absence of these species at Porth y Rhaw may be a reflection of the small size of the assemblage rather than their absence at the site. Wheat grains were also recovered from Penycoed as well as oat and rye (*Secale cereale*) (Nye 1985).

Conclusions about the environment and economy

The pollen evidence suggests a mainly open landscape, perhaps with some carr woodland in the valleys and some hazel scrub. It also suggests a largely pastoral economy with only limited cereal cultivation. The scarce plant macrofossil evidence from the site appears to confirm this, but it is probable that waste material was disposed of outside of the fort and therefore cereal remains are under-represented. The charred plant remains indicate that spelt wheat was the main cereal crop but that barley was also being grown, although it could also have been a contaminant like emmer. The pollen evidence indicates the development of heather communities, confirmed by the presence of charred heather remains, suggesting some soil acidification, perhaps as a result of agricultural activity. The evidence appears to be in keeping with that from other sites in west Wales at this time which suggest a mainly pastoral economy.

DISCUSSION

Porth y Rhaw is the first excavation of any size to be undertaken recently in west Wales on a coastal promontory fort. The work represents the first clear evidence from a promontory fort for permanent and dense occupation over a considerable period of time. It has also has suggested similarities to many of the defended inland sites in the region. Evidence of the manufacture of metalwork, the presence of items of personal adornment, and the scale of the defences, combining strength with an element of display, suggests that the settlement was of high status, probably able to draw on external subservient resources. Alternatively, it could be argued that these indicators are a demonstration of local pride by a small self-sufficient village or farmstead. However, considering the scale of the defences this is unlikely.

Dating and comparisons

A number of west Wales sites have produced evidence for occupation in the late Bronze Age, including Broadway (Williams and Mytum 1998) and Dale Fort (Benson and Williams 1987), both in Pembrokeshire, and possibly also at Caer Bayvil, Pembrokeshire and Llanstephan, Carmarthenshire (Guilbert 1974). Given the natural defensive slope and the close proximity of the spring at Porth y Rhaw, the site may have been settled before the ramparts were constructed. However, apart from a possible

Bronze Age socketted axe, the excavation provided no evidence for this. It is perhaps not surprising that there was no evidence for pre-rampart occupation at Porth y Rhaw because such a small section of the bank was excavated.

Promontories, whether coastal or inland, lend themselves to defence without the necessity for building complete enclosures (Harding 1974, 55). In west Wales there is little dating evidence for the coastal promontory forts, but, what there is, indicates that such sites have been utilized for defence over a long period of time, from the later Bronze Age, with the major earthworks constructed during the Iron Age, and occupation, perhaps not continuous, running into the Roman period. There is a small but growing body of evidence, including that from Porth y Rhaw, that places the construction of west Wales promontory forts within the Welsh and wider British early hillfort tradition, *c.* 800–550 BC, as defined by Davies and Lynch (2000). At Dale Fort, Pembrokeshire, dates of the ninth to eighth centuries BC were obtained from complex defences, which included palisade trenches pre-dating the rampart (Benson and Williams 1987, 43), and dates of ninth to fifth centuries were obtained from below the defences of Great Castle Head, Pembrokeshire (Crane 1999, 117, table 3) and from Llanstephan Castle, Carmarthenshire (Guilbert 1974, 43). The two radiocarbon dates from the hearth within the inner rampart at Porth y Rhaw and the date from the rear revetment trench all suggest a date of between the eighth and fourth centuries BC for the establishment of the inner defences. An early to mid-Iron Age date for the earlier occupation at Porth y Rhaw is also supported by the radiocarbon dates from Roundhouses I, II and III. In fact no fewer than seven of the nine radiocarbon dates from Porth y Rhaw suggest early or middle Iron Age occupation (three from the inner bank and four from the internal area). Given the relatively small size of the excavation in relation to the site it is not possible to come to firm conclusions regarding continuity, but the dates and artefacts from the site suggest a hiatus in occupation towards the end of the middle Iron Age and the beginning of the late Iron Age.

Excavation on Iron Age defended settlements in south-west Wales has concentrated on inland sites, and mostly on sites at the smaller end of the size range. No evidence is available from larger hillforts, which may prove to have origins equally as early, if not earlier, than coastal promontory forts, but dates from a medium sized fort at Broadway in Pembrokeshire indicate construction in the middle of the first millennium BC (Williams and Mytum 1998, 53). Alcock (1960) suggested that Castell Odo in north Wales, a similar sized fort to Broadway, also originated at the same time. At Castell Henllys in Pembrokeshire, an inland promontory fort with an internal area perhaps not dissimilar to the original size of that at Porth y Rhaw, the defences were laid out in the fourth to third centuries BC (unpublished information). Smaller forts, or defended enclosures, are later, usually dating to the second or first centuries BC, as demonstrated on excavations on the Llawhaden group of sites (Williams and Mytum 1998).

Evidence at Porth y Rhaw for occupation in the later Iron Age is limited. There is a radiocarbon date of 385–20 BC from the gully which pre-dates the stone roundhouse, although this also contained a fragment of Romano-British pottery. The archaeomagnetic date from the hearth in Roundhouse V suggested a date of between 200 BC and AD 100 and two possible Iron Age beads were recovered from the same structure. However, the bronze-working crucible fragments from near the hearth are thought to be of Romano-British date. By contrast, the pottery from the stone-footed roundhouse clearly indicates a Romano-British date, and this is supported by the single radiocarbon date from this structure.

There is a body of evidence for Roman occupation of coastal promontory forts and other forts in west Wales, such as the imported wares from Coygan Camp, Carmarthenshire (Wainwright 1967), and at Castell Henllys (unpublished information). Baring Gould (1899) excavated a group of stone-built roundhouses associated with Roman pottery, comparable to the Porth y Rhaw example, in Clawdd y Milwyr fort on St David's Head, a few kilometres to the west. These houses are still visible (Murphy

2001). Numerous casual finds are recorded coming from coastal forts; it is likely that excavation on other sites would reveal similar Romano-British remains to those at Porth y Rhaw.

There are distinct parallels between Porth y Rhaw and the more complete excavations of defended inland sites: the Llawhaden defended enclosure project (Williams and Mytum 1998), the continuing work on the inland promontory fort at Castell Henllys, Pembrokeshire, and especially the fully excavated defended enclosure at Walesland Rath (Wainwright 1971b), 15 kilometres to the south-east. All these excavations have produced evidence of closely built roundhouses and other structures. Porth y Rhaw appears to have been at least as densely occupied as these sites, and the similarity with the rebuilding of roundhouses at Walesland, followed by an apparently lighter occupation in the Roman period, is particularly striking.

The late Iron Age to early Roman period at Walesland also produced crucibles for bronze, while the pottery continued through into the fourth century AD (although no features associated with the later Roman period were found). However, Porth y Rhaw is far more heavily defended and probably had a larger number of dwellings, at least the earlier phases of its occupation.

It is not known whether all of the coastal promontory forts of Pembrokeshire were occupied at the same time, or were of similar status or function. Some are positioned quite close together. Porth y Rhaw, for example, has three near neighbours less than 2 kilometres away to the east and west, all substantial fortified structures. Even allowing for erosion, forts also vary greatly in the area of their interiors, from 10 hectares at Wooltack Point to 1 hectare at Dinas Fach, and in the size and form of their defences. However, the size of interiors may have more to do with where defences could be placed to make the best use of natural features and this would appear to be the case at Porth y Rhaw and Wooltack Point.

The comparison of coastal promontory forts in the west of Britain rests on only a limited amount of excavation and, where this has occurred, it has frequently been restricted to narrow sections through the defences with occasional limited examination of internal areas, often on known house sites. Where there is scientific dating evidence for the rampart or occupation it is inclined to be poor owing to problems with the calibration of radiocarbon data for this period. The Knave at Rhossili, Glamorgan, is a good example of a relatively small-scale excavation on a lightly defended bivallate promontory fort. Here, Audrey Williams (1939), cut a narrow trench through the ramparts and excavated the entrances and a small part of the interior. In contrast with Porth y Rhaw little evidence for structures was found, apart from a possible ‘hut’, but Glastonbury style pottery indicated cultural contact with people to the east along the Severn estuary coast. There is also a clear similarity between Pembrokeshire sites and with the promontory forts in south-west England, particularly Cornwall, for example the Rumps (Brooks 1974), Penhale Point (Smith 1988) and Gurnard’s Head (Gordon 1940), but these similarities are probably largely a result of a defensive response on comparable topography. As in Pembrokeshire, there has been little excavation on the interiors of these sites. Apart from the fact that south-west Wales sites and South West England sites are morphologically very similar, to date there is no direct evidence of cultural contact with Cornwall during the Iron Age. Pembrokeshire does not have the distinctive pottery of South West England in this period, nor are structures such as souterrains present. However, it has been suggested that four-posters, found in Wales but not in Cornwall, may have fulfilled the same function as souterrains (Williams and Mytum 1998, 143).

The evidence from Porth y Rhaw, and other Pembrokeshire coastal forts, provides a number of parallels for inland defended sites in west Wales. The longevity of these sites is increasingly apparent, extending through into the Romano-British period, and possibly, at least on some sites, beyond into the post-Roman period. There appears to be a high density of occupation during the Iron Age, with a reduced level of activity in the Romano-British period. The increasing number and range of artefacts from excavations shows that this area was not as isolated as might have been supposed, either in the pre-Roman or in the

Roman periods, with objects arriving at both coastal and inland sites from England and beyond. It is probable that other Pembrokeshire coastal forts, some of which are also under threat of erosion, would produce equivalent results to those from Porth y Rhaw. It is hoped that this programme of work will continue in order to obtain detailed comparisons, before the remaining information is lost to the sea.

The defences

Porth y Rhaw is one of the most massively defended promontory forts in west Wales, taking advantage of the natural slope of the ground. The eastern defences are closely spaced. However, the western part of the third ditch and fourth bank appear to be deliberately enclosing a large annexe. The creation of the fourth bank may have been simply the consequence of digging the western end of the third ditch, as it would be impossible to place the soil on the third bank. In this sense the ramparts should perhaps be properly seen as a triple rather than a quadruple defence. This enclosure of an outer area is a feature seen at some other west Wales coastal forts, such as Flimston Fort and Greenala Camp in south Pembrokeshire and Castell Bach, near Newquay in Cardiganshire (Rees 1992).

The entrance appears to have been along a metalled trackway, now lying along the cliff edge, before passing through the inner defence where there may have been a towered gateway with expanded bank terminals. The flat area behind the eastern half of the third bank could have formed a fighting platform, as was suggested for the terminal of the internal bank at Tower Point, Pembrokeshire (Wainwright 1971a). Furthermore, at Porth y Rhaw there is a pronounced mound at the western end of the third bank overlooking the entrance. Its purpose is unknown, but it could have formed the base of a tower, or even part of a bridge over an outer gateway. However, as any evidence of the outer defences on the eastern side of the entrance has presumably been lost, and the western side is eroded, no further conclusions can be drawn.

Both the surface evidence and that obtained from Trench 2 indicate that the outer defences have been remodelled to some degree. Given the long occupation of the site, it would seem likely that the inner defences were also rebuilt. However, the form of construction of the inner bank could not be conclusively determined. While it may have been built as a dump rampart with rear revetment, the radiocarbon determinations indicate a date of construction of the fifth century BC or earlier, which is probably too early for this type of structure. Furthermore, the layer of large stones in the ditch strongly suggests that the outer face was, at least partially, stone clad; from the visible cliff sections on a number of Pembrokeshire promontory forts, this appears to be a common form of construction. The nearest coastal fort, the Gribin, still retains stone facing on part of its bank, and Clawdd y Milwyr fort on St David's Head has stone-walled defences, although both sites are undated. The double slot at the rear of the bank may suggest some rebuilding. Excavated sites, such as Tower Point (Wainwright 1971a) and Dale (Benson and Williams 1987) have rebuilt revetted ramparts of *murus duplex* form, which are attributed to the later Iron Age.

The interior

Roundhouses I–VII are in the Iron Age tradition, which continued into the Romano-British period, and are not dissimilar from those found on other sites in Pembrokeshire, such as the Llawhaden enclosures (Williams and Mytum 1998), Walesland Rath (Wainwright 1971b) and Castell Henllys (Williams and Mytum 1998). At Porth y Rhaw there appears to be two forms of Iron Age roundhouse gully: those that were narrow and steep-sided, with clear evidence for stone-packing representing wall lines rather than being external drainage features; and larger, wider, more rounded and deeper gullies, again these seemed to be structural rather than drainage features. Recent analysis of the roundhouse gullies on the defended enclosures of Llawhaden (Williams and Mytum 1998, 122) indicated that later gullies tended to be more

substantial, and this seems to have been broadly the case at Porth y Rhaw. Roundhouse III was the only house demonstrated to have an internal post-ring. Roundhouse III showed evidence of more rebuilds than any of the others. It did not appear to overlie earlier features and seemed to have had a very long duration. It may be significant that the three shallow pits and a large number of stake holes were located between Roundhouse III and Roundhouse II to the south, possibly indicating contemporaneous association.

Roundhouse VIII appears, in structural terms, to be an example of a developed roundhouse, firmly in the Romano-British tradition rather than Iron Age. This is supported by both the pottery and the radiocarbon determinations. The roundhouse excavated at Tower Point, 13 kilometres to the south, had spread stone footings, but could not be firmly dated (Wainwright 1971a), although it appeared to be in the later Iron Age tradition. The closest parallel for Roundhouse VIII are the seven stone-footed roundhouses at Clawdd y Milwyr, at St David's Head just 7 kilometres to the north-west. Several of these were of very similar size to Roundhouse VIII (8–9.5 m diameter) and they are likely to be Romano-British in date (Baring Gould 1899). Three roundhouses, probably stone-footed, were recorded on the Gribin 1.5 kilometres to the east, and apparently destroyed around 1900 (Laws and Owen 1908, 46, no. 10).

The only known examples of internal drains in Pembrokeshire roundhouses are at Walesland Rath (Wainwright 1971b), although these are within timber structures. There are a number of examples of stone-capped drains in roundhouses in Anglesey, including at Ty Mawr, Holyhead and at three sites recently excavated on the A55 (Maynard *et al*. 1999). There are also parallels at some sites in Cornwall, where a number of stone-footed roundhouses from the Iron Age have internal drains. They are also found at the Romano-British defended site at Trethurgy (Miles and Miles 1973), where a number of the houses have these features.

Three roundhouses had clearly identified entrances, two Iron Age (Roundhouses II and III) and the other Romano-British (Roundhouse VIII). These entrances faced west and south-west, into the prevailing wind. The more usual entrance orientation both within Pembrokeshire and further afield during the Iron Age is south-east. However, a west-south-westerly orientation would capture the evening sunlight, which may have been of practical or social significance.

Economy

The artefacts from Porth y Rhaw, other than the amber bead and jet counter, are similar to assemblages from other Pembrokeshire coastal forts and defended inland sites. Spindle whorls are a fairly common artefact on Iron Age sites and those from Porth y Rhaw would not appear to be particularly diagnostic or distinctive. However, the small spindle whorl (Fig. 17, no. 14), while not complete, is very light and must have been used to spin a very slender thread, implying the weaving of fine cloth. The glass beads, together with the amber bead, the jet counter and the Roman pottery, must have been transported over some distance. However, they are not proof of direct contact with their areas of origin.

Evidence for metalworking from the limited number of samples taken indicates that this formed an important part of the site's economy. The identification of iron-working slags is of particular interest as these are not represented in the Iron Age archaeological literature of west Wales, and have only been identified in the Romano-British period in the town of Carmarthen (Crew 2003). However, evidence for both iron-working and bronze-working has been excavated at Castell Henllys (unpublished information), the publication of this work will add greatly to our knowledge. No smelting or primary working of iron was found at Port y Rhaw, but a variety of tasks associated with smithing have been recognised. In the absence of comparable data it is not possible to judge whether this is the norm.

A Roman road running west from Carmarthen has now been traced as far as Wiston in Pembrokeshire, some 20 kilometres from Porth y Rhaw. Excavation on a section of this road near Whitland, Carmarthenshire (Page 2000) indicated that the road was in use for some time. This discovery places west

Wales much more within the Roman sphere of influence than previously considered (although the western destination of the road is still unknown). However, it worth noting that the distribution of Roman finds in west Wales has a strong coastal bias and coastal trading would therefore have been a more important method of transport of goods than road transport.

The investigations of 1808 by Fenton reported a large amount of limpet shells. However, the recent excavations found no ancient deposits of mollusc shells and the chemistry of the site appears to be unfavourable to organics. The only such material recovered were small fragments of calcified bone. Therefore, it is possible that the limpet shells were a more recent deposit. Although no organic material survives, the sea would have been exploited for both fish and shellfish, and also possibly for salt for preservation or trade. The beaches below would be ideal for fishtraps, while the flat ground immediately behind the fort, with relatively good well-drained soil, few frosts and a long growing season, would have benefited both crops and cattle. Trees now grow readily in the sheltered valley to the north-west and would probably have been more plentiful elsewhere, except right on the coastal edge. However, location is probably one of the overriding aspects of this fort's long life: the sea access in the cove to the west and the springs immediately outside the entrance must have played a part, and few of the Pembrokeshire coastal forts are as well situated.

ACKNOWLEDGEMENTS

The excavations were supervised by Peter Crane with the assistance of Ian Darke (assistant supervisor), Louise Lane (finds supervisor), Eleanor Breen (finds assistant), Maugan Trethowen (project assistant), Hubert Wilson (draughtsman); other site assistants were Nigel Blackamore, Brian Milton, Sally Morgan and Jens Samuel. Thanks are due to these and to all the students and volunteers who helped on the project. Thanks are also due to Alan Davies (the former owner of the site), Robert Griffiths (tenant farmer), Jonathan Hughes and Emma Plunkett Dillon (National Trust, the new owners of the site) and to Nigel Bowie (for accommodation at the Nine Wells camp site). The archaeomagnetic dates were provided by Professor D. H. Tarling (Department of Geological Sciences, Plymouth University). The pottery was examined by Heather James (Dyfed Archaeological Trust), Dee Brennan (Lampeter University) and Peter Webster (Cardiff University). Metal detecting was undertaken by Richard Blacklaw-Jones and the Pembrokeshire Prospectors Society. Phil Parkes (Cardiff University) undertook the artefact conservation. Louise Lane, Gwilym Hughes and Ken Murphy provided editorial assistance. Paul Sambrook assisted with the Welsh translation for visitor pamphlets. Final deposition of the report, archive and finds will be at the National Museum Wales, Cardiff.

NOTES

1. Dyfed Archaeological Trust, The Shire Hall, Carmarthen Street, Llandeilo, Carmarthenshire SA19 6AF.
2. School of Archaeology, History and Anthropology, University of Wales Trinity St David, Lampeter, Ceredigion SA48 7ED.
3. Llwyn Deiniol, Llanddeiniol, Llanrhystud, Aberystwyth, Ceredigion SY23 5DT.
4. Colchester Archaeological Trust, 12 Lexdon Road, Colchester CO3 3NF.
5. English Heritage Centre for Archaeology, Fort Cumberland, Fort Cumberland Road, Eastney, Portsmouth PO4 9LD.

6. Department of Archaeology, University of Nottingham, University Park, Nottingham NG7 2RD.
7. GeoArch, Unit 6, Western Industrial Estate, Caerphilly, CF83 1BQ.
8. Department of Archaeology and Numismatics, National Museum of Wales, Cardiff CF10 3NP.
9. Ordnance Survey, 1973 SM72 SE4 County Pemb No. OS 495.

BIBLIOGRAPHY

Alcock, L., 1960. 'Castell Odo: an embanked settlement on Mynydd Ystum, near Aberdaron, Caernarvonshire', *Archaeologia Cambrensis* 109, 78–135.

Baring Gould, S., 1899. 'Exploration of the Stone Camp on St David's Head', *Archaeologia Cambrensis*, 5th ser., 16, 105–131.

Bartley, D. D. and Webley, D. P., 1965. 'Results of pollen analysis', in D. W. Crossley, 'Excavations at Knock Rath, Clarbeston, 1962', *Bulletin of the Board of Celtic Studies* 21, 269–70.

Benson, D. G. and Williams, G. H., 1987. 'Dale Promontory Fort', *Archaeology in Wales* 27, 43.

Briard, J., 1965. *Les Dépôts de Bretons et l'âge du Bronze Antlantique* (Rennes).

Briggs, C. S. and Williams, G., 1995. 'The Late Bronze Age hoard from Allt Gelli. Felen, Myddfai, Carmarthanshire, and other recent finds of South Wales axes', *Archaeologia Cambrensis* 44, 37–51.

Brooks, R. T., 1974. 'The Excavation of the Rumps cliff castle, St. Minver, Cornwall', *Cornish Archaeology* 13, 6–50.

Bulleid, A. and Gray, H. St G., 1911. *The Glastonbury Lake Village Volume 1* (Glastonbury Antiquarian Society).

Caseldine, A., 1990. *Environmental Archaeology in Wales* (St David's University College: Lampeter).

——1999. 'Environmental and archaeobotanical evidence', in P. Crane, 'Iron Age promontory fort to medieval castle? Excavations at Great Castle Head, Dale, Pembrokeshire 1999', *Archaeologia Cambrensis* 148, 118–28.

Caseldine, A. E. and Holden, T. G., 1998. 'The carbonised plant remains', in Williams and Mytum 1998, 105–118, 121.

Caseldine, A. E., Walker, M. J. C., James, J. H., Johnson, S. and Robinson, M., forthcoming. 'Palaeoecological Investigations Associated with the Whitland Bypass Roman Road, Carmarthenshire', in N. Page, *A Roman road west of Carmarthen*.

Coombs, D. G., 1975. 'Bronze Age weapon hoards in Britain', *Archaeologia Atlantica* 1, 69–87.

Crane, P., 1994. 'Dyfed Coastal Promontory Fort Assessment 1993–4', unpublished report, Cambria Archaeology.

——1999. 'Iron Age fort to medieval castle? Excavations at Great Castle Head, Dale, Pembrokeshire 1999', *Archaeologia Cambrensis* 148, 86–145.

Crew, P., 2003. 'Slags and other iron-working residues', in H. James, *Roman Carmarthen: Excavations 1978–1993*, Britannia Monograph Series No. 20.

Crummy, N., 1983. *The Roman Small Finds from Excavations in Colchester 1971–9*, Colchester Archaeological Report 2 (Colchester: Colchester Archaeological Trust).

Cunliffe, B., 1983. *Danebury: Anatomy of an Iron Age Hillfort* (London: Batsford).

——1984. *Danebury: an Iron Age Hillfort in Hampshire. Volume 2, The Excavations 1969–78: the finds*, Council for British Archaeology Research Report 52 (London).

——1994. *The Oxford Illustrated Prehistory of Europe* (Oxford: Oxford University Press).

——1997. *The Ancient Celts* (Oxford: Oxford University Press).
Davey, N. and Ling, R., 1982. *Wall-painting in Roman Britain*, Britannia Monograph Series No. 3.
David, A., 1990. 'Palaeolithic and Mesolithic Settlement in Wales, with special reference to Dyfed', unpublished PhD thesis: University of Lancaster.
——1998. 'Amber', in Williams and Mytum 1998, 95.
Davies, M., 1993. 'The identification of various jet and jet-like materials used in the Early Bronze Age in Scotland', *The Conservator* 17, United Kingdom Institute for Conservation.
Davies, J. L. and Lynch, F., 2000. 'The Late Bronze Age and Iron Age', in F. Lynch, S. Aldhouse-Green and J. L. Davies (eds), *Prehistoric Wales* (Stroud: Sutton), 139–219.
Driver, T., 2007. *Pembrokeshire. Historic Landscapes from the Air* (Aberystwyth: RCAHMW).
Eogan, G., 1983. *Hoards of the Irish later Bronze Ag*e (Dublin: University College).
Evans, J., 1897. *Ancient Bronze Implements* (London: Longmans).
Fenton, R., 1903. *A Historical Tour Through Pembrokeshire* (facsimile of 2nd edn, Dyfed County Council, 1994).
Fox, A., 1952. *Roman Exeter: Excavations in the War-damaged Areas* (Manchester: Manchester University Press).
Fyfe, R. M., 2007. 'The importance of local-scale openess within regions dominated by closed woodland', *Journal of Quaternary Science* 22, 571–8.
Gillam, J. P., 1976. 'Coarse Fumed Ware in North Britain and beyond', *Glasgow Archaeological Journal* 4, 57–80.
Gordon, A. S. R., 1940. 'The excavation of Gurnard's Head, an Iron Age cliff castle in western Cornwall', *Archaeological Journal* 97, 96–111.
Gray, H. St G., 1966. *The Meare Lake Village, Volume III*, M. A. Cotton (ed.) (Taunton: Taunton Castle).
Grimes, W. F., 1951. *The Prehistory of Wales* (Cardiff: National Museum of Wales).
——1966. 'Dale: interim report', *Archaeology in Wales* 6, 9.
Guido, M., 1978, *The Glass Beads of the Prehistoric and Roman Periods in Britain and Ireland* (London: Society of Antiquaries).
Guilbert, G., 1974. 'Llanstephan Castle: 1973 interim report', *Carmarthenshire Antiquary* 10, 37–48.
Harding, D. W., 1974. *The Iron Age in Lowland Britain* (London: Routledge and Kegan Paul).
Herring, P., 1994. 'The cliff castles and hillforts of West Penwith in the light of recent work at Maen Castle and Treryn Dinas', *Cornish Archaeology* 33, 40–56.
Jefferies, J. S., 1974, 'An excavation at the coastal promontory fort of Embury Beacon, Devon', *Proceedings of the Prehistoric Society* 40, 136–56.
Jones, B. and Freeman, E. A., 1856. *The History and Antiquities of Saint David's* (London).
Kenyon, J., 1953. 'Excavations at Sutton Walls, Herefordshire, 1948–1951', *Archaeological Journal* 110, 1–87.
Kilbride-Jones, H. E., 1980. *Celtic Craftsmanship in Bronze* (London: Croom Helm).
Laws, E., and Owen, H., 1908. *Pembrokeshire Archaeological Survey 1896–1907* (Tenby).
Maynard, D., Hughes, G. and Davidson, A., 1999. 'Archaeological operations on the new A55 Llandegai to Holyhead route', *Archaeology in Wales* 39, 51–5.
Miles, H. and Miles, T., 1973. 'Excavations at Trethurgy, St. Austell: interim report', *Cornish Archaeology* 12, 25–9.
Murphy, K., 2001. 'A prehistoric field system and related monuments on St David's Head and Carn Llidi, Pembrokeshire', *Proceedings of the Prehistoric Society* 67, 85–100.
Northover, J. P., 1980. 'The analysis of Welsh Bronze Age metal work', in H. N. Savory, *Guide Catalogue to the Bronze Age Collections* (Cardiff: National Museum of Wales), 229–43.

Nye, S., 1985. 'Plant macrofossils', in K. Murphy, 'Excavations at Penycoed, Llangynog, Dyfed 1983', *Carmarthenshire Antiquary* 21, 106–08.

Page, N., 2000. 'A Roman road west of Carmarthen: a new avenue of research', *Institute of Field Archaeologist's Yearbook and Directory of Members 2000*, 23–24.

Page, M., Driver, T., Barker, L., Murphy, K. and Crane P., 2009. 'Prehistoric Defended Enclosures: Remote Sensing 2008–09', unpublished report, Dyfed Archaeological Trust.

Raftery, B., and Henderson, J., 1988. 'Some glass beads of the later Bronze Age in Ireland', *Glasperlen der Vorrömischen Eisenzeit II*, Marburger Studien zur Vor- und Frühgeschichte 9, 39–53.

Raggett, P., 1990. *Solva. An introduction to village life and guide to the walks* (Haverfordwest).

Rainey, A., 1973. *Mosaics in Roman Britain* (Newton Abbot: David and Charles).

Ramsey, R. and Williams, G., 1992. 'Dale promontory fort', *Archaeology in Wales* 32, 68–9.

RCAHM, 1925. *Royal Commission on the Ancient and Historic Monuments and Constructions in Wales and Monmouthshire: County of Pembroke*.

Rees, S., 1992. *A Guide to Ancient and Historic Wales: Dyfed* (Cardiff: HMSO).

Shepherd, I. A. G., 1985. 'Jet and amber', in D. V. Clarke, T. G. Cowie and A. Foxon, *Symbols of power at the time of Stonehenge*, 204–16 (Edinburgh: HMSO).

Slater, F. M. and Seymour, E. J., 1977. 'Esgyrn Bottom – the most westerly raised bog in Wales', *Proceedings of Birmingham Natural History Society* 23, 193–205.

Smith, G., 1988. 'Excavation of the Iron Age cliff promontory fort and of Mesolithic and Neolithic flint working areas at Penhale Point, Holywell Bay, near Newquay, 1983', *Cornish Archaeolology* 27, 171–99.

Stead, I. M., 1991. *Iron Age cemeteries in East Yorkshire*, English Heritage *Archaeological Report 22* (London: English Heritage in association with British Museum Press).

Stuiver, M., and Reimer, P. J., 1993. *Radiocarbon* 35, 215–30.

Tarling, D. H., 1998a. 'Archaeomagnetic Results From Solva, Pembrokeshire, January 1998', unpublished report deposited with the Porth y Rhaw archive.

——1998b. 'Archaeomagnetic Results From Solva, Pembrokeshire, December 1998', unpublished report deposited with the Porth y Rhaw archive.

Thomas, K. W., 1965 . 'The stratigraphy and pollen analysis of a raised peat bog at Llanllwch, near Carmarthen', *New Phytologist* 64, 101–17.

Tylecote, R. F., 1986. *The Prehistory of Metallurgy in the British Isles* (London: Institute of Metals).

Wainwright, G. J., 1967. *Coygan Camp* (Cardiff: Cambrian Archaeological Association).

——1971a. 'Excavations at Tower Point, St. Brides, Pembrokeshire', *Archaeologia Cambrensis* 120, 84–90.

——1971b. 'Excavations of a fortified settlement at Walesland Rath, Pembrokeshire', *Britannia* 2, 48–108.

Walker, M. J. C., 1985. 'Pollen analysis', in K. Murphy, 'Excavations at Penycoed, Llangynog, Dyfed 1983', *Carmarthenshire Antiquary* 21, 108–9.

Warburton, F. W., 1944. *The History of Solva* (London: Blackheath Press).

Webley, D. P., 1964. 'Results of analysis of pollen', in D. W. Crossley, 'Excavations at Merryborough Camp, Wiston: a Pembrokeshire protected enclosure, 1963', *Bulletin of the Board of Celtic Studies* 21, 108.

Webster, P., 1976. 'Severn Valley Ware: a preliminary study', *Transactions of the Bristol and Gloucesteshire Archaeological Society* 94, 28–46.

Williams, A., 1939. 'Excavations at the Knave Promontory Fort, Rhossilli, Glamorgan', *Archaeologia Cambrensis* 94, 210–19.

——1945. ‘A promontory fort at Henllan, Cardiganshire’, *Archaeologia Cambrensis* 98, 226–40.
Williams, G. and Mytum, H., 1998. *Llawhaden, Dyfed: Excavations on a Group of Small Defended Enclosures, 1980–4*, British Archaeological Report, British Series 275 (Oxford).
Young, T. P. and Kearns, T., 2010. ‘Evaluation of archaeometallurgical residues from Kyrleside, Dymock, Gloucestershire (32523 & 33787)’, unpublished report: GeoArch report 2010/19.

Published with the aid of a grant from Cadw